School of Public Health

Changing patterns of lifestyle and nutrition of men in Japan and Australia

Kayo Cruickshank

This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University

June 2014

Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university.

Signature: Kayo Cruickshank

Date: 16 June 2014

Acknowledgements

I would like to thank my supervisor, Dr. Jill Sherriff, and my co-supervisors, Dr. Yun Zhao and Dr. Andrea Begley, during the various phases of this project from the preparation to the eventual submission of the thesis. Their advice, patience and useful feedback are very much appreciated. I would also like to thank Dr. Stanley Ulijaszek and Professor Colin Binns for their initial input.

Acknowledgement is due to Dr. Jean Hankin of the University of Hawaii Cancer Research Center for permission to use her questionnaire, and also Professor Miyuki Adachi of the Kagawa Nutrition University who helped me the early stage of this project, Dr. Tetsunojo Uehata and Dr. Tomofumi Sone of the National Institute of Public Health in Japan who willingly offered some of the related materials for this project, Ms. Masuko Imamura and Ms. Yoko Kohara who helped me to develop a number of ideas before I started this project.

I greatly appreciate the assistance of the staff of the University of Hyogo including Dr. Mikio Ouchi, Dr. Naoko Hiramatsu, Dr. Setsuko Miyamoto and Ms. Harumi Terasawa, during my data collection, and all the participants including the students at the University of Hyogo in Japan and Curtin University in Australia, as well as employees in the Hyogo area and the Perth city area. I would also like to thank Watanabe Metal Industry Co. Ltd. in Japan, and Woodside Corporation, Coles and ANZ Bank in Australia for allowing me access to their staff. Without their cooperation this research would not have been possible.

I wish to thank Mrs. Mihoko Kagawa who supported me financially during the first two years of my PhD research. Without her help I would not have been able to continue this study.

Finally, I would like to express my deepest gratitude to my husband, Alex Cruickshank, for his infinite patience, understanding and emotional support throughout this study, and also my mother-in-law, Joy, and his sister Susan.

Abstract

The patterns of diet, nutrition and associated health issues have evolved throughout recorded history and are continuing to do so. At this point Japan and Australia are among the nations with the greatest longevity but with markedly contrasting food cultures. This study attempts to assess differences in dietary patterns and other lifestyle practices between middle-aged and young men in both countries and link these differences to BMI and other measures of obesity.

The research instrument was an adaptation of an extensive food frequency and physical activity questionnaire developed by Hankin in 1993 for multiethnic diets including Japanese and Caucasians. Data was also collected on sleeping, smoking and working patterns. Self-reported weight, height, waist and hip circumferences were collected. The total sample was 812 with approximately equal numbers from each of the four focal populations, namely younger adult men and middle-aged men in Japan and Australia.

A lifestyle score was calculated from a weighted sum of the four component indices: diet quality, physical activity, smoking and alcohol consumption. Use of the same questionnaire for both Japanese and Australian young and middle-aged men, allowed us to estimate the relative impact of the lifestyle behaviours of the two countries and their respective two generations on the same basis.

In terms of diet quality, the Australian *variety* and *adequacy* was superior to that of the Japanese diet. In both countries, the middle-aged showed greater *moderation*. In *overall balance,* the Japanese scored higher than the Australians and the middle-aged higher than the young. In terms of total diet quality, the Australians appear to be superior to that of the Japanese in both generations, and the middle-aged in both countries were higher than the young generation. The Australians were more *physically active* than the Japanese and the younger generation was more active than the middle-aged generation; the younger generation *smoke* less than the middle-aged and the Australians smoke less than the Japanese; the younger Japanese generation consume the least *alcohol* and the middle-aged Australian men consume the greatest.

In terms of the lifestyle index, including diet, physical activity, smoking and alcohol consumption, the Australians appeared to be significantly better than the Japanese and the younger generations in both countries better than the middle-aged. There was a consistent moderate inverse relationship between both BMI and WC with *relative* physical activity (in kilojoules per kilogram of body weight) for both groups of Japanese and Australian subjects.

Further analysis of dietary intake was undertaken by classifying food items into 19 groupings to provide meaningful common ground across the focal populations sampled. The dietary patterns of the countries and their respective generations were analysed using Principal Component factor analysis with Varimax rotation, and were compared and contrasted in detail. Evidence in relation to the dietary patterns of the Japanese and Australian male diet was further examined and the relationship against the anthropometric measurements, nutrients and lifestyle items on the basis of statistically significant association were made. The relationship between dietary patterns and obesity indices namely BMI, WC and WHR were discussed in the present obesity trends and the current literature on chronic diseases especially CVD.

Three of the four dietary patterns tended to be more similar in both countries and their two generations. The overall profiles tended to show that the Japanese were more consistent between the generations, whereas the Australians displayed greater variation. The Australian diet was also much less distinct compared with the Japanese in terms of the relationship between the four extracted factors and the intakes of macronutrients. Unexpectedly, our results suggest that the 'vegetarian' pattern, characterized by vegetables, salad items and fish/seafood, was significantly positively related to obesity for both the Japanese and the Australian groups, with the Japanese showing the higher association.

Key Words:
Japan, Australia, Inter-generational study, Cross-cultural study, Nutrition Intake, Food Intake, Dietary Patterns, Obesity.

Abbreviations

ABS	Australian Bureau of Statistics
AI	Adequate Intake
AIHW	Australian Institute of Health and Welfare
AM	Australian Middle-aged men (aged 40-60)
ANOVA	Analysis of Variance
Aus-Diab	Australian Diabetes, Obesity and Lifestyle Study
AY	Australian Young adult men (aged 18-30)
BMI	Body Mass Index
BMR	Basal Metabolic Rate
BP	Blood Pressure
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
DHQ	Diet History Questionnaire
DLW	Doubly Labelled Water
DM	Diabetes Mellitus
DQI-I	Diet Quality Index-International
DR	Diet Record
DRI	Dietary Reference Intakes
EI	Energy Intake
FFQ	Food Frequency Questionnaire
HC	Hip Circumference
JM	Japanese Middle-aged men (aged 40-60)
JY	Japanese Young adult men (aged 18-30)
LI	Lifestyle Index
MetS	Metabolic Syndrome
MHLW	Ministry of Health, Labour and Welfare in Japan
MI	Myocardial Infarction
MUFA	Monounsaturated Fatty Acids
NNS-A	National Nutrition Survey in Australia
NNS-J	National Nutrition Survey in Japan
OECD	Organization for Economic Cooperation and Development

PUFA	Polyunsaturated Fatty Acids
RDA	Recommended Dietary Allowances
RDI	Recommended Dietary Intakes
RMR	Resting Metabolic Rate
SES	Socio Economic Status
SFA	Saturated Fatty Acids
VFA	Visceral Fat Area
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist-hip Ratio

Table of Contents

List of Figures

List of Tables

CHAPTER 8:

Chapter 1

Introduction

Japan and Australia have both undergone considerable changes in lifestyle including diet over recent decades. According to the definition that has been used in this study, Westernization would mean that a certain indigenous cultural element of the traditional East is replaced by the penetrating Western element, and the functional role of the former is taken over by the latter (Hirai 1999); thus Japan became more westernized, especially since the Second World War (WWII). Australia on the other hand, has been progressively more Asianized in that it is becoming Asian in character, culture, or outlook (American Heritage Dictionary 2013), particularly since it changed its immigration policy in 1973 (Wahlqvist 1994a). To compare these countries may give some clues towards understanding the diets, lifestyles and the rise in chronic diseases.

1.1 Background

Alongside the forces of change, run those that are conducive to stability. The food habits of a group are quite clearly the product of its past history as well as its present environment, and those with real meaning tend to be long lasting and not easily changed (Lake et al. 2006; Maynard et al. 2006; Mikkila et al. 2005; Von Post-Skagegard et al. 2002). In other words, as a general rule, people eat both what is now available *and* as their ancestors ate. The forces of tradition partly account for why food habits continue to vary from one cultural, and sometimes sub-cultural, group to another (Counihan & Van Esterik 1997; Riddell 1994) and even where cultural contact is high, change may still be slow and limited.

A meaningful study of changing patterns of diet and nutrition would be impossible without an awareness of the key historical events and periods that shaped the nature of a society in the broader sense, for these necessarily affect the behaviour of the people through the availability of resources, circumstantial demands and priorities, and the influence of external contact with contrasting cultures (Popkin 2006b; Popkin, Duffey & Gordon-Larsen 2005).

1.1.1 The changing dietary pattern in Japan and in Australia

The traditional Japanese diet

For hundreds if not thousands of years, rice, fish, soybean products and green vegetables constituted the traditional Japanese diet (Japan Dietetic Association 1996). The absence of oil and fat was one of the distinctive characteristics of traditional Japanese cooking (Ishige 2001; Yamasa Institute 2013). Since meat was not commonly eaten and butter was not produced, cooking with animal fats was unknown. Sesame was cultivated and pressed, but the oil was very costly (Ashkenazi & Jacob 2000; Ishige 2001). Very little dietary culture was introduced from abroad during the seclusion period (1639-1854). That period saw the formulation of what the Japanese today regard as their 'traditional' culinary values, cooking and eating habits. Afterward, during the age of modernization which began in 1868, a great deal of energy was devoted to the importation of new foods and recipes, but very little effort was made towards the further refinement or alteration of traditional foods which was seen as having reached such a degree of perfection that further change was difficult. The majority of the traditional dishes eaten today dated from the 220-year period of seclusion (Ishige 2001; Rath 2010).

The changing Japanese diet

From a socioeconomic standpoint, conditions in Japan during the 20th century can be divided into four periods: (i) the privation period (up to 1950); (ii) the reconstruction period (1950-1960); (iii) the high economic growth period (1960-1975); and (iv) the low economic growth period (after 1975) (Matsumura 2001). During the privation period, particularly before 1935, the Japanese relied too much on their staple food, steamed rice (H. Tanaka et al. 1992). In the period of high economic growth beginning with the late 1950s the intakes of foods of animal origin, such as milk, eggs and meats increased rapidly while those of vegetables, potatoes and seaweeds declined. Disease profiles shifted from the infectious disease to a non-communicable chronic disease types (S. Kobayashi 1992). The change in fat consumption was the most significant among the major nutrients, however fat intake for the Japanese was still quite different from that for Europeans and Americans, not only in quantity, but also in quality (H. Tanaka et al. 1992).

However, from the 1950s, a new, relatively uniform diet became prevalent in Japan (Cwiertka 1998). This type of cuisine was a mixture of various pre-modern culinary traditions from the *haute cuisine*, the simple peasant diet and those adopted from abroad – new foodstuffs, new cooking techniques and new attitudes towards consumption. During the following decades, this hybrid food culture diffused throughout the entire society, came to be perceived as "traditional" by the majority of the Japanese, and was propagated as such abroad. The emergence of this new tradition was the result of an historical process that took place in the background of the Western penetration of Japan in the latter half of the nineteenth century, through the industrialization, urbanization, and finally militarization of the country (Cwiertka 1998; 2006). The menus of Japanese restaurants today are full of these hybrid dishes that emerged in the early twentieth century and were passed on later generations.

Monitoring the changing diet and health in Japan

Initially the most rapid changes after WWII were in the areas of industrialization and government (Popkin 2006b; Popkin, Duffey & Gordon-Larsen 2005). These tended to be superficial and their effect on the deeper cultural character was slower and more limited (Phillips 1999; Shepherd 1999; 2005; Shepherd & Shepherd 2002; Sobal & Bisogni 2009). However, with the persistent western contact, the American occupation after 1945 and the trend towards globalization, some impact on the diet would be regarded as inevitable and there was ample evidence to support this (Japan Dietetic Association 1996; NHK Overseas Broadcasting Department 1995; Nishida, Shetty & Uauy 2004; Reischauer & Craig 1979; World Health Organization 2006a). From the point of view of nutrition, it involved a progressive 'Westernization' in the intake of the major nutrients and a corresponding drift towards the morbidity patterns that predominate in the western world (S. Kim, Moon & Popkin 2000; Matsumura 2001; Ministry of Health Labour and Welfare 2006; & 2007; Yoshiike, Kaneda & Takimoto 2002). Nevertheless, Westernization is a matter of kind and degree, and although Japanese society, like all other cultures, continues to evolve, it appears to retain much of its distinctive character in many areas including food preparation and consumption.

The new epidemiological approach that had been adopted in Japan during the second half of the nineteenth century, made little progress (Trowell & Burkitt 1981). Attempts were made, however, during this period to collect some data on disease prevalence and distribution, and the compilation of demographic and bio-statistical data by the government started in 1899 has continued ever since – except for the last two years (1944-1945) of the Second World War (WWII) (H. Tanaka et al. 1992; Trowell & Burkitt 1981). The first National Nutrition Survey (NNS-J) was carried out in the Tokyo area in 1945, following the end of WWII, under the direction of the US (Ministry of Health Labour and Welfare 2006). At that time, malnutrition and growth retardation were major concerns, so that the initial purpose of the survey was to assess the nutritional status and the socio-economic aspects of the population for acquiring urgent food supplies from other countries. The annual NNS-J is still the only nation-wide source of dietary intake information in Japan, and has covered the trend in nutritional status collected since 1945. Over this time, Japan has experienced the most radical changes in socio-economic conditions as well as improved health conditions evidenced by movements in the incidence of disease mortality (Matsumura 2001).

The traditional Australian diet

Rutishauser and Flint (1994) described the 'traditional' Australian diet as it existed in the post-WWII period. The British pattern of eating had been the basis for the development of the Australian food pattern, as the majority of non-Aboriginal inhabitants were of British origin. In the post-war years, basic meal patterns remained comparatively unchanged, although there had been changes in the relative consumption of most items in the diet. At that time, the day often commenced with a pre-breakfast cup of tea as the usual drink. Breakfast was a substantial meal consisting of porridge, oatmeal or wheat-meal, hot or cold milk and sugar. The wage earner took a cut lunch with him or purchased a meat pie at the local shop. Dinner in the evening was the main meal of the day. It was normally of three courses, such as soup followed by meat with gravy, potatoes, a yellow and a green vegetable, and a substantial sweet or dessert such as a steamed pudding or egg custard. Meat pie, cake/biscuits were also included within the traditional Australian staple foods. Egg was available at that time, but was too expensive to use in daily life (Rutishauser & Flint 1994).

Monitoring the changing diet and health in Australia

Very few food consumption surveys have been carried out in Australia (Wahlqvist 1994a). The first Australian dietary survey conducted in 1938 was a survey of domestic food budgets in households in five state capitals conducted by the National Advisory Council on Nutrition. The second survey in 1944 was directed by the NHMRC (National Health and Medical Research Council) and measured food consumption and dietary levels (Australian Bureau of Statistics 1998bc; Commonwealth Department of Health 1986). The only other information available on changes in Australian food consumption patterns between these two dates was that provided annually by the Australian Bureau of Statistics entitled, 'Apparent Consumption of Foodstuffs and Nutrients Australia' (Australian Bureau of Statistics 1998abc). In 1983 the National Dietary Survey of Adults (25-64 years and extended from 20-69 years in 1989) was conducted in the state capitals was part of the second National Heart Foundation Risk Factor Prevalence Survey enabling dietary data to be linked to cardiovascular disease risk factor data (Australian Bureau of Statistics 1998bc; National Heart Foundation of Australia 1990).

The National Nutrition Survey (NNS-A) in 1995 was a joint project between the Commonwealth Department of Health and Family Services (HFS) and the Australian Bureau of Statistics (ABS) conducted between February 1995 and March 1996. It collected information on food and beverage intake, physical measurements, food-related habits and attitudes, and average food consumption over 12 months. The overall objective of this survey was the provision of food and nutrient data to assist with the implementation of Australia's 'Food and Nutrition Policy', future revisions of the RDIs and future revisions of National Health Goals and Targets. More specific objectives were to provide data on food intake for comparison with dietary guidelines and nutrient intake for comparison with DRIs – for Australians in general, and for those population groups at risk of health problems related to diet. The NNS-A also provided benchmark data against which future surveys could be compared to assess changes over time in the dietary status of Australians (Australian Bureau of Statistics 1998bc). Currently, the data from 2011 – 2012 Australian Health Survey is being analyzed (Australian Bureau of Statistics 2012).

The changing Australian diet

In contrast to Japan, Australia has historically maintained high levels of immigration such that around a quarter of its current population was born overseas (Australian Bureau of Statistics 2013b), and the majority is only second- or third-generation Australian (Australian Bureau of Statistics 2013a). A consequence of a century of immigration has been the emergence of a culturally diverse society (Burnley 2001; Fernandez-Armesto 2001). Particularly since Australia adopted the policy of multiculturalism (Universal Migration Policy) in 1973 (MacLeod 2006; Sherington 1990; Tavan 2005; Wahlqvist 1994b; Walsh 2001) and opened its doors to Asian immigration (Coughlan & McNamara 1997; Tavan 2005), it was to be expected that there would also be some drift towards an increased consumption of Asian food alongside the more traditional European-based Australian diet. The evidence shows that Australia's food and health patterns are now inextricably and increasingly linked with Asia (Hsu-Hage, Ibiebele & Wahlqvist 1995; Wahlqvist 2002). This is to be expected given that 33% of migrants in 2011 were born in Asia (Australian Bureau of Statistics 2013a).

Although the dominant causal factors differed in Japan and Australia, both countries have experienced significant external influence in these regards. Thus, as with 'Westernisation in Japan', one could just as easily speak in terms of 'Asianization in Australia' (Coughlan & McNamara 1997; Wahlqvist 2002), although probably to a much more limited extent. At the same time, like the Japanese, Australian eating habits continue to retain much of their traditional character.

1.1.2 The impact of environment on diets and lifestyle patterns

Japan and Australia are rapidly changing in both diet and lifestyle owing to the impact of technology and market globalization. There is an increasing emphasis on takeaway food, lifestyle are more sedentary and people are less physically active (Arsenault et al. 2010; Hu et al. 2004b; van der Ploeg et al. 2012). Rapid changes in diets and lifestyle resulting from industrialization, urbanization and economic development, which began in the last half of the nineteenth century, continue to have a significant impact on the health and nutritional status of populations throughout the world (Popkin 2006b). While standards of living have improved and the access to services has increased, there have also been significant negative consequences.

There was a decline in personal energy expenditure that was associated with a sedentary lifestyle due to motorized transport and labour-saving devices in the home and the occupational environment (Hu et al. 2004b; Kearney 2010; Nishida, Shetty & Uauy 2004; Popkin 2006a). Changes in the world food systems have contributed to a shift in dietary patterns, for example, increased consumption of an energy-dense diet high in fat, particularly saturated fat, and low in complex carbohydrates. The disparity between availability and restraint in intake appears to cause imbalance in the diet (Dixon et al. 2007; Matsumura 2001; McMichael 2005; Thornton, Pearce & Ball 2013; Ward et al. 2013), and this still exists even in highly economically developed countries (Matsumura 2001; Sugano & Hirahara 2000; Ward et al. 2013) such as Japan and Australia. The focus in the field of nutrition had shifted in the past several decades from under-nutrition to over-nutrition, however the problem of under-nutrition was still very real and food may still be unevenly distributed in both Japan (Katayama et al. 2013; Matsumura 2001; Ministry of Health Labour and Welfare 2011b) and Australia (Ward et al. 2013).

1.1.3 Life expectancy in Japan and Australia

In terms of the life expectancy, Japan currently has the highest life expectancy in the world, and while the Australian life expectancy is a little lower (Centrol Intelligene Agency 2012; NSW Government & Health Statistics New South Wales 2010), it is regarded as one of the healthiest countries in the world (World Health Organization 2006b; 2007). The World Health Organization's (WHO) Healthy Life Expectancy (HALE), a healthy life expectancy indicator based on the estimates of the number of years to be lived in 'full health' (World Health Organization 2013b), reveals that both Japan and Australia are amongst the leading HALE nations (World Health Organization 2003b; 2010). Japan and Australia represent wide cultural contrasts, but the greatest burden of disability, morbidity and mortality in both countries is known to be due to chronic disease, although the patterns of disease vary (Australian Institute of Health and Welfare 2010; Ministry of Health Labour and Welfare 2011a). It is known that the prevalence and outcomes of chronic diseases are closely linked to diet, lifestyle and environmental influences (Nishida, Shetty & Uauy 2004; World Health Organization 2004). The rates and directions of change in dietary patterns in Japan and Australia have differed even in the past few decades, and it is possible that an examination of the differences in changes within these countries will highlight important lifestyle factors.

1.1.4 Chronic diseases in Japan and Australia

The burden of chronic diseases is rapidly increasing worldwide. Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading causes of mortality in the world, representing 63% of all deaths (World Health Organization 2013a). More people die per year from cardiovascular diseases (CVDs), mainly from heart disease and stroke, than from any other cause. These represent 30% of all global deaths (World Health Organization 2011a), and are projected to remain the single leading cause of death (Mathers & Loncar 2006). Most CVD can be prevented by addressing risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity, high blood pressure, diabetes and raised lipids (World Health Organization 2008a). Obesity and diabetes, both of which are risk factors for CVDs, are also showing worrying trends, not only because they already affect a large proportion of the population, but also because they have started to appear earlier in life (Darnton-Hill, Nishida & James 2004). Because of the changes in dietary and lifestyle patterns, chronic non-communicable diseases – obesity, diabetes mellitus, CVD, hypertension and stroke and various forms of cancer – are increasingly significant causes of disability and premature death (Kearney 2010; Nishida, Shetty & Uauy 2004; Popkin 2006a).

According to the condensed list of causes of death for Japan (Ministry of Health Labour and Welfare 2011a), death rates by cerebrovascular diseases, cancer, and heart diseases appeared in descending order over the period from 1958 to 1980. Between the period of 1981 and 1984, although the list of the top three leading causes of death has not changed, the death rates did. From 1985 until 2010, the death rates again changed in descending order to cancer, heart diseases, and cerebrovascular diseases, except 1995 and 1996 (Ministry of Health Labour and Welfare 2011a). Iso (2011) provided a profile of CVD and the relationships between lifestyle among Japanese adults, and demonstrated that compared with the US and Europe, the higher mortality from stroke and the lower mortality from coronary heart disease constituted a unique cardiovascular profile for Japan. However, the recent trend for the coronary heart disease incidence to increase among urban men is a cause for concern as a potential source of future problems for public health and clinical practice. In Australia, the top 20 specific causes of death were responsible for about 68% of all deaths in 2007 (Australian Institute of Health and Welfare 2010). Coronary heart disease (also known as ischaemic heart disease: heart attack and related disorders) was the leading specific cause of death and accounted for more than one-sixth of all deaths that year. Coronary heart disease causes the largest number of 'lost years' through death among males aged under 75 years. Lung cancer and cerebrovascular disease (notably stroke) were the second and third leading cause of male deaths (Australian Institute of Health and Welfare 2010).

1.1.5 The gender bias in health

A particular sub-group often has its own distinct patterns, and the incidence of many major diseases has a strong gender bias in both countries. Several types of health problems in Australia are distinctly more prevalent in men. For example, compared with females, males experience a range of health inequities including higher rates of diabetes and CVD (Commonwealth of Australia 2010; George, Rosenkranz & Kolt 2013; Malcher 2005). Similar contrasts between genders are observable in Japan. For example, Willcox et al. (2012) found that the age-adjusted risk for each of the top six causes of death in 2005 was found to be two to four times higher in men than in women in Japan.

The situation is of more pressing importance for men in the straightforward sense that many more men than women are at risk of developing weight-related disease (National Men's Health Week 2005 Policy Report 2005). Using the WHO definition, men are significantly more likely to suffer from metabolic syndrome than women. Men also have higher rates of the cancers most commonly associated with obesity (excluding those that only affect women) and are more likely to die earlier in life from heart disease or stroke, conditions that are markedly more common in those who are overweight or obese. Excess weight also causes or exacerbates numerous lesser health problems of varying degrees of seriousness and has recently been associated with a higher risk of dementia in old age. Furthermore, at its present level of prevalence, male overweight and obesity is very damaging to the national economy in terms of years of life lost, working days lost, and in terms of the cost of caring for those affected (National Men's Health Week 2005 Policy Report 2005; Rolls, Fedoroff & Guthrie 1991; WHO Expert Consultation 2004).

Several investigators (Aoun & Johnson 2002; Donovan & Egger 2000; Malcher 2005; Saunders & Peerson 2009; J. A. Smith 2007) pointed out that the underpinnings of men's health are complex and related to issues of male socialisation, the models of masculinity that are adopted by the Australian culture, and other issues pertaining to psycho-social, cultural, economic and geographic imperatives, and these involve broad public health concerns such as health risk behaviour, poor health care service utilization, and general diet and nutrition. Their observations may be universally applicable, and are presumably no less true for Japan.

1.1.6 Obesity as a risk factor for CVD

Obesity is a leading preventable cause of death worldwide with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century (Barness, Opitz & Gilbert-Barness 2007).

Obesity is a predominant nutrition problem in Australia (Organization for Economic Cooperation and Development 2005; Senauer & Gemma 2006). The prevalence of overweight and obesity in Australian men over 18 years (2011-2012) is 70.3% (Australian Bureau of Statistics 2012), with the group most affected being middle-aged men (Australian Government Preventative Health Taskforce 2010). While the prevalence of obesity is less in Japan, the rate of obesity is increasing rapidly (Kitamura et al. 2010; 2008), and 30.3% in men was reported to be obesity (BMI $\geq$ 25 kg/m^2) by the National Nutrition Survey in Japan (Ministry of Health Labour and Welfare 2011b). A study of a middle-aged white-collar employees of the Whitehall II Study from London, Helsinki Health Study, and the Japanese Civil Servants Study has shown the associations with unhealthy food habits, physical inactivity, heavy drinking, smoking, and obesity with middle-aged white-collar employees (Lallukka et al. 2008). Men and women in white-collar occupations [such as professional and technical workers, managers and administrators, etc. (Ruggles & Sobek 1997)] were more likely to report long hours than those in clerical, sales and service occupations or in blue-collar occupations [such as craftsmen, operatives and labourers (Ruggles

& Sobek 1997)] (Shields 1999). For male workers in Japan, obesity was associated with psychological tension and anxiety in their working environment, and higher degrees of stress that negatively affect subjects' diets may contribute to higher rates of obesity (Nishitani & Sakakibara 2007).

1.1.7 The links between diet, obesity, physical activity and CVD

The effect of diet on human health has already been underlined in many studies. For example, population-based surveys and large-scale clinical trials have provided scientific evidence that certain diets, especially those rich in fruits, vegetables, legumes, whole grains, fish and low-fat dairy products, are associated with lower incidence of various chronic diseases, including CVD and cancer (Expert panel on detection 2001; Ganji & Kafai 2003; D. B. Panagiotakos, Pitsavos & Stefanadis 2006). In contrast, abnormal blood lipid (fat) levels have a strong correlation with the risk of coronary artery disease (Huang et al. 2012; H. Kobayashi et al. 2001), and diets high in sodium have an increased risk of hypertension which is a major risk factor for CVD (He & MacGregor 2009; Odermatt 2011). Such 'western-style' diets may increase the risk of CVD (Hu et al. 2000; Kerver et al. 2003; Odermatt 2011). In addition, several other investigators studied diets in relation to obesity as a risk factor in the development of CVD. For example, in the Framingham Study, Hubert et al. (1983) and, Garrison and Castelli (1985) reported that weight gain in the middle and older ages conveyed an increased risk of CVD (Hubert et al. 1983), and overweight non-smoking men had CVD mortality rates that were up to 3.9 times higher compared with those for non-smoking men who were at the desirable weight (Garrison & Castelli 1985). Jousilahti et al. (1996) reported that among Finnish men obesity was an independent risk factor for coronary heart disease mortality in men. Their study also found that a higher cardiovascular mortality was observed at very low BMI, which was possibly related to greater smoking. Hu et al. (2004b) studied the joint associations of physical activity and obesity with the risk of CVD, and found that physical activity had a strong, independent, and inverse association with CVD risk. All obesity indicators predicted the risk of CVD in men, partly through the modification of other risk factors.

1.1.8 Summary of background

Although general knowledge concerning the historical evolution of diet in both Japan and Australia is readily available on an anecdotal basis, extensive systematic data collection did not start in either country until late in the first half of the twentieth century. Consequently, reliable assessments of the nutritional status of the general populations are also comparatively recent developments. This background provides the essential context of this study. Prior to the commencement of this project, there had been no studies undertaken to make a comparison of diet and lifestyle in Japan and Australia in young and middle-aged generations, in health or morbidity particularly relevant to the next generation of the respective male populations.

1.2 AIM

The aim of this thesis is to examine emerging patterns in food, dietary intake and lifestyles and their inter-relationships in young and middle-aged men in Japan and Australia, and explore some of their diet-related health implications.

1.2.1 Objectives

1. To analyse major components of diet and lifestyle using an existing comparative index system; then to compare, contrast and evaluate them with respect to Japanese and Australian men and their respective generations.
2. To analyse the dietary patterns of both countries with respect to their primary dimensions using factor analysis.
3. To discuss the dietary patterns that emerged with respect to their relationships with anthropometric obesity measures, selective nutrients and lifestyle aspects.
4. To make a more critical evaluation of the anthropometric obesity measures with respect to their relationships with lifestyle aspects, selective nutrients and food intake groupings.
5. To discuss the dietary patterns, the anthropometric obesity measures, and their relationships in a cross-cultural and inter-generational context in the background of current health literature.

1.3 Research approach

In most respects the title of this thesis, is self-explanatory. The word, "Changing", is used in the present tense. While history provides an interesting, useful and enlightening background, the essential contribution of this study is not its review of historical changes but its analysis of contemporary ongoing change.

This study generally follows the positivist paradigm with an approach that is exploratory. The timeframe is cross-sectional and the measurement level is quantitative in the prescribed units of the metric system. The perspective is simultaneously inter-generational and cross-cultural, and the assessment of trends is based on an inter-generational comparison of behaviour as distinct from the historical time series approaches.

1.4 Relevance and currency

This study is based on a survey that was completed in the year 2000. As such it naturally raises questions regarding its continuing relevance in the year 2013 and beyond.

- Firstly, the central subject matter of this study, namely food preferences and nutrition intake patterns tend to evolve relatively slowly, unlike trends in technology and communication that are more subject to 'revolution' and rapid change. Established lifestyle habits and ways of thinking tend to be relatively enduring within individuals, as evidenced by the perennial phenomenon of the 'generation gap' where the younger generation tend to be much earlier adopters of the new than the older generation.
- Secondly, the study is concerned with long-term trends by using inter-generational comparisons, which are much less volatile than short-term movements that are more responsive to incidental circumstances.
- Thirdly, as this study is 'inter-generational', the origin of the data is relatively recent compared with the commonly accepted span of a generation difference. The conditional projections are therefore expected to remain valid for some time beyond the date of this report. [In this context, it is noteworthy that the data used in this study is more recent than the latest Australian National Nutrition Survey (1995).]

1.5 SIGNIFICANCE OF THE STUDY

Current evidence suggests that the increasing westernization of Japanese life including eating habits and nutrition intake is leading to morbidity and mortality patterns that are closer to those observed in the Western world (Shimazu et al. 2007). Australia's lifestyle is also evolving, partly due to increasing contact with foreigners particularly from Asia (Wahlqvist 2002). Several studies have been done in nutrition transition focusing on particular nutrients (World Health Organization 2003a) in this context. However, it is difficult to characterize an individual's diet with only a few food items, or to evaluate the quality of the diet using only a few nutrients. It is even more difficult to investigate and compare the changing patterns in different populations that have their own established eating habits with such a limited approach. Following from the background above, it is clear that dietary patterns as an approach to investigating links between diet and disease is important, and that the combination of lifestyle behaviour factors show even stronger relationships with disease than any one factor (Kant 1996; E. Wirfalt et al. 2000). While narrowly focused studies are valuable in their own right, a need has also existed for a more comprehensive simultaneous coverage of the nutrition components that incorporates links with dietary behaviour. This study attempts to provide such coverage by using factor analysis, and compare the populations inter-generationally and cross-culturally. The present study enables a broader assessment of possible changes with implications for public health education and policy in the area of dietary intake.

Few researchers have attempted a systematic study of changing nutrition intake patterns simultaneously across both Western and Asian cultural groups. No study has been done within the area of changing pattern of nutrition focusing on a direct comparison between Japan and Australia, or indeed any Asian and Western country. Neither has any such study incorporated an inter-generational perspective that could allow the changing patterns with future generation to be more clearly identified, nor have they highlighted the cross-cultural similarities and differences. This study undertakes all of these tasks.

A comparison of the two countries across two generations, could give better indications of expected longer-term changes for predicting ongoing changing dietary patterns with associated health outcomes within already highly developed countries. This cross-sectional, inter-generational and cross-cultural study expects to make a contribution to the development of a method to predict such movements.

The index system to evaluate lifestyle offered insights that could be used for developing public health programs to encourage healthy dietary patterns by assessing the four major qualities of diet as well as some of the lifestyles, not only within the same country inter-generationally, but also comparing them cross-culturally. This index may also provide useful information for diet and lifestyle intervention and education programs in determining which areas of diet and lifestyles require improvement.

1.6 Delimitations

1. This study is confined to early-adult and middle-aged men in Japan and Australia. The findings cannot therefore be generalized to women, children, elderly people or other groups.
2. For reasons dictated by the economics of the sampling process, this study was confined to the urban environment in both countries. As the vast majority of Japanese and Australians live and work in an urban setting, the findings may be regarded as representative of adult men in the two countries, but should not be generalized to those living and working in the rural setting.
3. Nutrition is a broad discipline covering all phases of the process. This study is concerned with the intake aspect and issues related to areas such as absorption and retention are beyond the scope of this project.
4. The subjects of health and lifestyle are very broad and it was therefore necessary to limit the scope and context. In this study we focus mainly on the prominent areas of chronic diseases such as CVD and the problem of obesity, particularly with respect to their associated dietary and lifestyle factors.

1.7 Outline of the thesis

The current chapter provided the background to this study leading to its aim and specific objectives. The significance of the study was highlighted, and the principal delimitations were presented.

Chapter 2 reviews the current relevant literature for the thesis, including the anthropometric indicators and health risks, assessing dietary intake, under-reporting, evaluating FFQ data, lifestyle factors, work patterns, dietary patterns and health studies with special emphasis on CVD and/or related risk factors.

Chapter 3 discusses the methods used in this study including the rationale behind the choice of the food frequency questionnaire (FFQ) as the principal survey instrument, the sampling and survey process, and the derivation of nutrition intake are explained. The anthropometric measurements and criteria for the assessment of obesity are given. The formulas and criteria relevant for detecting under-reporting are elucidated. The construction of the comparative lifestyle indices is described. In the derivation of dietary patterns, the calculation process for the energy-adjusted food intake and the procedures for the use of factor analysis are explained. Suitable statistical tests are applied and explained.

Chapter 4 presents the sample representativeness, the subject characteristics and anthropometrics. The nutrition intake information from the samples is compared with the relevant National Nutrition Surveys for assessing the comparability. The demographic information are provided, and the profiles of each of the four sample groups of Japanese Young adult men (JY), Australian Young adult men (AY), Japanese Middle-aged men (JM) and Australian Middle-aged men (AM) are described. The profiles of the mean weight, height, body mass index (BMI), waist circumference (WC) and waist-hip ratio (WHR) are displayed, and discussed inter-generationally and cross-culturally.

Chapter 5 discusses under-reporting. Under-reporting is calculated using energy intake and basal metabolic rate (BMR) for the four population groups and discussed in the context of anthropometric characteristics, food groups and nutrient intakes inter-generationally and cross-culturally. The degree of under-reporting is then considered using the accepted criteria, and discussed.

Chapter 6 presents a lifestyle index. The scores of the lifestyle component indices, including diet quality, physical activity, smoking and alcohol consumption are presented for the Japanese and Australian men, and these are discussed in the context of overall healthfulness, particularly the problem of obesity, inter-generationally and cross-culturally.

Chapter 7 presents the dietary patterns. The chapter begins with a display of the food groupings and an analysis of their comparative mean order in the respective populations as a preliminary. Then the dietary patterns from factor analysis are discussed for each population group inter-generationally and cross-culturally. These patterns are also considered against the anthropometric measurements, nutrients and lifestyle items. The anthropometric measures and their correlations with physical activity, other lifestyles and dietary intakes are contrasted and discussed.

Chapter 8 concludes the report summarizing the outcomes of the study and its contributions to the field. The limitations of the study are reviewed and recommendations are made for further research.

Chapter 2

Literature Review

It is estimated that by 2020 two-thirds of the global burden of disease will be attributable to chronic non-communicable diseases; most of them are strongly associated with diet (Chopra, Galbraith & Darnton-Hill 2002; Wilborn et al. 2005; World Health Organization 2011b; World Health Organization 2013c). This review concerns the appropriate methods of anthropometric measurement, dietary intake measurement and under-reporting, and discusses some of the associated dietary and lifestyle factors that are relevant to chronic diseases, particularly CVD and obesity with emphasis on Japan and Australia.

2.1 ANTHROPOMETRIC INDICATORS AND HEALTH RISKS

Overweight and obesity are associated with numerous medical conditions and are linked with increasing morbidity and mortality (Australian Government Department of Health and Ageing 2005; Chopra, Galbraith & Darnton-Hill 2002; Cockram 2000; Gill 2001; Popkin 2001; Zhai et al. 2009). These include type 2 diabetes, CVD, stroke, and some cancers (Crespo et al. 2002; Gerdts et al. 2013; Todd & Robinson 2003). The BMI (kg/m^2) has been traditionally used as a measure of overweight and obesity, however it does not distinguish between muscle mass and fat mass (Alberti, Zimmet & Shaw 2006; Aronne 2002; Examination Committee of Criteria for 'Obesity Disease' in Japan 2002; Pi-Sunyer 2000). This is an important point to remember when measuring men of different age and ethnic groups. More and more studies are using the WC (M. M. Chen et al. 2001; Dhaliwal et al. 2010; Grievink et al. 2004) and WHR (L. Chen et al. 2007; Dhaliwal et al. 2010; Dhaliwal & Welborn 2009a; Megnien et al. 1999; Welborn & Dhaliwal 2007; Welborn, Dhaliwal & Bennett 2003) as measure of obesity due to their superior ability in predicting cardiovascular mortality and morbidity in obesity control programs (Dhaliwal et al. 2010). However, the cut-off points for all of these measures of obesity may vary between ethnic (Deurenberg-Yap et al. 2001; Deurenberg-Yap et al. 2000; Koster et al. 2008; Lear et al. 2010) and age groups (Wu et al. 2007) due to differences in body composition.

2.1.1 Classification of BMI and associated health risk in general

BMI is typically used to classify overweight and obese adults. Consistent with this, the World Health Organization (WHO) has published international standards for classifying overweight and obesity in adults. Overweight and obesity were defined as BMI ≥ 25.0 kg/m^2 and ≥ 30 kg/m^2, respectively, with extreme obesity defined as BMI ≥ 40 kg/m^2 (Aronne 2002; World Health Organization 2000; World Health Organization 2003a).

Despite the existence of these international standards, some Asian countries have developed their own criteria, thus it is often difficult to make direct comparisons of the prevalence of obesity between countries owing to the inconsistent classifications (International Union of Nutritional Sciences 2002). Japan is an excellent example of this. Based on the WHO classification, the world-wide prevalence of obesity has been found to be less than 5% in Japan. Furthermore, in the USA, for example, there are large differences in the prevalence of obesity between populations of the different ethnic origins within the same country (International Union of Nutritional Sciences 2002). Although the above data showed that Japan had one of the lowest rates of obesity using the WHO criteria, as an Asian population it was particularly susceptible to the health risks of excess adipose tissue and so, the Japanese redefined obesity as BMI greater than 25 (Examination Committee of Criteria for 'Obesity Disease' in Japan 2002). According to Kanazawa et al. (2002), using this redefined Japanese cut-off value, the prevalence of obesity in Japan was then 20%. This represented a threefold increase from 1962 to 2002. Japan’s obesity rate continue to increase (Ministry of Health Labour and Welfare 2006).

2.1.2 BMI as an indicator of CVD risk

Epidemiologic studies commonly use BMI as an indicator of overweight and obesity (Flegal et al. 2009), and it has been found to be consistently associated with an increased risk of CVD (Field et al. 2001; Gelber et al. 2007; Schienkiewitz, Mensink & Scheidt-Nave 2012; K. Tanaka et al. 2001). Field et al. (2001) conducted a 10-year follow-up of middle-aged women aged 30 to 55 years in the Nurses’ Health Study, and men aged 40 to 75 years in the Health Professionals Study in the USA. They assessed the health risks associated with overweight and found that the incidence of hypertension, heart disease and stroke, as well as other conditions increased with degrees of overweight in both men and women. Adults who were overweight but not obese, according to the WHO criteria, had significantly increased risk of developing numerous health conditions including CVD. Gelber et al. (2007) studied the association between excess body weight and the incidence of hypertension in a prospective cohort of over 13,500 initially healthy US male physicians with a 14.5 years follow-up study. They calculated the BMI from self-reported weight and height and defined hypertension as self-reported systolic blood pressure, and found a strong gradient between higher BMI and increased risk of hypertension, even among men within the “normal” and “mildly overweight” BMI range. In German adults, Schienkiewitz, Mensink and Scheidt-Nave (2012) investigated the comorbidity associated with overweight and obesity in a nationally representative sample consisting of 3,450 men and 3,674 women, aged 18 to 79 years. WHO cut-off criteria for BMI were applied using measured values for weight and height. They found that the crude prevalence of persons with cardiometabolic risk factors, diabetes mellitus, CVD and other diseases showed a significant stepwise increase from the lowest to the highest BMI category in both genders. Obese men and women had a three- to four-fold higher chance of having any cardiometabolic risk factor compared with normal weight persons. Overall, these studies showed that BMI was an effective indicator for the risk or presence of chronic diseases including CVD.

2.1.3 The relevance of WC and WHR, and their cut-off criteria

Although BMI provides a simple, convenient measurement of obesity, a more important aspect of obesity is the regional distribution of excess body fat. Mortality and morbidity vary with the distribution of body fat, with the highest risk linked to excessive visceral fat (referred to as central obesity) (Lear et al. 2010). Visceral fat is that fat which surrounds the visceral organs, and its products drain into the portal circulation and hence influence the liver (Item & Konrad 2012). Central obesity, measured by WC, has been found to relate to a number of diseases, including CVD, in a group of second-generation Japanese-American men in the USA (Fujimoto et al. 1999) and Japanese in Japan (Yoshida et al. 2009) and to all-cause mortality in the US (Kuk et al. 2006) and in Canada (Staiano et al. 2012). The importance of central obesity is clear in populations which tend to have relatively low BMIs but high levels of abdominal fat (e.g. Asian), and are particularly prone to hypertension and coronary heart disease (CHD) (International Union of Nutritional Sciences 2002; Pischon et al. 2008; World Health Organization 2008b; Yusuf et al. 2005).

The cut-off values for the WC, measured at midway between the lowest rib and the iliac crest, were initially used in predominantly white populations (T. S. Han et al. 1995; 1996). These were based on a single study from the Netherlands which had attempted to find some validity for the use of a simple measure of WC that corresponded to BMIs of 25 and 30 (T. S. Han et al. 1995). This study was based on a random sample of 2,183 men and 2,698 women aged 20-59 years, and the recommended cut-off points for men were 94 cm for increased risk, and 102 cm for substantially increased risk of CVD. Grol et al. (1997) were the first to explore the cut-off points in an ethnically mixed population (predominantly of west African/European descent) through the Curaçao Health Study (Grievink et al. 2004). Their study was intended to report the prevalence of obesity, abdominal fatness and WC in different socioeconomic classes in Curaçao, where a melting pot of different nationalities and cultures of African, Hispanic, Jewish, Portuguese and Dutch origins are frequently seen. The participants were 2,248 persons (964 men and 1,284 women) aged ≥ 18 years. In their study, obesity was defined according to the WHO standards of BMI ≥ 30 (World Health Organization 1995), and WC was measured at the same site as above. Since there were no validated cut-off points for the WC in non-white populations available, the cut-off points in their study were determined at 100 cm for men and 91 cm for women. These cut-off points were identified through the plotting of the sensitivity and specificity of the WC with the BMI as the Golden Standard. The mark where the sum of the sensitivity and specificity was the highest, was chosen as the most adequate cut-off point.

WHR is currently viewed as an index of the relative accumulation of abdominal fat (Alberti, Zimmet & Shaw 2006). Initially, HC was measured at the level of the great trochanters. Han et al. (1995) used 0.95 for men and 0.80 for women as relevant cut-off points for WHR. A WC exceeding 94 cm in men and 80 cm in women correctly identified subjects with BMI of ≥ 25 and WHR ≥ 0.95 in men and ≥ 0.80 in women with a sensitivity and specificity of ≥ 96%. Grol et al. (1997) analyzed the association between obesity (BMI ≥ 30), abdominal fatness (WHR ≥ 0.95 for men, WHR ≥ 0.80 for women) waist circumference (WC ≥ 100 cm for men, WC ≥ 91 cm for women) and socioeconomic status (SES) by six age-categories. Their results showed that compared with women of higher SES, the lower SES women had two to three times higher risk of BMI, WHR and WC. However there was no statistically significant difference between any increase in BMI, WHR or WC for different SES factors among men. The overlap between the three measures was greater in men (73%) than in women (56%).

The report of the WHO Expert Consultation on Obesity (World Health Organization 2000) indicated a "need to develop gender-specific WC cut-off points appropriate for different populations". However, to date, little data existed, namely the data of Han et al. (1995) and Grol et al. (1997).

Examination Committee of Criteria for 'Obesity Disease' in Japan (2002) attempted to establish adequate criteria for categorizing 'obesity disease' in Japan in relation to obesity-related complications including hyperglycemia, dyslipidemia, and hypertension. The subjects were 1,193 Japanese (775 men, 418 women; aged 20-84 years, and BMI: 14.9-56.4 kg/m^2). According to their results, measured WC had the closest relationship with visceral fat area (VFA), determined by computed tomography (CT) in men (r=0.68). The data suggested that obesity was adequately specified as a BMI ≥25 in Japan where the prevalence and degree of obesity remains mild. According to these authors, it was reasonable to establish the cut-off point of VFA at 100 cm^2 as indicative of the risk of obesity-related disorders, and a WC of 85 cm in men approximates to this visceral fat mass.

In 2008, the WHO recommended cut-off points for men were 94 cm for increased risk, and 102 cm for substantially increased risk (from the study of Han et al. (1995)) (World Health Organization 2008b). The WHO recommend the measurement of WC as 'at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest', (similar to that used by Han et al. (1995)). The WHO recommended the HC as 'around the widest portion of the buttocks' (similar to that used by Han et al. (1995)). Using these two sites the WHR cut-off for abdominal obesity was defined as 0.90 for males (World Health Organization 2008b).

2.1.4 Other measurement sites for WC and HC

Despite the WHO definitions for the measurement of WC and HC, many researchers have used other sites.

WC1 (WHO): midway between the lowest rib and iliac crest,
WC2: narrowest point of the waist,
WC3: umbilical level,
WC4: immediately above the iliac crest,
WC5: immediately below the lowest rib.

HC1 (WHO): around the widest portion of the buttocks,
HC2: symphysis pubis at the maximum protrusion of the hips.

2.1.5 Studies of WC and risk of CVD in Japan and Australia

Central obesity (or abdominal obesity) measured by WC has been repeatedly shown to be associated with health risks including CVD in a number of studies. Table 2.1 summarizes the studies below investigating the relationship between WC and the risk of CVD in Japan and Australia. The specific measurement site for WC (refer to *'2.1.4 Other measurement sites for WC and HC'*) is indicated in the Table.

In Japan, the WC cut-off value in diagnostic criteria for metabolic syndrome (MetS) was adopted as 85 cm for males and 90 cm for females which correspond to 100 cm^2 of intraperitoneal visceral fat in a cross section at the height of the navel as revealed by CT (Examination Committee for Metabolic Syndrome 2005). In contrast, the International Diabetes Federation (IDF) has adopted as its diagnostic criteria for Asians a WC cut-off value of 90 cm for males and 80 cm for females, but for Japanese, it has taken the values indicated by the Japanese Society of Internal Medicine – 85 cm for males and 90 cm for females (Alberti, Zimmet & Shaw 2006). However, there have been very few epidemiological studies in Japan on the prevalence of MetS using these Japanese criteria for assessing these cut-off values (Nishimura et al. 2007). Nishimura et al. (2007) (Table 2.1 (3)) examined the prevalence of the components of MetS. They also assessed the validity of the WC (WC3) cut-off value. The optimal WC cut-off value for male subjects, who fulfilled at least two of high blood pressure (HBP), dyslipidemia (DLP) or high fasting blood glucose (HFG), estimated from the receiver operating characteristic curve was found to be 85 cm.

Table 2.1 Studies investigating the relationship between WC and the risk of CVD in Japan and Australia

	Authors	Year	CVD risk factors	Country	Population & measure
1.1	Welborn, Dhaliwal & Bennett (Australian Risk Factor Prevalence Survey)	2003	- BMI - WHR - blood pressure - fasting serum lipid levels - smoking - history of heart disease or diabetes - waist-to-stature ratio	Australia	4508 M; 4698 F aged 20-69 y **WC2**
1.2	Welborn & Dhaliwal	2007	- (same as 1.1 above)	(as above)	(same as 1.1 above)
2	Cameron et al. (AusDiab)	2003	- BMI	Australia	5049 M; 6198 F aged ≥25 y **WC1 (WHO)**
3	Nishimura et al.	2007	- obesity - high blood pressure - dyslipidemia - glucose intolerance	Japan	955 M; 1158 F aged ≥20 y **WC3**
4	Yoshida et al.	2009	- high blood pressure - elevated non-HDL cholesterol - low HDL cholesterol - elevated hemoglobin A_{1c}	Japan	3758 M; 4517 F aged 50-74 y **WC3**
5	Satoh et al.	2010	- high blood pressure - dyslipidemia - glucose intolerance	Japan	4599 M; 1434 F aged 40-59 y **WC3**
6	Suka et al.	2011	- hypertension - hyperglycemia - dyslipidemia	Japan	37792 M; 19349 F aged 20-65 y **WC3**

M = Male; F = Female.
Abbreviations: CVD, cardiovascular disease; BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio.

Yoshida et al. (2009) (Table 2.1 (4)) used the measured WC (WC3) with the subject in a standing position, and found that it was strongly and positively associated with the prevalence odds ratios of each of the cardiovascular risk factors measured. Having two or more of these factors, and the optimal value of WC predicting cardiovascular risk factors was 85 cm for both men and women. Satoh et al. (2010) (Table 2.1 (5)) measured the WC (WC3) in Japanese middle-aged subjects. They found that a cut-off value of WC to predict the presence of multiple metabolic risk factors (two or more) was 86 cm in men. This difference may have arisen from the use of different age and geographical locations.

Suka et al. (2011) (Table 2.1 (6)) used the measured WC (WC3), and a clustering of cardiovascular risk factors (subjects who had any two of the three components of MetS) was in 16.0% of men, and high WC was associated with the increased risk of clustering of cardiovascular risk factors independent of BMI. These Japanese studies above show the association between WC and CVD or related health risk.

In Australia, Cameron et al. (2003) (Table 2.1 (2)) measured the prevalence of obesity, and examined the associations between obesity and socioeconomic and lifestyle factors in Australian Diabetes, Obesity and Lifestyle Study (Aus-Diab). WC (WC1 (WHO)) was measured, and the mean of the two closest measurements was calculated. Men with a WC of 94.0 - 101.9 cm, and WC of ≥ 102.0 cm, were classified as overweight, and obese, respectively. The authors found that the prevalence of overweight and obesity defined by WC of ≥ 94.0 cm in men was almost 60%, 2.5 times higher than in 1980. Using the cut-off values of 94 cm in men indicated an obesity-associated health risk including CVD.

2.1.6 Studies of WHR and risk of CVD in Japan and Australia

Several studies investigated the value of using WHR with BMI and/or WC for related health risk. There was a clear association between either the WC or the WHR and glucose abnormalities and coronary risk factors (Iso et al. 1991), glucose intolerance and obesity (Sekikawa et al. 1999), obesity and fat distribution (Ito et al. 2001), metabolic abnormalities and atherosclerosis (Takami et al. 2001), CVD and CHD mortality (Welborn, Dhaliwal & Bennett 2003), and all cause and CVD mortality (Welborn & Dhaliwal 2007). Table 2.2 summarizes the studies below investigating the relationship between WHR and the risk of CVD in Japan and Australia. The specific measurement site for WC and HC (refer to *'2.1.4 Other measurement sites for WC and HC'*) are indicated in the Table.

Lear et al. (2010) reviewed the cross-sectional literature regarding ethnic differences in body composition and the appropriateness of ethnic-specific WC and WHR cut-off values in various ethnic groups. Although a total of 10 studies investigated specific WC cut-off values in these populations, no studies in this review reported cut-off values of WHR for Japanese men. However, Iso et al. (1991) (Table 2.2 (1)) studied the relation of body fat distribution and body mass with abnormalities of glucose metabolism and coronary risk factors in Japan. Body fat distribution was measured by the WHR (WC3 & HC2). Body mass was estimated by Quetelet index

Table 2.2 Studies investigating the relationship between WHR and the risk of CVD in Japan and Australia

	Authors	Year	CVD risk factors	Country	Population & measure
1	Iso et al.	1991	- BMI - serum haemoglobin A_{1c} - blood pressure - blood lipids	Japan	874 M aged 40-59 y **WC3** **HC2**
2	Sekikawa et al.	1999	- BMI - diabetes - glucose intolerance	Japan	599 M; 809 F aged ≥45 y **WC3** **HC1 (WHO)**
3	Ito et al.	2001	- HC - BMI - fat mass - percentage fat mass - lean mass - bone mineral content - bone mineral density	Japan	625 M; 1786 F aged 20-79 y **WC2** **HC1 (WHO)**
4	Takami et al.	2001	- BMI - abdominal subcutaneous fat - intra-abdominal fat - carotid intimal-medial thickness	Japan	849 M aged 20-78 y **WC3** **HC1 (WHO)**
5.1	Welborn, Dhaliwal & Bennett (Australian Risk Factor Prevalence Survey)	2003	- BMI - blood pressure - fasting serum lipid levels - smoking - history of heart disease or diabetes	Australia	4508 M; 4698 F aged 20-69 y **WC2** **HC1 (WHO)**
5.2	Welborn & Dhaliwal	2007	- (same as 5.1 above)	(as above)	(same as 5.1 above)

M = Male; F = Female.
Abbreviations: CVD, cardiovascular disease; BMI, body mass index; WC, waist circumference; HC, hip circumference; WHR, waist-to-hip ratio.

(now referred to as BMI). They found that both WHR and BMI were positively associated with blood pressure and serum total cholesterol, and inversely associated with HDL-cholesterol. The associations of WHR with blood pressure and blood lipids were significant after controlling for BMI. Therefore, the WHR was a correlate of both glucose abnormalities and known coronary risk factors in urban Japanese men even when body mass was controlled for. Sekikawa et al. (1999) (Table 2.2 (2)) also examined the association of BMI and WHR (WC3 & HC1 (WHO)) with glucose intolerance among Japanese adults. BMI and WHR were independently associated with impaired glucose tolerance (IGT) and diabetes (DM) in both men and women, suggesting that WHR plays an important role for developing DM independent of BMI. In their study, they also showed the mean WHR for age 45-64 years to be 0.90 (± 0.05). In addition, Ito et al. (2001) (Table 2.2 (3)) studied the relation between age and body composition, particularly fat mass (FM) and lean mass (LM) in healthy Japanese adults. They also reported the mean measured WHR (WC2 & HC1 (WHO)). According to their results, in males, the values of BMI, WC, HC and WHR showed parabolic trends: the values were larger for the older age groups within the younger generations (20-29 years) but smaller in the older generations (40-59 years). In their forties and fifties, the curvilinear relations were seen for the variables associated with adiposity. They also showed the mean values of their samples of Japanese men age 20-29 years (n=140) and age 40-59 years (n=167), were 0.82 (± 0.05) and 0.90 (± 0.05), respectively. Takami et al. (2001) (Table 2.2 (4)) studied the relationship of body fatness and abdominal fat distribution, measured by direct methods, to carotid intimal-medial thickness (IMT) and to metabolic cardiovascular risk factors. They found that BMI, WC, WHR (WC3 & HC1 (WHO)), abdominal subcutaneous fat area (ASF), and intra-abdominal fat area (IAF) were all correlated with carotid IMT, and WHR retained a significant correlation with IMT. WHR and also BMI, were simple and better clinical predictors for carotid atherosclerosis versus IAF.

Australian investigators have also studied WHR in relation to health risk. Welborn, Dhaliwal and Bennett (2003) (Table 2.2 (5.1)) showed that for a given WHR increasing death rates of CHD appeared to occur with a WHR (WC2 & HC1 (WHO)) over 0.90 in men. Of the modifiable risk factors, obesity, as measured by WHR, was a dominant, independent, predictive variable for CVD and CHD deaths in Australian men, and suggested that obesity assessed by WHR was a better predictor of CVD and CHD mortality than WC, which, in turn, was a better predictor than BMI. In another 11-year mortality follow-up by Welborn and Dhaliwal (2007) (Table 2.2 (5.2)), it was again found that WHR (WC2 & HC1 (WHO)) was the preferred clinical measure of obesity for predicting all-cause and CVD mortality. This data was matched with the national death index, and used age-standardized Cox regression analysis to predicts all-cause mortality and CVD mortality. A 15-year follow-up (1989 to 2004) involved linking the baseline data with the National Death Index to determine the causes of death for the subjects who had died by 2004 (Dhaliwal & Welborn 2009a); there were 346 deaths due to all causes, 88 deaths due to CVD, and 64 deaths due to CHD. Their study confirmed that WHR and to a lesser extent WC, but not BMI, were significant predictors of CHD and CVD deaths.

2.1.7 Comparison of the usefulness of BMI, WC and WHR in predicting the risk for CVD

The usefulness of BMI

Tanaka et al. (2001) investigated the relationship between obesity and body-fat distribution, and angiographically-defined coronary atherosclerosis with 320 Japanese male (median age, 59 years) and 212 female patients. BMI and the WHR were used as the main exposure variables. Weight and height measurements were obtained from medical records. WC and HC were measured by nurses. Among male patients, BMI was progressively higher with an increasing number of vessels involved, and the positive association was more pronounced for younger patients. Their results suggested that BMI was predictive of coronary stenosis among male patients.

The usefulness of WC

WC has been found to be more useful than BMI. For example, Chan (2003) determined whether WC, WHR or BMI was the best predictor of intraperitoneal and posterior subcutaneous abdominal adipose tissue mass in 59 free-living Caucasian men in Australia. Weight, height, WC and HC were all measured, and both BMI and WHR were calculated. In univariate regression analysis, WC, WHR and BMI were all significantly and positively correlated (all $p<0.05$) with total adipose tissue as IPATM (Intraperitoneal - Anthropometric, biochemical and adipose tissue mass (ATM)), RPATM (Retroperitoneal ATM), ASAATM (Subcutaneous anterior ATM) and PSAATM (Subcutaneous posterior ATM). To assess the relative strength of these associations, they used non-nested regression models. There was no significant difference between WC and WHR in predicting IPATM and RPATM; WC was a stronger predictor of ASAATM ($p<0.001$) and PSAATM ($p<0.001$) than WHR; WC was also a stronger predictor of IPATM ($P=0.042$) and RPATM ($p=0.045$) than BMI, but the relative strengths of WC and BMI in predicting ASSATM and PSAATM did not different significantly ($p>0.05$); there was no significant difference between BMI and WHR in predicting IPATM and RPATM ($p>0.05$), but BMI was a stronger predictor of ASAATM ($P=0.036$) and PSAATM ($p<0.001$) than WHR. They suggested that their results confirmed the importance of the WC as a surrogate marker of the distribution of adiposity in the abdominal region in men. Accordingly, they proposed that WC was probably the most convenient and reliable clinical measure of abdominal fat compartments.

Shibuya, Kamizato and Tauchi (2005) studied the relationship between WC and BMI, and the relationships with diet and daily life including skipping breakfast, eat snacks between meals, sleeping hours, physical activities, smoking habits, alcohol beverage consumption, eat supper after 9:00pm, based on the study by Belloc and Breslow (1972), using 213 Japanese males aged over 35 years with a self-administered questionnaire. They used previously obtained BMI information, using the criteria of the Examination Committee of Criteria for 'Obesity Disease' in Japan (2002), but they measured WC at this time as it had not been previously recorded. Their result of multivariate logistic regression analysis revealed that the subjects who had a disease (Odd Ratio: 2.10, p=0.046), or an abnormal blood test (OR: 3.54, p=0.009) had a significantly larger WC, and concluded that WC could be a better index than BMI.

Zhu et al. (2005) studied race-ethnicity-specific WC cutoffs for non-Hispanic blacks (blacks), Mexican Americans (MA), and non-Hispanic whites (whites), linking WC values to established BMI cutoffs with equivalent risk of CVD risk factors in the US population of 5,313 men and 25,656 women, subjects aged ≥ 20 years. Weight, height and circumference were all measured (U.S. Department of Health & Human Services 2009). They found that correlations between WC and lipid profiles, blood pressure, and glucose were significantly higher than those between BMI and these same variables in all groups. The WC cutoffs were approximately 5-6 cm greater for white than for black men at BMIs between 25 and 40, and those for MA were intermediate. Simplified WC cutoffs corresponding to BMIs of 25 and 30, largely independent of age, for the three race-ethnicity groups were 89 and 101 cm, respectively for men. Minimal distances in receiver operating characteristic curves tended to be shorter when WC cut-offs rather than BMI cutoffs were used. They suggested that WC was a better indicator of CVD risk than is BMI in the three race-ethnicity groups studied. The proposed WC cut-offs were more sensitive than were BMI cut-offs in predicting CVD risk.

The usefulness of WHR

In Japan, several studies provided evidence for the superior value of WHR compared with WC and BMI for predicting CVD risk factors. For example, Ito et al. (2003) determined the cut-off points of indices of obesity for detecting hypertension, dyslipidemia and diabetes mellitus for 768 males and 1,960 females Japanese aged 20-79 years. Height, body weight, WC and HC were measured and the WHR and BMI were calculated. Percentage fat mass (%FM), trunk fat mass (FM(trunk)) and trunk-fat-mass to leg-fat-mass ratio (FM(trunk)/FM(legs)) were obtained by dual-energy X-ray absorptiometry (DXA). Cardiovascular risk factors studied were blood pressure, serum lipids, fasting blood glucose and hemoglobin A (1c). Their results showed that the cut-off points of BMI, WC and WHR were around 23.5 kg/m^2, 84 cm and 0.9, and the cut-off points of %FM, FM(trunk) and FM(trunk)/FM(legs) were around 24%, 8 kg and 1.6 for males. Indices of fat distribution detected the cardiovascular risk factors more accurately than those of overall adiposity. The accuracy of detecting the risk factors was comparable between the anthropometric indices and indices obtained by DXA. Ito et al. (2003) found that WHR and FM(trunk)/FM(legs) most accurately detected the risk factors.

Nakamura et al. (2007) examined the relationship between BMI, WC and WHR, and metabolic risk factors in a community-based population in Japan for 759 men and 1,255 women aged between 30 and 79 years, without histories of stroke or coronary heart diseases that were dichotomized at the medians of BMI-WHR, WC-WHR and BMI-WC. WC was measured over the unclothed abdomen at the level of the umbilicus, and HC was measured over a light undergarment at the level of the widest diameter around the buttocks. Both measurements were taken by the same person, each measurement was performed in triplicate and the average value was used to calculate the WC and HC. The authors examined the accumulation of the four metabolic risk factors: high blood pressure, high triglycerides, low high-density lipoprotein-cholesterol and impaired glucose tolerance. BMI and WC correlated well in both men (r=0.871) and women (r=0.874). All three obesity measures related with the metabolic risk factors, and the area under the receiver-operating characteristic curve for BMI, WC and WHR to predict the risk for men was 0.683, 0.709, and 0.700, respectively, and 0.715, 0.739, and 0.746, respectively, for women. They suggested that BMI may be used instead of WC if the latter is not available. When WC is measured, HC also should be measured because the WHR may be the most valuable measure of obesity.

In Australia, two population studies provided evidence for the superior value of WHR compared with WC and BMI for predicting CVD risk factors. The more recent one, the AusDiab study began in 1999 (Cameron et al. 2008) with a baseline study of 11,247 Australian adults at least 25 years of age, and included three measures of obesity: BMI, WC and WHR. Dalton et al. (2003) further found that the prevalence of obesity amongst Australian adults defined by BMI, WC and WHR was 20.8, 30.5 and 15.8%, respectively. Amongst those who were obese in each of these measures, the prevalence of each of the CVD risk factors, namely, type 2 diabetes, hypertension and dyslipidaemia in both male and female subjects was highest when WHR was used to define obesity.

In a 15 years follow-up, Dhaliwal and Welborn (2009a) confirmed that WHR and to a lesser extent WC, but not BMI, were significant predictors of CHD and CVD deaths. This database also allowed analysis relating to ethnicity. Dhaliwal and Welborn (2009b) found that WHR provides a superior measure of central obesity with low measurement error, high precision, and no bias over this range of ethnic groups.

Other studies have also considered the association between WHR with CVD risk in different ethnic groups. Yusuf et al. (2005), for example, recruited participants from 262 centres in 52 countries in Asia, Europe, the Middle East, Africa, Australia, North America, and South America. They found that WHR showed a graded and highly significant association with myocardial infarction risk worldwide, and that redefining obesity based on the WHR instead of BMI increases the accuracy estimate attributable to obesity in most ethnic groups. See et al. (2007) evaluated the different measures of obesity and the prevalence of atherosclerosis in a multiethnic (white, black, hispanic and other) population-based study of 6,101 adult subjects between the ages of 18 and 65 years, and discovered that WHR was independently associated with the prevalence of atherosclerosis, and provided better discrimination than either BMI or WC. The associations between obesity measurements and atherosclerosis mirror those observed between obesity and cardiovascular mortality, suggesting that obesity contributes to cardiovascular mortality via the increased atherosclerotic burden (See et al. 2007).

In a similar way, De Koning et al. (2007) performed a systematic review and meta-regression analysis of all available prospective cohort studies and randomized clinical trials of CVD that measured WC or WHR, and found that WHR and WC were significantly associated with the risk of incident CVD events, and suggested that WHR was more strongly associated with CVD than that for WC. Most recently, 11,140 men and women were followed for a mean of 4.8 years in a prospective cohort study by Czernichow et al. (2011). They studied the strength of associations and discrimination capability of BMI, WC and WHR with CVD risk, and showed that WHR was the best predictor compared with BMI and WC. They analyzed the strength of associations and discrimination capability of BMI, WC and WHR with CVD risk in individuals with type 2 diabetes, and found that WHR was the best predictor of cardiovascular events and mortality, and BMI the worst. Thus, there is evidence from several large studies that WHR is a superior measure of obesity in terms of predicting CVD risk.

2.1.8 Comparing the self-reported BMI and measured BMI in Japan and Australia

Despite BMI being the least useful predictor of CVD events and mortality, the use of self-reported weight and height for the estimation of BMI is still a favored measure of obesity as it can to be collected with little effort and at low cost (Dhaliwal et al. 2010; Gorber et al. 2007), and the procedure for measuring weight and height has been standardized for some time (Dhaliwal et al. 2010). The use of self-reported BMI in the Japan Public Health Center (JPHC) study was validated by Tsugane, Sasaki and Tsubono (2002). The JPHC Study Cohort 1 was a population-based prospective study in four public health center areas between 1990 and 1999. In 1990 a self-administered questionnaire including height (cm) and weight (kg), was distributed to all residents. Height and weight data from health check-ups were also available for the 5,575 and 9,736 men and women, respectively. The self-reported BMI in men (mean=23.45 kg/m^2) was slightly lower than the measured BMI (mean=23.54 kg/m^2), and the Spearman correlation coefficient was 0.89. A similar study was conducted in Australia by Dhaliwal et al. (2010) of community-based obesity control programs. They studied the adequacy of self-reported weight and height as indicators for BMI based on the data of 6,979 Australian adults, and found that the prevalence of obesity and overweight were lower using self-reported values. Self-reported height and weight values resulted in greater underestimates of BMI in women compared to men, and in older than younger subjects.

2.1.9 The validity of self-reported WC

Self-reported WC has been shown to have reasonable reliability (Rimm et al. 1990). Rimm et al. (1990) asked participants to measure their waist at the umbilicus and their hips at the largest circumference between their waist and thighs. These authors quantified the measurement error from self-reporting of waist, hip, and weight measurements in both male and female members of two large prospective studies (51,529 men, 40 to 75 years of age, from the Health Professionals Follow-up Study; and 121,700 women, 30 to 55 years of age, from the Nurses' Health Study), and compared the self-reported measurements from a mailed questionnaire from a population of 123 men, 40 to 75 years of age, and 140 women, 41 to 66 years of age, with two separate standardized measurements made by trained technicians. They found that Pearson correlations between self-reported WC and the average of two technician-measured WC were 0.95 for men. The corresponding correlations were 0.88 for hip measurements and 0.69 for WHR. The self-reported and measured weights were also highly correlated as 0.97. Therefore, the self-reported waist, hip, and weight measurements for men appear reasonably valid. A study by Spencer, Roddam and Key (2004) also investigated the accuracy of self-reported and self-measured waist and hip circumferences by comparing the measured waist and hip circumferences in a sample of middle-aged men (1,588) and women (2,904) aged 35-76 years in the Oxford cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford). No instructions were given to the participants as to how to take the waist and hip measurements. They found that self-reported waist measurements were sufficiently accurate for identifying relationships in epidemiological studies, although waist was underestimated and the extent of underestimation was greater in participants with larger waists and older participants. Dekkers et al. (2008) also evaluated the accuracy of self-reported weight, height and WC among a Dutch overweight working population, and investigated the extent to which the accuracy was moderated by gender, age, BMI, socio-economic status and health-related factors. The results of this study suggest that self-reported BMI and WC were satisfactorily accurate for the assessment of the prevalence of overweight or obesity in an overweight working population. However, the individual self-reporting of body weight and height was less accurate, especially in heavier, less tall, low socio-economic status and non-smoking subjects, and the self-reporting of WC was especially less accurate in males, younger subjects and subjects with a lower measured WC.

2.1.10 Different sites of measurements in WC and health risk

Several studies examined whether WC differs across measurement sites (refer to Table 2.3), and whether there was any relationship between the specific site and the prevalence of health risk (J. Wang et al. 2003; Willis et al. 2007). The specific measurement sites for WC were indicated.

Table 2.3 Comparison of outcomes using different measurement sites for WC

	Author	Year	Measurement sites*	Subjects	Outcomes
1	Wang et al.	2003	WC1 (WHO), WC2, WC4 & WC5	49 M (7-83 y) 62 F (7-83 y)	WC values were significantly correlated with fatness; correlations with total body and trunk adiposity in a gender-dependent manner.
2	Willis et al.	2007	WC2 & WC3	134 M (40-65 y) 132 F (40-65 y)	Minimal waist was significantly correlated with MS in men and and umbilical waist was not. For both genders, minimal waist was more highly correlated with visceral adipose tissue than umbilical waist.
3	Mason and Katzmarzyk	2009	WC1 (WHO), WC2, WC3 & WC4	223 M (20-67 y) 319 F (20-67 y)	No significant differences between the sites in men, and measurement site had an influence on the apparent prevalence of abdominal obesity from 23 to34% in men.
4	Matsushita et al.	2010	WC1 (WHO), WC2, WC3 & WC4	969 M (20-70 y) 171 F (20-70 y)	The four measurements had similar screening abilities. If the same WC cut-off value were applied, the prevalence of the MetS changed considerably according to the site of the WC measurement.

MS/MetS = Metabolic Syndrome; SFFQ = semi-quantitative FFQ

** WC1 (WHO) = midway between the lowest rib and iliac crest; WC2 = narrowest point of the waist; WC3 = umbilical level; WC4 = immediately above the iliac crest; WC5 = immediately below the lowest rib.*

A series of four measurements in the study by Mason and Katzmarzyk (2009) in Canada, were taken from the right side at the anatomical locations by a single, trained researcher (Table 2.3 (3)). They studied whether the magnitude of WC measurement differs systematically across four sites of measurement, and to quantify the influence of measurement site on prevalence estimates of abdominal obesity and on the reproducibility of the measures. Their results indicated that there were no significant differences between the four measurement sites in men in respect to identifying obesity, and the measurement site had an influence on the apparent prevalence of abdominal obesity ranging from 23% to 34% in men. The reproducibility of WC was high at all sites and was comparable across levels of BMI. In the study by Matsushita et al. (2010) in Japan (Table 2.3 (4)), each WC site was measured once by trained researchers and laboratory technicians. Their study indicated that the four WC measurements had similar screening abilities, but if the same WC cut-off value were applied, the prevalence of the metabolic syndrome changed considerably according to the site of the WC measurement. Given the differences in the WC values according to the site of measurement, WC must be measured at the site specified by each diagnostic guideline.

Waist circumference was measured at all four sites by one experienced observer, while the measurements were transcribed on a data form by a second observer, in the study of Wang et al. (2003) in the USA (Table 2.3 (1)). Repeat measurements were performed after one set of anthropometric measurements was completed. Their findings indicated that WC values at the four anatomic sites differ in magnitude depending on gender, were highly reproducible, and were correlated with body fat mass in a gender-dependent manner. WC measured immediately above the iliac crest has a higher correlation with total body fat than the WC values measured at the other three sites. The four WC measurement sites were not interchangeable, and between-study comparisons were valid only if the same measurement site was used in both studies. In the study by Willis et al. (2007) in the US, WC was measured (Table 2.3 (2)), and each measure was conducted once at each waist location before a second measure was conducted; the average was presented in this data. A third check of the WC measure was conducted when the first two attempts were greater than 0.7 cm apart. Their results showed that in men, minimal waist had a higher correlation coefficient than umbilical waist for insulin sensitivity, fasting insulin and visceral adipose tissue. Additionally, minimal waist was significantly correlated with metabolic syndrome in men and umbilical waist was not. For both genders, minimal waist was more highly correlated with visceral adipose tissue than umbilical waist. The data indicated that WC location is important when determining CVD risk, although the data were less compelling in men than women.

The variability in between-site differences for WC reported across the diverse populations suggests that these differences may themselves vary according to the characteristics of the sample, including age, gender, race/ethnicity, and level of adiposity (Lear et al. 2010; Mason & Katzmarzyk 2009; Matsushita et al. 2010).

These studies clearly show that the site of the measurement of the waist and the specific associated instructions about these measurements, do significantly affect the identification of the prevalence of the CVD and related health risk in men, although some were based on a cross-sectional view and others were limited to a small sample size. There is a need for large-scale studies whereby differences between genders, age categories and ethnic groups can be tested, to confirm these results more strongly and effectively.

2.2 ASSESSING DIETARY INTAKE

In the study of nutrition and health, many different methods have been used to assess dietary intake, namely; dietary records, 24-hour dietary recall, diet history and food frequency. The relative advantages and disadvantages of each dietary recording method are discussed in Thompson and Subar (2001).

2.2.1 Dietary records

For the dietary record approach, the respondent records the foods, the beverages and the amounts of each consumed over a period of days. This method has the potential for providing quantitatively accurate information on food consumed during the recording period (Rosalind. S. Gibson 2005). By recording foods as they are consumed, the problem of omission is lessened and the foods are described more fully (F. E. Thompson & Subar 2001). However, there are also a number of disadvantages in this method. For example, the respondent must be trained in the level of detail needed to describe adequately the foods and amounts consumed, and at the end of the recording period it should be reviewed by a trained interviewer (F. E. Thompson & Subar 2001). The practical and economic implications can also limit the usefulness of these methods in studies involving large numbers of people (Wheeler, Rutishauser & O'Dea 1995; W. Willett 1998) . In addition, several studies indicate that usual dietary intake as reported on diet records may be seriously underestimated (Goris, Westerterp-Plantenga & Westerterp 2000; Hill & Davies 2001; Trabulsi & Schoeller 2001). Under-reporting on food records is probably a result of the combined effects of incomplete recording and the impact of the recording process on dietary choices leading to undereating (Goris, Westerterp-Plantenga & Westerterp 2000). The highest levels of under-reporting on food records have been found among individuals with higher BMI (Black et al. 1993; Lichtman et al. 1992; Pryer et al. 1997). Other research showed that demographic or psychological indices such as socio-economic status, social desirability or dietary restraint may also be important factors related to under-reporting on diet records in men (Hebert et al. 1995; Hirvonen et al. 1997; Lafay et al. 1997; Rennie, Siervo & Jebb 2006; Stallone et al. 1997).

2.2.2 Twenty-four-hour dietary recall

For the 24-hour dietary recall, the respondent either self-reports or is asked (preferred option) to remember and report all the foods and beverages consumed in the preceding 24-hours or in the preceding day. Well-trained interviewers (nutritionists/dietitians or non-nutritionists who have been trained) are crucial in administering a 24-hour recall because much of the dietary information is collected by asking probing questions. An interviewer administers the tool and records the responses, therefore literacy of the respondent is not required. Furthermore, because of the immediacy of the recall period, respondents are generally able to recall most of their dietary intakes (F. E. Thompson & Subar 2001). In previous national dietary surveys using multiple-pass methods (Automated Multiple-Pass Method (AMPM), a computerized method for collecting interviewer-administered 24-hour dietary recalls either in person or by telephone was used. This research-based, multiple-pass approach employed five steps designed to enhance complete and accurate food recall and reduce respondent burden. The method used in ***What We Eat in America***, the dietary interview component of the National Health and Nutrition Examination

Survey and other research studies (Agricultural Research Service 2010), suggested that under-reporting may have affected 24-hour recall data (Briefel et al. 1995; Krebs-Smith et al. 2000). Under-reporters compared to non-under-reporters tended to report fewer numbers of foods, lower frequency of foods consumed, and smaller portion sizes across a wide range of food groups and tended to report more frequent intakes of low-fat/diet foods and less frequent intakes of fat added to foods (Krebs-Smith et al. 2000). Factors such as overweight, BMI, gender, body image, social desirability, restrained eating, and education have been shown in various studies to be related to under-reporting in recalls in men (Briefel et al. 1995; Hebert et al. 1995; Klesges, Eck & Ray 1995; Krebs-Smith et al. 2000; Novotny et al. 2003; Tooze et al. 2004).

2.2.3 Diet history

A dietary history is any dietary assessment that asks the respondent to report about past diet. Originally, as coined by Burke in 1947, the term “dietary history” referred to the collection of information not only about the frequency of intake of various foods but also about the typical makeup of meals (Burke 1947). The major strength of the diet history method is its assessment of meal patterns and details of food intake rather than intakes for a short period of time (as records or recalls) or only frequency of food consumption. A weakness of the approach is that respondents are asked to make many judgements both about the usual foods and the amounts of those foods eaten, and these subjective tasks may be difficult for many respondents. The approach, when conducted by interviewers, requires trained nutrition professionals (Rosalind. S. Gibson 2005; F. E. Thompson & Subar 2001). There were several validations of diet history questionnaires which show that under-reporting occurs in men when using this method (EPIC group of Spain 1997; Okubo et al. 2008).

2.2.4 Food frequency

The food frequency approach (W. Willett 1998; Zulkifli & Yu 1992) asks respondents to report their usual frequency of consumption of each food from a list of foods for a specific period of time. To estimate relative or absolute nutrient intakes, FFQs also incorporate portion size questions, or specify portion sizes as part of each question (Rosalind. S. Gibson 2005; F. E. Thompson & Subar 2001). The appropriateness of the food list is crucial in the food frequency method (Block et al. 1986). Strengths of the FFQ approach are that it is inexpensive to administer and process, and aims to estimate the respondent's usual intake of foods over an extended period of time. Because the costs of data collection and processing, and the respondent burden are typically much lower for FFQs than for multiple diet records or recalls, FFQs have become a common way to estimate usual dietary intake in large epidemiological studies (Rosalind. S. Gibson 2005; F. E. Thompson & Subar 2001). One study suggests that longer food frequency lists may overestimate, whereas shorter lists may underestimate intake of some food items such as fruits and vegetables (Krebs-Smith et al. 1994). Biomarkers that do represent usual intake without bias are available for energy (doubly-labeled water) (Livingstone & Black 2003) and protein (urinary nitrogen) (Bingham 2003). Validation studies of various FFQs using these biomarkers have found large underestimates of self-reported energy intake (Kroke et al. 1999; Subar et al. 2003) and some underestimation of protein intake (Kroke et al. 1999; Ocke et al. 1997; Pijls et al. 1999; Pisani et al. 1997; Subar et al. 2003). Factors such as social desirability, psychosocial characteristics, dietary restraint, BMI, obesity, eating frequency, and education have been shown in various studies to be related to under-reporting in food frequency in men (Becker et al. 1999; Kroke et al. 1999; Subar et al. 2003; Tooze et al. 2004; Voss et al. 1998).

2.3 UNDER-REPORTING – EVALUATING FFQ DATA

2.3.1 The difficulties of validation

An accurate assessment of habitual dietary intake is very important in determining the association between diet and disease. However, any method used to assess self-reported dietary intake is not entirely devoid of reporting errors (Barrett-Connor 1991), including random and systematic errors, and the misreporting of true intake by certain subject groups (Black & Cole 2001; Livingstone & Black 2003).

The development of the doubly labelled water technique made it possible to validate reported energy intake as an external biomarker (Black et al. 1996; Hill & Davies 2001; Trabulsi & Schoeller 2001), but it has been questioned on a number of occasions as under-reporting has been found to be prevalent in many different populations (Hill & Davies 2001). In addition, this technique cannot be used with a large number of participants in an epidemiological study because of the cost and complexity of the method. Therefore to evaluate the validity of energy intake (EI) and to identify under-reporters, EI has been compared with basal metabolic rate (BMR), and the Goldberg cut-off (Goldberg et al. 1991) to identify 'low energy reporters' has been used in some investigators (Ferrari et al. 2002; L. Johansson et al. 1998; McGowan et al. 2001). However there were considerable limitations using the Goldberg cut-off, including poor sensitivity for defining invalid reports at the individual level, wide confidence limits and the fact that only extreme degrees of misreporting can be identified (Black 2000).

2.3.2 Justifying the 1.27 cut-off

The WHO recommendations for energy requirements (World Health Organization 1985a) are well known and widely used (Black 2000; Okubo & Sasaki 2004; Okubo et al. 2006). The cut-off values are EI/BMR of 1.27 as the minimum survival level, 1.55 for sedentary men, and 2.0-2.4 as the maximum sustainable lifestyle level (World Health Organization 1985a). Thus, under-reporting was considered to occur when EI/BMR falls below 1.27, although the cut-off value for EI/BMR of 1.55 was also used to compare results in some of the studies (Black 2000; Black et al. 1991; Kromhout 1983).

2.3.3 Selection of the formula for estimating BMR

The energy requirement has been traditionally based on the basal metabolic rate, and many equations for estimating BMR are available, but the selection of the appropriate formula for estimating BMR remains under investigation. To calculate the BMR, several investigators used the equations from the WHO (Alfonzo-Gonzalez et al. 2004; Heywood, Harvey & Marks 1993; Okubo & Sasaki 2004; Okubo et al. 2006). Other investigators used the Schofield, Schofield and James's (Piers et al. 1997), those from the Recommended Dietary Allowances for the Japanese (Ebine et al. 2002), or combinations of several equations (Frankenfield, Roth-Yousey & Compher 2005; S. Tanaka et al. 2008).

Australian and Japanese studies using the WHO equations

Heywood, Harvey and Marks (1993) studied the assessment of validity and plausibility of overall food and nutrient intake, and evaluated total energy intake (EI) using the data from both the Australian National Dietary Survey of Adults: 1983 (Department of Community Services and Health 1987) and the National Heart Foundation as a component of the Second Risk Factor Prevalence Study (National Heart Foundation of Australia 1983). The intake of a sample of 6,255 men and women aged 25-64 years living in the six state capital cities, was assessed using the 24-h recall method. The BMR was calculated for each individual from the body weight using the age- and gender-specific equations shown in WHO (World Health Organization 1985a), and the ratio (EI/BMR) was calculated for each individual. According to Heywood, Harvey and Marks (1993), the results were biased due to under-reporting and the bias in this case was derived from particularly low reported intakes in older males.

Okubo et al. (2006) studied the relationships between EI/BMR, age and BMI among 183 healthy Japanese men and women aged ≥30 years. They used 4-day semi-weighed diet records to calculate EI, and BMR was estimated for each subject using the WHO formula (World Health Organization 1985a). To compare the relative degree of under- and over-reporting, they used the values defined by WHO (World Health Organization 1985a): the minimum survival level of 1.27, the sedentary level for men of 1.55 and the maximum sustainable lifestyle level of 2.0-2.4. They found that the oldest age group (≥60 years) had higher EI/BMR values than the youngest age group (30-39 years) in both genders (1.74 vs. 1.37 for men; 1.65 vs. 1.43 for women), and that age was correlated positively, and that BMI was correlated negatively with EI/BMR.

Modifications of the equations for the young aged Australians

Piers et al. (1997) measured BMR and then compared the accuracy of the Schofield, Schofield and James (1985) equations with those of Hayter and Henry (1994) in predicting BMR in 128 young volunteers of Australians (39 men and 89 women) aged between 18-30 years. They found that the Schofield, Schofield and James (1985) equations significantly overestimated the BMR of young Australian men and were not valid for the prediction of BMR. They concluded that these equations should no longer be recommended for the prediction of BMR in individuals aged between 18 and 30 years, and that Hayter and Henry's equation provided a more accurate estimate of the BMR for young Australian men. Although the equations taken from Schofield, Schofield and James (1985) were considered by the WHO (World Health Organization 1985a) to be the best estimates at that time available for predicting BMR in healthy people, the use of wide age ranges might have caused problems in the subjects of the upper and lower age ranges for each of these age groups (Warwick 1990). These concerns may also apply for the use of the WHO formula (World Health Organization 1985a) for BMR as this also covers the same upper and lower age ranges.

The [Japanese] Ministry of Health and Welfare equations

Ebine et al. (2002) determined the daily energy requirements of professional soccer players during a competitive season, and measured total energy expenditure in players using the doubly labelled water method. Energy intake was simultaneously estimated from seven day self-report dietary records, and the BMR and recommended energy allowance calculated from the Recommended Dietary Allowances for the Japanese (Ministry of Health and Welfare 1996). Individual basal metabolic rates were calculated from height and body mass (refer to Table 5.3), and they concluded that energy intake measured from dietary records was significantly lower than total energy expenditure measured using the doubly labelled water method because of under-reporting.

Other predictive equations for BMR

Cole and Henry (2005) produced a set of prediction equations for BMR that can be applied to individuals worldwide. The philosophy of the analysis for their study was to derive ‘seamless’ gender-specific equations that cover infancy to old age while avoiding discontinuities between age groups and that also make use of the entire dataset using the LMS (lambda, mu, sigma) method (Cole & Green 1992). This analysis ignored height, weight and the other factors, and their purpose was solely to explore the age changes in the distribution of BMR. The approach taken was to identify just two ethnic groups - white Caucasians and everyone else. The results showed that predicted BMR in Caucasians was 4% higher than in non-Caucasians, though the effect size was sensitive to the inclusion or exclusion of data from certain influential publications. The effect of measurement technique on BMR, closed-circuit versus open-circuit, was small, near 1%. They concluded that it is possible to develop prediction equations that avoid splitting the data into arbitrary age groups.

Heterogeneity between publications is greater than might be expected by chance, probably due to undocumented differences in technique (Cole & Henry 2005).

Studies of comparing some of the equations to estimate BMR

Frankenfield, Roth-Yousey and Compher (2005) documented the accuracy of predictive equations by a systematic review of the literature. Four prediction equations were identified, namely Harris-Benedict (Harris & Benedict 1919), Mifflin-St Jeor (Mifflin et al. 1990), Owen (Owen et al. 1987; 1986), and WHO (World Health Organization 1985a). Of these equations, the Mifflin-St Jeor equation was the most reliable, predicting the resting metabolic rate (RMR) within 10% of the measured in more non-obese and obese individuals, and had the narrowest error range. Older adults and US-residing ethnic minorities were underrepresented by existing validation studies of predictive equations, and a high level of suspicion regarding the accuracy of the equations is warranted (Frankenfield, Roth-Yousey & Compher 2005).

Tanaka et al. (2008) evaluated the accuracy of several predictive equations for BMR in obese Japanese men and women, by using the Japan-Dietary Reference Intakes (DRI) (Ministry of Health Labour and Welfare 2005), Harris-Benedict (Harris & Benedict 1919), the WHO (World Health Organization 1985a), Henry (Henry 2005), Owen (Owen et al. 1987; 1986), Mifflin (Mifflin et al. 1990), and Bernstein (R. S. Bernstein et al. 1983). For the Japan/DRI equation, the Ministry of Health and Welfare proposed adjusting for body weight (Ministry of Health and Welfare 1975), and therefore, the equations including this adjustment, were also examined. In addition, the WHO equation using body weight and height were also included and examined. According to their findings, all the equations with the exception of Bernstein’s, overestimated BMR in obese males. Some equations, including the Japan-DRI and the WHO equations, overestimated BMR in obese females, while the Harris-Benedict and Henry equations provided relatively accurate predictions of BMR in obese females.

2.3.4 Under-reporting issues when using FFQ

Aspects which tend to be out of the direct control of subjects, but will still contribute to under-reporting, can be generally referred to as unintentional under-reporting.

For example, these include poor memory, poor attention and literacy problems. Furthermore, low energy intakes may reflect troublesome situations (e.g. illness, dieting, genuine irregular eating patterns) rather than deliberate falsification (J. Macdiarmid & Blundell 1998).

Many dietary methods rely heavily upon the recall of foods eaten recently, for example, the 24-h recall and those method which cover an extended period such as the food frequency questionnaires. These depend on individuals having good medium- or long-term memory. Recalling this type of information can be demanding and in itself can introduce errors, contributing significantly to under-reporting the dietary intake (J. Macdiarmid & Blundell 1998; A. F. Smith 1993). Under-reporters might also have deliberately or unconsciously erred when estimating frequencies and/or portion sizes. The structure of the FFQ itself (for example, food items, frequency categories and reference portion sizes) could be a source of error, and the reference portion size photos included in the FFQ may have been misused by participants or not used at all, and these could also have affected the accuracy of the portion size choices (Bedard, Shatenstein & Nadon 2004; Gilsenan & Gibney 2004).

Becker et al. (1999) showed the patterns of food intake in Irish subjects with acceptable or unacceptable reported energy intakes gathered from an FFQ in their study of comparison between Swedish and Irish dietary surveys. Their results identified 53% as under-reporters (below a cut-off of EI/estimated BMR of 1.27). Bedard, Shatenstein and Nadon (2004) also evaluated energy intake data from a FFQ and indicated 54% of participants below 1.27.

Subar et al. (2003) studied dietary measurement error of two self-reported dietary instruments, the food frequency questionnaire (FFQ) and the 24-hour dietary recall (24HR), by using doubly labelled water (DLW) and urinary nitrogen as biomarkers of total energy expenditure and protein intake, respectively, for 261 men and 223 women aged 40-69 years. Under-reporters were defined as respondents whose values were below the 95% confidence interval of the log ratio of reported intakes to biomarker measurements [Protein biomarker (PBM) = urinary nitrogen/0.81 (converts urinary nitrogen to dietary nitrogen) × 6.25) (converts dietary nitrogen to dietary protein); Biomarker for protein density = PBM × 4 kcal (kcal per g of protein)/TEE × 100%]. Their results showed that 9% of men and 7% of women were under-reporters of both energy and protein intake on 24HR. For FFQ, the comparable values were much greater at 35% for men and 23% for women. On average, men under-reported energy intake compared with total energy expenditure by 12-14% on 24HR and 31-36% on FFQ and under-reported protein intake compared with a protein biomarker by 11-12% on 24HR and 30-34% on FFQ. Women under-reported energy intake on 24HR by 16-20% and on FFQ by 34-38% and under-reported protein intake by 11-15% on 24HRs and 27-32% on FFQs. There was little under-reporting of the percentage of energy from protein for men or women. They found that the under-reporting of energy was somewhat greater than that of protein, indicating a bias toward more under-reporting of fat, carbohydrate and alcohol, and suggested that under-reporters reported consuming less of all food groups, but that the degree of under-reporting can vary between foods. Assessing fat intake was an important concern.

Several authors have investigated the characteristics of under-reporters of energy intake when using food frequency questionnaires. Voss et al. (1998), for example, (Table 2.4 (1)) investigated whether German subjects with low reported relative energy intake differed from those with higher relative energy intake according to characteristics such as obesity, physical activity, and the macronutrient composition of the diet. They used cross-sectional data from a cohort study employing a semi-quantitative food frequency questionnaire (SFFQ). They determined the energy intake relative to BMR and the ratio of reported energy intake (EI) to BMR categorized by quintiles. BMR was calculated by using the Schofield, Schofield and James equations (Schofield, Schofield & James 1985). They found that a significant declining trend could be observed for BMI, percentage of body fat, and body weight from the lowest to the highest quintile of EI/BMR, and concluded that underestimation of energy intake was related to obesity and affects the relationship of macronutrients in the reported diet.

Table 2.4 Performance of FFQ: Under-reporters as judged by EI/estimated BMR* cut-offs

	Author	Year	Country	Subjects	Comparison	Cut-offs	Results
1	Voss et al. (SFFQ)	1998	Germany	2356 M (40-64 y) 2862 F (35-64 y)	quintiles of EI/BMR.	EI/BMR < 1.17 EI/BMR 1.17-1.36 EI/BMR 1.37-1.54 EI/BMR 1.55-1.81 EI/BMR > 1.81	Significant declining trend for BMI (wt was measured), % body fat & body wt.
2	Johansson et al. (SFFQ)	1998	Norway	1461 M (16-79 y) 1559 F (16-79 y)	degree of under- and overreporting of EI related to Wt and lifestyle.	EI/BMR < 1.35 (underreporting) EI/BMR > 2.4 (overreporting)	38% of the men & 45% of the women underreported, 7% of the men & 5% of the women overreported, own body wt influenced reported EI.
3	Bedard, Shatenstein & Nadon (SFFQ)	2004	Canada	106 M (18-82 y) 140 F (18-82 y)	LERs and non-LERs.	EI/BMR < 1.27 (underreporting)	Male LERs accounted for 54% vs 35% among females.
4	Mendez et al. (FFQ)	2004	Jamaica	351 M (25-75 y) 539 F (25-75 y)	examine food group intake patterns of under- & overreporters, and relationship between the patterns and overwt/ obesity.	EI/BMR < 1.35 (underreporting)	More women than men underreported, and underreporting was positively associated with obesity, diet, smoking and age. Lower energy from socially undesirable food groups and higher intakes of 'healthy' foods.

Wt = weight; SFFQ = semi-quantitative FFQ.

•Used equations to calculate BMR;

Schofield, Schofield and James (1985) equation: [Voss et al. (1998)], [Bedard, Shatenstein & Nadon (2004)] and [Mendez et al. (2004)].

WHO (1985a) equation: [Johansson et al. (1998)].

In Norway, Johansson et al. (1998) studied the degree to which under-reporting of EI was related to lifestyle, sociodemographic variables, and attitudes about body weight and diet in a nationwide dietary survey, by a self-administered quantitative food-frequency questionnaire (SFFQ) distributed to a representative sample (Table 2.4 (2)). Reported EI was related to estimated BMR based on self-reported body weight, age, and gender. BMR was calculated (Commission of the European Communities 1993) by using the WHO equation (World Health Organization 1985a). They considered EI:BMR < 1.35 as under-reporting and an EI:BMR ≥ 2.4 as overreporting of EI. Their results showed that a higher percentage of men than women under-reported EI, and a large proportion of under-reporters was obese (9%) and wanted to reduce their weight (41%). Under-reporters reported consuming fewer foods rich in fat and sugar than did the other subjects, and the desire for weight change and physical activity score were significantly correlated with both EI and EI:BMR. Therefore their findings indicated that attitudes about their own body weight influenced reported EI.

In Canada, Bedard, Shatenstein and Nadon (2004) also studied the potential underestimation of energy intake obtained from a semi-quantitative food-frequency questionnaire (SFFQ). The ratio of EI/BMR used to assess under-reporting was determined from self-administered questions (Table 2.4 (3)). BMR was calculated by using the Schofield, Schofield and James equations (Schofield, Schofield & James 1985). A comparison of the EI/BMR ratio with the Goldberg statistical cut-off allowed them to detect individuals who were low energy reporters (LERs). LERs and non-LERs were compared to determine whether they differed on sociodemographic, anthropometric and lifestyle variables. They found that under-reporting of energy intake (below $1.27 \times$ BMR, which is considered by the WHO (World Health Organization 1985a) to be the minimal energy intake for survival) was highest in men (male LERs accounted for 54% compared with 35% among females) and individuals who were older, heavier, with higher BMI and lower education level.

In Jamaica, Mendez et al. (2004) examined the prevalence, patterns and impact of energy under- and over-reporting on diet-obesity relationships in a middle-income developing country, using an interviewer-administered self-reported FFQ (Table 2.4 (4)). The under-reporters were defined by them as having energy intakes < 1.35 × BMR. Schofield, Schofield and James equations (Schofield, Schofield & James 1985) were used to estimate BMR based on age, weight and gender in their study, and a cut-off point of EI < 1.35 × BMR, estimated based on sedentary subjects in calorimeters, was used to identify implausibly low energy intakes as in other studies (Black 2000; Goldberg et al. 1991; L. Johansson et al. 1998; Samaras, Kelly & Campbell 1999) , according to Mendez et al. (2004). Their results indicated that more women than men under-reported, and the under-reporting was positively associated with obesity, special diets, smoking and age. Under-reporters showed lower energy from potentially socially undesirable food groups (e.g. snacks) and higher intakes of 'healthy' foods (e.g. fruit) than did plausible reporters.

Some studies have identified under-reporters using doubly labelled water (DLW) methods. For example, Svendsen and Tonstad (2006) studied the accuracy of reported energy intake according to self-reported FFQ and dietary records (DR) in obese subjects with metabolic syndrome risk factors for 23 men (24 - 64 years) and 27 women (30.5 - 43.8 years) in Norway. Total energy expenditure (TEE) was measured with the DLW methods. Subjects were identified as under-reporters, accurate reporters and overreporters of energy based on the 95% confidence limits (CL) of the expected EI:TEE ratio of 1.00. The 95% CL between the two measurements were calculated from the published equation (Black & Cole 2000). Their results showed that EI among male subjects were under-reported by 14.1% according to the FFQ and by 27.9% according to the DR compared with the measured TEE. No significant difference by gender was seen in the reported EI relative to TEE. Under-reporters had lower median intake of sweets, desserts and snacks than non under-reporters according to both the FFQ and the DR, and suggested that in obese subjects with metabolic risk factors, intake of sweets, desserts and snacks, bread and dietary restraint (inversely) were determinants of the reporting accuracy.

Millen et al. (2009) studied different aspects of a reported food group intake on an self-reported FFQ between low-energy reporters (LERs) and non-LERs identified using DLW. Responses were 40-70 year old adult US men and women. LERs are individuals who report a total energy intake on a dietary assessment tool that would be implausibly low to maintain their current weight. High-energy reporters (HERs) are just the opposite. To identify LERs and HERs in their study, a participant's reported total energy intake was compared with his or her TEE determined from DLW. TEE is assumed to be an objective biomarker of energy intake under conditions of weight maintenance. There were 220 LERs and 20 non-LERs. Their results showed that among men, there was no difference between LERs and non-LERs with respect to reporting *consumption* of food groups. Reported mean daily *frequency* of consumption was lower among LERs compared with non-LERs for 24 food groups among men (18 food groups were similar in men and women). In addition, reported mean *portion sizes* were smaller for LERs compared with non-LERs for five food groups among men. They concluded that LERs, compared with non-LERs, were more likely to differ regarding their reported *frequency* of the consumption of food groups than their reported *consumption* (yes/no) or *portion size* of food groups. It still remains unclear whether improvement in questionnaire design or additional tools or methods would lead to a decrease in differential reporting due to LER status on an FFQ.

Wakai (2009) assessed the usefulness of FFQs by reviewing questionnaires developed and validated in Japan. A literature search was conducted to identify articles on the development and/or validation of FFQs for Japanese populations. Twenty one eligible FFQs were identified. For each FFQ identified, validation studies were used to abstract its characteristics and information. The correlation coefficients between diet records (DRs) and FFQ estimates, and those between the same FFQs completed twice across time. They were found to be reasonably valid and reproducible. The median of correlation coefficients between DRs and FFQs ranged from 0.31 to 0.56 for target nutrients, and that between the same FFQs completed twice within a period of 9 months to 1 year ranged from 0.50 to 0.72. Relatively poor validity was found for FFQ estimates on consumption of potatoes, seaweed, sodium, niacin, and polyunsaturated fatty acids. For the purpose of analysis, FFQs were divided into long FFQs (97 or more food items) and short FFQs (< 70 items); the former had slightly higher validity. They concluded that FFQs were useful for assessing dietary intake in Japan, although careful consideration is required for the food groups and nutrients for which FFQs had low validity.

Summary

Under-reporting has been shown to be present across a range of energy intakes (Lissner et al. 1989; Livingstone et al. 1990) and has been observed with different methods of measuring energy intake (Becker et al. 1999). Black et al. (1991) concluded in their review that under-reporting and under-eating occur in most dietary assessments, but with varying frequency according to the dietary assessment method used.

However, at the individual level, identifying low energy reporters still provided useful information about the characteristics of under-reporters, according to Macdiarmid and Blundell (1998). Smith, Webb and Heywood (1994) also emphasis that they are not necessarily advocating the exclusion of under-reporters from analysis as the only or best solution to the measurement error problem described. In addition, few studies have investigated the frequency and characteristics of *over*-reporting, and young lean males were found to be such a group with a relatively high prevalence (L. Johansson et al. 1998; Mendez et al. 2004).

On a whole, however, the FFQ was found to have a respectable level of overall validity, although the instrument generally underestimates absolute intake (Subar et al. 2003).

2.4 LIFESTYLE FACTORS

2.4.1 Lifestyle behaviour and general health

Extensive clinical and epidemiological evidence points to the importance of healthy lifestyle behaviours – such as eating a well-balanced diet (Capita & Alonso-Calleja 2003; Elmadfa & Freisling 2005; Hu & Willett 2002; Lee et al. 2007; Mineharu et al. 2011; Nagura et al. 2009; Shikany & White 2000; Umesawa et al. 2008), being physically active (Barengo et al. 2004; Hu et al. 2004a; Hu et al. 2007a; Hu et al. 2007b; Hu et al. 2005; Hu et al. 2007c; Khaw et al. 2006; Y. Wang et al. 2010), not smoking (Baliunas et al. 2007; Kengne et al. 2009; K. Nakamura et al. 2008; Tamaki et al. 2006; Woodward et al. 2005), and drinking alcohol in moderation (Beulens et al. 2007; Bryson et al. 2006; Iso et al. 2004; Makita et al. 2012; Mukamal et al. 2005; Pai, Mukamal & Rimm 2012; Sesso et al. 2008; Yoshita et al. 2005) – in reducing chronic conditions including CVD. It should be noted, however, that benefits of a moderate but positive intake of alcohol, some authors do not regard as conclusive (Costanzo et al. 2010ab; Hines & Rimm 2001; Maclure 1993; Mukamal, Chiuve & Rimm 2006; Mukamal & Rimm 2001; Ronksley et al. 2011).

Although these lifestyle factors have been amply studied individually in relation to chronic health outcomes, only a few studies have considered them simultaneously, including the interrelation with other lifestyle behaviours, and especially the impact of the combination of these behaviours on CVD risk (Chourdakis et al. 2011; Eguchi et al. 2012; Khaw et al. 2008; S. Kim et al. 2004b; King et al. 2009; Kvaavik et al. 2010; Loef & Walach 2012; Mukamal, Chiuve & Rimm 2006; Myint et al. 2009; Otani et al. 2003; Pronk et al. 2004; Sasazuki et al. 2012; S. Tanaka et al. 2009).

The associations between a combination of these healthy lifestyle behaviours also lead to a lower mortality (Tamakoshi et al. 2009) and a longer life expectancy (Tamakoshi et al. 2010). Tamakoshi et al. (2009) studied the effect of a baseline combination of six lifestyle factors (current non-smoking, not heavily drinking, walking 1 hour or more per day, sleeping 6.5 to 7.4 hours per day, eating green leafy vegetables almost daily, and having a BMI between 18.5 to 24.9) on all-cause mortality. The Japanese men and women aged 40-79 years were followed for 12.5 years on average, and Tamakoshi et al. found an inverse association between the baseline combination of the six healthy lifestyle factors and all-cause mortality, as well as its impact on a preventable fraction of death. Their results demonstrated that healthy lifestyle behaviors were important even in old age. Tamakoshi et al. (2010) also estimated life expectancies at 40 and 60 years of age in this prospective cohort study with a 14.5 year follow-up. Maintaining all six healthy lifestyle factors was associated with longer life expectancy.

2.4.2 Impact of combined lifestyle behaviours on reducing CVD

Stroke is a common form of CVD (Health Development Agency 2000). Chiuve et al. (2008) showed that in men from US, a combination of five healthy lifestyle behaviours (not smoking, a BMI < 25 kg/m^2, > or = 30 min/day of moderate activity, modest alcohol consumption (5 to 30 g/day) and scoring within the top 40% of a healthy diet score) may prevent 35% of total stroke and 52% of ischemic stroke. Even more impressive were the results reported by Zhang et al. (2011). During the mean follow-up of 13.7 years, these authors prospectively investigated the association of different indicators of lifestyle (smoking, BMI, physical activity, and vegetable and alcohol consumption) with total and type-specific stroke incidence among 36,686 Finnish participants who were 25 to 74 years old at baseline. They found that healthy lifestyle factors were associated with a lower risk of stroke, and there was a graded inverse association between the number of healthy lifestyle indicators and the risk of total, ischemic, and hemorrhagic stroke. They also demonstrated that the partial population attributable risk percentages associated with adherence to 3, 4 and 5 healthy lifestyle indicators were 26.3%, 43.8%, and 54.6% for total stroke; 22.7%, 45.3%, and 59.7% for ischemic stroke; and 35.0%, 35.0%, and 36.1% for hemorrhagic stroke, respectively.

2.4.3 The combined lifestyle behaviours and CVD risk in countries and ethnic groups

Japan

Lifestyle behaviours such as the consumption of fruits, fish, milk, moderate physical activity, having a normal BMI, moderate alcohol intake, not currently smoking and moderate sleep duration were associated with lower mortality from CVD in Japan (Cui et al. 2005; Eguchi et al. 2012; Ikehara et al. 2009; Ikehara et al. 2008; Iso et al. 2005; Nagura et al. 2009; Noda et al. 2005; Umesawa et al. 2006; Yamagishi et al. 2008). For example, Eguchi et al. (2012) developed a healthy lifestyle score based on eight healthy lifestyle behaviours (consumption of fruits ≥ 1 intake per day, fish ≥ 1 intake per day, milk almost every day, exercise ≥ 5 hours per week and/or walking ≥ 1 hour per day, BMI of 21-25 kg/m2, alcohol intake < 46.0 g per day, non-smoking, and sleep duration of 5.5-7.5 hours per day) and examined the potential magnitude of the combined impact of them on mortality from stroke, coronary heart disease (CHD), and total CVD among Japanese men and women aged 40-79, during 16.5 years of follow-up. They found that for both genders, persons with the highest scores had the lowest CVD mortality. Mortality from stroke, CHD and CVD in the highest healthy lifestyle score category was one-third in men, which suggested that such a large fraction of CVD could be prevented through lifestyle modification.

Metabolic syndrome (MetS) is a high-risk state for the development of CVD (Ballantyne et al. 2008; Iso et al. 2007). Li et al. (2010) studied a combination of healthy lifestyles on the risk of metabolic syndrome (MetS) in a total of 1,897 men aged 35-60 years. Four healthy lifestyles were selected – regular physical activity, adherence to healthy eating behaviors, not current smoking, and maintaining a stable weight since one's mid-twenties. They used the minimally modified American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) criteria for MetS (Grundy et al. 2005), where three or more of the following abnormalities at follow-up were considered as having MetS incidence – (1) Abdominal obesity (defined as WC of ≥85 cm (Examination Committee of Criteria for 'Obesity Disease' in Japan 2002)), or BMI ≥25 kg/m^2 when WC was not available, (2) high blood pressure, (3) high fasting glucose; (4) high triglycerides; and (5) low high-density lipoprotein cholesterol. Adherence to healthy lifestyles was associated with a lower risk of MetS among apparently healthy middle-aged Japanese male workers.

Other Asian countries

Odegaard et al. (2011b) studied the association of six combined lifestyle factors (dietary pattern, physical activity, alcohol intake, usual sleep, smoking status, and BMI) with risk of CVD mortality and the major subgroups of CVD mortality (coronary heart disease and cerebrovascular disease mortality) in 50,466 Chinese men and women in Singapore who were 45 to 74 years of age at enrolment. The cohort was drawn between 1993 and 1998, and followed up through 2009. There was a strong, monotonic decrease in age- and gender-standardized CVD mortality rates with an increasing number of protective lifestyle factors in Chinese men and women.

Australia

Gall et al. (2009) studied whether a healthy lifestyle was associated with cardiovascular risk factors in a cohort of young Australian adults. Data from the 2004-2006 Childhood Determinants of Adult Health Study (age range 25-36 years) were used. A lifestyle score [0 (unhealthy) to 8 (healthy)] was derived from eight behaviours (normal BMI, non-smoking, low alcohol, salt and meat, and regular fish consumption, leisure time physical activity and skim milk use), and examined relationships between the lifestyle score and blood pressure (BP), low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, triglycerides, insulin, glucose and an estimate of insulin resistance (IR). They found that in men, higher lifestyle scores were linearly associated with lower diastolic BP, HDL cholesterol, insulin and IR, and suggested that even in young adults, a healthy lifestyle was clearly associated with a better cardiovascular risk profile.

Other Western countries

Villegas, Kearney and Perry (2008) studied the association between the previously identified protective behavioural factors (BMI < 25 kg/m^2, moderate exercise, alcohol intake, non-smoking and a favourable dietary pattern) and the prevalence of hypertension and dyslipidemia in an Irish adult population (491 men and 527 women), aged 50 and 69 years. They used a FFQ to obtain the dietary information, and found that the strong significant inverse associations between the number of protective factors and systolic blood pressure, diastolic blood pressure and dyslipidemia.

Myint et al. (2009) studied the potential magnitude of their combined impact of four health behaviours on incidence of stroke in men and women aged 40-79 years, over 11.5 years of follow-up in the Norfolk cohort of European Prospective Investigation of Cancer (EPIC-Norfolk cohort was comparable with national population samples in the UK). The combined health behaviour score was derived from smoking habit, physical activity, alcohol intake, and fruit and vegetable intake. They found that the four health behaviours combined predicted more than a twofold difference in incidence of stroke in men and women.

King et al. (2009) compared the adherence to five healthy lifestyle habits trends (≥ 5 fruits and vegetable/day, regular exercise > 12 times/month, maintaining healthy weight [BMI 18.5-29.9 kg/m^2], moderate alcohol consumption [up to 1 drink/day for women, 2/day for men] and not smoking) in adults over time. The results of the National Health and Nutrition Examination Survey (NHANES III) 1988-1994 were compared with those of the NHANES III 2001-2006 for the US adults aged 40-74 years. Adherence to all five healthy habits has gone from 15% to 8%, and suggested that generally, adherence to a healthy lifestyle pattern has decreased during the last 18 years, with decreases documented in three of the five healthy lifestyle habits.

Different ethnic groups

Kim et al. (2003) created a tool called the Diet Quality Index-International (DQI-I) for global monitoring and exploration of diet quality across countries. The major categories of the index components were variety ('*various food groups* – meat, poultry, fish, eggs; dairy, beans; grain; fruit; and vegetable', and '*within-group variety for protein source* – meat, poultry, fish, dairy, beans and eggs'), adequacy (vegetable group, fruit group, grain group, protein, iron, calcium, vitamin C and fiber), moderation (total fat, saturated fat, cholesterol, sodium and empty calorie foods) and overall balance. Using this tool, their research they presented a cross-national comparison of diet quality between China and the United States, incorporating comparable national in-depth diet data. They found that the mean of the DQI-I score was slightly higher in China than in the USA. By major categories of the DQI-I, dietary variety was better achieved in the USA diet; moderation and overall balance of intakes were better accomplished in China. Kim et al. (2004b) also created an overall measure of lifestyle called the Lifestyle Index (LI), integrating diet, physical activity, smoking, and alcohol use, to provide a global tool of monitoring healthfulness and patterns of lifestyle. They found that the mean of the LI scores was slightly higher in China than the USA. Scores of diet quality, physical activity, and smoking were higher in China, but scores of alcohol behavior were higher in the USA. Similar lifestyle patterns but different unhealthy behaviors were identified in these countries.

2.4.4 The outcome of non-work lifestyle behaviours and CVD risk

The consensus of the above indices is that the combination of lifestyle behaviour factors integrating diet, physical activity, smoking, and alcohol use, etc. tends to indicate an even stronger inverse relationship with overall CVD mortality, and cardiovascular risk than any one individual factor.

2.4.5 History of the relationship between work patterns and related diseases

Working outside normal hours either by extended days or shift work is a fact of industrial society (Harrington 1994). Its economic advantages must be weighed against detrimental effects on the individual worker in the form of circadian rhythm disturbance, poorer quality and quantity of sleep and increased fatigue (Harrington 1994). Such “abnormal” working hours are not a modern phenomenon (Harrington 2001). Historically the relationship between work patterns and work-related disease has been well documented going as far back as Ramazini (Dunn 1993), one of the great figures of 17th century Italian medicine and was given the name of ‘Hippocrates III’. Ramazzini (1633-1714) noted that bakers, innkeepers, and soldiers worked such hours. The advent of the industrial revolution led to many people working long hours until legislation was introduced to curtail the worst vicissitudes of the new factory-based economy (Harrington 2001).

2.4.6 Relationships between working conditions and CVD in Japan

Japanese people tend to work longer hours than people in most other industrial nations and this could affect their health (International Labour Organization 1993; T. Kato 1994). Following the Meiji Restoration of 1868, the government encouraged the nation to work hard in order to catch up with the economic progress made by Western nations. The national unity policy promoted during the American Occupation and just after further encouraged the Japanese to become “workaholics” (Lamont-Brown 1993).

A growing number of Japanese workers, particularly middle-aged men, have been dying from CVD in their most productive years (Fukuoka et al. 2005; Nishiyama & Johnson 1997). The increased risk of CVD related to excessive work and occupational stress, therefore, still remains a concern in Japan (Cheng et al. 2012; Fukuoka et al. 2005). Studies based on compensation claims related to fatalities, have shown that many of the victims had been putting in long hours before they died (Nishiyama & Johnson 1997; T. Uehata 1991). In Japan, where workers’ compensation claims are made to a government organization, such deaths are referred to as *Karoshi*, meaning “death from overwork” (Shields 1999).

The term *Karoshi* was coined in the early 1980s by Tetsunojo Uehata (Brown, Lubove & Kwalwasser 1994; Ishiyama & Kitayama 1994). Uehata (International Labour Organization 1993) describes *Karoshi* as occupational stress-related cardiovascular attacks among middle-aged workers. Uehata (1991) found that out of 203 *Karoshi* cases (196 men and 7 women), two thirds had worked sixty hours or more per week. In addition, *Karoshi* cases had worked more than fifty hours of overtime per month, and/or more than half of the weekends and fixed holidays.

Iwasaki, Takahashi and Nakata (2006) summarized the Japanese Ministry of Health, Labour and Welfare's (MHLW) progress in understanding the extent of and the circumstances surrounding *Karoshi*. The national statistics showed that more than 6 million people worked for 60 hours or more per week during years 2000 and 2004. In addition, approximately three hundred cases of brain and heart diseases were recognized as labour accidents resulting from overwork (*Karoshi*) by the MHLW between 2002 and 2005.

2.4.7 Long working hours and stress relating to CVD

Japan

Several authors (T. Kato 1994; Nagashima et al. 2007; Nishiyama & Johnson 1997; T. Uehata 1991) proposed a *Karoshi* model to examine the relationship between long hours and CVD. It is hypothesized that long hours bring about unhealthful lifestyle changes such as smoking, alcohol abuse, lack of physical activity, sleeplessness, poor eating habits, and fewer chances for medical examinations. Prolonged periods of working long hours may increase anxiety, strain and irritability. Over time, people can become fatigued and develop a propensity to obesity. The cumulative effect may be CVD (Shields 1999). The interplay between psychosocial stress at work and CVD has also been investigated by Olsen and Kristensen (1991).

In their study of long working hours and the risk of hypertension, Nakanishi et al. (2001) suggested that the influence of *work type* is important for determining the perception of overwork or stress and its associated responses of blood pressure. In addition, they indicated that their population of 941 male white collar workers who worked longer overtime, might be especially competitive, or may particularly enjoy their work. Thus these workers might not perceive working long overtime as job strain or stress.

Australia

Similar patterns are evident in Australia. As a result of new legislation in 1988 (WorkCover; the government agency responsible for overseeing the Workers' Compensation and injury management system (Shine Lawyers 2013)), claims on the grounds of stress had increased by 90 per cent by 1990 where they formed 35 per cent of all workers' compensation costs for government employees. Private sector claims were less significant at that time. WorkCover stress claims made up only 2.5 percent of the total in 1990, but the numbers were starting to grow rapidly (International Labour Organization 1993).

The association between long working hours and CVD risk in Australia was investigated by Raggatt and Morrissey (1997). Using drivers as subjects, they compared the stress indices collected on the road with matched rest-day baselines measures, and investigated the pattern of arousal over the course of shifts. They monitored 5 drivers during day shifts and 5 drivers during night shifts, collecting data on heart rate, BP, adrenaline, noradrenaline, cortisol, state anxiety, self-rated stress, and self-rated arousal, during 12-hour driving shifts and at matched times on non-driving rest days. They found that cardiovascular and catecholamine data were elevated across the entire work day, compared with rest days. Self-reported stress and anxiety were elevated only at the pre-shift measure, and these elevations were interpreted as the result of anticipatory anxiety and additional work demands at the beginning of the shift. Decelerating activation from the 9th to the 12th hours of driving was reflected in slower heart rate and lower subjective arousal ratings. Suggested explanations for these findings were that drivers experience a release of tension when they anticipate the end of the shift and therefore deactivation was a signal or precursor to the onset of fatigue in physiological adjustment mechanisms.

2.4.8 Link between life-style and CVD

Hypertension and coronary heart disease are caused or exacerbated by psychosocial pressures originating in the workplace (World Health Organization 1985b). Hypertension is one of the principal risk factors for the two most important causes of mortality among adults: CVD in the form of coronary heart disease and congestive heart failure, and cerebrovascular disease leading to stroke (Gaziano et al. 2010; World Health Organization 1985b). Virtanen et al. (2012) aggregated the results of observational studies examining the association between long working hours and coronary heart disease (CHD). Their study was conducted according to the Meta-analysis of Observational Studies in Epidemiology (MOOSE) recommendations. The results from prospective observational studies suggested that there was an approximately 40% excess risk of CHD in employees working long hours. The link between shift work and increased cardiovascular morbidity and mortality has strengthened from the previous study (Harrington 1994).

2.5 Dietary patterns and health studies

2.5.1 The importance of food patterns versus nutrients

Nutrition research has traditionally focused on single nutrients in relation to health (Tucker 2010), however, it has proven difficult to demonstrate the causes of the increase in the prevalence of obesity that is now seen in most countries (World Health Organization 2006a). Several studies (Brandhagen et al. 2012; Jeon et al. 2011; Lyles et al. 2006; W. C. Willett & Leibel 2002) examined the relations between nutrients, particularly dietary fat, and obesity, but the epidemiological evidence remains controversial (Auer et al. 2005; Schroder et al. 2004). Furthermore the evidence is not convincing since the blame for rising obesity rates seems to shift regularly from fats to sugars and then back again (Drewnowski 2007). For example, Willett and Leibel (2002) pointed out that there was no evidence linking a high dietary fat intake to long-term obesity. Lyles et al. (2006) developed a new dietary variety score (CVS) based on food macronutrient content, and determined the relationship between CVS and measures of adiposity, and found that BMI was not related to fat CVS. Percent body and trunk fat were not related to CVS for either gender. In a population-based cross-sectional study by Brandhagen et al. (2012), the authors found negative associations between fat intake and BMI and WC in men. On the other hand, another cross-sectional study by Duvigneaud et al. (2007) found that fat intake (kcal/day) was significantly higher in obese subjects compared to their lean counterparts in both genders, and the percentage of energy intake from fat was significantly higher in obese men compared with men of normal weight or WC. Similar results were also obtained by Jeon et al. (2011). They compared the clinical and dietary characteristics of obese adults with those of normal weight and found that the percentage of energy from fat was significantly higher in the obese group. They concluded that fat intake seems to be contributing to the obesity of these subjects. Thus the divergent trends in obesity and fat intake are paradoxical (Gutierrez-Fisac et al. 2002), and the role of dietary fat in the aetiology and maintenance of excess weight is controversial (Duvigneaud et al. 2007). Likewise, there is controversy with regard to the role of simple sugars particularly fructose (Barclay & Brand-Miller 2011). Epidemiological studies show growing evidence (Barclay & Brand-Miller 2011; Bermudez & Gao 2010; Bleich et al. 2009; Bray 2012; & 2013; de Koning et al. 2012; Hu & Malik 2010; Ko et al. 2010; Malik & Hu 2012; Malik, Schulze & Hu 2006; Tappy & Le 2010; Tappy et al. 2010; Y. C. Wang et al. 2012) that consumption of sweetened beverages (containing either sucrose or a mixture of glucose and fructose) is associated with a high energy intake, increased body weight and the occurrence of metabolic and cardiovascular disorders (Tappy et al. 2010). While there is, however, no unequivocal evidence that fructose intake at moderate doses is directly related with adverse metabolic effects (Tappy & Le 2010), there was compelling evidence that very high fructose intake can have deleterious metabolic effects including obesity and CVD (Hu & Malik 2010; Malik & Hu 2012), and fructose in the amounts currently consumed is hazardous to the health of some people (Bray 2012; 2013). However, the role of fructose in the development of the current epidemic of metabolic disorders remains controversial (Tappy & Le 2010). Perhaps total energy might be the main consideration, as several studies highlighted the relationship between sugar-sweetened beverages and total energy intake in CVD risk (Bermudez & Gao 2010; A. M. Bernstein et al. 2012; Bleich et al. 2009; Duffey et al. 2010; E. Han & Powell 2013; Odegaard et al. 2012; Park et al. 2013; Rangan et al. 2009; Thomson et al. 2011).

The nutrient-effect approach may be too simplistic, since each meal comprises a mixture of several foods, which in turn, are composed of many nutrients in different amounts (Schulze & Hoffmann 2006; Togo et al. 2001). The single nutrient or food approach fails to account for interactions between nutrients, inter-correlations between nutrients (collinearity), and the inability to detect small effects from single nutrients (Newby & Tucker 2004). Given the complexity of human diets, the assessment of food intake patterns, therefore, has become increasingly popular as an alternative or supplementary method in nutritional epidemiology (Togo et al. 2004). Additionally, from a public health perspective, the combinations of immediately identifiable foods may be more useful as bases for recommendations with regard to avoiding obesity development (Togo et al. 2001). Moreover, dietary patterns tend to be related to BMI (Y. A. Cho, Shin & Kim 2011; Paradis et al. 2009), and predict health risk, including CVD risk (Berg et al. 2008; Dhingra et al. 2007; J. Kim & Jo 2011; D. Panagiotakos et al. 2009; D. B. Panagiotakos et al. 2007; Schulze & Hoffmann 2006; Shin et al. 2009). Dietary patterns are, therefore, important precursors of disease versus good health (Maskarinec, Novotny & Tasaki 2000).

2.5.2 Approaches in food patterns

According to Newby and Tucker (2004), factor and cluster analysis are two commonly used methods to derive eating patterns in nutritional epidemiology. Empirically derived eating patterns are not defined a priori, and do not depend on how the authors define a healthful pattern. Rather, statistical methods are used to generate patterns from collected dietary data, and factor analysis reduces the data into patterns based on inter-correlations between dietary items, whereas cluster analysis reduces data into patterns based upon individual differences in mean intakes (Newby & Tucker 2004). Principal Component Analysis, a form of factor analysis, derives linear combinations of foods based on their inter-correlations. Cluster analysis groups individuals into maximally differing eating patterns. These approaches have been used in diverse populations with good reproducibility. The field, however, has not fully addressed the effects of diet in sub-populations, including ethnic minorities. Depending on food group coding, sub-dietary patterns may be obscured or artificially separated, leading to potentially misleading results (Tucker 2010).

2.5.3 The proportion of variation

Several investigators addressed the percent of variance in their studies by using factor analysis. For example, Shi et al. (2008) found that the vegetable-rich food pattern was associated with a higher risk of obesity/central obesity in Chinese adults in both genders. They presented four food factor patterns (‘macho’, ‘traditional’, ‘sweet tooth’ and ‘vegetable rich’) and these explained 28.5% of the variance in intake (9.8, 8.0, 5.5 and 5.2% for factors 1-4, respectively). Kim and Jo (2011) suggested that a specific dietary pattern that includes grains, vegetables, and fish may be associated with lower risk of metabolic syndrome in South Korean adults. Their study derived four dietary patterns (white rice and kimchi pattern; meat and alcohol pattern; high fat, sweets, and coffee pattern; and grains, vegetables, and fish pattern) using factor analysis. These factors explained 26.7% of the variance in total food intake, or 8.6%, 6.7%, 5.7%, and 5.7%, respectively. Another study, Naja et al. (2011), found that the presence of four distinct dietary patterns in the Lebanese population were associated with age, gender, education and meal pattern. They also identified four dietary patterns (‘Western’, ‘traditional Lebanese’, ‘prudent’ and ‘fish and alcohol’), and these patterns collectively explained 27.6% of the variance in dietary intake. Only the Western pattern was associated with higher BMI.

2.5.4 Dietary pattern studies and health-disease risk including CVD

The effect of diet on human health has already been underlined in many studies. For example, population-based surveys and large-scale clinical trials have provided scientific evidence that certain diets, especially those rich in fruits, vegetables, legumes, whole grains, fish and low-fat dairy products, are associated with lower incidence of various chronic diseases, including CVD and cancer (Expert panel on detection 2001; Ganji & Kafai 2003; D. B. Panagiotakos, Pitsavos & Stefanadis 2006).

In addition, the dietary pattern approach, namely the measurement of overall diet assessed a priori using a score-based approach (Kant 2004; Trichopoulou et al. 2003) or a posteriori using a data-driven technique such as factor analysis or cluster analysis (Hu 2002; Newby & Tucker 2004), has become an important alternative to the traditional single nutrient-oriented approach. The dietary pattern approach has been used in numerous nutritional epidemiological studies among different populations investigating associations with various health outcomes (Newby & Tucker 2004), including CVD (Kerver et al. 2003; Shimazu et al. 2007; van Dam et al. 2003), several types of cancer (M. K. Kim et al. 2004a; Nkondjock et al. 2005), type 2 diabetes (Duc Son le et al. 2005; McNaughton, Mishra & Brunner 2008; Nettleton et al. 2008; Odegaard et al. 2011a), obesity (Newby et al. 2004), osteoporosis (Langsetmo et al. 2010; Whittle et al. 2012) and health behaviours (E. R. Cho et al. 2011).

Dietary assessment questionnaires commonly used to characterize and explore dietary patterns predicting a health-disease risk, were not only used in Western countries (Newby & Tucker 2004), but also Okubo et al. (2010) examined the relative validity of dietary patterns among Japanese adults in Japan. The dietary information was derived from a self-administered diet history questionnaire (DHQ), which is similar to FFQ. Their data indicated that dietary patterns defined by factor analysis using data from DHQ, had reasonable validity against dietary records (DR) used as a reference method among Japanese adults. They identified three dietary patterns (‘healthy’, ‘Western’ and ‘Japanese traditional’) in women, and two (‘healthy’ and ‘Western’) in men in their study, which showed a relatively similar direction and magnitude of factor loadings of food groups. The Pearson correlation coefficients between the DHQ and the DR for the healthy and Western patterns in men were 0.62 and 0.56, respectively.

The links between obesity and CVD

Several investigators studied dietary patterns in relation to obesity as a risk factor in the development of CVD (Garrison & Castelli 1985; Gupta et al. 2007; Hubert et al. 1983; Jousilahti et al. 1996). For example, in the Framingham Study, Hubert et al. (1983) and Garrison and Castelli (1985) reported that obesity was an independent risk factor for CVD. The obesity index chosen to characterize the population was the Metropolitan Relative Weight (MRW), calculated as the percentage of desirable weight (the ratio of actual weight to desirable weight $\times$ 100) in both studies. Their results showed that weight gain into the middle and older ages conveyed an increased risk of CVD disease (Hubert et al. 1983), and overweight non-smoking men had CVD mortality rates that were up to 3.9 times higher compared with those for non-smoking men who were at the desirable weight (Garrison & Castelli 1985). Jousilahti et al. (1996) reported that among Finnish men obesity, as determined by the BMI, was an independent risk factor for coronary heart disease mortality in men. Gupta et al. (2007) studied the association of obesity measured by BMI, WC or WHR, with multiple risk factors in an urban population. They found a significant positive correlation of BMI, WC and WHR with systolic BP, diastolic BP, fasting glucose and LDL cholesterol, and a negative correlation with physical activity and HDL cholesterol in both men and women. With increasing BMI, WC and WHR, the prevalence of hypertension, diabetes, and metabolic syndrome increased significantly. WHR was also significantly related with the prevalence of high total- and LDL cholesterol and triglycerides. They concluded that there was a continuous positive relationship of all markers of obesity (BMI, WC and WHR) with the major coronary risk factors – hypertension, diabetes and metabolic syndrome in both men and women, while WHR also correlates with lipid abnormalities. Their study also found that a higher cardiovascular mortality was observed at very low BMI (<20 kg/m^2), which was possibly related to greater smoking among the group.

Below the literature has been reviewed in relation to dietary patterns and related CVD risk. Diabetes mellitus has also been reported to be a major risk factor for CVD in several studies (Alberti, Zimmet & Shaw 2007; Oba et al. 2008), and therefore was included. Approximately 75-80% of people with diabetes die of CVD. People with Type 2 diabetes have a two to four times higher risk of coronary heart disease than the rest of the population and their prognosis is poorer, according to Alberti, Zimmet and Shaw (2007) and Oba (2008).

2.5.5 Dietary patterns and obesity

1. Japan

Mizoue et al. (2006) identified three dietary patterns among 2,106 Japanese men (47-59 years) using a 45-item FFQ: 1) 'high-dairy, high-fruit and vegetable, high-starch, low-alcohol' pattern; 2) an animal food pattern; and 3) a Japanese pattern. Men with a higher score for the animal food dietary pattern had higher BMI and consumed larger amounts of alcohol.

In contrast, Shimazu et al. (2007) identified three dietary patterns (Japanese pattern, 'animal food' pattern and 'high-dairy, high-fruit-and-vegetable, low-alcohol' pattern) in a 7 year follow-up. This was a large population study of 40,547 men and women aged 40-79 years using a 40-item FFQ for dietary assessment. Interestingly enough, there were no appreciable differences in the BMI between or within the quartiles of any of the dietary pattern scores. There were no p-values given to assess the significance of the differences.

In addition, Sadakane et al. (2008) investigated Japanese subjects aged 40-69 years using a 30-item FFQ, and identified three dietary patterns (vegetable pattern, meat pattern and Western pattern) in 6,886 men and women for the analysis of blood pressure, and 7,641 men and women for the analysis of serum lipids. These authors reported that BMI was not associated with any of the dietary patterns.

2. Other Asian countries

Shi et al. (2008) studied the association between a vegetable-rich food pattern and obesity among Chinese adults of 2,849 men and women aged 20 years and over in a cross-sectional survey. General obesity was defined as BMI ≥ 28 kg m^{-2} according to the Chinese standard (Bei-Fan 2002), and central obesity was defined as WC ≥ 90 cm in men, according to the International Diabetes Federation criteria (Alberti, Zimmet & Shaw 2005). Food intake was assessed by FFQ. Four distinct food patterns were obtained: 'macho' (was characterized by various kinds of animal foods and alcohol, that is, foods commonly eaten by men), 'traditional' (rice, fresh vegetable and wheat flour), 'sweet tooth' (cake, milk, yogurt and drinks) and 'vegetable rich' (whole grains, fruits, root vegetables, fresh and pickled vegetables, milk, eggs and fish). Shi et al. (2008) found that the vegetable-rich food pattern was positively associated with vegetable oil and energy intake, and obesity/central obesity increased across the quartiles of the vegetable-rich food pattern.

Dugee et al. (2009) studied the major dietary patterns of Mongolian adults in relation to the risk of obesity with 418 adults (200 men and 218 women) aged ≥ 25 years using an FFQ with 68 items. Subjects with a BMI ≥ 25 kg/m^2 were defined as obese according to the proposed classification for Asian adults by the Western Pacific Region of World Health Organization, and central obesity was defined as WC ≥ 90 cm for men (World Health Organization 2000). An exploratory factor analysis resulted in three dietary patterns: 'transitional pattern' which was high in processed meat and potato (mono- gastric meat, ruminant meat, white vegetables, dark yellow vegetables, potato, bread, biscuits and milk), 'traditional pattern' which was rich in whole milk, fats and oils (milk, yogurt, kumis [fermented mare milk], fats and oils, sugar, confectionery, horse meat and refined wheat products) and 'healthy pattern', which comprised of a greater intake of whole grains, mixed vegetables and fruits (egg, barley, whole wheat, rice, millet, mixed vegetables and fruits,). Dugee et al.

found that individuals in the upper quintile of the 'transitional pattern' had a significantly greater risk of obesity, while subjects in the highest quintile of the 'healthy dietary pattern' were found to have a significantly decreased risk of obesity. Men in the highest quintile of the 'transitional pattern' had greater risk of abdominal obesity (WC $\geq$ 90 cm) than those in the lowest quintile.

Cho, Shin and Kim (2011) identified the major dietary patterns and evaluated the association between these patterns and BMI for 1,118 South Korean subjects (403 men and 715 women) aged 30 to 70 years, using BMI > 27.5 as an indicator of obesity. The typical dietary intake was assessed using an FFQ, and dietary patterns were derived from 39 predefined food groups using factor analysis. Three dietary patterns; 'vegetable-seafood' (characterized by high factor loading for vegetables, shellfish, seaweeds, soy foods, fish, and fruits), 'meat-fat' (characterized by high factor loadings of red meat, oil, poultry, noodles, and processed meats), and 'snack' (characterized by higher intakes of bread, cakes, pizza, cracker, cookie, and fruit products) were identified. The 'meat-fat' dietary pattern was positively associated with obesity, whereas the 'vegetable-seafood' and 'snack' dietary patterns showed no association with obesity. Their results suggested that diets high in meat, oil, and sugar may be associated with obesity in Korean adults.

Unlike the Japanese studies, these three Asian population studies revealed different dietary patterns in relation to obesity, and interestingly, three different cut-off values for BMI were used to define obesity.

3. Western countries

Newby et al. (2003) studied the nutritional etiology of changes in BMI and WC by dietary intake patterns, and hypothesized that a healthy dietary pattern would lead to smaller changes in BMI and WC than would other dietary patterns. The subjects were 240 healthy American men and 219 women, aged 30-80 years. Diet was assessed by using 7-day dietary records, from which 41 food groups were created and analysed using cluster analysis. Five dietary patterns were derived (healthy, white bread, alcohol, sweets, and meat-and-potatoes pattern). They found that the mean annual change in WC was more than 3 times as great for subjects in the white-bread cluster as for those in the healthy cluster. They suggested that consuming a diet high in fruit, vegetables, reduced-fat dairy, and whole grains and low in red and processed meat, fast food, and soda was associated with smaller gains in BMI and WC. Using the same data, Newby et al. (2004) also studied whether food patterns derived from exploratory factor analysis are related to anthropometric changes. Six food patterns were derived; Factor 1 (reduced-fat dairy products, fruit, and fiber), Factor 2 (protein and alcohol), Factor 3 (sweets), Factor 4 (vegetable fats and vegetables), Factor 5 (fatty meats) and Factor 6 (eggs, bread, and soup). Their results suggested that a pattern rich in reduced-fat dairy products and high-fiber foods may lead to smaller gains in WC in both women and men in the USA.

Togo et al. (2004) studied prospective associations between food intake factor scores and subsequent BMI changes, as well as longitudinal associations between changes in food intake patterns and the subsequent BMI changes, in a Danish population of 1,200 women and 1,236 men, aged 30-60 years at baseline. Height and weight were measured and a FFQ was completed at baseline with two follow-up surveys, at 5 and 11 years later. Their results showed that for men, three factors labelled 'green', 'sweet' and 'traditional' were identified. In men, scores on the 'sweet' factor was inversely associated with the baseline BMI. The 'traditional' factor score was inversely associated with both the subsequent 5- and 11-year BMI change.

Thus, factor analysis has been used to study the dietary patterns, as well as investigating relationships between dietary patterns and changes in the measures of obesity. No studies were found relating dietary patterns and obesity in Australian male subjects.

2.5.6 Dietary patterns, CVD risk factors and mortality

The investigation and analysis of dietary patterns and its role in the chronic diseases, including CVD, has received much attention (Mizoue et al. 2006). The focus here is on Japanese studies, and in the absence of any Australian studies, some examples of Western studies have been included.

1. Japan

The following six studies have suggested how dietary patterns of Japanese people are related to CVD risk factors or mortality (refer to Table 2.5 below). All of these studies have considered the impact of dietary patterns on indicators of body fatness.

Chi, Nakano and Yamamoto (2003) (Table 2.5 (1)) studied the relationships of HDL cholesterol with gender, age, body composition, and lifestyle related factor including dietary patterns, alcohol consumption, smoking, and physical activity. BMI was used to categorized weight into “underweight (BMI < 20)”, “normal (BMI 20-24.9)” and “obese (BMI ≥ 25)”, according to New Japanese Obesity Classification (Examination Committee of Criteria for 'Obesity Disease' in Japan 2002). These were selected for the factor analysis, and three dietary patterns were identified: The ‘prudent pattern’, the ‘Western pattern’ and the ‘high-salt dietary pattern’. They found that the important predictors of higher HDL cholesterol levels were being female and a higher frequency of alcohol consumption. Less strongly related with HDL cholesterol levels were age and a prudent dietary pattern. Smoking and BMI were strongly negatively related to HDL cholesterol levels.

Mizoue et al. (2006) (Table 2.5 (2)) studied the association between major dietary patterns and the glucose tolerance status. Three dietary patterns were generated by factor analysis: 1) a high-dairy, high-fruit and vegetable, high-starch, low-alcohol (DFSA) pattern; 2) an animal food pattern; and 3) a Japanese pattern. The potential confounding variables considered were hospital, age, parental history of diabetes, occupational rank, BMI, smoking and leisure-time physical activity. Mizoue et al. found that the dietary pattern characterized by a frequent consumption of dairy products, fruits and vegetables, but low alcohol intake, may be associated with a decreased risk of developing poor glucose tolerance, and in turn reduces the risk of type 2 diabetes, and therefore reduces the risk of CVD.

Shimazu et al. (2007) (Table 2.5 (3)) studied contemporary dietary patterns among the Japanese and their impact on CVD mortality in a large-scale population-based prospective cohort study. Factor analysis (principal component) identified three dietary patterns; (i) a ‘Japanese pattern’, (ii) an ‘animal food’ dietary pattern and (iii) a ‘high-dairy, high-fruit-and-vegetable, and low-alcohol (DFA)’ dietary pattern.

They found that the Japanese dietary pattern was related to high sodium intake and high prevalence of hypertension. After adjustment for potential confounders, the Japanese dietary pattern score was associated with a lower risk of CVD mortality (hazard ratio of the highest quartile vs the lowest, 0.73; 95% confidence interval: 0.59-0.90; P for trend = 0.003). The 'animal food' dietary pattern was associated with an increased risk of CVD, but the DFA dietary pattern was not. Shimazu et al. concluded that the Japanese dietary pattern was associated with a decreased risk of CVD mortality despite its relation to sodium intake and hypertension. Furthermore, after adjustment by age, gender, smoking status, walking duration, education, total energy intake, BMI and history of hypertension, the results remained similar.

Using a FFQ, Sadakane et al. (2008) (Table 2.5 (4)) studied the association between dietary patterns derived from factor analysis and the levels of blood pressure and serum lipids in a Japanese population. This cross-sectional analysis involved 6,886 men and women for the analysis of blood pressure, and 7,641 men and women for the analysis of serum lipids. Three dietary patterns were identified: 'vegetable', 'meat', and 'Western'. Their results showed that in men, the 'meat' pattern was associated with higher total cholesterol, HDL cholesterol and LDL cholesterol. The 'Western' pattern was also associated with higher total cholesterol and LDL cholesterol.

Nanri et al. (2011) (Table 2.5 (5)) investigated the association between dietary pattern and serum high-sensitivity C-reactive protein (hs-CRP), an acute-phase protein involved in inflammation. Chronic inflammation is independently and directly associated with several diseases including CVDs, atherosclerosis, type 2 diabetes, and metabolic syndrome (Dandona et al. 2005; Pepys & Hirschfield 2003; Pradhan et al. 2001; Ridker 2003; K. J. Williams & Tabas 2002). The cross-sectional study conducted by Nanri et al. (2011) identified five dietary patterns: healthy, Western, seafood, bread, and dessert. They found that after adjustment for age, alcohol use, smoking, physical activity, and BMI, hs-CRP levels in men were inversely associated with the healthy, bread, and dessert patterns and positively associated with the seafood pattern. On the other hand, the hs-CRP was positively significantly associated with the Western dietary pattern in women and largely mediated by increasing BMI. In this study, the Western pattern score was significantly positively associated with estimated fat intake, but the fat-derived energy intake accounted for a mean of 20% of total energy intake in men and 26% in women, and these values were substantially lower than the corresponding estimates in the American population (eg. 31%-38% in an ethnically diverse American population (Nettleton et al. 2006) and 27%-31% in Iranian women (Esmaillzadeh et al. 2007)), according to Nanri et al. (2011).

Maruyama et al. (2013) (Table 2.5 (6)) studied dietary patterns that were associated with CVD mortality among middle-aged Japanese. They identified three major dietary patterns, 'vegetable', 'animal food' and 'dairy product'. They also measured the following CVD risk factors by a self-administered questionnaire at baseline: height, weight, smoking habit, walking time, hours of sports, education status, perceived mental stress, sleep duration and history of hypertension and diabetes, and calculated BMI. They found that 'vegetable' and 'dairy product' patterns were associated with lower mortality from total CVD, while the 'animal food' pattern was not associated with mortality from total CVD among Japanese. After adjustment for CVD risk factors, the inverse association with mortality from CHD was of borderline statistical significance for the vegetable pattern in men, and the inverse association with mortality from stroke remained statistical significant for both genders for the dairy product pattern. In addition, for animal food pattern, after adjustment for CVD risk factors, the inverse association from CHD became no longer statistically significant for both genders. They concluded that the animal food pattern was not associated with mortality from stroke, coronary heart disease or total CVD for either gender.

Of the six studies identified, two were directly concerned with CVD mortality and dietary factors. The other four smaller studies were related with CVD risks and dietary factors. All six studies involved BMI and include other variables for adjustments.

Table 2.5 Japanese research on factor analysis in dietary

	Author	Year	Subjects	Assessment of dietary pattern	Identified/contents of dietary patterns	**A**uthor'**s** **O**bjectives **(A's O)** & **F**indings (**F**)
1	Chi, Nakano & Yamamoto	2003	463 M (40-79 y) 845 W (40-79 y)	16-items FFQ	1. Prudent; vegetables, bean foods, fruits, red meat, fishes and consumption of milk and milk products 2. Western; fatty foods, cake and juice 3. High-salt; misoshiru (traditional Japanese soup), pickle, and other salty foods	(**A's O**) HDL cholesterol (CHD associated) risk factors (**F**) Important predictors of higher HDL choles-terol levels were; - being female - higher frequency of alcohol consumption - less strongly related were age & prudent dietary pattern - strongly negatively related were smoking & BMI
2	Mizoue et al.	2006	2,106 M (47-59 y)	74-items FFQ	1. DFSA pattern; frequent intake of fermented dairy products, milk, confectioneries, bread, fruits, and vegetables, and infrequent intake of shochu (a local alcoholic beverage) 2. 'animal food' pattern; red meat, poultry, seafood excluding fish, processed meat and fish products, and fried or broiled foods 3. Japanese pattern; soybean products, seaweeds, pickles, and green tea, vegetables, and fish	(**A's O**) Dietary patterns in relation to glucose tolerance status (**F**) DFSA pattern and Japanese pattern was positively associated with impaired glucose tolerance, thus related to the risk of CVD
3	Shimazu et al.	2007	40,547 M+W (40-79 y)	40-items FFQ	1. Japanese pattern; soybean products, fish, seaweeds, vegetables, fruits & green tea 2. 'animal food' pattern; various animal-derived foods (beef, pork, ham, sausage, chicken, liver and butter), coffee & alcoholic beverages 3. DFA pattern; dairy products (milk and yoghurt), margarine, fruits & vegetables (carrot, pumpkin and tomato), & low-alcohol	(**A's O**) Dietary patterns and their impact upon CVD* mortality (**F**) Japanese dietary pattern was associated with a decreased risk of CVD mortality
4	Sadakane et al.	2008	BP analysis 2,742 M (40-69 y) 4,144 W (40-69 y) Serum lipids analysis 2,992 M (40-69 y) 4,649 W (40-69 y)	30-items FFQ	1. Vegetable pattern; vegetables, potatoes, soybeans products tofu and fermented soybeans, fruits, sea weeds, citrus, beans, and dried fish 2. Meat pattern; processed meats, beef, pork, poultry, steamed fish paste, high-fat products, and butter 3. Western pattern; breads, butter, and yoghurt, and lower intakes of rice, salty products, and miso soup	(**A's O**) The association between dietary patterns and the major CVD risk factors (**F**) The association between 'meat pattern' and total, HDL and LDL cholesterol; and also 'Western pattern' and total and LDL cholesterol

(cont.)

	Author	Year	Subjects	Assessment of dietary pattern	Identified/contents of dietary patterns	**A**uthor'**s** **O**bjectives **(A's O)** & **F**indings (**F**)
5	Nanri et al.	2011	3,905 M (40-69 y) 5,640 W (40-69 y)	47-items FFQ	1. healthy high in vegetables and fruit 2. Western high in meat and fried foods 3. seafood high in shellfish, squid, fish etc 4. bread high in bread and low in rice 5. dessert high in confections and fruit	(**A's O**) Dietary patterns and CRP (**F**) After adjustment for age, alcohol use, smoking, physical activity, and BMI, high-sensitivity CRP levels in men were inversely associated with the healthy, bread, and dessert patterns and positively associated with the seafood pattern
6	Maruyama et al.	2012	26,598 M (40-79 y) 37,439 W (40-79 y)	40-items FFQ	1. Vegetable pattern; fresh fish, vegetables, fungi, potatoes, algae, tofu (soybean curd) and fruits 2. 'animal food' pattern; meats, fishes and deep-fried foods or tempura 3. 'dairy product' pattern; milk and dairy products, butter, margarine, fruits, coffee and tea	(**A's O**) Whether dietary patterns were associated with risk of CVD (**F**) vegetable' and 'dairy product' patterns were associated with lower CVD mortality, while the 'animal food' pattern was not associated with CVD mortality

Abbreviations used;

DFA='high-dairy, high-fruit-and-vegetable, low-alcohol'

DFSA='high-dairy, high-fruit and -vegetable, high-starch, low-alcohol'

CVD=Cardiovascular disease

CHD=Coronary heart disease

BP=blood pressure

CRP=C-reactive protein

2. Other Asian countries

Kim and Jo (2011) examined the association between habitual South Korean dietary patterns and the risk of metabolic syndrome, a cluster of metabolic risk factors associated with increased risks of CVD and type 2 diabetes (Ambrosini et al. 2010; McNeill et al. 2005). The components of metabolic syndrome include abdominal obesity, hyperglycemia, hypertension, and dyslipidemia. A total of 9,850 South Korean adults aged 19 years or more, participated. In this study the dietary data were assessed by the 24-hour recall method rather than FFQ. Factor analysis showed that there were four dietary patterns: The 'white rice and kimchi pattern'; the 'meat and alcohol pattern'; the 'high fat, sweets, and coffee pattern'; and the 'grains, vegetables, and fish pattern'. The 'meat and alcohol pattern' was adversely associated with hypertriglyceridemia and elevated blood pressure. In contrast, the 'grains, vegetables, and fish pattern' was associated with lower risk of hypertriglyceridemia and was also inversely associated with the risk of metabolic syndrome. This dietary pattern has some similarities to the Japanese pattern identified by Shimazu et al. (2007) which was associated with decreased risk of CVD mortality (Table 2.5 (3)).

Cho et al. (2011) studied Korean dietary patterns with lifestyle risk factors of chronic diseases, including CVD and cancer. The study population included 11,440 participants (6,434 men and 5,006 women) aged ≥30 years. Dietary information was collected using an FFQ. Three main dietary patterns were identified; The 'Western pattern' was characterized by high consumption of fast foods, animal fat-rich foods, fried foods, grilled meat and seafood (barbecue), cholesterol-rich foods, sweet foods and caffeinated drinks; the 'healthy pattern' was characterized by high consumption of green-yellow vegetables, seaweeds, healthy protein foods, bonefish, fruit and dairy products; and the 'traditional pattern' was characterized by high consumption of salted vegetables and seafood, cereals and light-coloured vegetables. Smoking was positively associated with the Western pattern and the traditional pattern, but was inversely associated with the healthy pattern in men. Alcohol consumption was positively associated with all patterns in both genders, and physical activity was also positively related with all patterns but only in men. They found that the three dietary patterns were strongly associated with health behaviours, including not smoking, low alcohol consumption, participating in physical activity, and suggested that the possible confounding effect of other risk behaviours should be appropriately considered when conducting nutritional epidemiological studies of the association between dietary patterns and disease outcomes. Their study also considered BMI, and they found that participants with a higher Western dietary pattern score were younger and more likely to smoke and drink, and men were more likely to have a higher BMI (E. R. Cho et al. 2011).

Odegaard et al. (2011a) studied the association between dietary patterns and incident type 2 diabetes, for 43,176 Chinese men and women, aged 45-74 years, free of diabetes, CVD and cancer at baseline. Dietary information was collected using a semi-quantitative FFQ. Two major dietary patterns were identified using principal components analysis: a vegetable, fruit, and soy-rich pattern (VFS) and a dim sum and meat-rich pattern (DSM), and the associations of the two dietary patterns with diabetes risk were modified by smoking status. Even so, a VFS dietary pattern was inversely associated with the incident type 2 diabetes. DSM pattern was associated with a significantly increased risk of type 2 diabetes, and therefore the risk of CVD. In their study, BMI was calculated using self-reported height and weight. Individuals with incident diabetes were older, had a higher BMI, reported less physical activity, had less education, and smoked more. They evaluated the potential effect modification through stratification by gender, BMI, age, physical activity, and smoking habits, but the results did not differ.

3. Western countries

Several studies considered the relationships between dietary patterns and various risk factors for CVD in a variety of Western population, but not Australia. For example, McNaughton, Mishra and Brunner (2008) attempted to identify a dietary pattern associated with insulin resistance and whether this pattern was prospectively associated with type 2 diabetes. The investigation was based on 7,339 participants of the Whitehall II study (phase 3) in the UK, including men and women aged 39-63 years, and dietary intake was measured using an FFQ. Ten dietary patterns were identified. They found that high consumption of the ‘low calorie/diet soft drinks’, ‘onions, leeks, and garlic’, ‘sugar-sweetened beverages’, ‘burgers and sausages’, ‘crisps or other packet snacks’ and ‘white bread and rolls’ dietary patterns, and low consumption of the ‘wholemeal bread and rolls’, ‘French dressing and vinaigrette’, ‘jam, marmalade, and honey’ and ‘medium- and high-fiber breakfast cereals’ dietary patterns, were related with insulin resistance and significantly increased with the risk of type 2 diabetes. They were therefore associated with the risk of CVD. In their study, weight and height were measured to calculate the BMI. Participants with a higher dietary score were also more likely to be smokers, participate less in vigorous physical activity, have higher BMIs, and be hypertensive.

There was a five-year follow-up study by Panagiotakos et al. (2009) of the incidence of CVD in relation to dietary habits, among men and women from Greece. CVD (coronary heart disease, acute coronary syndromes, stroke, or other CVD) was developed during the follow-up period, and was defined according to WHO criteria. Principal components analysis was applied, and 15 dietary patterns were identified. They found that the dietary patterns characterized mainly by cereals, small fish, hardtack and olive oil intake (Component (CP) 2), and fruits, vegetables intake and olive oil use in daily cooking (CP 5) were associated with lower CVD risk; while patterns that were mainly characterized by sweets, red meat, margarine, salty nuts intake (CP 7), and hard cheese (CP 8), as well as alcohol intake (CP 11 to 15), were associated with higher CVD risk.

3.1 Blood pressure

Van Dam et al. (2003) analysed the food consumption patterns and their association with cardiovascular risk factors in the general Dutch population for 9,321 men and 10,429 women aged 20-65 years from a cross-sectional study using a validated FFQ. Food consumption patterns were identified with the use of factor analysis. They identified three food consumption patterns: the ‘cosmopolitan’ pattern (greater intakes of fried vegetables, salad, rice, chicken, fish, and wine), the ‘traditional’ pattern (greater intakes of red meat and potatoes and lesser intakes of low-fat dairy and fruit), and the ‘refined-foods’ pattern (greater intakes of French fries, high-sugar beverages, and white bread and lesser intakes of whole-grain bread and boiled vegetables). Independent of other lifestyle factors and BMI, the ‘cosmopolitan-pattern’ score was significantly associated with lower blood pressure and higher HDL-cholesterol concentrations, and the ‘traditional-pattern’ score was associated with higher blood pressure and higher concentrations of HDL cholesterol, total cholesterol and glucose. The ‘refined-foods-pattern’ score was associated with higher total cholesterol concentrations and lower intakes of micronutrients.

3.2 Myocardial infarction

Martinez-Ortiz et al. (2006) studied the association between dietary patterns and the risk of a first nonfatal acute myocardial infarction (MI) in a study of Costa Rican adults involving 496 cases and 518 controls. The mean age was 57 ± 11 years. The dietary information was obtained using a semi-quantitative FFQ. Two diet patterns were identified, ‘vegetable’ characterized by increased intake of vegetables and fruits, and ‘staple’ characterized by an increased use of palm oil for cooking, and intake of refined grains (mostly white rice and white bread), legumes, coffee, added sugar, and red meat. They found that the ‘staple’ dietary pattern was associated with low plasma HDL cholesterol, low α-linolenic acid in adipose tissue, and increased risk of MI.

3.3 Chronic disease

The Medical Research Council (MRC) National Survey of Health and Development (NSHD, also known as the 1946 British Birth Cohort) is a longitudinal study conducted on stratified social classes in England, Scotland and Wales. In this study, McNaughton et al. (2007) investigated the relationship between dietary patterns during adult life (at ages 36, 43, and 53 years), and risk factors for chronic disease at age 53 years. WC, height, and weight were measured, and BMI was calculated as kg/m^2. “At risk” was defined as a WC > 102 cm in men (Expert panel on detection 2001), and the standard cut-offs were used for BMI (World Health Organization 1995). Participants (696 females and 569 males) completed a 5-day food diary at three occasions during adult life. Factor analysis was used to identify dietary patterns, and a pattern score was calculated from the consumption of the food items in each dietary pattern. They found that two dietary patterns were apparent in men and were labelled ‘ethnic foods and alcohol pattern’ (red wine, other legumes, avocados and olives, mineral water, white wine, and fried Indian and Chinese foods); and ‘mixed pattern’ (soya milk, other vegetables, fruit juice, skimmed-milk beverages, sweet biscuits, and ice cream). [The original detailed descriptions of the dietary patterns has been published by Mishra et al. (2006)]. The ‘mixed pattern’ was inversely associated with WC and blood pressure, whereas there were no significant associations with the 'ethnic foods and alcohol pattern'. They suggested that specific dietary patterns throughout adult life were associated with chronic disease risk factors.

3.4 Metabolic syndrome/multiple metabolic risk factors

Metabolic syndrome is a cluster of metabolic risk factors associated with increased risks of CVD and type 2 diabetes (Ambrosini et al. 2010; McNeill et al. 2005). The components of metabolic syndrome include abdominal obesity, hyperglycemia, hypertension, and dyslipidemia. Panagiotakos et al. (2007) studied the associations between food patterns and the characteristics of the metabolic syndrome for 1,514 men aged 18 to 87 years and 1,528 women aged 18 to 89 years in Greece, using a semi-quantitative FFQ. Principal components analysis was applied to extract dietary patterns from 22 foods or groups of foods. Six components were derived: Component 1 was characterized by the consumption of cereals, fish, legumes, vegetables, and fruits; component 2 was characterized by the intake of potatoes and meat, and component 6 was characterized by alcohol intake. The other components were mainly characterized by the consumption of dairy and sweets. It was found that component 1 was inversely associated with WC, systolic blood pressure, triglycerides; positively associated with high-density lipoprotein cholesterol levels; and inversely with the likelihood of the metabolic syndrome. Components 2 and 6 were positively correlated with the above indexes, and the likelihood of having the metabolic syndrome which was conducive to CVD.

There were no studies using Australian male subjects in the areas of '*Dietary patterns and cardiovascular related diseases*.'

Other studies of 'Western dietary patterns' and obesity

Paradis (2009) investigated whether dietary patterns were associated with obesity phenotypes in Canada. This was a cross-sectional study based on a sample of 664 participants including men and women aged between 18 and 55 years. Dietary data were collected from an FFQ, and a factor analysis was performed to derive dietary patterns. Anthropometric variables including weight, height, waist and hip circumference were all measured by the same experienced staff member. Obesity was defined as having a BMI ≥ 30 kg m^{-2}. Their results showed that there were two dietary patterns were identified: Western and prudent. The Western pattern was mainly characterized by a higher consumption of refined grains, French fries, red meats, condiments, processed meats and regular soft drinks whereas the prudent pattern was mainly characterized by a higher consumption of non-hydrogenated fat, vegetables, eggs and fish and seafood. Subjects in the top tertile of the Western pattern had higher BMI, weight, waist girth, waist-to-hip ratio and fat mass than those in the bottom tertile. In contrast, subjects in the top tertile of the prudent pattern had lower BMI, weight, waist girth, fat mass, HDL-cholesterol levels, and lower triglyceride levels than those in the bottom tertile. These suggested that individuals having a high score of the Western pattern were more likely to be obese, and those having a higher score of the prudent pattern were less likely to be obese.

Naja et al. (2011) characterize the dietary patterns in Lebanon and investigated their associations with socio-demographic factors, BMI and WC, in a cross-sectional survey for a nationally representative sample of 2,048 adults aged 20-55 years. Dietary intake was assessed using a 61 item FFQ. Weight, height and WC were measured and BMI was calculated. The prevalence of obesity (BMI ≥ 30.0 kg/m^2) and elevated WC (≥ 94 cm for men) were classified according to the International Diabetes Foundation cut-offs. In their results, four dietary patterns were identified: 'Western' (pies and pizzas, fast-food sandwiches, fried potatoes, regular soda, bottled juices, meat and poultry, cured meats, nuts and seeds, refined grains, mayonnaise, ice cream and sweets); 'traditional Lebanese' (fruit, vegetables, burghul *(crushed wheat)*, legumes, olives, whole-fat dairy, starchy vegetables, fats and oils, and eggs); 'prudent' (primarily whole bread, low-fat dairy and light soda, refined grains, fats and oils and regular soda) and 'Fish and alcohol' (fish and alcohol). They found a positive association between the scores of the Western pattern, and the BMI and WC.

Denova-Gutierrez et al. (2011) studied the relationships between dietary patterns and obesity, abdominal obesity, and high body fat proportion for 6,070 participants (27.1% men and 72.9% women) aged 20-70 years in a cross-sectional analysis in Mexico. The dietary intake was evaluated using a 116-item FFQ. Weight, height and WC were measured, overweight/obese was defined as BMI ≥ 25 kg/m^2 (World

Health Organization 2012), and abdominal obesity was defined as having WC >102 cm in men (Expert panel on detection 2001). Body composition was assessed as body fat proportion determined by dual-energy X-ray absorptiometry. High body fat proportion was defined as >25% in men (Deurenberg, Yap & van Staveren 1998). Factor analysis identify three major dietary patterns: prudent (high in fruits, vegetables, and legumes and low in pastries, refined cereals, and cookies), Westernized (high in refined cereals, pastries, corn tortillas, and sodas and low in whole grain cereals, seafood, and dairy products), and high animal protein/fat (high in processed meat, red meat, poultry, butter, and eggs and low in fresh fruits and pastries). They found that participants in the highest quintile of the prudent pattern were less likely to have high body fat proportion, and that participants in the highest quintile of the Westernized pattern had greater odds for obesity and abdominal obesity. Additionally, participants in the upper quintile of the high-animal protein/fat pattern had greater odds of being obese.

Other studies of 'Western dietary patterns' and CVDs

Hu et al. (2000) investigated the dietary patterns and predicted the incidence of CHD using a prospective cohort study of 44,875 US men aged 40-75 years at baseline in 1986. This was part of an eight-year follow-up in the health Professionals Follow-up Study (HPFS). The data was collected through a 131-item FFQ. Factor analysis was used to identify two major dietary patterns. The first factor, which was labelled the 'prudent pattern', was characterized by higher intake of vegetables, fruit, legumes, whole grains, fish, and poultry, whereas the second factor, the 'Western pattern', was characterized by higher intake of red meat, processed meat, refined grains, sweets and dessert, French fries, and high-fat dairy products. Their results indicated that the prudent pattern may reduce the risk of CHD.

Osler et al. (2001) examined whether food intake patterns, defined both on an *a priori* basis of food recommendations and on an *a posterior* basis by factor analysis, determine subsequent mortality. The total population comprised 3,698 middle-aged Danish men and 3618 women, aged 30-70 years, and completed a twenty-eight item FFQ. These were analysed using principal component analysis, and three dietary patterns were identified at baseline: (1) a predefined healthy food index, which reflected daily intakes of fruits, vegetables and wholemeal bread, (2) a prudent pattern associated with frequent intake of wholemeal bread, fruits and vegetables, and (3) a Western dietary pattern characterized by frequent intakes of meat products, potatoes, white bread, butter and lard. Among participants with complete information on all variables, 398 men and 231 women died during the follow-up. After controlling for confounding variables, the prudent pattern was found to be inversely associated with all-cause and cardiovascular mortality. The Western pattern was not significantly associated with mortality. Osler et al. (2002) also investigated the risk of coronary heart disease (CHD) associated with food intake patterns, on a cohort study with a follow-up in 1996. Their results showed that the healthy food index [(1) predefined healthy food index above] and the Western pattern were not associated with CHD. A decreased risk of CHD was observed with the ‘prudent’ pattern, which represented a diet high in wholemeal bread, pasta, rice, oatmeal products, fruit, vegetables, fish, and low in white bread, but the association vanished after controlling for confounding. The BMI modified the effect of the prudent and the Western patterns on CHD risk, suggesting an inverse association between both patterns and CHD in persons with low BMI, while the risk of CHD seemed to be positively related to the prudent and the Western pattern in those with high BMIs (Osler et al. 2002).

Kerver et al. (2003) studied the hypothesis that the complex dietary behaviours could be grouped into major dietary patterns and that they were related to the risk factors for CVD in the US adults. An FFQ data was collected from 13,130 subjects aged over 20 in the third National Health and Nutrition Examination Survey. Factor analysis identified six dietary patterns, of which two emerged as the most predominant: ‘The Western pattern’ (characterized by high intakes of processed meats, eggs, red meats, and high-fat dairy products), and ‘the American-healthy pattern’ (characterized by high intakes of green, leafy vegetables; salad dressings; tomatoes; other vegetables; cruciferous vegetables; and tea). Their results showed that the Western pattern was associated positively with serum C-peptide, serum insulin, and glycated haemoglobin and inversely with red blood cell folate concentrations, and therefore were associated with biomarkers of CVD risk, whereas the American-healthy pattern had no linear relation with any of the biomarkers examined.

Iqbal et al. (2008) assessed the association between dietary patterns and acute myocardial infarction (AMI) globally. INTERHEART was a standardized case-control study involving participants from 52 countries, and included 5,761 cases and 10,646 control subjects. They identified three major dietary patterns using factor analysis: 'oriental' (high intake of tofu and soy and other sauces), 'Western' (high in fried foods, salty snacks, eggs, and meat), and 'prudent' (high in fruit and vegetables). They observed an inverse association between the prudent pattern and AMI, with higher levels being protective. The Western pattern showed a U-shaped association with AMI, but the oriental pattern demonstrated no relationship with AMI. They suggested that increased consumption of fruits and vegetables and reduced intake of fried foods, probably related to the type of fat used for frying and salty snacks, was likely to reduce the risk of AMI in all regions of the world.

Deshmukh-Taskar et al. (2009) identified differences in dietary patterns by socio-economic, demographic and lifestyle factors and examined the association between dietary patterns and the risk for metabolic syndrome (MetS) in the USA. The sample consisted of young adults (19-39 years; n=995; 61% females/39% males; 80% whites/20% blacks) who completed an FFQ. Two dietary patterns were identified: The 'Western dietary pattern' consisted of refined grains, French fries, high-fat dairy foods, cheese dishes, red meats, processed meats, eggs, snacks, sweets/desserts, sweetened beverages and condiments. The 'prudent dietary pattern' consisted of whole grains, legumes, vegetables, fruits, 100 % fruit juices, low-fat dairy products, poultry, clear soups and low-fat salad dressings. Their results showed that WC, triceps skinfold, plasma insulin, serum triacylglycerol (TAG), and the occurrence of MetS were all inversely associated with the 'prudent dietary pattern'.

Denova-Gutierrez et al. (2010) used exploratory factor analysis to examine whether particular dietary patterns were related to risk of metabolic syndrome (MetS) in Mexican adults. 1,489 men and 3,751 women aged 20-70 years, completed a semi-quantitative FFQ. Analysis revealed three major dietary patterns: 'Prudent' (processed vegetable juices, potatoes, fresh fruits, fresh vegetables, and legumes), 'Western' (pastries, refined cereals, corn tortillas, soft drinks, whole cereals, seafood, and full-fat dairy products) and 'high protein/fat' (red meat, processed meat, margarine, and eggs). They found that those in the highest tertile of the Western dietary pattern had higher BMI, higher prevalence of obesity, and higher prevalence of MetS compared with the lowest tertile. Their study suggested that a Western dietary pattern was strongly associated with MetS, which was consistent with the solid body of metabolic evidence supporting the value of the dietary pattern approach.

Dietary patterns of food consumption were investigated by Brenner et al. (2011) among young urban Toronto adults. The sample consisted of 352 men and 801 women, aged 20 to 29 years from different ethno-cultural groups. Three predominant patterns were identified and termed 'prudent' (consisted of fruits and vegetables, including those that were uncooked, nuts, dried lentils and beans, whole grains, and water), 'Western' (consisted of processed, high-salt, and sugary foods, enriched white-flour products and high-sugar/-energy beverages) and 'Eastern' (consisted of vegetables, seafood, rice, and organ meat) patterns. They found that Caucasians had significantly higher 'prudent pattern' scores than did Asians and South Asians, while Asians had significantly higher 'Eastern pattern' scores than did other ethno-cultural groups. Higher prudent pattern scores were positively associated with the highest partial correlation values (controlling for total energy intake) with intakes of vitamins A, B1, B2, B6, C, D, and K, magnesium, iron, omega-3 and omega-6 fatty acids, and polyunsaturated fat. Higher Western pattern scores were associated with the highest positive partial correlation values with intake of sodium, total fat, saturated fat, and total calories. Higher Eastern pattern scores had the highest positive partial correlation values with intake of vitamin B12 and cholesterol. They suggested that dietary pattern scores were correlated with nutrient and energy intakes: The foods consumed in the prudent and Eastern patterns were considerably less energy-dense and higher in beneficial nutrients (increased vitamin and mineral levels) than are those in the Western pattern.

2.5.7 Other studies of obesity, physical activity and CVD risk

Hu et al. (2004b) studied joint associations of physical activity and different indicators of obesity (BMI, WC, and WHR), with the risk of CVD, for 8,928 Finnish men and 9,964 women aged 25-74 years. The median follow-up time was 9.8 years. Their study found that physical activity had a strong, independent, and inverse association with CVD risk in both genders, and concluded that their study confirmed that both physical inactivity and obesity were important risk factors for CVD. All obesity indicators predicted the risk of CVD in men. Obesity increases the risk partly through the modification of other risk factors. Maitra and Sharma (2007) re-examined the relationship between obesity (as measured by BMI) and the duration of exercise in Australia, and showed that exercise duration has a negative and statistically significant effect on the probability of being overweight or obese, although when they take into account the potential endogeneity of exercise duration, they no longer found a negative relationship between exercise duration and BMI.

2.6 Relevance of the literature review to other chapters

Except for 2.2, 'Assessing Dietary Intake', which is relevant to the method section, the remainder of the review provide the background material for the following results chapters:

Literature Review	Results Chapter
2.1 Anthropometric indicators and health risks	4.3 Anthropometric characteristics 4.4.2 [Anthropometrics] Discussion
2.3 Under-reporting - Evaluating FFQ data	5.2 Under-reporting 5.3 [Under-reporting] Discussion
2.4 Livestyle factors	6.2 [Lifestyle factors] Discussion
2.5 Dietary patterns & Health studies	7.5 [Dietary patterns] Discussion 7.6 Implications of dietary patterns

Chapter 3

Methods

3.1 Overview

A cross-sectional study of diet and lifestyle in two generations of Japanese and Australian men was undertaken using self-reported data. This chapter discusses the methods used in this study. It covers the rationale behind the choice of survey instrument and its validation, the sampling method and data collection. The calculation of food and nutrition intake, relevant anthropometric measures, physical activity, sleeping and smoking were described. The issue of under-reporting is addressed. The criteria of obesity are given and compared. Dietary patterns were analyzed using factor analysis for the Japanese and Australians including the young and middle-aged. Relationships between measures of obesity and a range of food groups, nutrition, diet factors, and lifestyle factors were computed using correlation analysis for each of the four focal samples, and the procedures for creating the lifestyle indices were described.

3.2 Subjects

To accomplish the aim and objectives of this study through a simultaneously inter-generational and cross-cultural perspective, it was necessary to draw samples from the four focal populations in this research, namely the middle-aged adult men and the young adult men in Japan and Australia. The following population groups were sampled:

1. Younger-generation Japanese adult male aged between 18 and 30 years in Japan (JY).
2. Middle-aged men between 40 and 60 years in Japan (JM).
3. Younger-generation Australian adult male aged between 18 and 30 years in Australia (AY).
4. Middle-aged men between 40 and 60 years in Australia (AM).

These comprise the four focal groups JY, JM, AY and AM respectively, where the younger (Y) and middle-aged (M) groups would be approximately a generation (about 25 to 30 years) apart. Children and early teenagers were excluded from consideration as their eating habits could not yet be regarded as having stabilized sufficiently to contribute meaningfully to inter-generational comparisons, and the elderly are generally retired, less active and often have diets dictated more by personally changing necessity than by choice. The respective samples in both countries therefore coincided with the earlier and later parts of the active working life of adult men where their diet and lifestyle might have a greater level of stability (Lake et al. 2006; Mikkila et al. 2005; Y. Wang et al. 2002) and who have greater personal autonomy.

3.3 THE RESEARCH INSTRUMENT

A self-administered questionnaire was used. This contained a food frequency questionnaire and information on demographic, anthropometric and lifestyle questions.

3.3.1 The Food Frequency Questionnaire

Given the sampling technique (refer to Chapter 2 – '2.2 Assessing dietary intake' and Chapter 3 – '3.4.3 Sampling method and sample selection process'), the FFQ was the most practical way of obtaining the dietary information.

The FFQ used in this research was originally developed by the Hawaii and Los Angeles Cohort Study to assess the diets of five ethnic groups (Hispanics, African-Americans, Japanese, Hawaiians and Caucasians) in a multiethnic cohort (Hankin 1993). After pilot testing the adapted FFQ (refer to '3.4.1 Pilot study') no substantial modifications were required.

The food frequency part includes 169 items with eight frequency categories for foods and beverages. Photographs of portion sizes are included to assist respondents in identifying quantities more accurately. ** The English and Japanese versions of the full questionnaire are shown in Appendix 1.3 and 1.4.

3.3.2 Validation of the FFQ for the Japanese and the Caucasians

For the purposes of cross-cultural comparison, it was essential to use exactly the same questionnaire (except for language) for both Japan and Australia. In addition to the FFQ being seen as the most appropriate dietary assessment method in this study, the adopted version of the FFQ was available in validated English (Frances. E. Thompson & Byers 1994) and Japanese versions (Frances. E. Thompson, Byers & Tokudome 1997). Although no "gold standard" for validating a dietary method exists, investigators of this questionnaire utilized detailed food records of variable durations as a basis for comparisons (Block et al. 1990; Hankin et al. 1991; Jain et al. 1980; Larkin et al. 1989; Pietinen et al. 1988; Sobell et al. 1989; van Leeuwen et al. 1983; W. C. Willett et al. 1987; W. C. Willett et al. 1985). The English version was based on the original questionnaire from the Cancer Research Centre of Hawaii (Hankin 1993), and the Japanese translation was obtained from the Dietary Assessment Resource Manual, written in Japanese (Frances. E. Thompson, Byers & Tokudome 1997). This FFQ method was developed to estimate the usual dietary intakes of subjects from the five major ethnic groups in Hawaii (Hispanics, African-Americans, Japanese, Hawaiians and Caucasians). The reasoning behind this was that the eating patterns of these groups may differ in several ways, including average amounts consumed of particular items. For example, Orientals are likely to eat far less meat than Caucasians or Hawaiians in a particular meal, often resulting in considerable differences in fat and protein intakes (Hankin et al. 1991; Kolonel et al. 1981). For these reasons, and because of the large variation in average serving sizes of the same items among ethnic groups as well as substantial individual variation within these groups, investigators used coloured photographs of foods in three portion sizes to aid subjects in estimating quantities consumed more accurately (Hankin 1986; Hankin et al. 1991). It is granted that recipes may differ in the countries even for the same FFQ item; indeed these differ even *within* each country. Such further elaborations would be impossible in such a questionnaire. Individual intakes were computed from the responses on frequencies and amounts of each food item consumed during a usual week, month, or year, and tested against for example, 7-days weighed records. Several studies have demonstrated the relatively good validity of the FFQ for most foods and nutrients (Block et al. 1990; Hankin et al. 1991; Jain et al. 1980; Larkin et al. 1989; Pietinen et al. 1988; Sobell et al. 1989; van Leeuwen et al. 1983; W. C. Willett et al. 1987; W. C. Willett et al. 1985). In view of the extensive validation of these FFQ by previous researchers in multi-cultural contexts above, it was considered that no further validation was required for this study.

3.3.3 Other data collected

1. Demographic data

Demographic data was collected including age range, country of birth and years lived in Japan/Australia.

2. Anthropometric data

Anthropometric measurements namely weight, height, waist and hip circumferences were self-reported and no specific instructions were given in the questionnaire. Weight was measured in kilograms and height, waist and hip circumference measurements were in centimetres. BMI was calculated as weight (kg) / height $(m)^2$. Waist hip ratio was the circumference of the waist divided by that of the hip.

3. Physical activity

Physical activity questions were taken from Hankin (1993). Physical activity was measured as times per day or week spent in sedentary, light, moderate and vigorous activity, with examples of each shown in the questionnaire (refer to Appendix 1.3 & 1.4). This questionnaire was validated by several investigators (Foote et al. 2003; Kolonel et al. 2000; Nothlings et al. 2007).

4. Sleeping and smoking

Sleeping question was from the WHO Regional Office for Europe (1988) and Uehata (1993). Hours slept was self-reported as average hours per day. Smoking status was coded as 1 = smokers, and 0 = non-smokers (dichotomous variable).

5. Working pattern

Several of the questions related to the working pattern were taken from the National Health Survey (Australian Bureau of Statistics 1995), National Heart Foundation of Australia (1983), Time Use Survey Australia (Australian Bureau of Statistics 1993) and 'An epidemiological survey on work stress and health' by Uehata (1993). The questions of this section include current occupational status, position of job, days per week worked, hours of week worked, days off, hours of work overtime, unfinished work taken home, and work between 10:00pm and 5:00am in next morning.

3.4 SAMPLING

3.4.1 Pilot study

The entire questionnaire was reviewed by peers and administered to a sample of 40 people representing a cross section of the four focal groups. Completion took between 15-60 minutes and averaged 30 minutes.

3.4.2 Determination of required sample sizes

According to Margetts & Nelson (1997), when the means of two groups are to be compared, the required sample size for each group can be determined by the formula

$$N = 2\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2 / f^2$$

where α is the level of significance (0.05), $1-\beta$ is the desired power of the test (0.8) and f, known as an effect size, is the ratio of the size of difference to be detected and the standard deviation of the variable.

Owing to the broad range of food sources and nutrients to be considered with their heterogeneous variations and different units of measurement, there was no single absolute size difference or standard deviation that could be specified, however an effect size f, of around 0.3 was considered to be adequate. Assuming the range of each variable to be approximately 6 standard deviations, this effect size f enables the detection of population mean differences as small as 1.8 at 5% of significance level with 80% power. This resulted in a recommended minimum sample size for each group of around 175. Thus a target was set to achieve samples as close as possible to 200.

3.4.3 Sampling method and sample selection process

Approximately 200 male university students representing the younger generation, and about 200 middle-aged men around their fathers' age group, participated in the study in Japan and Australia.

Due to financial and time limitations a combination of cluster and random sampling was used. The clusters consisted of the cities of Himeji in Japan and Perth in Australia. Within these, the middle-aged subjects were chosen at random from the general population in a public place and the young adults were chosen at random from the university student populations of Himeji Institute of Technology (now University of Hyogo) and Curtin University of Technology (now Curtin University).

Students studying in health science, medical and nutrition areas were excluded as their generally superior understanding of health-related matters could have biased the results.

3.4.4 The sample

In both places, the younger-generation sample was taken from the university student population. This has some advantages and disadvantages. In some obvious practical respects the life of the student differs from the working employee, however those aspects of lifestyle that can be expected to change directly as a result of employment, marital status or personal catastrophe are beyond the scope of this study. Apart from this, there is no reason to suspect that this group would be substantially different from their working peers in food preferences. On the other hand, university students are the leaders and trendsetters at the forefront of the new generation (Craven & Hawks 2006) whose example is likely to have considerable influence on their generation. It can be argued that they are more likely to be "ahead of" their peers rather than simply "unlike" them, and therefore may be more representative of the changes that could eventually be expected.

3.5 DATA COLLECTION

The data were collected from May 1999 to September 1999 in Japan, and from October 1999 to February 2000 in Australia. This ensured that the data in both countries were collected in similar seasons. Participation in the research was voluntary. In Australia, men likely to be of appropriate age (middle-aged men, aged 40-60 years) were approached at random in several public places by the researcher. Young men (aged 18-30 years) were recruited at Curtin University, by flyer and by personal invitation on the main thoroughfare. The opportunity to win a $200 dinner prize was used as an incentive. All subjects were asked to return the completed questionnaire in the self-addressed envelope within one week. Professor Ouchi from the University of Hyogo recruited the Japanese subjects. The middle-aged men were recruited from the community and the University of Hyogo. The young men were recruited from the student population of the University of Hyogo. The completed questionnaires were collected after a week. The study abided by the NHMRC (National Health and Medical Research Council) guidelines for human research in 1998 [Approval Number, HR 127/98]. Participants were asked to sign the attached letter of consent when returning the questionnaire. Information was coded and the names were deleted from the data file. All coded data were entered into a computer at the University and stored according to the University's ethics policy.

3.5.1 Response rates and achieved sample sizes

For each of the four focal groups, the sampling process was continued until approximately 200 usable responses were obtained as required by the sample size calculations. The table below represents the initial response rates and the final sample sizes after unusable responses were eliminated.

Sampling Group	Response Rate (%)	Unusable Excluded	Usable Sample
JY	39.20	3	201
JM	31.20	7	188
AY	58.00	12	220
AM	73.00	16	203

Responses were deemed to be unusable when

- More than 50% of items in the questionnaire were not completed,
- The age of the respondent was outside the limits of this study,
- The respondent was studying in the health science, medicine or nutrition area,
- There were systematic errors such as whole pages left blank or respondents gave exactly the same answer to a long series of questions.

3.5.2 Accuracy of data entry

To verify the accuracy of data entry a sample of 40 cases were examined in detail. This involved 14,160 entries (40 × 354 variables) of which 14 were found to contain errors. This represents an entry error rate of approximately 1/1,011, which may be regarded as negligible.

3.5.3 Identification of outliers

The sample distributions of all variables were examined for extreme values. The apparent upper and lower limits of the natural patterns were determined visually and very few cases were found to lie seriously outside these limits. Those cases were examined for feasibility and the possibility of recording errors, and where necessary corrected or excluded. Generally, it is not unusual to find a small number of cases close to the apparent upper or lower limits and occasionally slightly exceeding them, and they were not expected to unduly distort the analysis.

3.6 CALCULATION OF FOOD AND NUTRITION INTAKE

3.6.1 Calculation of food intake

The FFQ contained a list of 169 food and beverage items with serving size options, as in the part of the questionnaire shown below. Participants were asked to indicate their frequency of consumption of each food item during the previous year by marking the corresponding box, and also to indicate their usual serving size. Photographs of typical portion sizes were included on some pages of the questionnaire to assist respondents in indicating their usual intake more accurately. The frequencies were converted to a yearly basis and portion sizes of the respective food items were converted by the researcher into common measure equivalents (e.g. Cups) as specified in Appendix 2.1.

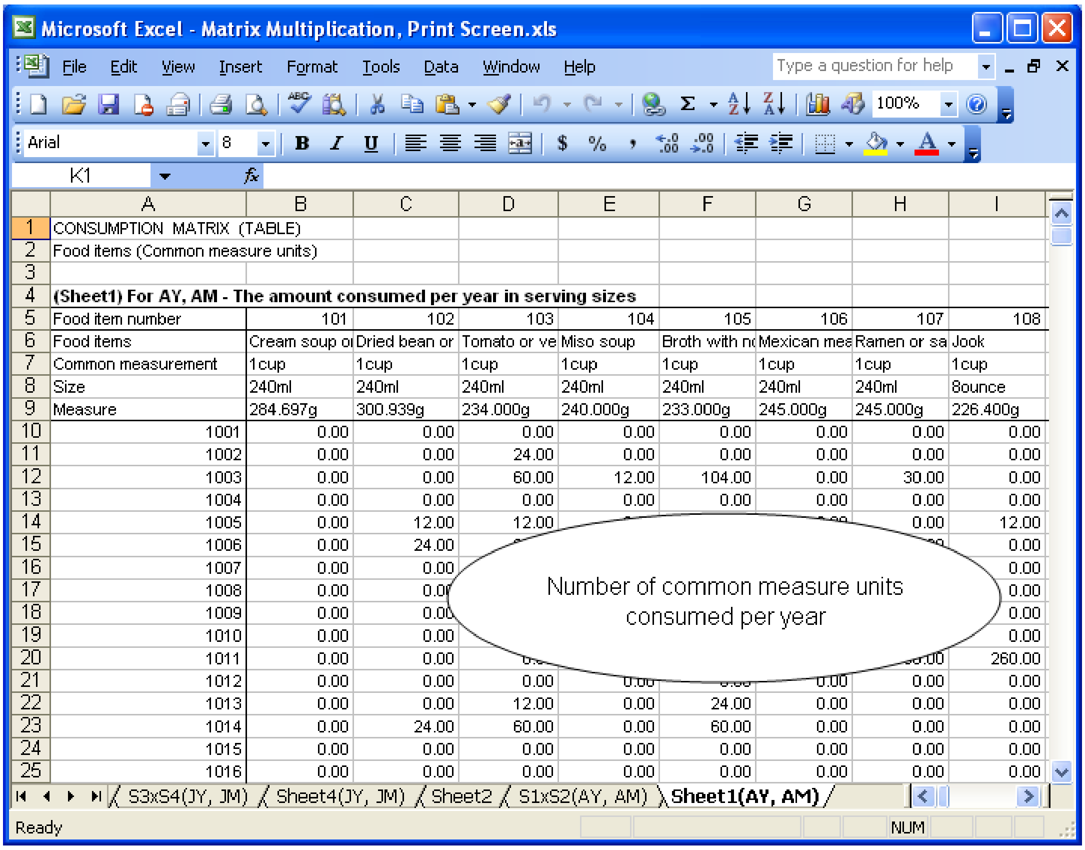
Example: Food item 0101, (Cream Soup or Chowder)	Cups
Serving size 1= ½ cup or less OR	= 0.5
Serving size 2= Small bowl (about 1 cup) OR	= 1
Serving size 3= Large bowl (2 cups or more)	= 2

Example of Food Intake Data Generated from the FFQ

Diet Questionnaire for the Hawaii and Los Angeles Cohort Study (Excerpt)

SOUPS, RAMEN, AND JOOK	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a mont h	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Cream Soup or Chowder									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
2. Dried Bean or Pea (Legume) Soup (such as Portuguese bean, split pea)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
3. Tomato or Vegetable Soup (may include meat, poultry, or fish)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
4. Miso Soup									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
5. Broth with Noodles or Rice (such as beef noodle, chicken rice, won tun mein)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)

The frequencies and common measure equivalents were combined to give the consumption of each food item calculated in the specified common measure units per year for the given respondent. The results were tabulated in an Excel spreadsheet labelled “Sheet 1”, where the rows identified the respondents, the columns identified the food items and the tabulated values indicated the annual intake of the given food item by the given respondent in common measure units per year. This is illustrated in Figure 3.1 below.



	A	B	C	D	E	F	G	H	I
1	CONSUMPTION MATRIX (TABLE)								
2	Food items (Common measure units)								
3									
4	(Sheet1) For AY, AM - The amount consumed per year in serving sizes								
5	Food item number	101	102	103	104	105	106	107	108
6	Food items	Cream soup o	Dried bean or	Tomato or ve	Miso soup	Broth with n	Mexican mea	Ramen or sa	Jook
7	Common measurement	1cup	1cup	1cup	1cup	1cup	1cup	1cup	1cup
8	Size	240ml	240ml	240ml	240ml	240ml	240ml	240ml	8ounce
9	Measure	284.697g	300.939g	234.000g	240.000g	233.000g	245.000g	245.000g	226.400g
10	1001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	1002	0.00	0.00	24.00	0.00	0.00	0.00	0.00	0.00
12	1003	0.00	0.00	60.00	12.00	104.00	0.00	30.00	0.00
13	1004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	1005	0.00	12.00	12.00	[illegible]	[illegible]	[illegible]	0.00	12.00
15	1006	0.00	24.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
16	1007	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
17	1008	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
18	1009	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
19	1010	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
20	1011	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	260.00
21	1012	0.00	0.00	0.00	[illegible]	[illegible]	0.00	0.00	0.00
22	1013	0.00	0.00	12.00	0.00	24.00	0.00	0.00	0.00
23	1014	0.00	24.00	60.00	0.00	60.00	0.00	0.00	0.00
24	1015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	1016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3.1 Sheet 1 - Food intake matrix for the Australian Younger generation

3.6.2 Food items excluded from the data analysis

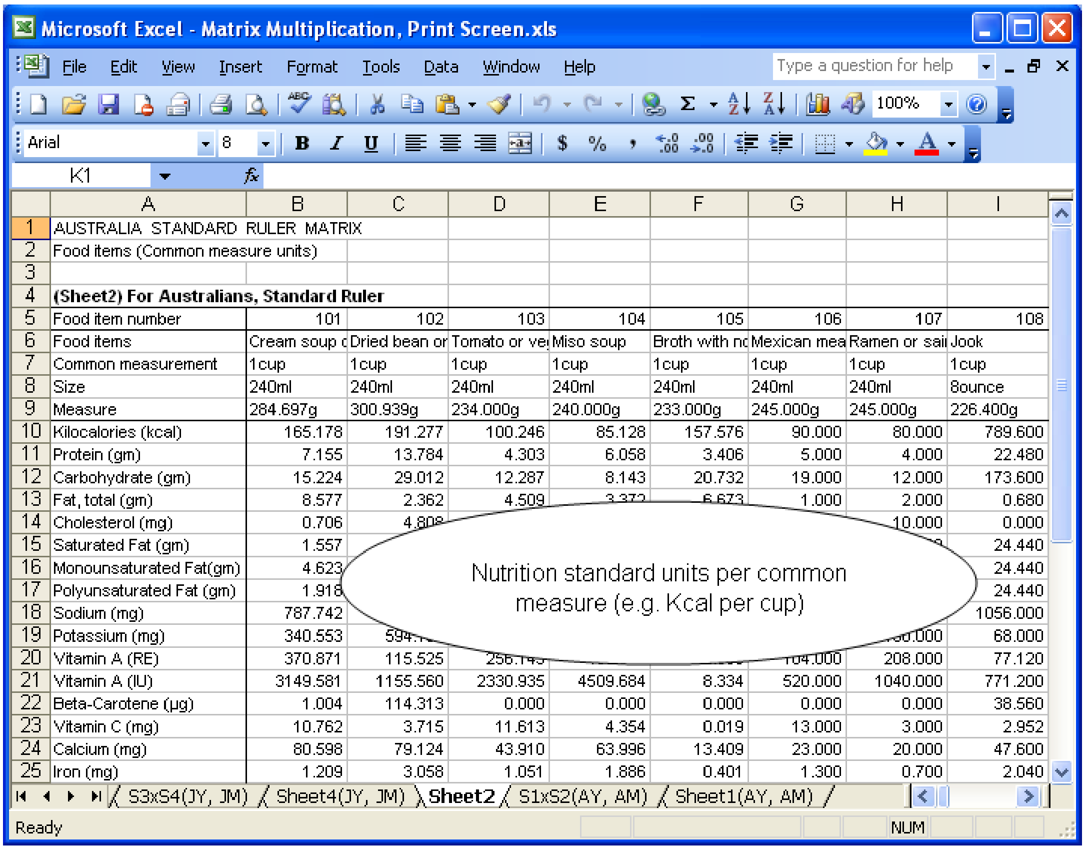
1. Items 1109 (apples and applesauce) and 1110 (bananas) were omitted from the data analysis as they were accidentally omitted from the Australian questionnaire.
2. Items 1115 (Any other fruit) and 1118 (Other fruit juices or fruit drinks) were omitted from the data analysis because no nutrition information was available from the Nutritionist Five database for unspecific categories.

3.6.3 Food items calculated in different measurements between Japan and Australia

The items, '1501 Regular or draft beer', '1502 Light beer', '1506 Regular sodas', '1507 Diet sodas' and '1513 Fortified diet beverages' were calculated by 350 ml per bottle/tin in Japan, whereas they were calculated by 375 ml in Australia.

3.6.4 Calculation of nutrition intake

The Nutritionist Five software (version 2.3; First DataBank, Inc.) enabled the researcher to quantitatively break down the common measure unit of each food item into its basic nutrients expressed in their usual standard units. The outcome of this process was tabulated in an Excel spreadsheet labelled "Sheet 2", where the rows identify the nutrients, the columns identify the food items and the tabulated cell values indicate the nutrient content of the given food item in their usual standard units per common intake measure of that food item. This is illustrated in Figure 3.2 below.

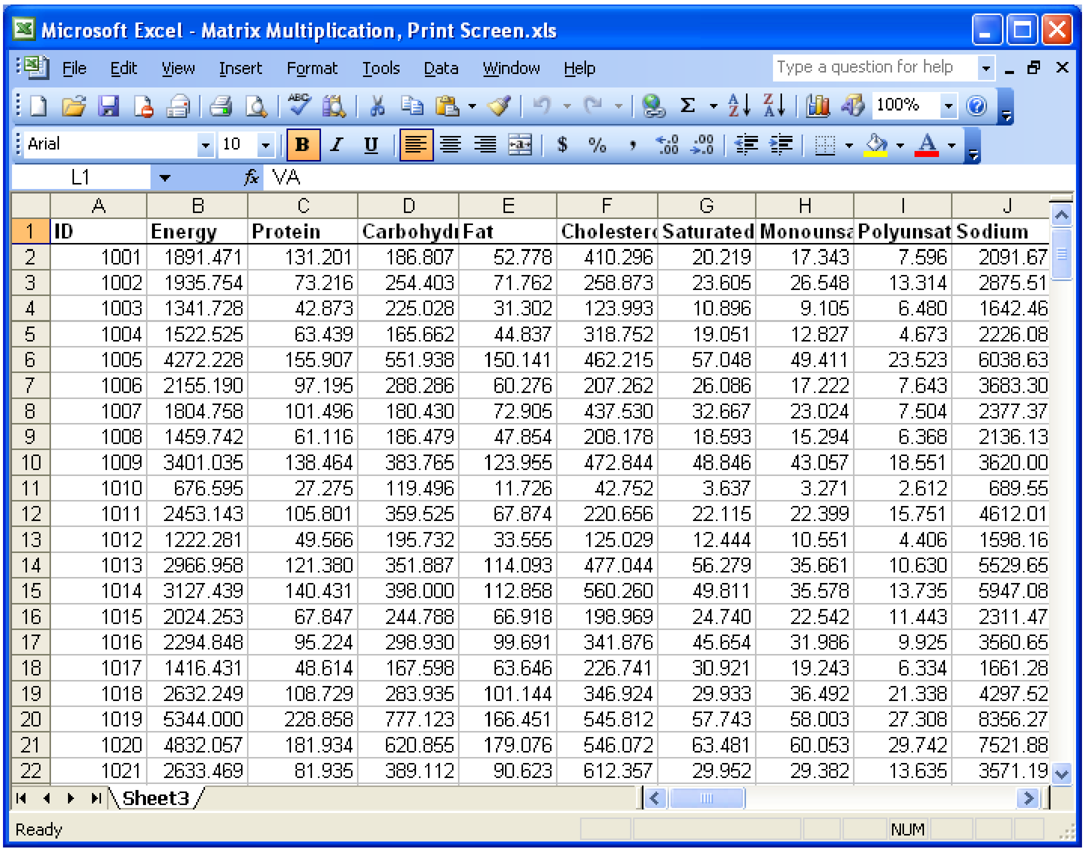


	A	B	C	D	E	F	G	H	I
1	AUSTRALIA STANDARD RULER MATRIX								
2	Food items (Common measure units)								
3									
4	**(Sheet2) For Australians, Standard Ruler**								
5	Food item number	101	102	103	104	105	106	107	108
6	Food items	Cream soup c	Dried bean or	Tomato or ve	Miso soup	Broth with nc	Mexican mea	Ramen or sai	Jook
7	Common measurement	1cup	1cup	1cup	1cup	1cup	1cup	1cup	1cup
8	Size	240ml	240ml	240ml	240ml	240ml	240ml	240ml	8ounce
9	Measure	284.697g	300.939g	234.000g	240.000g	233.000g	245.000g	245.000g	226.400g
10	Kilocalories (kcal)	165.178	191.277	100.246	85.128	157.576	90.000	80.000	789.600
11	Protein (gm)	7.155	13.784	4.303	6.058	3.406	5.000	4.000	22.480
12	Carbohydrate (gm)	15.224	29.012	12.287	8.143	20.732	19.000	12.000	173.600
13	Fat, total (gm)	8.577	2.362	4.509	3.372	6.673	1.000	2.000	0.680
14	Cholesterol (mg)	0.706	4.808	[illegible]	[illegible]	[illegible]	[illegible]	10.000	0.000
15	Saturated Fat (gm)	1.557	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24.440
16	Monounsaturated Fat(gm)	4.623	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24.440
17	Polyunsaturated Fat (gm)	1.918	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24.440
18	Sodium (mg)	787.742	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1056.000
19	Potassium (mg)	340.553	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68.000
20	Vitamin A (RE)	370.871	115.525	[illegible]	[illegible]	[illegible]	[illegible]	208.000	77.120
21	Vitamin A (IU)	3149.581	1155.560	2330.935	4509.684	8.334	520.000	1040.000	771.200
22	Beta-Carotene (µg)	1.004	114.313	0.000	0.000	0.000	0.000	0.000	38.560
23	Vitamin C (mg)	10.762	3.715	11.613	4.354	0.019	13.000	3.000	2.952
24	Calcium (mg)	80.598	79.124	43.910	63.996	13.409	23.000	20.000	47.600
25	Iron (mg)	1.209	3.058	1.051	1.886	0.401	1.300	0.700	2.040

Figure 3.2 Sheet 2 - Food to nutrient conversion matrix for the Australians

It should be noted that this "Sheet 2" is specifically for Australians. The Japanese equivalent differs slightly to compensate for differences in the commonly understood serving sizes.

The information in "Sheet 1" and "”Sheet 2" was then combined through the process of Matrix Multiplication to produce "Sheet 1 × Sheet 2". All cell values were then divided by 365 to produce "Sheet 3" as illustrated in Figure 3.3 below, where the rows indicate the respondents, the columns indicate the nutrients and the tabulated cell values represent the daily intake of the given nutrient by the given respondent in the usual standard units.



ID	Energy	Protein	Carbohydr	Fat	Cholester	Saturated	Monounsa	Polyunsat	Sodium
1001	1891.471	131.201	186.807	52.778	410.296	20.219	17.343	7.596	2091.67
1002	1935.754	73.216	254.403	71.762	258.873	23.605	26.548	13.314	2875.51
1003	1341.728	42.873	225.028	31.302	123.993	10.896	9.105	6.480	1642.46
1004	1522.525	63.439	165.662	44.837	318.752	19.051	12.827	4.673	2226.08
1005	4272.228	155.907	551.938	150.141	462.215	57.048	49.411	23.523	6038.63
1006	2155.190	97.195	288.286	60.276	207.262	26.086	17.222	7.643	3683.30
1007	1804.758	101.496	180.430	72.905	437.530	32.667	23.024	7.504	2377.37
1008	1459.742	61.116	186.479	47.854	208.178	18.593	15.294	6.368	2136.13
1009	3401.035	138.464	383.765	123.955	472.844	48.846	43.057	18.551	3620.00
1010	676.595	27.275	119.496	11.726	42.752	3.637	3.271	2.612	689.55
1011	2453.143	105.801	359.525	67.874	220.656	22.115	22.399	15.751	4612.01
1012	1222.281	49.566	195.732	33.555	125.029	12.444	10.551	4.406	1598.16
1013	2966.958	121.380	351.887	114.093	477.044	56.279	35.661	10.630	5529.65
1014	3127.439	140.431	398.000	112.858	560.260	49.811	35.578	13.735	5947.08
1015	2024.253	67.847	244.788	66.918	198.969	24.740	22.542	11.443	2311.47
1016	2294.848	95.224	298.930	99.691	341.876	45.654	31.986	9.925	3560.65
1017	1416.431	48.614	167.598	63.646	226.741	30.921	19.243	6.334	1661.28
1018	2632.249	108.729	283.935	101.144	346.924	29.933	36.492	21.338	4297.52
1019	5344.000	228.858	777.123	166.451	545.812	57.743	58.003	27.308	8356.27
1020	4832.057	181.934	620.855	179.076	546.072	63.481	60.053	29.742	7521.88
1021	2633.469	81.935	389.112	90.623	612.357	29.952	29.382	13.635	3571.19

Figure 3.3 Sheet 3 - Nutrient intake matrix for the Australian Younger generation

The figure above shows the results of Sheet 1 multiplied by Sheet 2 for Australians. The general principle of Matrix Multiplication is presented in Figure 3.4.

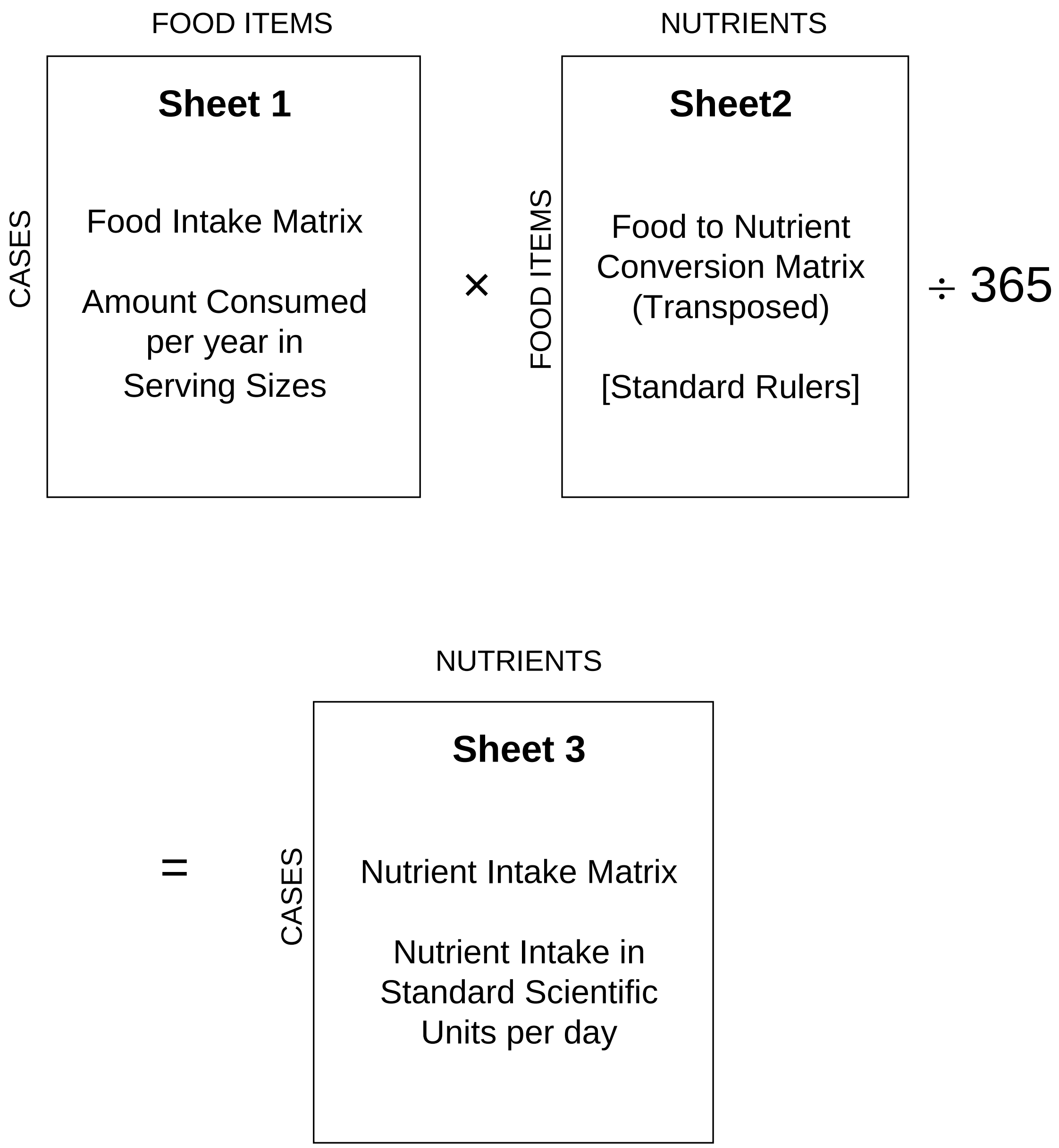


Figure 3.4 Overview for matrix multiplication

3.7 ANTHROPOMETRIC MEASURES AND OBESITY CRITERIA

Calculation of Body Mass Index

We adopted the World Health Organisation (WHO) standardized classification for obesity (World Health Organization 2003a) in the cross-cultural comparisons between Japan and Australia in this study. Body mass index (BMI) (kg m^{-2}) was calculated by using the self-reported body weight and height, and then the samples were compared for young and middle-aged for the Japanese and Australians using the classifications of BMI <18.5 kg m^{-2} (underweight), ≥18.5 - <25.0 kg m^{-2} (normal), ≥25.0 - <30.0 kg m^{-2} (overweight) and ≥30.0 kg m^{-2} (obese).

Waist Circumference

Waist circumferences (WC) used the country-specific cut-off criteria for obesity (85.0 cm for Japanese (Ministry of Health Labour and Welfare 2006) and 94.0 cm for Australian (National Health and Medical Research Council 2004)).

Calculation of Waist Hip Ratio

WHR was calculated as Waist/Hip for the respondents. A cut-off point for WHR of 0.9 for obesity was accepted as detecting a cardiovascular risk (Australian Bureau of Statistics 1998c; Ito et al. 2003; Ito et al. 2001; Lear et al. 2010; Sekikawa et al. 1999; Welborn, Dhaliwal & Bennett 2003).

3.8 UNDER-REPORTING

3.8.1 Preliminary calculations of selected nutrition intake as a percentage of energy intake

The energy contents of total fat (including saturated fat, mono-unsaturated fat & poly-unsaturated fat), protein, carbohydrate and alcohol intake were each calculated as a percentage of total energy intake to compare the profiles of the macro-nutrients. Where energy was expressed in kilocalories, it was re-calculated in kJ at the rate of 4.184 kJ per kcal.

3.8.2 Energy intake, macro-nutrients, micro-nutrients and food groups

Energy was expressed as MJ per day. The macro-nutrients were expressed as % of energy, micro-nutrients were expressed as mg per 10MJ, and dietary fiber and food groups were expressed in g per 10MJ, respectively per day.

3.8.3 Formulas for Basal Metabolic Rate

BMR was estimated for each member of the respective four groups according to the formulas below. The BMR formula from the Ministry of Health and Welfare in Japan (1996) was used for both Japanese groups, the formula from Hayter & Henry (1994) was used for the young Australian men, and the formula from the 1990 Recommended Nutrient Intakes taken from Schofield, Schofield and James (1985) was used for the middle-aged Australian men.

BMR formula for JY

$$BMR\left(kcal \times day^{-1}\right) = C^{\dagger}\left(kcal \times m^{-2} \times h^{-1}\right) \times \left(W^{0.444} \times H^{0.663} \times 88.83/1000\right)\left(m^{2}\right) \times 24\,(h) \times 1.04$$

[C† is a constant for basal metabolism for JY: 38.6. W (kg) and H (cm) are the individual body weight and height of the subject] (Ebine et al. 2000; Ebine et al. 2002).

BMR formula for JM

$$BMR\left(kcal \times day^{-1}\right) = C^{\ddagger}\left(kcal \times m^{-2} \times h^{-1}\right) \times \left(W^{0.444} \times H^{0.663} \times 88.83/1000\right)\left(m^{2}\right) \times 24\,(h) \times 1.04$$

[C‡ is a constant for basal metabolism for JM: 35.2. W (kg) and H (cm) are the individual body weight and height of the subject] (Ebine et al. 2000; Ebine et al. 2002).

BMR formula for AY

$$BMR\left(MJ\ day^{-1}\right) = \left(0.051 \times body\ weight(kg)\right) + 3.500$$

BMR formula for AM

$$BMR\left(MJ\ day^{-1}\right) = \left(0.048 \times body\ weight(kg)\right) + 3.653$$

3.8.4 Analysis of EI/BMR quartiles

To evaluate the validity of energy intake, we calculated the EI/BMR ratio to compare the relative degree of under- and over-reporting. The mean values of body weight and height, BMI, BMR and EI by quartiles of EI/BMR were calculated in Table 5.4. The mean nutrient intakes by quartiles of EI/BMR were calculated in Table 5.5. The mean intakes of 85 foods from the FFQ were selected and re-grouped into 12 food groups (Appendix 2.2), and were also compared by quartiles of EI/BMR in Table 5.6. These results were compared for the four groups. We tested all the differences across quartiles of EI/BMR. The ANOVA was tested overall, and the Tukey HSD were used to test the first quartile compared with the subsequent quartile categories. The p-value of <0.01 was considered significant.

3.8.5 Cut-off criteria

In the current study, we used the minimum survival level of 1.27 values defined by WHO (1985a), Bedard, Shatenstein and Nadon (2004), and Okubo and Sasaki (2004), the sedentary level for men of 1.55 (World Health Organization 1985a), and the maximum sustainable lifestyle level of 2.4 (Bedard, Shatenstein & Nadon 2004; Okubo & Sasaki 2004; World Health Organization 1985a). The histograms of EI/BMR were compared for each of the four groups using their respective BMR formula (Table 5.3). The respective proportions of the samples with EI/BMR below and above 1.27, 1.55 and 2.4 using their respective group BMR formulas (Tables 5.7 – 5.9) were compared. In addition, we also compared the various proportions below and above 1.27 for the four groups, according to the three different equations for calculating the BMR (Table 5.10).

3.9 ASSESSMENT OF PHYSICAL ACTIVITY

3.9.1 U.S. version (US)

Physical activity was divided into four levels: *very light, light, moderate and heavy activities*. The amount of sleeping per day was also recorded.

Very light activity was further divided into sitting in transport, sitting at work, watching television, sitting at meals and other sitting activities. The respondent nominated the time of duration (never, less than 1 hour, 1 to 2 hours, 3 to 4 hours, 5 to 6 hours, 7 to 10 hours and 11 hours or more) for the average day for that activity. These were converted into 0, 0.5, 1.5, 3.5, 5.5, 8.5 and 11 hours, respectively. The sum of these activities was calculated as the total amount of very light activity per day. This was then multiplied by a factor of 1.5 to give its weighted activity (National Academy of Sciences 1989).

For the three other categories namely *light, moderate and heavy activitie,* are approximately equivalent to the questionnaire activities; moderate activity, vigorous work and strenuous sports, respectively, and the respondent nominated the time of duration (never, ½ to 1 hour, 2 to 3 hours, 4 to 6 hours, 7 to 10 hours, 11 to 20 hours, 21 to 30 hours and 31 hours or more) for the average weekly duration for that activity. These were converted into 0, 0.75, 2.5, 5.0, 8.5, 15.5, 25.5 and 31.0 hours, respectively. These were then converted on daily basis. The respective activities were then multiplied by the respective factors of 2.5, 5.0 and 7.0 (National Academy of Sciences 1989), to give the corresponding weighted activities, respectively.

These weighted four activities were added and divided by 24 hours to get the mean of weighted REE factor. Resting Energy Expenditure was calculated using the following equations (W. P. T. James & Schofield 1990; World Health Organization 1985a).

Table 3.1 Equations for predicting Resting Energy Expenditure from body weight[a]

Age (years)	Equation to Derive REE in kcal/day
Males	
18-30 (for young men)	(15.3 x wt[b]) + 679
40-60 (for middle-aged men)	(11.6 x wt) + 879

[a] From World Health Organization (1985a). These equations were derived from BMR data.
[b] Weight of person in kilograms.

The results of the respective equations were then multiplied by the mean of weighted REE factor to give the energy requirement in kilocalories per day. The result was converted into kilojoules per day and labelled as the actual ***physical activity,*** and then divided by the weight of the subject to give energy expenditure in kilojoules per day per kilogram, or the ***relative physical activity***.

3.9.2 Australian version (Aus)

The Australian physical activity was divided into four levels: *lying and sitting activities, light activities, moderate activities and strenuous activities*.

Lying and sitting activities were further divided into sleeping, sitting quietly and sitting busy. The amount of sleeping per day was recorded. Sitting in transport and watching TV were regarded as sitting quietly, coded and summed. Sitting at work, sitting at meals and other activities were regarded as sitting busy, coded and also summed. The hours of sleeping, sitting quietly and sitting busy were then multiplied by their 'energy costs' of 1.0, 1.2 and 1.5, respectively. The sum of these products give the weighted activity of this category (Truswell et al. 1990).

For the three other categories namely *light activities, moderate activities and strenuous activities*, are approximately equivalent to the questionnaire activities, moderate activity, vigorous work and strenuous sports, respectively, and were coded as above. The respective activities were then multiplied by the respective 'energy costs' of 3.0, 4.0 and 7.0 (Truswell et al. 1990). These corresponded light, moderate and strenuous, to give the corresponding weighted activities, respectively.

These weighted four activities were added and divided by 24 hours to get the mean of weighted BMR factor (energy costs). BMR was calculated following equations (Truswell et al. 1990).

Table 3.2 Equations for estimating basal metabolic rate (BMR) in MJ/day from body weight (kg) of adults and children over the age of 10 years

Age (years)		Equations
Males	18-30 (for young men)	(0.051 x wt) + 3.500 = BMR[(a)]
	40-60 (for middle-aged men)	(0.048 x wt) + 3.653 = BMR[(b)]

[(a)] *Equations taken from Hayter & Henry (1994),*
[(b)] *Equations taken from Schofield, Schofield and James (1985).*

The results of the respective equations were then multiplied by the mean of weighted BMR factor (energy costs) for the respective age groups (the young and the middle-aged) to give the energy requirement in kilocalories per day. Again, the result was converted into kilojoules per day and labelled as the actual ***physical activity,*** and then divided by the weight of the subject to give energy expenditure in kilojoules per day per kilogram, or the ***relative physical activity***.

3.10 CONSTRUCTION OF THE COMPARATIVE LIFESTYLE INDICES

The Lifestyle Index (LI) was based on the current scientific lifestyle recommendations related to four major lifestyle factors to emphasize the importance of preventing chronic conditions including cardiovascular disease and obesity (S. Kim et al. 2004b). It consists of a combination of the Diet Quality Index-

International, the Physical Activity Index, the Smoking Index, and the Alcohol Consumption Index, developed by Kim (2004b).

3.10.1 The Diet Quality Index-International

1 Variety

Various food groups (meat, poultry, fish, egg; beans, dairy; vegetable; fruit; grain; [The detailed food items of each category can be found in Appendix 2.3]):

The intake frequencies of these items were converted into a 'per year' basis according to the following coding: 'never or hardly ever = 0', 'once a month = 12', '2 to 3 times a month = 30', 'once a week = 52', '2 to 3 times a week = 130', '4 to 6 times a week = 260', 'once a day = 365' and '2 or more times a day = 730'.

The amounts in servings multiplied by their frequency per day were calculated in each of the food items in servings per year. The items for each category were summed and divided by 365. This result was then divided into the two categories classified: ≥1 (coded as 1), and < 1 (coded as 0).

Pure *vegetables* were calculated in servings, but when combined with other ingredients such as 'stir fried meat' etc. were calculated by 1/3 of the servings, because they were generally combined with other ingredients.

Fruit including fruit juices were calculated in servings, but some of the mixed fruit/vegetable groups were calculated by 1/2 of the servings, because they were combined with some other ingredients.

These coded values (1 and 0) were further added to make a total of 0 to 9. Each of these is converted into a score for every sample member as follows:

Categories		**Score α**
9	**= (at least 1serving from each food groups per day)**	**→ 15 points**
8	**= (any 1 food group missing)**	**→ 12 points**
7	**= (any 2 food group missing)**	**→ 9 points**
6	**= (any 3 food group missing)**	**→ 6 points**
1 to 5	**= (any 4 or more food group missing)**	**→ 3 points**
0	**= (none from any food groups is present)**	**→ 0 points**

Within-group variety for the principal protein sources (meat, poultry, fish, dairy, beans, eggs)

The items covered in this section were coding separately in the same manner as the above. The coded values (1 and 0) were added to make a total of 0 to 6. Each of these was converted to a score for every sample member as follows:

Categories		Score α
3 to 6	= (≥3 different sources per day)	→ 5 points
2	= (2 different sources per day)	→ 3 points
1	= (from 1 source per day)	→ 1 points
0	= (none)	→ 0 points

2 Adequacy

Vegetable group

The vegetable group was calculated by combining the frequency with the adjusted serving size along the lines of the Australian Guide to Healthy Eating booklet (Kellett, Smith & Schmerlaib 1998), and expressed in average servings per day. A score was then allocated according to the average daily servings of vegetables modified by the total daily energy intake as follows:

Energy intake	Score α
1) <1950 kcal diet:	servings per day / 3×5
2) ≥1950 kcal - <2450 kcal diet:	servings per day / 4×5
3) ≥2450 kcal diet:	servings per day / 5×5

A maximum calculated score ≥5 was reduced to 5.

Fruit group

The fruit group was calculated by combining the frequency with the adjusted serving size along the lines of the Australian Guide to Healthy Eating booklet (Kellett, Smith & Schmerlaib 1998) and expressed in average servings per day. A score was then allocated according to the average daily servings of fruit modified by the total daily energy intake as follows:

Energy intake	Score α
1) <1950 kcal diet:	servings per day / 2×5
2) ≥1950 kcal - <2450 kcal diet:	servings per day / 3×5
3) ≥2450 kcal diet:	servings per day / 4×5

A maximum calculated score ≥5 was reduced to 5.

Grain group

The grains group was calculated by combining the frequency with the adjusted serving size along the lines of the Australian Guide to Healthy Eating booklet (Kellett, Smith & Schmerlaib 1998) and expressed in average servings per day. A score was then allocated according to the average daily servings of grain modified by the total daily energy intake as follows:

Energy intake	Score α
1) <1950 kcal diet:	servings per day / 6 $\times$ 5
2) ≥1950 kcal - <2450 kcal diet:	servings per day / 9 $\times$ 5
3) ≥2450 kcal diet:	servings per day / 11 $\times$ 5

A maximum calculated score ≥5 was reduced to 5.

Protein

Protein intake was calculated in grams, then multiplied by 4 kcal/g and divided by total energy intake. It was then expressed as % of total energy intake. A score was calculated as a proportion of 5 as follows:

Percent of total energy intake	Score α
< 10%	(% of total energy intake) / 10 $\times$ 5
≥ 10%	5

*Iron**

Iron intake was calculated by milligrams and assessed in relation to the RDA-J/RDI-A (Commonwealth of Australia 2006; Ministry of Health Labour and Welfare 2005), and then given a score out of 5:

Country	Standard	Score α
Japan	7.5 mg/day	intake / 7.5 $\times$ 5, or 5 when intake ≥ 7.5 mg/day
Australia	8 mg/day	intake / 8 $\times$ 5, or 5 when intake ≥ 8 mg/day

*Calcium**

Calcium intake was calculated by milligrams and assessed in relation to the AI-J/RDI-A (Commonwealth of Australia 2006; Ministry of Health Labour and Welfare 2005), and then given a score out of 5:

Country	Standard	Score α
Japan	788 mg/day	intake / 788 $\times$ 5, or 5 when intake ≥ 788 mg/day
Australia	1000 mg/day	intake / 1000 $\times$ 5, or 5 when intake ≥ 1000 mg/day

*Vitamin C**

Vitamin C intake was calculated by milligrams and assessed in relation to the RDA-J/RDI-A (Commonwealth of Australia 2006; Ministry of Health Labour and Welfare 2005), and then given a score out of 5:

Country	**Standard**	**Score α**
Japan	**100 mg/day**	**intake / 100×5, or 5 when intake ≥ 100 mg/day**
Australia	**45 mg/day**	**intake / 45×5, or 5 when intake ≥ 45 mg/day**

The α values were then cross-tabulated with the four sample groups, JY, JM, AY and AM (Table 6.1 and Appendix 3.1), showing percentages for each α, for each sample group.

Fiber

The fiber were calculated and expressed in average grams intake per day. A score was then allocated according to the average daily intake of fiber modified by the total daily energy intake as follows:

Energy intake	**Score α**
1) <1950 kcal diet:	**intake per day / 20×5**
2) ≥1950 kcal to <2450 kcal diet:	**intake per day / 25×5**
3) ≥2450 kcal diet:	**intake per day / 30×5**

A maximum calculated score ≥5 was reduced to 5.

* *The differences in reference values for different countries with respect to the same nutrients has always been a contentious issue. Different countries may choose different bases for setting reference values, e.g. some countries use the prevention of scurvy as the basis for the RDI for vitamin C, while others may use the maintenance of a particular body pool size. Personal nutrient requirements vary, are subject to a large number of variables and not fully understood; ethnic and environment requirements may also differ. Thus reference values may be subject to different criteria and emphases. For these reasons, the rigorous comparisons of these reference values can be very difficult.*

3 Moderation

Total fat

Fat intake was calculated in grams, then multiplied by 9 kcal/g and divided by total energy intake. It was then expressed as % of total energy intake. The score allocated was as follows:

Percent of total energy intake	Score α
≤ 20%	6
> 20% - ≤ 30%	3
> 30%	0

Saturated fat

Saturated fat intake was calculated in grams, then multiplied by 9 kcal/g and divided by total energy intake. It was then expressed as % of total energy intake. The score allocated was as follows:

Percent of total energy intake	Score α
≤ 7%	6
> 7% - ≤ 10%	3
> 10%	0

Cholesterol

Cholesterol intake was calculated by milligrams and then given a score as follows:

Intake	Score α
≤ 300 mg	6
> 300 mg - ≤ 400 mg	3
> 400 mg	0

Sodium

Sodium intake was calculated by milligrams and then given a score as follows:

Intake	Score α
≤ 2400 mg	6
> 2400 mg - ≤ 3400 mg	3
> 3400 mg	0

Empty calorie foods (refer to Appendix 2.3)

The energy intake of these items were calculated and summed, and was expressed as a % of the total energy intake per day. The intake was given a score as follows:

% of Total Energy per day	Score α
≤ 3 % of total energy per day	6
> 3 % to 10 % of total energy per day	3
> 10 % of total energy per day	0

4 Overall balance

CPF ratio (C:P:F)

The intakes of carbohydrate, protein and fat were expressed in grams. Their energy components were converted to kilocalories at the rates of 4 kcal/g, 4 kcal/g and 9 kcal/g, respectively, and then expressed as a % of total energy intake. Their % ratios of carbohydrate, protein and fat were scored as follows:

C	P	F	Score α
(55-65)	(10-15)	(15-25)	6
(52-68)	(9-16)	(13-27)	4
(50-70)	(8-17)	(12-30)	2
Otherwise			0

Fatty acid ratio (PUFA:MUFA:SFA)

The polyunsaturated fatty acids (PUFA), monounsaturated fatty acids (MUFA), and the saturated fatty acids (SFA) were expressed as grams. Their ratios were scored as follows:

Ratios	Scores α
PUFA/SFA = 1-1.5 and MUFA/SFA = 1-1.5	4
PUFA/SFA = 0.8-1.7 and MUFA/SFA = 0.8-1.7	2
Otherwise	0

Calculation of the Diet Quality Index-International

The scores of all the items comprising the Variety, Adequacy, Moderation and Overall balance sections have been summed to create the Diet Quality Index-International in a total out of 100 points.

3.10.2 The Physical Activity Index

The average hours in the moderate, vigorous and strenuous sections from the physical activity questions (Hankin 1993) were summed to give an indication of physical activity. The level was scored as follows:

Average hours per day	Activity level	Scores α
> 2.5 hours per day	Very active	30
1 to 2.5 hours per day	Active	24
0.5 to 1 hours per day	Moderate	15
0.05 to 0.5 hours per day	Light	6
< 0.05 hours per day	Sedentary	0

3.10.3 The Smoking Index

1. Smoking status

The smoking status was classified as well as their current cigarettes smoked per day. They were scored as follows:

Status	**Scores α**
Never smoked	**30**
Former smoker	**21**
Current smoker	**As below**

2. Smoking amount (average number of cigarettes smoked per day)

Status	**Cigarettes**	**Scores α**
Light smoker	**1-4 per day**	**15**
Light-medium smoker	**5-9 per day**	**9**
Medium smoker	**10-19 per day**	**3**
Heavy smoker	**Over 20 per day**	**0**

3.10.4 The Alcohol Consumption Index

Drinking pattern

Five categories of alcoholic beverages were identified and the amounts in millilitres per day was calculated. The alcohol in each category was then multiplied by a factor according to the type of beverage and then converted into grams of alcohol. These were summed and multiplied by 7/13 to give the standard drink per seven-day week. (A standard "drink" is defined as an amount of alcoholic beverage containing about 13 g of pure alcohol (S. Kim et al. 2004b)). The results were then converted to a score as follows:

Standard drinks per week	**Scores α**
0 to 14	**20**
>14 to 21	**12**
>21 to 28	**6**
>28 to 35	**2**
> 35	**0**

3.10.5 Calculation of the Lifestyle Index

The Lifestyle Index was comprised of the Diet Quality Index-International, the Physical Activity Index, the Smoking Index and the Alcoholic Consumption Index (S. Kim et al. 2004b), weighted in the ratios of 0.2 (×100), 1 (×30), 1 (×30) and 1 (×20) to make a total of 100 points.

Analysis of the group scores and indices

The score of each subsection and the resulting indices were cross-tabulated with the four sample groups, JY, JM, AY and AM. These formed a metric variable, thus the groups were analyzed using one-way Analysis of Variance (ANOVA) (IBM SPSS

Statistics (version 19)), followed with the post hoc Tukey HSD to identify the distinct groups. Appendix 3.1 also shows the ANOVA *p*-value, and the *p*-values for the respective pair-wise sample comparisons and also the means and standard errors for each sample group.

3.11 COMPONENTS OF DIETARY PATTERN ANALYSIS

3.11.1 Food groupings

As there are a large number of possible food classification systems, and it is impossible to offer any system that divides foods into groups that are distinct by all criteria, the choice would have been largely arbitrary. For the purposes of pattern analysis, and inter-generational and cross-cultural comparisons in food intake (as distinct from nutrition intake) the food items were grouped for convenience following the structure of the questionnaire as follows:

1. Soups and related items
2. Noodles, Spaghetti and related dishes
3. [General] Mixed dishes
4. Meat (not part of mixed dishes)

5-1. Poultry (not part of mixed dishes)
5-2. Fish and Seafood (not part of mixed dishes)
6. Processed meats and Mexican dishes
7-1. Rice
7-2. Potatoes and related items
8. Salad items, eggs and other non-meat items
9. Raw or cooked vegetables (not in soups or mixed dishes)
10. Dried beans and related items (not in soups or mixed dishes)
11. Fruit and juices
12. Bread items
13-1. Breakfast cereals
13-2. Dairy products
14. Desserts and snacks
15-1. Alcoholic beverages
15-2. Non-alcoholic beverages

These categories and their respective sub-categories made a total of 19 groups (refer to Table 7.1 or Appendix 2.4). The food intake items (g/day) of each food grouping were totalled. This process was repeated in all sample groups. These were used for the subsequent analysis of the dietary patterns.

The mean intakes of these food groupings were also ranked for all sample groups and the rank of the same food grouping was compared across the respective populations. The overall relative similarities (or differences) between the set of rank orders for the respective populations were assessed using Spearman correlation.

3.11.2 Factor analysis of food patterns

Prior to the factor analysis, the distributions of the 19 food groups were assessed for normality and all were found to be distinctly positively-skewed (Kolmogorov-Sminov test: $p<0.01$), therefore a square root (SQRT) transformation was used for improving the normality. The transformed 19 food groups were then adjusted for total energy intake using the residual method as explained by Willett (1998) to obtain factors uncorrelated with total energy. For the cases where a food group showed no intake, the adjusted intake were given a ‘zero’ adjustment.

IBM SPSS Statistics (version 19) was used to perform the factor analyses for the six sample groups, namely the Japanese (Jap) and the Australian (Aus) overall, and their respective young and middle-aged sub-groups (JY, JM, AY and AM). The procedure used factor analysis with Principal Component analysis as the extraction method, and Varimax as the rotation method. The anti-image correlation matrix was used to assess the sampling adequacy (all diagonal > 0.5) of each food group. The preliminary results of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were slightly less (between 0.537 and 0.598) than the ideal 0.6 for all six sample groups. Further attempts were made to improve the KMO, however the results showed only a very marginal increase at the cost of the removal of meaningful food groups. According to the suggestion of Kaiser (1974) that variables with slightly lower KMO values still have reasonably adequate communalities for factor analysis, and therefore the original 19 food groupings were retained in the factor analysis. The Bartlett’s test for all the six sample groups was significant ($p<0.001$), suggesting good factorability of the food groups data. Overall, these tests indicated suitability for factor analysis.

As the six-factor solution based on scree-plot and eigenvalues >1 did not provide a meaningful interpretation, a forced four-factor solution were extracted for each of the six groups. The dietary patterns, or factors, were named according to the higher loadings with a view to the associations of the items. Food groups with factor loadings < 0.4 were excluded from the tables for simplicity.

The diet factor scores were computed using the regression method within the Factor Analysis routine and saved as variables.

The associations with the diet factor scores and the anthropometrics and lifestyle elements were later calculated using Pearson Correlation.

3.12 SPECIFIC STATISTICAL TESTS AND PROCEDURES

3.12.1 Testing for group differences – Analysis of Variance

As all of the data in this study was of metric or dichotomous level, sample groups were tested for differences of means using One-way Analysis of Variance (ANOVA). The basic assumptions of ANOVA are that the criterion variable is metric, the groups are normally distributed and their variances are homogeneous. The first of these is clearly satisfied. Normality can be tested using the Kolmogorov-Smirnov statistic with a Lilliefors significance level whereby *p*-values over 0.01 are regarded as acceptable. Homogeneity of variance is usually confirmed with Levene's test where *p*-values over 0.01 are acceptable. However, according to Diekhoff (1992), if the sample sizes are approximately equal and large (over 25), one-way ANOVA is fairly robust to violations of the assumptions of normality and homogeneity of variances. Therefore, owing to the comparatively large sample sizes involved, the latter two assumptions were not tested. In each case the ANOVA was followed up with the post hoc Tukey's 'honestly significant difference' (HSD) test to determine which pair of the four groups were significantly different.

3.12.2 Correlation and Cross-tabulation

Pearson Correlation

Each of the respective variables was metric or dichotomous allowing the respective relationships to be calculated by Pearson's Correlation Coefficient. The measures could range between -1 and 1. Positive values indicated a direct/positive linear relationship and negative values indicate an inverse linear relationship. Deviations from zero indicate, the strength of the linear relationship or closeness from linearity where zero indicates no liniear relationship through to unity indicating to a perfect linear relationship. Associated with each correlation measure is a measure of significance between 0 and 1. When the significance is less than 0.01, it generally indicates that there is less than 1% likelihood that there is no credible relationship. For the purposes of this thesis, the 1% level of significance or less was assumed, but a significance below 0.05 or 5% was generally accepted as relationships warranting further investigation. Although a significance below 5% is traditionally acceptable in the literature, the large number of correlations to be investigated could have increased the cumulative risk of a larger Type 1 error, and therefore the lower value of 1% was preferred. Regardless of the significance, a very small value of correlation tends to indicate a very weak relationship and values below +/- 0.15 was generally disregarded and values over +/- 0.3 was regarded as indicating relationships that are particularly noteworthy.

Spearman Correlation

Where the respective variables were ordinal or ranked, the respective relationships were calculated by Spearman Correlation. Otherwise the same explanations apply as with the above.

Comparisons of correlations across sample groups

Pearson's Correlations (r) were transformed using Fisher's formula.

$$z' = \frac{1}{2}\left[\ln(1+r) - \ln(1-r)\right]$$ (Cohen & Cohen 1975)

The Standard (z) for the differences of the correlations r_1 and r_2 was calculated as

$$z = (z'_1 - z'_2) \Big/ \sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}$$ (Cohen & Cohen 1975)

where n_1 and n_2 were the respective sample groups and z'_1 and z'_2 were the transformed values of r_1 and r_2.

The difference between the group correlations were significant when z was > |2.58| at the 1% level (Appendix 3.2.19).

Associations in Cross-tabulations

Where nominal variables were cross-tabulated, the test to ascertain whether these may be associated was generally the Chi-squared procedure. Again, a p-value less than 0.01 would indicate that there was almost certainly some relationship.

Chapter 4

Results and Discussion (A)
Samples, Demographics and Anthropometrics

4.1 Sample representativeness

Table 4.1 below shows the comparisons of our results for energy and nutrient intakes with those of the NNS-J and the NNS-A. NNS in Japan in 1999, and NNS in Australia in 1995, which is the closest source of information with the data collected, had been carried out in both countries across both genders and a range of age groups. These and our sample results were compared in terms of selected nutrients.

The approach to assess the comparability was to derive the sample mean and standard deviation of the intakes of each of the nutrients, and calculate the 95% confidence limits for the respective population means using the one-sample t-formula. If the mean intake for the items in the corresponding gender/age group documented in the NNS lay within these limits, the result were considered comparable. The highlighted parts of Table 4.1 below indicate nutrients that are deemed as having no significant differences, that is, comparable intake for those samples.

However, the process and interpretation were more difficult for the following reasons:

- Firstly, the age-groups required for the purposes of this study did not coincide exactly with the age-groups in either country's NNS, nor did the Japanese and Australian NNS age-groups fully coincide with each other.
- Secondly, as explained in the discussion concerning the choice of survey instrument (refer to Chapter 3 in Method 3.3.2), it was necessary for cross-cultural comparisons that the same instrument be used for both Japanese and Australian subjects. However, the methods for the Japanese NNS (that used the semi-weighed recording method for one day) and Australian NNS (that used 24-hour dietary recall supplemented by a non-quantitative FFQ) differed from each other.

- Thirdly, the closest Japanese NNS to the timing of our survey was 1999 and the most recent Australian NNS was in 1995, and changes may have taken place in the average intake of some nutrients in the intervening periods.
- Finally, differences between the intake estimates of our study and the NNS's could also partly be attributable to one of the limitations of this study, namely that it is confined to the urbanized context. The exclusion of the rural populations could influence the average intake of some nutrients more than others.

Table 4.1 Compared the results of the current study with NNS-J, NNS-A with energy and nutrients intake

	Our results				NNS-J		NNS-A		Differences calculation (%)			
Generation	JY	JM	AY	AM	Young	Middle-aged	Young	Middle-aged	JY	JM	AY	AM
Age range	18-30 y	40-60 y	18-30 y	40-60 y	20-29 y	40-59 y	19-24 y	45-64 y				
Subjects	201	188	220	203	707	1,766	866	1,900				
Nutrients mean intake:												
Energy (kcal)	2,327 LB=2,150 UB=2,503	2,010 LB=1,886 UB=2,134	2,857 LB=2,679 UB=3,035	2,216 LB=2,077 UB=2,355	2,277	2,302	3,171	2,460	2.2	-12.7	-9.9	-9.9
Fat (g)	76.3 LB=69.4 UB=83.2	60.3 LB=55.4 UB=65.2	99.0 LB=92.2 UB=105.8	71.6 LB=66.6 UB=76.7	69.2	64.2	119.1	90.6	10.3	-6.1	-16.9	-21.0
Protein (g)	104.8 LB=95.6 UB=114.0	88.4 LB=81.9 UB=94.9	118.3 LB=111.0 UB=125.6	91.0 LB=84.8 UB=97.3	88.9	92.7	127.7	104.5	17.9	-4.6	-7.4	-12.9
Carbohydrate (g)	300 LB=278.1 UB=321.4	252 LB=237.5 UB=266.3	362 LB=338.6 UB=385.5	284 LB=265.5 UB=302.9	308	301	376	274	-2.7	-16.3	-3.7	3.7
Calcium (mg)	898 LB=816.2 UB=980.5	740 LB=677.2 UB=802.4	1459 LB=1347.5 UB=1571.2	1031 LB=952.6 UB=1109.8	540	567	1101	885	66.4	30.5	32.6	16.5
Iron (mg)	15.7 LB=14.6 UB=16.7	14.1 LB=13.3 UB=14.8	19.4 LB=18.2 UB=20.5	17.1 LB=15.9 UB=18.3	12.1	13.1	17.9	16.2	29.8	7.6	8.4	5.6
Viamin B_1 (mg)	1.95 LB=1.81 UB=2.09	1.74 LB=1.63 UB=1.84	2.68 LB=2.51 UB=2.85	2.14 LB=2.00 UB=2.28	1.36	1.33	2.30	1.80	43.4	30.8	16.5	18.9
Vitamin B_2 (mg)	1.93 LB=1.76 UB=2.09	1.65 LB=1.54 UB=1.77	3.00 LB=2.79 UB=3.20	2.31 LB=2.15 UB=2.46	1.53	1.56	2.70	2.20	26.1	5.8	11.1	5.0
Vitamin C (mg)	92 LB=82 UB=101	74 LB=66 UB=83	168 LB=152 UB=185	138 LB=125 UB=151	131	133	150	138	-30.0	-44.1	12.6	0.4

NNS-J: National Nutrition Survey in Japan (Ministry of Health Labour and Welfare 2001).
NNS-A: National Nutrition Survey in Australia (Australian Bureau of Statistics 1998c).
LB=Lower bound (95% Confidence Interval for mean).
UB=Upper bound (95% Confidence Interval for mean).

4.2 DEMOGRAPHICS

The profiles of the four sample groups in this study, namely the

Japanese Young adult men (JY) (n=201)

Australian Young adult men (AY) (n=220)

Japanese Middle-aged men (JM) (n=188)

Australian Middle-aged men (AM) (n=203)

were described below:

4.2.1 General description of the young men

Table 4.2 and Figures 4.1 and 4.2 provide demographic information, including age groups, place of birth (home/migrant), employment/study status and years lived in Japan/Australia of the young Japanese and Australian men.

Table 4.2 Demographic characteristics of the young Japanese (n=201) and Australian men (n=220)

	Category	JY(%)	AY(%)
Age groups*	18-24	99.0	88.6
	25-30	1.0	11.4
Place of birth (home/migrant)*	Home	100.0	84.5
	Migrant	0.0	15.5
Employment/study*	Full-time student	45.3	62.3
	Full-time student and employed part-time	53.7	30.5
	Other	1.0	7.3

** P<0.01*

JY = Japanese Young adult men

AY = Australian Young adult men

Although the samples targeted were 18 to 30 years of age, most respondents were 18 to 24 years old in both the Japanese and the Australian cohorts due to the university student clusters chosen. There were no migrants in this Japanese sample, but 15.5% of the Australian sample were migrants. In employment/study status, more than half of the full-time Japanese students were employed part-time, whereas the majority of the Australian students were studying full-time and not employed.

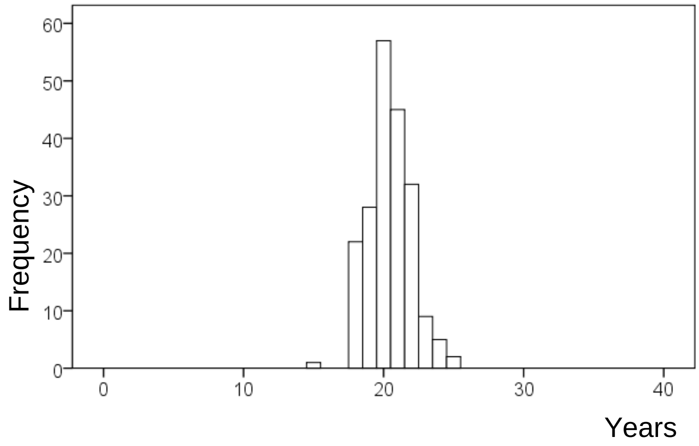


Figure 4.1 The number of years lived in Japan by the young Japanese men

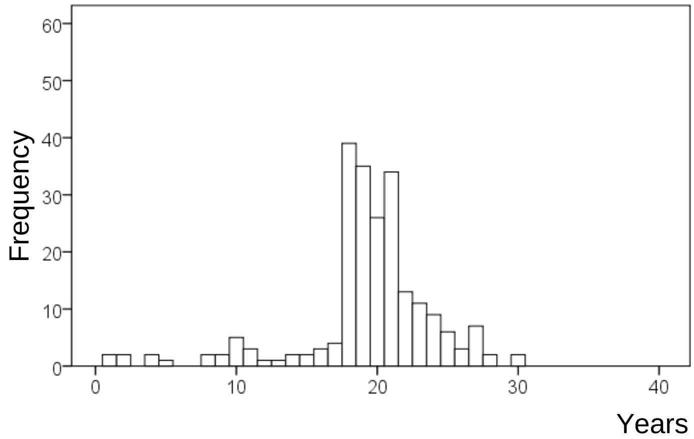


Figure 4.2 The number of years lived in Australia by the young Australian men

Difference of means: t : P<0.01; Mann-Whitney : P<0.01

Consistent with the variation in place of birth (Table 4.2), the mean number of years lived in Australia for Australians (19.29 (sd=4.8)) was less than the Japanese (20.44 (sd=1.6)) of equivalent age (Figures 4.1 & 4.2).

4.2.2 General description for the middle-aged men

Tables 4.3 and 4.4, and Figures 4.3 and 4.4 show the characteristics of the middle-aged Japanese and Australian subjects.

Table 4.3 Demographic characteristics of the middle-aged Japanese (n=188) and Australian men (n=203)

	Category	JM(%)	AM(%)
Age groups**	40-44	17.9	17.7
	45-49	33.9	23.6
	50-54	38.1	29.6
	55-60	10.1	29.1
Place of birth (home/migrant)**	Home	100.0	58.1
	Migrant	0.0	41.9
Current status**	Employed full-time	93.5	91.6
	Employed part-time	0.6	5.4
	Unemployed	5.9	0.0
	Retired	0.0	3.0
Position of Job**	Non-career	16.3	5.0
	Junior level administrator	8.4	3.5
	Middle level administrator	34.9	18.6
	Senior level administrator	15.1	16.1
	Professional	8.4	30.7
	Self-employed	16.3	19.1
	not applicable	0.6	7.0
Number of days off from work per week**	None	4.8	5.2
	Less than 1 day/week	8.6	2.1
	1 day/week	25.3	15.5
	2 days/week	55.9	72.2
	More than 3 days/week	5.4	5.2
Work on days off**	Yes	63.6	19.2
	No	36.4	80.8
Work overtime*	Yes	69.4	57.0
	No	30.6	43.0
Take unfinished work home at night**	Never	15.5	39.7
	Yes - but seldom	40.1	23.2
	Yes - some of the time	31.6	20.1
	Yes - most of the time	6.4	10.3
	Yes - all the time	6.4	6.7
Work extra job between 10pm and 5am in next morning**	Yes	34.8	17.6
	No	65.2	82.4

** P<0.05*
*** P<0.01*
JM = Japanese middle-aged men
AM = Australian middle-aged men

The proportions for all of the above demographic characteristics were significantly different between Japanese and Australian middle-aged groups (Table 4.3).

The number of years resident in Japan was greater than the corresponding Australian sample (Figures 4.3 and 4.4).

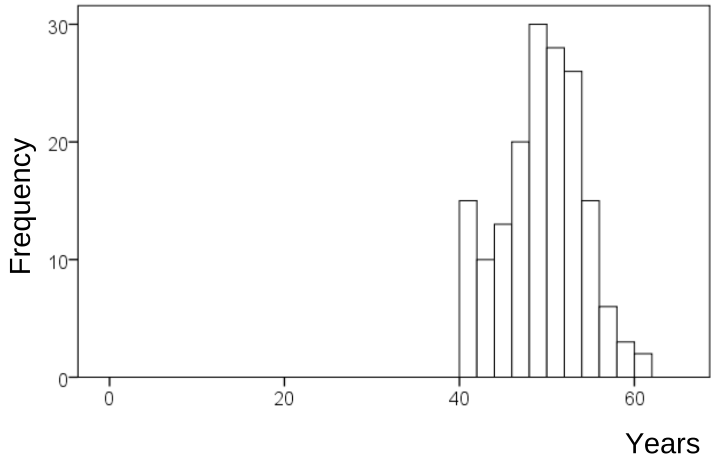


Figure 4.3 The number of years lived in Japan by the middle-aged Japanese men

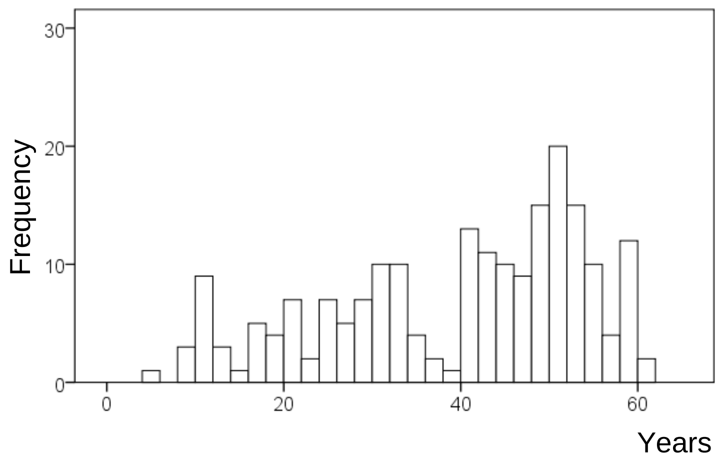


Figure 4.4 The number of years lived in Australia by the middle-aged Australian men

Difference of means: t : P<0.01; Mann-Whitney : P<0.01

Table 4.4 Work profile of the Japanese and Australian middle-aged men

Groups	days/week mean (sd)	hours/day mean (sd)	hours/week mean (sd)
JM	5.38 (0.66)	7.11 (2.33)	49.80 (16.26)
AM	5.17 (0.64)	6.25 (2.18)	43.82 (15.22)
Test results	*P<0.01*	*P<0.05*	*P<0.05*

JM = Japanese middle-aged men

AM = Australian middle-aged men

As the profiles were non-normal, the Mann-Whitney test were applied to assess the differences of mean

Most of our middle-aged subjects were employed full-time including self-employment (Table 4.3), but there were many differences in the work profiles of the two groups. Majority of our employers in middle-aged group in our study were white-collar workers. The results of the work profiles (Table 4.4) showed statistically that Japanese workers put in more time at work than the Australian workers.

4.3 ANTHROPOMETRIC CHARACTERISTICS

Table 4.5 summarizes the mean and standard deviation (mean (sd)) for weight, height and BMI of the four groups of subjects as compared with the NNS-J and the NNS-A. The profiles of weight, height and BMI are displayed in Figures 4.5, 4.6 and 4.7.

Table 4.5 Comparisons of the mean weight, height and BMI results of the current study with the NNS-J and the NNS-A

Groups	Weight (kg)		Height (cm)		BMI (kg/m^2)	
	mean (sd)	n	mean (sd)	n	mean (sd)	n
JY (18-30)†	62.4 (7.9)	201	171.5 (5.3)	201	21.2 (2.5)	201
JM (40-60)†	66.7 (9.0)	184	168.7 (5.3)	185	23.4 (2.7)	184
NNS-J (20-29 y)‡	65.5 (11.0#)	482	170.8 (5.7#)	482	22.4 (3.4)	480
NNS-J (40-59 y)‡	66.2 (9.6#)	1,317	167.3 (5.8#)	1,320	23.7 (3.1)	1,316
AY (18-30)†	75.4 (11.3)	218	179.8 (6.9)	216	23.3 (2.7)	216
AM (40-60)†	83.1 (13.9)	192	176.9 (7.2)	201	26.5 (3.8)	193
NNS-A (19-24 y)‡	78.3 (-)	≈485	178.0 (-)	≈485	24.6 (-)	≈485
NNS-A (45-64 y)‡	84.4 (-)	≈1554	174.0 (-)	≈1554	27.8 (-)	≈1554
Tukey HSD						
JY:JM	$P<0.01$		$P<0.01$		$P<0.01$	
AY:AM	$P<0.01$		$P<0.01$		$P<0.01$	
JY:AY	$P<0.01$		$P<0.01$		$P<0.01$	
JM:AM	$P<0.01$		$P<0.01$		$P<0.01$	

JY=Japanese young adult men; JM=Japanese middle-aged men;
AY=Australian young adult men; AM=Australian middle-aged men.
† self-reported; ‡ measured.
NNS-J (Ministry of Health Labour and Welfare 2001); NNS-A (Australian Bureau of Statistics 1998c).
As n is large (>30), ANOVA is robust to violations of normality and homogeneity of variance (Diekhoff 1992).
 # Based on the pooled standard deviation (Killeen 2005; Morien 2007).

1. Weight

The mean self-reported weight of the Japanese middle-aged cohort was approximately 4 kg greater than that of the young Japanese men. In contrast, the middle-aged Australian men were almost 8 kg heavier than the young Australian men. The difference in the means of the young Japanese and young Australian men was 13.0 kg, and the difference for the middle-aged generations was 16.4 kg (Table 4.5). The percentage of missing values varied between 0% and 5% across the four groups.

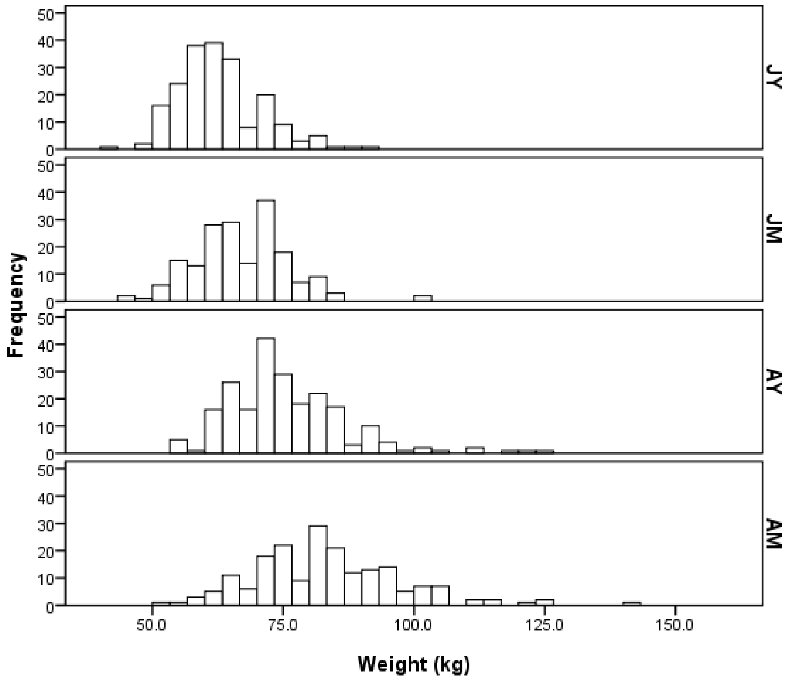


Figure 4.5 Self-reported weight

JY=Japanese young adult men; JM=Japanese middle-aged men; AY=Australian young adult men; AM=Australian middle-aged men.

2. Height

The mean height of the young generations in both countries was greater than that for the corresponding middle-aged generations. Both the Australian young and middle-aged groups were approximately 8 cm taller than the corresponding Japanese groups (Table 4.5). The percentage of missing values varied between 0% and 2% across the four groups.

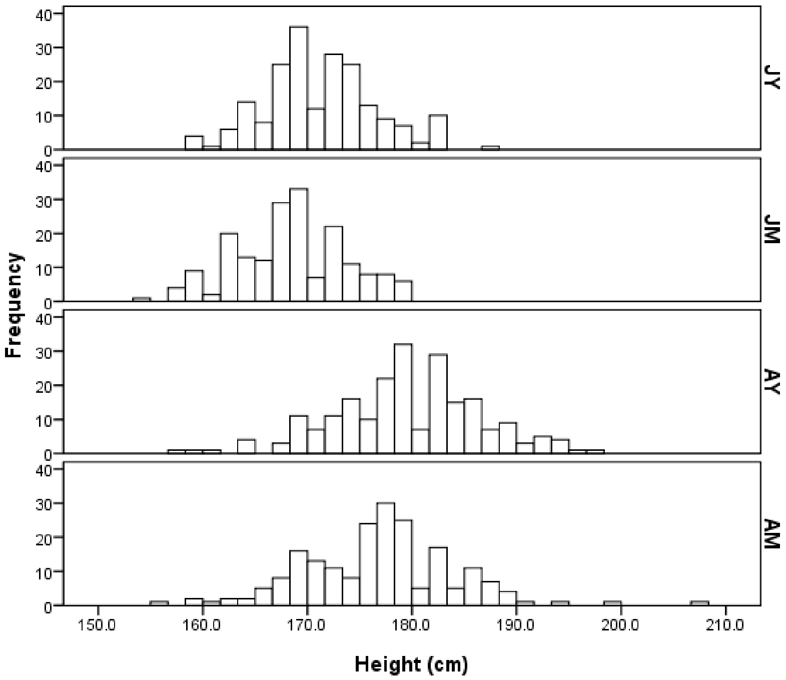


Figure 4.6 Self-reported height

JY=Japanese young adult men; JM=Japanese middle-aged men; AY=Australian young adult men; AM=Australian middle-aged men.

3. BMI

Table 4.5 indicates that the lowest mean BMI was for the young Japanese men, and the highest mean was for the Australian middle-aged men. The Japanese middle-aged men and Australian young men had a similar mean BMI. The profiles of BMI for the young and for the middle-aged Japanese and Australian men are shown in Figure 4.7. Even though the middle-aged Japanese and the young Australian men had a similar mean BMI, Figure 4.7 shows that the peak BMI in the young Australian men was substantially higher than that for the middle-aged Japanese men. Table 4.6 shows the proportion of overweight and obese using WHO criteria. The highest proportions of overweight and obesity were in the Australian middle-aged group. There were higher proportions of overweightedness in the middle-aged group of both countries. For the young generations, the proportion of overweight Australian men was twice that of the Japanese. However, around 12% of young Japanese men were underweight.

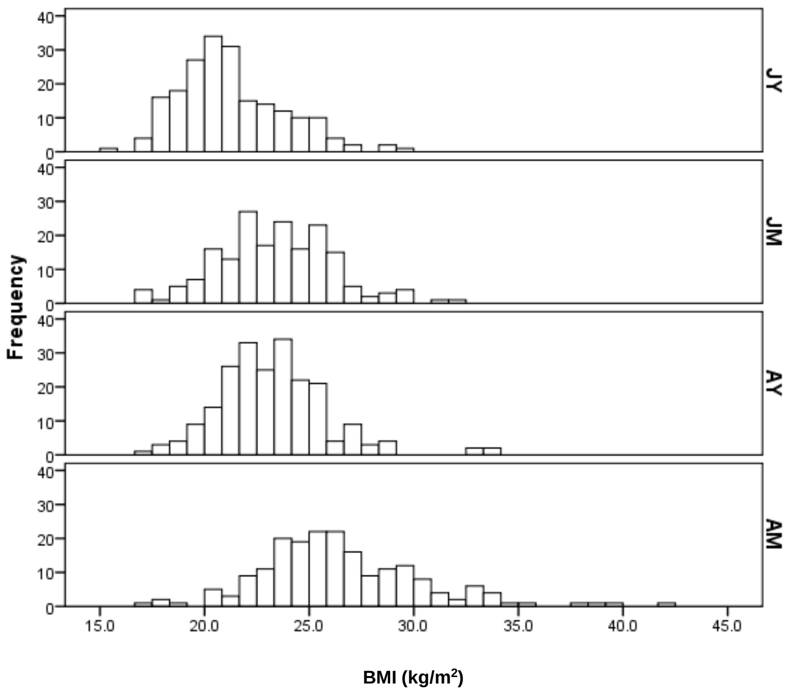


Figure 4.7 Body Mass Index (calculated from self-reported weight and height)

JY=Japanese young adult men; JM=Japanese middle-aged men; AY=Australian young adult men; AM=Australian middle-aged men.

Table 4.6 Body Mass Index classification using WHO criteria

Classification BMI categories	Underweight (%) <18.5	Normal (%) ≥18.5 - <25.0	Overweight (%) ≥25.0 - <30.0	Obese (%) ≥30.0
JY	11.9	78.6	9.5	0.0
JM	2.7	67.9	28.3	1.1
AY	1.9	77.3	19.0	1.9
AM	1.6	35.4	47.4	15.6

χ^2 : *P* <0.01

4. Waist and hip circumference

Table 4.7 summarizes the self-reported WC and HC data and derived WHR. The Australian middle-aged men had the highest mean WC and HC. Of the four groups, the young Japanese men had the lowest mean WC and HC. The profiles of WC and HC for the four groups are displayed in Figure 4.8 and 4.9. The Australian middle-aged men had a much wider spread of WC (sd=11.64) than any other group. The percentage of missing values varied between 7% and 23% across the four groups.

Table 4.7 Mean WC, HC and WHR

Groups	WC (cm) mean (sd)	WC n	HC (cm) mean (sd)	HC n	WHR mean (sd)	WHR n
JY (18-30 y) †	73.65 (7.73)	170	86.73 (7.96)	150	0.85 (0.10)	150
JM (40-60 y) †	82.20 (6.62)	174	91.99 (7.78)	151	0.89 (0.08)	151
AY (18-30 y) †	81.72 (9.78)	170	87.38 (9.61)	161	0.93 (0.08)	149
AM (40-60 y) †	92.95 (11.64)	178	100.30 (10.84)	133	0.94 (0.08)	127
NNS-A (19-24 y)‡	84.4 (-)	≈485	99.8 (-)	≈485	0.84 (-)	≈485
NNS-A (45-64 y)‡	98.4 (-)	≈1554	103.5 (-)	≈1554	0.95 (-)	≈1554
Tukey HSD						
JY:JM	*P* <0.01		*P* <0.01		*P* <0.01	
AY:AM	*P* <0.01		*P* <0.01		*P* >0.10	
JY:AY	*P* <0.01		*P* >0.10		*P* <0.01	
JM:AM	*P* <0.01		*P* <0.01		*P* <0.01	

WC=Waist circumference; HC=Hip Circumference; WHR=Waist-hip ratio.
JY=Japanese young adult men; JM=Japanese middle-aged men;
AY=Australian young adult men; AM=Australian middle-aged men.
† self-reported; ‡ measured
NNS-A (Australian Bureau of Statistics 1998c), [There is no equivalent information is available in Japan].
As n is large (>30), ANOVA is robust to violations of normality and homogeneity of variance (Diekhoff 1992).

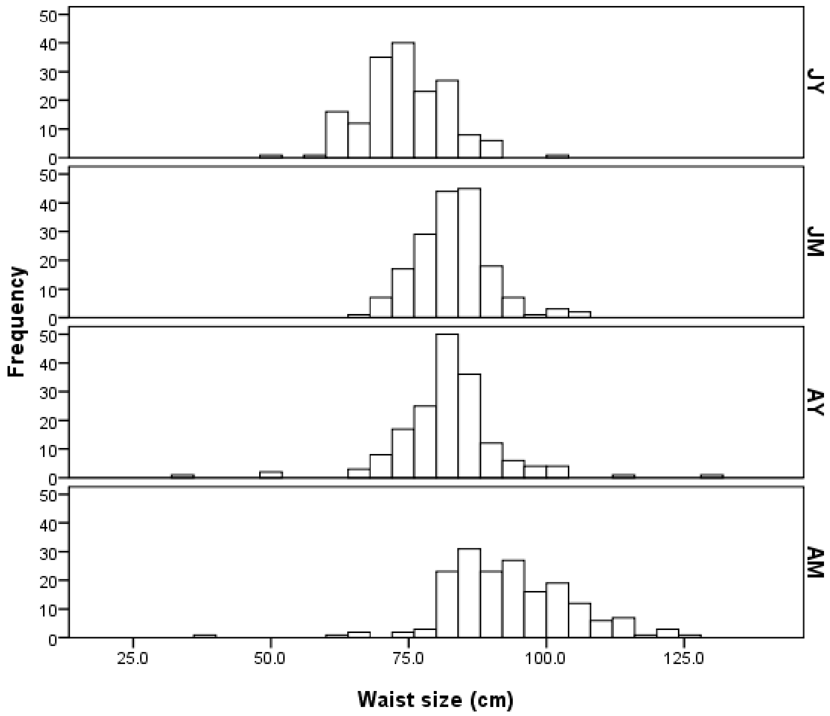


Figure 4.8 Self-reported waist circumference

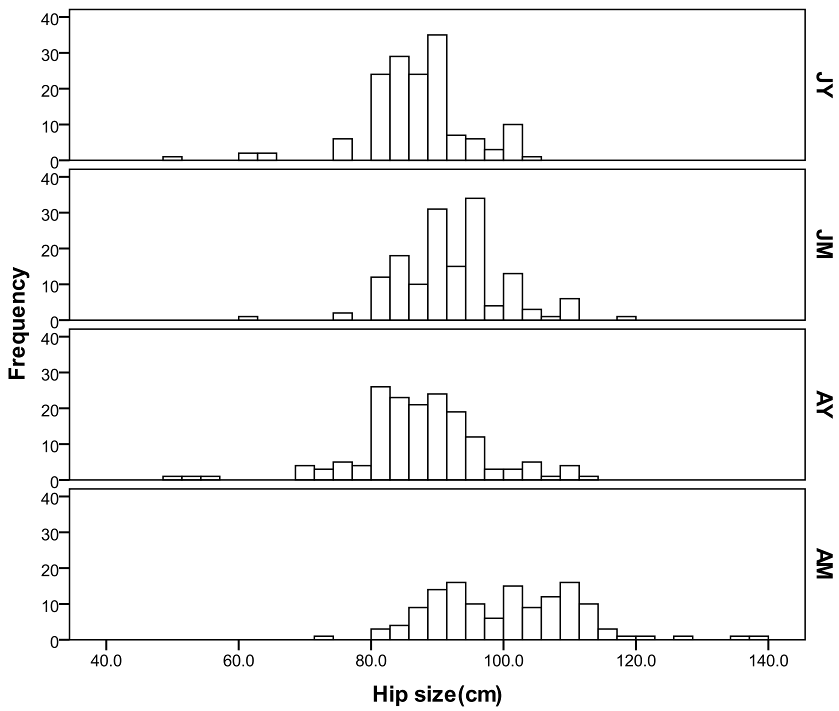


Figure 4.9 Self-reported hip circumference

JY=Japanese young adult men; JM=Japanese middle-aged men; AY=Australian young adult men; AM=Australian middle-aged men.

Table 4.8 shows the WC using the country-specific cut-off criteria (85.0 cm for Japanese and 94.0 cm for Australian). Although there was a statistically significant difference between the respective generations for Japan and Australia, the comparison between the corresponding generations in both countries showed similar proportions in the young men and the middle-aged men.

Table 4.8 Proportion of subjects by respective Japanese and Australian waist circumference classifications

Classification	<85.0 cm (%)[a]	≥85.0 cm (%)
JY	91.2	8.8
JM	58.6	41.4
Total	74.7	25.3

χ^2 : P<0.01
a : Ministry of Health Labour and Welfare (2006)

Classification	<94.0 cm (%)[b]	≥94.0 cm (%)
AY	91.2	8.8
AM	56.7	43.3
Total	73.6	26.4

χ^2 : P<0.01
b : National Health and Medical Research Council (2004)

5. Waist-hip ratios

The profiles of WHR for the four groups are displayed in Figure 4.10. As expected, of the four groups, the young Japanese men had the lowest mean. There were statistically significant mean differences between young and middle-aged groups only for Japan, and between the corresponding generations of both Japan and Australia (Table 4.7). The percentage of missing values for the reported HC varied from 20% to 37% across the four groups, thus the missing values for WHR were much higher for this parameter, which may result in misleading interpretations.

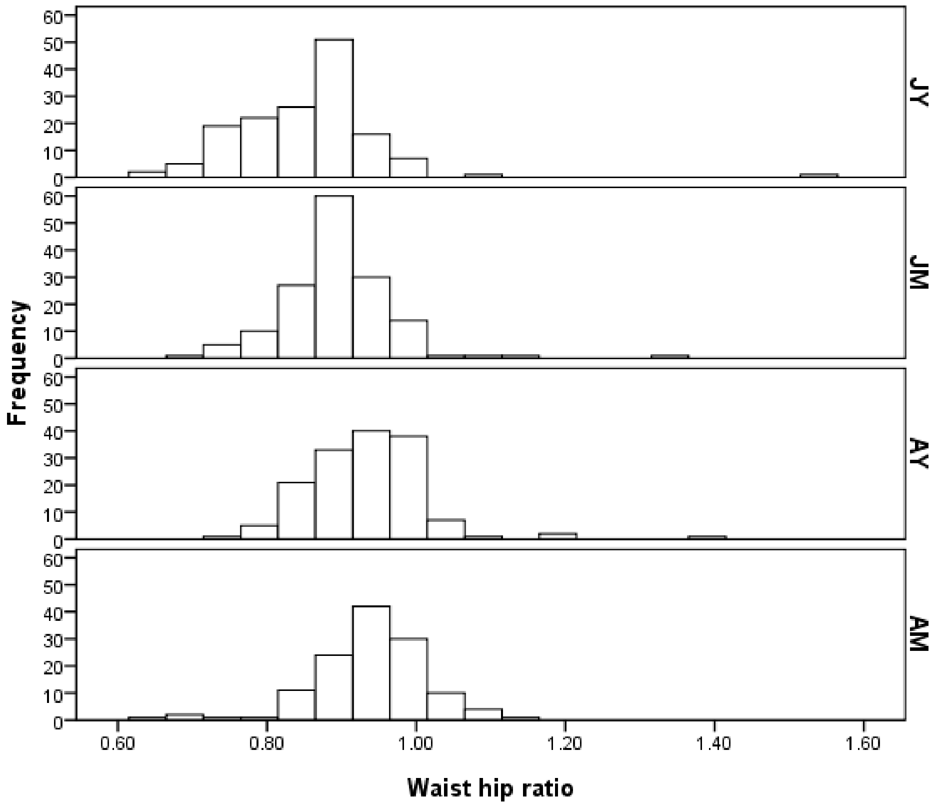


Figure 4.10 Self-reported waist-hip ratio

JY=Japanese young adult men; JM=Japanese middle-aged men; AY=Australian young adult men; AM=Australian middle-aged men.

Table 4.9 shows that a greater proportion of both Australians groups, particularly the middle-aged men, had waist-hip ratio greater than 0.90 compared with the corresponding Japanese groups.

Table 4.9 Proportion of subjects by waist-hip ratio classifications

Classification	≤0.90 (%)[ab]	>0.90 (%)
JY	81.3	18.7
JM	61.6	38.4
AY	34.2	65.8
AM	24.4	75.6
Total	51.5	48.5

χ^2 : P<0.01
a : Australian Bureau of Statistics (1998c).
b : Lear et al. (2010).

4.4 DISCUSSION

4.4.1 Demographics

Although the younger generation were targeted from 18 to 30 years of age, most respondents were 18 to 24 years old in both the Japanese and the Australian cohorts owing to the university student clusters chosen (Table 4.2). Consequently these samples may not be fully representative of the target populations in terms of age. However, the university students are regarded as often being at the forefront of the nutrition transition due to experimentation with new dietary attempts to enhance personal status, counter-cultural impulses, and exposure to western media in urban centres (Hawks et al. 2004; Pan et al. 1999), and arguably represent the most progressive members of the next generation (Craven & Hawks 2006; Hawks et al. 2003; Hawks et al. 2004).

Majority of our employers in middle-aged group in our study were white-collar workers; 34.9% of Japanese middle-aged men worked as middle level administrators and 30.7% of Australian men worked as professionals (Table 4.3). According to Shields (1999), white-collar occupations were more likely to report long working hours than were those in clerical, sales and service occupations or in blue-collar occupations. One study of middle-aged white-collar employees have shown associations with unhealthy food habits, physical inactivity, heavy drinking, smoking, and obesity (Lallukka et al. 2008). Another study has also shown that long hours bring about unhealthful lifestyle changes such as smoking, alcohol abuse, lack of physical activity, sleeplessness, poor eating habits, and fewer chances for medical examinations. Prolonged periods of working long hours may increase anxiety, strain and irritability; over time, people can become fatigued and develop a propensity to obesity, and the cumulative effect may be CVD (Shields 1999). These results clearly showed the relationship between working hours and obesity related health risk including CVD with white-collar workers. Therefore in the current study, both Japanese and Australian middle-aged workers in that category would tend to have a higher risk of obesity related health problems including CVD, in view of their type of occupations.

4.4.2 Anthropometrics

1. Body mass index

For international comparisons, it should be noted that it is often difficult to make direct comparisons of the prevalence of overweight and obesity between countries owing to the inconsistent classifications used for obesity. We adopted the WHO standardized classification for obesity (World Health Organization 2003a) in the cross-cultural comparisons between Japan and Australia in this study. BMI was calculated by using the *self-reported* body weight and height, and then the samples were compared for younger and middle-aged for the Japanese and Australians using the classifications of BMI ≥ 25.0 kg m^{-2} (overweight) and ≥ 30.0 kg m^{-2} (obese).

The mean (sd) BMI for Japanese young men age 18-30 years and the Japanese middle-aged men age 40-60 years were 21.2 (2.5) and 23.4 (2.7) kg/m^2, respectively (Table 4.5). The NNS-J in 1999 (Ministry of Health Labour and Welfare 2001) obtained the *measured* weight and height in the same year as our data were collected. The mean BMI for the 20-29 year aged group (n=480) (the closest age range corresponding to our younger sample) was 22.4 (3.4) or 1.2 BMI units higher for young men, and for 40-59 years (n=1,316) it was 23.7 (3.1), or virtually identical to ours. The corresponding data from the current study (Table 4.5) for the Australian young men (18-30 years) and the middle-aged men (40-60 years) were 23.3 (sd=2.7) and 26.5 (sd=3.8), respectively. These values were 1.3 BMI units lower than the mean BMI from the *measured* weight and height of the 1995 NNS-A (Australian Bureau of Statistics 1998c); 24.6 (19-24 years; closest category) and 27.8 (45-64 years; closest category), respectively.

Even though 18 to 30 year-old men were targeted in the current study, 99% of the Japanese sample were 18 to 24 years old (compared with 20 to 29 in NNS-J), and 88.6% of the Australian sample were 18 to 24 years old (which is very similar to the NNS-A age range) (Table 4.2). Furthermore, the subjects were all university students in the current study whereas the NNS were presumably representative of the entire population in this age group. Therefore, our lower BMI was likely to be due to a combination of a lower age range, higher education level, smaller sample size and some under-reporting. As expected, the mean BMI were higher in the middle-aged groups than the young groups for both the Japanese and the Australians (Table 4.5), and both of the Australian groups showed higher values compared with the corresponding Japanese groups.

The Organization for Economic Cooperation and Development (OECD (2010)), published changing rates of obesity between 1995 and 2009 in 30 countries including Japan and Australia. These were obtained from national health surveys and were likely to be representative of the general population. For the 1999 data, 4 out of 12 countries used measured weight and height, including Japan and Australia, and 8 used self-reporting. The prevalence of obesity (percentage of total population with BMI ≥ 30 kg/m^2) in the report for the same time-period, showed only 2.8% in Japan compared with 21.7% in Australian men. In the same table (OECD (2010)), in 2007, 7 out of 13 countries used measured weight and height, including Japan and Australia, and 6 countries used self-reported. The prevalence of obesity in 2007 was 3.3% in Japan and 24.8% in Australia. Thus, both countries showed increasing trends from that period, although the Japanese rate was still relatively low compared with Australia.

Several other surveys (Australian Institute of Health and Welfare 2008; International Diabetes Institute 2000; International Obesity Task Force 2005) also reported similar results, indicating that the obesity prevalence was considerably lower in Japan compared with other countries. Our results likewise showed similar differences, with a substantially lower prevalence of overweight/obesity in Japanese middle-aged men compared with Australian middle-aged men (Table 4.6).

Although the results showed that our data are comparable with those reported in the National Nutrition Surveys of both Japan and Australia, the data for the BMI calculation in the current study were based on self-reported rather than researcher-measured heights and weights. The trends of the under-reporting for BMI given by Gorber et al. (2007) and by Wada et al. (2005) noted that the subjects with higher measured BMI significantly under-estimated their values compared with those with lower BMI. According to Dhaliwal et al. (2010), measured obesity was shown to be higher than self-reported obesity, which suggest that the estimation of obesity prevalence for both the young and middle-aged men in the current study are under-reported. According to the results of the current study, the estimated proportion of obesity for Australian young adult men was 1.9% (Table 4.6). Dhaliwal et al. reported the difference between measured and self-reported BMI for 20-29 years to be 2.1%. When applying this correction factor to the prevalence of obesity in the present data, this leads to a value of 4.0% obese allowing for under-estimation. Similarly, the proportion for Australian middle-aged men in the current study was 15.6%, and applying the correction factor of 4.75% (40-49 years for 4.4% and the 50-59 years for 5.1%) this gave 20.35% allowing for under-estimation.

2. Waist circumference

In the current study, the comparison of the mean self-reported WC, for four groups showed that there were statistically significant differences between the values for young and middle-aged men in both Japan and Australia, and also between the generations within both countries (Table 4.7 and Figure 4.8). Using the country specific cut-off criteria of WC, the comparison between the corresponding generations showed similar proportions in both young and middle-aged groups, with the middle-aged groups of both countries showing a higher proportion of respondents that were greater than the cut-off criteria (Table 4.8).

The mean (sd) self-reported WC in the current study for the Japanese young group 18-30 years (n=170), was 73.65 (7.73) cm (Table 4.7). The mean measured WC (narrowest point between the lower costal (10^{th} rib) border and the iliac crest) (International Society for the Advancement of Kinanthropometry 2001) for Japanese men age 18-40 years (n=45), reported by Kagawa, Binns and Hills (2007) was 73.5 ± 5.2 cm. Thus, the mean WC for the young Japanese group in the current study was comparable. In addition, the mean self-reported WC for Japanese middle-aged men (40-60 years) (n=174) in the current study was 82.20 (6.62) cm (Table 4.7), while Kato et al. (2008) reported 84.8 (8.0) cm for 40-59 year olds (n=315) using a measured WC (with the subject in a standing position, at the umbilical level). Our values were again comparable to those of Kato et al. In the present study, the mean self-reported WC for the Australian young (18-30 years) (n=170) and middle-aged groups (40-60 years) (n=178) were 81.72 (9.78) cm and 92.95 (11.64) cm, respectively (Table 4.7). According to the NNS-A in Australia in 1995 (Australian Bureau of Statistics 1998c), the mean measured WC (midway between the inferior margin of the last rib and the crest of the illium in the mid-axillary plane) for young men (19-24 years) was 84.4 cm (n≈485), and the middle-aged group (45-64 years) was 98.4 cm (n≈1554). Thus our results for both the young and middle-aged Australian men were smaller than the values reported in the NNS, but the difference in age groupings and method used are likely to have accounted for the differences.

Several studies examined the magnitude of WC and whether it differs across different anatomical measurement sites (Mason & Katzmarzyk 2009; Matsushita et al. 2010), and whether there was any relationship between the specific site and the prevalence of health risk (J. Wang et al. 2003; Willis et al. 2007). The findings from the former authors indicated that there are no significant differences between the results from four measurement sites in men, but that the measurement itself (cut-point >102cm) indicated the apparent prevalence of abdominal obesity (Mason & Katzmarzyk 2009). Another study indicated that the four WC measurements had similar screening abilities, but that different WC cut-off values would have to be applied according to the site of WC to diagnose the prevalence of the metabolic syndrome (Matsushita et al. 2010). The variability in between-site differences for WCs reported across diverse populations suggests that these differences may themselves vary according to the characteristics of the sample including age, gender, race/ethnicity, and level of adiposity (Lear et al. 2010; Mason & Katzmarzyk 2009; Matsushita et al. 2010) (refer to Chapter 2 of literature review 2.1.10). For practical reasons, single gender-specific thresholds (male: >102 cm) are most commonly used to denote elevated risk associated with abdominal obesity in clinical settings (Lean, Han & Morrison 1995; Mason & Katzmarzyk 2009), but alternate cut-points have been proposed for specific racial/ethnic groups (Alberti, Zimmet & Shaw 2006; Lau et al. 2007; Mason & Katzmarzyk 2009). Despite the lack of a specified measurement site for the WC used within the samples of the present study, the proportions of the young versus the middle-aged men did not differ significantly for the Japanese and Australian men using the country specific cut-off criteria (Japan: ≥85 cm, Australia ≥94 cm) (Ministry of Health Labour and Welfare 2006; National Health and Medical Research Council 2004) (Table 4.8). Our findings are consistent with previous observations that Japanese men have smaller WC measurements than Australian Caucasian men (Kagawa, Binns & Hills 2007) and that Asians in general have smaller WC measurements than western men (Hara et al. 2006; Lear et al. 2010) as expected.

Self-reported WC has been shown to be reasonably reliable, according to Rimm et al. (1990). In previous studies, several authors investigated the accuracy of self-reported and/or self-measured WC. For example, Hall and Young (1989) studied the accuracy of self-measured WC and HC for 30-85 year-old men and women, and no systematic bias was found in the circumferences measured by the men. Spencer, Roddam and Key (2004) assessed the accuracy of self-reported waist and hip circumferences (WHC) and the WHR by comparing the WHC and WHR in an [external-observed] measured sample of middle-aged men and women. They found that self-reported waist measurements was sufficiently accurate for identifying relationships in epidemiological studies, although the waist was under-estimated and the extent of under-estimation was greater in participants with larger waists and older participants. Bigaard et al. (2005) investigated body size measurements using baseline technician-measured BMI and baseline body shape measurements, and found that the self-reported WC at the level of the umbilicus was correlated with the technician-measured circumference at the natural waist. Dekkers et al. (2008) also evaluated the accuracy of self-reported weight, height and WC among the Dutch overweight working population, and investigated the extent to which the accuracy was moderated by gender, age, BMI, socio-economic status and health-related factors. Their results suggested that self-reported WC was satisfactorily accurate for the assessment of overweight/obesity in a middle-aged overweight working population. There has, as yet, been little information related to the self-reported or self-measured WC for Japanese adult male subjects. Thus, we cannot exclude the possibility of any misclassification due to under-estimation among these subjects in the current study. Further investigation would be needed.

3. Waist-hip ratios

In the current study, anthropometric measurements including height, weight, waist, and hip circumference were all self-reported. According to Rimm et al. (1990), although the degree of measurement error for the ratio of waist and hip circumference may have both been under-estimated, the Pearson correlations between self-reported WCs and the average of technician-measured WCs were highly correlated, and similar correlations were also found for hip measurements for men. The self-reported WHR measurements should also be reasonably valid.

There were statistically significant differences between mean young and middle-aged WHR for the Japanese groups and between the corresponding generations of both the Japanese and the Australian (Table 4.7 and Figure 4.10) in the current study, and a greater proportion of young (65.8%) and middle-aged groups (75.6%) of Australians had a WHR greater than 0.90 compared with the respective Japanese groups (18.7% and 38.4%) (Table 4.9) (refer to Chapter 2 of literature review 2.1.6). The mean WHR for the Japanese young group age 18-30 years and the Japanese middle-aged group age 40-60 years, based on the self-reported WC and HC, were 0.85 (sd=0.10) and 0.89 (sd=0.08), respectively (Table 4.7 and Figure 4.10). These results are within the range of both studies of Ito et al. (2001) and Sekikawa et al. (1999). The mean WHR for the Australian young (18-30 years) and middle-aged groups (40-60 years) were 0.93 (sd=0.08) and 0.94 (sd=0.08), respectively (Table 4.7 and Figure 4.10). According to Welborn and Dhaliwal (2007), the mean WHR, calculated by WC (at the narrowest point between ribs and hips after exhaling when viewed from the front) (Boyle et al. 1993) and HC (at the point of maximum extension of the buttocks when viewed from the side) for aged 20-69 years was 0.89 ± 0.06 for men, and were, therefore, comparable to our results.

Sekikawa et al. (1999) (refer to Chapter 2 of literature review 2.1.6) indicated that WHR was independently associated with impaired glucose tolerance (IGT) and diabetes (DM), therefore, there is a possibility that a higher proportion of both Australian young and middle-aged men, particularly the latter group, would have a higher risk of IGT and DM compared with both generations of the Japanese (Table 4.7). Kodama et al. (1999) examined the relation of BMI and WHR to gallstones and postcholecystectomy risk in middle-aged Japanese men aged 48-59 years, and their findings indicated that obesity was associated with increased gallstone risk in men. The results, therefore, suggest that both young and middle-aged Australian generations in our study, may have a higher gallstone risk, especially the middle-aged, compared with both generations of the Japanese (Tables 4.6 and 4.7).

Chapter 5

Results and Discussion (B)
Under-reporting

5.1 ENERGY- NUTRITION PROFILE

Table 5.1 shows the profiles of the energy intake and the percentage of energy from several macronutrients displayed for an inter-generational and cross-cultural comparison among four groups. The profiles including fat, protein, carbohydrate and alcohol, and the sub-categories of total fat – saturated, mono-unsaturated and poly-unsaturated fat – were also included. The figures give the median intake.

For energy, the Australian generations have greater intake than the corresponding Japanese groups, and the younger Australian group had the highest intake of all the groups. Concerning total fat, the younger generations of both countries showed higher intake compared with the middle-aged generations. In terms of both saturated and monounsaturated fat intake, both Australian generations had higher intake compared with the corresponding Japanese groups. In contrast, for PUFA intake, both Japanese generations had higher intakes than both Australian groups, although the actual values for young and middle-aged groups showed similar results. In terms of alcohol, the middle-aged generations of both countries had greater intake than the younger generation, with the Japanese having the highest.

Discussion

Table 5.1 below showed the results of energy and several nutrient intakes, and the percentage of energy contribution that were obtained from the semi-quantitative FFQ. It illustrated both age and ethnic differences in the intake values. Kagawa et al. (2006) studied the differences in nutrient intakes of 65 Japanese males living in Australia using a four-day dietary record and compared this with 81 Japanese males living in Japan as well as 70 Australian Caucasian males living in Australia, all aged 18-30 years old. According to Kagawa, in terms of energy intake, the young Australian male showed the higher intake compared with the young Japanese male,

Table 5.1 Energy intake and percentage of energy from macronutrients

	JY	JM	AY	AM
Energy intake (MJ/day)				
Median	8.5	7.7	11.0	8.6
Minimum	1.3	1.3	0.8	1.5
Maximum	40.5	27.1	41.5	34.1
Interquartile Range	5.1	4.3	6.2	4.8
Total fat (% of energy)				
Median	29.6	25.8	30.6	27.8
Minimum	12.8	8.5	8.8	8.9
Maximum	40.6	41.4	44.6	42.5
Interquartile Range	6.5	7.3	6.4	7.0
SFA (% of energy)				
Median	9.8	8.0	11.6	10.0
Minimum	3.0	1.9	1.8	3.2
Maximum	18.6	18.6	20.0	18.5
Interquartile Range	3.5	3.2	3.9	3.8
MUFA (% of energy)				
Median	8.8	8.2	10.2	9.6
Minimum	4.3	2.5	3.0	3.0
Maximum	13.0	14.5	16.0	18.0
Interquartile Range	2.2	2.7	2.5	2.9
PUFA (% of energy)				
Median	5.7	5.7	4.6	4.5
Minimum	2.4	1.4	1.7	1.4
Maximum	11.1	10.9	8.5	10.4
Interquartile Range	1.8	2.0	1.6	1.6
Protein (% of energy)				
Median	17.6	17.1	16.2	15.8
Minimum	8.3	8.3	10.6	7.9
Maximum	25.9	29.9	32.0	30.8
Interquartile Range	3.7	3.7	3.6	3.2
Carbohydrate (% of energy)				
Median	51.6	50.3	49.4	50.1
Minimum	35.7	32.3	26.1	31.7
Maximum	77.3	77.8	70.9	68.3
Interquartile Range	8.9	10.6	7.2	10.4
Alcohol (% of energy)				
Median	0.4	4.4	2.5	3.6
Minimum	0.0	0.0	0.0	0.0
Maximum	16.9	29.2	25.4	46.1
Interquartile Range	1.4	8.2	4.0	7.0

JY = Japanese Young adult men / Younger generation,
JM = Japanese Middle-aged adult men / Older generation,
AY = Australian Young adult men / Younger generation,
AM = Australian Middle-aged adult men / Older generation,
SFA; Saturated fat acid,
MUFA; Mono-unsaturated fatty acid,
PUFA; Poly-unsaturated fatty acid.

which is consistent with the results of our current study. In the Kagawa study, the intake of total fat and the sub-categories of saturated and monounsaturated fat showed that the Australian men had a higher value than that of Japanese young men, whereas polyunsaturated fat showed the opposite results. Their results were consistent with the current study, although the method to assess nutrient intake differed and their sample size for each groups were smaller than ours.

5.2 UNDER-REPORTING

Table 5.2 shows the mean and standard deviation of EI/BMR for the four groups. Although, the Kolmogorov-Smirnov normality test showed that the data was not normally distributed, tests of means are robust to violations of normality and homogeneity of variance if the samples are large enough (Diekhoff 1992). According to the ANOVA and Tukey's HSD results, there was a significant difference between the young groups of the Japanese and Australian men (*P*<0.05), but not between the respective middle-aged groups. There was also a significant difference between the generation of Australian young and middle-aged groups (*P*<0.001), but not between the generations of the Japanese groups.

Table 5.2 Mean and standard deviation of EI/BMR for the four groups

JY n=201	JM n=183	AY n=218	AM n=192
1.44 (0.80)	1.34 (0.57)	1.63 (0.78)	1.23 (0.59)

JY = Japanese young adult men.
JM = Japanese middle-aged men.
AY = Australian young adult men.
AM = Australian middle-aged men.

ANOVA F : P<0.001

Tukey HSD JY-JM *P* > 0.05
AY-AM *P* < 0.001
JY-AY *P* < 0.05
JM-AM *P* > 0.05

As n is large (>30), ANOVA is robust to violations to normality and homogeneity of variance (Diekhoff, 1992)

Table 5.3 and Figure 5.1 show the mean and standard deviation of BMR for the four groups. The BMR formula from the Ministry of Health and Welfare in Japan (1996) was used for both Japanese groups, whereas the formula from Hayter & Henry (1994) was used for the young Australian men and the formula from the 1990

Recommended Nutrient Intakes taken from Schofield et al. (1985) was used for the middle-aged Australian men.

Table 5.3 Mean and standard deviation of BMR for the four groups

	BMR equation	Mean (MJ/day) & sd
JY	BMR (kcal × day^{-1}) = $C^{\dagger}$ (kcal × m^{-2} × h^{-1}) × ($W^{0.444}$ × $H^{0.663}$ × 88.83 / 10000) (m^2) × 24 (h) × 1.04	6.79 (0.45)
JM	BMR (kcal × day^{-1}) = $C^{\ddagger}$ (kcal × m^{-2} × h^{-1}) × ($W^{0.444}$ × $H^{0.663}$ × 88.83 / 10000) (m^2) × 24 (h) × 1.04	6.30 (0.46)
AY	BMR (MJ day^{-1}) = (0.051 × body weight (kg)) + 3.500	7.34 (0.58)
AM	BMR (MJ day^{-1}) = (0.048 × body weight (kg)) + 3.653	7.64 (0.67)

$C^{\dagger}$ is a constant for basal metabolism for JY ; 38.6. $C^{\ddagger}$ is a constant for basal metabolism for JM ; 35.2,
W (kg) and H (cm) are the individual body weight and height of the subject.

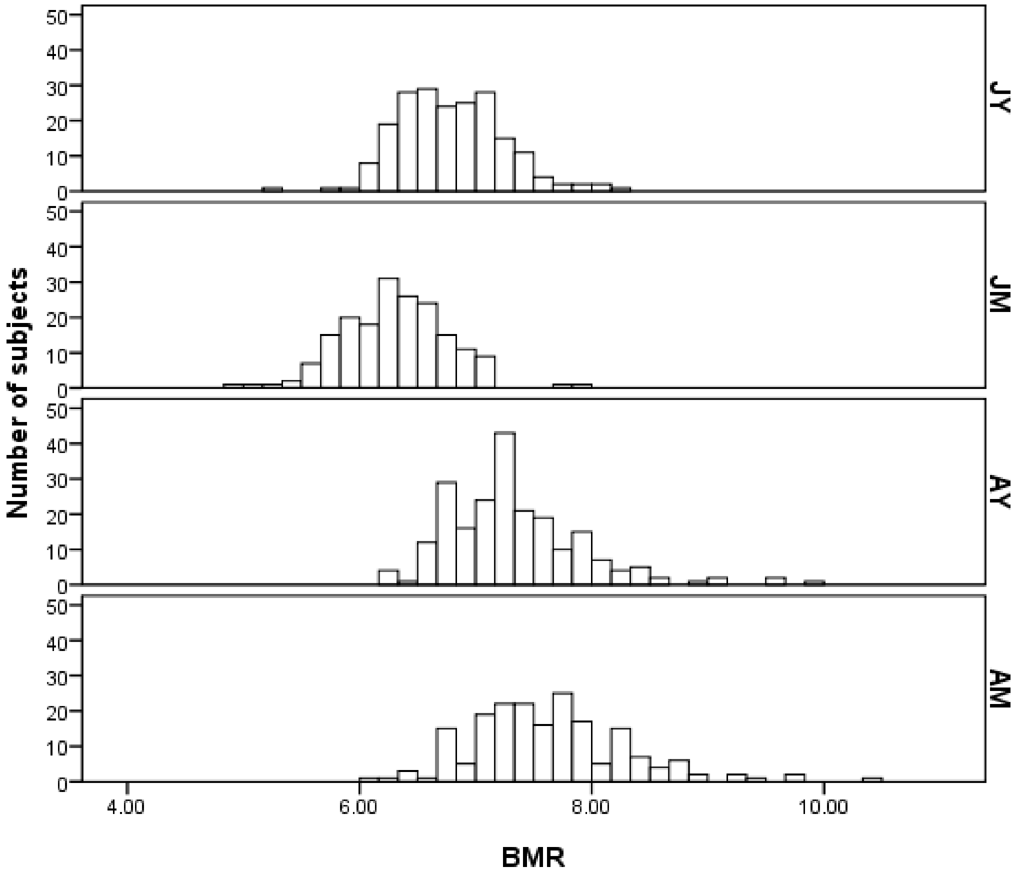


Figure 5.1 Mean and standard deviation of BMR for the four groups

JY = Japanese young adult men. n=201, mean=6.79, sd=0.45
JM = Japanese middle-aged men. n=183, mean=6.30, sd=0.46
AY = Australian young adult men. n=218, mean=7.34, sd=0.58
AM = Australian middle-aged men. n=192, mean=7.64, sd=0.67

ANOVA F : P<0.001

Tukey HSD	JY-JM	$P < 0.001$
	AY-AM	$P < 0.001$
	JY-AY	$P < 0.001$
	JM-AM	$P < 0.001$

As n is large (>30), ANOVA is robust to violations to normality and homogeneity of variance (Diekhoff, 1992)

Tables 5.4 to 5.9, and Figure 5.1 above & 5.2 below were based on the formulae presented in Table 5.3 above.

Table 5.4 Values of anthropometric characteristics by quartile of EI/BMR

	Quartile of EI/BMR for JY				
	First quartile (n=50)	Second quartile (n=50)	Third quartile (n=50)	Fourth quartile (n=51)	ANOVA Sig.
EI/BMR	0.77 (0.17)	1.09 (0.08)***	1.44 (0.11)***	2.43 (0.95)***	0.000
Weight (kg)	62.2 (8.3)	62.8 (7.2)	63.4 (7.8)	61.4 (8.4)	0.631
Height (cm)	170.1 (4.6)	172.6 (5.1)	172.1 (5.6)	171.1 (5.5)	0.080
BMI (kg/m^2)	21.5 (2.8)	21.1 (2.4)	21.4 (2.4)	21.0 (2.4)	0.707
BMR (MJ/day)	6.7 (0.5)	6.8 (0.4)	6.9 (0.5)	6.7 (0.5)	0.354
Energy intake (MJ/day)	5.2 (1.2)	7.5 (0.7)***	9.9 (1.1)***	16.3 (6.3)***	0.000
	Quartile of EI/BMR for JM				
	First quartile (n=46)	Second quartile (n=46)	Third quartile (n=46)	Fourth quartile (n=46)	ANOVA Sig.
EI/BMR	0.74 (0.15)	1.08 (0.10)***	1.42 (0.11)***	2.11 (0.48)***	0.000
Weight (kg)	67.7 (9.0)	66.0 (8.2)	66.8 (9.7)	66.2 (9.2)	0.826
Height (cm)	169.9 (5.9)	168.7 (5.4)	168.0 (5.3)	168.1 (4.7)	0.305
BMI (kg/m^2)	23.4 (2.5)	23.2 (2.6)	23.6 (3.0)	23.4 (2.8)	0.905
BMR (MJ/day)	6.4 (0.5)	6.3 (0.4)	6.3 (0.5)	6.3 (0.5)	0.661
Energy intake (MJ/day)	4.7 (1.0)	6.8 (0.8)***	9.0 (1.0)***	13.2 (3.3)***	0.000
	Quartile of EI/BMR for AY				
	First quartile (n=54)	Second quartile (n=54)	Third quartile (n=55)	Fourth quartile (n=55)	ANOVA Sig.
EI/BMR	0.86 (0.20)	1.32 (0.12)***	1.70 (0.11)***	2.62 (0.82)***	0.000
Weight (kg)	78.3 (13.2)	74.7 (9.4)	74.9 (11.2)	73.6 (11.1)	0.156
Height (cm)	180.3 (7.4)	180.2 (6.4)	179.2 (6.7)	179.4 (7.3)	0.812
BMI (kg/m^2)	24.0 (3.1)	23.1 (2.3)	23.3 (2.9)	22.8 (2.2)	0.111
BMR (MJ/day)	7.8 (0.8)	7.6 (0.6)	7.6 (0.7)	7.5 (0.7)	0.156
Energy intake (MJ/day)	6.5 (1.6)	9.7 (1.1)***	12.4 (1.2)***	19.0 (5.9)***	0.000
	Quartile of EI/BMR for AM				
	First quartile (n=48)	Second quartile (n=48)	Third quartile (n=48)	Fourth quartile (n=48)	ANOVA Sig.
EI/BMR	0.67 (0.13)	0.98 (0.08)***	1.29 (0.08)***	1.97 (0.67)***	0.000
Weight (kg)	86.3 (10.3)	87.7 (16.8)	79.0 (13.4)**	79.2 (12.2)**	0.001
Height (cm)	176.6 (6.4)	178.7 (7.4)	176.3 (6.5)	176.4 (8.5)	0.328
BMI (kg/m^2)	27.7 (3.3)	27.4 (4.7)	25.4 (3.4)**	25.4 (3.3)**	0.001
BMR (MJ/day)	7.8 (0.5)	7.9 (0.8)	7.4 (0.6)**	7.5 (0.6)**	0.001
Energy intake (MJ/day)	5.3 (1.1)	7.7 (1.0)***	9.6 (1.1)***	14.6 (4.7)***	0.000

Values show mean and standard deviation.
** P <0.05, *** P <0.01.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men and AM: Australian middle-aged men.
EI - energy intake, BMR - basal metabolic rate, BMI - body mass index.
EI/BMR: Energy intake divided by BMR.
BMR equations: Taken from the Ministry of Health and Welfare (1996) for JY and JM, from Hayter and Henry (1994) for AY, and from Schofield, Schofield and James (1985) for AM.

Table 5.4 above shows the mean values of body weight and height, BMI, BMR and EI by quartiles of EI/BMR. A significant increasing trend from the lowest to the highest quartile of EI/BMR was observed for energy intake for all four groups. That there is a clear increasing trend of total energy from the first to the fourth quartile and EI/BMR may also be partly necessary due to the common present of EI due to partial colinearity (Glenn. James & James 1967). However, in Tables 5.5 & 5.6, the nutrient and food group data had been corrected for energy intake, and therefore no such trend was expected. A slight significant declining trend was observed for BMI only for the Australian middle-aged men. There was also a declining trend for BMR only for Australian young men, but this was not significant.

Tables 5.4 above and 5.5 below present the mean energy and nutrient intakes by quartiles of EI/BMR. Mean iron intake decreased with increasing EI/BMR for both Japanese groups and the Australian middle-aged group, however, significantly decreasing trends were observed only for the Japanese young and middle-aged groups, but not for the Australian middle-aged men. A similar tendency was observed for carbohydrate intake expressed as a percentage of total energy, but only for Japanese middle-aged men, although this difference was significant only between the first and fourth quartiles. There were apparent slight decreasing tendencies with increasing EI/BMR for sodium intake for the Australian young group, and dietary fibre intake for the Australian middle-aged group, although these were not significant. On the other hand, there were significant increasing trends for both total fat and saturated fat intake expressed as a percentage of total energy with increasing EI/BMR for Japanese middle-aged men. A gradually increasing trend was also apparent for total fat intake, SFA, MUFA and PUFA for the Australian middle-aged men, although these are not significant. There was also an overall significant increasing trend in SFA for the young Japanese men. The middle-aged Australian group show an apparent decreasing trend in alcohol intake, but this was not significant.

Table 5.6 below presents the mean intakes of food groups by quartiles of EI/BMR. A positive trend was observed for fish intake for the Japanese young group, although it was not significant. An increasing significant trend from the lowest to the highest quartile of EI/BMR was also observed for meats for JY and confectioneries for AM. Potatoes and dairy products for JM, and confectioneries for AY, show some increasing trend, although these were not significant. On the other hand, a significant declining trend was observed for cereals for JM.

Table 5.5 Intakes of nutrients by quartiles of EI/BMR

	Quartile of EI/BMR for JY				
	First quartile (n=50)	Second quartile (n=50)	Third quartile (n=50)	Fourth quartile (n=51)	ANOVA Sig.
Total fat (% of energy)	27.6 (5.9)	27.0 (4.9)	29.6 (3.9)	31.0 (4.5)***	0.000
SFA (% of energy)	9.1 (2.8)	9.0 (2.1)	10.0 (2.0)	10.8 (2.2)***	0.000
MUFA (% of energy)	8.7 (1.9)	8.1 (1.8)	8.9 (1.5)	9.4 (1.7)	0.002
PUFA (% of energy)	6.0 (1.6)	5.2 (1.2)**	6.1 (1.3)	5.7 (1.2)	0.006
Protein (% of energy)	17.4 (3.1)	17.1 (2.3)	17.8 (2.5)	18.6 (3.1)	0.055
Carbohydrate (% of energy)	53.7 (7.9)	54.8 (6.3)	51.7 (4.6)	49.1 (5.9)***	0.000
Alcohol (% of energy)	1.3 (2.0)	1.1 (1.9)	0.8 (1.4)	1.3 (2.6)	0.652
Calcium (mg/10MJ)	986 (426)	896 (351)	909 (361)	928 (335)	0.628
Iron (mg/10MJ)	18.6 (2.4)	16.8 (3.0)***	16.4 (2.9)***	15.1 (2.4)***	0.000
Sodium (mg/10MJ)	4205 (1204)	3913 (983)	4221 (901)	3955 (760)	0.247
Vitamin C (mg/10MJ)	86.3 (45.3)	93.7 (41.2)	97.7 (58.9)	95.7 (45.2)	0.661
Dietary fibre (g/10MJ)	16.3 (3.2)	15.7 (3.1)	16.5 (3.7)	16.0 (2.9)	0.624

	Quartile of EI/BMR for JM				
	First quartile (n=46)	Second quartile (n=46)	Third quartile (n=46)	Fourth quartile (n=46)	ANOVA Sig.
Total fat (% of energy)	23.4 (6.5)	25.3 (5.5)	26.0 (5.2)	29.5 (4.2)***	0.000
SFA (% of energy)	7.3 (2.9)	7.8 (2.1)	8.3 (2.5)	10.0 (2.1)***	0.000
MUFA (% of energy)	7.7 (2.2)	8.3 (2.2)	8.5 (2.0)	8.5 (2.3)	0.227
PUFA (% of energy)	5.6 (1.6)	5.8 (1.6)	5.9 (1.4)	5.6 (1.6)	0.812
Protein (% of energy)	15.6 (3.0)	17.7 (3.3)***	17.2 (2.8)	18.3 (2.6)***	0.000
Carbohydrate (% of energy)	53.8 (7.7)	52.2 (7.6)	50.5 (6.4)	48.0 (6.4)***	0.001
Alcohol (% of energy)	7.1 (7.3)	4.8 (4.6)	6.3 (5.7)	4.3 (4.8)	0.064
Calcium (mg/10MJ)	806 (250)	839 (275)	924 (335)	904 (331)	0.203
Iron (mg/10MJ)	18.5 (3.2)	18.1 (2.6)	17.2 (2.9)	15.3 (3.1)***	0.000
Sodium (mg/10MJ)	3797 (1374)	3675 (797)	3574 (1095)	3776 (796)	0.720
Vitamin C (mg/10MJ)	97.7 (48.3)	82.7 (35.1)	80.9 (41.6)	90.4 (50.4)	0.247
Dietary fibre (g/10MJ)	16.5 (4.0)	16.0 (2.9)	15.1 (3.7)	16.8 (2.8)	0.119

	Quartile of EI/BMR for AY				
	First quartile (n=54)	Second quartile (n=54)	Third quartile (n=55)	Fourth quartile (n=55)	ANOVA Sig.
Total fat (% of energy)	30.3 (6.0)	29.6 (4.6)	30.9 (5.6)	30.6 (4.8)	0.592
SFA (% of energy)	11.4 (3.4)	11.5 (2.6)	12.0 (2.8)	11.6 (2.6)	0.704
MUFA (% of energy)	10.1 (2.4)	9.7 (1.7)	10.3 (2.1)	10.4 (1.8)	0.365
PUFA (% of energy)	4.7 (1.2)	4.4 (1.0)	4.7 (1.1)	4.7 (1.0)	0.256
Protein (% of energy)	16.9 (3.3)	16.5 (2.8)	16.2 (2.3)	16.1 (2.6)	0.426
Carbohydrate (% of energy)	49.3 (7.9)	49.9 (5.4)	49.4 (6.1)	49.7 (6.1)	0.969
Alcohol (% of energy)	3.5 (3.9)	4.0 (4.1)	3.5 (3.0)	3.5 (4.3)	0.857
Calcium (mg/10MJ)	1149 (398)	1256 (340)	1194 (326)	1236 (326)	0.396
Iron (mg/10MJ)	17.4 (5.2)	17.7 (5.9)	15.9 (4.7)	15.7 (3.9)	0.093
Sodium (mg/10MJ)	3657 (706)	3605 (589)	3499 (647)	3443 (697)	0.316
Vitamin C (mg/10MJ)	137.6 (97.8)	153.7 (112.5)	143.0 (78.0)	135.6 (80.8)	0.745
Dietary fibre (g/10MJ)	25.9 (15.8)	29.1 (16.1)	24.1 (12.5)	24.4 (10.4)	0.229

	Quartile of EI/BMR for AM				
	First quartile (n=48)	Second quartile (n=48)	Third quartile (n=48)	Fourth quartile (n=48)	ANOVA Sig.
Total fat (% of energy)	26.3 (6.2)	27.7 (6.0)	28.4 (6.2)	29.4 (4.9)	0.071
SFA (% of energy)	9.5 (3.1)	9.6 (2.7)	10.3 (3.1)	10.4 (2.4)	0.269
MUFA (% of energy)	9.1 (2.4)	9.9 (2.6)	10.0 (2.4)	10.1 (2.1)	0.194
PUFA (% of energy)	4.2 (1.2)	4.7 (1.4)	4.7 (1.3)	5.1 (1.4)**	0.020
Protein (% of energy)	16.1 (3.9)	16.1 (2.0)	16.0 (3.1)	16.1 (2.4)	0.993
Carbohydrate (% of energy)	49.7 (8.1)	50.1 (8.8)	50.9 (6.6)	49.8 (6.1)	0.880
Alcohol (% of energy)	7.8 (9.0)	6.1 (5.3)	4.7 (6.3)	4.7 (5.0)	0.062
Calcium (mg/10MJ)	1163 (519)	1112 (276)	1263 (458)	982 (301)	0.008
Iron (mg/10MJ)	19.5 (7.2)	19.1 (5.3)	18.3 (5.1)	17.9 (4.5)	0.520
Sodium (mg/10MJ)	3254 (718)	3496 (612)	3319 (734)	3388 (680)	0.359
Vitamin C (mg/10MJ)	161.0 (118.6)	170.5 (122.3)	169.8 (74.7)	131.8 (75.1)	0.197
Dietary fibre (g/10MJ)	34.4 (22.6)	33.2 (15.2)	32.3 (15.1)	29.0 (13.1)	0.436

Values show mean and standard deviation.
** *P* <0.05, *** *P* <0.01.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men and AM: Australian middle-aged men.
SFA - Saturated fatty acids, MUFA - Monounsaturated fatty acids, and PUFA - Polyunsaturated fatty acids.
EI - energy intake, BMR - basal metabolic rate.
EI/BMR: Energy intake divided by BMR.

Table 5.6 Intakes of food groups (g/10 MJ) by quartiles of EI/BMR

	Quartile of EI/BMR for JY				
	First quartile (n=50)	Second quartile (n=50)	Third quartile (n=50)	Fourth quartile (n=51)	ANOVA Sig.
Cereal	1170.3 (588.5)	1252.9 (567.5)	1021.1 (507.2)	771.1 (320.3)***	0.000
Potatoes	60.5 (67.4)	54.6 (42.3)	62.6 (46.7)	82.5 (61.4)	0.068
Confectioneries	172.1 (169.7)	187.3 (126.7)	177.7 (116.5)	205.6 (149.6)	0.655
Pulses	4.9 (13.4)	9.6 (19.3)	14.8 (50.6)	8.2 (10.2)	0.366
Fruits	80.3 (97.6)	139.0 (141.1)	120.8 (117.8)	162.2 (192.1)**	0.032
Vegetables	417.7 (416.7)	283.5 (223.8)	326.0 (226.1)	301.0 (267.7)	0.107
Soft Drinks, Sugar-containing	69.4 (125.9)	74.9 (127.3)	88.5 (129.0)	76.1 (134.8)	0.900
Soft Drinks, Non-sugar-containing	62.0 (112.9)	105.5 (139.6)	102.8 (178.2)	87.9 (92.3)	0.352
Fish	262.1 (253.2)	285.1 (210.4)	324.4 (226.0)	329.9 (224.4)	0.391
Meats	285.9 (187.6)	287.6 (176.8)	300.4 (173.3)	406.8 (291.1)**	0.012
Eggs	265.3 (275.9)	213.9 (197.3)	163.8 (127.9)**	184.2 (150.0)	0.058
Dairy Products	399.7 (450.3)	417.8 (392.7)	402.3 (460.3)	388.0 (378.0)	0.988

	Quartile of EI/BMR for JM				
	First quartile (n=46)	Second quartile (n=46)	Third quartile (n=46)	Fourth quartile (n=46)	ANOVA Sig.
Cereal	1370.1 (704.9)	1295.9 (499.5)	1156.6 (444.3)	899.8 (320.6)***	0.000
Potatoes	26.1 (37.3)	34.4 (37.5)	43.5 (44.5)	45.0 (47.1)	0.111
Confectioneries	122.3 (196.6)	112.0 (93.6)	139.1 (126.6)	180.7 (147.0)	0.119
Pulses	8.7 (18.1)	20.8 (47.2)	18.9 (30.0)	23.3 (29.6)	0.160
Fruits	162.9 (157.7)	123.4 (124.1)	130.2 (130.3)	146.4 (198.8)	0.620
Vegetables	555.2 (442.5)	465.4 (282.5)	413.3 (330.2)	432.0 (223.0)	0.173
Soft Drinks, Sugar-containing	17.9 (53.5)	24.8 (56.4)	16.8 (30.2)	16.6 (37.4)	0.802
Soft Drinks, Non-sugar-containing	87.3 (133.3)	51.5 (58.3)	62.7 (93.2)	104.6 (159.1)	0.129
Fish	392.8 (352.1)	527.1 (537.9)	533.2 (486.1)	488.6 (462.0)	0.445
Meats	326.2 (291.6)	327.1 (234.6)	301.9 (184.7)	322.9 (226.3)	0.951
Eggs	214.7 (198.9)	292.9 (259.3)	259.1 (192.6)	204.7 (143.3)	0.136
Dairy Products	264.9 (301.7)	356.8 (335.6)	365.1 (382.2)	372.0 (344.7)	0.398

	Quartile of EI/BMR for AY				
	First quartile (n=54)	Second quartile (n=54)	Third quartile (n=55)	Fourth quartile (n=55)	ANOVA Sig.
Cereal	568.2 (473.6)	469.3 (380.6)	388.3 (244.0)**	407.7 (247.1)	0.035
Potatoes	143.8 (130.2)	166.6 (141.3)	170.1 (142.4)	160.4 (138.5)	0.765
Confectioneries	218.1 (217.5)	221.3 (165.1)	255.7 (205.8)	287.5 (243.2)	0.265
Pulses	42.9 (77.1)	13.9 (20.8)***	16.4 (19.0)***	24.6 (27.6)	0.002
Fruits	253.7 (378.2)	264.3 (292.7)	218.9 (223.1)	283.5 (253.4)	0.704
Vegetables	373.4 (362.3)	344.9 (276.7)	316.9 (262.0)	330.8 (257.4)	0.775
Soft Drinks, Sugar-containing	237.5 (337.4)	214.8 (309.7)	280.5 (528.9)	238.7 (282.1)	0.836
Soft Drinks, Non-sugar-containing	127.6 (216.0)	173.9 (292.9)	198.9 (219.7)	147.0 (167.1)	0.389
Fish	168.9 (236.7)	80.6 (94.0)**	114.0 (169.7)	81.0 (73.0)**	0.011
Meats	586.1 (537.1)	475.1 (371.9)	545.5 (375.5)	518.8 (364.6)	0.570
Eggs	70.7 (91.0)	85.6 (112.6)	82.3 (73.8)	56.8 (72.3)	0.314
Dairy Products	655.0 (548.2)	688.9 (444.8)	644.2 (397.7)	657.6 (340.6)	0.958

	Quartile of EI/BMR for AM				
	First quartile (n=48)	Second quartile (n=48)	Third quartile (n=48)	Fourth quartile (n=48)	ANOVA Sig.
Cereal	468.7 (356.1)	524.4 (357.1)	450.6 (300.1)	401.7 (297.3)	0.335
Potatoes	186.0 (154.3)	218.4 (145.5)	178.7 (136.1)	212.6 (179.4)	0.514
Confectioneries	169.1 (161.6)	198.5 (189.2)	221.6 (162.6)	297.5 (255.0)***	0.012
Pulses	26.7 (40.1)	38.9 (45.0)	46.6 (62.1)	35.9 (65.6)	0.350
Fruits	427.8 (559.6)	479.4 (475.3)	375.0 (307.8)	309.1 (254.9)	0.226
Vegetables	693.2 (571.3)	490.0 (223.6)**	560.4 (340.6)	495.4 (305.1)	0.035
Soft Drinks, Sugar-containing	234.9 (589.7)	166.2 (388.7)	99.0 (256.8)	146.4 (253.4)	0.408
Soft Drinks, Non-sugar-containing	60.0 (137.1)	90.9 (184.1)	143.7 (155.9)**	63.8 (87.5)	0.019
Fish	137.4 (113.1)	174.0 (181.8)	145.1 (140.4)	140.9 (139.9)	0.596
Meats	600.3 (465.1)	512.1 (324.1)	478.1 (302.8)	535.7 (384.0)	0.437
Eggs	111.7 (99.5)	92.2 (106.9)	63.6 (64.4)	91.6 (89.5)	0.085
Dairy Products	545.3 (586.1)	551.2 (316.8)	738.8 (515.3)	447.0 (370.4)	0.020

Values show mean and standard deviation.
** *P* <0.05, *** *P* <0.01.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men and AM: Australian middle-aged men.
EI - energy intake, BMR - basal metabolic rate.
EI/BMR: Energy intake divided by BMR.
BMR equations: Taken from the Ministry of Health and Welfare (1996) for JY and JM, from Hayter and Henry (1994) for AY, and from Schofield, Schofield and James (1985) for AM.

Figure 5.2 displays the distributions of EI/BMR. The distribution is slightly skewed to the right for all four groups.

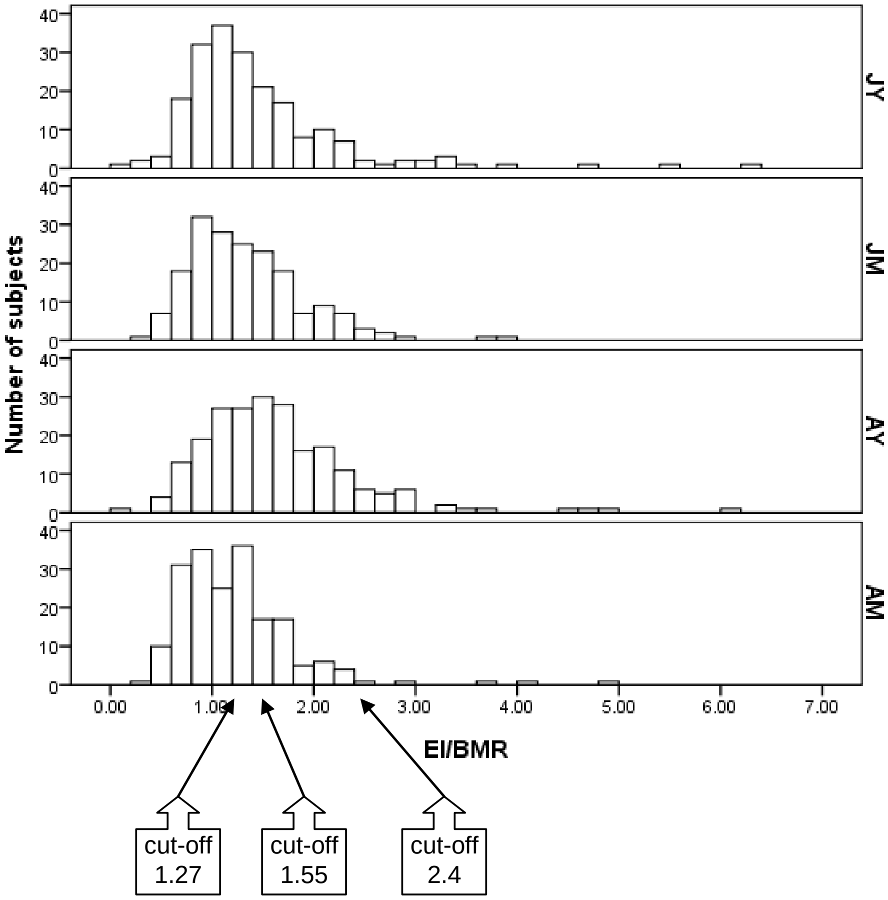


Figure 5.2 Ratio of energy intake to basal metabolic rate

EI/BMR: Energy Intake divided by BMR.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men, & AM: Australian middle-aged men.
JM & JM: using the BMR formula from the Ministry of Health and Welfare (1996), AY: using the BMR formula from Hayter & Henry (1994), AM: using the BMR formula from Schofield, Schofield and James (1985).
Cut-off 1.27: the minimum survival level, cut-off 1.55: the sedentary level for men, and cut-off 2.4: the maximum sustainable lifestyle level.

Tables 5.7 to 5.9 shows the proportion of sample whose EI/BMR was below *the minimum survival level* of 1.27 (World Health Organization 1985a); they were Japanese young men 50.7%, middle-aged men 50.3%, Australian young men 36.7% and middle-aged men 59.9%. Below *the sedentary level* of 1.55 (World Health Organization 1985a), for JY, JM, AY and AM they were 69.7% 70.5% 52.8% and 77.6% respectively. Only 7.5% (JY), 4.4% (JM), 11.5% (AY) and 2.6% (AM) of the subjects showed an EI/BMR exceeding *the maximum sustainable lifestyle level* of 2.4 (Bedard, Shatenstein & Nadon 2004; Okubo & Sasaki 2004; World Health Organization 1985a).

Table 5.7 Proportion of sample with EI/BMR below and above 1.27, using the three different formulas for four groupings to calculate the BMR

	Groupings				
EI/BMR	JY	JM	AY	AM	Total
≤ 1.27	102	92	73	115	382
	50.7%	50.3%	33.5%	59.9%	48.1%
> 1.27	99	91	145	77	412
	49.3%	49.7%	66.5%	40.1%	51.9%
Total	201	183	218	192	794
	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.8 Proportion of sample with EI/BMR below and above 1.55, using the three different formulas for four groupings to calculate the BMR

	Groupings				
EI/BMR	JY	JM	AY	AM	Total
≤ 1.55	140	129	115	149	533
	69.7%	70.5%	52.8%	77.6%	67.1%
> 1.55	61	54	103	43	261
	30.3%	29.5%	47.2%	22.4%	32.9%
Total	201	183	218	192	794
	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.9 Proportion of sample with EI/BMR below and above 2.4, using the three different formulas for four groupings to calculate the BMR

	Groupings				
EI/BMR	JY	JM	AY	AM	Total
≤ 2.4	186	175	193	187	741
	92.5%	95.6%	88.5%	97.4%	93.3%
> 2.4	15	8	25	5	53
	7.5%	4.4%	11.5%	2.6%	6.7%
Total	201	183	218	192	794
	100.0%	100.0%	100.0%	100.0%	100.0%

EI/BMR: Energy Intake divided by BMR.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men, & AM: Australian middle-aged men.
JY & JM: using the BMR formula based on the Ministry of Health and Welfare (1996).
AY: using the BMR formula based on Hayter & Henry (1994).
AM: using the BMR formula based on Schofield, Schofield and James (1985).
Cut-off 1.27: the minimum survival level, cut-off 1.55: the sedentary level for men, and cut-off 2.4: the maximum sustainable lifestyle level.

Table 5.10 below shows the various proportions for the four groups according to the three different equations (Ministry of Health and Welfare 1996; Schofield, Schofield & James 1985; World Health Organization 1985a) for calculating the BMR. The proportions for the BMR-A (Schofield, Schofield & James 1985) and the BMR-WHO (World Health Organization 1985a) equations are almost identical. In contrast, the results using BMR-J (Ministry of Health and Welfare 1996) equation show similar relative proportions for the Japanese young and middle-aged, unlike the Australians. However, all three tables show the younger Australian group as having the smaller proportion below 1.27. Overall, the largest proportion below 1.27 was observed using the BMR-WHO equation, and the smaller proportion using the BMR-J equation. The three tables show relatively greater consistency with regard to the younger groups but rather different patterns with respect to the middle-aged groups in the first table (BMR-J).

Table 5.10 Proportion of sample with EI/BMR below and above cut-off 1.27 using a different BMR formula in each table to calculate the BMR

BMR-J

	Groupings				
EI/BMR	**JY**	**JM**	**AY**	**AM**	**Total**
≤ 1.27	102	93	79	101	375
	50.7%	50.5%	36.6%	52.6%	47.3%
> 1.27	99	91	137	91	418
	49.3%	49.5%	63.4%	47.4%	52.7%
Total	201	184	216	192	793
	100.0%	100.0%	100.0%	100.0%	100.0%

BMR-A

	Groupings				
EI/BMR	**JY**	**JM**	**AY**	**AM**	**Total**
≤ 1.27	101	110	80	115	406
	50.2%	59.8%	36.7%	59.9%	51.1%
> 1.27	100	74	138	77	389
	49.8%	40.2%	63.3%	40.1%	48.9%
Total	201	184	218	192	795
	100.0%	100.0%	100.0%	100.0%	100.0%

BMR-WHO

	Groupings				
EI/BMR	**JY**	**JM**	**AY**	**AM**	**Total**
≤ 1.27	100	113	81	120	414
	49.8%	61.4%	37.2%	62.5%	52.1%
> 1.27	101	71	137	72	381
	50.2%	38.6%	62.8%	37.5%	47.9%
Total	201	184	218	192	795
	100.0%	100.0%	100.0%	100.0%	100.0%

EI/BMR: Energy intake divided by BMR.
JY: Japanese young adult men, JM: Japanese middle-aged men, AY: Australian young adult men, & AM: Australian middle-aged men.
BMR-J: using the BMR formula based on the Ministry of Health and Welfare (1996) for four groups; BMR-A: using the BMR formula based on Schofield, Schofield and James (1985) for four groups; BMR-WHO: using the BMR formula based on WHO (World Health Organization 1985a) for four groups.
Cut-off 1.27: the minimum survival level.

In summary, using the criterion of the minimum survival level of EI/BMR of 1.27 as the cutoff point, the proportion of under-reporting show between about 50% to 62% for the JY, JM and AM, depending of the equation used. All of the above equations indicated around 33% to 37% under-reporting for the AY (Tables 5.7 & 5.10).

5.3 Discussion

The intake of energy is often reported to be less than what is credibly required to sustain life. In this study, the energy intake (EI) was calculated using data from a semi-quantitative FFQ. This under-reporting is considered to fall when the EI/BMR is less than 1.27, which is considered the minimum survival level (refer to Chapter 2 of literature review 2.3.2). A cut-off value of 1.55 for EI/BMR is considered a sedentary level, and 2.4 would be regarded as the maximum sustainable lifestyle level (World Health Organization 1985a). These values were also used for comparisons (Tables 5.7 - 5.10). EI/BMR and the prevalence of under-reporting were known to be related to several factors. In the discussion below, we consider the statistics of under-reporting in relation to the Japanese and Australian younger and middle-aged men of our samples in the context of relevant literature. The difficulties related to interpreting the under-reporting will also be discussed.

The calculation of energy requirement has been traditionally based on basic metabolic rate, but the selection of the appropriate formula remains problematic. Okubo and Sasaki (2004) used the prediction formula given by the WHO (1985a) to calculate the BMR for Japanese subjects, but pointed out that it might be inadequate for estimating the true BMR in Japanese populations. According to Okubo and Sasaki (2004), their previous report by Yamamura and Kashiwazaki (2002) that calculated the BMR from the WHO formula (World Health Organization 1985a) was also higher than the measured BMR in the Japanese populations, and explained that their results might have overestimated the number of under-reporters. Taking this into account, our results might also have over-estimated the number of under-reporters if we used the WHO formula (World Health Organization 1985a). Therefore, we decided to use the formula by the Ministry of Health and Welfare in Japan (1996) for calculating the BMR for both Japanese groups. In Australia, the Schofield, Schofield and James (1985a) equation is typically used to estimate BMR. Although this equation was considered by the WHO (1985a) to be the best estimates at that time available in healthy people, the use of large age-ranges does cause problems when predicting BMR for subjects in the upper and lower ranges of each of the age groups (Warwick 1990). As the current study also used wide age ranges, the predicted BMR of the upper and lower ranges of the Australian groups may have introduced similar errors. Similar concerns may apply to the use of the WHO formula for BMR as this also covers the same wide ranges in age groups. Piers et al. (1997) assessed the accuracy of the Schofield, Schofield and James (1985) equation and those of Hayter and Henry (1994) for the prediction of the basal metabolic rate (BMR) in 128 young Australian volunteers (39 men and 89 women) aged between 18-30 years, and found that the Schofield, Schofield and James (1985) equation significantly over-estimated the BMR of young Australian men, and thus, was not valid for the prediction of BMR. These authors concluded that this equation should no longer be recommended for the prediction of BMR in men aged between 18 and 30 years, and that Hayter and Henry's equation (1994) provided a more accurate estimate of the BMR for young Australian men. According to our result, using the Schofield, Schofield and James (1985) equation gave a mean BMR for the young Australian group of 7.64 (sd=0.71) MJ/day. When we used the Hayter and Henry's equation (1994), it gave 7.34 (sd=0.58) MJ/day (Table 5.3 and Figure 5.1). Therefore, our results were consistent with the findings of Piers et al. (1997) that using the Schofield, Schofield and James (1985) equation had also over-estimated the BMR of the young Australian men. Consequently we have used the Hayter and Henry (1994) equation for young Australian men, and Schofield, Schofield and James (1985) equation for the middle-aged Australians to calculate the BMR. However, our results may still have been affected by using different equations in the same study for comparison purposes, and may not represent the true BMR. Caution should, therefore, be applied in using these formulae and interpreting the results.

The ratio of energy intake (as estimated from the semi-quantitative FFQ) and the basal metabolic rate (EI/BMR) was calculated for JY, JM, AY and AM and compared. There was a significant difference between the young groups of the Japanese and Australian men, but not between the respective middle-aged groups. There was also a significant difference between the generation of Australian young and middle-aged groups, but not between the generations of the Japanese groups (Table 5.2). A search of available journals encompassing the areas related to the under-reporting issue of the EI/BMR for young Japanese adult men, revealed no published material, to compare our results for JY. Ishihara et al. (2003) studied the validity and reproducibility of a self-administered FFQ to estimate the nutrient and food intake in a Japan Public Health Center-based prospective Study (JPHC Study). A total of 174 men subjects age 40-69 years were included, and daily nutrient and food intakes from an FFQ and Dietary Record (DR) were estimated. Their results gave a value of EI/BMR was 1.42 for men (Murakami (2004) reviewing Ishihara et al. (2003)), and therefore, was probably comparable to the Japanese middle-aged group (JM) of 1.34 (sd=0.57) in the current study. In Australia, Smith, Webb and Heywood (1994) estimated the prevalence of under-reporting in a dietary survey and characterized the subgroups most likely to under-report dietary intakes, and documented the difference in results obtained when data from under-reporters were included and excluded from various analyses. They used the dietary data of 512 male and female subjects from the Western Sydney Dietary Survey 1989-90. A modified CSIRO semi-quantitative FFQ was used to estimate their usual intake. BMR was calculated for each individual using the Schofield, Schofield and James equation (1985) based on measured height and weight. Their value for the ratio of measured energy intake to estimated energy requirements from the BMR (EI/BMR) for age ≤ 40 years (n=96) in male was 1.55 ± 0.53. In our result, using the Schofield, Schofield and James (1985) equation to calculate the BMR for the young Australian men (AY), was 1.57 (sd=0.76). When we calculated the BMR using the Hayter and Henry (1994) equation for young Australian men it gave 1.63 (sd=0.78) (Table 5.2), and therefore our mean value were slightly higher compared with theirs, even though both used a similar semi-quantitative FFQ to obtain the dietary information, although the sample size of their study was smaller. In addition, their EI/BMR for males age > 40 years (n=108), was 1.39 ± 0.48, whereas in our results for the Australian middle-aged men (AM) (40-60 years) was 1.23 (sd=0.59). Their result was slightly higher than ours, although, again, their sample size was smaller.

Okubo et al. (2006) found that an older age group of Japanese males had higher mean EI/BMR values than the younger age groups (30-39 years 1.37 ± 0.21; 40-49 years 1.44 ± 0.33; 50-59 years 1.50 ± 0.28; ≥ 60 years 1.74 ± 0.25), and showed a significant difference between the 30-39 years and the over 60 years category. In contrast, the results of the current study showed the opposite results, where the younger Japanese men (1.44 (sd=0.80)) had a higher mean EI/BMR values compared with the middle-aged group (1.34 (sd=0.57)) (Table 5.2). However, their study used a 4-day semi-weighed diet record and the sample sizes were smaller (n=92 for men) compared with the current study. In addition, their method for estimating the BMR differed from ours. They used the formulae given by the WHO (1985a) for the estimation for the BMR, whereas in the current study, the Ministry of Health and Welfare in Japan (1996) for calculating the BMR for both Japanese groups, Hayter and Henry (1994) equation was used for the young Australian men, and Schofield, Schofield and James (1985) equation was used for the middle-aged Australian men.

In the present analyses, there was a significant inverse relationship between EI/BMR and BMI for the middle-aged Australian group, but not for the Japanese groups. Our results also showed some declining trends for BMI in relation to EI/BMR, but only for young Australian men. Voss et al. (1998) investigated whether subjects with low reported energy intake indicated by a low ratio EI/BMR, differ from subjects reporting high relative energy intake according to certain characteristics such as obesity, physical activity and composition of dietary intake. They used a self-administered, semi-quantitative food frequency questionnaire (SFFQ) among 5,218 subjects including women (35-64 years) and men (40-64 years). They reported an inverse relationship between BMI, and also BMR was slightly decreasing from the lower to the highest quintiles of EI/BMR in the study population of a western country (Germany). These were consistent with our results for a western country (Australian groups). According to the NNS-J in 1999 (Ministry of Health Labour and Welfare 2001), the same year as when our data was collected, the mean BMI for 20-29 years age group (the closest age corresponding to our sample of Japanese young men) was 22.4 ± 3.4 kg/m^2, whereas the NNS-A (Australian Bureau of Statistics 1998c) found the mean BMI value for 19-24 years (closest category) to be 24.6 kg/m^2. The corresponding data of the current study for both the Japanese young (JY) and Australian young (AY) men age 18-30 years were 21.2 (sd=2.5) kg/m^2 and 23.3 (sd=2.7) kg/m^2, respectively (Table 4.5). Although the mean BMI results in our study for both Japanese and the Australian young men were comparable with the values reported in the NNS of both Japan and Australia, respectively, compared with Western populations (Schoenborn, Adams & Barnes 2002), Japanese men are generally leaner in the same age range. Nevertheless, we observed a tendency of under-reporting, rather than over-reporting similar to that found in Western populations (Tables 5.7 to 5.9). This indicates that some inaccuracy of energy intake should be taken into account when the results of dietary surveys are interpreted, even in a non-obese population such as young Japanese men.

A higher percentage with EI/BMR exceeding the maximum sustainable lifestyle level of 2.4 was found for both young groups compared with the middle-aged groups (Table 5.9) in the current study. Few studies have investigated the frequency and characteristics of over-reporting, and young lean males have been reported to be such a group with a relatively high prevalence (L. Johansson et al. 1998; Mendez et al. 2004). Therefore, out results of the relatively high prevalence of over-reporting in young lean men in both Japan and Australia compared with the middle-aged groups, were consistent with those studies. We further investigated whether subjects reported some specific nutrients than others in an inter-generational and cross-cultural comparison. The results showed that the energy from carbohydrate was significantly higher, whereas that from fat (total fat) and saturated fatty acids were significantly lower in the lower quartiles of EI/BMR for the middle-aged Japanese group (Table 5.5). These results were consistent with those of Okubo and Sasaki (2004), although their sample were Japanese females. According to a review by Livingstone and Black (2003), energy from protein tends to be reported significantly higher in low-energy reporters. This showed a similar tendency in our own results, but only for the young Australian men (Table 5.5), and was not significant. Nevertheless, these results in the current study showed some of the differences between the Japanese (Asian) and the Australian (western) in the nutrient intake pattern. In the present study (Table 5.6), a significant declining trend from the lowest to the highest quartile of EI/BMR was observed for cereals in only the middle-aged Japanese men. A significant positive correlation was observed for fish and meats only for young Japanese men. These results were also consistent with the results observed by Okubo and Sasaki (2004). These consistent results in food intake may have been reflected by the Japanese food culture in general. In contrast, intakes of confectioneries was increasing from the lower to the higher EI/BMR groups for both Australian young and middle-aged groups, although only the middle-aged group’s trend was significant. Overall, these food intake results also suggested a somewhat different pattern from that observed between Japanese (Asian) and Australian (western). In addition, the previous study (Okubo & Sasaki 2004) indicated that low-energy reporters tended to report the consumption of 'socially desirable' foods such as fish, fruit and salad higher, whereas 'socially undesirable' foods such as snacks, cakes, sugar and fats were reported lower. According to Hebert et al. (1995; 1997) there was a relatively large bias due to social desirability, and the bias increased with the level of fat, saturated fat, and total energy intake (Hebert et al. 1997), although the bias was generally smaller in men (Hebert et al. 1995). Our results may suggest that Japanese subjects have some tendency to consume 'socially desirable' foods, whereas Australian subjects tend to prefer 'socially undesirable food'. The current study showed the social desirability across the country and culture, instead of across the generations in the same country and culture.

To better understand these differences, we compared the three different predictive equations for calculating the basal metabolic rate (BMR) for each of the four groups (Ministry of Health and Welfare 1996; Schofield, Schofield & James 1985; World Health Organization 1985a). In Table 5.10, 'BMR-J' used the formula from the Ministry of Health and Welfare in Japan (1996), 'BMR-A' used the formula in the 1990 Recommended Nutrient Intakes for Australians taken from Schofield et al. (1985), and the 'BMR-WHO' formula was proposed by the WHO (1985a). According to our results the proportions for the 'BMR-A' and the 'BMR-WHO' equations are almost identical. In contrast, the results from the 'BMR-J' equation gave similar relative proportions for both the young and middle-aged Japanese, but for the young and middle-aged Australian men the tables were unalike. Overall, the largest proportion below 1.27 was observed using the 'BMR-WHO' equation, and the smaller proportion using 'BMR-J' equation. However, predictive equations are no substitute for actual measurements when these can be properly made (World Health Organization 1985a), especially for individuals, and for obese people they may not be appropriate (Warwick 1990). Several studies have suggested that the use of the WHO (1985a) equation over-estimated BMR when compared with measured BMR (Alfonzo-Gonzalez et al. 2004; Ganpule et al. 2007; Okubo & Sasaki 2004; S. Tanaka et al. 2008; Yamamura & Kashiwazaki 2002). In addition, Smith, Webb and Heywood (1994) also emphasized that they are not necessarily advocating the exclusion of under-reporters from analysis as the only, or best, solution to the measurement error problem described. It is likely that the under-reporting detected in our study is a complex phenomenon. We can only speculate as to the actual mechanisms operating here, because this bias is present from several factors, including the use of different equations in different groups being used in the same study. Lack of motivation and the inability or unwillingness on the part of the subjects to correctly report intake is also a possible explanation, with consequences for the accuracy of the FFQ (Bedard, Shatenstein & Nadon 2004; Subar et al. 2003). According to Subar et al. (2003; 2001), the 24-hour dietary recall questionnaire generally took 30-60 minutes to complete, and the diet history questionnaire required about 60 minutes. In the current study, on average, respondents took between 15 minutes to 60 minutes to complete the FFQ, according to the results of our pre-survey. These times may have reflected the amount of detail required to measure diet well, and may have led participants to complete the instruments inaccurately either consciously or accidentally, although generally the length of the questionnaire did not have much effect on the response rate according to Subar et al. (2001). Under-reporters might also have deliberately or unconsciously erred when estimating frequencies and/or portion sizes; the structure of the FFQ itself (for example, food items, frequency categories and reference portion sizes) could be sources of error, and the reference portion size photos included may have been misused by participants or not used at all, which would have affected the accuracy of the portion size choices (Bedard, Shatenstein & Nadon 2004; Gilsenan & Gibney 2004). Millen et al. (2009) examined food group reports of low-energy reporters (LERs) and non-low-energy reporters (non-LERs) on a food frequency questionnaire, and found differences between LERs and non-LERs in terms of their reported mean daily frequency of consumption and portion sizes. Ferrari et al. (2002) studied under- and over-reporting and their determinants in the 24-hour diet recall measurements in 35,955 men and women, aged 35-74 years, for 27 redefined centres in the 10 countries participating in the European Prospective Investigation into Cancer and Nutrition (EPIC). In their study, Goldberg’s cut-off points were used to identify participants with physiologically extreme low or high energy intake. They have chosen, at the aggregate level, the value of 1.55 as reference and indicated that over-weight subjects are significantly more likely to under-estimate energy intake than subjects in the bottom BMI category. Older people were less likely to under-estimate energy intake. In addition, according to them, the evaluation of the relationship between EI/BMR and BMI (or weight) is problematic since both terms are a function of height and weight, and therefore share a common source of variation. Part of the statistical association observed may simply be due to the common source of variability between EI/BMR and its components, and they concluded that BMI (or weight) and age are causally related to under-reporting. This seems to be confirmed in their study. All of the results in this section should be interpreted cautiously both for possible under-reporting and over-reporting. Many prediction equations are available for estimating BMR, but their applicability to different ethnic groups is uncertain (Frankenfield, Roth-Yousey & Compher 2005; Hayter & Henry 1993). Clearly more study is needed to investigate the accuracy of predicting BMR by using the different equations in different age, gender and ethnic groups for inter-national comparison purposes.

The uncovering of the problems associated with systematic bias in dietary assessments does not mean that dietary studies should be abandoned, according to Livingstone and Black (2003). The study of nutrition cannot be isolated from the reality of food intake. Nutritional health is ultimately dependent on the availability/environment and composition of food and the choices made by the individual in the selection of the person's diet. The current inter-generational and cross-cultural study clearly showed the difference in the food choices between generations and culture. Dietetics professionals should take into consideration the problem of under-reporting whenever conclusions are made about associations between diet and health and/or when evaluating the impact of food assistance programs on dietary intake. Misreporting is not simply a nutritionist's problem, but requires a multidisciplinary approach (including psychology, sociology and physiology) to advance the understanding of under-reporting in dietary intake studies (Livingstone & Black 2003; J. Macdiarmid & Blundell 1998). Further research is required.

Chapter 6

Results and Discussion (C)
Lifestyle factors

6.1 A LIFESTYLE INDEX

The following results display the lifestyle scores using an inter-generational and cross-cultural format for Japanese and Australian men. The lifestyle index is a weighted sum of the four major component indices and then combined, as demonstrated by Kim et al. (2004b).

Table 6.1 below (also Appendix 3.1 expanded) show the results of the lifestyle index. The mean of the *total lifestyle index* score for the Australian are significantly higher than for the Japanese in both generation groups, and the young generation in both countries are significantly higher than the corresponding middle-aged generations.

Breaking down to the components of the lifestyle index, the *diet quality index* score indicates a significantly higher level for both young and middle-aged among the Australians than the corresponding Japanese groups. In both countries the middle-aged group show a higher score than the corresponding young generations.

The Australian groups show a significantly higher score in *variety* than the Japanese groups, but within the countries there appear to be no significant differences. Within these, the 'variety of the various food groups' show almost the same overall pattern, except that for the 'within-group variety for protein source', the young Australian group have a significantly greater score than the young Japanese group, while there is no significance between the middle-aged groups of both countries.

The patterns in terms of *adequacy* reflect the same pattern as with *variety*. There are significant cross-cultural differences within this component, but no significant differences within the countries. Breaking down the components, 'fruit group', 'grain group' and 'fiber' showed the same pattern as with total adequacy. In all components except protein, Australians of both generations have a significantly greater score than both of the Japanese generations. Particularly, the younger Australian group showed the highest score in the fruit and grain groups, although the intake may have been under-estimated because data on apples and bananas were not available. On the other hand, there was a greater inter-generational difference in the ‘vegetable group’, and the middle-aged groups of both countries showed a higher score than the young groups of both countries. The middle-aged Australian group have the highest score for adequacy for the vegetable group, but there is no significant between the young groups of both countries for this component. The intake for iron, calcium and vitamin C, were assessed for adequacy in relation to the respective countries’ RDA, and they can therefore only be interpreted inter-generationally. In terms of calcium adequacy, the middle-aged men showed a significantly greater proportion below the respective AI/RDI than the young men in both countries. Concerning vitamin C adequacy, the middle-aged men also showed a significantly greater proportion below the RDA but only in Japan.

Both generations of Japanese men showed higher scores than the corresponding Australian men for *moderation*. The Japanese and the Australian middle-aged men appear to be alike, and the younger Japanese group appears to show a significantly higher moderation than the younger Australian group. Breaking down the components of the moderation index, ‘total fat’ and ‘sodium’ showed similar patterns; the middle-aged groups in both countries had significantly greater scores than the younger groups. In terms of ‘saturated fat’, both Japanese groups had significantly greater scores than the corresponding Australian groups, and the middle-aged groups in both countries showed significantly greater scores than the younger groups. In terms of ‘empty calorie foods’, the younger Japanese men had a significantly greater score than the three other groups.

In terms of overall balance, the Japanese groups show a significantly higher score than the corresponding Australian groups, and the middle-aged groups in both countries show a significantly higher score than the young groups. Within the overall balance, the fatty acid ratio was significantly greater in both Japanese groups compared with the corresponding Australian groups, with the highest score being the

Japanese middle-aged group. In terms of the CPF ratio, only the Australian younger and middle-aged groups showed significant difference.

The index of *physical activity* shows that both Australian generations are significantly more active than either of the Japanese generations, and in both countries the young generations are significantly more active than the middle-aged generations.

In terms of (refraining from) *smoking*, the young generations have a significantly higher score than the middle-aged groups, and the Australian groups smoke less than the Japanese.

In terms of (refraining from) *alcohol*, all groups show relatively high scores. The young generations of both countries show higher score than the middle-aged generations. The young Japanese group have a significantly greater score than the young Australian group, but there is no significance between the middle-aged groups of both countries.

In summary, among the scores of the lifestyle component indices, those of the diet quality, physical activity and smoking indices were higher in both generations of Australia, but those of alcohol consumption were higher in both of the Japanese generations.

Table 6.1 Comparison of scores of the Lifestyle Index (LI) and its components for the young and middle-aged men in Japan and Australia (also Appendix 3.1 expanded)

		Japan				Australia			
		JY [a]		JM [a]		AY [a]		AM [a]	
		Mean	SE [b]	Mean	SE [b]	Mean	SE [b]	Mean	SE [b]
Component	Score	%		%		%		%	
1. VARIETY									
Various food groups	*0-15 points*	***7.8***	***0.23***	***7.8***	***0.20***	***9.8***	***0.26***	***10.0***	***0.24***
Within-group variety for protein source	*0-5 points*	***1.4***	***0.13***	***1.4***	***0.12***	***2.1***	***0.14***	***1.7***	***0.14***
TOTAL VARIETY	0-20 points	**9.2**	**0.33**	**9.2**	**0.30**	**11.9**	**0.37**	**11.8**	**0.35**
2. ADEQUACY									
Vegetable group	*0-5 points*	***1.3***	***0.06***	***1.6***	***0.07***	***1.4***	***0.07***	***1.9***	***0.07***
Fruit group	*0-5 points*	***1.1***	***0.07***	***0.9***	***0.06***	***1.9***	***0.10***	***1.9***	***0.10***
Grain group	*0-5 points*	***2.3***	***0.07***	***2.3***	***0.07***	***2.8***	***0.08***	***2.7***	***0.09***
Protein	*0-5 points*	***5.0***	***0.00***	***5.0***	***0.01***	***5.0***	***0.00***	***5.0***	***0.01***
Iron	*0-5 points*	***4.9***	***0.03***	***4.9***	***0.03***	***4.9***	***0.03***	***4.9***	***0.03***
Calcium	*0-5 points*	***4.1***	***0.08***	***3.8***	***0.09***	***4.5***	***0.06***	***4.1***	***0.08***
Vitamin C	*0-5 points*	***3.5***	***0.09***	***3.1***	***0.10***	***4.9***	***0.04***	***4.9***	***0.04***
Fiber	*0-5 points*	***3.0***	***0.07***	***2.8***	***0.07***	***4.1***	***0.07***	***4.2***	***0.08***
TOTAL ADEQUACY	0-40 points	**25.4**	**0.30**	**24.5**	**0.33**	**29.7**	**0.28**	**29.4**	**0.30**
3. MODERATION									
Total fat	*0-6 points*	***1.8***	***0.12***	***2.7***	***0.13***	***1.4***	***0.11***	***2.3***	***0.12***
Saturated fat	*0-6 points*	***1.9***	***0.15***	***3.2***	***0.16***	***1.0***	***0.12***	***1.9***	***0.15***
Cholesterol	*0-6 points*	***3.5***	***0.19***	***3.9***	***0.18***	***3.1***	***0.18***	***4.3***	***0.16***
Sodium	*0-6 points*	***2.1***	***0.17***	***3.1***	***0.18***	***1.5***	***0.15***	***3.0***	***0.17***
Empty calorie foods	*0-6 points*	***4.9***	***0.12***	***3.0***	***0.18***	***2.6***	***0.15***	***2.9***	***0.17***
TOTAL MODERATION	0-30 points	**14.2**	**0.47**	**15.8**	**0.50**	**9.5**	**0.41**	**14.4**	**0.45**
4. OVERALL BALANCE									
CPF ratio (C:P:F)	*0-6 points*	***0.8***	***0.11***	***0.8***	***0.11***	***0.5***	***0.09***	***1.0***	***0.12***
Fatty acid ratio	*0-4 points*	***0.5***	***0.08***	***1.0***	***0.10***	***0.0***	***0.02***	***0.1***	***0.03***
TOTAL OVERALL BALANCE	0-10 points	**1.2**	**0.14**	**1.8**	**0.15**	**0.6**	**0.09**	**1.1**	**0.12**
DIET QUALITY INDEX-INTERNATIONAL	0-100 points	**47.9**	**0.63**	**57.0**	**0.90**	**57.4**	**0.74**	**62.6**	**0.87**
Diet Quality Index-International	0-20 points	9.6	0.13	11.4	0.18	11.5	0.15	12.5	0.17
Physical Activity Index	0-30 points	13.7	0.66	10.6	0.63	19.8	0.54	17.3	0.60
Smoking Index	0-30 points	24.0	0.75	14.3	0.93	26.9	0.48	21.8	0.69
Alcohol Consumption Index	0-20 points	19.9	0.10	17.6	0.38	18.3	0.30	17.0	0.40
LIFESTYLE INDEX	0-100 points	**67.1**	**0.93**	**53.9**	**1.23**	**76.4**	**0.77**	**68.6**	**1.01**

[a] Based on sample size of 201 for Japanese young adult men (JY), 188 for Japanese middle-aged men (JM), 220 for Australian young adult men (AY), and 203 for Australian middle-aged men (AM).
[b] SE = Standard error of mean.

6.2 Discussion

The lifestyle index (LI), integrates the detailed component indices of important lifestyle factors into a summary measure with differential weightings based on the principles of healthy lifestyles found in the literature, and presented a promising new way of examining the overall healthfulness of a given lifestyle. It was developed by Kim et al. (2004b) specifically for cross-national comparisons. Secondly, one of the strengths of our study was that the same questionnaire (self-reported semi-quantitative FFQ) was used for both Japan and Australia, apart from language, in both young and middle-aged generations. In conjunction, these allowed us to estimate the relative impact of the lifestyle behaviours of two generations in two countries on the same basis. The 'healthy lifestyle score' that we adopted was easy to understand and practical to calculate. It corresponded to the possible lifestyle improvements and thereby motivates both individuals and health promoters in seeking lifestyle improvement in both countries.

6.2.1 The effect of country-specific standards

The use of the country-specific recommendations based on differing standards of adequacy for some nutrients in the DQI-I, is worth addressing. In the current study, we used the country-specific DRI as it was assumed that each authority used the best scientific knowledge available in making the appropriate local recommendations (S. Kim et al. 2003) and set their best guidelines with which to evaluate their own dietary adequacies. For example, recommendations differed with respect to dealing with the complex issue of bioavailability of iron, calcium and vitamin C in Japan (Ministry of Health Labour and Welfare 2005) and Australia (Commonwealth of Australia 2006). The RDA for vitamin C in Japan was set higher than that of Australia, whereas iron and calcium in Australia was set higher than that of Japan.

6.2.2 Environmental and cultural influences

The distinctive characteristics of the diets in Japan and Australia resulted in clearly different performances in some of the DQI-I components. The data was collected in the respective springs in both countries (from May in Japan and from October in Australia), a period in which food availability differences were minimized because key fruits and vegetables were available. However, there were low intakes of various food groups as well as protein sources and therefore there was a lack of *variety* in both generations of Japanese men. Our results also showed that intake of vegetable, fruit, grain, and fiber were low, therefore the lack of *adequacy* was an issue again in both generations of Japanese men. These suggest that increasing both variety and adequacy were important for the Japanese diet. On the other hand, the lack of *moderation* in total fat, saturated fat, sodium and empty calorie foods intakes, and the *overall imbalance* especially in fatty acid ratio was an issue in both Australian men, especially the younger generation. Regarding lifestyle, our results clearly revealed the need to improve the physical activity levels and the cessation of smoking in both generations of Japanese men, especially the middle-aged group. The alcohol consumption was an issue in both generations of Australian men, especially the middle-aged group. Lifestyle is multidimensional and it is clear from our current study that the lifestyles in each country had different strengths and weaknesses.

6.2.3 Obesity

The DQI-I assessed four major qualities of diet. The overall DQI-I scores showed that both generations of Australians were higher than the corresponding Japanese generations, and the middle-aged groups were higher than the younger groups in the same countries. An investigation into the major categories revealed interesting differences in detail between the countries reflecting each nutritional status and concerns. Diet was multidimensional, and different strengths and weaknesses of the dietary patterns were well conceptualized by the specific major categories of the DQI-I. The results of the current study showed the cross-cultural differences, with the higher *variety* and *adequacy* scores and the lower *moderation* and *overall balance* scores in Australia, compared with the higher *moderation* and *overall balance* scores in Japan. There were inter-generation differences in both *moderation* and *overall balance* with the higher scores in the middle-aged generations in both countries. The results of *moderation* and *overall balance* seemed to reflect the current obesity trends in both Australian and Japanese men. Over-nutrition, in other words *obesity*, which is lack of *moderation*, is the predominant nutrition problem in Australia rather than Japan (Organization for Economic Cooperation and Development 2005; Senauer & Gemma 2006) with a more severe problem in the middle-aged generation in Australian men (Australian Bureau of Statistics 2006; Australian Government Preventative Health Taskforce 2010); although obesity was also an increasing issue in middle-aged Japanese men (McCurry 2007; Ministry of Health Labour and Welfare 2006; Miyoshi, Tsuboyama-Kasaoka & Nishi 2012; Otsuka et al. 2006). The results of the current study showed the consistent current obesity trend and revealed lower moderation scores in both generations of Australian men compared with those of the corresponding generations of Japanese men. However, our results also showed higher moderation scores (not lower scores) in the middle-aged generations in both countries could not fully explain the current obesity trend by diet quality between the generations, as the obesity rate was higher in the middle-aged generation than the younger generation (Australian Bureau of Statistics 2009). The results suggested that obesity could be affected by other lifestyle factors besides diet such as physical inactivity. In fact, the World Health Organization had described the effect of changes as creating an obesity-promoting or 'obesogenic' environment that promotes over-consumption of energy-dense foods, high in sugar and saturated fats, and increasingly sedentary lifestyles with lower levels of physical activity (World Health Organization 2013d).

The disparity between availability and prudence in intake appears to cause imbalance in the diet (Dixon et al. 2007; Matsumura 2001; McMichael 2005; Thornton, Pearce & Ball 2013; Ward et al. 2013), and this still seemed to exist even in highly economically developed countries such as Japan and Australia. Although the focus in the field of nutrition had shifted in the past several decades from under-nutrition to over-nutrition, the problem of under-nutrition was still very real as shown by our results for the *overall balance* scores in both countries. This lower *overall balance* was an issue in Australia especially for the younger Australian men. Obesity was reported to be continuing to rise in Australia even for the newest generation: Results from the 2007-2008 Australian National Children's Nutrition and Physical Activity Survey indicated that one in four children aged 5-17 years were now overweight or obese, and the proportion of boys who were obese were higher than the proportion of girls (Australian Bureau of Statistics 2009).

6.2.4 Summary and recommendations

The LI provided a useful tool for inter-generational and cross-cultural dietary assessment. It appears that the results of the current study showed that the total lifestyle index was higher in both generations of Australia than the corresponding

Japanese generations. However, a more detailed comparison identified areas of diet needing improvement in each country and generation, and provides a general picture of nutrition issues connected to the diet related health risk. A healthier lifestyles through better diet quality especially for younger Japanese, and an increase in physical activity and an improvement of smoking behaviours especially for middle-aged Japanese men, were needed. In terms of alcohol consumption, all four groups showed close to optimality, however improvement behaviour was desirable in the middle-aged groups of both countries.

In view of the evidence from the literature linking CVD and related health risks, the consensus of the authors suggest that the combination of lifestyle behaviour factors integrating diet, physical activity, smoking, and alcohol use, etc. tends to indicate an even stronger inverse relationships with overall CVD mortality, and cardiovascular risk than any one individual factor, even among apparently healthy middle-aged male workers (Li et al. 2010). Among the scores of the lifestyle component indices, those of diet quality of variety and adequacy, physical activity and [refraining from] smoking indices were higher in both of the Australian generations, whereas those of the diet quality of moderation, overall balance and [refraining from] alcohol consumption indices were higher in both of the Japanese generations. Therefore, it is recommended from the results of the current study that both generations of Japanese men should improve the variety and adequacy of their diet as well as their physically activity level, and cease smoking, whereas in Australia the issue was to improve the moderation and overall balance through reduding total- and saturated fat, sodium and empty calorie foods intake as well as alcohol consumption. The results offered insights that could be used for developing public health programs to encourage healthy dietary patterns by assessing the four major qualities of diet as well as some of the lifestyles, not only within the same country inter-generationally, but also comparing them cross-culturally. This index may also provide useful information for nutrition and lifestyle intervention and education programs in determining which areas of diet and lifestyles most require improvement.

6.2.5 Limitations to the lifestyle index

There may be a difference in self-reporting of lifestyle behaviours between the Japanese and the Australians. The over-reporting of fruit and vegetable intake

(Bogers et al. 2003; Mendez et al. 2011) and physical activity (Neuhouser et al. 2013; Rzewnicki, Vanden Auweele & De Bourdeaudhuij 2003), and the under-reporting of energy and fat intake (Novotny et al. 2003; Okubo et al. 2008; Tooze et al. 2004) , smoking (Laugesen 2009; West et al. 2007), and alcohol consumption (Boniface & Shelton 2013; Laatikainen et al. 2002) were some of the most common reporting biases found in the literature. The degree, and even the direction, of bias may differ among individuals with varying level of behaviors (Azizi, Esmaillzadeh & Mirmiran 2005; Bedard, Shatenstein & Nadon 2004; Mendez et al. 2004; Yannakoulia et al. 2007). In our cross-cultural comparison, differential reporting bias may have been an issue. These under- or over-reporting biases could be very culturally sensitive, but the difference between the countries has not been fully explored. Although there is no direct information regarding under- or over-reporting of health behaviours comparing Japanese with the Australian populations, there was evidence that socially desirable behaviours tend to be over-reported, whereas culturally less acceptable behaviours or food items with a negative health image tend to be under-reported (Craven & Hawks 2006; Embree & Whitehead 1993; Hebert et al. 1995; Hebert et al. 1997; G. Johansson et al. 2001; J. Macdiarmid & Blundell 1998). These reporting biases may have affected the data for both Japan and Australia.

Only selected components of lifestyle were included for the purposes of inter-generational and cross-cultural comparisons in the LI. More detailed information could result in a more precise measure of healthfulness. The self-reported nature of the data and its vulnerability to recall bias were also a well-known feature of such studies including our own.

6.3 Working hours

6.3.1 Reflection on the demographics of the middle-aged working hours in the context of lifestyle and CVD

The working hours per week for the Japanese male workers in 1999 (aged 15 years and over) was between 45.4 and 47.7 hours (International Labour Organization 2013). Therefore, in our results of the Japanese men (49.80 hours per week) (Table 4.4) work slightly longer hours than ILO report. In addition, according to OECD report (Organisation for Economic Cooperation and Development 2013b), the average usual weekly hours worked for Australian men (aged 55 to 64 years and full-time employment) was 47.8 in 2000. In the current study (Table 4.4), the Australian men work 43.82 hours per week (data was collected in 2000), which was less than that reported by the OECD.

The study by Fukuoka et al. (2005) showed that in patients who had suffered an acute myocardial infarction (AMI), the average number of hours worked per week prior to the AMI was significantly greater than in healthy workers. AMI patients who reported acute stressful events at work during the month prior to AMI were 6.88 times more likely to believe that job stress/overwork caused their AMI after controlling for working hours per week and age. The association between prolonged work hours before AMI and an increased risk of AMI has also been reported by other investigators (Liu, Tanaka & Fukuoka Heart Study Group 2002; Sokejima & Kagamimori 1998). For example, one published study reported that Japanese men who worked more than 60 hours per week had a twofold increased risk of AMI compared with those who worked less than or equal to 40 hours per week (Liu, Tanaka & Fukuoka Heart Study Group 2002). Table 4.4 in the current study showed that on average middle-aged Japanese work about 50 hours per week compared with 44 hours per week for middle-aged Australian men. However, Table 4.3 shows that the percentage working on their days off in the Japanese group was higher than the Australian group. The Japanese men also had more overtime work compared with the Australian men (indicated from both in our results as well as in the ILO report (International Labour Organization 1993)), and the Japanese men take unfinished work home at night more often than the Australian men. Therefore, the total number of hours per week for the Japanese group may be of concern. They may be in increased risk of AMI category in terms of the average number of working hours per week when compared with Australian men.

Boggild and Knutsson (1999) reported that shift workers were found to have a 40% increase in risk of CVD than non-shift-workers, in their review paper. Causal mechanisms are not well defined but do contribute factors include disruption of circadian rhythm, disturbed socio-temporal patterns and social support, stress, smoking, poor diet, and lack of exercise. The health outcomes are mainly angina pectoris, hypertension, and myocardial infarction (Harrington 2001). The current study showed that almost one in three Japanese workers have an extra job between 10pm and 5am, compared with one in six for Australian workers (Table 4.3). Therefore, there is a possibility that the Japanese workers were more likely than the Australian workers to have a higher risk of the above mentioned health outcomes, as the night shift appears to cause a disproportionate number of these problems.

Table 6.2 Working hours of middle-aged men

Working hours	JM	AM
< 60 hours	80.9%	86.7%
≥ 60 hours	19.1%	13.3%

JM = Japanese middle-aged men;
AM = Australian middle-aged men.

Although working long hours or overtime have received increasing attention for its adverse effects of health (Spurgeon, Harrington & Cooper 1997), evidence linking long working hours to the risk for hypertension is very limited (Nakanishi et al. 2001). Recently, a meta-analysis study examined the effects of long working hours and the risk of CVD (Kang et al. 2012). They found that long working hours was associated with increased CVD risk when compared with regular working hours. The Whitehall II prospective cohort study showed the same consistent results (Virtanen et al. 2010). Using their cut-off value of long working hours (45 to 55 hours), the results of the current study (Tables 4.3 and 4.4) may also suggest that the Japanese middle-aged workers could have a higher risk of CVD. In general, Japanese workers might have a higher CVD risk compared with the Australian workers, as the total working hours including ‘work overtime’ and ‘taking unfinished work home at night’ were longer (International Labour Organization 1993). Concerning overtime work in Japan, a survey by Keidanren, a federation of employers’ organizations, clearly indicated that 88 per cent of companies rely on unpaid “service overtime” (International Labour Organization 1993).

OECD stat’s (Organisation for Economic Cooperation and Development 2013a) showed that Japanese working hours have been gradually decreasing. By 1995 the average annual hours had decreased to 1,884 hours and by 2009 to 1,714 hours. In addition, the same report also showed that by 1995 the average annual hours in Australian workers was 1,792 hours, and this annual hours also decreased to 1,685 hours by 2009. Although both countries show decreasing trends, this same report also showed that the Japanese nevertheless work longer than the Australians. In the current study (Table 4.4), the Japanese middle-aged men work 7.11 hours per day and 49.80 hours per week on average, compared with the Australian men work 6.25 hours per day and 43.82 hours per week, which is consistent with the OECD report that the Japanese have longer hours of work compared with the Australians. No notable relationships were found between the reported working hours and any anthropometric measurement.

The above studies showed the relationship between the long working hours as part of their lifestyles and CVD. When studying Japanese people, particularly in the middle-aged working men, the effects of these long working hours need to be considered.

6.3.2 Limitations regarding the work patterns

There is no specific definition for "overtime" and so the term could have been interpreted in a variety of ways: referring, for example, to long work hours, work that exceeds the respondent's conventional work schedule, unusual or unexpected hours of work, or work that qualifies the worker for overtime pay (Kang et al. 2012). In the current study, the term were not defined, therefore our results of these responses may be biased depending on respondent's definition of "overtime".

Professionals and managers often work unpaid over-time to deal with excessive workloads. These workers may not report those additional hours, which would result in an under-estimate of working hours for this group, according to Shields (1999). The higher proportion of our samples indicated that they work as administrators or professionals (Table 4.3). Therefore, the working hours reported in the current study may also have been under-estimated.

Chapter 7

Results and Discussion (D)
Dietary patterns

7.1 SAMPLES AND FOOD GROUPS FOR THE DIETARY PATTERN ANALYSIS

7.1.1 Samples

For the purposes the dietary pattern analysis the original samples, namely the young Japanese men (JY), middle-aged Japanese men (JM), young Australian men (AY) and middle-aged Australian men (AM), plus their combined-aged Japanese (Jap) and their combined-aged Australian (Aus) samples were used. These made six working sample groups.

7.1.2 Food groupings

Table 7.1 shows the food groupings used in the dietary pattern analyses. As there are a large number of possible food classification systems, and it is impossible to offer any system that divides foods into groups that are distinct by all criteria, the choice would have been to a degree largely arbitrary. For the purposes of dietary pattern analysis, and inter-generational and cross-cultural comparisons in food intake, the food items were grouped following the structure of the questionnaire (University of Hawaii Cancer Research Center of Hawaii 1993). These categories and their respective sub-categories made a total of 19 groups. These have also been listed in the Method chapter (Chapter 3 - 3.11.1) or expanded in Appendix 2.4.

Table 7.1 Food groupings used for the dietary pattern analysis[1]

	Foods/food Groups	Food items
1	Soups and related items	Cream soup or chowder; Dried bean or pea soup; Tomato or vegetable soup; Miso soup; Broth with noodles or rice; Mexican meat soup or stew; Ramen or saimin; Jook.
2	Noodles, spaghetti and related dishes	Chow mein, chow fun, or yakisoba; Spaghetti, ravioli, lasagna, or other pasta with tomato sauce; Macaroni and cheese or other pasta and cheese casseroles; Macaroni or potato salad; Pasta or somen salad; Noodle casseroles; Pasta with cream sauce; Arroz con pollo; Stew, curry, pot pie or empanada (with beef or lamb); Stew, curry, pot pie or empanada (with chicken or turkey).
3	Mixed dishes	Stir-fried beef or pork and vegetables, or fajitas; Stir-fried chicken and vegetables, or fajitas; Stair-fried shrimp or fish and vegetables; Stir-fried vegetables; Pork and greens or laulaus; Chili con carne; Hamburgers; Cheeseburgers; Meat loaf, meatballs, or patties; Pizza.
4	Meat	Beef steak or roast, veal or lamb; Shortribs; Corned beef; Corned beef hash; Pork chops or roasts, kalua pig, or camitas; Ham; Ham hocks or pig's feet; Spareribs; Liver; Chicken or thrkey wings.
5-1	Poultry	Fried chicken; Roasted, baked, grilled or stewed chicken; Turkey.
5-2	Fish and seafood	Fried shrimp or other shellfish; Cooked, canned, or raw shellfish; Fried fish; Baked, broiled, boiled or raw fish; Canned tunafish; Other canned fish; Salted and dried fish.
6	Processed meats and Mexican dishes	Bacon; Regular hot dogs; Chicken or turkey hot dogs or luncheon meats; Spam, bologna, salami, pastrami or other luncheon meats; Sausage; Tacos, tostadas, sopes, or taco salad (with beef or pork); Tacos, tostadas, sopes, or taco salad (with chicken); Meat burritos; Vegetable or bean burritos, tacos, or tostadas; Enchiladas with chicken; Enchiladas with beef; Enchiladas with cheese, quesadillas, or nachos with cheese; Tamales; Chili rellenos.
7-1	Rice	White rice; Sushi or barazushi; Brown or wild rice; Mexican or spanish rice; Fried rice.
7-2	Potatoes and related items	French-fried, hash-browned or other fried potatoes; Mashed, scalloped or au gratin potatoes; Baked or boiled white potatoes; Yellow-orange sweet potatoes or yams; White or purple sweet potatoes; Taro; Poi.
8	Salad items, eggs and other non-meat items	Light green lettuce or tossed salad; Dark green lettuce; Tomatoes; Coleslaw; Regular salad dressings or mayonnaise added to salads; Low-calorie or diet dressings added to salads; Eggs, cooked or raw; Egg substitute; Tofu; Vegetarian meat loaf, meatballs or patties.
9	Raw or cooked vegetables	Broccoli; Cabbage; Dark leafy greens; Green beans or peas; Other green vegetables; Cauliflower; Carrots; Corn; Pumpkin or yellow-orange winter spuash; Other vegetables.
10	Dried beans and related items	Refried beans; Baked beans or pork and beans; Boiled dried beans or peas.
11	Fruit and juices	Oranges; Tangerines or mandarin oranges; Grapefruit or pomelo; Papaya; Pineapple; Peaches; Apricots; Pears; Cantaloupe; Watermelon; Mangoes; Avocados and guacamole; Orange or grapefruit juice; Tomato or V-8 juice.
12	Bread items	White bread; Whole wheat or rye bread; Other bread; Rolls, buns, biscuits, or flour tortillas; Corn tortillas, corn muffines, or cornbread; Bran, blueberry or other muffins, banana or mango bread; Sweet rolls, croissants, doughnuts, danish pastry, or coffee cake; Pancakes, waffles, or french toast; Margarine added to bread items; Butter added to bread items; Peanut butter added to bread items; Jam or jelly added to bread items; Mayonnaise in sandwiches.
13-1	Breakfast cereals	Highly fortified cereals; Bran or high fiber cereals; Other cold cereals; Cooked cereals.
13-2	Dairy products	Whole milk; Lowfat milk; Nonfat or skim milk or buttermilk; Yogurt; Chocolate milk, cocoa, or ovaltine; Milkshakes or malts; Cottage cheese; Lowfat cheese; Other cheese.
14	Desserts and snacks	Ice cream; Ice milk, frozen yogurt, or sherbet; Cookies, brownies, or fruit bars; Cake; Apple or other fruit pies, tarts, cobblers, or turnovers; Pumpkin, sweet potato, or carrot pies; Cream or custard pies, eclairs, or cream puffs; Puddings or custards; Chocolate candy; Dim sum, such as bao or manapua; Other dim sum; Crackers and pretzels; Peanuts or other nuts; Potato, corn, tortilla or other chips, or chicharrones; Popcorn.
15-1	Alcoholic beverages	Regular or draft beer; Light beer; White or pink wine; Red wine; Hard liquor.
15-2	Non-alcoholic beverages	Regular sodas; Diet sodas; Cappuccino; Regular coffee; Decaffeinated; Black tea; Green, herbal, or other tea; Fortified diet beverages.

[1] Foods were grouped based on 165 food items.

7.1.3 Prominent differences in food grouping intakes

Table 7.2 display the mean intakes of the food groupings for the Japanese and Australian combined-aged samples and also their respective generations. The comparative rank orders of the same food groupings can be measured across the different population groups, and therefore assess the contribution it makes towards the overall differences in the respective food patterns. For each pair of population patterns, the food groupings are organized in decreasing differences in rank order.

Japan and Australia (using the combined-aged samples)

1. Soups (J=3rd, A=13th)
2. Rice (J=2nd, A=11th)
3. Potatoes (J=17th, A=8th)
4. Processed meats and Mexican dishes (J=6th, A=14th)
5. Bread items (J=13th, A=6th)
6. Fruit and juices (J=9th, A=4th)

Young Japanese and young Australians

1. Soups (JY=3rd, AY=14th),
2. Rice (JY=2nd, AY=12th),
3. Alcoholic beverages (JY=11th, AY=3rd),
4. Potatoes (JY=16th, AY=8th),
5. Bread items (JY=13th, AY=6th),
6. Processed meats and Mexican dishes (JY=6th, AY=11th).

Middle-aged Japan and middle-aged Australia

1. Processed meats and Mexican dishes (JM=6th, AM=17th),
2. Rice (JM=3rd, AM=13th),
3. Potatoes (JM=16th, AM=7th),
4. Soups (JM=4th, AM=12th),
5. Bread items (JM=13th, AM=6th),
6. Fruit and juices (JM=9th, AM=4th).

Young Japanese and middle-aged Japanese

1. Alcohol (JY=11th, JM=2nd).

Young Australians and middle-aged Australians

1. Processed meats and Mexican dishes (AY=11th, AM=17th).

In terms of food group preferences, altogether it is evident that there are much greater differences between the two countries than between their respective generations in terms of their food intake preferences. Nevertheless, there are also similarities between the respective sample groups in respect to the rank orders of the food groupings as is evident from the positive, but moderate, Spearman rank correlations between the countries (r = 0.577). The high correlations between the young and the middle-aged within each country also verifies the greater similarities between the generations (JY – JM: r = 0.896 and AY – AM: r = 0.946) (Table 7.3).

Table 7.2 Mean intakes and ranks of food groupings

	Japan		JY		JM		Australia		AY		AM	
Food groups	Means	Ranks	Means	Ranks	Means	Ranks	Means	Ranks	Means	Ranks	Means	Ranks
01. Soups and related items	317.27	3	342.16	3	290.67	4	60.75	13	59.24	14	62.39	12
02. Noodles, spaghetti and related dishes	130.70	7	154.58	5	105.16	8	168.48	5	196.84	5	137.76	5
03. Mixed dishes	94.15	10	110.24	8	76.94	10	103.98	7	116.53	7	90.38	9
04. Meat (not part of mixed dishes)	25.86	15	27.69	17	23.91	15	45.92	16	52.48	15	38.82	15
05-1. Poultry (not part of mixed dishes)	24.69	16	32.81	15	16.02	17	36.92	17	40.96	17	32.55	16
05-2. Fish and seafood (not part of mixed dishes)	36.20	14	33.44	14	39.16	14	17.55	18	15.73	18	19.51	18
06. Processed meats and Mexican dishes	139.12	6	152.66	6	124.65	6	50.13	14	69.87	11	28.75	17
07-1. Rice	357.88	2	358.97	2	356.71	3	63.83	11	68.23	12	59.06	13
07-2. Potatoes and related items	23.56	17	30.14	16	16.53	16	102.22	8	100.66	8	103.91	7
08. Salad items, eggs and other non-meat items	107.85	8	97.13	9	119.30	7	61.99	12	59.48	13	64.72	11
09. Raw or cooked vegetables (not in soups or mixed dishes)	68.44	12	61.07	12	76.31	11	84.79	9	74.65	10	95.77	8
10. Dried beans and related items (not in soups or mixed dishes)	3.56	18	3.27	18	3.88	18	15.17	19	15.14	19	15.20	19
11. Fruit and juices	106.02	9	115.54	7	95.84	9	218.22	4	246.08	4	188.02	4
12. Bread items	51.71	13	58.85	13	44.62	13	153.48	6	169.32	6	136.32	6
13-1. Breakfast cereals	1.56	19	2.34	19	0.73	19	49.49	15	50.94	16	47.91	14
13-2. Dairy products	228.77	4	263.34	4	191.81	5	381.64	2	489.68	2	264.56	3
14. Desserts and snacks	73.05	11	88.84	10	56.16	12	82.75	10	93.87	9	70.70	10
15-1. Alcoholic beverages	225.30	5	78.19	11	382.59	2	347.02	3	321.71	3	374.46	2
15-2. Non-alcoholic beverages	577.75	1	478.91	1	683.43	1	563.87	1	491.42	1	642.38	1

Mean intake is in grams per day.
Ranks are in order from highest to lowest.

Table 7.3 Rank correlations for food groups

Sample groups	Japan	JY	JM	Australia	AY	AM
Japan	1	0.951 **	0.984 **	**0.577** **	0.577 **	0.491 *
JY	0.951 **	1	**0.896** **	0.568 *	**0.568** *	0.463 *
JM	0.984 **	0.896 **	1	0.612 **	0.611 **	**0.539** *
Australia	0.577 **	0.568 *	0.612 **	1	0.986 **	0.977 **
AY	0.577 **	0.568 *	0.611 **	0.986 **	1	**0.946** **
AM	0.491 *	0.463 *	0.539 *	0.977 **	0.946 **	1

JY=young Japanese men; JM=middle-aged Japanese men; AY=young Australian men; AM=middle-aged Australian men.
*** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level.*

7.1.4 Discussion

This analysis highlighted the qualitative differences in the respective populations. It emphasizes the relative cultural differences between Japan and Australia, particularly in respect to the importance of soup (miso-soup) and rice in Japan, compared with bread and potatoes in Australia. There were also important specific cultural differences in the respective generations, such as the comparative low ranking of alcohol in the young Japanese, and the relatively higher ranking of fruit and juices in the middle-aged Australians. Compared with the cross-cultural differences, there were very few inter-generational differences within the respective food group rankings.

7.2 DIETARY FACTOR PATTERNS

7.2.1 Preliminary tests for factor analysis

Prior to the factor analysis, the distributions of the 19 variables were assessed for normality and all were found to be distinctly positively-skewed (Kolmogorov-Smirnov test: $p<0.01$), therefore a square root (SQRT) transformation was used for improving the normality.

The preliminary results of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were slightly less than the ideal 0.6 for all six sample groups, although the results (between 0.537 and 0.598) were still acceptable, suggesting that the food groups had reasonably adequate communality for factor analysis (Kaiser 1974). The Bartlett's test was significant ($p<0.001$), suggesting good factorability of the food groups data. Overall, these tests indicated suitability for factor analysis.

7.2.2 Dietary factor patterns in Japan and Australia

Table 7.4 shows the rotated factor loadings of the forced four-factor patterns for the food groups of Japan and Australia, and their respective generations. The factor patterns for each of the respective sample groups are also displayed in figures 7.1 to 7.6, where the individual factor loadings of the 19 food groups are expressed in the heights of their columns for reference.

The individual food items from the FFQ had been aggregated into 19 food groups (refer to Table 7.1, or Appendix 2.4). Factor analysis was used separately for each sample using Principal Components as the extraction method and Varimax as the rotation method. Forced four-factors were extracted for each of the six samples. The rotated factor-loading matrices for each of the samples were reported in Tables 7.4. Food groups with factor loadings <0.4 were excluded from the tables for simplicity. The tables also show the percentages of variation explained by each factor for each sample group. The forced four-factor structure accounted for a total of 39.0% of the variance in the combined-aged Japanese and 38.6% of the combined-aged Australian food groups. In Table 7.4, the first factors of the respective groups accounted for the largest proportion (10.5% and 10.4%, respectively) of the total variance explained.

Although many of the major food items of the dietary patterns among the groups were similar, it is clear from the factor analyses of the respective populations that the clusters were formed and characterized differently to varying degrees (Table 7.4). The dietary patterns, or factors, were named according to the higher loadings with a view to the associations of the items.

A preliminary free factor analysis had been attempted where the number of factors was determined according to the traditional eigenvalue ‘greater than 1’ criterion. This resulted in between seven and eight factors depending on the sample groups, and giving a total variation approaching around 60%. While those results were attractive because of the higher total variation explained, the factors were very difficult to name, interpret and compare across the samples. It is notable that a number of authors using factor analysis in a similar way in the area of nutrition also used a three or four factors structure in the factor analysis, and their total variations were likewise low (Barker et al. 1990; J. Kim & Jo 2011; Naja et al. 2011; Shi et al. 2008; D. E. Williams et al. 2000). For the purposes of comparisons, both internally between the sample groups and for the results of other authors, this study used a forced four factor method. The Principal Axis Factoring method had also been attempted, but the results were not as distinct and less interpretable.

Dietary factor patterns in Japan and Australia and their generations

There were common dietary patterns in all six samples, such as the *meat oriented*, the *vegetarian type*, and the *mixed food type*. In Japan, the dietary patterns were comparatively similar in the generations, showing more stable factor patterns. Among the Australian patterns, the factors were rather differently constructed, particularly with respect to the vegetarian types of foods between the respective generations. Interesting features emerged between the two countries and generations:

Comparing the countries,

- Alcohol was always associated in the Meat factor in Australia, but did not emerge in that factor in Japan,
- Potatoes were always associated in the Meat factor in Japan, but only as a lower item in the Vegetarian factor in Australia,
- Fish and seafood were associated with the Vegetarian factor in Japan, but less so in Australia,
- Cereals tended to be associated with dairy in Australia, but not in Japan,
- Rice was an important item in *one* factor (*mixed foods*) in Australia, but in Japan, as a staple food, it plays a much lower role and does not emerge as a prominent item. In one of the preliminary analyses in the current study, the comparative ranking of food groupings intakes were organized in decreasing order in each population group (Table 7.2). The results highlighted the relative cultural differences between Japan and Australia, particularly in respect to the higher importance of soup (miso soup) and rice in Japan compared with Australia, and the comparative prominence of bread and potatoes in Australia compared with Japan, on a quantitative basis.

Comparing the generations,

- In JY, unlike JM, the *meat factor* also included fish and seafood, suggesting a more diverse intake of animal protein sources,
- In JM, the *dessert and cereal factor* tended to have a slightly lower but more diverse number of items including fruit juices and dairy, unlike JY that has a higher loading of desserts and cereals. Alcohol appears to be more an alternative to dessert in JM,
- In AY, unlike AM, the *meat factor* has more diverse items, but a lower intake of alcohol,
- In AY, the *vegetarian factor* tends to be more 'pure', whereas in AM the factor is of a more 'modified' vegetarian type that includes fish and seafood,
- In AY, dairy is distinctly associated with desserts, and tends to be negatively related with fish and seafood. In AM, dairy and cereals were seen as an alternative to noodles and soups, and apparently not associated with desserts.

Table 7.4 Rotated factor loadings of the food items

Japan

	Factor 1	Load-ings	Factor 2	Load-ings	Factor 3	Load-ings	Factor 4	Load-ings
Jap	Desserts & cereals		Vegetarian		Meat		Mixed foods	
	Desserts	0.81	Vegetables	0.78	Meat	0.71	Noodles	0.77
	Cereals	0.61	Salad items	0.67	Poultry	0.66	Mixed dishes	0.63
	Bread items	0.49	Fish/seafood	0.53	Potatoes	0.45	Bread items	-0.40
			Non-alcohol	0.41	Proc. Meats	0.43		
					Fish/seafood	0.43		
	Variance %	10.50	Variance %	10.47	Variance %	9.28	Variance %	8.71
JY	Desserts & cereals		Vegetarian		Meat		Mixed foods	
	Desserts	0.84	Vegetables	0.75	Poultry	0.68	Noodles	0.78
	Cereals	0.76	Salad items	0.66	Meat	0.67	Mixed dishes	0.57
	Rice	-0.44	Fish/seafood	0.47	Fish/seafood	0.54	Bread items	-0.48
	Bread items	0.43			Potatoes	0.48		
					Proc. Meats	0.48		
	Variance %	10.74	Variance %	10.54	Variance %	10.46	Variance %	8.64
JM	Desserts & cereals		Vegetarian		Meat		Mixed foods	
	Desserts	0.69	Vegetables	0.70	Meat	0.66	Noodles	0.69
	Bread items	0.64	Salad items	0.62	Poultry	0.56	Mixed dishes	0.54
	Fruit & juices	0.46	Fish/seafood	0.54	Potatoes	0.50	Rice	-0.48
	Alcohol	-0.41			Non-alcohol	-0.48	Soups	0.43
	Dairy	0.41						
	Variance %	10.02	Variance %	9.96	Variance %	9.19	Variance %	8.67

Australia

	Factor 1	Load-ings	Factor 2	Load-ings	Factor 3	Load-ings	Factor 4	Load-ings
Aus	Mixed foods		Vegetarian		Meat		Dairy & cereals	
	Mixed dishes	0.68	Vegetables	0.75	Meat	0.66	Dairy	0.66
	Rice	0.61	Salad items	0.69	Poultry	0.63	Cereals	0.57
	Soups	0.59	Dried beans	0.49	Proc. Meats	0.46	Desserts	0.55
	Bread items	-0.48	Potatoes	0.48	Alcohol	0.44	Fruit & juices	0.44
	Noodles	0.44	Fish/seafood	0.48				
	Variance %	10.41	Variance %	10.32	Variance %	9.35	Variance %	8.52
AY	Meat		Vegetarian		Dairy & cereals		Mixed foods	
	Meat	0.61	Vegetables	0.78	Dairy	0.67	Soups	0.64
	Poultry	0.55	Salad items	0.69	Desserts	0.58	Rice	0.62
	Mixed dishes	0.50	Dried beans	0.50	Cereals	0.52	Bread items	-0.43
	Proc. Meats	0.48	Potatoes	0.48	Fruit & juices	0.52	Noodles	0.42
	Non-alcohol	0.48			Fish/seafood	-0.42		
	Alcohol	0.41						
	Variance %	11.09	Variance %	10.14	Variance %	9.76	Variance %	9.44
AM	Mixed foods		Dairy & cereals		Vegetarian		Meat	
	Rice	0.82	Cereals	-0.61	Vegetables	0.70	Meat	0.64
	Mixed dishes	0.79	Dairy	-0.61	Fish/seafood	0.55	Alcohol	0.59
	Desserts	-0.43	Noodles	0.56	Salad items	0.53	Poultry	0.55
			Soups	0.53	Fruit & juices	0.44		
			Bread items	-0.41	Dried beans	0.42		
	Variance %	10.85	Variance %	9.94	Variance %	9.78	Variance %	9.58

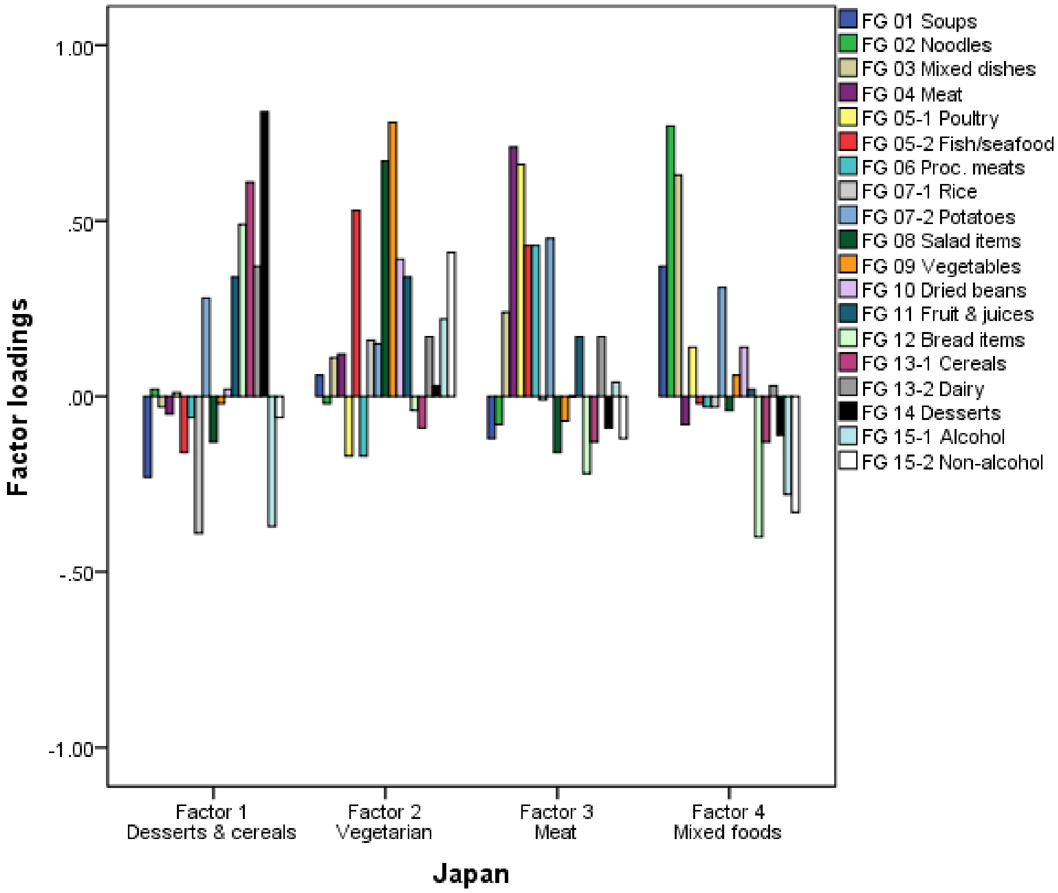


Figure 7.1 Loadings of the food groups in the respective rotated factors for the combined aged Japanese men

FG = Food group

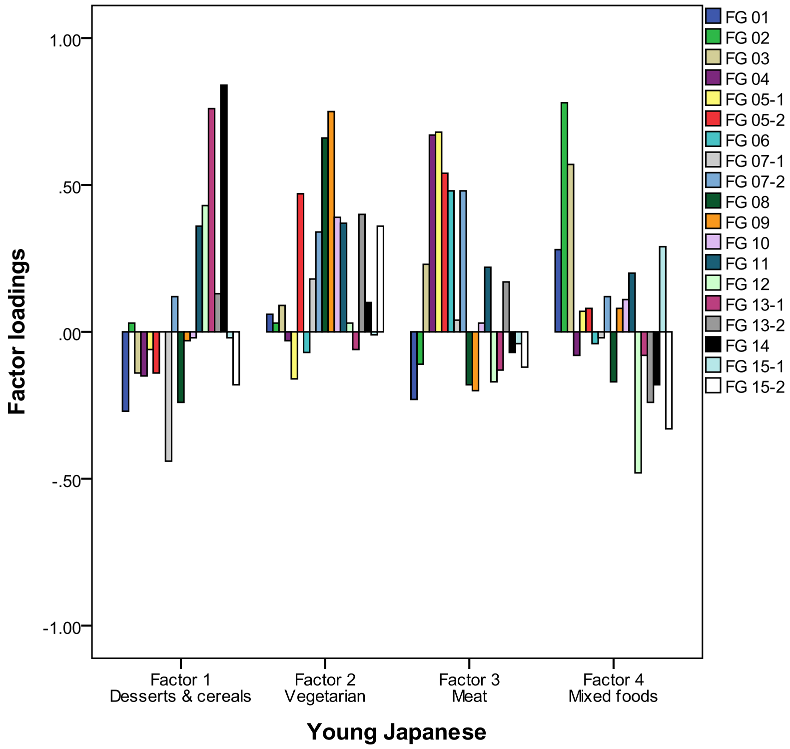


Figure 7.2 Loadings of the food groups in the respective rotated factors for the young Japanese men

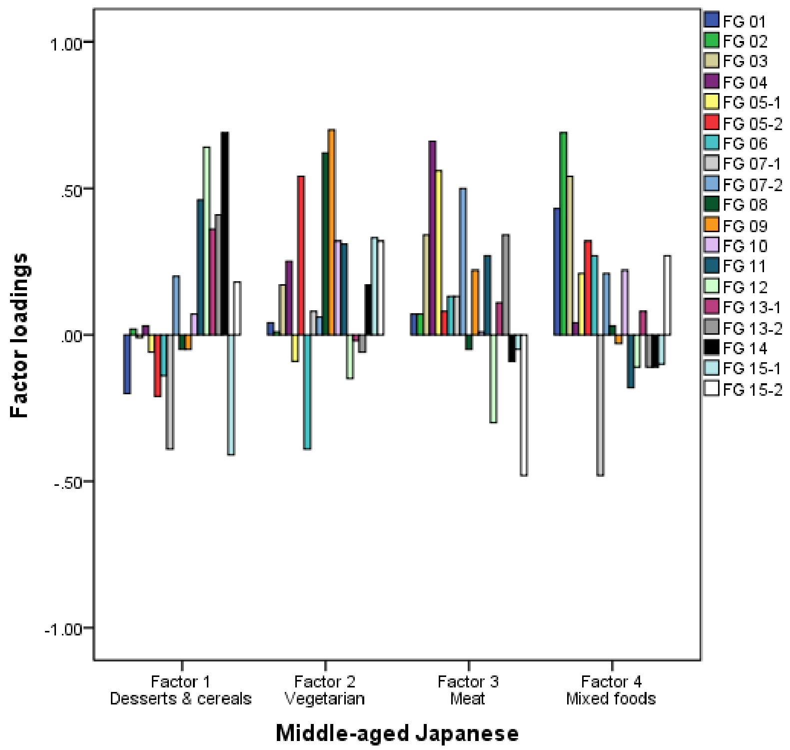


Figure 7.3 Loadings of the food groups in the respective rotated factors for the middle-aged Japanese men

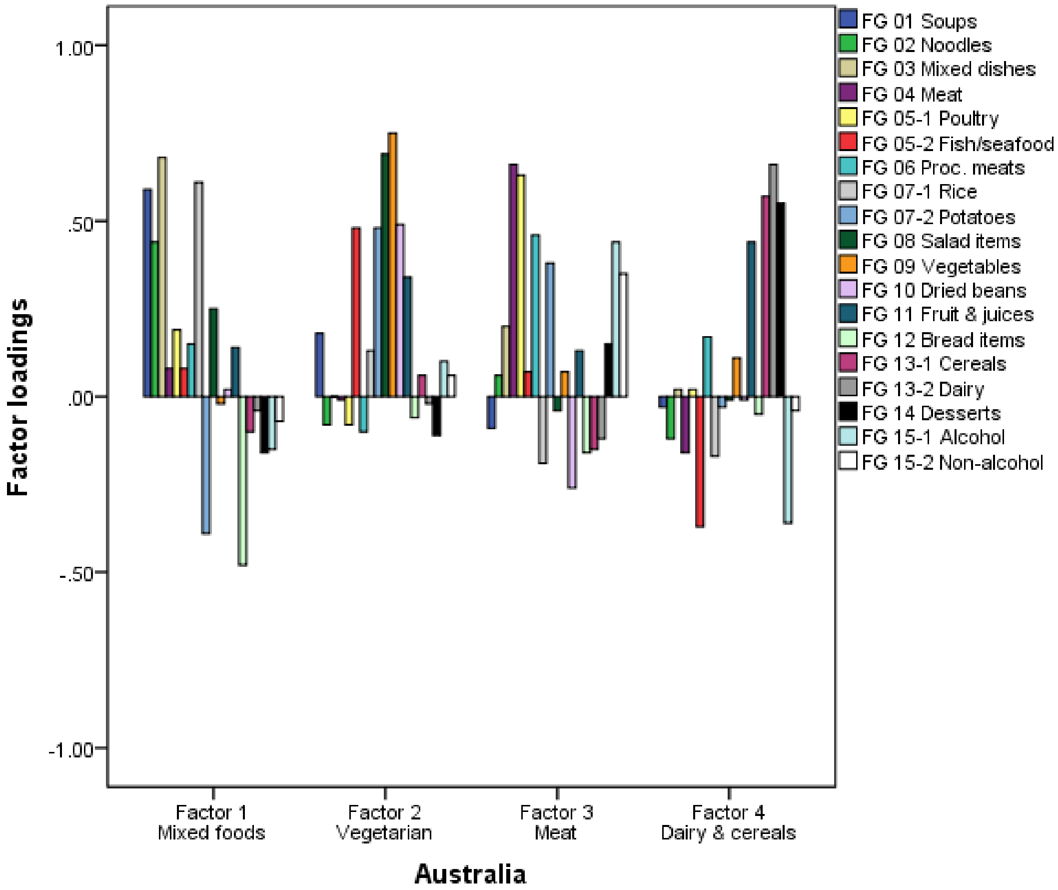


Figure 7.4 Loadings of the food groups in the respective rotated factors for the combined aged Australian men

FG = Food group

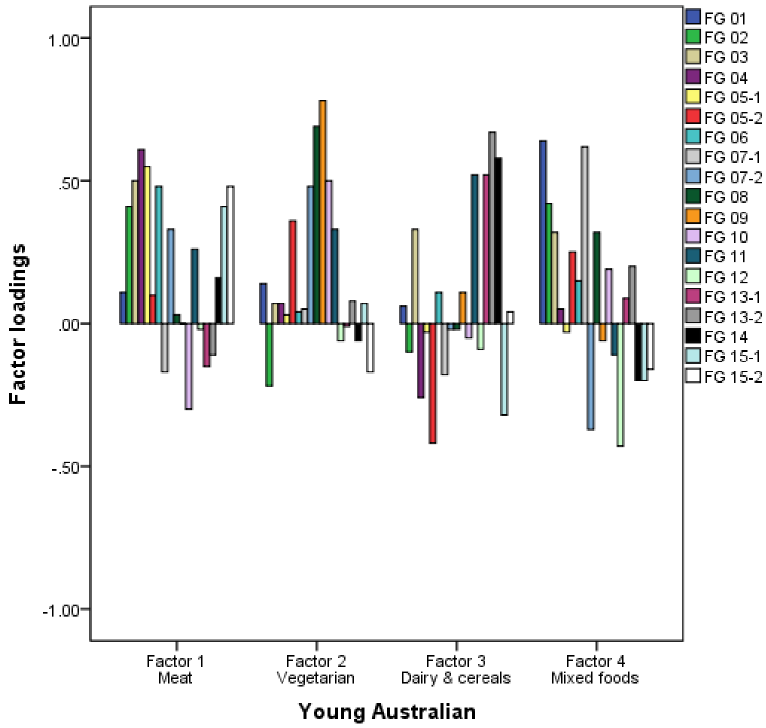


Figure 7.5 Loadings of the food groups in the respective rotated factors for the young Australian men

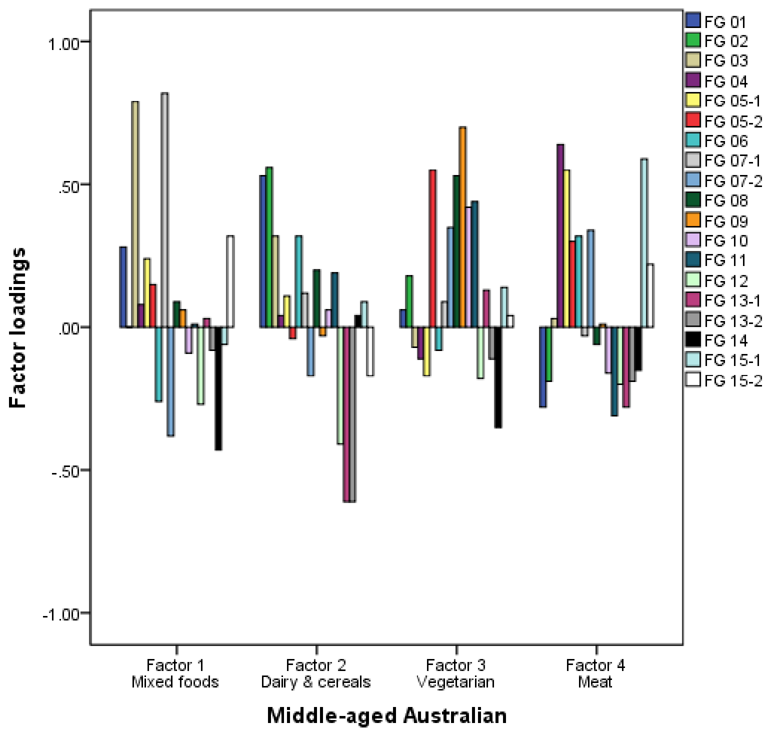


Figure 7.6 Loadings of the food groups in the respective rotated factors for the middle-aged Australian men

7.2.3 Alternative analysis, contrast and commentary

Other authors, for example Newby et al. (2004), conducted factor analysis using FFQ data without transformation to correct skewness or energy-adjustment. To compare the impact of transformation and energy-adjustment on the dietary pattern (Table 7.4), factor analysis was also carried out using our data with no-transformation or energy-adjustment. The corresponding results can be found in appendices 3.3.1 and 3.3.2. It is notable that the overall analysis procedure was therefore simpler, the KMO and Anti-image diagonal correlations were higher, and their factor analysis were a little more robust in the factor analysis results. However, with minor modifications, the outcomes in terms of their factor structures were very similar (Appendix 3.4). The rationale for the transformation was to improve the markedly skew of the data to improve its normality, which is known to be a desirability for factor analysis (Coakes & Steed 2001; Hair et al. 2010). The purpose of the energy adjustment is to reduce the possible confounding effect of energy intake that is correlated with most nutrients (W. Willett 1998).

7.2.4 Summary of dietary factor patterns

Factor analysis was used to find the dominant dimensions among the nineteen energy-adjusted food groups for both Japan and Australia and their different generations. The factor analysis forced four independent dimensions accounting for approximately 39% of the total variation in the nineteen energy-adjusted food groups in each of the respective samples. Each factor or dimension comprised an inter-correlated list of food items that tended to 'go together' as a cluster, whereas the respective factors or dimensions are independent or uncorrelated. Three of the four dietary patterns tended to be more similar in both countries and their different generations, namely, *meat oriented*, *vegetarian type* and *mixed food type*, but it is evidently that these factors were characterized by different food items with different loading scores. The last dietary pattern (factor) had a distinct difference, particularly with respect to dairy, desserts and cereals in the respective countries. The overall profiles in dietary pattern tended to show that the Japanese had a more consistent pattern over the generations, whereas the Australians displayed greater variation. In other words, the Japanese dietary patterns were changing more slowly than the Australian dietary patterns between the generations. Overall, it is clear that the dietary patterns do differ between the countries, and also between the generations, at least in Australia, but it would be very difficult to measure or quantify the differences using factor analysis.

7.3 DIET FACTOR RELATIONSHIPS

Tables 7.5 to 7.10 show the Pearson's correlation coefficients of the forced four factors against the anthropometric measurements, nutrients and lifestyle items. We emphasize that the Factors 1 to 4 were different independent dimensions in the food groups in the Japanese and Australian male diets. In the Physical Activity section of each tables there are four rows of entries: These represent the correlations of the four physical activity measures, namely the *US* (kJ), the *relative US* (kJ/kg [activity/body-weight]), the *Aus* (kJ), and the *relative Aus* (kJ/kg) and their relationships with each of the four dietary factors. All correlations below 0.2 were disregarded, and those that not significant at the 1% level were also disregarded for the purposes of further discussion as they were considered very weak.

7.3.1 Dietary factor relationships with nutrients

Below is an overall summary of the main macronutrients associated with the respective factors of the Japanese and Australians' diets and their young and middle-aged generations.

1. Japan

In terms of association with macronutrients, the Japanese diet showed the four factors as distinctly different – the *desserts and cereals factor* were significantly positively associated with higher intakes of saturated fat, sugar and [total] fat, and lower intakes of alcohol and protein; the *vegetarian factor* was significantly positively related to intakes of fiber and protein; the *meat factor* had a strong positive relationship with intakes of protein and was inversely related to carbohydrate; and the *mixed foods factor* was most positively related with protein (Table 7.5).

2. The Japanese generations

The young and the middle-aged generation reflected a similar pattern as the combined-aged Japanese nutrient pattern above, except their correlations for JY were generally a little lower than JM, suggesting that the nutrient pattern was less distinct. Apart from the *meat factor*, the macronutrients were more strongly associated in the JM compared with JY (Tables 7.6 and 7.7).

3. Australia

The Australian diet was much less distinct compared with Japan in terms of the relationship between the four factors and the intakes of macronutrients. The *mixed food factor* was positively associated with high intake of protein and low intake in sugar; the *vegetarian factor* had a moderate emphasis on intake of fiber and was negatively related to saturated fat; the *meat factor* had a moderate emphasis on protein and fat, and was negatively related to carbohydrate; and the *dairy and cereals factor* had a moderate component of saturated fat and carbohydrate, and was inversely related to alcohol (Table 7.8).

4. The Australian generations

For young and middle-aged Australian, the Meat factor was also positively related to higher intake of protein, and was inversely related to carbohydrate, but in AM this factor was found also moderate positively associated with intake of alcohol. The *vegetarian factor* was a little more distinct in AM compared with AY. The *dairy and cereal factor* was significantly positively related to the intake of saturated fat, and was inversely related to alcohol in AY. For AY and AM, the *mixed foods factor* was most positively associated with the intake of protein (Tables 7.9 and 7.10).

7.3.2 Dietary factors relationships with anthropometric measures and lifestyle items

1. Japan

In the combined-aged Japanese sample, there were significantly positive relationships between BMI and WC with the *vegetarian factor*. There also appears to be a negative association between WHR and the *meat factor* (Table 7.5).

2. The Japanese Generations

In the young Japanese, WC was significantly positively related to the *vegetarian factor*, and WHR was negatively related to the *meat factor* and the *mixed foods factor*. Sleeping hours was negatively associated with the *vegetarian factor*. For the middle-aged Japanese, the physical activity (Aus) has a positive relationship with the *dessert & cereals factor* (Tables 7.6 and 7.7).

3. Australia

There were no notable correlations in the combined-aged Australian sample (Table 7.8).

4. The Australian Generations

For the young Australians, BMI and the physical activity (US and Aus) were positively related to the *meat factor*, and in the middle-aged Australians, both BMI and WC were positively related to the *meat factor*, and the physical activity (US and Aus) was positively related to the *vegetarian factor* (Tables 7.9 and 7.10).

Table 7.5 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for the combined-aged Japanese men

Anthropometric measures and items of diet and lifestyle	Diet Factors adjusted by energy intake			
	F1 Desserts & cereals	F2 Vegetarian	F3 Meat	F4 Mixed foods
Anthropometric & Physical activity				
BMI (kg/m^2)	-0.109 *[1]	0.239 **	-0.068	-0.015
Waist circumference (cm)	-0.157 **	0.288 **	-0.069	-0.128 *
Waist hip ratio	-0.048	-0.021	-0.206 **	-0.198 **
Physical activity (kJ), US[2]	0.107 *	0.029	0.074	0.090
Physical activity (kJ/kg), US[2]	0.118 *	-0.064	0.018	0.023
Physical activity (kJ), Aus[3]	0.117 *	0.008	0.069	0.109 *
Physical activity (kJ/kg), Aus[3]	0.144 **	-0.116 *	0.005	0.056
Sleeping hours/day	-0.047	-0.093	0.010	-0.064
Current smokers	-0.118 *	0.078	-0.002	-0.105 *
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.218 **	0.037	0.190 **	-0.007
Carbohydrate (% of energy)	-0.041	-0.187 **	-0.439 **	-0.184 **
Protein (% of energy)	-0.142 **	0.259 **	0.603 **	0.404 **
Fat (% of energy)	0.403 **	-0.046	0.273 **	0.209 **
Saturated fat (% of energy)	0.490 **	-0.149 **	0.178 **	0.064
Sugar (% of energy)	0.476 **	0.020	-0.115 *	-0.198 **
Alcohol (% of energy)	-0.321 **	0.165 **	-0.050	-0.222 **
Fiber (1000 kJ)	0.068	0.300 **	-0.047	0.254 **

*[1] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

Table 7.6 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for young Japanese men

	Diet Factors adjusted by energy intake			
Anthropometric measures and items of diet and lifestyle	F1 Desserts & cereals	F2 Vegetarian	F3 Meat	F4 Mixed foods
Anthropometric & Physical activity				
BMI (kg/m^2)	-0.054	0.175 *[1]	-0.042	0.066
Waist circumference (cm)	-0.035	0.202 **	-0.021	-0.029
Waist hip ratio	0.019	-0.131	-0.266 **	-0.215 **
Physical activity (kJ), US[2]	0.024	-0.010	-0.046	0.127
Physical activity (kJ/kg), US[2]	0.068	-0.059	-0.006	0.054
Physical activity (kJ), Aus[3]	0.013	-0.023	-0.052	0.134
Physical activity (kJ/kg), Aus[3]	0.056	-0.085	-0.014	0.062
Sleeping hours/day	0.008	-0.224 **	0.045	0.042
Current smokers	0.024	-0.026	0.075	0.059
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.216 **	0.083	0.175 *	-0.074
Carbohydrate (% of energy)	-0.067	-0.131	-0.439 **	-0.118
Protein (% of energy)	-0.298 **	0.191 **	0.520 **	0.229 **
Fat (% of energy)	0.269 **	0.082	0.291 **	-0.062
Saturated fat (% of energy)	0.322 **	0.037	0.203 **	-0.228 **
Sugar (% of energy)	0.391 **	0.130	-0.097	-0.277 **
Alcohol (% of energy)	-0.043	-0.046	-0.026	0.222 **
Fiber (1000 kJ)	0.151 *	0.294 **	-0.200 **	0.178 *

*[1] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

Table 7.7 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for middle-aged Japanese men

	Diet Factors adjusted by energy intake			
Anthropometric measures and items of diet and lifestyle	F1 Desserts & cereals	F2 Vegetarian	F3 Meat	F4 Mixed foods
Anthropometric & Physical activity				
BMI (kg/m^2)	0.031	0.087	0.042	0.149 *
Waist circumference (cm)	-0.085	0.124	0.076	0.080
Waist hip ratio	0.046	-0.067	-0.146	0.064
Physical activity (kJ), US[2]	0.187 *[1]	0.125	0.192 **	0.050
Physical activity (kJ/kg), US[2]	0.115	0.112	-0.007	-0.091
Physical activity (kJ), Aus[3]	0.205 **	0.111	0.187 *	0.044
Physical activity (kJ/kg), Aus[3]	0.163 *	0.083	-0.032	-0.128
Sleeping hours/day	-0.033	0.026	-0.044	-0.058
Current smokers	-0.096	0.003	-0.048	0.012
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.103	0.013	0.221 **	0.092
Carbohydrate (% of energy)	-0.012	-0.239 **	-0.330 **	-0.587 **
Protein (% of energy)	-0.126	0.368 **	0.592 **	0.597 **
Fat (% of energy)	0.435 **	-0.015	0.175 *	0.411 **
Saturated fat (% of energy)	0.556 **	-0.188 **	0.094	0.161 *
Sugar (% of energy)	0.568 **	0.021	-0.178 *	-0.201 **
Alcohol (% of energy)	-0.352 **	0.123	-0.069	0.016
Fiber (1000 kJ)	-0.008	0.327 **	0.218 **	0.399 **

*[1] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

Table 7.8 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for the combined-aged Australian men

	Diet Factors adjusted by energy intake			
Anthropometric measures and items of diet and lifestyle	F1 Mixed foods	F2 Vegetarian	F3 Meat	F4 Dairy & cereals
Anthropometric & Physical activity				
BMI (kg/m^2)	0.027	0.164 **[1]	0.179 **	-0.191 **
Waist circumference (cm)	-0.020	0.161 **	0.168 **	-0.152 **
Waist hip ratio	-0.069	0.048	0.033	-0.014
Physical activity (kJ), US[2]	0.040	0.062	0.139 **	-0.012
Physical activity (kJ/kg), US[2]	0.044	-0.003	-0.049	0.039
Physical activity (kJ), Aus[3]	0.041	0.060	0.140 **	-0.009
Physical activity (kJ/kg), Aus[3]	0.051	-0.012	-0.057	0.051
Sleeping hours/day	-0.009	-0.136 **	0.017	0.047
Current smokers	0.057	0.077	0.143 **	-0.108 *
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.086	0.071	0.116 *	0.078
Carbohydrate (% of energy)	-0.164 **	0.102 *	-0.495 **	0.233 **
Protein (% of energy)	0.423 **	0.128 **	0.299 **	-0.140 **
Fat (% of energy)	0.056	-0.168 **	0.258 **	0.182 **
Saturated fat (% of energy)	-0.060	-0.273 **	0.176 **	0.302 **
Sugar (% of energy)	-0.247 **	0.029	-0.079	0.240 **
Alcohol (% of energy)	-0.074	-0.022	0.202 **	-0.412 **
Fiber (1000 kJ)	-0.086	0.280 **	-0.221 **	0.231 **

*[1] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

Table 7.9 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for young Australian men

	Diet Factors adjusted by energy intake			
Anthropometric measures and items of diet and lifestyle	F1 Meat	F2 Vegetarian	F3 Dairy & cereals	F4 Mixed foods
Anthropometric & Physical activity				
BMI (kg/m^2)	0.200 **[1]	-0.041	-0.184 **	0.105
Waist circumference (cm)	0.098	-0.018	-0.143	-0.016
Waist hip ratio	-0.117	0.087	-0.058	-0.081
Physical activity (kJ), US[2]	0.213 **	0.074	-0.033	-0.040
Physical activity (kJ/kg), US[2]	-0.007	0.159 *	0.029	0.045
Physical activity (kJ), Aus[3]	0.223 **	0.076	-0.033	-0.047
Physical activity (kJ/kg), Aus[3]	-0.001	0.179 *	0.035	0.035
Sleeping hours/day	0.087	-0.058	-0.069	0.006
Current smokers	0.184 **	0.014	-0.003	0.002
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.144 *	0.091	0.098	0.042
Carbohydrate (% of energy)	-0.466 **	0.017	0.099	-0.080
Protein (% of energy)	0.268 **	0.206 **	-0.123	0.346 **
Fat (% of energy)	0.344 **	-0.058	0.281 **	0.019
Saturated fat (% of energy)	0.231 **	-0.149 *	0.409 **	-0.052
Sugar (% of energy)	-0.038	-0.053	0.231 **	-0.324 **
Alcohol (% of energy)	0.111	-0.097	-0.458 **	-0.141 *
Fiber (1000 kJ)	-0.232 **	0.174 **	0.187 **	0.149 *

*[1] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

Table 7.10 Pearson correlations of the dietary factors with anthropometric measures, items of diet and lifestyle for middle-aged Australian men

Anthropometric measures and items of diet and lifestyle	Diet Factors adjusted by energy intake			
	F1 Mixed foods	F2 Dairy & cereals	F3 Vegetarian	F4 Meat
Anthropometric & Physical activity				
BMI (kg/m^2)	0.081	0.007	0.080	0.248 **[1]
Waist circumference (cm)	0.107	-0.029	0.034	0.237 **
Waist hip ratio	-0.027	-0.147	-0.099	0.177 *
Physical activity (kJ), US[2]	0.037	0.051	0.212 **	0.020
Physical activity (kJ/kg), US[2]	-0.052	0.098	0.066	-0.118
Physical activity (kJ), Aus[3]	0.043	0.051	0.205 **	0.012
Physical activity (kJ/kg), Aus[3]	-0.028	0.110	0.040	-0.161 *
Sleeping hours/day	-0.109	-0.101	-0.028	-0.042
Current smokers	0.116	0.102	0.101	0.122
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.093	0.070	0.039	0.037
Carbohydrate (% of energy)	-0.046	-0.282 **	0.128	-0.584 **
Protein (% of energy)	0.390 **	0.273 **	0.167 *	0.298 **
Fat (% of energy)	-0.144 *	0.025	-0.214 **	0.196 **
Saturated fat (% of energy)	-0.264 **	-0.134	-0.302 **	0.158 *
Sugar (% of energy)	-0.169 *	-0.151 *	0.093	-0.243 **
Alcohol (% of energy)	0.004	0.172 *	-0.030	0.349 **
Fiber (1000 kJ)	-0.094	-0.262 **	0.360 **	-0.241 **

[1] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[2] *Refer to the National Academy of Sciences (1989).*
[3] *Refer to Truswell et al. (1990).*

7.4 RELATIONSHIPS WITH OBESITY INDICES

7.4.1 Diet and lifestyle relationships with obesity indices

Appendix 3.2.1 to 3.2.18 in Appendix (3.2) contrast three different anthropometric measures in terms of their correlations with physical activity, other lifestyles and dietary intakes in Japanese and Australian men, and their young and middle-aged sub-groups. In the Physical Activity section of each table there are four rows of entries: The first column give the correlations of the four physical activity measures, namely the *US* (kJ), the *relative US* (kJ/kg), the *Aus* (kJ), and the *relative Aus* (kJ/kg) with the anthropometric obesity measure; the remaining columns give the mean physical activity measures for the anthropometric obesity categories. All correlation results were reported at the 1% significance level. Correlations below 0.2 can be considered very weak. The following Table 7.11 (the combined-aged Japanese, also refer to Appendix 3.2.1) below shows an example of the relationship between the diet and lifestyle components with obesity indices.

1. BMI relationships with diet or lifestyle in Japan

For the combined-aged Japanese sample, BMI had a statistically significant associations with only 'raw or cooked vegetables' (*r*=0.223) from among the food groups. There was a weak positive relationship between physical activity and BMI (US *r*=0.218 and Aus *r*=0.210). However, there was a notable moderate negative association with relative physical activity (*r*=-0.400 using the US method, and *r*=-0.482 using the Australian method, explained in chapter 3.9). These were confirmed with their respective 'underweight, normal, and overweight' categories showing downward monotonic trends (Table 7.11, also Appendix 3.2.1).

For the JY, concerning the correlations between the BMI and the macronutrients or food groups, there was also only a relatively weak positive association between 'raw or cooked vegetables' (*r*=0.201). There was a moderate positive relationship between physical activity and BMI (US *r*=0.338 and Aus *r*=0.335). However, there was a notable weak to moderate negative association with relative physical activity (US *r*=-0.232 and Aus *r*=-0.304). In this case, the trend was not monotonic according to the categories of BMI, and the normal BMI category group had a higher mean value (Appendix 3.2.2). For the JM there was a similar relatively weak positive association between BMI and 'noodles, spaghetti and related dishes'(*r*=0.223). Again, there was a notable moderate negative association with relative physical activity (US *r*=-0.461 and Aus *r*=-0.535) that was also confirmed with their respective 'underweight, normal, and overweight' categories showing their downward monotonic trends (Appendix 3.2.3).

Table 7.11 BMI category relationships with other anthropometric measures, physical activity and diet for the combined-aged Japanese men (also Appendix 3.2.1)

Items of diet and lifestyle	BMI Pearson correlation (n=385) (kg/m²)	BMI categories[1] Underweight (n=29) (<18.5 kg/m²)	Normal (n=283) (≥18.5 - <25.0 kg/m²)	Overweight & obese (n=73) (≥25.0 kg/m²)
Physical activity				
Physical activity (kJ), US[3]	0.218 **[2]	7339.8 ± 2235.4	8692.3 ± 2152.8	9375.1 ± 2298.7
Physical activity (kJ/kg), US[3]	-0.400 **	139.5 ± 41.6	139.2 ± 34.3	123.3 ± 30.1
Physical activity (kJ), Aus[4]	0.210 **	7548.0 ± 2246.6	8791.1 ± 2068.2	9423.8 ± 2254.6
Physical activity (kJ/kg), Aus[4]	-0.482 **	143.5 ± 41.7	140.8 ± 33.0	123.9 ± 29.3
Sleeping hours/day	0.061	6.3 ± 0.8	6.6 ± 0.9	6.6 ± 0.8
Current smokers	0.004	0.2 ± 0.4	0.4 ± 0.5	0.3 ± 0.5
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	-0.027	10526.7 ± 7036.5	8811.3 ± 4334.7	9695.1 ± 4477.1
Carbohydrate (% of energy)	-0.092	52.0 ± 8.4	52.2 ± 6.8	49.9 ± 6.7
Protein (% of energy)	0.050	17.5 ± 2.9	17.3 ± 3.0	18.0 ± 2.7
Fat (% of energy)	-0.028	29.3 ± 6.5	27.2 ± 5.6	28.0 ± 5.4
Saturated fat (% of energy)	-0.062	10.3 ± 2.9	8.9 ± 2.6	9.2 ± 2.4
Sugar (% of energy)	-0.033	11.8 ± 4.1	10.7 ± 4.3	10.8 ± 4.1
Alcohol (% of energy)	0.135 **	1.2 ± 1.9	3.3 ± 4.9	4.1 ± 5.0
Fiber (1000 kJ)	0.085	1.4 ± 0.3	1.6 ± 0.3	1.6 ± 0.4
Food groups (g/day)				
Soups and related items	-0.012	322.9 ± 173.6	308.0 ± 189.6	346.6 ± 204.5
Noodles, spaghetti and related dishes	0.041	107.8 ± 72.4	128.3 ± 102.6	150.9 ± 136.2
Mixed dishes	0.029	103.8 ± 81.7	91.0 ± 77.8	103.7 ± 101.6
Meat (not part of mixed dishes)	-0.023	46.6 ± 87.9	22.4 ± 20.7	31.8 ± 37.2
Poultry (not part of mixed dishes)	-0.141 **	53.1 ± 72.9	22.5 ± 30.1	22.5 ± 31.9
Fish and seafood (not part of mixed dishes)	0.039	39.2 ± 48.3	34.0 ± 32.0	43.8 ± 42.5
Processed meats and Mexican dishes	-0.054	201.7 ± 601.4	136.1 ± 276.6	127.3 ± 294.7
Rice	0.009	396.1 ± 208.4	350.0 ± 185.6	368.8 ± 168.8
Potatoes and related items	-0.076	38.0 ± 51.5	22.1 ± 28.3	24.9 ± 29.0
Salad items, eggs and other non-meat items	0.182 **	105.6 ± 97.2	98.1 ± 77.9	144.9 ± 107.3
Raw or cooked vegetables (not in soups or mixed dishes)	0.223 **	46.6 ± 36.6	63.7 ± 52.3	97.7 ± 76.4
Dried beans and related items (not in soups or mixed dishes)	0.064	1.0 ± 2.0	3.7 ± 12.0	4.3 ± 7.2
Fruit and juices	-0.008	138.3 ± 177.7	100.3 ± 142.1	119.9 ± 146.7
Bread items	-0.064	65.5 ± 67.7	52.2 ± 71.5	46.6 ± 38.1
Breakfast cereals	-0.056	0.3 ± 1.7	2.0 ± 19.0	0.3 ± 1.5
Dairy products	0.036	284.7 ± 395.4	206.8 ± 234.0	295.6 ± 358.8
Desserts and snacks	-0.078	92.7 ± 65.0	73.7 ± 120.3	65.8 ± 51.3
Alcoholic beverages	0.132 **	78.2 ± 120.8	219.2 ± 359.0	295.0 ± 377.1
Non-alcoholic beverages	0.124 *	535.6 ± 337.6	565.6 ± 322.3	653.3 ± 320.7

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

2. BMI relationships with diet or lifestyle in Australia

For the combined-aged Australian sample, the BMI showed very few statistically significant associations with the macronutrients or food groups, and those that were emerged were very weak except the slight positive correlation with alcohol (r=0.202), and a relatively moderate to weak negative association with sleeping hours (r=-0.271). However, there was a notable moderate negative association with relative physical activity (US r=-0.472 and Aus r=-0.527). All of these were also confirmed with their respective ‘underweight, normal, and overweight’ categories showing their monotonic trends (Appendix 3.2.4).

For the AY, there was a relatively weak positive association between the BMI and smoking (*r*=0.230), and between physical activity (US *r*=0.287 and Aus *r*=0.291). However, there was a notable weak to moderate negative association between BMI and relative physical activity (US *r*=-0.283 and Aus *r*=-0.330) with a monotonic trend according to the categories (Appendix 3.2.5). For the AM there was relatively weak negative association between BMI and sleeping hours (*r*=-0.225). Again, there was a notable moderate negative association with relative physical activity (US *r*=-0.532 and Aus *r*=-0.593) that was also confirmed with their respective ‘underweight, normal, and overweight’ categories showing their downward monotonic trends (Appendix 3.2.6).

3. WC relationships with diet or lifestyle in Japan

For the combined-aged Japanese sample, WC showed a moderate to weak positive association with alcohol (both the alcohol nutrient *r*=0.256, and the alcoholic beverages group *r*=0.247). There was a weak positive association with physical activity (US *r*=0.204). However, there was a notable moderate negative association with relative physical activity (US *r*=-0.335 and Aus *r*=-0.405) (Appendix 3.2.7).

For the JY, WC showed no significant associations with macronutrients or food groups. There was a weak positive relationship with physical activity for both the JY (US *r*=0.266 and Aus *r*=0.262) and the JM (US *r*=0.252 and Aus *r*=0.273) (Appendix 3.2.8). For the JM, there was a notable moderate negative association with relative physical activity (US *r*=-0.384 and Aus *r*=-0.426) (Appendix 3.2.9).

4. WC relationships with diet or lifestyle in Australia

For the combined-aged Australian sample, WC showed very few statistically significant associations with macronutrients or food groups, and those that were emerged were very weak except the slightly negative correlation with sleeping hours (*r*=-0.205). However, there was a notable moderate negative association with relative physical activity (US *r*=-0.434 and Aus *r*=-0.490) (Appendix 3.2.10).

For AY, there was a relatively weak negative association between the WC and 'fruit and juices' (r=-0.200), and a weak positive association with physical activity (US r=0.246 and Aus r=0.251). However, there was a weak negative association between WC and relative physical activity for AY (US r=-0.243 and Aus r=-0.285) (Appendix 3.2.11). For AM, there were a moderate negative association between WC and relative physical activity (US r=-0.428 and Aus r=-0.498) (Appendix 3.2.12).

5. WHR relationships with diet or lifestyle in Japan

In terms of the macronutrients, food groups or lifestyles, WHR showed no significant noticeable associations with both of the combined-ages of Japanese sample, JY or JM (Appendix 3.2.13 to 3.2.15).

6. WHR relationships with diet or lifestyle in Australia

For the combined ages of the Australian sample, the WHR showed no significant noticeable associations with macronutrients, food groups or lifestyles. The same applied to AY. For AM, there was only a weak negative association with relative physical activity (Aus r=-0.259) (Appendix 3.2.16 to 3.2.18).

7.4.2 Relationships between the obesity indices and the interaction with alcohol and smoking

The interaction between alcohol and smoking was measured by multiplying the associated variables. The relationships between this interaction and the respective obesity indices, BMI, WC and WHR were investigated using Pearson's correlations. Only WC emerged at the 1% significance that was very weak (r=0.144) and this was for the combined-aged Japanese. There were no notable relationships for any of the other sample groups. These results were not presented in this report.

7.4.3 Summary of the relationships between BMI, WC and WHR indices and the items of diet and lifestyle

The only notably consistent relationship that emerged was the moderate negative associations between both BMI and WC with relative physical activity (using both the US and the Aus measures) for both Japan and Australia in all sample groups. Although there were a number of other statistically significant correlations between the macronutrients, food groups and lifestyle items with BMI, WC and WHR, most of these were relatively weak at best and generally not consistent across the different samples.

The relationships between the anthropometric measures and lifestyle items were further compared across the sample groups, but very few proved significant or consistent over several group comparisons (Appendix 3.2.19).

7.5 DISCUSSION

This section discusses the dietary patterns, their relationships with anthropometric measures and elements of lifestyle of Japanese and Australian adult men and their respective generations. Their similarities and differences have been highlighted. In Tables 7.5 to 7.11, and Appendices 3.2.1 to 3.2.18, all correlations that are not significant at the 1% level were disregarded for the purposes of further discussion. Correlations below 0.2 can be considered very weak.

7.5.1 Dietary Patterns

The extracted factors represent the dominant independent dimensions of the respective Japanese and Australian cuisines, and describe the food structure and dietary patterns of the respective countries and generations. The items loaded on a specific factor were more strongly associated with that particular dimension. Thus, the food items loaded on a factor can be thought of as a cluster that is relatively more independent of other clusters. The higher the loading, the more strongly connected with that factor or dimension and with the other food items highly loaded on the same factor. It is likely for items with lower loadings to be more cross-loaded, in other words, to be members of more than one cluster.

We are not aware of any studies comparing between Japanese and Australian men that examined the dietary patterns derived by using factor analysis, and the relationships between the dietary patterns and lifestyles, as well as the three obesity indices, the BMI, WC and WHR.

Total % of variance explained

Several authors investigating dietary patterns using four factors report around 28.5% of total variance or lower. For example, Shi et al. (2008) reported 28.5%, Kim and Jo (2011) reported 26.7%, and Naja et al. (2011) reported 27.6%. In the current study, the forced four-factor structure accounted for a total of 39.0% of the variance in the combined-aged Japanese and 38.6% of the combined-aged Australian food groups.

7.5.2 Dietary patterns in Japan and Australia

In our results, in both countries the factor structures were designed as forced four-factors patterns. Three of the factors tended to be similar in both countries and generations, and motivated the names: meat oriented, vegetarian type and mixed food type, although their loadings and their associated items tended to vary in the different sample groups (Table 7.4). The fourth factor differed in Japan and Australia.

In Japan, the dietary patterns were comparatively similar in the generations, thus showing a more stable factor pattern. Among the Australian generations, the factors were rather differently constructed, particularly with respect to the vegetarian types of foods. Other interesting features emerged between the two countries. For example, the *meat pattern* was associated with alcohol in both generations of Australians but not so associated in Japan, and also cereals tended to be associated with dairy in Australia, but not in Japan. The overall profiles tended to show that the Japanese had a more consistent pattern over the generations, whereas the Australians displayed greater variation. In other words, the Japanese dietary patterns appeared to be changing more slowly than the Australian dietary patterns between the generations.

Our results shared common elements with several of the dietary patterns derived in a number of other studies. For example, in the *vegetarian pattern* in our study, there was an association with fish/seafood for all sample groups except AY. Table 7.12 below showed the association with vegetables and fish/seafood in studies involving factor analysis.

Table 7.12 Association with vegetables and fish/seafood in studies involving factor analysis

Dietary pattern	Country	Authors	Dietary asessment
Prudent pattern	Japan	Chi, Nakano and Yamamoto (2003)	FFQ
Japanese pattern	Japan	Shimazu et al. (2007)	FFQ
Healthy pattern	Sweden	Berg et al. (2008)	FFQ
Prudent pattern	Canada	Paradis (2009)	FFQ
Healthy pattern & Traditional pattern	South Korea	Cho et al. (2011)	FFQ
Vegetable-seafood pattern	South Korea	Cho, Shin and Kim (2011)	FFQ
Grains, vegetables, and fish pattern	South Korea	Kim and Jo (2011)	24-hour recall
Eastern pattern	Canada	Brenner et al. (2011)	FFQ

The *meat pattern* in our study showed an association with potatoes for both generations of Japanese, but not with the Australian generations. This association with meat products and potatoes, was similar to the Western dietary pattern derived in Denmark by Osler et al. (2001). In addition, in the *meat pattern* in our study, there was an association with alcohol in both generations of Australian. The association was also common in South Korea (J. Kim & Jo 2011) but was not in either generations of the Japanese. The fourth dimension or factor had a distinct difference, particularly with respect to dairy, desserts and cereals in the respective countries (Table 7.4), and the generations of Australians showed a higher association between dairy and cereals in the *dairy and cereal pattern*, not shown in the Japanese groups. This factor was similar to the Western pattern derived in Denova-Gutierrez et al. (2010) in Mexico, with high factor loadings for dairy and cereals.

Rice

Although rice is a staple food in Japan, it was surprisingly not prominent in any of the factors in our results. Factor analysis is the analysis of dimensionality based on correlation, rather than quantity. In other words, rice is quantitatively a very important item overall in Japan (Table 7.2), but it does not necessarily lead a special dimension or factor. Furthermore, in the Self-Defence Forces Health Study in Japan, food items with factor loadings less than ±0.30 were omitted, and rice was also noticeably absent (Mizoue et al. 2005). Rice, as a food grouping, also had no correlations with BMI, WC or WHR.

7.5.3 'Dietary patterns' and obesity

There were several studies that examined the relation between eating patterns and obesity indices namely BMI, WC and WHR, although the findings were inconsistent

(Newby & Tucker 2004). A longitudinal study of health by McNaughton et al. (2007) in the UK showed an inverse relationship between food patterns and obesity, and found that milk, fruit juice, sweet biscuits and ice cream, was inversely associated with obesity measured by WC. In our results, the *dairy and cereals factor* was inversely associated with BMI in the combined-aged Australian (Table 7.8) and the young Australian group (Table 7.9), and with WC in the combined-aged Australian group (Table 7.8), however, all of these results were very weak. As with the Australian *dairy and cereals factor*, the *desserts and cereals factor* of the combined-aged Japanese men (Table 7.5) showed a significant negative relationship with WC. These results were consistent with McNaughton et al. (2007).

Concerning the relationship between the vegetable patterns and obesity, two investigators found positive associations (Newby et al. 2003; Shi et al. 2008). Newby et al. (2003) found in a longitudinal study (refer to Chapter 2 of literature review 2.5.5) that among the US adults there was an smaller increase [but still positive] in both BMI and WC in their *healthy pattern* (that was similar to the *vegetarian factor* in the current study). In addition, a National Study in Nutrition and Health in China also found that the *vegetable-rich food pattern*, was associated with higher risk of obesity or central obesity, although their study was due to the generous use of oil for stir-frying the vegetables (Shi et al. 2008). In our study, the *vegetarian factor* showed a significantly positive relationship with both BMI and WC, both for the combined-aged Japanese (Table 7.5) and the combined-aged Australian (Table 7.8) groups. The *vegetarian factor* also showed a significantly positive relationship with WC, but only for the young Japanese group (Table 7.6). Our results of the *vegetarian factor* of a positive relationship with obesity were, therefore, broadly consistent with those of Newby et al. (2003) and Shi et al. (2008). In contrast to the studies above, Dugee et al. (2009) found that a *healthy pattern* among Mongolian adults had a significantly decreasing risk of obesity, but their factor patterns differed with respect to their relative emphasis in vegetable intake possibly due to their differing environment and cultural cuisine. Their *transitional pattern* put emphasis on vegetables with meat that was positively related to BMI, and a *healthy pattern* which also put emphasis on (mixed) vegetables but with grains and fruits, was negatively related to BMI.

A population-based cohort study showed that a *traditional pattern* (such as saturated and trans fat sources, red meat, processed meat and starchy vegetables) as shared by similar food groups in the *meat pattern* in the current study, was associated with an increase in the obesity indices, BMI, WC and WHR in Iran (Sherafat-Kazemzadeh et al. 2010). A *meat pattern* in the USA (Maskarinec, Novotny & Tasaki 2000) and a *meat-and-potatoes pattern* in the American adults (Newby et al. 2003) have been positively related to BMI in men. Another study by Cho, Shin and Kim (2011) in South Korea also found that the *meat-fat dietary pattern* was positively associated with obesity. In our study, the Australian groups (Tables 7.8 to 7.10) had a significantly positive relationship between the *meat pattern* and BMI. These results therefore tended to be in agreement. Our results also showed a significantly positive relationship with WC for both the combined-aged Australian and the middle-aged Australian men (Tables 7.8 and 7.10).

Selected food groups and obesity

Although there was a number of statistically significant relationships between the food groups with BMI, WC and WHR, most of these were relatively weak at best and generally not consistent across the countries or the generations in the current study (Appendix 3.2.1 to 3.2.18). Some limited comparisons existed with other authors such as Newby et al. (2003) who showed that their *healthy pattern* had the highest intake of foods such as high-fiber cereal, reduced-fat dairy, fruit, non-white bread, whole grains, beans and legumes, and vegetables, and the smallest gains in BMI and WC. Focusing on the common food groups in both the study by Newby et al. (2003) and our own study, including 'salad items', 'raw or cooked vegetables' and 'bread items', these showed a similar positive relationships with the obesity indices, BMI and WC, although our study showed a relationships with WHR as well. Specifically, the intake of salad items showed stronger associations with BMI for the combined-aged Japanese (Table 7.11 and also Appendix 3.2.1), and also the middle-aged Japanese men but only at the 5% level (Appendix 3.2.3). There was a significant positive relationship between raw or cooked vegetables and BMI for the combined-aged Japanese (Table 7.11 and also Appendix 3.2.1), the young Japanese (Appendix 3.2.2) and the middle-aged Japanese (Appendix 3.2.3), but the relationship for the middle-aged Japanese was only at the 5% level. There were positive relationships between salad items and BMI for both the combined-aged

Japanese (Table 7.11 and also Appendix 3.2.1) and the middle-aged Japanese men (Appendix 3.2.3), although the latter was only at the 5% level. The association between raw or cooked vegetables and WC also exists for both the combined-aged Japanese (Appendix 3.2.7) and the combined-aged Australians (Appendix 3.2.10), but these results were at the 5% level for both groups. Furthermore, there was a significant positive relationship between bread items and WHR for the middle-aged Australian group at the 5% significant level (Appendix 3.2.18). The positive associations above, especially in the common food groups of the 'healthy pattern' and obesity, were consistent with the study by Newby et al. (2003).

Sugar intake, fat intake and obesity

A controversial issue that continues to dominate the understanding of obesity is the role of dietary fat (Crowe et al. 2004; Golay & Bobbioni 1997; Lissner & Heitmann 1995) and sugar consumption in weight gain (Bermudez & Gao 2010; Bleich et al. 2009; J. I. Macdiarmid et al. 1998; Park et al. 2013; Rangan et al. 2009). Macdiarmid et al. (1998) found a negative relationship between sugar intake and BMI for men when intake was expressed as a percentage of energy, and low energy reporters (LER) were excluded. They also found that for men, when all reporters included LER, produced a statistically significant negative correlation between sugar intake and BMI. Comparing the current study with those of Macdiarmid's, we also found a negative relationship between BMI and total sugar intake when expressed as a percentage of energy, although this result applied for the combined-aged Japanese (Table 7.11 and also Appendix 3.2.1), combined aged Australian (Appendix 3.2.4), the young Australian (Appendix 3.2.5) and middle-aged Australian men (Appendix 3.2.6). These relationships were not significant and very weak. Our results of a negative relationship also existed between WC and sugar intake in all sample groups except the young Japanese generation (Appendix 3.2.7, 3.2.9, 3.2.10, 3.2.11 and 3.2.12), and these too were not significant. In addition, there was a negative relationship between WHR and sugar intake but only in the Australian sample groups (Appendix 3.2.16 to 3.2.18), and these again were not significant. Nevertheless, the negative association with obesity was in agreement with Macdiarmid et al. (1998). Recently, epidemiological studies show growing evidence (refer to Chapter 2 of literature review 2.5.1) that the consumption of sweetened beverages was associated with a high energy intake, increased body weight and the occurrence of metabolic and cardiovascular disorders (Tappy et al. 2010), although no unequivocal evidence that fructose intake at moderate doses is directly related with adverse metabolic effects (Tappy & Le 2010). However, a very high fructose intake can have deleterious metabolic effects including obesity and CVDs (Hu & Malik 2010; Malik & Hu 2012), and fructose in the amounts currently consumed was hazardous to the health of some people (Bray 2012; 2013). Clearly, the role of fructose in the development of metabolic disorders and the increased risks of CVD, still remains controversial (Tappy & Le 2010). The comprehensive expert scientific review of sugars and obesity was reported in the Dietary Reference Intakes report on macronutrients published by the US Institute of Medicine in collaboration with Health Canada (National Academy of Sciences 2005). Based on available evidence, it was concluded that no Tolerable Upper Intake Level could be set for total or added sugars in relation to obesity. It was concluded that "there is no clear and consistent association between increased intake of added sugars and BMI". In fact, it was noted that higher intakes of total or added sugars are actually associated with a lower incidence of obesity (Canadian Sugar Institute 2013; National Academy of Sciences 2005). The report stated that "a negative correlation between total sugar intake and BMI has been consistently reported for children and adults", and "a negative correlation between added sugar intake and BMI has been observed". Trends in sugar consumption in Canada plotted against obesity rates support this inverse correlation (Canadian Sugar Institute 2004; Canadian Sugar Institute 2013). Other countries, including Australia (Barclay & Brand-Miller 2011), the UK (Canadian Sugar Institute 2013), and the USA (Welsh et al. 2011) are also showing a declining trend in added sugars consumption while obesity rates have plateaued or continue to rise. For example, Barclay and Brand-Miller (2011) studied the trends in obesity and sugar consumption in Australia over the past 30 years and confirmed an "Australian Paradox" – a substantial decline in refined sugars intake and an increased obesity over the same timeframe. These studies show that the relationships between sugar intake and obesity as a CVD related risk remains controversial (S. Gibson 2008; Wolff & Dansinger 2008).

There were several studies showing a positive association between dietary fat intake and obesity (Duvigneaud et al. 2007; Jeon et al. 2011; J. I. Macdiarmid et al. 1998). In the current study, fat consumption, including total fat and saturated fat intake, had a positive relationship with BMI and WHR (but not WC). For the middle-aged Japanese men there was a positive relationship between BMI and fat intake when expressed as a percentage of energy (Appendix 3.2.3), but this was significant only at the 5% level. A positive relationship between WHR and saturated fat intake also existed when expressed as a percentage of energy (Appendix 3.2.15), but this was also significant only at the 5% level. Nevertheless, our result of a positive association between obesity and fat intake was in agreement with the authors above. As with sugar intake, the relationships between fat intake and obesity also remains controversial (Duvigneaud et al. 2007; Gutierrez-Fisac et al. 2002).

Obesity and Physical Activity

The calculation of physical activity by the U.S. method and the Australian method in their actual basic measures (kJ) as well in their relative measures (kJ/kg) were explained in chapter three. The differences between the actual and the relative physical activity measures may require some explanation. It was noted that in absolute terms, there was a general positive relationship between physical activity and the three chosen obesity measures, contrary to the researcher's expectations. On further investigation, however, it emerged that the *rate of increase* in activity *in relation to their body weight* was generally negative. In reflection, by Kleiber's Law, the heavier organism generally requires more energy (a positive relationship), but not proportionally; the use of energy in relation to their weight actually declines progressively (Kleiber 1947). In other words, there is a negative association between *relative* energy expenditure and weight. This is consistent with our results.

Both correlations for the actual and the relative measures have been displayed in table 7.11 and the appendices (3.2.1 to 3.2.18). The correlations between the relative physical activity (kJ/kg) and BMI (kg/m^2) may have been partly inflated owing to the common presence of the weight (kg), and between relative physical activity (kJ/kg) and WC (m) where the latter is collinear with weight (Glenn. James & James 1967).

In the current study, in terms of the actual physical activity there was a generally weak positive relationship with BMI for the combined-aged Japanese, the young Japanese and the young Australians, and with WC for all Japanese groups. Both countries showed that the most prominent variable that explain both BMI and WC, was relative physical activity. The notably consistent relationship that emerged was the moderate negative associations between BMI and relative physical activity (as measured in kJ per kg of body weight) for both Japan and Australia in all sample groups (Appendix 3.2.1 to 3.2.6), and also between WC and relative physical activity with all groups except the young Japanese (Appendix 3.2.7, 3.2.9, 3.2.10, 3.2.11 and 3.2.12). According to Hu et al. (2004b) both physical inactivity and obesity were important risk factors for CVD. The results of the current study also showed the association between physical activity and obesity indices.

7.5.4 Summary

In the current study, there were three factors common to all sample groups despite our samples being from different cultural groups and different age groups. Our results suggest that the *vegetarian factor* had a significantly positive relationship with both BMI and WC for both the combined-ages of the Japanese and the Australian groups, with the Japanese showing the higher association compared with the Australian. The *meat pattern* had a significantly positive relationship with BMI for the Australian sample groups, and also a significantly positive relationship with WC for the combined-aged and the middle-aged Australian groups. In addition, the *desserts and cereals factor* for the Japanese and the *dairy and cereals factor* for the Australians, both showed inverse associations with WC. In the lifestyle factors, there was a notable and consistent moderate negative relationship between both BMI and WC with the relative physical activity for both Japan and Australia in all sample groups.

In view of the evidence from the literature linking obesity, CVD and related health risks, it is recommended that to reduce these disease risks, people should focus on weight control and good daily lifestyles especially in middle-aged populations.

7.5.5 The reproducibility, benefits and the need for research

Reproducibility of the dietary patterns analysis

With the use of factor analysis, several studies have identified *healthy* (Berg et al. 2008; E. R. Cho et al. 2011; Dugee et al. 2009; Nanri et al. 2011; Newby et al. 2003) as was sharing the similar food groups of the *vegetarian pattern* in the current study

(Table 7.4), and the *meat-based patterns* (Y. A. Cho, Shin & Kim 2011; Denova-Gutierrez et al. 2011; J. Kim & Jo 2011; Maruyama et al. 2013; Mizoue et al. 2006; Newby et al. 2003; D. B. Panagiotakos, Pitsavos & Stefanadis 2006; Sadakane et al. 2008; Shimazu et al. 2007) as was sharing the similar food groups of the *meat pattern* in the current study, and a *sweets pattern* (Berg et al. 2008; J. Kim & Jo 2011; Nanri et al. 2011; Newby et al. 2004; Newby et al. 2003; Shi et al. 2008; Togo et al. 2004) as was sharing the similar food groups of *desserts and cereals pattern* in the current study. The consistency of patterns across studies derived from factor analysis suggests that dietary patterns are reasonably reproducible (Newby et al. 2003; Sadakane et al. 2008).

The benefits of dietary pattern studies and the need for more research

The major value of the eating pattern concept is that it provides a model by which nutritionists and clinicians can explore the relationship between food consumption for various population groups and the incidence of such nutritionally related diseases such as obesity, hypertension, CVDs, and cancer (Schwerin et al. 1981). Studies of data, whether measured by cluster or factor analysis, suggested that eating patterns were significantly associated with many different disease outcomes including CVDs and related risk factors. However, many inconsistencies in findings also remain (Newby & Tucker 2004). For example, while one prospective study showed no significant relation between any eating pattern and the development of overweight (Quatromoni et al. 2002), and two prospective studies (Newby et al. 2004; 2003) in the same dataset found an association between the *healthy cluster* (high in fruit, vegetables, reduced-fat dairy, and whole grains and low in red and processed meat, fast food, and soda) and smaller gains in BMI (Newby et al. 2003), and also an inverse association between the *healthy fiber rich food pattern* (Reduced-fat dairy products, fruit, and fiber factor) and annual change in BMI (Newby et al. 2004). The [positive] relationship between the intake of high-fat foods, broadly defined, and obesity, addressed in cross-sectional studies of nutrients (Lissner & Heitmann 1995), was supported by several food intake pattern studies (Heitmann et al. 2000; Hu et al. 2000; McCullough et al. 2000; Pryer et al. 2001). Four other studies found inverse associations between energy-dense (eg high-fat) foods and BMI (Barker et al. 1990; Fraser et al. 2000; Gex-Fabry, Raymond & Jeanneret 1988; A. K. Wirfalt & Jeffery 1997), while one study observed a *high-fat/sugar dairy factor* associated with lower BMI, and a *western factor* (with many high-fat foods) associated with higher BMI (Slattery et al. 1998). Obviously more research is needed to better understand this area.

More research is needed to further explore the detailed relations among dietary patterns and obesity and other lifestyle factors between Japanese and Australian men.

7.6 Implications of dietary patterns and obesity on CVDs and related health risks

For the most part, the higher *prudent pattern* scores had strong correlations with increased vitamin and mineral levels, which was likely because of the relatively large presence of fruits and vegetables in this pattern. This contrasts with the Western pattern that was correlated with high sodium, fat and energy intake, because of their high proportions of processed foods (Brenner et al. 2011). Significant relationships were observed between these eating patterns, and CVD or related health risks. Factor analysis studies found that a *prudent pattern* is protective against CHD (Hu et al. 2000) and CVD (Osler et al. 2001), in contrast to the increased risk for CHD for a Western pattern (Hu et al. 2000). A dietary pattern that was highly correlated with *vegetables and fruits pattern* was associated with a decreased risk of CVD mortality, and a dietary pattern that was highly correlated with meat and fat was associated with an increased risk of CVD mortality (Shimazu et al. 2007). The *vegetable and fruits pattern* correlated with the characteristics to the *healthy dietary patterns* reported previously among Western populations (Osler et al. 2001; Trichopoulou et al. 2003) that were inversely associated with CVD mortality. In contrast, the Health Professionals Follow-up Study showed that a Western dietary pattern characterized by high intakes of red meat, processed meat, high-fat dairy products, and refined grains was associated with CHD mortality (Kerver et al. 2003). The effect of an eating pattern on CHD, however, may be modified by BMI (Osler et al. 2002).

In the context of our own study, the dietary patterns from our factor analyses did not completely coincide with those of other authors, and they did not completely agree with one another in detail. From our interpretation of these authors, it would suggest that among our derived patterns the least favourable dietary pattern from the cardiovascular point of view would appear to be the *meat pattern* and the most favourable diet may be the *vegetarian pattern*. However, none of our dietary patterns have been totally optimized in all criteria to minimize CVD risk. Furthermore, from the obesity point of view, there was no clear indication from our results that any of these dietary patterns were significantly superior. Obesity may have a relevance to CVD, but we cannot link this through any relationships between diet and obesity in our study.

Chapter 8

General Discussion and Conclusions

8.1 CONTRIBUTIONS TO THE FIELD OF DIETARY INTAKE AND LIFESTYLE RESEARCH

- Prior to this study, no attempt had been made to undertake an inter-generational dietary intake and lifestyle study in Japan or Australia that was relevant to men's health. This project is understood to be the first such relatively comprehensive cross-cultural and inter-generational study of men in these countries. [The only other study comparing Japanese and Australian men (Kagawa et al. 2006) was confined to a single generation.]
- While in theory the respective National Nutrition Surveys of Japan (Ministry of Health Labour and Welfare 2001) and Australia (Australian Bureau of Statistics 1998c) might have been attractive means of comparing the nutrition intakes of the two countries, their methods were different. [The Japanese NNS used the semi-weighed recording method for one day, while the Australian NNS used 24-hour dietary recall supplemented by a non-quantitative FFQ.] This project was the first inter-generational and cross-cultural study of food and nutrition intake between Japan and Australia using *exactly the same* questionnaire (except for language) for both Japanese and Australians.
- Although Lifestyle Indices had been used to compare Asian (Chinese) and Western (U.S.A) populations (S. Kim et al. 2004b), until this project, the method had not been used to compare Japan with any other country such as Australia using an inter-generational and cross-cultural format.
- This is the first study of comparative dietary patterns that explored these multi-dimensionally through factor analysis using the identical methods and criteria for all of the respective populations.

8.2 IMPORTANT OUTCOMES

8.2.1 Comparative under-reporting patterns and tendencies

One of the relatively unique features of this study was the cross-cultural and inter-generational nature using the same data instrument and methods of analysis.

Considering the expected under-reporting in almost all dietary assessment methods including FFQ, this was not unexpected in our own study. It is also possible in under-reporting that a number of food items had been omitted in the questionnaire that could have been particularly important to one or other of the focal populations. However, the calculations of the basal metabolic rate (BMR) against which the energy intake is measured (EI/BMR), were also controversial owing to the choice of BMR formulas used. These inconsistencies were further highlighted by the relative differing under-reported rates and clearly showed that both the estimation of BMR and the estimation of energy intake by the use of self-reporting questionnaires remain problematic.

8.2.2 Food intake in Japan and Australia

Major differences in diet exist between Japanese and Australian men, not only in food combination, preparation and presentation, but in the emphases of the actual intake in the key food groupings. Although there are indications of on-going changes in food intake within both Japan and Australia, it was evident that in terms of the food intake the differences between the countries were far greater than the changes revealed by the differences between their respective generations. Nevertheless, there were also parallels for the two countries in respect to the rank orders of the food groupings as shown by the positive, but only moderate, associations. These may be due partly to their common advanced development and general cultural interchange.

8.2.3 Lifestyle factors

Based on our results, in terms of diet quality, the Australian *variety* and *adequacy* was superior to that of the Japanese diet, but there was little difference between the respective generations. In both countries, the middle-aged showed greater *moderation*, and the young Australians had the least. For *overall balance*, in their CPF ratio and also the fatty acid ratio, the Japanese scored higher than the Australians and the middle-aged higher than the young. Altogether in terms of total diet quality, the Australians appear to be superior to that of the Japanese in both generations, and the middle-aged in both countries were higher than the young generation. In 'lifestyle', the Australians were more *physically active* than the Japanese and the younger generation was more active than the middle-aged generation; the younger generation *smoke* less than the middle-aged and the Australians smoke less than the Japanese with the middle-aged Japanese men smoking the most; of the four groups, the younger Japanese generation consume the least *alcohol* and the middle-aged Australian men consume the greatest, but even this group is closer to optimal.

The results from the measure of total lifestyle index score, including diet and the other lifestyle factors, suggest that the Australians were significantly higher than the Japanese, and the younger generations in both countries were higher than the middle-aged. While covering many aspects of lifestyles, the index we used from Kim et al. (2004b) did not include a number of aspects relating to food, such as the pattern of eating (Adachi & Eto 2005). Much of the long life expectancy of the Japanese has been attributed in part to the total approach in their diet behavior (Cockerham, Hattori & Yamori 2000; Melby & Takeda 2013). However, it would be very difficult to design such a comprehensive system that would include all relevant criteria.

Table 8.1 compared the life expectancy at birth between those born in 1950, 1975 and currently (2013) (Centrol Intelligene Agency 2013) for Japanese and Australian men. According to the table, the middle-aged generation (born around 1950) (World Health Organization 1996) in Japan have lower life expectancy than the Australians, and the younger Japanese generation (born around 1975) (Index Mundi 2013) had higher life expectancy than the younger Australian generation. These figures might be upgraded later due to future conditions.

Table 8.1 Comparisons of the life expectancy at birth for men born in 1950, 1975 and current (2013) for Japan and Australia

Year of born	Japan (years)	Australia (years)
1950[a]	56.2	66.5
1975[b]	73.35	69.24
current[c]	80.85	79.55

[a] *World Health Organization (1996),*
[b] *Index Mundi (2013),*
[c] *Central Intelligence Agency (2013).*

Clearly other factors must be considered in a total lifestyle score, which may include medical technology, the national medical insurance system, traditional health culture, genetic factors, the distributions of income and wealth, social structure and socio economic differentials, public health policies, high literacy rates and educational levels, and a stable political environment (Horiuchi 2011; Murray 2011; Reich et al. 2011) that are beyond the scope of the current study. All of these are likely to have an impact on longevity and overall quality of life both in Japan and in Australia.

In view of the evidence from the literature linking CVD and related health risks, it was recommended from the results of the current study that both generations of Japanese men should improve the variety and adequacy of their diet as well as their physical activity level, and cease smoking, whereas in Australia the main issue was to improve the moderation and overall balance through reducing fat intake including saturated fat, sodium and empty calorie food intake.

8.2.4 Dietary patterns

Comparisons of dietary patterns in Japan and Australia

Three of the four dietary patterns tended to be more similar in both countries and their respective generations, namely the meat oriented, the vegetarian type, and the mixed food type. In Japan, the dietary patterns were comparatively similar between the generations, showing more stable patterns. The Australian patterns were rather differently constructed, particularly with respect to the vegetarian types of foods between the young and middle-aged generations. The overall profiles in the dietary patterns tended to show that the Japanese had more consistency over the generations, whereas the Australians displayed greater variation. In other words, the Japanese dietary patterns were changing more slowly than the Australian between the generations. Overall, it is clear that the dietary patterns do differ between the countries, and also between the generations at least in Australia. In terms of association with macro-nutrients, the Japanese diet showed the four dietary patterns as distinctly different from one another; the young and the middle-aged generation reflected a similar pattern. The Australian diet was much less distinct compared with Japan in terms of the relationship between the four factors and the intakes of macro-nutrients.

Relationships between dietary patterns and anthropometric measures

In our study, there were three factors that were common to all four groups despite being from different cultures and age groups. Our results suggest that the ‘vegetarian’ pattern had a significant positive relationship with both BMI and WC for both the combined-ages of the Japanese and the Australian groups, with the Japanese showing the higher association. The ‘meat’ pattern had a significant positive relationship with BMI for the Australian sample groups, and also a significantly positive relationship with WC for the middle-aged Australian group. The ‘desserts and cereals’ pattern for the combined-ages of the Japanese and the ‘dairy and cereals’ pattern for the combined-ages of Australians, both showed inverse associations with WC. Regarding lifestyle factors, although several of the associations between BMI and WC with physical activity (kilojoules) were weak and positive, there was a notable and consistent moderate inverse relationship between both BMI and WC with *relative* physical activity (kilojoules per kilogram of body weight) for both Japan and Australia in all sample groups.

8.3 IMPLICATIONS FOR HEALTH EDUCATION AND PUBLIC HEALTH POLICY

Whereas much is known about single lifestyle-related health risk factor prevalence and their covariates, more research is needed to elucidate the interactions among multiple healthy lifestyle factors.

The consensus of more recent research in the field of diet patterns analysis with respective to CVD and related health risks or diseases, appears to indicate the following general findings below. For the most part, the higher ‘prudent pattern’ scores had strong correlations with increased vitamin and mineral levels, which was likely because of the relatively greater presence of fruits and vegetables in this pattern. This contrasts with the Western pattern that was correlated with high sodium, fat and energy intake, because of their high proportions of processed foods (Brenner et al. 2011). Significant relationships were observed between these eating patterns, and CVD or related health risks. Factor analysis studies found that a prudent pattern was protective against CHD (Hu et al. 2000) and CVD (Osler et al. 2001), in contrast to the increased risk for CHD for a Western pattern (Hu et al. 2000). A dietary pattern that was highly correlated with vegetables and fruits pattern was associated with a decreased risk of CVD mortality, and a dietary pattern that was highly correlated with meat and fat was associated with an increased risk of CVD mortality (Shimazu et al. 2007). The vegetable and fruits pattern were correlated with the characteristics to the 'healthy' dietary patterns reported previously among Western populations (Osler et al. 2001; Trichopoulou et al. 2003), and these were inversely associated with CVD mortality. In contrast, the Health Professionals Follow-up Study showed that a Western dietary pattern characterized by high intakes of red meat, processed meat, high-fat dairy products, and refined grains was associated with CHD mortality (Kerver et al. 2003). The effect of an eating pattern on CHD, however, may be modified by BMI (Osler et al. 2002).

In the context of our own study, the structures of the dietary patterns from our factor analyses did not completely coincide with those of other authors, and indeed they did not always completely agree with one another in detail. From our interpretation of these authors, it would suggest that among our derived patterns the least favourable dietary pattern from the cardiovascular point of view would appear to be the 'meat' pattern and the most favourable diet may be the 'vegetarian' pattern. However, none of our own dietary patterns have been totally optimized in all criteria to minimize CVD risk. Furthermore, from the obesity point of view, there was no clear indication from our results that any of these dietary patterns were significantly superior. Obesity may have a relevance to CVD, but we cannot link this through any relationships between diet and obesity in our study.

Although the evidence for the link between dietary intake patterns and obesity is still unclear, a number of researchers believe that there was some relationship (refer to Chapter 7). Likewise the evidence pathway through obesity to CVD has not yet been conclusively verified, but the effect of an eating pattern towards coronary heart disease may be modified by BMI (Osler et al. 2002). More research is needed to further explore the detailed relationships among dietary patterns, obesity and other lifestyle factors towards the prevention of CVD or related health risks, both globally, and also for Japanese and Australian men of different age groups. When the relationship between obesity and CVD (by medical researchers) is firmly established, then our own study would also add further support for another link from physical activity through obesity to a reduction in CVD.

Although this thesis does not contribute directly to the internal understanding of CVD, it provides a powerful motive towards understanding some of the possibly important variables, such as dietary patterns, obesity and physical activity, in a cross-cultural and inter-generational context. As Nazmi Aydin (Nazmi & Monteiro 2013) wrote in an editorial, "Research into socio-cultural traditions, beliefs or values that dictate eating behaviour and body morphology, and how these change with social and economic transitions, would be a welcome addition to the literature". We hope this study will make a contribution.

8.4 LIMITATIONS OF THE STUDY

1. Although the sample sizes were found to have been generally adequate for the purposes of this study, larger samples could naturally have enabled the researcher to test group differences with greater sensitivity and detect more subtle inter-generational changes and cross-cultural differences. In a few cases, differences that appeared marginal might have proved statistically significant.
2. For reasons of economy, it was necessary to confine this study to the urbanized context, and consequently generalizations cannot be extended to the rural setting.
3. For the lifestyle index (LI) study section, only selected components of lifestyle were included for the purposes of inter-generational and cross-cultural comparisons. More detailed information could results in a more precise measure of healthfulness. In addition, the meaning of "overtime" is not precise, and thus the term might be used differently in different contexts and studies. In the current study, we did not clearly defined this term itself, therefore our results might be biased depending on respondent's definition of "overtime".
4. Dietary Pattern Analysis is likely to be a more robust, longer-term and more accurate measure of dietary habits than is the estimation of the intake of specific nutrients and their interactions(Kerver et al. 2003). As with all nutrition research, however, dietary pattern analysis can only be as good as the dietary assessment method upon which it is based. Measurement errors inherent in the use of FFQs for dietary assessment include possible under-

reporting or over-reporting of general food intake, selective under-reporting or over-reporting of the intakes of certain foods, or both (Kerver et al. 2003). Accordingly, the limitations of the FFQs also applied to the dietary pattern analyses that were based on the FFQ dietary information. Nevertheless, similar dietary patterns, including the vegetable and meat patterns in our study, have been identified in other Japanese studies by using FFQ (Mizoue et al. 2006; Mizoue et al. 2005; Shimazu et al. 2007). Furthermore, because FFQs were designed to assess usual intake, have lower cost and greater relative ease of administration, most large epidemiologic studies used FFQs (Kerver et al. 2003). This was a compromise.

5. The official Japanese measuring cup is currently defined as 200 millilitres; in Australia, one cup is commonly defined as 250 millilitres; the Nutritionist Five software which was used to calculate nutrition intake, was from the U.S.A. where the cup currently used was nutrition labeling is defined in law as 240 millilitres. Although the FFQ attempted to represent the true intake volumes as perceived according to the labelled pictures, the respondent may in some cases have been misled by the associated cup measure.
6. A further issue related to FFQ was that items 1109 (Apples and Applesauce) and 1110 (Banana) were accidentally omitted from the questionnaire and was therefore excluded from the data analysis; and item 1115 (Any other fruit) and 1118 (Other fruit juices or fruit drinks) were also excluded from the data analysis because no nutrition information was available for an unspecific category. This also may have affected our results.
7. According to Pryer et al. (2001), dietary patterns may differ among educational groups. For this reason, our findings may not be completely generalizable to the younger generations as a whole as they were targeted to university students.
8. The self-reported nature of the anthropometry was a major limitation. A validation sub-study within this study could have improved the validity of the findings.

8.5 DIRECTIONS FOR FURTHER RESEARCH

1. Appropriate changes in the detailed content of the research instrument would render these methods effective for investigating and contrasting the changing patterns of diet, nutrition and lifestyles of any other cultural groups.
2. With continuing advances in the field of nutrition intake related health research and suitable modifications to take advantage of the greater sensitivity of larger samples, the methods demonstrated in this study could enable more precise informative predictions of the future incidence of nutrition intake related health conditions.
3. While it is known that individual dietary patterns, once established, tend to have a degree of longer-term stability (Lake et al. 2006; Mikkila et al. 2005; Nakatsuka et al. 1999; Y. Wang et al. 2002), more extensive longitudinal studies could comprehensively investigate the extent and manner in which they persist, and the deeper reasons for both retention and change. This would lead to a better understanding of the causal dimensions of internally driven dietary evolution.
4. Whereas much is known about single lifestyle-related health risk factors prevalence and covariates, more research is needed to elucidate the interactions among multiple healthy lifestyle factors. For example, when studying Japanese people, particularly in the middle-aged working men, the effects of the work patterns on CVD need to be considered.

Bibliography

Adachi, M & Eto, K 2005, 'Expectations for "Shokuiku"', *Japanese Journal of Nutrition and Dietetics*, vol. 63, no. 4, pp. 201-12.

Agricultural Research Service 2010, *What we eat in America*, *NHANES. USDA Automated Multiple-Pass Method. What is AMPM?*, United States Department of Agriculture, from http://www.ars.usda.gov/Services/docs.htm?docid=9098

Alberti, KG, Zimmet, P & Shaw, J 2005, 'The metabolic syndrome--a new worldwide definition', *Lancet*, vol. 366, no. 9491, pp. 1059-62.

Alberti, KG, Zimmet, P & Shaw, J 2006, 'Metabolic syndrome--a new world-wide definition. A Consensus Statement from the International Diabetes Federation', *Diabet Med*, vol. 23, no. 5, pp. 469-80.

Alberti, KG, Zimmet, P & Shaw, J 2007, 'International Diabetes Federation: a consensus on Type 2 diabetes prevention', *Diabet Med*, vol. 24, no. 5, pp. 451-63.

Alfonzo-Gonzalez, G, Doucet, E, Almeras, N, Bouchard, C & Tremblay, A 2004, 'Estimation of daily energy needs with the FAO/WHO/UNU 1985 procedures in adults: comparison to whole-body indirect calorimetry measurements', *Eur J Clin Nutr*, vol. 58, no. 8, pp. 1125-31.

Ambrosini, GL, Huang, RC, Mori, TA, Hands, BP, O'Sullivan, TA, de Klerk, NH, Beilin, LJ & Oddy, WH 2010, 'Dietary patterns and markers for the metabolic syndrome in Australian adolescents', *Nutr Metab Cardiovasc Dis*, vol. 20, no. 4, pp. 274-83.

American Heritage Dictionary 2013, *Asianization*, from http://www.yourdictionary.com/asianization

Aoun, S & Johnson, L 2002, 'Men's health promotion by general practitioners in a workplace setting', *Aust J Rural Health*, vol. 10, no. 6, pp. 268-72.

Aronne, LJ 2002, 'Classification of obesity and assessment of obesity-related health risks', *Obes Res*, vol. 10 Suppl 2, pp. 105S-15S.

Arsenault, BJ, Rana, JS, Lemieux, I, Despres, JP, Kastelein, JJ, Boekholdt, SM, Wareham, NJ & Khaw, KT 2010, 'Physical inactivity, abdominal obesity and risk of coronary heart disease in apparently healthy men and women', *Int J Obes (Lond)*, vol. 34, no. 2, pp. 340-7.

Ashkenazi, M & Jacob, J 2000, *The Essence of Japanese Cuisine*, Curzon Press, UK.

Auer, J, Weber, T, Berent, R, Lassnig, E, Maurer, E, Lamm, G, Kvas, E & Eber, B 2005, 'Obesity, body fat and coronary atherosclerosis', *Int J Cardiol,* vol. 98, no. 2, pp. 227-35.

Australian Bureau of Statistics 1993, 'Time use survey Australia 1992. User's guide', in *ABS Catalogue No. 4150.0*.

Australian Bureau of Statistics 1995, *National Health Survey. Users' Guide Australia*, Catalogue No. 4363.0.

Australian Bureau of Statistics 1998a, *Apparent Consumption of Foodstuffs Australia, 1994-95 and 1995-96.*, Cat. no. 4306.0.

Australian Bureau of Statistics 1998b, *National Nutrition Survey Users' Guide 1995*, Commonwealth of Australia.

Australian Bureau of Statistics 1998c, *National Nutrition Survey. Nutrient Intakes and Physical Measurements Australia 1995.*, Canberra.

Australian Bureau of Statistics 2006, 'National Health Survey: Summary of results 2004-05. Report number 4364.0'.

Australian Bureau of Statistics 2009, *National Health Survey: Summary of Results, 2007-2008 (Reissue). Health risk factors.*, Canberra, 4364.0.

Australian Bureau of Statistics 2012, 'Australian Health Survey: First Results, 2011-12. Key findings'.

Australian Bureau of Statistics 2013a, 'Reflecting a Nation: Stories from the 2011 Census, 2012-2013. Cultural Diversity in Australia'.

Australian Bureau of Statistics 2013b, 'Reflecting a Nation: Stories from the 2011 Census, 2012-2013. Who are Australia's Older People?'

Australian Government Department of Health and Ageing 2005, *A literature review of the evidence for interventions to address overweight and obesity in adults and older Australians (with special reference to people living in rural and remote Australia and aboriginal and torres strait islanders).* Prepared by NSW centre for overweight and obesity University of Sydney. Undertaken for the Australian Government Department of Health and Ageing for the National Obesity Taskforce.

Australian Government Preventative Health Taskforce 2010, *National Preventative Health Taskforce. Technical Report No 1. Obesity in Australia: a need for urgent action. 2.5 - Middle-aged and older Australians.*

Australian Institute of Health and Welfare 2008, *House of Representatives Standing Committee on Health and Ageing. Inquiry into obesity in Australia. Australian Institute of Health and Welfare Submission May 2008,* Canberra, Submission No. 10.

Australian Institute of Health and Welfare 2010, *Australia's Health 2010. The twelfth biennial health report of the Australian Institute of Health and Welfare*, Canberra, Cat. no. AUS 122.

Azizi, F, Esmaillzadeh, A & Mirmiran, P 2005, 'Correlates of under- and over-reporting of energy intake in Tehranians: body mass index and lifestyle-related factors', *Asia Pac J Clin Nutr,* vol. 14, no. 1, pp. 54-9.

Baliunas, D, Patra, J, Rehm, J, Popova, S, Kaiserman, M & Taylor, B 2007, 'Smoking-attributable mortality and expected years of life lost in Canada 2002: conclusions for prevention and policy', *Chronic Dis Can,* vol. 27, no. 4, pp. 154-62.

Ballantyne, CM, Hoogeveen, RC, McNeill, AM, Heiss, G, Schmidt, MI, Duncan, BB & Pankow, JS 2008, 'Metabolic syndrome risk for cardiovascular disease and diabetes in the ARIC study', *Int J Obes (Lond),* vol. 32 Suppl 2, pp. S21-4.

Barclay, AW & Brand-Miller, J 2011, 'The Australian paradox: a substantial decline in sugars intake over the same timeframe that overweight and obesity have increased', *Nutrients,* vol. 3, no. 4, pp. 491-504.

Barengo, NC, Hu, G, Lakka, TA, Pekkarinen, H, Nissinen, A & Tuomilehto, J 2004, 'Low physical activity as a predictor for total and cardiovascular disease mortality in middle-aged men and women in Finland', *Eur Heart J,* vol. 25, no. 24, pp. 2204-11.

Barker, ME, McClean, SI, Thompson, KA & Reid, NG 1990, 'Dietary behaviours and sociocultural demographics in Northern Ireland', *Br J Nutr,* vol. 64, no. 2, pp. 319-29.

Barness, LA, Opitz, JM & Gilbert-Barness, E 2007, 'Obesity: genetic, molecular, and environmental aspects', *Am J Med Genet A,* vol. 143A, no. 24, pp. 3016-34.

Barrett-Connor, E 1991, 'Nutrition epidemiology: how do we know what they ate?' *Am J Clin Nutr,* vol. 54, no. 1 Suppl, pp. 182S-7S.

Becker, W, Foley, S, Shelley, E & Gibney, M 1999, 'Energy under-reporting in Swedish and Irish dietary surveys: implications for food-based dietary guidelines', *Br J Nutr,* vol. 81 Suppl 2, pp. S127-31.

Bedard, D, Shatenstein, B & Nadon, S 2004, 'Underreporting of energy intake from a self-administered food-frequency questionnaire completed by adults in Montreal', *Public Health Nutr,* vol. 7, no. 5, pp. 675-81.

Bei-Fan, Z 2002, 'Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults: study on optimal cut-off points of body mass index and waist circumference in Chinese adults', *Asia Pac J Clin Nutr,* vol. 11 Suppl 8, pp. S685-93.

Belloc, NB & Breslow, L 1972, 'Relationship of physical health status and health practices', *Prev Med,* vol. 1, no. 3, pp. 409-21.

Berg, CM, Lappas, G, Strandhagen, E, Wolk, A, Toren, K, Rosengren, A, Aires, N, Thelle, DS & Lissner, L 2008, 'Food patterns and cardiovascular disease risk factors: the Swedish INTERGENE research program', *Am J Clin Nutr,* vol. 88, no. 2, pp. 289-97.

Bermudez, OI & Gao, X 2010, 'Greater consumption of sweetened beverages and added sugars is associated with obesity among US young adults', *Ann Nutr Metab,* vol. 57, no. 3-4, pp. 211-8.

Bernstein, AM, de Koning, L, Flint, AJ, Rexrode, KM & Willett, WC 2012, 'Soda consumption and the risk of stroke in men and women', *Am J Clin Nutr,* vol. 95, no. 5, pp. 1190-9.

Bernstein, RS, Thornton, JC, Yang, MU, Wang, J, Redmond, AM, Pierson, RN, Jr., Pi-Sunyer, FX & Van Itallie, TB 1983, 'Prediction of the resting metabolic rate in obese patients', *Am J Clin Nutr,* vol. 37, no. 4, pp. 595-602.

Beulens, JW, Rimm, EB, Ascherio, A, Spiegelman, D, Hendriks, HF & Mukamal, KJ 2007, 'Alcohol consumption and risk for coronary heart disease among men with hypertension', *Ann Intern Med,* vol. 146, no. 1, pp. 10-9.

Bigaard, J, Spanggaard, I, Thomsen, BL, Overvad, K & Tjonneland, A 2005, 'Self-reported and technician-measured waist circumferences differ in middle-aged men and women', *J Nutr,* vol. 135, no. 9, pp. 2263-70.

Bingham, SA 2003, 'Urine nitrogen as a biomarker for the validation of dietary protein intake', *The journal of nutrition*, vol. 133, no. Suppl 3, pp. 921S-4S.

Black, AE 2000, 'Critical evaluation of energy intake using the Goldberg cut-off for energy intake:basal metabolic rate. A practical guide to its calculation, use and limitations', *Int J Obes Relat Metab Disord*, vol. 24, no. 9, pp. 1119-30.

Black, AE & Cole, TJ 2000, 'Within- and between-subject variation in energy expenditure measured by the doubly-labelled water technique: implications for validating reported dietary energy intake', *Eur J Clin Nutr*, vol. 54, no. 5, pp. 386-94.

Black, AE & Cole, TJ 2001, 'Biased over- or under-reporting is characteristic of individuals whether over time or by different assessment methods', *J Am Diet Assoc*, vol. 101, no. 1, pp. 70-80.

Black, AE, Coward, WA, Cole, TJ & Prentice, AM 1996, 'Human energy expenditure in affluent societies: an analysis of 574 doubly-labelled water measurements', *Eur J Clin Nutr*, vol. 50, no. 2, pp. 72-92.

Black, AE, Goldberg, GR, Jebb, SA, Livingstone, MB, Cole, TJ & Prentice, AM 1991, 'Critical evaluation of energy intake data using fundamental principles of energy physiology: 2. Evaluating the results of published surveys', *Eur J Clin Nutr*, vol. 45, no. 12, pp. 583-99.

Black, AE, Prentice, AM, Goldberg, GR, Jebb, SA, Bingham, SA, Livingstone, MB & Coward, WA 1993, 'Measurements of total energy expenditure provide insights into the validity of dietary measurements of energy intake', *Journal of the American dietetic association*, vol. 93, no. 5, pp. 572-9.

Bleich, SN, Wang, YC, Wang, Y & Gortmaker, SL 2009, 'Increasing consumption of sugar-sweetened beverages among US adults: 1988-1994 to 1999-2004', *Am J Clin Nutr*, vol. 89, no. 1, pp. 372-81.

Block, G, Hartman, AM, Dresser, CM, Carroll, MD, Gannon, J & L., G 1986, 'A data-based approach to diet questionnaire design and testing', *American journal of epidemiology*, vol. 124, no. 3, pp. 453-69.

Block, G, Woods, M, Potosky, A & Clifford, C 1990, 'Validation of a self-administered diet history questionnaire using multiple diet records', *J Clin Epidemiol*, vol. 43, no. 12, pp. 1327-35.

Bogers, RP, Dagnelie, PC, Westerterp, KR, Kester, AD, van Klaveren, JD, Bast, A & van den Brandt, PA 2003, 'Using a correction factor to correct for overreporting in a food-frequency questionnaire does not improve biomarker-assessed validity of estimates for fruit and vegetable consumption', *J Nutr,* vol. 133, no. 4, pp. 1213-9.

Boggild, H & Knutsson, A 1999, 'Shift work, risk factors and cardiovascular disease', *Scand J Work Environ Health,* vol. 25, no. 2, pp. 85-99.

Boniface, S & Shelton, N 2013, 'How is alcohol consumption affected if we account for under-reporting? A hypothetical scenario', *Eur J Public Health,* vol. 23, no. 6, pp. 1076-81.

Boyle, CA, Dobson, AJ, Egger, G & Bennett, SA 1993, 'Waist-to-hip ratios in Australia: a different picture of obesity', *Australian Journal of Nutrition and Dietetics,* vol. 50, pp. 57-64.

Brandhagen, M, Forslund, HB, Lissner, L, Winkvist, A, Lindroos, AK, Carlsson, LM, Sjostrom, L & Larsson, I 2012, 'Alcohol and macronutrient intake patterns are related to general and central adiposity', *Eur J Clin Nutr,* vol. 66, no. 3, pp. 305-13.

Bray, GA 2012, 'Fructose and risk of cardiometabolic disease', *Curr Atheroscler Rep,* vol. 14, no. 6, pp. 570-8.

Bray, GA 2013, 'Energy and Fructose From Beverages Sweetened With Sugar or High-Fructose Corn Syrup Pose a Health Risk for Some People', *Adv Nutr,* vol. 4, no. 2, pp. 220-5.

Brenner, DR, Boucher, BA, Kreiger, N, Jenkins, D & El-Sohemy, A 2011, *Dietary patterns in an ethnoculturally diverse population of young Canadian adults*, Fall. Retrieved 3, from http://web.ebscohost.com.dbgw.lis.curtin.edu.au/ehost/pdfviewer/pdfviewer?sid=e1e61729-0620-49af-a403-78dd3b4c3061%40sessionmgr4002&vid=2&hid=114

Briefel, RR, McDowell, MA, Alaimo, K, Caughman, CR, Bischof, AL, Carroll, MD & Johnson, CL 1995, 'Total energy intake of the US population: the third National health and Nutrition Examination Survey, 1988-1991', *The American journal of clinical nutrition,* vol. 62, no. 5 Suppl, pp. 1072S-80S.

Brown, WS, Lubove, RE & Kwalwasser, J 1994, 'Karoshi: Alternative perspectives of Japanese management styles', *Business Horizons,* vol. 37, no. 2, pp. 58-60.

Bryson, CL, Mukamal, KJ, Mittleman, MA, Fried, LP, Hirsch, CH, Kitzman, DW & Siscovick, DS 2006, 'The association of alcohol consumption and incident heart failure: the Cardiovascular Health Study', *J Am Coll Cardiol*, vol. 48, no. 2, pp. 305-11.

Burke, BS 1947, 'The dietary history as a tool in research', *Journal of the American Dietetic Association*, vol. 23, pp. 1041-6.

Burnley, IH 2001, *The Impact of Immigration on Australia. A demographic Approach.*, Oxford University Press., UK.

Cameron, AJ, Welborn, TA, Zimmet, PZ, Dunstan, DW, Owen, N, Salmon, J, Dalton, M, Jolley, D & Shaw, JE 2003, 'Overweight and obesity in Australia: the 1999-2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab)', *Med J Aust*, vol. 178, no. 9, pp. 427-32.

Cameron, AJ, Zimmet, PZ, Atkins, RC & Shaw, JE 2008, 'The Australian diabetes, obesity and lifestyle study - Profiling diabetes and cardiovascular disease risk in the nation. Cholesterol management and risk reduction ', in *Touch briefings 2008*, pp. 25-8.

Canadian Sugar Institute 2004, *Carbohydrate News - Winter 2004. Dietary Reference Intakes for Sugars*, from http://www.sugar.ca/english/pdf/carbohydratenews/CarboNews9.pdf

Canadian Sugar Institute 2013, *Health professionals, Sugars and Health, Weight management, Sugars and body weight*, 3/04/2013, from http://www.sugar.ca/english/healthprofessionals/weightmanagement.cfm

Capita, R & Alonso-Calleja, C 2003, 'Intake of nutrients associated with an increased risk of cardiovascular disease in a Spanish population', *Int J Food Sci Nutr*, vol. 54, no. 1, pp. 57-75.

Centrol Intelligene Agency 2012, *The Work of a Nation. The Center of intelligence. The world facebook. Country comparison - Life expectancy at birth*.

Centrol Intelligene Agency 2013, *The Work of a Nation. The Center of Intelligence. The world facebook. Country comparison - Life expectancy at birth, males (years).*

Chan, DC, Watts, GF, Barrett, PH & Burke, V 2003, 'Waist circumference, waist-to-hip ratio and body mass index as predictors of adipose tissue compartments in men', *Qjm*, vol. 96, no. 6, pp. 441-7.

Chen, L, Peeters, A, Magliano, DJ, Shaw, JE, Welborn, TA, Wolfe, R, Zimmet, PZ & Tonkin, AM 2007, 'Anthropometric measures and absolute cardiovascular risk estimates in the Australian Diabetes, Obesity and Lifestyle (AusDiab) Study', *Eur J Cardiovasc Prev Rehabil*, vol. 14, no. 6, pp. 740-5.

Chen, MM, Lear, SA, Gao, M, Frohlich, JJ & Birmingham, CL 2001, 'Intraobserver and interobserver reliability of waist circumference and the waist-to-hip ratio', *Obes Res*, vol. 9, no. 10, p. 651.

Cheng, Y, Park, J, Kim, Y & Kawakami, N 2012, 'The recognition of occupational diseases attributed to heavy workloads: experiences in Japan, Korea, and Taiwan', *Int Arch Occup Environ Health*, vol. 85, no. 7, pp. 791-9.

Chi, D, Nakano, M & Yamamoto, K 2003, 'Correlates of serum high-density lipoprotein cholesterol: a community-based study of middle-aged and older men and women in Japan', *Asia Pac J Public Health*, vol. 15, no. 1, pp. 17-22.

Chiuve, SE, Rexrode, KM, Spiegelman, D, Logroscino, G, Manson, JE & Rimm, EB 2008, 'Primary prevention of stroke by healthy lifestyle', *Circulation*, vol. 118, no. 9, pp. 947-54.

Cho, ER, Shin, A, Lim, SY & Kim, J 2011, 'Dietary patterns and their associations with health behaviours in Korea', *Public Health Nutr*, vol. 14, no. 2, pp. 356-64.

Cho, YA, Shin, A & Kim, J 2011, 'Dietary patterns are associated with body mass index in a Korean population', *J Am Diet Assoc*, vol. 111, no. 8, pp. 1182-6.

Chopra, M, Galbraith, S & Darnton-Hill, I 2002, 'A global response to a global problem: the epidemic of overnutrition', *Bulletin of the World Health Organization*, vol. 80, no. 12, pp. 952-8.

Chourdakis, M, Tzellos, T, Pourzitaki, C, Toulis, KA, Papazisis, G & Kouvelas, D 2011, 'Evaluation of dietary habits and assessment of cardiovascular disease risk factors among Greek university students', *Appetite*, vol. 57, no. 2, pp. 377-83.

Coakes, SJ & Steed, LG 2001, *SPSS Analysis without Anguish. Version 10.0 for Windows, p155-169*, John Wiley & Sons Australia, Ltd, Milton, Queensland.

Cockerham, WC, Hattori, H & Yamori, Y 2000, 'The social gradient in life expectancy: the contrary case of Okinawa in Japan', *Soc Sci Med*, vol. 51, no. 1, pp. 115-22.

Cockram, CS 2000, 'The epidemiology of diabetes mellitus in the Asia-Pacific region', *Hong Kong Med J*, vol. 6, no. 1, pp. 43-52.

Cohen, J & Cohen, P 1975, *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates, Inc., USA.

Cole, TJ & Green, PJ 1992, 'Smoothing reference centile curves: the LMS method and penalized likelihood', *Stat Med,* vol. 11, no. 10, pp. 1305-19.

Cole, TJ & Henry, CJ 2005, 'The Oxford Brookes basal metabolic rate database--a reanalysis', *Public Health Nutr,* vol. 8, no. 7A, pp. 1202-12.

Commission of the European Communities 1993, *Reports of the Scientific Committee for Food. Nutrient and energy intakes for the European Community (Thirty-first series).* Office for Official Publications of the European Communities, Luxembourg.

Commonwealth Department of Health 1986, *National Dietary Survey of Adults: 1983 no. 1 Foods consumed,* AGPS, Canberra.

Commonwealth of Australia 2006, 'Nutrient Reference Values for Australia and New Zealand. Executive Summary', ed. AGDoHaANHaMR Council.

Commonwealth of Australia 2010, 'National Male Health Policy. Building on the strengths of Australian males'.

Costanzo, S, Di Castelnuovo, A, Donati, MB, Iacoviello, L & de Gaetano, G 2010a, 'Alcohol consumption and mortality in patients with cardiovascular disease: a meta-analysis', *J Am Coll Cardiol,* vol. 55, no. 13, pp. 1339-47.

Costanzo, S, Di Castelnuovo, A, Donati, MB, Iacoviello, L & de Gaetano, G 2010b, 'Cardiovascular and overall mortality risk in relation to alcohol consumption in patients with cardiovascular disease', *Circulation,* vol. 121, no. 17, pp. 1951-9.

Coughlan, JE & McNamara, D 1997, *Asians in Australia. Patterns of Migration and Settlement.*, Macmillan Education Australia Pty. Ltd., Melbourne.

Counihan, C & Van Esterik, P 1997, *Food and Culture: A Reader.*, Routledge., London.

Craven, KL & Hawks, SR 2006, 'Cultural and western influences on the nutrition transition in Thailand', *Promot Educ,* vol. 13, no. 1, pp. 14-20.

Crespo, CJ, Palmieri, MR, Perdomo, RP, McGee, DL, Smit, E, Sempos, CT, Lee, IM & Sorlie, PD 2002, 'The relationship of physical activity and body weight with all-cause mortality: results from the Puerto Rico Heart Health Program', *Ann Epidemiol,* vol. 12, no. 8, pp. 543-52.

Crowe, TC, Fontaine, HL, Gibbons, CJ, Cameron-Smith, D & Swinburn, BA 2004, 'Energy density of foods and beverages in the Australian food supply: influence of macronutrients and comparison to dietary intake', *Eur J Clin Nutr*, vol. 58, no. 11, pp. 1485-91.

Cui, R, Iso, H, Toyoshima, H, Date, C, Yamamoto, A, Kikuchi, S, Kondo, T, Watanabe, Y, Koizumi, A, Wada, Y, Inaba, Y & Tamakoshi, A 2005, 'Body mass index and mortality from cardiovascular disease among Japanese men and women: the JACC study', *Stroke*, vol. 36, no. 7, pp. 1377-82.

Cwiertka, KJ 1998, 'A note on the making of culinary tradition - an example of modern Japan', *Appetite*, vol. 30, pp. 117-28.

Cwiertka, KJ 2006, *Modern Japanese Cuisine. Food, Power and National Identity*, Reaktion Books.

Czernichow, S, Kengne, AP, Huxley, RR, Batty, GD, de Galan, B, Grobbee, D, Pillai, A, Zoungas, S, Marre, M, Woodward, M, Neal, B & Chalmers, J 2011, 'Comparison of waist-to-hip ratio and other obesity indices as predictors of cardiovascular disease risk in people with type-2 diabetes: a prospective cohort study from ADVANCE', *Eur J Cardiovasc Prev Rehabil*, vol. 18, no. 2, pp. 312-9.

Dalton, M, Cameron, AJ, Zimmet, PZ, Shaw, JE, Jolley, D, Dunstan, DW & Welborn, TA 2003, 'Waist circumference, waist-hip ratio and body mass index and their correlation with cardiovascular disease risk factors in Australian adults', *J Intern Med*, vol. 254, no. 6, pp. 555-63.

Dandona, P, Aljada, A, Chaudhuri, A, Mohanty, P & Garg, R 2005, 'Metabolic syndrome: a comprehensive perspective based on interactions between obesity, diabetes, and inflammation', *Circulation*, vol. 111, no. 11, pp. 1448-54.

Darnton-Hill, I, Nishida, C & James, W 2004, 'A life course approach to diet, nutrition and the prevention of chronic diseases', *Public Health Nutrition*, no. 28 February 2006, pp. 101-21.

de Koning, L, Malik, VS, Kellogg, MD, Rimm, EB, Willett, WC & Hu, FB 2012, 'Sweetened beverage consumption, incident coronary heart disease, and biomarkers of risk in men', *Circulation*, vol. 125, no. 14, pp. 1735-41, S1.

de Koning, L, Merchant, AT, Pogue, J & Anand, SS 2007, 'Waist circumference and waist-to-hip ratio as predictors of cardiovascular events: meta-regression analysis of prospective studies', *Eur Heart J*, vol. 28, no. 7, pp. 850-6.

Dekkers, JC, van Wier, MF, Hendriksen, IJ, Twisk, JW & van Mechelen, W 2008, *Accuracy of self-reported body weight, height and waist circumference in a Dutch overweight working population*, from http://www.biomedcentral.com/content/pdf/1471-2288-8-69.pdf

Denova-Gutierrez, E, Castanon, S, Talavera, JO, Flores, M, Macias, N, Rodriguez-Ramirez, S, Flores, YN & Salmeron, J 2011, 'Dietary patterns are associated with different indexes of adiposity and obesity in an urban Mexican population', *J Nutr*, vol. 141, no. 5, pp. 921-7.

Denova-Gutierrez, E, Castanon, S, Talavera, JO, Gallegos-Carrillo, K, Flores, M, Dosamantes-Carrasco, D, Willett, WC & Salmeron, J 2010, 'Dietary patterns are associated with metabolic syndrome in an urban Mexican population', *J Nutr*, vol. 140, no. 10, pp. 1855-63.

Department of Community Services and Health 1987, *National dietary survey of adults: 1983. No.2 Nutrient intakes. In collaboration with the National Heart Foundation.*, Australian Government Publishing Service, Canberra.

Deshmukh-Taskar, PR, O'Neil, CE, Nicklas, TA, Yang, SJ, Liu, Y, Gustat, J & Berenson, GS 2009, 'Dietary patterns associated with metabolic syndrome, sociodemographic and lifestyle factors in young adults: the Bogalusa Heart Study', *Public Health Nutr*, vol. 12, no. 12, pp. 2493-503.

Deurenberg-Yap, M, Chew, SK, Lin, VF, Tan, BY, van Staveren, WA & Deurenberg, P 2001, 'Relationships between indices of obesity and its co-morbidities in multi-ethnic Singapore', *Int J Obes Relat Metab Disord*, vol. 25, no. 10, pp. 1554-62.

Deurenberg-Yap, M, Schmidt, G, van Staveren, WA & Deurenberg, P 2000, 'The paradox of low body mass index and high body fat percentage among Chinese, Malays and Indians in Singapore', *Int J Obes Relat Metab Disord*, vol. 24, no. 8, pp. 1011-7.

Deurenberg, P, Yap, M & van Staveren, WA 1998, 'Body mass index and percent body fat: a meta analysis among different ethnic groups', *Int J Obes Relat Metab Disord*, vol. 22, no. 12, pp. 1164-71.

Dhaliwal, SS, Howat, P, Bejoy, T & Welborn, TA 2010, 'Self-reported weight and height for evaluating obesity control programs', *Am J Health Behav,* vol. 34, no. 4, pp. 489-99.

Dhaliwal, SS & Welborn, TA 2009a, 'Central obesity and multivariable cardiovascular risk as assessed by the Framingham prediction scores', *Am J Cardiol,* vol. 103, no. 10, pp. 1403-7.

Dhaliwal, SS & Welborn, TA 2009b, 'Measurement error and ethnic comparisons of measures of abdominal obesity', *Prev Med,* vol. 49, no. 2-3, pp. 148-52.

Dhingra, R, Sullivan, L, Jacques, PF, Wang, TJ, Fox, CS, Meigs, JB, D'Agostino, RB, Gaziano, JM & Vasan, RS 2007, 'Soft drink consumption and risk of developing cardiometabolic risk factors and the metabolic syndrome in middle-aged adults in the community', *Circulation,* vol. 116, no. 5, pp. 480-8.

Diekhoff, G 1992, *Statistics for the social and behavioral sciences: Univariate, Bivariate, Multivariate*, Wm. C. Brown Publishers, Midwesternstate University.

Dixon, J, Omwega, AM, Friel, S, Burns, C, Donati, K & Carlisle, R 2007, 'The health equity dimensions of urban food systems', *J Urban Health,* vol. 84, no. 3 Suppl, pp. i118-29.

Donovan, RJ & Egger, G 2000, *Men's Health Beliefs: A Qualitative Research Report. CBRCC Report No. 1, April 2000*, Healthy Blockes Project (Funded by Healthway) & The National Heart Foundation (WA). The Cancer Foundation of WA. Diabetes Australia (WA). Centre for Behavioural Research in Cancer Control.

Drewnowski, A 2007, 'The real contribution of added sugars and fats to obesity', *Epidemiol Rev,* vol. 29, pp. 160-71.

Duc Son le, NT, Hanh, TT, Kusama, K, Kunii, D, Sakai, T, Hung, NT & Yamamoto, S 2005, 'Anthropometric characteristics, dietary patterns and risk of type 2 diabetes mellitus in Vietnam', *J Am Coll Nutr,* vol. 24, no. 4, pp. 229-34.

Duffey, KJ, Gordon-Larsen, P, Steffen, LM, Jacobs, DR, Jr. & Popkin, BM 2010, 'Drinking caloric beverages increases the risk of adverse cardiometabolic outcomes in the Coronary Artery Risk Development in Young Adults (CARDIA) Study', *Am J Clin Nutr,* vol. 92, no. 4, pp. 954-9.

Dugee, O, Khor, GL, Lye, MS, Luvsannyam, L, Janchiv, O, Jamyan, B & Esa, N 2009, 'Association of major dietary patterns with obesity risk among Mongolian men and women', *Asia Pac J Clin Nutr*, vol. 18, no. 3, pp. 433-40.

Dunn, PM 1993, 'Dr Ramazzini (1633-1714) and the occupational diseases of midwives and wet nurses', *Archives of Disease in Childhood*, vol. 68, pp. 337-9.

Duvigneaud, N, Wijndaele, K, Matton, L, Philippaerts, R, Lefevre, J, Thomis, M, Delecluse, C & Duquet, W 2007, *Dietary factors associated with obesity indicators and level of sports participation in Flemish adults: a cross-sectional study*, from http://www.nutritionj.com/content/pdf/1475-2891-6-26.pdf

Ebine, N, Feng, JY, Homma, M, Saitoh, S & Jones, PJ 2000, 'Total energy expenditure of elite synchronized swimmers measured by the doubly labeled water method', *Eur J Appl Physiol*, vol. 83, no. 1, pp. 1-6.

Ebine, N, Rafamantanantsoa, HH, Nayuki, Y, Yamanaka, K, Tashima, K, Ono, T, Saitoh, S & Jones, PJ 2002, 'Measurement of total energy expenditure by the doubly labelled water method in professional soccer players', *J Sports Sci*, vol. 20, no. 5, pp. 391-7.

Eguchi, E, Iso, H, Tanabe, N, Wada, Y, Yatsuya, H, Kikuchi, S, Inaba, Y & Tamakoshi, A 2012, 'Healthy lifestyle behaviours and cardiovascular mortality among Japanese men and women: the Japan collaborative cohort study', *Eur Heart J*, vol. 33, no. 4, pp. 467-77.

Elmadfa, I & Freisling, H 2005, 'Fat intake, diet variety and health promotion', *Forum Nutr*, no. 57, pp. 1-10.

Embree, BG & Whitehead, PC 1993, 'Validity and reliability of self-reported drinking behavior: dealing with the problem of response bias', *J Stud Alcohol*, vol. 54, no. 3, pp. 334-44.

EPIC group of Spain 1997, 'Relative validity and reproducibility of a diet history questionnaire in Spain. III. Biochemical markers', *International journal of epidemiology*, vol. 26, no. 1 (suppl. 1), pp. S110-S7.

Esmaillzadeh, A, Kimiagar, M, Mehrabi, Y, Azadbakht, L, Hu, FB & Willett, WC 2007, 'Dietary patterns and markers of systemic inflammation among Iranian women', *J Nutr*, vol. 137, no. 4, pp. 992-8.

Examination Committee for Metabolic Syndrome 2005, 'Examination committee of criteria for the metabolic syndrome in Japan (in Japanese)', *Journal of Japanese society of internal medicine,* vol. 94, no. 4, pp. 794-809.

Examination Committee of Criteria for 'Obesity Disease' in Japan 2002, 'New criteria for 'obesity disease' in Japan', *Circ J,* vol. 66, no. 11, pp. 987-92.

Expert panel on detection, e, and treatment of high blood cholesterol in adults, 2001, 'Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III)', *Jama,* vol. 285, no. 19, pp. 2486-97.

Fernandez-Armesto, F 2001, *Food: A History.*, Macmillan., London.

Ferrari, P, Slimani, N, Ciampi, A, Trichopoulou, A, Naska, A, Lauria, C, Veglia, F, Bueno-de-Mesquita, HB, Ocke, MC, Brustad, M, Braaten, T, Jose Tormo, M, Amiano, P, Mattisson, I, Johansson, G, Welch, A, Davey, G, Overvad, K, Tjonneland, A, Clavel-Chapelon, F, Thiebaut, A, Linseisen, J, Boeing, H, Hemon, B & Riboli, E 2002, 'Evaluation of under- and overreporting of energy intake in the 24-hour diet recalls in the European Prospective Investigation into Cancer and Nutrition (EPIC)', *Public Health Nutr,* vol. 5, no. 6B, pp. 1329-45.

Field, AE, Coakley, EH, Must, A, Spadano, JL, Laird, N, Dietz, WH, Rimm, E & Colditz, GA 2001, 'Impact of overweight on the risk of developing common chronic diseases during a 10-year period', *Arch Intern Med,* vol. 161, no. 13, pp. 1581-6.

Flegal, KM, Shepherd, JA, Looker, AC, Graubard, BI, Borrud, LG, Ogden, CL, Harris, TB, Everhart, JE & Schenker, N 2009, 'Comparisons of percentage body fat, body mass index, waist circumference, and waist-stature ratio in adults', *Am J Clin Nutr,* vol. 89, no. 2, pp. 500-8.

Foote, JA, Murphy, SP, Wilkens, LR, Hankin, JH, Henderson, BE & Kolonel, LN 2003, 'Factors associated with dietary supplement use among healthy adults of five ethnicities: the Multiethnic Cohort Study', *Am J Epidemiol,* vol. 157, no. 10, pp. 888-97.

Frankenfield, D, Roth-Yousey, L & Compher, C 2005, 'Comparison of predictive equations for resting metabolic rate in healthy nonobese and obese adults: a systematic review', *J Am Diet Assoc,* vol. 105, no. 5, pp. 775-89.

Fraser, GE, Welch, A, Luben, R, Bingham, SA & Day, NE 2000, 'The effect of age, sex, and education on food consumption of a middle-aged English cohort-EPIC in East Anglia', *Prev Med*, vol. 30, no. 1, pp. 26-34.

Fujimoto, WY, Bergstrom, RW, Boyko, EJ, Chen, KW, Leonetti, DL, Newell-Morris, L, Shofer, JB & Wahl, PW 1999, 'Visceral adiposity and incident coronary heart disease in Japanese-American men. The 10-year follow-up results of the Seattle Japanese-American Community Diabetes Study', *Diabetes Care*, vol. 22, no. 11, pp. 1808-12.

Fukuoka, Y, Dracup, K, Froelicher, ES, Ohno, M, Hirayama, H, Shiina, H & Kobayashi, F 2005, 'Do Japanese workers who experience an acute myocardial infarction believe their prolonged working hours are a cause?' *Int J Cardiol*, vol. 100, no. 1, pp. 29-35.

Gall, SL, Jamrozik, K, Blizzard, L, Dwyer, T & Venn, A 2009, 'Healthy lifestyles and cardiovascular risk profiles in young Australian adults: the Childhood Determinants of Adult Health Study', *Eur J Cardiovasc Prev Rehabil*, vol. 16, no. 6, pp. 684-9.

Ganji, V & Kafai, MR 2003, 'Demographic, health, lifestyle, and blood vitamin determinants of serum total homocysteine concentrations in the third National Health and Nutrition Examination Survey, 1988-1994', *Am J Clin Nutr*, vol. 77, no. 4, pp. 826-33.

Ganpule, AA, Tanaka, S, Ishikawa-Takata, K & Tabata, I 2007, 'Interindividual variability in sleeping metabolic rate in Japanese subjects', *Eur J Clin Nutr*, vol. 61, no. 11, pp. 1256-61.

Garrison, RJ & Castelli, WP 1985, 'Weight and thirty-year mortality of men in the Framingham Study', *Ann Intern Med*, vol. 103, no. 6 (Pt 2), pp. 1006-9.

Gaziano, TA, Bitton, A, Anand, S, Abrahams-Gessel, S & Murphy, A 2010, 'Growing epidemic of coronary heart disease in low- and middle-income countries', *Curr Probl Cardiol*, vol. 35, no. 2, pp. 72-115.

Gelber, RP, Gaziano, JM, Manson, JE, Buring, JE & Sesso, HD 2007, 'A prospective study of body mass index and the risk of developing hypertension in men', *Am J Hypertens*, vol. 20, no. 4, pp. 370-7.

George, ES, Rosenkranz, RR & Kolt, GS 2013, 'Chronic disease and sitting time in middle-aged Australian males: findings from the 45 and Up Study', *Int J Behav Nutr Phys Act*, vol. 10, p. 20.

Gerdts, E, de Simone, G, Lund, BP, Okin, PM, Wachtell, K, Boman, K, Nieminen, MS, Dahlof, B & Devereux, RB 2013, 'Impact of overweight and obesity on cardiac benefit of antihypertensive treatment', *Nutr Metab Cardiovasc Dis,* vol. 23, no. 2, pp. 122-9.

Gex-Fabry, M, Raymond, L & Jeanneret, O 1988, 'Multivariate analysis of dietary patterns in 939 Swiss adults: sociodemographic parameters and alcohol consumption profiles', *Int J Epidemiol,* vol. 17, no. 3, pp. 548-55.

Gibson, RS 2005, *Principles of nutritional assessment.,* 2nd edn, Oxford University Press., New York.

Gibson, S 2008, 'Sugar-sweetened soft drinks and obesity: a systematic review of the evidence from observational studies and interventions', *Nutr Res Rev,* vol. 21, no. 2, pp. 134-47.

Gill, TP 2001, 'Cardiovascular risk in the Asia-Pacific region from a nutrition and metabolic point of view: abdominal obesity', *Asia Pac J Clin Nutr*, vol. 10, no. 2, pp. 85-9.

Gilsenan, MB & Gibney, MJ 2004, 'Assessment of the influence of energy under-reporting on intake estimates of four food additives', *Food Addit Contam,* vol. 21, no. 3, pp. 195-203.

Golay, A & Bobbioni, E 1997, 'The role of dietary fat in obesity', *Int J Obes Relat Metab Disord,* vol. 21 Suppl 3, pp. S2-11.

Goldberg, GR, Black, AE, Jebb, SA, Cole, TJ, Murgatroyd, PR, Coward, WA & Prentice, AM 1991, 'Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording', *Eur J Clin Nutr,* vol. 45, no. 12, pp. 569-81.

Gorber, SC, Tremblay, M, Moher, D & Gorber, B 2007, 'A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review', *Obes Rev,* vol. 8, no. 4, pp. 307-26.

Goris, AH, Westerterp-Plantenga, MS & Westerterp, KR 2000, 'Undereating and underrecording of habitual food intake in obese men: selective underreporting of fat intake', *The American journal of clinical nutrition,* vol. 71, no. 1, pp. 130-4.

Grievink, L, Alberts, JF, O'Niel, J & Gerstenbluth, I 2004, 'Waist circumference as a measurement of obesity in the Netherlands Antilles; associations with hypertension and diabetes mellitus', *Eur J Clin Nutr,* vol. 58, no. 8, pp. 1159-65.

Grol, ME, Eimers, JM, Alberts, JF, Bouter, LM, Gerstenbluth, I, Halabi, Y, van Sonderen, E & van den Heuvel, WJ 1997, 'Alarmingly high prevalence of obesity in Curacao: data from an interview survey stratified for socioeconomic status', *Int J Obes Relat Metab Disord,* vol. 21, no. 11, pp. 1002-9.

Grundy, SM, Cleeman, JI, Daniels, SR, Donato, KA, Eckel, RH, Franklin, BA, Gordon, DJ, Krauss, RM, Savage, PJ, Smith, SC, Jr., Spertus, JA & Costa, F 2005, 'Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement', *Circulation,* vol. 112, no. 17, pp. 2735-52.

Gupta, R, Rastogi, P, Sarna, M, Gupta, VP, Sharma, SK & Kothari, K 2007, 'Body-mass index, waist-size, waist-hip ratio and cardiovascular risk factors in urban subejcts', *J Assoc Physicians India,* vol. 55, pp. 621-7.

Gutierrez-Fisac, JL, Guallar-Castillon, P, Diez-Ganan, L, Lopez Garcia, E, Banegas Banegas, JR & Rodriguez Artalejo, F 2002, 'Work-related physical activity is not associated with body mass index and obesity', *Obes Res,* vol. 10, no. 4, pp. 270-6.

Hair, JFJ, Black, WC, Babin, BJ & Anderson, RE 2010, *Multivariate data analysis p102-103,* Seventh Edition edn, Pearson Prentice Hall, New Jersey, USA.

Hall, TR & Young, TB 1989, 'A validation study of body fat distribution as determined by self-measurement of waist and hip circumference', *Int J Obes,* vol. 13, no. 6, pp. 801-7.

Han, E & Powell, LM 2013, 'Consumption patterns of sugar-sweetened beverages in the United States', *J Acad Nutr Diet,* vol. 113, no. 1, pp. 43-53.

Han, TS, van Leer, EM, Seidell, JC & Lean, ME 1995, 'Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample', *British Medical Journal,* vol. 311, no. 7017, pp. 1401-5.

Han, TS, van Leer, EM, Seidell, JC & Lean, ME 1996, 'Waist circumference as a screening tool for cardiovascular risk factors: evaluation of receiver operating characteristics (ROC)', *Obes Res,* vol. 4, no. 6, pp. 533-47.

Hankin, JH 1986, '23rd Lenna Frances Cooper memorial lecture: a diet history method for research, clinical, and community use', *J Am Diet Assoc,* vol. 86, no. 7, pp. 868-72.

Hankin, JH 1993, 'The Hawaii Cancer Research Survey, University of Hawaii Cancer Research Center of Hawaii'.

Hankin, JH, Wilkens, LR, Kolonel, LN & Yoshizawa, CN 1991, 'Validation of a quantitative diet history method in Hawaii', *Am J Epidemiol,* vol. 133, no. 6, pp. 616-28.

Hara, K, Matsushita, Y, Horikoshi, M, Yoshiike, N, Yokoyama, T, Tanaka, H & Kadowaki, T 2006, 'A proposal for the cutoff point of waist circumference for the diagnosis of metabolic syndrome in the Japanese population', *Diabetes Care,* vol. 29, no. 5, pp. 1123-4.

Harrington, JM 1994, 'Shift work and health--a critical review of the literature on working hours', *Ann Acad Med Singapore,* vol. 23, no. 5, pp. 699-705.

Harrington, JM 2001, 'Health effects of shift work and extended hours of work', *Occupational and Environmental Medicine,* vol. 58, pp. 68-72.

Harris, JA & Benedict, GF 1919, *A biometric study of basal metabolism in man. Publication No. 279,* Carnegie Institute of Washington, Washington DC.

Hawks, SR, Madanat, HN, Merrill, RM, Goudy, MB & Miyagawa, T 2003, 'A cross-cultural analysis of 'motivation for eating' as a potential factor in the emergence of global obesity: Japan and the United States', *Health Promot Int,* vol. 18, no. 2, pp. 153-62.

Hawks, SR, Merrill, RM, Madanat, HN, Miyagawa, T, Suwanteerangkul, J, Guarin, CM & Shaofang, C 2004, 'Intuitive eating and the nutrition transition in Asia', *Asia Pac J Clin Nutr,* vol. 13, no. 2, pp. 194-203.

Hayter, JE & Henry, CJ 1993, 'Basal metabolic rate in human subjects migrating between tropical and temperate regions: a longitudinal study and review of previous work', *Eur J Clin Nutr,* vol. 47, no. 10, pp. 724-34.

Hayter, JE & Henry, CJ 1994, 'A re-examination of basal metabolic rate predictive equations: the importance of geographic origin of subjects in sample selection', *Eur J Clin Nutr,* vol. 48, no. 10, pp. 702-7.

He, FJ & MacGregor, GA 2009, 'A comprehensive review on salt and health and current experience of worldwide salt reduction programmes', *J Hum Hypertens,* vol. 23, no. 6, pp. 363-84.

Health Development Agency 2000, 'Health update, Coronary heart disease and stroke'.

Hebert, JR, Clemow, L, Pbert, L, Ockene, IS & Ockene, JK 1995, 'Social desirability bias in dietary self-report may compromise the validity of dietary intake measures', *Int J Epidemiol*, vol. 24, no. 2, pp. 389-98.

Hebert, JR, Ma, Y, Clemow, L, Ockene, IS, Saperia, G, Stanek, EJ, 3rd, Merriam, PA & Ockene, JK 1997, 'Gender differences in social desirability and social approval bias in dietary self-report', *Am J Epidemiol*, vol. 146, no. 12, pp. 1046-55.

Heitmann, BL, Erikson, H, Ellsinger, BM, Mikkelsen, KL & Larsson, B 2000, 'Mortality associated with body fat, fat-free mass and body mass index among 60-year-old swedish men-a 22-year follow-up. The study of men born in 1913', *Int J Obes Relat Metab Disord*, vol. 24, no. 1, pp. 33-7.

Henry, CJ 2005, 'Basal metabolic rate studies in humans: measurement and development of new equations', *Public Health Nutr*, vol. 8, no. 7A, pp. 1133-52.

Heywood, P, Harvey, PW & Marks, GC 1993, 'An evaluation of energy intakes in the 1983 Australian National Dietary Survey of Adults', *Eur J Clin Nutr*, vol. 47, no. 8, pp. 604-6.

Hill, RJ & Davies, PS 2001, 'The validity of self-reported energy intake as determined using the doubly labelled water technique', *Br J Nutr*, vol. 85, no. 4, pp. 415-30.

Hines, LM & Rimm, EB 2001, 'Moderate alcohol consumption and coronary heart disease: a review', *Postgrad Med J*, vol. 77, no. 914, pp. 747-52.

Hirai, N 1999, *Cultural Identify and Modernization in Asian Countries. Traditional cultures and modernization: Several problems in the case of Japan*, Institute for Japanese Culture and Classics, Kokugakuin University.

Hirvonen, T, Mannisto, S, Roos, E & Pietinen, P 1997, 'Increasing prevalence of underreporting does not necessarily distort dietary surveys', *European journal of clinical nutrition*, vol. 51, no. 5, pp. 297-301.

Horiuchi, S 2011, 'Major causes of the rapid longevity extension in postwar Japan', *The Japanese Journal of Population*, vol. 9, no. 1, pp. 162-71.

Hsu-Hage, BH, Ibiebele, T & Wahlqvist, ML 1995, 'Food intakes of adult Melbourne Chinese', *Aust J Public Health*, vol. 19, no. 6, pp. 623-8.

Hu, FB 2002, 'Dietary pattern analysis: a new direction in nutritional epidemiology', *Curr Opin Lipidol*, vol. 13, no. 1, pp. 3-9.

Hu, FB & Malik, VS 2010, 'Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence', *Physiol Behav*, vol. 100, no. 1, pp. 47-54.

Hu, FB, Rimm, EB, Stampfer, MJ, Ascherio, A, Spiegelman, D & Willett, WC 2000, 'Prospective study of major dietary patterns and risk of coronary heart disease in men', *Am J Clin Nutr*, vol. 72, no. 4, pp. 912-21.

Hu, FB & Willett, WC 2002, 'Optimal diets for prevention of coronary heart disease', *Jama*, vol. 288, no. 20, pp. 2569-78.

Hu, G, Eriksson, J, Barengo, NC, Lakka, TA, Valle, TT, Nissinen, A, Jousilahti, P & Tuomilehto, J 2004a, 'Occupational, commuting, and leisure-time physical activity in relation to total and cardiovascular mortality among Finnish subjects with type 2 diabetes', *Circulation*, vol. 110, no. 6, pp. 666-73.

Hu, G, Jousilahti, P, Antikainen, R & Tuomilehto, J 2007a, 'Occupational, commuting, and leisure-time physical activity in relation to cardiovascular mortality among finnish subjects with hypertension', *Am J Hypertens*, vol. 20, no. 12, pp. 1242-50.

Hu, G, Jousilahti, P, Borodulin, K, Barengo, NC, Lakka, TA, Nissinen, A & Tuomilehto, J 2007b, 'Occupational, commuting and leisure-time physical activity in relation to coronary heart disease among middle-aged Finnish men and women', *Atherosclerosis*, vol. 194, no. 2, pp. 490-7.

Hu, G, Sarti, C, Jousilahti, P, Silventoinen, K, Barengo, NC & Tuomilehto, J 2005, 'Leisure time, occupational, and commuting physical activity and the risk of stroke', *Stroke*, vol. 36, no. 9, pp. 1994-9.

Hu, G, Tuomilehto, J, Borodulin, K & Jousilahti, P 2007c, 'The joint associations of occupational, commuting, and leisure-time physical activity, and the Framingham risk score on the 10-year risk of coronary heart disease', *Eur Heart J*, vol. 28, no. 4, pp. 492-8.

Hu, G, Tuomilehto, J, Silventoinen, K, Barengo, N & Jousilahti, P 2004b, 'Joint effects of physical activity, body mass index, waist circumference and waist-to-hip ratio with the risk of cardiovascular disease among middle-aged Finnish men and women', *Eur Heart J*, vol. 25, no. 24, pp. 2212-9.

Huang, G, Wang, D, Zeb, I, Budoff, MJ, Harman, SM, Miller, V, Brinton, EA, El Khoudary, SR, Manson, JE, Sowers, MR, Hodis, HN, Merriam, GR, Cedars, MI, Taylor, HS, Naftolin, F, Lobo, RA, Santoro, N & Wildman, RP 2012, 'Intra-thoracic fat, cardiometabolic risk factors, and subclinical cardiovascular disease in healthy, recently menopausal women screened for the Kronos Early Estrogen Prevention Study (KEEPS)', *Atherosclerosis*, vol. 221, no. 1, pp. 198-205.

Hubert, HB, Feinleib, M, McNamara, PM & Castelli, WP 1983, 'Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study', *Circulation*, vol. 67, no. 5, pp. 968-77.

Ikehara, S, Iso, H, Date, C, Kikuchi, S, Watanabe, Y, Wada, Y, Inaba, Y & Tamakoshi, A 2009, 'Association of sleep duration with mortality from cardiovascular disease and other causes for Japanese men and women: the JACC study', *Sleep*, vol. 32, no. 3, pp. 295-301.

Ikehara, S, Iso, H, Toyoshima, H, Date, C, Yamamoto, A, Kikuchi, S, Kondo, T, Watanabe, Y, Koizumi, A, Wada, Y, Inaba, Y & Tamakoshi, A 2008, 'Alcohol consumption and mortality from stroke and coronary heart disease among Japanese men and women: the Japan collaborative cohort study', *Stroke*, vol. 39, no. 11, pp. 2936-42.

Index Mundi 2013, *Japan - Life expectancy at birth, male (years) in 1975 & Australia - Life expectancy at birth, male (years) in 1975*.

International Diabetes Institute 2000, *The Asia-Pacific Perspective: Redefining Obesity and its treatment*, A World Health Organization Collaborating Centre for the Epidemiology of Diabetes Mellitus and Health Promotion for Noncommunicable Diseases, Health Communications Australia, on behalf of the Steering Committee.

International Labour Organization 1993, 'World Labour Report', *Chapter 5. Stress at work*, pp. 65-76.

International Labour Organization 2013, 'Hours of work per week in non-agricultural activities. Labour Statistics Database 1999-2000.'

International Obesity Task Force 2005, *International Association for the Study of Obesity*. Retrieved 28 February 2006, from http://www.iotf.org/database/GlobalAdultsAugust2005.asp

International Society for the Advancement of Kinanthropometry 2001, *International Standards for Anthropometric Assessment*, International Society for the Advancement of Kinanthropometry.

International Union of Nutritional Sciences 2002, 'Obesity. The Global Challenge of Obesity and the International Obesity Task Force'.

Iqbal, R, Anand, S, Ounpuu, S, Islam, S, Zhang, X, Rangarajan, S, Chifamba, J, Al-Hinai, A, Keltai, M & Yusuf, S 2008, 'Dietary patterns and the risk of acute myocardial infarction in 52 countries: results of the INTERHEART study', *Circulation*, vol. 118, no. 19, pp. 1929-37.

Ishige, N 2001, *The History and Culture of Japanese Food*, Kegan Paul Limited, London, UK.

Ishihara, J, Sobue, T, Yamamoto, S, Yoshimi, I, Sasaki, S, Kobayashi, M, Takahashi, T, Iitoi, Y, Akabane, M & Tsugane, S 2003, 'Validity and reproducibility of a self-administered food frequency questionnaire in the JPHC Study Cohort II: study design, participant profile and results in comparison with Cohort I', *J Epidemiol*, vol. 13, no. 1 Suppl, pp. S134-47.

Ishiyama, IF & Kitayama, A 1994, 'Overwork and career-centered self-validation among the Japanese: Psychosocial issues and counselling implications', *International Journal for the Advancement of Counselling*, vol. 17, pp. 167-82.

Iso, H 2011, 'Lifestyle and cardiovascular disease in Japan', *J Atheroscler Thromb*, vol. 18, no. 2, pp. 83-8.

Iso, H, Baba, S, Mannami, T, Sasaki, S, Okada, K, Konishi, M & Tsugane, S 2004, 'Alcohol consumption and risk of stroke among middle-aged men: the JPHC Study Cohort I', *Stroke*, vol. 35, no. 5, pp. 1124-9.

Iso, H, Date, C, Yamamoto, A, Toyoshima, H, Watanabe, Y, Kikuchi, S, Koizumi, A, Wada, Y, Kondo, T, Inaba, Y & Tamakoshi, A 2005, 'Smoking cessation and mortality from cardiovascular disease among Japanese men and women: the JACC Study', *Am J Epidemiol*, vol. 161, no. 2, pp. 170-9.

Iso, H, Kiyama, M, Naito, Y, Sato, S, Kitamura, A, Iida, M, Konishi, M, Sankai, T, Shimamoto, T & Komachi, Y 1991, 'The relation of body fat distribution and body mass with haemoglobin A1c, blood pressure and blood lipids in urban Japanese men', *Int J Epidemiol*, vol. 20, no. 1, pp. 88-94.

Iso, H, Sato, S, Kitamura, A, Imano, H, Kiyama, M, Yamagishi, K, Cui, R, Tanigawa, T & Shimamoto, T 2007, 'Metabolic syndrome and the risk of ischemic heart disease and stroke among Japanese men and women', *Stroke*, vol. 38, no. 6, pp. 1744-51.

Item, F & Konrad, D 2012, 'Visceral fat and metabolic inflammation: the portal theory revisited', *Obes Rev*, vol. 13 Suppl 2, pp. 30-9.

Ito, H, Nakasuga, K, Ohshima, A, Maruyama, T, Kaji, Y, Harada, M, Fukunaga, M, Jingu, S & Sakamoto, M 2003, 'Detection of cardiovascular risk factors by indices of obesity obtained from anthropometry and dual-energy X-ray absorptiometry in Japanese individuals', *Int J Obes Relat Metab Disord*, vol. 27, no. 2, pp. 232-7.

Ito, H, Ohshima, A, Ohto, N, Ogasawara, M, Tsuzuki, M, Takao, K, Hijii, C, Tanaka, H & Nishioka, K 2001, 'Relation between body composition and age in healthy Japanese subjects', *Eur J Clin Nutr*, vol. 55, no. 6, pp. 462-70.

Iwasaki, K, Takahashi, M & Nakata, A 2006, 'Health problems due to long working hours in Japan: working hours, workers' compensation (Karoshi), and preventive measures', *Ind Health*, vol. 44, no. 4, pp. 537-40.

Jain, M, Howe, GR, Johnson, KC & Miller, AB 1980, 'Evaluation of a diet history questionnaire for epidemiologic studies', *Am J Epidemiol*, vol. 111, no. 2, pp. 212-9.

James, G & James, RC 1967, *Mathematics Dictionary*, Students edn, D. Van Nostrand Company (Canada), Ltd., Toronto.

James, WPT & Schofield, EC 1990, *Human Energy Requirements. A Manual for Planners and Nutritionists.*, Published by arrangement with the Food and Agriculture Organization of the United Nations. Oxford University Press., New York.

Japan Dietetic Association 1996, *Nutrition and Dietetics in Japan*, Seventh edn, Tokyo.

Jeon, KJ, Lee, O, Kim, HK & Han, SN 2011, 'Comparison of the dietary intake and clinical characteristics of obese and normal weight adults', *Nutr Res Pract*, vol. 5, no. 4, pp. 329-36.

Johansson, G, Wikman, A, Ahren, AM, Hallmans, G & Johansson, I 2001, 'Underreporting of energy intake in repeated 24-hour recalls related to gender, age, weight status, day of interview, educational level, reported food intake, smoking habits and area of living', *Public Health Nutr*, vol. 4, no. 4, pp. 919-27.

Johansson, L, Solvoll, K, Bjorneboe, GE & Drevon, CA 1998, 'Under- and overreporting of energy intake related to weight status and lifestyle in a nationwide sample', *Am J Clin Nutr*, vol. 68, no. 2, pp. 266-74.

Jousilahti, P, Tuomilehto, J, Vartiainen, E, Pekkanen, J & Puska, P 1996, 'Body weight, cardiovascular risk factors, and coronary mortality. 15-year follow-up of middle-aged men and women in eastern Finland', *Circulation*, vol. 93, no. 7, pp. 1372-9.

Kagawa, M, Binns, CB & Hills, AP 2007, 'Body composition and anthropometry in Japanese and Australian Caucasian males and Japanese females', *Asia Pac J Clin Nutr*, vol. 16 Suppl 1, pp. 31-6.

Kagawa, M, Saito, Y, Kerr, D, Uchida, H & Binns, CW 2006, 'Differences in nutrient intakes and physical activity levels of Japanese and Australian Caucasian males living in Australia and Japanese males living in Japan', *Asia Pac J Clin Nutr*, vol. 15, no. 2, pp. 208-16.

Kaiser, HF 1974, 'An index of factorial simplicity', *Psychometrika*, vol. 39, no. 1, pp. 31-6.

Kanazawa, M, Yoshiike, N, Osaka, T, Numba, Y, Zimmet, P & Inoue, S 2002, 'Criteria and classification of obesity in Japan and Asia-Oceania', *Asia Pac J Clin Nutr*, vol. 11 Suppl 8, pp. S732-7.

Kang, MY, Park, H, Seo, JC, Kim, D, Lim, YH, Lim, S, Cho, SH & Hong, YC 2012, 'Long working hours and cardiovascular disease: a meta-analysis of epidemiologic studies', *J Occup Environ Med*, vol. 54, no. 5, pp. 532-7.

Kant, AK 1996, 'Indexes of overall diet quality: a review', *J Am Diet Assoc*, vol. 96, no. 8, pp. 785-91.

Kant, AK 2004, 'Dietary patterns and health outcomes', *J Am Diet Assoc*, vol. 104, no. 4, pp. 615-35.

Katayama, A, Miyatake, N, Oda, K, Saito, T, Murakami, S & Sakano, N 2013, 'The relationship between income inequality and obesity in all 47 prefectures of Japan: Ecological study', *Open Journal of Epidemiology*, pp. 1-3.

Kato, M, Takahashi, Y, Inoue, M, Tsugane, S, Kadowaki, T & Noda, M 2008, 'Comparisons between anthropometric indices for predicting the metabolic syndrome in Japanese', *Asia Pac J Clin Nutr*, vol. 17, no. 2, pp. 223-8.

Kato, T 1994, 'The political economy of Japanese karoshi (death from overwork)', *Hitotsubashi journal of social studies*, vol. 26, pp. 41-54.

Kearney, J 2010, 'Food consumption trends and drivers', *Philos Trans R Soc Lond B Biol Sci*, vol. 365, no. 1554, pp. 2793-807.

Kellett, E, Smith, A & Schmerlaib, Y 1998, 'The Australian Guide to Healthy Eating. Background information for consumers', eds. Australian Government Department of Health and Ageing by the Children's Health Development Foundation, Women's and Children's Hospital (South Australia) & DUV Faculty of Health and Behavioural Science. Commonwealth of Australia.

Kengne, AP, Nakamura, K, Barzi, F, Lam, TH, Huxley, R, Gu, D, Patel, A, Kim, HC & Woodward, M 2009, 'Smoking, diabetes and cardiovascular diseases in men in the Asia Pacific region', *J Diabetes*, vol. 1, no. 3, pp. 173-81.

Kerver, JM, Yang, EJ, Bianchi, L & Song, WO 2003, 'Dietary patterns associated with risk factors for cardiovascular disease in healthy US adults', *Am J Clin Nutr*, vol. 78, no. 6, pp. 1103-10.

Khaw, KT, Jakes, R, Bingham, S, Welch, A, Luben, R, Day, N & Wareham, N 2006, 'Work and leisure time physical activity assessed using a simple, pragmatic, validated questionnaire and incident cardiovascular disease and all-cause mortality in men and women: The European Prospective Investigation into Cancer in Norfolk prospective population study', *Int J Epidemiol*, vol. 35, no. 4, pp. 1034-43.

Khaw, KT, Wareham, N, Bingham, S, Welch, A, Luben, R & Day, N 2008, *Combined impact of health behaviours and mortality in men and women: the EPIC-Norfolk prospective population study*, Jan 8. Retrieved 1, from http://www.plosmedicine.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pmed.0050012&representation=PDF

Killeen, PR 2005, 'An alternative to null-hypothesis significance tests', *Psychol Sci*, vol. 16, no. 5, pp. 345-53.

Kim, J & Jo, I 2011, 'Grains, vegetables, and fish dietary pattern is inversely associated with the risk of metabolic syndrome in South korean adults', *J Am Diet Assoc*, vol. 111, no. 8, pp. 1141-9.

Kim, MK, Sasaki, S, Sasazuki, S & Tsugane, S 2004a, 'Prospective study of three major dietary patterns and risk of gastric cancer in Japan', *Int J Cancer,* vol. 110, no. 3, pp. 435-42.

Kim, S, Haines, PS, Siega-Riz, AM & Popkin, BM 2003, 'The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States', *J Nutr,* vol. 133, no. 11, pp. 3476-84.

Kim, S, Moon, S & Popkin, BM 2000, 'The nutrition transition in South Korea', *Am J Clin Nutr,* vol. 71, no. 1, pp. 44-53.

Kim, S, Popkin, BM, Siega-Riz, AM, Haines, PS & Arab, L 2004b, 'A cross-national comparison of lifestyle between China and the United States, using a comprehensive cross-national measurement tool of the healthfulness of lifestyles: the Lifestyle Index', *Prev Med,* vol. 38, no. 2, pp. 160-71.

King, DE, Mainous, AG, 3rd, Carnemolla, M & Everett, CJ 2009, 'Adherence to healthy lifestyle habits in US adults, 1988-2006', *Am J Med,* vol. 122, no. 6, pp. 528-34.

Kitamura, A, Kiyama, M, Okada, T, Maeda, K, Ido, M, Nakamura, M, Shimamoto, T, Iida, M & Ishikawa, Y 2010, '[Trends in cardiovascular risk factors among urban Japanese male employees from 1977 to 2008]', *Sangyo Eiseigaku Zasshi,* vol. 52, no. 3, pp. 123-32.

Kitamura, A, Sato, S, Kiyama, M, Imano, H, Iso, H, Okada, T, Ohira, T, Tanigawa, T, Yamagishi, K, Nakamura, M, Konishi, M, Shimamoto, T, Iida, M & Komachi, Y 2008, 'Trends in the incidence of coronary heart disease and stroke and their risk factors in Japan, 1964 to 2003: the Akita-Osaka study', *J Am Coll Cardiol,* vol. 52, no. 1, pp. 71-9.

Kleiber, M 1947, 'Body size and metabolic rate', *Physiological Reviews,* vol. 27, no. 4, pp. 511-41.

Klesges, RC, Eck, LH & Ray, JW 1995, 'Who underreports dietary intake in a dietary recall? Evidence from the Second National health and Nutrition Examination Survey', *Journal of consulting and clinical psycology,* vol. 63, no. 3, pp. 438-44.

Ko, GT, So, WY, Chow, CC, Wong, PT, Tong, SD, Hui, SS, Kwok, R, Chan, A, Chan, CL & Chan, JC 2010, 'Risk associations of obesity with sugar-sweetened beverages and lifestyle factors in Chinese: the 'Better Health for

Better Hong Kong' health promotion campaign', *Eur J Clin Nutr*, vol. 64, no. 12, pp. 1386-92.

Kobayashi, H, Nakamura, T, Miyaoka, K, Nishida, M, Funahashi, T, Yamashita, S & Matsuzawa, Y 2001, 'Visceral fat accumulation contributes to insulin resistance, small-sized low-density lipoprotein, and progression of coronary artery disease in middle-aged non-obese Japanese men', *Jpn Circ J*, vol. 65, no. 3, pp. 193-9.

Kobayashi, S 1992, 'Trends in national nutritional survey of Japan', *Nutr Health*, vol. 8, no. 2-3, pp. 91-6.

Kodama, H, Kono, S, Todoroki, I, Honjo, S, Sakurai, Y, Wakabayashi, K, Nishiwaki, M, Hamada, H, Nishikawa, H, Koga, H, Ogawa, S & Nakagawa, K 1999, 'Gallstone disease risk in relation to body mass index and waist-to-hip ratio in Japanese men', *Int J Obes Relat Metab Disord*, vol. 23, no. 2, pp. 211-6.

Kolonel, LN, Hankin, JH, Nomura, AM & Chu, SY 1981, 'Dietary fat intake and cancer incidence among five ethnic groups in Hawaii', *Cancer Res*, vol. 41, no. 9 Pt 2, pp. 3727-8.

Kolonel, LN, Henderson, BE, Hankin, JH, Nomura, AM, Wilkens, LR, Pike, MC, Stram, DO, Monroe, KR, Earle, ME & Nagamine, FS 2000, 'A multiethnic cohort in Hawaii and Los Angeles: baseline characteristics', *Am J Epidemiol*, vol. 151, no. 4, pp. 346-57.

Koster, A, Leitzmann, MF, Schatzkin, A, Mouw, T, Adams, KF, van Eijk, JT, Hollenbeck, AR & Harris, TB 2008, 'Waist circumference and mortality', *Am J Epidemiol*, vol. 167, no. 12, pp. 1465-75.

Krebs-Smith, SM, Graubard, BI, Kahle, LL, Subar, AF, Cleveland, LE & Ballard-Barbash, R 2000, 'Low energy reporters vs others: a comparison of reported food intakes', *European journal of clinical nutrition*, vol. 54, no. 4, pp. 281-7.

Krebs-Smith, SM, Heimendinger, J, Subar, AF, Patterson, BH & Pivonka, E 1994, 'Estimating fruit and vegetable intake using food frequency questionnaires: a comparison of instruments', *The American journal of clinical nutrition*, vol. 59, no. 1, p. 283S.

Kroke, A, Klipstein-Grobusch, K, Voss, S, Moseneder, J, Thielecke, F, Noack, R & Boeing, H 1999, 'Validation of a self-administered food-frequency questionnaire administered in the European Prospective Investigation into Cancer and Nutrition (EPIC) Study: comparison of energy, protein, and macronutrient intakes estimated with the doubly labeled water, urinary nitrogen, and repeated 24-h dietary recall methods', *Am J Clin Nutr,* vol. 70, no. 4, pp. 439-47.

Kromhout, D 1983, 'Energy and macronutrient intake in lean and obese middle-aged men (the Zutphen study)', *Am J Clin Nutr,* vol. 37, no. 2, pp. 295-9.

Kuk, JL, Katzmarzyk, PT, Nichaman, MZ, Church, TS, Blair, SN & Ross, R 2006, 'Visceral fat is an independent predictor of all-cause mortality in men', *Obesity (Silver Spring),* vol. 14, no. 2, pp. 336-41.

Kvaavik, E, Batty, GD, Ursin, G, Huxley, R & Gale, CR 2010, 'Influence of individual and combined health behaviors on total and cause-specific mortality in men and women: the United Kingdom health and lifestyle survey', *Arch Intern Med,* vol. 170, no. 8, pp. 711-8.

Laatikainen, T, Alho, H, Vartiainen, E, Jousilahti, P, Sillanaukee, P & Puska, P 2002, 'Self-reported alcohol consumption and association to carbohydrate-deficient transferrin and gamma-glutamyltransferase in a random sample of the general population in the Republic of Karelia, Russia and in North Karelia, Finland', *Alcohol Alcohol,* vol. 37, no. 3, pp. 282-8.

Lafay, L, Basdevant, A, Charles, MA, Vyay, M, Balkau, B, Borys, JM, Eschwege, E & Romon, M 1997, 'Determinants and nature of dietary underreporting in a free-living population: the Fleurbaix Laventie Ville Sante (FLVS) Study', *International journal of obesity and related metabolic disorderes,* vol. 21, no. 7, pp. 567-73.

Lake, AA, Mathers, JC, Rugg-Gunn, AJ & Adamson, AJ 2006, 'Longitudinal change in food habits between adolescence (11-12 years) and adulthood (32-33 years): the ASH30 Study', *J Public Health (Oxf),* vol. 28, no. 1, pp. 10-6.

Lallukka, T, Lahelma, E, Rahkonen, O, Roos, E, Laaksonen, E, Martikainen, P, Head, J, Brunner, E, Mosdol, A, Marmot, M, Sekine, M, Nasermoaddeli, A & Kagamimori, S 2008, 'Associations of job strain and working overtime with adverse health behaviors and obesity: evidence from the Whitehall II Study, Helsinki Health Study, and the Japanese Civil Servants Study', *Soc Sci Med,* vol. 66, no. 8, pp. 1681-98.

Lamont-Brown, R 1993, 'Karoshi - A fatal export from Japan', *The contemporary review*, vol. 263, no. 1533, pp. 197-9.

Langsetmo, L, Poliquin, S, Hanley, DA, Prior, JC, Barr, S, Anastassiades, T, Towheed, T, Goltzman, D & Kreiger, N 2010, *Dietary patterns in Canadian men and women ages 25 and older: relationship to demographics, body mass index, and bone mineral density*. Retrieved 20, from http://www.biomedcentral.com/content/pdf/1471-2474-11-20.pdf

Larkin, FA, Metzner, HL, Thompson, FE, Flegal, KM & Guire, KE 1989, 'Comparison of estimated nutrient intakes by food frequency and dietary records in adults', *J Am Diet Assoc*, vol. 89, no. 2, pp. 215-23.

Lau, DC, Douketis, JD, Morrison, KM, Hramiak, IM, Sharma, AM & Ur, E 2007, '2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children [summary]', *Cmaj*, vol. 176, no. 8, pp. S1-13.

Laugesen, M 2009, 'Has smoking prevalence markedly decreased despite more cigarettes released for sale?' *N Z Med J*, vol. 122, no. 1290, pp. 76-82.

Lean, ME, Han, TS & Morrison, CE 1995, 'Waist circumference as a measure for indicating need for weight management', *Bmj*, vol. 311, no. 6998, pp. 158-61.

Lear, SA, James, PT, Ko, GT & Kumanyika, S 2010, 'Appropriateness of waist circumference and waist-to-hip ratio cutoffs for different ethnic groups', *Eur J Clin Nutr*, vol. 64, no. 1, pp. 42-61.

Lee, S, Harnack, L, Jacobs, DR, Jr., Steffen, LM, Luepker, RV & Arnett, DK 2007, 'Trends in diet quality for coronary heart disease prevention between 1980-1982 and 2000-2002: The Minnesota Heart Survey', *J Am Diet Assoc*, vol. 107, no. 2, pp. 213-22.

Li, Y, Yatsuya, H, Iso, H, Tamakoshi, K & Toyoshima, H 2010, 'Incidence of metabolic syndrome according to combinations of lifestyle factors among middle-aged Japanese male workers', *Prev Med*, vol. 51, no. 2, pp. 118-22.

Lichtman, SW, Pisarska, K, Berman, ER, Pestone, M, Dowling, H, Offenbacher, E, Weisel, H, Heshka, S, Matthews, DE & Heymsfield, SB 1992, 'Discrepancy between self-reported and actual caloric intake and exercise in obese subjects', *The New England journal of medicine*, vol. 327, no. 27, pp. 1893-8.

Lissner, L, Habicht, JP, Strupp, BJ, Levitsky, DA, Haas, JD & Roe, DA 1989, 'Body composition and energy intake: do overweight women overeat and underreport?' *Am J Clin Nutr*, vol. 49, no. 2, pp. 320-5.

Lissner, L & Heitmann, BL 1995, 'Dietary fat and obesity: evidence from epidemiology', *Eur J Clin Nutr*, vol. 49, no. 2, pp. 79-90.

Liu, Y, Tanaka, H & Fukuoka Heart Study Group 2002, 'Overtime work, insufficient sleep, and risk of non-fatal acute myocardial infarction in Japanese men', *Occup Environ Med*, vol. 59, no. 7, pp. 447-51.

Livingstone, MB & Black, AE 2003, 'Markers of the validity of reported energy intake', *The journal of nutrition*, vol. 133 Suppl 3, pp. 895S-920S.

Livingstone, MB, Prentice, AM, Strain, JJ, Coward, WA, Black, AE, Barker, ME, McKenna, PG & Whitehead, RG 1990, 'Accuracy of weighed dietary records in studies of diet and health', *Bmj*, vol. 300, no. 6726, pp. 708-12.

Loef, M & Walach, H 2012, 'The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis', *Prev Med*, vol. 55, no. 3, pp. 163-70.

Lyles, TE, 3rd, Desmond, R, Faulk, LE, Henson, S, Hubbert, K, Heimburger, DC & Ard, JD 2006, *Diet variety based on macronutrient intake and its relationship with body mass index*. Retrieved 3, from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1781268/?report=printable

Macdiarmid, J & Blundell, J 1998, 'Assessing dietary intake: Who, what and why of under-reporting', *Nutr Res Rev*, vol. 11, no. 2, pp. 231-53.

Macdiarmid, JI, Vail, A, Cade, JE & Blundell, JE 1998, 'The sugar-fat relationship revisited: differences in consumption between men and women of varying BMI', *Int J Obes Relat Metab Disord*, vol. 22, no. 11, pp. 1053-61.

MacLeod, CL 2006, *Multiethnic Australia. Its History and Future.*, McFarland & Company, Inc., North Carolina, USA.

Maclure, M 1993, 'Demonstration of deductive meta-analysis: ethanol intake and risk of myocardial infarction', *Epidemiol Rev*, vol. 15, no. 2, pp. 328-51.

Maitra, P & Sharma, A 2007, 'Does exercise reduce obesity? Evidence from Australia', *Centre for Health Economics. Research paper 2007 (20)*.

Makita, S, Onoda, T, Ohsawa, M, Tanaka, F, Segawa, T, Takahashi, T, Satoh, K, Itai, K, Tanno, K, Sakata, K, Omama, S, Yoshida, Y, Ishibashi, Y, Koyama, T, Kuribayashi, T, Ogasawara, K, Ogawa, A, Okayama, A & Nakamura, M

2012, 'Influence of mild-to-moderate alcohol consumption on cardiovascular diseases in men from the general population', *Atherosclerosis*, vol. 224, no. 1, pp. 222-7.

Malcher, G 2005, 'Men's health, GPs, and 'GPs4Men'', *Aust Fam Physician*, vol. 34, no. 1-2, pp. 21-3.

Malik, VS & Hu, FB 2012, 'Sweeteners and Risk of Obesity and Type 2 Diabetes: The Role of Sugar-Sweetened Beverages', *Curr Diab Rep*, pp. 195-203.

Malik, VS, Schulze, MB & Hu, FB 2006, 'Intake of sugar-sweetened beverages and weight gain: a systematic review', *Am J Clin Nutr*, vol. 84, no. 2, pp. 274-88.

Margetts, BM & Nelson, M 1997, *Design concepts in nutritional epidemiology (2nd Ed.)*, Oxford university press, Oxford.

Martinez-Ortiz, JA, Fung, TT, Baylin, A, Hu, FB & Campos, H 2006, 'Dietary patterns and risk of nonfatal acute myocardial infarction in Costa Rican adults', *Eur J Clin Nutr*, vol. 60, no. 6, pp. 770-7.

Maruyama, K, Iso, H, Date, C, Kikuchi, S, Watanabe, Y, Wada, Y, Inaba, Y & Tamakoshi, A 2013, 'Dietary patterns and risk of cardiovascular deaths among middle-aged Japanese: JACC Study', *Nutr Metab Cardiovasc Dis*, vol. 23, no. 6, pp. 519-27.

Maskarinec, G, Novotny, R & Tasaki, K 2000, 'Dietary patterns are associated with body mass index in multiethnic women', *J Nutr*, vol. 130, no. 12, pp. 3068-72.

Mason, C & Katzmarzyk, PT 2009, 'Variability in waist circumference measurements according to anatomic measurement site', *Obesity (Silver Spring)*, vol. 17, no. 9, pp. 1789-95.

Mathers, CD & Loncar, D 2006, 'Projections of global mortality and burden of disease from 2002 to 2030', *PLoS Med*, vol. 3, no. 11, pp. 2011-30.

Matsumura, Y 2001, 'Nutrition trends in Japan.' *Asia Pacific Journal of Clinical Nutrition*, vol. 10 (Suppl.), pp. S40-S7.

Matsushita, Y, Tomita, K, Yokoyama, T & Mizoue, T 2010, 'Relations between waist circumference at four sites and metabolic risk factors', *Obesity (Silver Spring)*, vol. 18, no. 12, pp. 2374-8.

Maynard, M, Gunnell, D, Ness, AR, Abraham, L, Bates, CJ & Blane, D 2006, 'What influences diet in early old age? Prospective and cross-sectional analyses of the Boyd Orr cohort', *Eur J Public Health*, vol. 16, no. 3, pp. 316-24.

McCullough, ML, Feskanich, D, Rimm, EB, Giovannucci, EL, Ascherio, A, Variyam, JN, Spiegelman, D, Stampfer, MJ & Willett, WC 2000, 'Adherence to the Dietary Guidelines for Americans and risk of major chronic disease in men', *Am J Clin Nutr*, vol. 72, no. 5, pp. 1223-31.

McCurry, J 2007, 'Japan battles with obesity', *Lancet*, vol. 369, no. 9560, pp. 451-2.

McGowan, MJ, Harrington, KE, Kiely, M, Robson, PJ, Livingstone, MB & Gibney, MJ 2001, 'An evaluation of energy intakes and the ratio of energy intake to estimated basal metabolic rate (EI/BMRest) in the North/South Ireland Food Consumption Survey', *Public Health Nutr*, vol. 4, no. 5A, pp. 1043-50.

McMichael, AJ 2005, 'Integrating nutrition with ecology: balancing the health of humans and biosphere', *Public Health Nutr*, vol. 8, no. 6A, pp. 706-15.

McNaughton, SA, Mishra, GD & Brunner, EJ 2008, 'Dietary patterns, insulin resistance, and incidence of type 2 diabetes in the Whitehall II Study', *Diabetes Care*, vol. 31, no. 7, pp. 1343-8.

McNaughton, SA, Mishra, GD, Stephen, AM & Wadsworth, ME 2007, 'Dietary patterns throughout adult life are associated with body mass index, waist circumference, blood pressure, and red cell folate', *J Nutr*, vol. 137, no. 1, pp. 99-105.

McNeill, AM, Rosamond, WD, Girman, CJ, Golden, SH, Schmidt, MI, East, HE, Ballantyne, CM & Heiss, G 2005, 'The metabolic syndrome and 11-year risk of incident cardiovascular disease in the atherosclerosis risk in communities study', *Diabetes Care*, vol. 28, no. 2, pp. 385-90.

Megnien, JL, Denarie, N, Cocaul, M, Simon, A & Levenson, J 1999, 'Predictive value of waist-to-hip ratio on cardiovascular risk events', *Int J Obes Relat Metab Disord*, vol. 23, no. 1, pp. 90-7.

Melby, MK & Takeda, W 2013, 'Lifestyle constraints, not inadequate nutrition education, cause gap between breakfast ideals and realities among Japanese in Tokyo', *Appetite*.

Mendez, MA, Popkin, BM, Buckland, G, Schroder, H, Amiano, P, Barricarte, A, Huerta, JM, Quiros, JR, Sanchez, MJ & Gonzalez, CA 2011, 'Alternative methods of accounting for underreporting and overreporting when measuring dietary intake-obesity relations', *Am J Epidemiol*, vol. 173, no. 4, pp. 448-58.

Mendez, MA, Wynter, S, Wilks, R & Forrester, T 2004, 'Under- and overreporting of energy is related to obesity, lifestyle factors and food group intakes in Jamaican adults', *Public Health Nutr,* vol. 7, no. 1, pp. 9-19.

Mifflin, MD, St Jeor, ST, Hill, LA, Scott, BJ, Daugherty, SA & Koh, YO 1990, 'A new predictive equation for resting energy expenditure in healthy individuals', *Am J Clin Nutr,* vol. 51, no. 2, pp. 241-7.

Mikkila, V, Rasanen, L, Raitakari, OT, Pietinen, P & Viikari, J 2005, 'Consistent dietary patterns identified from childhood to adulthood: the cardiovascular risk in Young Finns Study', *Br J Nutr,* vol. 93, no. 6, pp. 923-31.

Millen, AE, Tooze, JA, Subar, AF, Kahle, LL, Schatzkin, A & Krebs-Smith, SM 2009, 'Differences between food group reports of low-energy reporters and non-low-energy reporters on a food frequency questionnaire', *J Am Diet Assoc,* vol. 109, no. 7, pp. 1194-203.

Mineharu, Y, Koizumi, A, Wada, Y, Iso, H, Watanabe, Y, Date, C, Yamamoto, A, Kikuchi, S, Inaba, Y, Toyoshima, H, Kondo, T & Tamakoshi, A 2011, 'Coffee, green tea, black tea and oolong tea consumption and risk of mortality from cardiovascular disease in Japanese men and women', *J Epidemiol Community Health,* vol. 65, no. 3, pp. 230-40.

Ministry of Health and Welfare 1975, *Recommended dietary allowances for the Japanese, revision in 1975. (in Japanese)*, Ministry of Health and Welfare, Tokyo. p. 23-48.

Ministry of Health and Welfare 1996, *Recommended Dietary Allowances for the Japanese, Fifth Revision (1994),* Dai-ichi Shuppan, Tokyo.

Ministry of Health Labour and Welfare 2001, *Annual Report of the National Nutrition Survey in 1999.,* Daiichi-Shuppan Co., Ltd. (in Japanese), Tokyo.

Ministry of Health Labour and Welfare 2005, *Dietary Reference Intakes for Japanese, 2005 (in Japanese),* Daiichi shuppan, Tokyo.

Ministry of Health Labour and Welfare 2006, *The National Health and Nutrition Survey in Japan, 2003.,* Daiichi-Shuppan, Co., Ltd. (in Japanese), Tokyo.

Ministry of Health Labour and Welfare 2007, *Jinkou doutai toukei geppo (gaisuu), Heisei 18nen 8gatsu bun,* from http://www.mhlw.go.jp/toukei/saikin/hw/jinkou/geppo/m2006/08.html

Ministry of Health Labour and Welfare 2011a, 'Handbook of health and welfare statistics 2011. Chapter 2 Vital statistics'.

Ministry of Health Labour and Welfare 2011b, *The National Health and Nutrition Survey in Japan 2011*.

Mishra, GD, McNaughton, SA, Bramwell, GD & Wadsworth, ME 2006, 'Longitudinal changes in dietary patterns during adult life', *Br J Nutr*, vol. 96, no. 4, pp. 735-44.

Miyoshi, M, Tsuboyama-Kasaoka, N & Nishi, N 2012, 'School-based "Shokuiku" program in Japan: application to nutrition education in Asian countries', *Asia Pac J Clin Nutr*, vol. 21, no. 1, pp. 159-62.

Mizoue, T, Yamaji, T, Tabata, S, Yamaguchi, K, Ogawa, S, Mineshita, M & Kono, S 2006, 'Dietary patterns and glucose tolerance abnormalities in Japanese men', *J Nutr*, vol. 136, no. 5, pp. 1352-8.

Mizoue, T, Yamaji, T, Tabata, S, Yamaguchi, K, Shimizu, E, Mineshita, M, Ogawa, S & Kono, S 2005, 'Dietary patterns and colorectal adenomas in Japanese men: the Self-Defense Forces Health Study', *Am J Epidemiol*, vol. 161, no. 4, pp. 338-45.

Morien, D 2007, *Business Statistics*, Thomson, Melbourne, Australia.

Mukamal, KJ, Ascherio, A, Mittleman, MA, Conigrave, KM, Camargo, CA, Jr., Kawachi, I, Stampfer, MJ, Willett, WC & Rimm, EB 2005, 'Alcohol and risk for ischemic stroke in men: the role of drinking patterns and usual beverage', *Ann Intern Med*, vol. 142, no. 1, pp. 11-9.

Mukamal, KJ, Chiuve, SE & Rimm, EB 2006, 'Alcohol consumption and risk for coronary heart disease in men with healthy lifestyles', *Arch Intern Med*, vol. 166, no. 19, pp. 2145-50.

Mukamal, KJ & Rimm, EB 2001, 'Alcohol's effects on the risk for coronary heart disease', *Alcohol Res Health*, vol. 25, no. 4, pp. 255-61.

Murakami, K 2004, 'Critical examination of reported energy intake in published dietary studies of Japanese subjects using the Goldberg cut-off', *J Nutr Sci Vitaminol (Tokyo)*, vol. 50, no. 3, pp. 165-70.

Murray, CJ 2011, 'Why is Japanese life expectancy so high?' *Lancet*, vol. 378, no. 9797, pp. 1124-5.

Myint, PK, Luben, RN, Wareham, NJ, Bingham, SA & Khaw, KT 2009, *Combined effect of health behaviours and risk of first ever stroke in 20,040 men and women over 11 years' follow-up in Norfolk cohort of European Prospective Investigation of Cancer (EPIC Norfolk): prospective population study*, from http://www.bmj.com.dbgw.lis.curtin.edu.au/content/338/bmj.b349.pdf%2Bhtml

Nagashima, S, Suwazono, Y, Okubo, Y, Uetani, M, Kobayashi, E, Kido, T & Nogawa, K 2007, 'Working hours and mental and physical fatigue in Japanese workers', *Occup Med (Lond)*, vol. 57, no. 6, pp. 449-52.

Nagura, J, Iso, H, Watanabe, Y, Maruyama, K, Date, C, Toyoshima, H, Yamamoto, A, Kikuchi, S, Koizumi, A, Kondo, T, Wada, Y, Inaba, Y & Tamakoshi, A 2009, 'Fruit, vegetable and bean intake and mortality from cardiovascular disease among Japanese men and women: the JACC Study', *Br J Nutr*, vol. 102, no. 2, pp. 285-92.

Naja, F, Nasreddine, L, Itani, L, Chamieh, MC, Adra, N, Sibai, AM & Hwalla, N 2011, 'Dietary patterns and their association with obesity and sociodemographic factors in a national sample of Lebanese adults', *Public Health Nutr*, vol. 14, no. 9, pp. 1570-8.

Nakamura, K, Barzi, F, Lam, TH, Huxley, R, Feigin, VL, Ueshima, H, Woo, J, Gu, D, Ohkubo, T, Lawes, CM, Suh, I & Woodward, M 2008, 'Cigarette smoking, systolic blood pressure, and cardiovascular diseases in the Asia-Pacific region', *Stroke*, vol. 39, no. 6, pp. 1694-702.

Nakamura, Y, Turin, TC, Kita, Y, Tamaki, S, Tsujita, Y, Kadowaki, T, Murakami, Y, Okamura, T & Ueshima, H 2007, 'Associations of obesity measures with metabolic risk factors in a community-based population in Japan', *Circ J*, vol. 71, no. 5, pp. 776-81.

Nakanishi, N, Yoshida, H, Nagano, K, Kawashimo, H, Nakamura, K & Tatara, K 2001, 'Long working hours and risk for hypertension in Japanese male white collar workers', *J Epidemiol Community Health*, vol. 55, no. 5, pp. 316-22.

Nakatsuka, H, Satoh, H, Watanabe, T, Yamamoto, R, Satoh, R, Imai, Y, Abe, K & Ikeda, M 1999, 'Poorer nutritional status of the older-generation in a Japanese farming village, as related to fewer types of food consumed', *Public Health*, vol. 113, no. 5, pp. 251-3.

Nanri, H, Nakamura, K, Hara, M, Higaki, Y, Imaizumi, T, Taguchi, N, Sakamoto, T, Horita, M, Shinchi, K & Tanaka, K 2011, 'Association between dietary pattern and serum C-reactive protein in Japanese men and women', *J Epidemiol*, vol. 21, no. 2, pp. 122-31.

National Academy of Sciences 1989, *Recommended Dietary Allowances. Subcommittee on the Tenth Edition of the RDAs, Food and Nutrition Board, Commission on Life Sciences, National Research Council.*, 10th edn, National Academy Press, Washington, D.C.

National Academy of Sciences 2005, *Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids*, The National Academies Press, Washington, D.C., USA.

National Health and Medical Research Council 2004, *Department of Health and Aging - Clinical Practice Guidelines for the Management of Overweight and Obesity in Adults. 3. Measuring overweight and obesity*, Canberra.

National Heart Foundation of Australia 1983, *National Heart Foundation Risk Factor Prevalence Study Report No 2.*, Canberra.

National Heart Foundation of Australia 1990, *Risk Factor Prevalence Study Management Committee. Risk Factor Prevalence Study: Survey No 3 1989. National Heart Foundation of Australia and Australian Institute of Health*, Canberra.

National Men's Health Week 2005 Policy Report 2005, *Hazardous waist?. Tackling the epidemic of excess weight in men*.

Nazmi, A & Monteiro, C 2013, 'The nutrition transition: the same, but different', *Public Health Nutr*, vol. 16, no. 4, pp. 571-2.

Nettleton, JA, Steffen, LM, Mayer-Davis, EJ, Jenny, NS, Jiang, R, Herrington, DM & Jacobs, DR, Jr. 2006, 'Dietary patterns are associated with biochemical markers of inflammation and endothelial activation in the Multi-Ethnic Study of Atherosclerosis (MESA)', *Am J Clin Nutr*, vol. 83, no. 6, pp. 1369-79.

Nettleton, JA, Steffen, LM, Ni, H, Liu, K & Jacobs, DR, Jr. 2008, 'Dietary patterns and risk of incident type 2 diabetes in the Multi-Ethnic Study of Atherosclerosis (MESA)', *Diabetes Care*, vol. 31, no. 9, pp. 1777-82.

Neuhouser, ML, Di, C, Tinker, LF, Thomson, C, Sternfeld, B, Mossavar-Rahmani, Y, Stefanick, ML, Sims, S, Curb, JD, Lamonte, M, Seguin, R, Johnson, KC & Prentice, RL 2013, 'Physical Activity Assessment: Biomarkers and Self-Report of Activity-Related Energy Expenditure in the WHI', *Am J Epidemiol*, vol. 177, no. 6, pp. 576-85.

Newby, PK, Muller, D, Hallfrisch, J, Andres, R & Tucker, KL 2004, 'Food patterns measured by factor analysis and anthropometric changes in adults', *Am J Clin Nutr,* vol. 80, no. 2, pp. 504-13.

Newby, PK, Muller, D, Hallfrisch, J, Qiao, N, Andres, R & Tucker, KL 2003, 'Dietary patterns and changes in body mass index and waist circumference in adults', *Am J Clin Nutr,* vol. 77, no. 6, pp. 1417-25.

Newby, PK & Tucker, KL 2004, 'Empirically derived eating patterns using factor or cluster analysis: a review', *Nutr Rev,* vol. 62, no. 5, pp. 177-203.

NHK Overseas Broadcasting Department, EP 1995, *A Bilingual Guide to the Japanese Economy,* Kodansha International Ltd, Tokyo.

Nishida, C, Shetty, P & Uauy, R 2004, 'The Nutrition Society, Introduction', *Public Health Nutrition,* vol. 7, no. Number 1 Supplement 1001, pp. 7(1A), 99-100.

Nishimura, R, Nakagami, T, Tominaga, M, Yoshiike, N & Tajima, N 2007, 'Prevalence of metabolic syndrome and optimal waist circumference cut-off values in Japan', *Diabetes Res Clin Pract,* vol. 78, no. 1, pp. 77-84.

Nishitani, N & Sakakibara, H 2007, 'Relationship of BMI increase to eating behavior and job stress in a 2-year cohort study of non-obese male Japanese workers', *Obesity Research and Clinical Practice,* vol. 1, pp. 179-85.

Nishiyama, K & Johnson, JV 1997, 'Lean production and health: The case of Japan. Karoshi - Death from overwork: Occupational health consequences of Japanese production management', *International Journal of Health Services,* vol. 27, no. 4, pp. 625-41.

Nkondjock, A, Krewski, D, Johnson, KC & Ghadirian, P 2005, 'Dietary patterns and risk of pancreatic cancer', *Int J Cancer,* vol. 114, no. 5, pp. 817-23.

Noda, H, Iso, H, Toyoshima, H, Date, C, Yamamoto, A, Kikuchi, S, Koizumi, A, Kondo, T, Watanabe, Y, Wada, Y, Inaba, Y & Tamakoshi, A 2005, 'Walking and sports participation and mortality from coronary heart disease and stroke', *J Am Coll Cardiol,* vol. 46, no. 9, pp. 1761-7.

Nothlings, U, Wilkens, LR, Murphy, SP, Hankin, JH, Henderson, BE & Kolonel, LN 2007, 'Body mass index and physical activity as risk factors for pancreatic cancer: the Multiethnic Cohort Study', *Cancer Causes Control,* vol. 18, no. 2, pp. 165-75.

Novotny, JA, Rumpler, WV, Riddick, H, Hebert, JR, Rhodes, D, Judd, JT, Baer, DJ, McDowell, M & Briefel, R 2003, 'Personality characteristics as predictors of underreporting of energy intake on 24-hour dietary recall interviews', *J Am Diet Assoc*, vol. 103, no. 9, pp. 1146-51.

NSW Government & Health Statistics New South Wales 2010, 'International rankings of life expectancy. Life expectancy in the highest ranking and selected other WHO countries by sex, 2010', vol. Version 1.10.2n.

Oba, S, Nagata, C, Nakamura, K, Takatsuka, N & Shimizu, H 2008, 'Self-reported diabetes mellitus and risk of mortality from all causes, cardiovascular disease, and cancer in Takayama: a population-based prospective cohort study in Japan', *J Epidemiol*, vol. 18, no. 5, pp. 197-203.

Ocke, MC, Bueno-de-Mesquita, HB, Pols, MA, Smit, HA, van Staveren, WA & Kromhout, D 1997, 'The Dutch EPIC food frequency questionnaire. II. Relative validity and reproducibility for nutrients', *International journal of epidemiology*, vol. 26, no. Suppl 1, pp. S49-58.

Odegaard, AO, Choh, AC, Czerwinski, SA, Towne, B & Demerath, EW 2012, 'Sugar-sweetened and diet beverages in relation to visceral adipose tissue', *Obesity (Silver Spring)*, vol. 20, no. 3, pp. 689-91.

Odegaard, AO, Koh, WP, Butler, LM, Duval, S, Gross, MD, Yu, MC, Yuan, JM & Pereira, MA 2011a, 'Dietary patterns and incident type 2 diabetes in chinese men and women: the singapore chinese health study', *Diabetes Care*, vol. 34, no. 4, pp. 880-5.

Odegaard, AO, Koh, WP, Gross, MD, Yuan, JM & Pereira, MA 2011b, 'Combined lifestyle factors and cardiovascular disease mortality in Chinese men and women: the Singapore Chinese health study', *Circulation*, vol. 124, no. 25, pp. 2847-54.

Odermatt, A 2011, 'The Western-style diet: a major risk factor for impaired kidney function and chronic kidney disease', *Am J Physiol Renal Physiol*, vol. 301, no. 5, pp. F919-31.

Okubo, H, Murakami, K, Sasaki, S, Kim, MK, Hirota, N, Notsu, A, Fukui, M & Date, C 2010, 'Relative validity of dietary patterns derived from a self-administered diet history questionnaire using factor analysis among Japanese adults', *Public Health Nutrition*, vol. 13, no. 7, pp. 1080-9.

Okubo, H & Sasaki, S 2004, 'Underreporting of energy intake among Japanese women aged 18-20 years and its association with reported nutrient and food group intakes', *Public Health Nutr*, vol. 7, no. 7, pp. 911-7.

Okubo, H, Sasaki, S, Hirota, N, Notsu, A, Todoriki, H, Miura, A, Fukui, M & Date, C 2006, 'The influence of age and body mass index on relative accuracy of energy intake among Japanese adults', *Public Health Nutr,* vol. 9, no. 5, pp. 651-7.

Okubo, H, Sasaki, S, Rafamantanantsoa, HH, Ishikawa-Takata, K, Okazaki, H & Tabata, I 2008, 'Validation of self-reported energy intake by a self-administered diet history questionnaire using the doubly labeled water method in 140 Japanese adults', *European journal of clinical nutrition,* vol. 62, no. 11, pp. 1343-50.

Olsen, O & Kristensen, TS 1991, 'Impact of work environment on cardiovascular diseases in Denmark', *J Epidemiol Community Health,* vol. 45, no. 1, pp. 4-9; discussion -10.

Organisation for Economic Cooperation and Development 2010, 'International comparisons of obesity prevalence. Adult obesity prevalence trend data.' 10/04/2011.

Organisation for Economic Cooperation and Development 2013a, 'OECD. StatExtracts. Average annual hours actually worked per worker'.

Organisation for Economic Cooperation and Development 2013b, 'OECD. StatExtracts. Average usual weekly hours worked on the main job'.

Organization for Economic Cooperation and Development 2005, 'OECD Health statistics, Obesity (most recent) by country'.

Osler, M, Heitmann, BL, Gerdes, LU, Jorgensen, LM & Schroll, M 2001, 'Dietary patterns and mortality in Danish men and women: a prospective observational study', *Br J Nutr,* vol. 85, no. 2, pp. 219-25.

Osler, M, Helms Andreasen, A, Heitmann, B, Hoidrup, S, Gerdes, U, Morch Jorgensen, L & Schroll, M 2002, 'Food intake patterns and risk of coronary heart disease: a prospective cohort study examining the use of traditional scoring techniques', *Eur J Clin Nutr,* vol. 56, no. 7, pp. 568-74.

Otani, T, Iwasaki, M, Yamamoto, S, Sobue, T, Hanaoka, T, Inoue, M & Tsugane, S 2003, 'Alcohol consumption, smoking, and subsequent risk of colorectal cancer in middle-aged and elderly Japanese men and women: Japan Public Health Center-based prospective study', *Cancer Epidemiol Biomarkers Prev,* vol. 12, no. 12, pp. 1492-500.

Otsuka, R, Tamakoshi, K, Yatsuya, H, Murata, C, Sekiya, A, Wada, K, Zhang, HM, Matsushita, K, Sugiura, K, Takefuji, S, OuYang, P, Nagasawa, N, Kondo, T, Sasaki, S & Toyoshima, H 2006, 'Eating fast leads to obesity: findings based on self-administered questionnaires among middle-aged Japanese men and women', *J Epidemiol,* vol. 16, no. 3, pp. 117-24.

Owen, OE, Holup, JL, D'Alessio, DA, Craig, ES, Polansky, M, Smalley, KJ, Kavle, EC, Bushman, MC, Owen, LR, Mozzoli, MA & et al. 1987, 'A reappraisal of the caloric requirements of men', *Am J Clin Nutr,* vol. 46, no. 6, pp. 875-85.

Owen, OE, Kavle, E, Owen, RS, Polansky, M, Caprio, S, Mozzoli, MA, Kendrick, ZV, Bushman, MC & Boden, G 1986, 'A reappraisal of caloric requirements in healthy women', *Am J Clin Nutr,* vol. 44, no. 1, pp. 1-19.

Pai, JK, Mukamal, KJ & Rimm, EB 2012, 'Long-term alcohol consumption in relation to all-cause and cardiovascular mortality among survivors of myocardial infarction: the Health Professionals Follow-up Study', *Eur Heart J,* vol. 33, no. 13, pp. 1598-605.

Pan, YL, Dixon, Z, Himburg, S & Huffman, F 1999, 'Asian students change their eating patterns after living in the United States', *J Am Diet Assoc,* vol. 99, no. 1, pp. 54-7.

Panagiotakos, D, Pitsavos, C, Chrysohoou, C, Palliou, K, Lentzas, I, Skoumas, I & Stefanadis, C 2009, 'Dietary patterns and 5-year incidence of cardiovascular disease: a multivariate analysis of the ATTICA study', *Nutr Metab Cardiovasc Dis,* vol. 19, no. 4, pp. 253-63.

Panagiotakos, DB, Pitsavos, C, Skoumas, Y & Stefanadis, C 2007, 'The association between food patterns and the metabolic syndrome using principal components analysis: The ATTICA Study', *J Am Diet Assoc,* vol. 107, no. 6, pp. 979-87; quiz 97.

Panagiotakos, DB, Pitsavos, C & Stefanadis, C 2006, 'Dietary patterns: a Mediterranean diet score and its relation to clinical and biological markers of cardiovascular disease risk', *Nutr Metab Cardiovasc Dis,* vol. 16, no. 8, pp. 559-68.

Paradis, AM, Godin, G, Perusse, L & Vohl, MC 2009, 'Associations between dietary patterns and obesity phenotypes', *Int J Obes (Lond),* vol. 33, no. 12, pp. 1419-26.

Park, S, Onufrak, S, Blanck, HM & Sherry, B 2013, 'Characteristics associated with consumption of sports and energy drinks among US adults: National Health Interview Survey, 2010', *J Acad Nutr Diet*, vol. 113, no. 1, pp. 112-9.

Pepys, MB & Hirschfield, GM 2003, 'C-reactive protein: a critical update', *J Clin Invest*, vol. 111, no. 12, pp. 1805-12.

Phillips, CV 1999, 'Complex systems model of dietary choice with implications for improving diets and promoting vegetarianism', *Am J Clin Nutr*, vol. 70, no. 3 Suppl, pp. 608S-14S.

Pi-Sunyer, FX 2000, 'Obesity: criteria and classification', *Proc Nutr Soc*, vol. 59, no. 4, pp. 505-9.

Piers, LS, Diffey, B, Soares, MJ, Frandsen, SL, McCormack, LM, Lutschini, MJ & O'Dea, K 1997, 'The validity of predicting the basal metabolic rate of young Australian men and women', *Eur J Clin Nutr*, vol. 51, no. 5, pp. 333-7.

Pietinen, P, Hartman, AM, Haapa, E, Rasanen, L, Haapakoski, J, Palmgren, J, Albanes, D, Virtamo, J & Huttunen, JK 1988, 'Reproducibility and validity of dietary assessment instruments. I. A self-administered food use questionnaire with a portion size picture booklet', *Am J Epidemiol*, vol. 128, no. 3, pp. 655-66.

Pijls, LT, Vries, H, Donker, AJ & van Eijk, JT 1999, 'Reproducibility and biomarker-based validity and responsiveness of a food frequency questionnaire to estimate protein intake', *American journal of epidemiology*, vol. 150, no. 9, pp. 987-95.

Pisani, P, Faggiano, F, Krogh, V, Palli, D, Vineis, P & Berrino, F 1997, 'Relative validity and reproducibility of a food frequency dietary questionnaire for use in the Italian EPIC centres', *International journal of epidemiology*, vol. 26, no. Suppl 1, pp. S152-60.

Pischon, T, Boeing, H, Hoffmann, K, Bergmann, M, Schulze, MB, Overvad, K, van der Schouw, YT, Spencer, E, Moons, KG, Tjonneland, A, Halkjaer, J, Jensen, MK, Stegger, J, Clavel-Chapelon, F, Boutron-Ruault, MC, Chajes, V, Linseisen, J, Kaaks, R, Trichopoulou, A, Trichopoulos, D, Bamia, C, Sieri, S, Palli, D, Tumino, R, Vineis, P, Panico, S, Peeters, PH, May, AM, Bueno-de-Mesquita, HB, van Duijnhoven, FJ, Hallmans, G, Weinehall, L, Manjer, J, Hedblad, B, Lund, E, Agudo, A, Arriola, L, Barricarte, A, Navarro, C, Martinez, C, Quiros, JR, Key, T, Bingham, S, Khaw, KT, Boffetta, P, Jenab, M, Ferrari, P & Riboli, E 2008, 'General and abdominal adiposity and risk of death in Europe', *N Engl J Med*, vol. 359, no. 20, pp. 2105-20.

Popkin, BM 2001, 'Nutrition in transition: the changing global nutrition challenge', *Asia Pac J Clin Nutr*, vol. 10 Suppl, pp. S13-8.

Popkin, BM 2006a, 'Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases', *Am J Clin Nutr*, vol. 84, no. 2, pp. 289-98.

Popkin, BM 2006b, 'Technology, transport, globalization and the nutrition transition food policy', *Food Policy*, pp. 554-69.

Popkin, BM, Duffey, K & Gordon-Larsen, P 2005, 'Environmental influences on food choice, physical activity and energy balance', *Physiol Behav*, vol. 86, no. 5, pp. 603-13.

Pradhan, AD, Manson, JE, Rifai, N, Buring, JE & Ridker, PM 2001, 'C-reactive protein, interleukin 6, and risk of developing type 2 diabetes mellitus', *Jama*, vol. 286, no. 3, pp. 327-34.

Pronk, NP, Anderson, LH, Crain, AL, Martinson, BC, O'Connor, PJ, Sherwood, NE & Whitebird, RR 2004, 'Meeting recommendations for multiple healthy lifestyle factors. Prevalence, clustering, and predictors among adolescent, adult, and senior health plan members', *Am J Prev Med*, vol. 27, no. 2 Suppl, pp. 25-33.

Pryer, JA, Nichols, R, Elliott, P, Thakrar, B, Brunner, E & Marmot, M 2001, 'Dietary patterns among a national random sample of British adults', *J Epidemiol Community Health*, vol. 55, no. 1, pp. 29-37.

Pryer, JA, Vrijheid, M, Nichols, R, Kiggins, M & Elliott, P 1997, 'Who are the 'low energy reporters' in the dietary and nutritional survey of British adults?' *International journal of epidemiology*, vol. 26, no. 1, pp. 146-54.

Quatromoni, PA, Copenhafer, DL, D'Agostino, RB & Millen, BE 2002, 'Dietary patterns predict the development of overweight in women: The Framingham Nutrition Studies', *J Am Diet Assoc*, vol. 102, no. 9, pp. 1239-46.

Raggatt, PT & Morrissey, SA 1997, 'A field study of stress and fatigue in long-distance bus drivers', *Behav Med*, vol. 23, no. 3, pp. 122-9.

Rangan, AM, Schindeler, S, Hector, DJ, Gill, TP & Webb, KL 2009, 'Consumption of 'extra' foods by Australian adults: types, quantities and contribution to energy and nutrient intakes', *Eur J Clin Nutr*, vol. 63, no. 7, pp. 865-71.

Rath, EC 2010, *Food and fantasy in early modern Japan*, Berkeley: University of California Press.

Reich, MR, Ikegami, N, Shibuya, K & Takemi, K 2011, '50 years of pursuing a healthy society in Japan', *Lancet*, vol. 378, no. 9796, pp. 1051-3.

Reischauer, EO & Craig, AM 1979, *Japan, tradition & transformation.*, George Allen & Unwin Australia Pty Ltd., Sydney.

Rennie, KL, Siervo, M & Jebb, SA 2006, 'Can self-reported dieting and dietary restraint identify underreporters of energy intake in dietary surveys?' *Journal of the American dietetic association*, vol. 106, no. 10, pp. 1667-72.

Riddell, R 1994, *Food and Culture in Australia*, Longman Cheshire Pty Ltd., Melbourne, Australia.

Ridker, PM 2003, 'Clinical application of C-reactive protein for cardiovascular disease detection and prevention', *Circulation*, vol. 107, no. 3, pp. 363-9.

Rimm, EB, Stampfer, MJ, Colditz, GA, Chute, CG, Litin, LB & Willett, WC 1990, 'Validity of self-reported waist and hip circumferences in men and women', *Epidemiology*, vol. 1, no. 6, pp. 466-73.

Rolls, BJ, Fedoroff, IC & Guthrie, JF 1991, 'Gender differences in eating behavior and body weight regulation', *Health Psychol*, vol. 10, no. 2, pp. 133-42.

Ronksley, PE, Brien, SE, Turner, BJ, Mukamal, KJ & Ghali, WA 2011, *Association of alcohol consumption with selected cardiovascular disease outcomes: a systematic review and meta-analysis*, from http://www.bmj.com.dbgw.lis.curtin.edu.au/highwire/filestream/376294/field_highwire_article_pdf/0/bmj.d671

Ruggles, S & Sobek, M 1997, *Integrated Public Use Microdata Series: Version 2.0. Minneapolis: Historical Census Projects*, , University of Minnesota, from http://www.ipums.umn.edu.

Rutishauser, IHE & Flint, DM 1994, 'Section One. The sociology of food. 4 Australian eating patterns', in ML Wahlqvist (ed.), *Food & Nutrition in Australia (Third Edition)*, Thomas Nelson Australia, South Melbourne, Victoria.

Rzewnicki, R, Vanden Auweele, Y & De Bourdeaudhuij, I 2003, 'Addressing overreporting on the International Physical Activity Questionnaire (IPAQ) telephone survey with a population sample', *Public Health Nutr,* vol. 6, no. 3, pp. 299-305.

Sadakane, A, Tsutsumi, A, Gotoh, T, Ishikawa, S, Ojima, T, Kario, K, Nakamura, Y & Kayaba, K 2008, 'Dietary patterns and levels of blood pressure and serum lipids in a Japanese population', *J Epidemiol,* vol. 18, no. 2, pp. 58-67.

Samaras, K, Kelly, PJ & Campbell, LV 1999, 'Dietary underreporting is prevalent in middle-aged British women and is not related to adiposity (percentage body fat)', *Int J Obes Relat Metab Disord,* vol. 23, no. 8, pp. 881-8.

Sasazuki, S, Inoue, M, Iwasaki, M, Sawada, N, Shimazu, T, Yamaji, T & Tsugane, S 2012, 'Combined impact of five lifestyle factors and subsequent risk of cancer: the Japan Public Health Center Study', *Prev Med,* vol. 54, no. 2, pp. 112-6.

Satoh, H, Fujii, S, Furumoto, T, Kishi, R & Tsutsui, H 2010, 'Waist circumference can predict the occurrence of multiple metabolic risk factors in middle-aged Japanese subjects', *Ind Health,* vol. 48, no. 4, pp. 447-51.

Saunders, M & Peerson, A 2009, 'Australia's national men's health policy: masculinity matters', *Health Promot J Austr,* vol. 20, no. 2, pp. 92-7.

Schienkiewitz, A, Mensink, GB & Scheidt-Nave, C 2012, 'Comorbidity of overweight and obesity in a nationally representative sample of German adults aged 18-79 years', *BMC Public Health,* vol. 12, p. 658.

Schoenborn, CA, Adams, PF & Barnes, PM 2002, 'Body weight status of adults: United States, 1997-98', *Adv Data,* no. 330, pp. 1-15.

Schofield, WN, Schofield, C & James, WPT 1985, 'Basal metabolic rate - review and prediction, together with an annotated bibliography of source material', *Human Nutrition: Clinical Nutrition,* vol. 39 Suppl 1, pp. 5-91.

Schroder, H, Marrugat, J, Vila, J, Covas, MI & Elosua, R 2004, 'Adherence to the traditional mediterranean diet is inversely associated with body mass index and obesity in a spanish population', *J Nutr,* vol. 134, no. 12, pp. 3355-61.

Schulze, MB & Hoffmann, K 2006, 'Methodological approaches to study dietary patterns in relation to risk of coronary heart disease and stroke', *Br J Nutr,* vol. 95, no. 5, pp. 860-9.

Schwerin, HS, Stanton, JL, Riley, AM, Jr., Schaefer, AE, Leveille, GA, Elliott, JG, Warwick, KM & Brett, BE 1981, 'Food eating patterns and health: a reexamination of the Ten-State and HANES I surveys', *Am J Clin Nutr,* vol. 34, no. 4, pp. 568-80.

See, R, Abdullah, SM, McGuire, DK, Khera, A, Patel, MJ, Lindsey, JB, Grundy, SM & de Lemos, JA 2007, 'The association of differing measures of overweight and obesity with prevalent atherosclerosis: the Dallas Heart Study', *J Am Coll Cardiol,* vol. 50, no. 8, pp. 752-9.

Sekikawa, A, Eguchi, H, Igarashi, K, Tominaga, M, Abe, T, Fukuyama, H & Kato, T 1999, 'Waist to hip ratio, body mass index, and glucose intolerance from Funagata population-based diabetes survey in Japan', *Tohoku J Exp Med,* vol. 189, no. 1, pp. 11-20.

Senauer, B & Gemma, M 2006, 'Why is the obesity rate so low in Japan and high in the U.S. ?'

Sesso, HD, Cook, NR, Buring, JE, Manson, JE & Gaziano, JM 2008, 'Alcohol consumption and the risk of hypertension in women and men', *Hypertension,* vol. 51, no. 4, pp. 1080-7.

Shepherd, R 1999, 'Social determinants of food choice', *Proc Nutr Soc,* vol. 58, no. 4, pp. 807-12.

Shepherd, R 2005, 'Influences on food choice and dietary behavior', *Forum Nutr*, no. 57, pp. 36-43.

Shepherd, R & Shepherd, R 2002, 'Resistance to changes in diet', *Proc Nutr Soc,* vol. 61, no. 2, pp. 267-72.

Sherafat-Kazemzadeh, R, Egtesadi, S, Mirmiran, P, Gohari, M, Farahani, SJ, Esfahani, FH, Vafa, MR, Hedayati, M & Azizi, F 2010, 'Dietary patterns by reduced rank regression predicting changes in obesity indices in a cohort study: Tehran Lipid and Glucose Study', *Asia Pac J Clin Nutr,* vol. 19, no. 1, pp. 22-32.

Sherington, G 1990, *The Australian Experience. Australia's immigrants 1788-1988.*, Allen & Unwin Australia Pty Ltd., NSW Australia.

Shi, Z, Hu, X, Yuan, B, Hu, G, Pan, X, Dai, Y, Byles, JE & Holmboe-Ottesen, G 2008, 'Vegetable-rich food pattern is related to obesity in China', *Int J Obes (Lond),* vol. 32, no. 6, pp. 975-84.

Shibuya, M, Kamizato, M & Tauchi, K 2005, '[Waist circumference as a health index and its related factors]', *Sangyo Eiseigaku Zasshi*, vol. 47, no. 3, pp. 122-7.

Shields, M 1999, 'Long working hours and health', *Health Rep*, vol. 11, no. 2, pp. 33-48(Eng); 37-55(Fre).

Shikany, JM & White, GL, Jr. 2000, 'Dietary guidelines for chronic disease prevention', *South Med J*, vol. 93, no. 12, pp. 1138-51.

Shimazu, T, Kuriyama, S, Hozawa, A, Ohmori, K, Sato, Y, Nakaya, N, Nishino, Y, Tsubono, Y & Tsuji, I 2007, 'Dietary patterns and cardiovascular disease mortality in Japan: a prospective cohort study', *Int J Epidemiol*, vol. 36, no. 3, pp. 600-9.

Shin, A, Lim, SY, Sung, J, Shin, HR & Kim, J 2009, 'Dietary intake, eating habits, and metabolic syndrome in Korean men', *J Am Diet Assoc*, vol. 109, no. 4, pp. 633-40.

Shine Lawyers 2013, 'Workers' compensation'.

Slattery, ML, Boucher, KM, Caan, BJ, Potter, JD & Ma, KN 1998, 'Eating patterns and risk of colon cancer', *Am J Epidemiol*, vol. 148, no. 1, pp. 4-16.

Smith, AF 1993, 'Cognitive psychological issues of relevance to the validity of dietary reports', *Eur J Clin Nutr*, vol. 47 Suppl 2, pp. S6-18.

Smith, JA 2007, 'Beyond masculine stereotypes: moving men's health promotion forward in Australia', *Health Promot J Austr*, vol. 18, no. 1, pp. 20-5.

Smith, WT, Webb, KL & Heywood, PF 1994, 'The implications of underreporting in dietary studies', *Australian Journal of Public Health*, vol. 18, no. 3, pp. 311-4.

Sobal, J & Bisogni, CA 2009, 'Constructing food choice decisions', *Ann Behav Med*, vol. 38 Suppl 1, pp. S37-46.

Sobell, J, Block, G, Koslowe, P, Tobin, J & Andres, R 1989, 'Validation of a retrospective questionnaire assessing diet 10-15 years ago', *Am J Epidemiol*, vol. 130, no. 1, pp. 173-87.

Sokejima, S & Kagamimori, S 1998, 'Working hours as a risk factor for acute myocardial infarction in Japan: case-control study', *Bmj*, vol. 317, no. 7161, pp. 775-80.

Spencer, EA, Roddam, AW & Key, TJ 2004, 'Accuracy of self-reported waist and hip measurements in 4492 EPIC-Oxford participants', *Public Health Nutr,* vol. 7, no. 6, pp. 723-7.

Spurgeon, A, Harrington, JM & Cooper, CL 1997, 'Health and safety problems associated with long working hours: a review of the current position', *Occup Environ Med,* vol. 54, no. 6, pp. 367-75.

Staiano, AE, Reeder, BA, Elliott, S, Joffres, MR, Pahwa, P, Kirkland, SA, Paradis, G & Katzmarzyk, PT 2012, 'Body mass index versus waist circumference as predictors of mortality in Canadian adults', *Int J Obes (Lond),* vol. 36, no. 11, pp. 1450-4.

Stallone, DD, Brunner, EJ, Bingham, SA & Marmot, MG 1997, 'Dietary assessment in Whitehall II: the influence of reporting bias on apparent socioeconomic variation in nutrient intakes', *European journal of clinical nutrition,* vol. 51, no. 12, pp. 815-25.

Subar, AF, Kipnis, V, Troiano, RP, Midthune, D, Schoeller, DA, Bingham, S, Sharbaugh, CO, Trabulsi, J, Runswick, S, Ballard-Barbash, R, Sunshine, J & Schatzkin, A 2003, 'Using intake biomarkers to evaluate the extent of dietary misreporting in a large sample of adults: the OPEN study', *Am J Epidemiol,* vol. 158, no. 1, pp. 1-13.

Subar, AF, Ziegler, RG, Thompson, FE, Johnson, CC, Weissfeld, JL, Reding, D, Kavounis, KH & Hayes, RB 2001, 'Is shorter always better? Relative importance of questionnaire length and cognitive ease on response rates and data quality for two dietary questionnaires', *Am J Epidemiol,* vol. 153, no. 4, pp. 404-9.

Sugano, M & Hirahara, F 2000, 'Polyunsaturated fatty acids in the food chain in Japan', *American Journal of Clinical Nutrition,* vol. 71 (suppl), pp. 189s-96s.

Suka, M, Miwa, Y, Ono, Y & Yanagisawa, H 2011, 'BMI, waist circumference, and clustering of cardiovascular risk factors in Japanese adults', *Environ Health Prev Med,* vol. 16, no. 2, pp. 90-6.

Svendsen, M & Tonstad, S 2006, 'Accuracy of food intake reporting in obese subjects with metabolic risk factors', *Br J Nutr,* vol. 95, no. 3, pp. 640-9.

Takami, R, Takeda, N, Hayashi, M, Sasaki, A, Kawachi, S, Yoshino, K, Takami, K, Nakashima, K, Akai, A, Yamakita, N & Yasuda, K 2001, 'Body fatness and fat distribution as predictors of metabolic abnormalities and early carotid atherosclerosis', *Diabetes Care,* vol. 24, no. 7, pp. 1248-52.

Tamaki, J, Ueshima, H, Hayakawa, T, Choudhury, SR, Kodama, K, Kita, Y & Okayama, A 2006, 'Effect of conventional risk factors for excess cardiovascular death in men: NIPPON DATA80', *Circ J,* vol. 70, no. 4, pp. 370-5.

Tamakoshi, A, Kawado, M, Ozasa, K, Tamakoshi, K, Lin, Y, Yagyu, K, Kikuchi, S & Hashimoto, S 2010, 'Impact of smoking and other lifestyle factors on life expectancy among japanese: findings from the Japan Collaborative Cohort (JACC) Study', *J Epidemiol,* vol. 20, no. 5, pp. 370-6.

Tamakoshi, A, Tamakoshi, K, Lin, Y, Yagyu, K & Kikuchi, S 2009, 'Healthy lifestyle and preventable death: findings from the Japan Collaborative Cohort (JACC) Study', *Prev Med,* vol. 48, no. 5, pp. 486-92.

Tanaka, H, Yamaguchi, M, Date, C, Nakayama, T, Yamamoto, T, Yoshi-Ike, N, Iwaya, M, Matsumura, Y, Yokoyama, T, Noji, A & et al. 1992, 'Nutrition and cardiovascular disease--a brief review of epidemiological studies in Japan', *Nutr Health,* vol. 8, no. 2-3, pp. 107-23.

Tanaka, K, Kodama, H, Sasazuki, S, Yoshimasu, K, Liu, Y, Washio, M, Tokunaga, S, Kono, S, Arai, H, Koyanagi, S, Hiyamuta, K, Doi, Y, Kawano, T, Nakagaki, O, Takada, K, Nii, T, Shirai, K, Ideishi, M, Arakawa, K, Mohri, M & Takeshita, A 2001, 'Obesity, body fat distribution and coronary atherosclerosis among Japanese men and women', *Int J Obes Relat Metab Disord,* vol. 25, no. 2, pp. 191-7.

Tanaka, S, Ohkawara, K, Ishikawa-Takata, K, Morita, A & Watanabe, S 2008, 'Accuracy of predictive equations for basal metabolic rate and contribution of abdominal fat distribution to basal metabolic rate in obese Japanese people', *Anti-Aging Medicine,* vol. 5, no. 1, pp. 17-21.

Tanaka, S, Yamamoto, S, Inoue, M, Iwasaki, M, Sasazuki, S, Iso, H & Tsugane, S 2009, 'Projecting the probability of survival free from cancer and cardiovascular incidence through lifestyle modification in Japan', *Prev Med,* vol. 48, no. 2, pp. 128-33.

Tappy, L & Le, KA 2010, 'Metabolic effects of fructose and the worldwide increase in obesity', *Physiol Rev,* vol. 90, no. 1, pp. 23-46.

Tappy, L, Le, KA, Tran, C & Paquot, N 2010, 'Fructose and metabolic diseases: new findings, new questions', *Nutrition*, vol. 26, no. 11-12, pp. 1044-9.

Tavan, G 2005, *The long, slow death of White Australia.*, Scribe Publications Pty Ltd., Victoria, Australia.

Thompson, FE & Byers, T 1994, 'Dietary Assessment Resource Manual', *J Nutr*, vol. 124, no. 11 Suppl, pp. 2245S-317S.

Thompson, FE, Byers, T & Tokudome, S 1997, *Dietary Assessment Resource Manual*, Ishiyaku shuppan.

Thompson, FE & Subar, AF 2001, 'Chapter 1. Dietary assessment methodology.' in AM Coulston, CL Rock & ER Monsen (eds), *In "Nutrition in the prevention and treatment of disease".* Academic Press, San Diego, CA, pp. 3-30.

Thomson, JL, Tussing-Humphreys, LM, Onufrak, SJ, Zoellner, JM, Connell, CL, Bogle, ML & Yadrick, K 2011, 'A simulation study of the potential effects of healthy food and beverage substitutions on diet quality and total energy intake in Lower Mississippi Delta adults', *J Nutr*, vol. 141, no. 12, pp. 2191-7.

Thornton, LE, Pearce, JR & Ball, K 2013, 'Sociodemographic factors associated with healthy eating and food security in socio-economically disadvantaged groups in the UK and Victoria, Australia', *Public Health Nutr*, pp. 1-11.

Todd, JA & Robinson, RJ 2003, 'Osteoporosis and exercise', *Postgrad Med J*, vol. 79, no. 932, pp. 320-3.

Togo, P, Osler, M, Sorensen, TI & Heitmann, BL 2001, 'Food intake patterns and body mass index in observational studies', *Int J Obes Relat Metab Disord*, vol. 25, no. 12, pp. 1741-51.

Togo, P, Osler, M, Sorensen, TI & Heitmann, BL 2004, 'A longitudinal study of food intake patterns and obesity in adult Danish men and women', *Int J Obes Relat Metab Disord*, vol. 28, no. 4, pp. 583-93.

Tooze, JA, Subar, AF, Thompson, FE, Troiano, RP, Schatzkin, A & Kipnis, V 2004, 'Psychosocial predictors of energy underreporting in a large doubly labeled water study', *The American journal of clinical nutrition*, vol. 79, no. 5, pp. 795-804.

Trabulsi, J & Schoeller, DA 2001, 'Evaluation of dietary assessment instruments against doubly labeled water, a biomarker of habitual energy intake', *Am J Physiol Endocrinol Metab*, vol. 281, no. 5, pp. E891-9.

Trichopoulou, A, Costacou, T, Bamia, C & Trichopoulos, D 2003, 'Adherence to a Mediterranean diet and survival in a Greek population', *N Engl J Med*, vol. 348, no. 26, pp. 2599-608.

Trowell, HC & Burkitt, DP 1981, *Western Diseases: their emergence and prevention,* Edward Arnold, London.

Truswell, AS, Dreosti, IE, English, RM, Palmer, N, Rutishauser, IHE, Beard, TC, Bullock, JR, Fraser, DR, Nordin, BEC, Read, RSD, Roberts, DCK, Roeser, HP, Warwick, PM & Wood, BM 1990, *Recommended Nutrient Intakes Australian Papers*, Australian professional publications, Sydney.

Tsugane, S, Sasaki, S & Tsubono, Y 2002, 'Under- and overweight impact on mortality among middle-aged Japanese men and women: a 10-y follow-up of JPHC study cohort I', *Int J Obes Relat Metab Disord,* vol. 26, no. 4, pp. 529-37.

Tucker, KL 2010, 'Dietary patterns, approaches, and multicultural perspective', *Appl Physiol Nutr Metab*, vol. 35, no. 2, pp. 211-8.

U.S. Department of Health & Human Services 2009, 'Vital and Health Statistics. Anthropometric reference data for children and adults: United States, 1988-1994. Safer healthier people. Monitoring the Nation's Health.'

Uehata, T 1991, 'Long working hours and occupational stress-related cardiovascular attacks among middle-aged workers in Japan', *Journal of Human Ergology,* vol. 20, pp. 147-53.

Uehata, T 1993, '"Stress, Lifestyle and Health - 'Stress and Health' study. Bulletin of the Institute of Public Health 42(3): 1993"', in *An Epidemiological Survey on Work Stress and Health in Various Kinds of Occupations of Japan (1996). Third Report*, pp. 24-7.

Umesawa, M, Iso, H, Date, C, Yamamoto, A, Toyoshima, H, Watanabe, Y, Kikuchi, S, Koizumi, A, Kondo, T, Inaba, Y, Tanabe, N & Tamakoshi, A 2006, 'Dietary intake of calcium in relation to mortality from cardiovascular disease: the JACC Study', *Stroke,* vol. 37, no. 1, pp. 20-6.

Umesawa, M, Iso, H, Date, C, Yamamoto, A, Toyoshima, H, Watanabe, Y, Kikuchi, S, Koizumi, A, Kondo, T, Inaba, Y, Tanabe, N & Tamakoshi, A 2008, 'Relations between dietary sodium and potassium intakes and mortality from cardiovascular disease: the Japan Collaborative Cohort Study for Evaluation of Cancer Risks', *Am J Clin Nutr,* vol. 88, no. 1, pp. 195-202.

University of Hawaii Cancer Research Center of Hawaii 1993, *The Hawaii Cancer Research Survey*.

van Dam, RM, Grievink, L, Ocke, MC & Feskens, EJ 2003, 'Patterns of food consumption and risk factors for cardiovascular disease in the general Dutch population', *Am J Clin Nutr*, vol. 77, no. 5, pp. 1156-63.

van der Ploeg, HP, Chey, T, Korda, RJ, Banks, E & Bauman, A 2012, 'Sitting time and all-cause mortality risk in 222 497 Australian adults', *Arch Intern Med,* vol. 172, no. 6, pp. 494-500.

van Leeuwen, FE, de Vet, HC, Hayes, RB, van Staveren, WA, West, CE & Hautvast, JG 1983, 'An assessment of the relative validity of retrospective interviewing for measuring dietary intake', *Am J Epidemiol,* vol. 118, no. 5, pp. 752-8.

Villegas, R, Kearney, PM & Perry, IJ 2008, *The cumulative effect of core lifestyle behaviours on the prevalence of hypertension and dyslipidemia*, from http://www.biomedcentral.com/content/pdf/1471-2458-8-210.pdf

Virtanen, M, Ferrie, JE, Singh-Manoux, A, Shipley, MJ, Vahtera, J, Marmot, MG & Kivimaki, M 2010, 'Overtime work and incident coronary heart disease: the Whitehall II prospective cohort study', *Eur Heart J,* vol. 31, no. 14, pp. 1737-44.

Virtanen, M, Heikkila, K, Jokela, M, Ferrie, JE, Batty, GD, Vahtera, J & Kivimaki, M 2012, 'Long working hours and coronary heart disease: a systematic review and meta-analysis', *Am J Epidemiol*, vol. 176, no. 7, pp. 586-96.

Von Post-Skagegard, M, Samuelson, G, Karlstrom, B, Mohsen, R, Berglund, L & Bratteby, LE 2002, 'Changes in food habits in healthy Swedish adolescents during the transition from adolescence to adulthood', *Eur J Clin Nutr,* vol. 56, no. 6, pp. 532-8.

Voss, S, Kroke, A, Klipstein-Grobusch, K & Boeing, H 1998, 'Is macronutrient composition of dietary intake data affected by underreporting? Results from the EPIC-Potsdam Study. European Prospective Investigation into Cancer and Nutrition', *Eur J Clin Nutr,* vol. 52, no. 2, pp. 119-26.

Wada, K, Tamakoshi, K, Tsunekawa, T, Otsuka, R, Zhang, H, Murata, C, Nagasawa, N, Matsushita, K, Sugiura, K, Yatsuya, H & Toyoshima, H 2005, 'Validity of self-reported height and weight in a Japanese workplace population', *Int J Obes (Lond),* vol. 29, no. 9, pp. 1093-9.

Wahlqvist, ML 1994a, *Food & Nutrition in Australia*, Thomas Nelson Australia, South Melbourne, Victoria.

Wahlqvist, ML 1994b, *Food & Nutrition in Australia (Third Edition)*, Thomas Nelson Australia, South Melbourne, Victoria.

Wahlqvist, ML 2002, 'Asian migration to Australia: food and health consequences', *Asia Pac J Clin Nutr*, vol. 11 Suppl 3, pp. S562-8.

Wakai, K 2009, 'A review of food frequency questionnaires developed and validated in Japan', *J Epidemiol*, vol. 19, no. 1, pp. 1-11.

Walsh, K 2001, *The changing face of Australia. A century of immigration 1901-2000*, NSW, Australia.

Wang, J, Thornton, JC, Bari, S, Williamson, B, Gallagher, D, Heymsfield, SB, Horlick, M, Kotler, D, Laferrere, B, Mayer, L, Pi-Sunyer, FX & Pierson, RN, Jr. 2003, 'Comparisons of waist circumferences measured at 4 sites', *Am J Clin Nutr*, vol. 77, no. 2, pp. 379-84.

Wang, Y, Bentley, ME, Zhai, F & Popkin, BM 2002, 'Tracking of dietary intake patterns of Chinese from childhood to adolescence over a six-year follow-up period', *J Nutr*, vol. 132, no. 3, pp. 430-8.

Wang, Y, Tuomilehto, J, Jousilahti, P, antikainen, R, Mahonen, M, Katzmarzyk, P & Hu, G 2010, 'Occupational, commuting, and leisure-time physical activity in relation to heart failure among finnish men and women.' *Journal of the American college of cardiology*, vol. 56, no. 14, pp. 1140-8.

Wang, YC, Coxson, P, Shen, YM, Goldman, L & Bibbins-Domingo, K 2012, 'A penny-per-ounce tax on sugar-sweetened beverages would cut health and cost burdens of diabetes', *Health Aff (Millwood)*, vol. 31, no. 1, pp. 199-207.

Ward, PR, Verity, F, Carter, P, Tsourtos, G, Coveney, J & Wong, KC 2013, 'Food stress in Adelaide: the relationship between low income and the affordability of healthy food', *J Environ Public Health*, vol. 2013, p. 968078.

Warwick, PM 1990, 'Recommended Nutrient Intakes Australian Papers. Australian Professional Publications', in AS Truswell, IE Dreosti, RM English, IHE Rutishauser & N Palmer (eds), *24. Predicting food energy requirements from estimates of energy expenditure*, Sydney, pp. 295-320.

Welborn, TA & Dhaliwal, SS 2007, 'Preferred clinical measures of central obesity for predicting mortality', *Eur J Clin Nutr*, vol. 61, no. 12, pp. 1373-9.

Welborn, TA, Dhaliwal, SS & Bennett, SA 2003, 'Waist-hip ratio is the dominant risk factor predicting cardiovascular death in Australia', *Med J Aust,* vol. 179, no. 11-12, pp. 580-5.

Welsh, JA, Sharma, AJ, Grellinger, L & Vos, MB 2011, 'Consumption of added sugars is decreasing in the United States', *Am J Clin Nutr,* vol. 94, no. 3, pp. 726-34.

West, R, Zatonski, W, Przewozniak, K & Jarvis, MJ 2007, 'Can we trust national smoking prevalence figures? Discrepancies between biochemically assessed and self-reported smoking rates in three countries', *Cancer Epidemiol Biomarkers Prev,* vol. 16, no. 4, pp. 820-2.

Wheeler, CE, Rutishauser, IHE & O'Dea, K 1995, 'Comparison of nutrient intake data from two food frequency questionnaires and weighed records', *Australian journal of nutrition and dietetics*, vol. 52, no. 3, pp. 140-8.

Whittle, CR, Woodside, JV, Cardwell, CR, McCourt, HJ, Young, IS, Murray, LJ, Boreham, CA, Gallagher, AM, Neville, CE & McKinley, MC 2012, 'Dietary patterns and bone mineral status in young adults: the Northern Ireland Young Hearts Project', *Br J Nutr,* vol. 108, no. 8, pp. 1494-504.

WHO Expert Consultation 2004, 'Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies', *Lancet,* vol. 363, no. 9403, pp. 157-63.

WHO Regional Office for Europe 1988, *MONICA psychosocial optional study: MOPSY suggested measurement and instruments. draft 3037H MRC.*, WHO Regional Office for Europe, Copenhagen.

Wilborn, C, Beckham, J, Campbell, B, Harvey, T, Galbreath, M, La Bounty, P, Nassar, E, Wismann, J & Kreider, R 2005, 'Obesity: prevalence, theories, medical consequences, management, and research directions', *J Int Soc Sports Nutr,* vol. 2, pp. 4-31.

Willcox, DC, Willcox, BJ, Yasura, S, Ashitomi, I & Suzuki, M 2012, 'Gender gap in healthspan and life expectancy in Okinawa: health behaviours', *Asian Journal of Gerontology and Geriatrics,* vol. 7, no. 1, pp. 49-58.

Willett, W 1998, *Monographs in Epidemiology and Biostatistics. Volume 30. Nutritional Epidemiology,* 2nd edn, Oxford University Press, New York.

Willett, WC & Leibel, RL 2002, 'Dietary fat is not a major determinant of body fat', *Am J Med*, vol. 113 Suppl 9B, pp. 47S-59S.

Willett, WC, Reynolds, RD, Cottrell-Hoehner, S, Sampson, L & Browne, ML 1987, 'Validation of a semi-quantitative food frequency questionnaire: comparison with a 1-year diet record', *J Am Diet Assoc,* vol. 87, no. 1, pp. 43-7.

Willett, WC, Sampson, L, Stampfer, MJ, Rosner, B, Bain, C, Witschi, J, Hennekens, CH & Speizer, FE 1985, 'Reproducibility and validity of a semiquantitative food frequency questionnaire', *Am J Epidemiol,* vol. 122, no. 1, pp. 51-65.

Williams, DE, Prevost, AT, Whichelow, MJ, Cox, BD, Day, NE & Wareham, NJ 2000, 'A cross-sectional study of dietary patterns with glucose intolerance and other features of the metabolic syndrome', *Br J Nutr,* vol. 83, no. 3, pp. 257-66.

Williams, KJ & Tabas, I 2002, 'Atherosclerosis and inflammation', *Science,* vol. 297, no. 5581, pp. 521-2.

Willis, LH, Slentz, CA, Houmard, JA, Johnson, JL, Duscha, BD, Aiken, LB & Kraus, WE 2007, 'Minimal versus umbilical waist circumference measures as indicators of cardiovascular disease risk', *Obesity (Silver Spring),* vol. 15, no. 3, pp. 753-9.

Wirfalt, AK & Jeffery, RW 1997, 'Using cluster analysis to examine dietary patterns: nutrient intakes, gender, and weight status differ across food pattern clusters', *J Am Diet Assoc,* vol. 97, no. 3, pp. 272-9.

Wirfalt, E, Mattisson, I, Gullberg, B & Berglund, G 2000, 'Food patterns defined by cluster analysis and their utility as dietary exposure variables: a report from the Malmo Diet and Cancer Study', *Public Health Nutr,* vol. 3, no. 2, pp. 159-73.

Wolff, E & Dansinger, ML 2008, *Soft drinks and weight gain: how strong is the link?* Retrieved 8, from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2562148/

Woodward, M, Lam, TH, Barzi, F, Patel, A, Gu, D, Rodgers, A & Suh, I 2005, 'Smoking, quitting, and the risk of cardiovascular disease among women and men in the Asia-Pacific region', *Int J Epidemiol,* vol. 34, no. 5, pp. 1036-45.

World Health Organization 1985a, *Food and Agriculture Organization/World Health Organization/United Nations University (FAO/WHO/UNU). Energy and protein requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. World Health Organization Technical Report Series 724* WHO, Geneva.

World Health Organization 1985b, *Identification and control of work-related diseases*, Report of a WHO Expert Committee. World Health Organization, Technical Report Series 714, Geneva.

World Health Organization 1995, 'Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee', *World Health Organization. Technical Report Series 854*, pp. 1-452.

World Health Organization 1996, *World Health Statistics Annual, 1995. Life expectancy, males (years)*, Geneva.

World Health Organization 2000, 'Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity', *Technical Report Series 894*, pp. i-xii, 1-253.

World Health Organization 2003a, 'Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series 916. Diet, nutrition and the prevention of chronic diseases', pp. 1-149.

World Health Organization 2003b, *The World Health Report 2003, Healthy life expectancy (HALE) in all member states, estimates for 2002*. Retrieved 9 March 2006, from http://www.who.int/whr/2003/en/Annex4-en.pdf.

World Health Organization 2004, 'Global strategy on diet, physical activity and health'.

World Health Organization 2006a, *Obesity and overweight, facts*. Retrieved 28 February 2006, from http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/print.html

World Health Organization 2006b, 'Working together for health', *The World Health Report 2006*.

World Health Organization 2007, 'Global comparative assessments of life expectancy: the impact of migration with reference to Australia', *Bulletin of the World Health Organization*, vol. 85, no. 6, pp. 421-500.

World Health Organization 2008a, *Cardiovascular diseases (CVDs). Fact sheet No. 317*.

World Health Organization 2008b, *Waist circumference and waist-hip ratio: Report of a WHO Expert Consultation*, Geneva.

World Health Organization 2010, *Part II Global health indicators. World Health Statistics 2010. 1. Mortality and burden of disease. Healthy life expectancy (HALE) at birth (years).*

World Health Organization 2011a, *Chronic diseases and health promotion. Global status report on noncommunicable diseases 2010*, Geneva.

World Health Organization 2011b, *Global status report on noncommunicable diseases 2010*.

World Health Organization 2012, *Global strategy on diet, physical activity, and health. Obesity and overweight, facts.* Retrieved Retrieved 23 January 2012, from http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/

World Health Organization 2013a, *Chronic diseases*, Geneva.

World Health Organization 2013b, 'Health statistics and health information systems. Health status statistics: Mortality. Healthy life expectancy (HALE)'.

World Health Organization 2013c, 'Revised draft. Global action plan for the prevention and control of noncommunicable diseases 2013-2020'.

World Health Organization 2013d, *WHO Obesity and overweight. Fact sheet. What causes obesity and overweight?* , No. 311.

Wu, CH, Heshka, S, Wang, J, Pierson, RN, Jr., Heymsfield, SB, Laferrere, B, Wang, Z, Albu, JB, Pi-Sunyer, X & Gallagher, D 2007, 'Truncal fat in relation to total body fat: influences of age, sex, ethnicity and fatness', *Int J Obes (Lond)*, vol. 31, no. 9, pp. 1384-91.

Yamagishi, K, Iso, H, Date, C, Fukui, M, Wakai, K, Kikuchi, S, Inaba, Y, Tanabe, N & Tamakoshi, A 2008, 'Fish, omega-3 polyunsaturated fatty acids, and mortality from cardiovascular diseases in a nationwide community-based cohort of Japanese men and women the JACC (Japan Collaborative Cohort Study for Evaluation of Cancer Risk) Study', *J Am Coll Cardiol*, vol. 52, no. 12, pp. 988-96.

Yamamura, C & Kashiwazaki, H 2002, 'Factors affecting the post-absorptive resting metabolic rate of Japanese subjects: Reanalysis based on published data (in Japanese)', *Japanese Journal of Nutrition and Dietetics*, vol. 60, no. 2, pp. 75-83.

Yamasa Institute 2013, 'History of Japanese cuisine'.

Yannakoulia, M, Panagiotakos, DB, Pitsavos, C, Bathrellou, E, Chrysohoou, C, Skoumas, Y & Stefanadis, C 2007, 'Low energy reporting related to lifestyle, clinical, and psychosocial factors in a randomly selected population sample of Greek adults: the ATTICA Study', *J Am Coll Nutr,* vol. 26, no. 4, pp. 327-33.

Yoshida, D, Toyomura, K, Fukumoto, J, Ueda, N, Ohnaka, K, Adachi, M, Takayanagi, R & Kono, S 2009, 'Waist circumference and cardiovascular risk factors in Japanese men and women', *Journal of atherosclerosis and thrombosis,* vol. 16, no. 4, pp. 431-41.

Yoshiike, N, Kaneda, F & Takimoto, H 2002, 'Epidemiology of obesity and public health strategies for its control in Japan.' *Asia Pacific Journal of Clinical Nutrition,* vol. 11 (Suppl.), pp. S727-S31.

Yoshita, K, Miura, K, Morikawa, Y, Ishizaki, M, Kido, T, Naruse, Y, Soyama, Y, Suwazono, Y, Nogawa, K & Nakagawa, H 2005, 'Relationship of alcohol consumption to 7-year blood pressure change in Japanese men', *J Hypertens,* vol. 23, no. 8, pp. 1485-90.

Yusuf, S, Hawken, S, Ounpuu, S, Bautista, L, Franzosi, MG, Commerford, P, Lang, CC, Rumboldt, Z, Onen, CL, Lisheng, L, Tanomsup, S, Wangai, P, Jr., Razak, F, Sharma, AM & Anand, SS 2005, 'Obesity and the risk of myocardial infarction in 27,000 participants from 52 countries: a case-control study', *Lancet,* vol. 366, no. 9497, pp. 1640-9.

Zhai, F, Wang, H, Du, S, He, Y, Wang, Z, Ge, K & Popkin, BM 2009, 'Prospective study on nutrition transition in China', *Nutr Rev,* vol. 67 Suppl 1, pp. S56-61.

Zhang, Y, Tuomilehto, J, Jousilahti, P, Wang, Y, Antikainen, R & Hu, G 2011, 'Lifestyle factors on the risks of ischemic and hemorrhagic stroke', *Arch Intern Med,* vol. 171, no. 20, pp. 1811-8.

Zhu, S, Heymsfield, SB, Toyoshima, H, Wang, Z, Pietrobelli, A & Heshka, S 2005, 'Race-ethnicity-specific waist circumference cutoffs for identifying cardiovascular disease risk factors', *Am J Clin Nutr,* vol. 81, no. 2, pp. 409-15.

Zulkifli, SN & Yu, SM 1992, 'The food frequency method for dietary assessment', *Journal of the American dietetic association,* vol. 92, no. 6, pp. 681-5.

APPENDICES

Section 1: Data collection instruments and related materials

1. 1. 1: Invitation to participate in the study – for Australian Young adult men-1

1. 1. 2: Invitation to participate in the study – for Australian Young adult men-2

1. 2: Informed consent form

1. 3: Permission to use the questionnaire

1. 4: Questionnaire (Australian form)

1. 5: Questionnaire (Japanese form)

Section 2: Food intakes and Parameters

2. 1: Food list and intake parameters used with the Nutritionist Five Software

2. 2: Selected food lists for the under-reporting analysis

2. 3: Selected food lists for the Diet Quality Index-International

2. 4: Food groupings used for the dietary pattern analysis

Section 3: Supplementary results

3. 1: Comparison of scores of the Lifestyle Index (LI) and its components for the young and middle-aged men in Japan and Australia

3. 2: Diet and lifestyle relationships with obesity indices (Appendix 3.2.1 to 3.2.18) and Group differences (Appendix 3.2.19)

3. 3. 1: Alternative factor analysis using raw data intake with no energy-adjustments

3. 3. 2: Factor analysis with SQRT transformation, energy-adjustment and zero-intake-adjustment

3. 4: Alternative rotated factor loadings using raw data intake with no energy-adjustments

Section 4: Poster presentations

4. 1: Meal Patterns in Japanese and Australian men

4. 2: A Comparison of Physical Activity of Men in Japan and Australia

APPENDIX 1.1.1 INVITATION TO PARTICIPATE IN THE STUDY – FOR AUSTRALIAN YOUNG ADULT MEN-1

Wanted! Aussie Males.

Win a Dinner for Two (Value $200)

- Please assist in my study of lifestyle and diet. Aussie male students who are studying at Curtin University are needed to complete a questionnaire. All participants in the study have a chance to win a dinner for 2 valued at $200.

- The required age range for students is between 18 to 30.

- The questionnaire is divided into two sections: Lifestyle, and Eating habits, and takes about 30 minutes to complete.

- The study is to compare students from Japan and Australia. Approximately 400 Japanese people have already answered the questionnaire (200 young men from among the University students, and 200 middle-aged men from the general population).

Please contact me if you can assist.

<u>Contact details</u>
Kayo Yasuda, PhD student
School of Public Health
Phone: 9266-2817

APPENDIX 1.1.2 INVITATION TO PARTICIPATE IN THE STUDY – FOR AUSTRALIAN YOUNG ADULT MEN-2

12 October 1999

Project title: Patterns of Lifestyle and Nutrition of Men in Japan and Australia.

My name is Kayo Yasuda and I am enrolled at Curtin University as a PhD student under the supervision of Professor Colin Binns of the School of Public Health. This research study will explore the relationship between Lifestyle and Eating Habits in two different countries, Japan and Australia. There has been relatively little comparative research undertaken on students attending University in Japan and in Australia. This research will help for document similarities and differences in lifestyles, particularly in areas that might affect health.

I would like to invite you to participate in my research. The project will involve you to completing this questionnaire where you are asked to respond to statements and questions about the lifestyles of University students in both Japan and Australia.

This questionnaire will take about 30 minutes to complete. You can just complete it now and hand it to me, or use the reply paid envelope to return the questionnaire to me, or place it in the Curtin Internal Mail. All information given on the questionnaires will be kept completely confidential and only aggregate data will be analysed. You can be assured that all responses will be treated in the strictest confidence.

All who complete a questionnaire will have their names placed in a draw for a dinner for two at a first class Perth Restaurant. The value of the meal will be up to $200.

Thank you for considering my request.

Kayo YASUDA (PhD student)

Supervisor details: Professor Colin Binns
School of Public Health
Contact Phone No.: 9266-2817 (Kayo YASUDA)

APPENDIX 1.2

Informed consent form: Lifestyle and Nutrition study

The School of Public Health at Curtin University is conducting a survey to determine the Lifestyle and Nutrition of Men in Japan and Australia. This research study will explore the relationship between Lifestyle and Eating Habits in two situations in different countries, Japan and Australia. There has been relatively little comparative research undertaken on students attending University in Japan and in Australia. This research will help for document similarities and differences in lifestyles, particularly in areas, which might affect health.

I would like to invite you to participate in my research. If you would like to be part of the study, please complete this form. For any further enquiries, contact Kayo Yasuda at the School of Public Health on 9266-2817.

I, ____ am willing to

Participate in this study about Lifestyle and Nutrition of Men in Japan and Australia.

I understand that:

1. **I will be required to fill out one questionnaire including two different sections such as Lifestyle section and Eating Habits section.**
2. **Participation is voluntary.**
3. **All results are confidential and follow-up survey will be offered if there are missing data in your results of questionnaire.**

Signature: __________________________ Date: ____________

Researcher's signature: ___________________ Date: ____________

☆To be eligible for the dinner prize, please fill out the section below and return *WITH THE COMPLETE QUESTIONNAIRE* in the prepaid envelope provided <u>within one week</u> from the data which you received it. It will then be placed in a draw for the prize.

Name(Age):	
Address:	
Phone number:	
E-mail address:	

APPENDIX 1.3 Permission to use the questionnaire

(Copy)

Date sent: Sat, 19 Sep 1998 12: 10: 11 -1000
From: "Jean Hankin" JeanH@crch.hawaii.edu
To: yasudak@health.curtin.edu.au
Subject: Your request

Dear Ms Yasuda:

Thank you for your letter. You have our permission to use our questionnaire. However, we would appreciate your acknowledging the source in any future publications University of Hawaii Cancer Research Center of Hawaii: "The Hawaii Cancer Research Survey", copyright 1993. We assume that you would develop a new title on the cover for your new survey, with the notation of the source.

I assume that you plan to print your own copies. However, I wondered how you plan to analyze the information.

We look forward to hearing from you.

Sincerely,

Jean H. Hankin, DrPH, RD
Nutrition Researcher and
Professor of Public Health

APPENDIX 1.4 QUESTIONNAIRE (AUSTRALIAN FORM)

Curtin
University of Technology
Western Australia

Changing patterns of Lifestyle and Nutrition
of Men in Japan and Australia

Please read the following notes:

This is a study comparing Japanese and Australian habits. Some of the questions may not be applicable in your country, but please assist me in answering them.

- **Information gathered from this questionnaire will remain confidential.**
- **All respondents will remain anonymous.**
- **Your participation in this study is appreciated, but you may withdraw at any time.**

<u>Contact details</u>
Kayo Yasuda
School of Public Health
Curtin University of Technology
Direct phone : 9266-2817
Fax : 9266-2958

If you are willing to be part of a possible follow-up survey. Please put your name and contact details below:

Name:	
Phone number:	
E-mail address:	

Thank you again. If you want to discuss anything about this questionnaire use my contact details:

<u>Contact details</u>
Kayo Yasuda
School of Public Health
Curtin University of Technology
Direct phone : 9266-2817
Fax : 9266-2958

EATING HABITS

The first questions are about your usual eating habits DURING THE LAST YEAR. For each food group, please tick ☑ the box of that item that best describes HOW OFTEN you ate those items and then tick the box of that item that best describes your USUAL SERVING SIZE.

Most categories include examples. They are only suggestions, and you may not eat all of the listed items. Some ethnic foods are also listed. If you don't recognize the name, you probably don't eat that item.

For each item, please include any fresh, frozen, canned, and packaged foods you ate, such as TV dinners, frozen entrees, vegetables, or side dishes.

<u>If you did not eat an item, or if you ate an item less than once a month, tick the box of that item in the first column, DO NOT LEAVE BLANK. It is not necessary to choose a serving size for these items.</u>

For some categories, pictures of food on a dinner plate are included to help you estimate your usual serving size. Please note that "1 cup" refers to an 8-ounce (240 ml.) measuring cup.

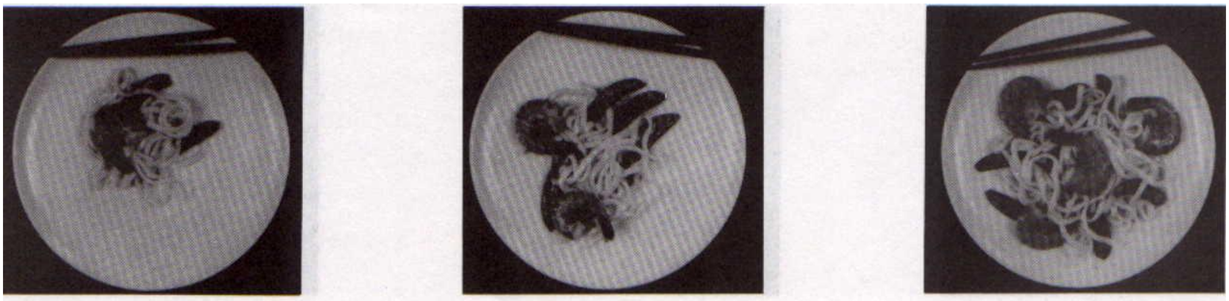
1. Soups, Ramen and Jook

For EACH FOOD GROUP, fill in the big box by ticking ☑ that best describes HOW OFTEN you ate those items during the last year. Then fill in the small box by ticking ☑ that best describes you USUAL SERVING SIZE.

SOUPS, RAMEN, AND JOOK	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Cream Soup or Chowder									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
2. Dried Bean or Pea (Legume) Soup (such as Portuguese bean, split pea)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
3. Tomato or Vegetable Soup (may include meat, poultry, or fish)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
4. Miso Soup									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
5. Broth with Noodles or Rice (such as beef noodle, chicken ri ce, won tun mein)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
6. Mexican Meat Soup or Stew (such as menudo, albondigas, cocido, pozole)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
7. Ramen or Saimin (Oriental noodles with broth)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)
8. Jook (rice gruel – may include meat, poultry, fish, or vegetables)									CHOOSE ONE **1.** ☐ ½ Cup or less OR **2.** ☐ Small bowl (about 1 cup) OR **3.** ☐ Large bowl (2 cups or more)

2. Noodles, Spaghetti and Mixed Dishes

Serving Size Examples:

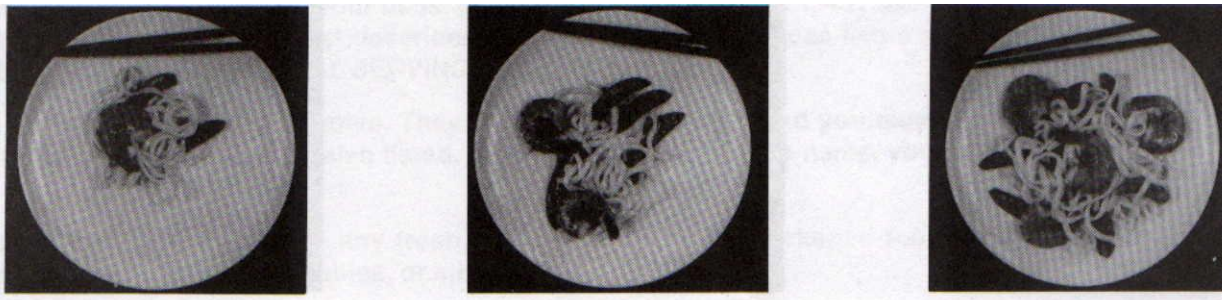


A B C

NOODLES, SPAGHETTI, AND MIXED DISHES	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Chow Mein, Chow Fun, or Yakisoba (Oriental fried noodles)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
2. Spaghetti, Ravioli, Lasagna, or Other Pasta with Tomato Sauce									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
3. Macaroni and Cheese or Other Pasta and Cheese Casseroles									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
4. Macaroni or Potato Salad (with mayonnaise)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
5. Pasta or Somen Salad									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
6. Noodle Casseroles (with tuna, chicken or turkey)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
7. Pasta with Cream Sauce (such as linguine with clam sauce, beef stroganoff)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
8. Arroz Con Pollo (rice with chicken)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
9. Stew, Curry, Pot Pie or Empanada (with beef or lamb)									CHOOSE ONE **1.** ☐ Photo A (½ cup or 1 Empanada) OR **2.** ☐ Photo B (about 1 cup or 1 pie) OR **3.** ☐ Photo C (2 cups or more)
10. Stew, Curry, Pot Pie or Empanada (with chicken or turkey)									CHOOSE ONE **1.** ☐ Photo A (½ cup or 1 Empanada) OR **2.** ☐ Photo B (about 1 cup or 1 pie) OR **3.** ☐ Photo C (2 cups or more)

3. Mixed Dishes

Serving Size Examples:

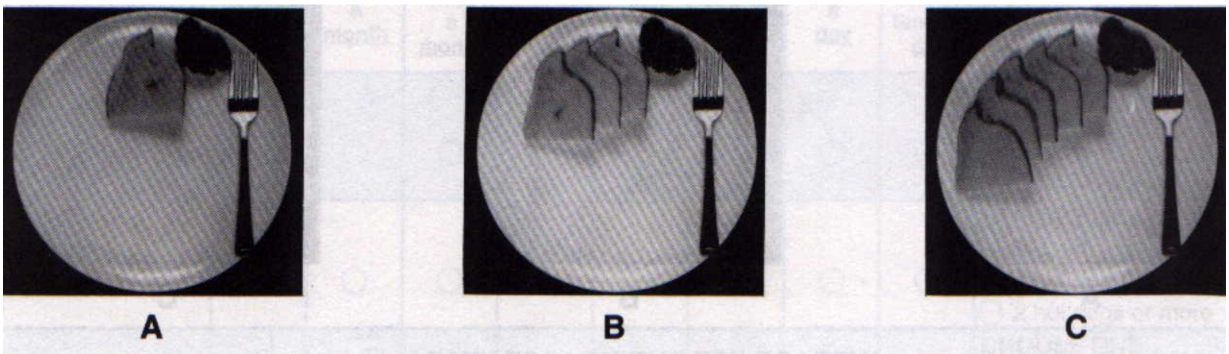


A B C

MIXED DISHES	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Stir-Fried Beef or Pork and Vegetables, or Fajitas (such as beef broccoli, pork tofu, chop suey, sukiyaki)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
2. Stir-Fried Chicken and Vegetables, or Fajitas (such as sukiyaki, nishime, chicken long rice)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
3. Stir-Fried Shrimp or Fish and Vegetables									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
4. Stir-Fried Vegetables (no meat)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
5. Pork and Greens or Laulaus									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B or 1 laulau OR **3.** ☐ Photo C or 2 laulaus or more
6. Chili con carne									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (2 cups or more)
7. Hamburgers (on a bun)									CHOOSE ONE **1.** ☐ 1 regular size burger OR **2.** ☐ 1 quarter-pound burger OR **3.** ☐ 1 large double burger
8. Cheeseburgers (on a bun)									CHOOSE ONE **1.** ☐ 1 regular size burger OR **2.** ☐ 1 quarter-pound burger OR **3.** ☐ 1 large double burger
9. Meat Loaf, Meatballs, or Patties (not fast-food hamburgers)									CHOOSE ONE **1.** ☐ 1 to 2 meatballs OR **2.** ☐ 1 patty or slice or 3 meatbalOR **3.** ☐ 1 large patty or 5 meatballs
10. Pizza									CHOOSE ONE **1.** ☐ 1 piece or slice or less OR **2.** ☐ 2 to 3 pieces OR **3.** ☐ 4 pieces or more

4. Meats (not part of Mixed Dishes)

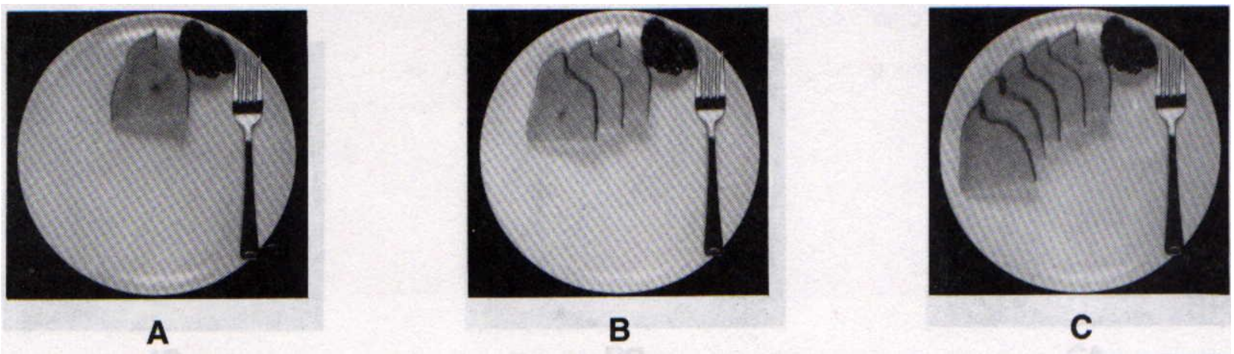
Serving Size Examples:



MEATS (NOT PART OF MIXED DISHES)	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVINGSIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Beef Steak or Roast, Veal or Lamb (includes beef teriyaki, chile colorado and carne asada)									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (3 oz. Or 1 lamb chop) OR **3.** ☐ Photo C (5 ounces or more)
2. Shortribs									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (or 2 shortribs) OR **3.** ☐ Photo C (or 3 ribs or more)
3. Corned Beef (fresh or canned)									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (or ¼ 12-oz. tin) OR **3.** ☐ Photo C (or ½ 12-oz. tin or more)
4. Corned Beef Hash									CHOOSE ONE **1.** ☐ Photo A or 1 patty OR **2.** ☐ Photo B or 2 patties OR **3.** ☐ Photo C or 3 patties or more
5. Pork Chops or Roasts, Kalua Pig, or Carnitas (includes chile verde)									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (3 ounces) OR **3.** ☐ Photo C (5 ounces or more)
6. Ham (includes baked, fried, or sandwich)									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (3 ounces) OR **3.** ☐ Photo C (5 ounces or more)
7. Ham Hocks or Pig's Feet									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (3 ounces) OR **3.** ☐ Photo C (5 ounces or more)
8. Spareribs									CHOOSE ONE **1.** ☐ 3 small or 1 long rib or less OR **2.** ☐ 2 to 3 long ribs (5-7 inches) OR **3.** ☐ 4 long ribs or more
9. Liver									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B or 3 chicken livers OR **3.** ☐ Photo C (5 ounces or more)
10. Chicken or Turkey Wings									CHOOSE ONE **1.** ☐ 2 chicken wings or less OR **2.** ☐ 3 chicken wings OR **3.** ☐ 1 turkey or 4 chicken wings or more

5. Poultry and Fish (not part of Mixed Dishes)

Serving Size Examples:



POULTRY AND FISH (NOT PART OF MIXED DISHES)	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Fried Chicken (includes fried chicken sandwich, nuggets)									CHOOSE ONE **1.** ☐ Photo A (or 1 drumstick) OR **2.** ☐ Photo B (or 1 breast, 2 thighs, 3 wings, or 1 sandwich) OR **3.** ☐ Photo C (or 2 breasts or 4 thighs)
2. Roasted, Baked, Grilled or Stewed Chicken (includes grilled chicken sandwich)									CHOOSE ONE **1.** ☐ Photo A (or 1 drumstick) OR **2.** ☐ Photo B (or 1 breast, 2 thighs, 3 wings, or 1 sandwich) OR **3.** ☐ Photo C (or 2 breasts or 4 thighs)
3. Turkey (includes roast, ground, deli-style, or sandwich)									CHOOSE ONE **1.** ☐ Photo A (1 ounce or less) OR **2.** ☐ Photo B (3 ounces) OR **3.** ☐ Photo C (5 ounces or more)
4. Fried Shrimp or Other Shellfish (includes tempura, fried calamari or squid)									CHOOSE ONE **1.** ☐ 1 to 3 items OR **2.** ☐ 4 to 5 items or ½ cup OR **3.** ☐ 6 items or more
5. Cooked, Canned, or Raw Shellfish (such as crab, squid, shrimp)									CHOOSE ONE **1.** ☐ 5-6 shrimp or ¼ cup OR **2.** ☐ 1 crab or ½ cup OR **3.** ☐ 1 lobster tail or 1 cup or more
6. Fried Fish (includes pan-fried fish, frozen fish sticks, fried fish sandwich)									CHOOSE ONE **1.** ☐ Photo A (about 1 ounce) OR **2.** ☐ Photo B (3 oz. or 1 sandwich OR **3.** ☐ Photo C (5 ounces or more)
7. Baked, Broiled, Boiled or Raw Fish (such as red snapper, salmon, sashimi)									CHOOSE ONE **1.** ☐ Photo A (about 1 ounce) OR **2.** ☐ Photo B (3 ounces) OR **3.** ☐ Photo C (5 ounces or more)
8. Canned Tunafish (plain, salad, or sandwich)									CHOOSE ONE **1.** ☐ ¼ cup or ½ sandwich OR **2.** ☐ ½ cup or 1 sandwich OR **3.** ☐ 1 cup or 2 sandwiches
9. Other Canned Fish (such as salmon, mackerel, sardines)									CHOOSE ONE **1.** ☐ 3 small sardines or ¼ cup OR **2.** ☐ ½ cup fish OR **3.** ☐ 1 cup fish or more
10. Salted and Dried Fish (such as ike, cuttlefish, iriko)									CHOOSE ONE **1.** ☐ 1 slice or strip or piece OR **2.** ☐ 2 slices OR **3.** ☐ 4 slices or more

6. Processed Meats and Mexican Dishes

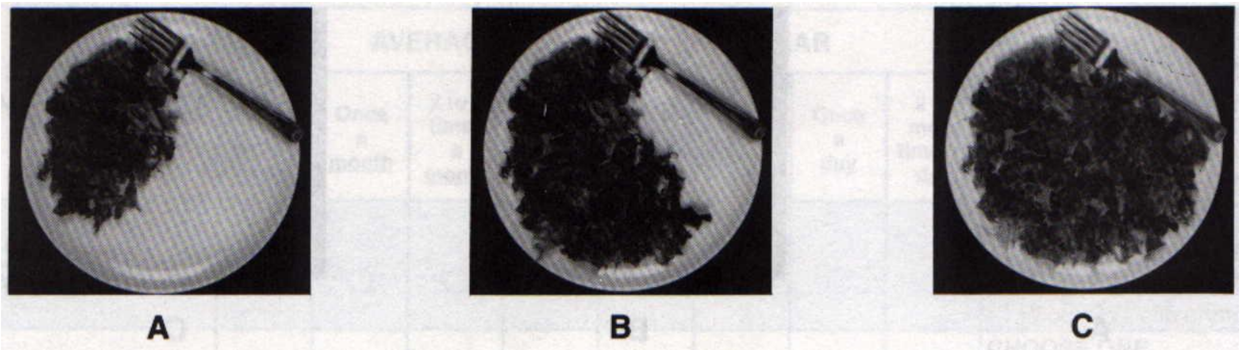
PROCESSED MEATS AND MEXICAN DISHES	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVINGSIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Bacon (includes Canadian bacon)									CHOOSE ONE **1.** ☐ 1 slice or strip or piece OR **2.** ☐ 2 slices OR **3.** ☐ 3 slices or more
2. Regular Hot Dogs (beef or pork)									CHOOSE ONE **1.** ☐ ½ hot dog OR **2.** ☐ 1 hot dog OR **3.** ☐ 2 hot dogs or more
3. Chicken or Turkey Hot Dogs or Luncheon Meats									CHOOSE ONE **1.** ☐ ½ hot dog or 1 slice OR **2.** ☐ 1 hot dog or 2 slices OR **3.** ☐ 2 hot dogs or 3 slices or more
4. Spam, Bologna, Salami, Pastrami or Other Luncheon Meats									CHOOSE ONE **1.** ☐ 1 slice (1 ounce or less) OR **2.** ☐ 2 slices OR **3.** ☐ 3 slices or more
5. Sausage (such as pork, beef, chorizo, Polish, Vienna, Portuguese, hot links)									CHOOSE ONE **1.** ☐ 1 piece or link OR **2.** ☐ 2-3 pieces or links or 1 patty OR **3.** ☐ 4 pieces or links or more
6. Tacos, Tostadas, Sopes, or Taco Salad (with beef or pork)									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items OR **3.** ☐ 3 items or more
7. Tacos, Tostadas, Sopes, or Taco Salad (with chicken)									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items OR **3.** ☐ 3 items or more
8. Meat Burritos (includes beef and bean and other combinations)									CHOOSE ONE **1.** ☐ 1 fast-food burrito OR **2.** ☐ 1 medium burrito OR **3.** ☐ 1 large or 2 fast-food burritos
9. Vegetable or Bean Burritos, Tacos, or Tostadas (no meat)									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items OR **3.** ☐ 3 items or more
10. Enchiladas with Chicken									CHOOSE ONE **1.** ☐ 1 enchilada or less OR **2.** ☐ 2 enchiladas OR **3.** ☐ 3 enchiladas or more
11. Enchiladas with Beef									CHOOSE ONE **1.** ☐ 1 enchilada or less OR **2.** ☐ 2 enchiladas OR **3.** ☐ 3 enchiladas or more
12. Enchiladas with Cheese, Quesadillas, or Nachos with Cheese									CHOOSE ONE **1.** ☐ 1 enchilada or small quesadilla OR **2.** ☐ 2 enchiladas or 1 serving nachos OR **3.** ☐ 3 enchiladas
13. Tamales									CHOOSE ONE **1.** ☐ ½ tamale or less OR **2.** ☐ 1 tamale OR **3.** ☐ 2 tamales or more
14. Chili Rellenos									CHOOSE ONE **1.** ☐ ½ chili relleno or less OR **2.** ☐ 1 chili relleno OR **3.** ☐ 2 chili rellenos or more

7. Rice, Potatoes, Taro and Poi

RICE, POTATOES, TARO, AND POI	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVINGSIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. White Rice (includes musubi)									CHOOSE ONE **1.** ☐ ½ cup or 1 scoop or less OR **2.** ☐ 1 rice bowl (1 cup) or 1 musubi OR **3.** ☐ 2 rice bowls or 2 musubi or more
2. Sushi or Barazushi									CHOOSE ONE **1.** ☐ 1-2 pieces or small cone OR **2.** ☐ 3-4 pieces or 1 large cone or ½ cup **3.** ☐ 5 pieces or 1 cup or more
3. Brown or Wild Rice									CHOOSE ONE **1.** ☐ ½ cup or 1 scoop or less OR **2.** ☐ 1 cup or 2 scoops OR **3.** ☐ 2 cups or more
4. Mexican or Spanish Rice									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup OR **3.** ☐ 2 cups or more
5. Fried Rice									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup OR **3.** ☐ 2 cups or more
6. French-Fried, Hash-Browned or other Fried Potatoes									CHOOSE ONE **1.** ☐ fast-food small order or 1 cup OR **2.** ☐ fast-food medium order OR **3.** ☐ fast-food large order or more
7. Mashed, Scalloped or Au Gratin Potatoes									CHOOSE ONE **1.** ☐ ½ cup or 1 scoop or less OR **2.** ☐ 1 cup or 2 scoops OR **3.** ☐ 2 cups or more
8. Baked or Boiled White Potatoes									CHOOSE ONE **1.** ☐ 1 small or ½ medium or less OR **2.** ☐ 1 medium (about 5 inches) OR **3.** ☐ 1 large potato or more
9. Yellow-Orange Sweet Potatoes or Yams									CHOOSE ONE **1.** ☐ 1 small or ½ medium or less OR **2.** ☐ 1 medium (about 5 inches) OR **3.** ☐ 1 large potato or more
10. White or Purpie Sweet Potatoes									CHOOSE ONE **1.** ☐ 1 small or ½ medium or less OR **2.** ☐ 1 medium (about 5 inches) OR **3.** ☐ 1 large potato or more
11. Taro									CHOOSE ONE **1.** ☐ ¼ taro or less OR **2.** ☐ ½ taro OR **3.** ☐ 1 whole taro or more
12. Poi									CHOOSE ONE **1.** ☐ ¼ cup or less OR **2.** ☐ ½ cup OR **3.** ☐ 1 cup or more

8. Salad items, Eggs and Other Non-meat items

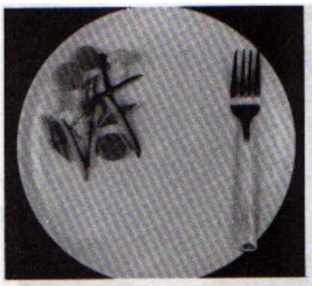
Serving Size Examples:



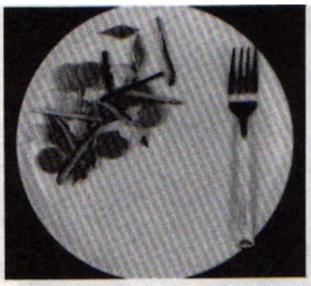
SALAD ITEMS, EGGS, AND OTHER NON-MEAT ITEMS	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Light Green Lettuce or Tossed Salad(such as iceberg or head lettuce)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (1-½ cups or more)
2. Dark Green Lettuce (such as romaine, red, butter, manoa, endive)									CHOOSE ONE **1.** ☐ Photo A (½ cup or less) OR **2.** ☐ Photo B (about 1 cup) OR **3.** ☐ Photo C (1-½ cups or more)
3. Tomatoes									CHOOSE ONE **1.** ☐ 2 slices or wedges or 2 cherry tomatoes or less OR **2.** ☐ 4 sleces or ½ medium tomato OR **3.** ☐ 1 medium tomato or more
4. Coleslaw									CHOOSE ONE **1.** ☐ ¼ cup or less OR **2.** ☐ ½ cup OR **3.** ☐ 1 cup or more
5. Regular Salad Dressings or Mayonnaise Added to Salads									CHOOSE ONE **1.** ☐ 2 teaspoons or less OR **2.** ☐ 1 Tablespoon OR **3.** ☐ 2 Tablespoons or more
6. Low-Calorie or Diet Dressings Added to Salads									CHOOSE ONE **1.** ☐ 2 teaspoons or less OR **2.** ☐ 1 Tablespoon OR **3.** ☐ 2 Tablespoons or more
7. Eggs, Cooked or Raw (includes egg salad)									CHOOSE ONE **1.** ☐ ½ egg OR **2.** ☐ 1 egg or 1 sandwich OR **3.** ☐ 2 eggs or more
8. Egg Substitute									CHOOSE ONE **1.** ☐ 2 Tablespoons OR **2.** ☐ ¼ cup (= 1 egg) OR **3.** ☐ ½ cup (= 2 eggs) or more
9. Tofu (soybean curd)									CHOOSE ONE **1.** ☐ 2 cubes or ¼ cup OR **2.** ☐ ¼ block or ½ cup OR **3.** ☐ ½ block or more
10. Vegetarian Meat Loaf, Meatballs or Patties									CHOOSE ONE **1.** ☐ 1 to 2 meatballs OR **2.** ☐ 1 patty or slice or 3 meatballs OR **3.** ☐ 1 large patty, 5 meatballs or more

9. Raw or Cooked Vegetables (not in Soups or Mixed Dishes)

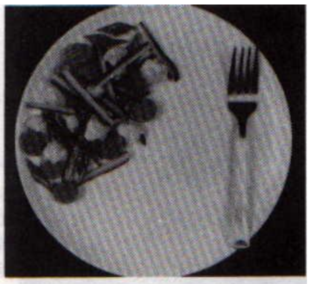
Serving Size Examples:



A



B



C

RAW OR COOKED VEGETABLES (NOT IN SOUPS OR MIXED DISHES)	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Broccoli (raw or cooked)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
2. Cabbage (such as head, Chinese or Napa cabbage Brussels sprouts)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
3. Dark Leafy Greens (such as spinach, collard, mustard or turnip greens, bok choy, watercress, chard)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
4. Green Beans or Peas									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
5. Other Green Vegetables (such as zucchini, celery, asparagus, green pepper, okra)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
6. Cauliflower									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
7. Carrots (raw or cooked)									CHOOSE ONE **1.** ☐ Photo A (or 4-5 sticks or less) OR **2.** ☐ Photo B (½ cup or 1 med.) OR **3.** ☐ Photo C (1 cup or more)
8. Corn (fresh, frozen, or canned)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (½ cup or 1 cob) OR **3.** ☐ Photo C (1 cup or more)
9. Pumpkin or Yellow-Orange Winter Squash									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
10. Other Vegetables (such as white or summer squash, beets, eggplant)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)

10. Dried Beans (not in Soups or Mixed Dishes)

DRIED BEANS (NOT IN SOUPS OR MIXED DISHES)	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Refried Beans (not in burritos or tostadas)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
2. Baked Beans or Pork and Beans									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)
3. Boiled Dried Beans or Peas (such as red, lima, pinto or soy beans, black-eyed peas, frijoles de la olla)									CHOOSE ONE **1.** ☐ Photo A (¼ cup or less) OR **2.** ☐ Photo B (about ½ cup) OR **3.** ☐ Photo C (1 cup or more)

11. Fruit and Juices

FRUITS AND JUICES	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Oranges									CHOOSE ONE **1.** ☐ ½ orange or ½ cup or less OR **2.** ☐ 1 orange or 1 cup OR **3.** ☐ 2 oranges or more
2. Tangerines or Mandarin Oranges									CHOOSE ONE **1.** ☐ 1 tangerine or ½ cup or less OR **2.** ☐ 2 tangerines or 1 cup OR **3.** ☐ 3 tangerines or more
3. Grapefruit or Pomelo									CHOOSE ONE **1.** ☐ ¼ cup or less OR **2.** ☐ ½ grapefruit or ½ cup OR **3.** ☐ 1 cup or more
4. Papaya									CHOOSE ONE **1.** ☐ ¼ papaya or less OR **2.** ☐ ½ papaya OR **3.** ☐ 1 papaya or more
5. Pineapple (fresh or canned)									CHOOSE ONE **1.** ☐ 1 slice or wedge or less OR **2.** ☐ ½ cup or 2 slices or wedges OR **3.** ☐ 1 cup or more
6. Peaches (fresh, canned, or dried)									CHOOSE ONE **1.** ☐ ½ peach or less OR **2.** ☐ 1 peach or 2 halves or ½ cup OR **3.** ☐ 2 peaches or 1 cup or more
7. Apricots (fresh, canned, or dried)									CHOOSE ONE **1.** ☐ 1 apricot or less OR **2.** ☐ 2 apricots or ½ cup OR **3.** ☐ 3 apricots or more
8. Pears (fresh, canned, or dried)									CHOOSE ONE **1.** ☐ ½ pear or ½ cup OR **2.** ☐ 1 pear or 1 cup OR **3.** ☐ 2 pears or more

11. Fruit and Juices (continued)

FRUITS AND JUICES (continued)	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
9. Apples and Applesauce									CHOOSE ONE **1.** ☐ ½ apple or ½ cup OR **2.** ☐ 1 apple or 1 cup OR **3.** ☐ 2 apples or more
10. Bananas									CHOOSE ONE **1.** ☐ ½ banana OR **2.** ☐ 1 banana OR **3.** ☐ 2 bananas or more
11. Cantaloupe (in season)									CHOOSE ONE **1.** ☐ ¼ cantaloupe or less OR **2.** ☐ ½ cantaloupe OR **3.** ☐ 1 cantaloupe or more
12. Watermelon (in season)									CHOOSE ONE **1.** ☐ 1 quarter slice or ½ cup OR **2.** ☐ 1 half slice or 1 cup OR **3.** ☐ 1 whole slice or more
13. Mangoes (in season)									CHOOSE ONE **1.** ☐ ½ cup slices OR **2.** ☐ 1 medium or Pirie or 1 cup OR **3.** ☐ 1 large or Hayden or more
14. Avocados and Guacamole									CHOOSE ONE **1.** ☐ 2 slices or 2 Tablespoons OR **2.** ☐ ¼ avocado or ¼ cup OR **3.** ☐ ½ avocado or ½ cup or more
15. Any Other Fruit (fresh, canned, or dried)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 fruit or 1 cup OR **3.** ☐ 2 fruits or more
16. Orange or Grapefruit Juice (not orange drinks or orange soda)									CHOOSE ONE **1.** ☐ Small juice glass (½ cup) OR **2.** ☐ Large glass (8 ounces) OR **3.** ☐ 12-ounce can or more
17. Tomato or V-8 Juice									CHOOSE ONE **1.** ☐ Small juice glass (½ cup) OR **2.** ☐ Large glass (8 ounces) OR **3.** ☐ 12-ounce can or more
18. Other Fruit Juices or Fruit Drinks									CHOOSE ONE **1.** ☐ Small juice glass (½ cup) OR **2.** ☐ Large glass (8 ounces) OR **3.** ☐ 12-ounce can or more

12. Bread items

BREAD ITEMS	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVINGSIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. White Bread (includes sandwich, French, sourdough, pan dulce, Portuguese sweet bread)									CHOOSE ONE **1.** ☐ 1 slice or less OR **2.** ☐ 2 slices OR **3.** ☐ 3 slices or more
2. Whole Wheat or Rye Bread (includes pumpernickel, whole wheat pita bread)									CHOOSE ONE **1.** ☐ 1 slice or less OR **2.** ☐ 2 slices OR **3.** ☐ 3 slices or more
3. Other Bread (such as mixed grain, oat bran, raisin bread)									CHOOSE ONE **1.** ☐ 1 slice or less OR **2.** ☐ 2 slices OR **3.** ☐ 3 slices or more
4. Rolls, Buns, Biscuits, or Flour Tortillas (includes bagels, English muffins)									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items or 1 bagel or English muffin **3.** ☐ 3 items or more
5. Corn Tortillas, Corn Muffins, or Cornbread (includes cornbread stuffing)									CHOOSE ONE **1.** ☐ 1 tortilla or 1 piece cornbread or ½ cup stuffing OR **2.** ☐ 2 tortillas or 1 muffin OR **3.** ☐ 3 tortillas or 2 muffins or more
6. Bran, Blueberry or Other Muffins, Banana or Mango Bread									CHOOSE ONE **1.** ☐ 1 regular muffin or 1 slice OR **2.** ☐ 1 large muffin or 2 slices OR **3.** ☐ 3 muffins or slices or more
7. Sweet Rolls, Croissants, Doughnuts, Danish Pastry, or Coffee Cake									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items OR **3.** ☐ 3 items or more
8. Pancakes, Waffles, or French Toast									CHOOSE ONE **1.** ☐ 1 item or less OR **2.** ☐ 2 items OR **3.** ☐ 3 items or more
9. Margarine Added to Bread Items									CHOOSE ONE **1.** ☐ spread thin OR **2.** ☐ spread thick
10. Butter Added to Bread Items									CHOOSE ONE **1.** ☐ spread thin OR **2.** ☐ spread thick
11. Peanut Butter Added to Bread Items									CHOOSE ONE **1.** ☐ spread thin OR **2.** ☐ spread thick
12. Jam or Jelly Added to Bread Items									CHOOSE ONE **1.** ☐ spread thin OR **2.** ☐ spread thick
13. Mayonnaise in Sandwiches									CHOOSE ONE **1.** ☐ spread thin OR **2.** ☐ spread thick

13. Breakfast Cereals, Milk and Cheese

BREAKFAST CEREALS, MILK, AND CHEESE	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVING SIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Highly Fortified Cereals (such as Product 19, Total, Most)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or individual box OR **3.** ☐ 1-½ cups or more
2. Bran or High Fiber Cereals									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or individual box OR **3.** ☐ 1-½ cups or more
3. Other Cold Cereals (such as corn flakes, Cheerios, granola)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or individual box OR **3.** ☐ 1-½ cups or more
4. Cooked Cereals (such as oatmeal, cream of wheat, corn grits)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or individual packet OR **3.** ☐ 1-½ cups or more
5. Whole Milk (as beverage or added to cereal)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or half-pint carton OR **3.** ☐ 2 cups or more
6. Lowfat Milk (1% or 2%) (as beverage or added to cereal – includes lactaid and acidophilus milk)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or half-pint carton OR **3.** ☐ 2 cups or more
7. Nonfat or Skim Milk or Buttermilk (as beverage or added to cereal)									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup or half-pint carton OR **3.** ☐ 2 cups or more
8. Yogurt (includes lowfat and nonfat)									CHOOSE ONE **1.** ☐ ½ cup or 4-6 oz. carton OR **2.** ☐ 1 cup or 8 oz. carton OR **3.** ☐ 2 cups or more
9. Chocolate Milk, Cocoa, or Ovaltine									CHOOSE ONE **1.** ☐ ½ cup or less OR **2.** ☐ 1 cup OR **3.** ☐ 2 cups or more
10. Milkshakes or Malts									CHOOSE ONE **1.** ☐ ½ milkshake or malt OR **2.** ☐ 1 milkshake or malt (12 oz.) OR **3.** ☐ 2 milkshakes or malts
11. Cottage Cheese (includes farmer's and ricotta cheese)									CHOOSE ONE **1.** ☐ ¼ cup or less OR **2.** ☐ ½ cup or 1 scoop OR **3.** ☐ 1 cup or more
12. Lowfat Cheese (such as lowfat American, lowfat Swiss, mozzarella)									CHOOSE ONE **1.** ☐ ½ slice OR **2.** ☐ 1 slice (1 ounce) OR **3.** ☐ 2 slices (2 ounces) or more
13. Other Cheese (such as American, cheddar, cream cheese)									CHOOSE ONE **1.** ☐ ½ slice or 1 tablespoon OR **2.** ☐ 1 slice (1 ounce) OR **3.** ☐ 2 slices (2 ounces) or more

14. Desserts and Snacks

DESSERTS AND SNACKS	AVERAGE USE DURING LAST YEAR								YOUR USUAL SERVINGSIZE
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	
1. Ice Cream									CHOOSE ONE **1.** ☐ 1 scoop (½ cup) or less OR **2.** ☐ 2 scoops (1 cup) or 1 bar OR **3.** ☐ 3 to 4 scoops (1 pint) or more
2. Ice Milk, Frozen Yogurt, or Sherbet									CHOOSE ONE **1.** ☐ 1 scoop (½ cup) or less OR **2.** ☐ 2 scoops (1 cup) or 1 bar OR **3.** ☐ 3 to 4 scoops (1 pint) or more
3. Cookies, Brownies, or Fruit Bars									CHOOSE ONE **1.** ☐ 1 to 2 average size cookies OR **2.** ☐ 3 to 4 average or 1 extra large cookie or 1 brownie or fruit bar OR **3.** ☐ 2 large cookies or brownies or more
4. Cake									CHOOSE ONE **1.** ☐ 1 small piece or cupcake OR **2.** ☐ 1 average piece (1/12 of cake) OR **3.** ☐ 2 pieces or more
5. Apple or Other Fruit Pies, Tarts, Cobblers, or Turnovers									CHOOSE ONE **1.** ☐ 1 small piece OR **2.** ☐ 1 piece (1/8 pie) or 1 item OR **3.** ☐ 1/6 pie or more
6. Pumpkin, Sweet Potato, or Carrot Pies									CHOOSE ONE **1.** ☐ 1 small piece OR **2.** ☐ 1 average piece (1/8 pie) OR **3.** ☐ 1/6 pie or more
7. Cream or Custard Pies, Eclairs, or Cream Puffs									CHOOSE ONE **1.** ☐ 1 small piece OR **2.** ☐ 1 average piece or 1 item OR **3.** ☐ 1/6 pie or more
8. Puddings or Custards (includes flan)									CHOOSE ONE **1.** ☐ 1 snack-size or ½ cup OR **2.** ☐ 2 snack-size or 1 cup OR **3.** ☐ 3 snack-size or 1-1/2 cups
9. Chocolate Candy									CHOOSE ONE **1.** ☐ 1 to 3 pieces OR **2.** ☐ 1 regular-size bar OR **3.** ☐ 1 giant-size bar or more
10. Dim Sum, such as Bao or Manapua (Chinese bun with meat and vegetables)									CHOOSE ONE **1.** ☐ ½ bao or less OR **2.** ☐ 1 bao OR **3.** ☐ 2 bao or more
11. Other Dim Sum (such as pork hash, gau gee, fried won ton, eggroll)									CHOOSE ONE **1.** ☐ 1 to 2 pieces OR **2.** ☐ 3 to 4 pieces OR **3.** ☐ 5 pieces or more
12. Crackers and Pretzels (such as soda, graham, Japanese rice crackers, wheat thins)									CHOOSE ONE **1.** ☐ 4 to 5 snack or 1 large cracker OR **2.** ☐ 6 to 10 snack or 2 large crackers OR **3.** ☐ 3 large crackers or more
13. Peanuts or Other Nuts									CHOOSE ONE **1.** ☐ 12 nuts or less OR **2.** ☐ ¼ cup OR **3.** ☐ ½ cup or more
14. Potato, Corn, Tortilla or Other Chips, or Chicharrones (pork rinds)									CHOOSE ONE **1.** ☐ 1 snack bag or ½ cup OR **2.** ☐ 1-ounce bag (1 cup) OR **3.** ☐ ½ twin-pack or more
15. Popcorn									CHOOSE ONE **1.** ☐ 1 to 3 cups or less OR **2.** ☐ 1 microwave bag OR **3.** ☐ 1 medium theater tub or more

15. Alcoholic and Other Beverages

ALCOHOLIC AND OTHER BEVERAGES	AVERAGE USE DURING LAST YEAR **1** Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day	YOUR USUAL SERVING SIZE
1. Regular or Draft Beer									CHOOSE ONE **1.** ☐ 1 can or bottle or less OR **2.** ☐ 2 cans or bottles OR **3.** ☐ 3 cans or bottles OR **4.** ☐ 4 cans or bottles or more
2. Light Beer									CHOOSE ONE **1.** ☐ 1 can or bottle or less OR **2.** ☐ 2 cans or bottles OR **3.** ☐ 3 cans or bottles OR **4.** ☐ 4 cans or bottles or more
3. White or Pink Wine (includes champagne and sake)									CHOOSE ONE **1.** ☐ 1 glass or less OR **2.** ☐ 2 glasses OR **3.** ☐ 3 glasses OR **4.** ☐ 4 glasses or more
4. Red Wine									CHOOSE ONE **1.** ☐ 1 glass or less OR **2.** ☐ 2 glasses OR **3.** ☐ 3 glasses OR **4.** ☐ 4 glasses or more
5. Hard Liquor (such as bourbon, scotch, gin, vodka, tequila, rum, cocktails)									CHOOSE ONE **1.** ☐ 1 drink or less OR **2.** ☐ 2 drinks OR **3.** ☐ 3 drinks OR **4.** ☐ 4 drinks or more
6. Regular Sodas (such as Coca-Cola, Pepsi, 7-Up)									CHOOSE ONE **1.** ☐ ½ can or small glass OR **2.** ☐ 1 can or large glass OR **3.** ☐ 2 cans or glasses OR **4.** ☐ 3 cans or glasses or more
7. Diet Sodas (such as Diet Coke, Diet Pepsi, Diet 7-Up)									CHOOSE ONE **1.** ☐ ½ can or small glass OR **2.** ☐ 1 can or large glass OR **3.** ☐ 2 cans or glasses OR **4.** ☐ 3 cans or glasses or more
8. Cappuccino – 1 cup or mug (includes café au lait, caffe latte, café con leche)									MARK ALL THAT APPLY **1.** ☐ Sugar or honey **2.** ☐ Sugar substitute
9. Regular Coffee – 1 cup or mug (brewed or instant)									MARK ALL THAT APPLY **1.** ☐ Cream or half & half **2.** ☐ Milk **3.** ☐ Non-dairy cream **4.** ☐ Sugar or honey **5.** ☐ Sugar substitute
10. Decaffeinated (“Decaf”) Coffee – 1 cup or mug (brewed or instant)									MARK ALL THAT APPLY **1.** ☐ Cream or half & half **2.** ☐ Milk **3.** ☐ Non-dairy cream **4.** ☐ Sugar or honey **5.** ☐ Sugar substitute
11. Black Tea – 1 cup or glass (such as Lipton’s, oolong, iced tea)									MARK ALL THAT APPLY **1.** ☐ Cream or half & half **2.** ☐ Milk **3.** ☐ Non-dairy cream **4.** ☐ Sugar or honey **5.** ☐ Sugar substitute
12. Green, Herbal, or Other Tea – 1 cup									
13. Fortified Diet Beverages – 1 glass or can (such as Slimfast)									

16. HOW OFTEN DID YOU EAT THE FOLLOWING ITEMS?	AVERAGE USE DURING LAST YEAR							
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day
1. Western Pickles or Relish (such as dill or sweet pickles)								
2. Olives								
3. Salsa or Hot Chili Peppers (red or green)								
4. Garlic								
5. Onions								
6. Oriental Salted or Pickled Vegetables (such as salted cabbage or leafy greens, takuwan, kim chee)								
7. Seaweed (fresh or dried) (such as ogo limu, furikake)								
8. Gravy on meat, potatoes, rice								

17. HOW OFTEN DID YOU ADD THE FOLLOWING ITEMS TO YOUR FOODS AT THE TABLE…	AVERAGE USE DURING LAST YEAR							
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day
1. Salt								
2. Shoyu (Soy Sauce) or Teriyaki Sauce								
3. Mustard								
4. Catsup								
5. Sour Cream								

18. HOW OFTEN DID YOU EAT YOUR MEAT, POULTRY, OR FISH PREPARED IN THE FOLLOWING WAYS….	AVERAGE USE DURING LAST YEAR							
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day
1. Charcoal-broiled								
2. Oven-broiled								
3. Fried								
4. Barbecued								

19. HOW OFTEN DID YOU EAT MEAT, CHICKEN, OR FISH COOKED WITH…	AVERAGE USE DURING LAST YEAR							
	1 Never or hardly ever	**2** Once a month	**3** 2 to 3 times a month	**4** Once a week	**5** 2 to 3 times a week	**6** 4 to 6 times a week	**7** Once a day	**8** 2 or more times a day
1. Vegetable Oil								
2. Salt Pork, Lard, or Bacon Fat								
3. Vegetable Shortening (such as Crisco)								
4. Margarine								
5. Butter								
6. Vegetable spray, water, or non-stick pan								

20. ANSWER THE FOLLOWING FOR THE LAST YEAR:

20-1. When you ate meat, how was it usually prepared? *(Circle one number only)*

1=Rare 3=Well-done
2=Medium 4=Don’t eat meat

20-2. When you ate meat, did you eat the fat: *(Circle one number only)*

1=Most of the time 3=Never or hardly ever
2=Some of the time 4=Don’t eat meat

20-3. When you ate chicken, did you eat the skin: *(Circle one number only)*

1=Most of the time 3=Never or hardly ever
2=Some of the time 4=Don’t eat meat

20-4. What kind of margarine did you usually use? *(Circle one number only)*

1=Regular Stick OR 4=Don’t use margarine
2=Regular Tub OR 5=Don’t know
3=Diet or Spread OR

20-5. What kind of butter did you usually use? *(Circle one number only)*

1=Regular OR 3=Don’t use butter
2=Whipped OR 4=Don’t know

20-6. What kind of vegetable oil did you usually use? *(Circle one number only)*

1=Soybean or corn oil 4=Any other oil
2=Olive oil 5=Don’t use oil
3=Canola oil 6=Don’t know

DIRECTIONS

- **The next section will ask questions about your lifestyle. Some of these are personal. However, answering these questions will help me understand the sorts of things that influence eating habits.**
- **Please indicate your answer by circling the correct number or by entering a written response.**
- **If you are uncertain about the answer to any of the questions ask me to help you when you have reached the end of the questionnaire.**

21. What is your age? *(Circle one number only)*

1=18-24	3=30-34	5=40-44	7=50-54	9=60 or more
2=25-29	4=35-39	6=45-49	8=55-59	

22. In which country were you born? (Name of country:)

23. How many years have you lived in Australia? ( ) **years**

24. Which of the following best describes your current status?
(Circle more than one number if applicable.)

1 = Employed full-time
2 = Employed part-time
3 = Unemployed
4 = Full time student
5 = Part time student
6 = Home duties
7 = Retired
8 = Permanently unable to work/ill
9 = Other (please specify:)

Questions 25-31 [Please answer only middle-aged (40-60 years) respondents]

25. What is the position of your job in your company? *(Circle one number only)*

1 = Non-career
2 = Junior level administrator
3 = Middle level administrator
4 = Senior level administrator
5 = Professional
6 = Self-employed
7 = not applicable

26. If you are either employed full-time or part time: how many days a week do you work?

( ) days a week

27. How many hours in total including overtime work and work on your days off, paid or unpaid, do you usually work each week?

( ) hours a week

28. Do you work at the office on your days off?

1 = Yes
2 = No

29. Do you work overtime? When you work overtime, paid or unpaid, approximately how many hours overtime do you work per month maximum?

1 = Yes
If yes, approximately how many hours overtime do you work per month? ( ) hours a month

2 = No

30. Do you take unfinished work home at night? *(Circle one number only)*

1 = Yes - all the time
2 = Yes - most of the time
3 = Yes - some of the time
4 = Yes - but seldom
5 = Never

31. Do you work between 10:00pm and 5:00am in next morning? If yes, how many times a month do you work these hours?

1 = Yes (   ) times a month   2 = No

32. Do you smoke? *(Circle one number only)*

1 = Yes, I currently smoke   2 = No, used to smoke but quit   3 = Never smoked

If you answered 1 in question 8:

31-2. How many cigarettes do you smoke per day?

About (   ) cigarettes/day

33. How much do you currently weigh? *(Record weight in pounds or kilograms)*

________ pounds   OR   ________ kilograms

34. How tall are you?*(Record height in feet/inches or centimeters)*

________ feet ________ inches   OR   ________ cm

35. What is your waist and hip size?

Waist ________ cm   Hip ________ cm

36. Please comment on your recent sleeping patterns. *(please circle in each questions)*

Recent sleeping patterns	Not at all	1-3 days a month	4-7 days a month	8-14 days a month	15-21 days a month	> 22 days a month
1. Have trouble falling asleep?	0	1	2	3	4	5
2. Have trouble staying asleep asleep (including waking far too early)?	0	1	2	3	4	5
3. Wake up two or more times per night?	0	1	2	3	4	5
4. Wake up after your usual amount of Sleep feeling tired and worn out?	0	1	2	3	4	5
5. What is your average sleeping hours.	less than 5 hrs	6 hrs	7 hrs	8 hrs	9 hrs	more than 10 hrs
	1	2	3	4	5	6

PHYSICAL ACTIVITY

37. On the average, during the last year, how many hours *in a day* did you spend in the following sitting activities? (*Please tick one for each of question 1-5.*)

	NEVER	Less Than 1 hr.	1 to 2 hrs.	3 to 4 hrs.	5 to 6 hrs.	7 to 10 hrs.	11 hrs. or more
1. Sitting in car or bus							
2. Sitting at work							
3. Watching TV							
4. Sitting at meals							
5. Other sitting activities (such as reading, playing cards, sewing, computer games)							
	1	**2**	**3**	**4**	**5**	**6**	**7**

38. On the average, during the last year, how many hours *in a week* did you spend in the following activities? (*Please tick one for each of question 1-3.*)

	NEVER	½ to 1 hr.	2 to 3 hrs.	4 to 6 hrs.	7 to 10 hrs.	11 to 20 hrs.	21 to 30 hrs.	31 hrs. or more
1. Strenuous Sports (such as jogging, bicycling on hills, tennis, racquetball, swimming laps, aerobics)								
2. Vigorous Work (such as moving heavy furniture, loading or unloading trucks, shoveling, weight lifting, or equivalent manual labor)								
3. Moderate Activity (such as housework, brisk walking, golfing, bowling, bicycling on level ground, gardening)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Thank you very much for your co-operation in this questionnaire. Your help has been valuable and your results vital in comparing the Public Health of Japanese people to that of Australian people.

Thank you for your time and effort.

curtin
University of Technology
Western Australia

http://www.curtin.edu.au

APPENDIX 1.5 QUESTIONNAIRE (JAPANESE FORM)

curtin
University of Technology
Western Australia

日本とオーストラリアにおける男性の食生活と日常の生活様式の変化

Changing patterns of Lifestyle and Nutrition of Men in Japan and Australia

カーティン工科大学
公衆衛生学部、栄養学科、博士課程
安　田　佳　代
【指導教官】
公衆衛生学部、学部長
Professor Colin Binns
(コリン　ビンズ教授)

連絡先

1．日本（姫路工業大学）
〒**671-2201**　兵庫県姫路市書写　**2167**
姫路工業大学工学部応用化学科　　　助教授　大内　幹雄
電話＆**FAX**：**0792-67-4890**　（問い合わせ先）安田　佳代

2. オーストラリア（カーティン工科大学）
Kayo Yasuda (PhD Student)
Curtin University of Technology
School of Public Health
GPO Box U 1987
Perth 6845
Western Australia
(International)Fax+61-8-9266-2958, Tel+61-8-9266-2817
E-Mail: Yasudak@health.curtin.edu.au

GPO Box U 1987
Perth 6845
Western Australia
Fax(08) 9266 2958

Telephone
(08) 9266 9266 7927

1999 年 **5** 月吉日

「ストレスと健康、食生活に関するアンケート調査」
ご協力についてのお願い

皆様には、お忙しい日々をお過ごしのことと存じます。
さて、私は西オーストラリアにあるカーティン工科大学の公衆衛生学部、栄養学科、博士課程で学んでいる学生です。現在、「日本とオーストラリアにおける男性の食生活と日常の生活様式の変化」というテーマに取り組んでおります。

この調査は、学生と、さまざまな産業・職場にはたらくその父親の世代の人達の食生活や日常生活行動との関係の実態を明らかにし、病気の予防や健康増進対策を確立するための基礎資料とするために日本人とオーストラリア人のそれぞれ約 **400** 名の方々のご協力がぜひ必要です。将来、健康で快適な生活をおくるための食生活のヒントと、お忙しい方々のお役に立てる情報を提供できるものと期待されます。

個人のくわしい状態をお聞きする質問もありますが、本調査の結果は、全て統計的に処理し個人が特定されるような使用はいたしません。また、個人の情報の秘密保持にも十分注意して使用させていただきます。

つきましては、御多用中恐縮ではございますが調査の主旨をご理解のうえご協力たまわりますようお願い申し上げます。

カーティン工科大学
公衆衛生学部、栄養学科、博士課程
安　田　佳　代

【指導教官】
公衆衛生学部、学部長
Professor Colin Binns
(コリン　ビンズ教授)

記入および回収上のご注意

１．質問項目が多岐にわたっていますが、これはあなた自身の食事を含めた日常の生活習慣を客観的に評価するとともに、他の産業や職種と比較できるよう、またさらに日本人とオーストラリア人との間でも比較できるよう調査項目を設定しているためです。

２．とくにことわりのあるところ以外は、(　　)内に実数字または文字を記入するか、あるいは番号をふってあるすべての答えの中から一つだけを選んでその番号を○印で囲むか、またはその番号のある枠に○印をおつけください。例えば、項目によっては、実数字と文字の両方を記入していただく必要がある場合もあります。　また例えば、身長、体重、からだのサイズ、タバコの量などをたずねている項目等については、(　　)内に実数字を記入していただきます。

３．すべての質問にお答えください。空欄を作らないようにお願いいたします。

４．お分かりにならない事がございましたら、前ページに記載されている連絡先へお問い合わせください。また、お電話いただいた場合には、一度あなた様のご連絡先をご伝言頂きその後こちらより電話連絡をさせて頂きますことをご了承ください。

※　場合によっては後日さらに細かいことをお伺いするかも知れません。もしそれに同意いただける場合には、ご連絡先住所または電話番号のご記入をお願い致します。

(フリガナ) 氏　　名	
連絡先住所	〒
電話番号	(　　　　　)　　　　　　　―

食生活について

以下の質問は昨年１年間の日常の食生活についておうかがいします。下記の項目のそれぞれの食物グループについて、当てはまる箇所に「○」印をおつけください。まず最初に昨年１年間に平均してどれくらいの頻度で食べたかという事について、最も近いものを選びワク内に○印をつけ、その次に通常あなたが食べる一人前の量について、最も近いものを選び数字を○印で囲んでください。

大部分の食物グループの項目に例が示されていますが、それらは単なる一例にすぎません。いくらかの特別な国の料理も含まれていますので、もしかしたら今までに食べたことの無いものも含まれているかも知れません。もしも、耳慣れない料理名や食物が出てきたら、それは通常食べていないものかも知れません。

各項目の食物グループについては、あなたが日常食べているものであれば、生のもの、冷凍食品、缶詰め、レトルト食品などのパック詰めにされたもの、例えば、インスタント料理、冷凍ものの盛り合わせの料理、また、野菜や添えものとしての料理などすべてを含めてお考えください。

もしも食べたことのない食品の項目が出てきたり、または食べても月に一回以下の場合には、最初の欄すなわち「食べない又はほとんど食べない」に○印をおつけください。決して無記入の項目を作らないようにお願い致します。この場合にはあなたの通常の一人前の量については回答していただかなくて結構です。

皿にのった食物の写真が使われているページもありますのでご参照ください。

回答のしかた例　：　例えば、以下の様に 回答して下さい。

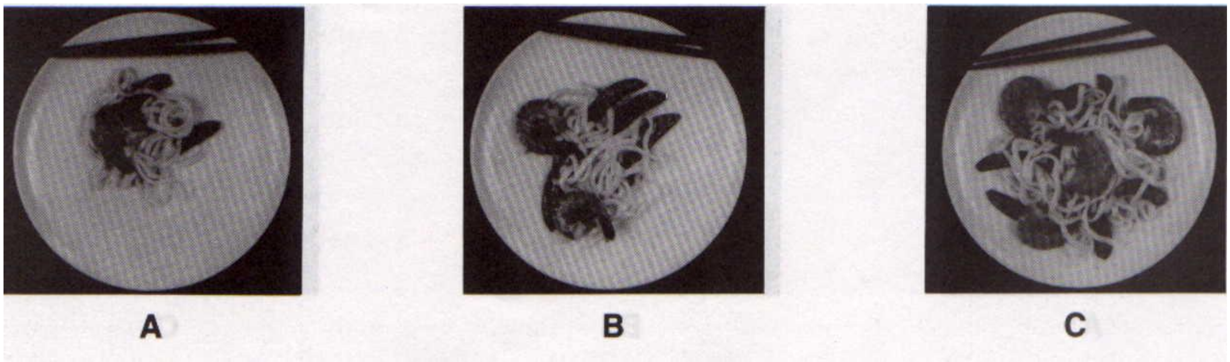
スープ、ラーメン、粥	昨年 1 年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２－３回	4 週に１回	5 週に２－３回	6 週に４－６回	7 日に１回	8 日に２回以上	
1. クリームスープまたはチャウダー			○						１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） (3.) 大きめのお茶碗（2 カップまたはそれ以上）

それでは、回答をスタートして下さい！！！

1. 下記の項目のそれぞれの食物グループ（スープ、ラーメン、粥）について、当てはまる箇所に「〇」印をおつけ下さい。まず最初に昨年 1 年間に平均してどれくらいの頻度で食べたかについて、最も近いものを選びワク内に〇印をつけ、その次に通常あなたが食べる 1 人前の量について、1-3 の中から最も近いものを選び数字を〇で囲んで下さい。

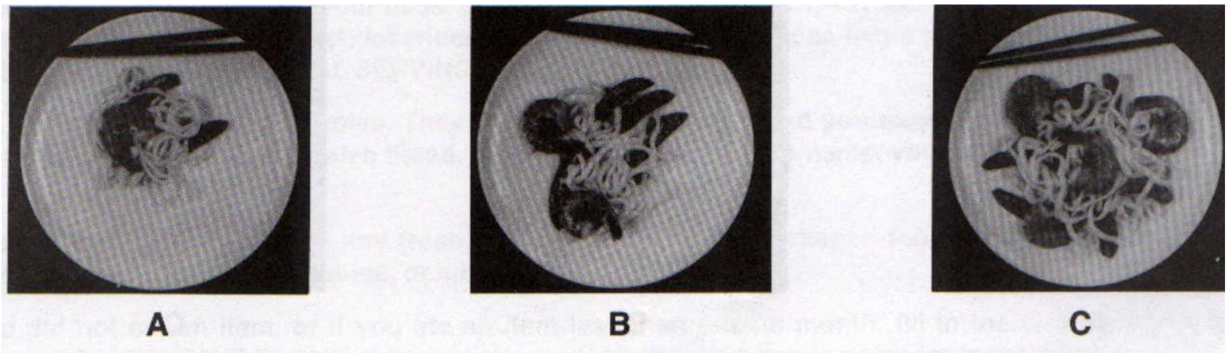
<u>スープ、ラーメン、粥</u>	昨年 1 年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２－３回	4 週に１回	5 週に２－３回	6 週に４－６回	7 日に１回	8 日に２回以上	
1. クリームスープまたはチャウダー									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
2. 乾燥いんげん豆やえんどう豆のスープ（ポルトガル豆や乾燥えんどう豆など）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
3. トマトスープまたは野菜スープ（肉、鳥肉、魚の入っているものも含む）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
4. 味噌汁									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
5. 麺類やライスの入ったスープ（ビーフヌードル、チキンライス、ワンタン麺など）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
6. メキシカンミートスープまたはシチュー（メヌード、アルボンディガス、コシード、ポゾレ）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
7. ラーメンまたはハワイ汁麺（スープで食べる東洋風の麺類）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）
8. 粥（米粥－肉や鶏肉、魚、野菜などが入ったものも含む）									１つ選んでください 1. ½ カップまたはそれ以下 2. 小さめのお茶碗（およそ 1 カップ） 3. 大きめのお茶碗（2 カップまたはそれ以上）

2. 下記の項目のそれぞれの食物グループ（麺類、 スパゲティなど、ミックスディッシュ）
について



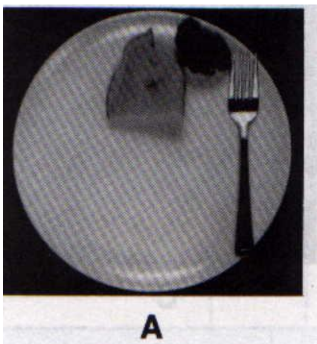
麺類、スパゲティなど、ミックスディッシュ	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. 中華ビーフン、チャーハンまたは焼そば（東洋風の炒めた麺類）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
2. スパゲティ、ラビオリ、ラザーニャ又は他のトマトスープで食べるパスタ料理									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
3. マカロニチーズまたはその他のパスタ料理、チーズキャセロール									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
4. マカロニまたはポテトサラダ（マヨネーズ味）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
5. パスタまたは素麺サラダ									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
6. ヌードルキャセロール（ツナ、鶏や七面鳥の入ったもの）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
7. クリームソース味のパスタ料理（クラムソースのリングヴィーネやビーフストロガノフなど）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
8. アロスコンポヨ（若鶏入り米料理）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
9. シチュー、カレー、ポットパイまたはエンパナーダ（牛肉や子羊の入ったもの）									１つ選んでください 1. 写真 A（½カップ又は１エンパナーダ） 2. 写真 B（およそ１カップ又は１パイ） 3. 写真 C（2 カップ又はそれ以上）
10. シチュー、カレー、ポットパイまたはエンパナーダ（鶏肉や七面鳥の入ったもの）									１つ選んでください 1. 写真 A（½カップ又は１エンパナーダ） 2. 写真 B（およそ１カップ又は１パイ） 3. 写真 C（2 カップ又はそれ以上）

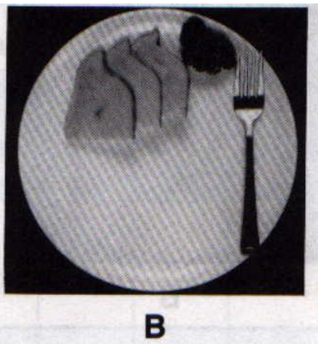
3. 下記の項目のそれぞれの食物グループ（ミックスディッシュ）について



ミックスディッシュ	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. 牛肉または豚肉と野菜の炒め物またはファヒタス（ビーフブロッコリ、麻婆豆腐、中華炒め、すき焼き）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
2. 鶏肉と野菜の炒め物またはファヒタス（すき焼き、煮しめ、鶏ごはん）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
3. えびまたは魚と野菜の炒め物									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
4. 野菜炒め（肉を含まないもの）									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
5. 豚肉と緑色野菜の炒め物又はラウラウス									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B 又は１ラウラウス 3. 写真 C 又は 2 ラウラウス又はそれ以上）
6. チリコンカン									１つ選んでください 1. 写真 A（½カップ又はそれ以下） 2. 写真 B（およそ１カップ） 3. 写真 C（2 カップ又はそれ以上）
7. ハンバーガー（ハンバーガー用のパンにはさんだもの）									１つ選んでください 1. 普通サイズバーガー１個 2. 1/4 ポンドバーガー１個 3. 大きめダブルバーガー１個
8. チーズバーガー（ハンバーガー用のパンにはさんだもの）									１つ選んでください 1. 普通サイズバーガー１個 2. 1/4 ポンドバーガー１個 3. 大きめダブルバーガー１個
9. ミートローフ、肉団子またはパッティ（ファーストフードのハンバーガーなどでないもの）									１つ選んでください 1. 肉団子１－２個 2. １パッティまたはスライス又は肉団子３個 3. 大きめパッティまたは肉団子５個
10. ピザ									１つ選んでください 1. １切れ又はそれ以下 2. 2-3 切れ 3. ４切れ又はそれ以上

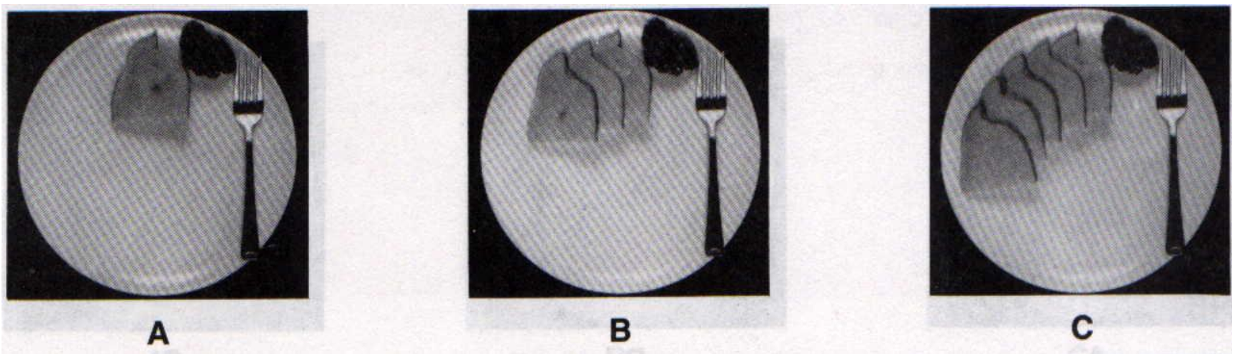
4.　下記の項目のそれぞれの食物グループ（肉類－ミックスディッシュの一部としてではなく）について





肉類(ミックスディッシュの一部としてではなく)	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２－３回	4 週に１回	5 週に２－３回	6 週に４－６回	7 日に１回	8 日に２回以上	
1. ビーフステーキまたはローストビーフ、子牛または子羊（牛肉の照り焼き、コロラド風チリやカルネアサダを含む）									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(およそ 100g 又は厚切りラム１片) 3. 写真 C(150ｇ又はそれ以上)
2. ショートリブ									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(２ショートリブ) 3. 写真 C(3 リブ又はそれ以上)
3. コーンビーフハッシュ（生または缶詰）									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(340g 入り缶詰およそ 1/4) 3. 写真 C(340g 入り缶詰およそ 1/2 又はそれ以上)
4. コーンビーフハッシュ									１つ選んでください 1. 写真 A または１パテ 2. 写真 B または２パテ 3. 写真 C または３パテ又はそれ以上
5. ポークチョップまたはローストポーク、カルアピッグまたは肉の小片（チリベルデを含む）									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(およそ 100g) 3. 写真 C(およそ 150g 又はそれ以上)
6. ハム（焼いたもの、揚げたもの、サンドイッチにはさむものを含む）									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(およそ 100g) 3. 写真 C(およそ 150g 又はそれ以上)
7. 豚脚のハムまたは豚足									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B(およそ 100g) 3. 写真 C(およそ 150g 又はそれ以上)
8. スペアリブ									１つ選んでください 1. 短かめのリブ３本又は長めのリブ１本又はそれ以下 2. 長めのリブ(およそ 15cm)2-3 本 3. 長めのリブ４本又はそれ以上
9. 肝									１つ選んでください 1. 写真 A(およそ 30g 又はそれ以下) 2. 写真 B または鳥レバー3 個 3. 写真 C(およそ 150g 又はそれ以上)
10. 鶏または七面鳥の手羽									１つ選んでください 1. 鳥の手羽先２個またはそれ以下 2. 鳥の手羽先３個 3. 七面鳥一羽又は鳥の手羽先 4 個又はそれ以上

5.　下記の項目のそれぞれの食物グループ（鶏肉と魚－ミックスディッシュの一部としてではなく）について



鶏肉と魚（ミックスディッシュの一部としてではなく）	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２－３回	4 週に１回	5 週に２－３回	6 週に４－６回	7 日に１回	8 日に２回以上	
1. フライドチキン（フライドチキンサンド、ナゲットを含む）									１つ選んでください 1. 写真 A（又は鶏の足 1 本） 2. 写真 B（又は胸肉 1, 腿肉 2, 手羽先又はサンドイッチ 1 個） 3. 写真 C（又は胸肉 2, 又は腿肉 4）
2. ロースト、オーブン焼き、直火焼き、煮込んだりした鶏肉（焼き鳥サンドを含む）									１つ選んでください 1. 写真 A（又は鶏の足 1 本） 2. 写真 B（又は胸肉 1, 腿肉 2, 手羽先又はサンドイッチ 1 個） 3. 写真 C（又は胸肉 2, 又は腿肉 4）
3. 七面鳥（ロースト、挽き肉、調理済み又はサンドイッチの物を含む）									１つ選んでください 1. 写真 A（およそ 30g 又はそれ以下） 2. 写真 B（およそ 100g） 3. 写真 C（およそ 150g 又はそれ以上）
4. 直火焼き海老その他の甲殻類のフライ（天ぷらやいかのフライなどを含む）									１つ選んでください 1. 1-3 品 2. 4-5 品又は 1/2 カップ 3. 6 品又はそれ以上
5. 調理したもの、缶詰や生の甲殻類（かに、いか、えびなど）									１つ選んでください 1. えび 5-6 個又は 1/4 カップ 2. かに 1 匹又は 1/2 カップ 3. 伊勢海老 1 尾又は 1 カップ又はそれ以上
6. 魚フライ（フライパン揚げの魚や冷凍のフィッシュスティック、フィッシュフライサンドを含む）									１つ選んでください 1. 写真 A（およそ 30g） 2. 写真 B（およそ 100g 又はサンドイッチ１個） 3. 写真 C（およそ 150g 又はそれ以上）
7. オーブン焼き、あぶり焼き、煮魚または生の魚（鯛、鮭、さしみなど）									１つ選んでください 1. 写真 A（およそ 30g） 2. 写真 B（およそ 100g） 3. 写真 C（およそ 150g 又はそれ以上）
8. ツナの缶詰（そのままあるいはサラダやサンドイッチ）									１つ選んでください 1. 1/4 カップ又はサンドイッチ半分 2. 1/2 カップ又はサンドイッチ１個 3. １カップ又はサンドイッチ２個
9. その他の魚の缶詰（鮭、さば、サーディンなど）									１つ選んでください 1. 小さめのサーディン３匹又は 1/4 カップ 2. 魚 1/2 カップ 3. 魚１カップ又はそれ以上
10. 塩漬けあるいは乾燥魚（いか、いか類、いりこなど）									１つ選んでください 1. １切れ又は１枚 2. ２切れ 3. ４切れ又はそれ以上

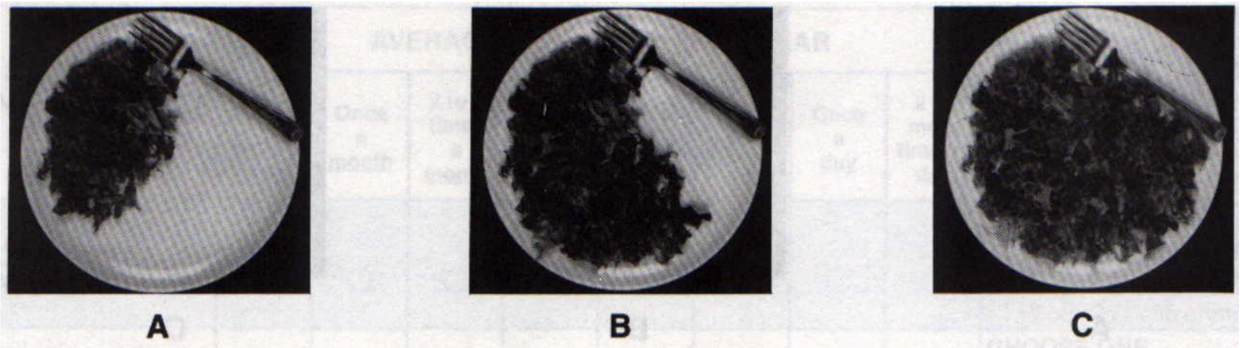
6.　下記の項目のそれぞれの食物グループ（肉の加工食品とメキシコ料理）について

<u>肉の加工食品とメキシコ料理</u>	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. ベーコン(カナディアンベーコンを含む)									１つ選んでください 1. 1切れ又は1枚 2. 2切れ 3. 4切れ又はそれ以上
2. ホットドッグ(牛肉または豚肉)									１つ選んでください 1. ホットドッグ 1/2 個 2. ホットドッグ 1 個 3. ホットドッグ 2 個又はそれ以上
3. 鶏肉または七面鳥のホットドッグまたはランチョンミート									１つ選んでください 1. ホットドッグ 1/2 個又は 1 切れ 2. ホットドッグ 1 個又は 2 切れ 3. ホットドッグ 2 個又は 3 切れ又はそれ以上
4. スパム、ボローニャソーセージ、サラミ、パストラーミまたはその他のランチョンミート									１つ選んでください 1. 1切れ又は1枚 2. 2切れ 3. 4切れ又はそれ以上
5. ソーセージ(ポーク、ビーフ、チョリーゾ、ポーリッシュ、ヴィエンナ、ポルトガル、ホットリンクスソーセージなど)									１つ選んでください 1. 1切れ又は1個 2. 2-3切れ又は1パテ 3. 4切れ又はそれ以上
6. タコス、トースト、パンまたはタコスサラダ(牛肉または豚肉を含むもの)									１つ選んでください 1. 1品又はそれ以下 2. 2品 3. 3品又はそれ以上
7. タコス、トースト、パンまたはタコスサラダ(鶏肉を含むもの)									１つ選んでください 1. 1品又はそれ以下 2. 2品 3. 3品又はそれ以上
8. 肉のブリトー(牛肉や豆その他の組み合わせのものを含む)									１つ選んでください 1. 小さめのブリトー1個 2. 中くらいのブリトー1個 3. 大きめのブリトー1個又は小さめのブリトー2個
9. 野菜または豆のブリトー、タコス、トースト(肉を含まないもの)									１つ選んでください 1. 1品又はそれ以下 2. 2品 3. 3品又はそれ以上
10. 鶏肉のエンチラーダ									１つ選んでください 1. 1エンチラーダ又はそれ以下 2. 2エンチラーダ 3. 3エンチラーダ又はそれ以上
11. 牛肉のエンチラーダ									１つ選んでください 1. 1エンチラーダ又はそれ以下 2. 2エンチラーダ 3. 3エンチラーダ又はそれ以上
12. チーズのエンチラーダ、ケサディーヤまたはチーズナチョス									１つ選んでください 1. 1エンチラーダ又は小さめのケサディーヤ 2. 2エンチラーダまたは1人前のナチョス 3. 3エンチラーダ
13. タマル									１つ選んでください 1. 1/2タマル又はそれ以下 2. 1タマル 3. 2タマル又はそれ以上
14. チリレレノス									１つ選んでください 1. 1/2タマル又はそれ以下 2. 1タマル 3. 2タマル又はそれ以上

7.　下記の項目のそれぞれの食物グループ（ライス、じゃがいも、タロイモ、ポイ）について

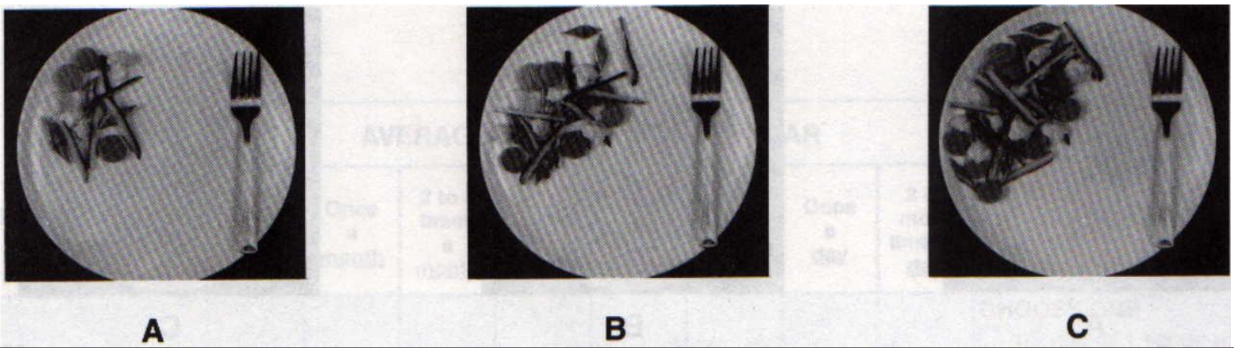
ライス、じゃがいも、タロイモ、ポイ	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1.　精白米 (おむすびを含む)									１つ選んでください 1. 1/2 カップ又は 1 しゃもじ又はそれ以下 2. ご飯茶碗 1 杯(1 カップ)又はむすび 1 個 3. ご飯茶碗 2 杯又はむすび 2 個又はそれ以上
2. すし又はばらずし									１つ選んでください 1. 1-2 個または小盛りで 1 杯 2. 3-4 個または大盛りで 1 杯または 1/2 カップ 3. 5 個または 1 カップ又はそれ以上
3. ブラウンライスまたはワイルドライス									１つ選んでください 1. 1/2 カップ又は 1 しゃもじ又はそれ以下 2. 1 カップ又は 2 しゃもじ 3. 2 カップ又はそれ以上
4. メキシカンライスまたはスパニシュライス									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ 3. 2 カップ又はそれ以上
5. フライドライス									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ 3. 2 カップ又はそれ以上
6. フレンチフライポテト、ハッシュブラウンポテト又はその他のフライドポテト									１つ選んでください 1. 小サイズまたは 1 カップ 2. 中サイズ 3. 大サイズまたはそれ以上
7. マッシュポテト、スカラップポテトまたはポテトのグラタン									１つ選んでください 1. 1/2 カップ又は 1 しゃもじ又はそれ以下 2. 1 カップ又は 2 しゃもじ 3. 2 カップ又はそれ以上
8. ベークドポテトまたはボイルドポテト									１つ選んでください 1. 小サイズ 1 個又は中サイズ 1/2 個又はそれ以下 2. 中サイズ 1 個(およそ 12-13cm) 3. 大サイズのポテト 1 個又はそれ以上
9. 黄色のさつまいも、またはヤムイモ									１つ選んでください 1. 小サイズ 1 個又は中サイズ 1/2 個又はそれ以下 2. 中サイズ 1 個(およそ 12-13cm) 3. 大サイズのポテト 1 個又はそれ以上
10. 白または紫のさつまいも									１つ選んでください 1. 小サイズ 1 個又は中サイズ 1/2 個又はそれ以下 2. 中サイズ 1 個(およそ 12-13cm) 3. 大サイズのポテト 1 個又はそれ以上
11. タロ									１つ選んでください 1. タロイモ 1/4 個又はそれ以下 2. タロイモ 1/2 個 3. タロイモ 1 個又はそれ以上
12. ポイ									１つ選んでください 1. 1/4 カップ又はそれ以下 2. 1/2 カップ 3. 1 カップ又はそれ以上

8.　下記の項目のそれぞれの食物グループ（サラダ、卵、その他の肉類以外の食品）について



サラダ、卵、その他の肉類以外の食品	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. ライトグリーンレタスまたはトストサラダ（アイスバーグレタス、ヘッドレタスなど）									１つ選んでください 1. 写真 A（1/2 カップ又はそれ以下） 2. 写真 B（およそ 1 カップ） 3. 写真 C（1•1/2 カップ又はそれ以上）
2. ダークグリーンレタス（ロマイン、レッド、バター、マノア、エンダイブなど）									１つ選んでください 1. 写真 A（1/2 カップ又はそれ以下） 2. 写真 B（およそ 1 カップ） 3. 写真 C（1•1/2 カップ又はそれ以上）
3. トマト									１つ選んでください 1. 2 切れまたは小トマト 2 個又はそれ以下 2. 4 切れまたは中サイズのトマト 1/2 個 3. 中サイズのトマト 1 個又はそれ以上
4. コールスロー									１つ選んでください 1. 1/4 カップ又はそれ以下 2. 1/2 カップ 3. 1 カップ又はそれ以上
5. サラダにかけるレギュラードレッシングまたはマヨネーズ									１つ選んでください 1. 小さじ 2 杯又はそれ以下 2. 大さじ 1 杯 3. 大さじ 2 杯又はそれ以上
6. サラダにかける低カロリーまたはダイエットドレッシング									１つ選んでください 1. 小さじ 2 杯又はそれ以下 2. 大さじ 1 杯 3. 大さじ 2 杯又はそれ以上
7. 生または調理した卵（エッグサラダを含む）									１つ選んでください 1. 卵 1/2 個 2. 卵 1 個又はサンドイッチ 1 枚 3. 卵 2 個又はそれ以上
8. 卵の代用品									１つ選んでください 1. 大さじ 2 杯 2. 1/4 カップ（＝卵 1 個） 3. 1/2 カップ（＝卵 2 個）又はそれ以上
9. 豆腐									１つ選んでください 1. 1/4 カップ 2. 1/4 サイズまたは 1/2 カップ 3. 1/2 サイズ又はそれ以上
10. ベジタリアンミートローフ、肉団子、パッティ									１つ選んでください 1. ミートボール 1-2 個 2. 1 パティまたは 1 枚またはミートボール 3 個 3. 大きめのパティ 1 枚、ミートボール 5 個又はそれ以上

9.　下記の項目のそれぞれの食物グループ（生または調理した野菜–スープやミックスディッシュに入っているものを除く）について



生または調理した野菜(スープやミックスディッシュに入っているものを除く)	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1.　ブロッコリー(生または調理したもの)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
2.　キャベツ(タマキャベツ、白菜、中国キャベツ、芽キャベツなど)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
3. 青菜(ほうれん草、コラード、からし菜、かぶら菜、白菜、クレソン、トウジシャなど)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
4.　いんげん豆またはえんどう豆									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
5.　その他の青い野菜(ズッキーニ、セロリ、アスパラガス、グリーンペパー、オクラなど)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
6.　カリフラワー									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
7.　人参(または調理したもの)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(1/2 カップ又は中 1 本) 3. 写真 C(1 カップ又はそれ以上)
8.　とうもろこし(生、冷凍または缶詰)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(1/2 カップ又は 1 本) 3. 写真 C(1 カップ又はそれ以上)
9.　カボチャまたは西洋カボチャ									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
10. その他の野菜(ペポカボチャ、ビート、なす等)									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)

10.　下記の項目のそれぞれの食物グループ（乾燥豆–スープやミックスディッシュに入っているものを除く）について

乾燥豆(スープやミックスディッシュに入っているものを除く)	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. フライビーンズ（ブリトーやトーストに含まれるものは除く）									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
2. ベークトビーンズまたはポークビーンズ									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)
3. 乾燥豆やえんどう豆のゆでたもの（あずき、アオイマメ、ぶちいんげん豆または大豆、ささげ、フリホール豆など）									１つ選んでください 1. 写真 A(1/4 カップ又はそれ以下) 2. 写真 B(およそ 1/2 カップ) 3. 写真 C(1 カップ又はそれ以上)

11.　下記の項目のそれぞれの食物グループ（果物とジュース）について

果物とジュース	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1.　オレンジ									１つ選んでください 1. オレンジ 1/2 個又は 1/2 カップ又はそれ以下 2. オレンジ 1 個又は 1 カップ 3. オレンジ 2 個又はそれ以上
2.　タンジェリン、マンダリン									１つ選んでください 1. 1 個又は 1/2 カップ又はそれ以下 2. 2 個又は 1 カップ 3. 3 個又はそれ以上
3.　グレープフルーツまたはザボン									１つ選んでください 1. 1/4 カップ又はそれ以下 2. グレープフルーツ 1/2 個又は 1/2 カップ 3. 1 カップ又はそれ以上
4.　パパイヤ									１つ選んでください 1. パパイヤ 1/4 個又はそれ以下 2. パパイヤ 1/2 個 3. パパイヤ 1 個又はそれ以上
5.　パイナップル（生または缶詰）									１つ選んでください 1. 1 切れ又はそれ以下 2. 1/2 カップ又は 2 切れ 3. 1 カップ又はそれ以上
6.　桃（生、缶詰、乾燥品）									１つ選んでください 1. 桃 1/2 個又はそれ以下 2. 桃 1 個又は 1/2 サイズを 2 個又は 1/2 カップ 3. 桃 2 個又は 1 カップ又はそれ以上
7.　アプリコット（生、缶詰、または乾燥品）									１つ選んでください 1. アプリコット 1 個又はそれ以下 2. アプリコット 2 個又は 1/2 カップ 3. アプリコット 3 個又はそれ以上
8.　西洋なし（生、缶詰または乾燥品）									１つ選んでください 1. 西洋なし 1/2 個又は 1/2 カップ 2. 西洋なし 1 個又は 1 カップ 3. 西洋なし 2 個又はそれ以上

11.　下記の項目のそれぞれの食物グループ（果物とジュース：続き）について

果物とジュース(続き)	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
9.　リンゴ、リンゴソース									１つ選んでください 1. リンゴ 1/2 個又は 1/2 カップ 2. リンゴ 1 個又は 1 カップ 3. リンゴ 2 個又はそれ以上
10.　バナナ									１つ選んでください 1. バナナ 1/2 本 2. バナナ 1 本 3. バナナ 2 本又はそれ以上
11.　カンタロープ(旬の時期)									１つ選んでください 1. カンタロープ 1/4 又はそれ以下 2. カンタロープ 1/2 3. カンタロープ 1 又はそれ以上
12.　すいか(旬の時期)									１つ選んでください 1. 1/4 切れ又は 1/2 カップ 2. 1/2 切れ又は 1 カップ 3. 1 切れ又はそれ以上
13.　マンゴー(旬の時期)									１つ選んでください 1. 薄切り 1/2 カップ 2. 中サイズ 1 個又は 1 カップ 3. 大サイズ 1 個又はそれ以上
14.　アボカド、ガカモーレ									１つ選んでください 1. 薄切り 2 枚又はテーブルスプーン 2 杯 2. アボカド 1/4 個又は 1/4 カップ 3. アボカド 1/2 個又は 1/2 ｶｯﾌﾟ又はそれ以上
15.　その他の果物(生、缶詰、または乾燥品)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 果物 1 個又は 1 カップ 3. 果物 2 個又はそれ以上
16.　オレンジまたはグレープフルーツジュース(オレンジドリンクやオレンジソーダではない)									１つ選んでください 1. 小さめのグラス 1 杯 (1/2 カップ) 2. 大きめのグラス 1 杯 (およそ 240ml) 3. およそ 360ml 入り缶又はそれ以上
17.　トマトまたはＶ-8 ジュース									１つ選んでください 1. 小さめのグラス 1 杯 (1/2 カップ) 2. 大きめのグラス 1 杯 (およそ 240ml) 3. およそ 360ml 入り缶又はそれ以上
18.　その他のフルーツジュースまたはフルーツドリンク									１つ選んでください 1. 小さめのグラス 1 杯 (1/2 カップ) 2. 大きめのグラス 1 杯 (およそ 240ml) 3. およそ 360ml 入り缶又はそれ以上

12.　下記の項目のそれぞれの食物グループ（パン類）について

パン類	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1.　精製パン(サンドイッチパン、フランスパン、サウアドー、菓子パン、ポルトガル風スウィートブレッド)									１つ選んでください 1. 1 切れ又はそれ以下 2. 2 切れ 3. 3 切れ又はそれ以上
2.　全粒パンまたはライ麦パン(パンパーニッケル、全粒ピタパンを含む)									１つ選んでください 1. 1 切れ又はそれ以下 2. 2 切れ 3. 3 切れ又はそれ以上
3.　その他のパン(混合粉、オートブラン、ぶどうパンなど)									１つ選んでください 1. 1 切れ又はそれ以下 2. 2 切れ 3. 3 切れ又はそれ以上
4.　ロールパン、パンス、ビスケット、小麦粉で作ったトルティーヤ(ベーゲル、イングリッシュマフィン)									１つ選んでください 1. 1 品又はそれ以下 2. 2 品又はイングリッシュマフィン 1 個 3. 3 品又はそれ以上
5.　コーントルティーヤ、コーンマフィンまたはコーンブレッド(詰め物のあるコーンブレッドも含む)									１つ選んでください 1. 1 トルティーヤ又はコーンブレッド 1 切れ又は 1/2 カップのスタッフィング 2. 2 トルティーヤ又は 1 マフィン 3. 3 トルティーヤ又は 2 マフィン又はそれ以上
6.　ブラン、ブルーベリーまたはその他のマフィンまたはマンゴーブレッド									１つ選んでください 1. 普通サイズのマフィン 1 個または 1 切れ 2. 大サイズのマフィン 1 個又は 2 切れ 3. マフィン 3 個又は 3 切れ又はそれ以上
7.　甘いロールパン、クロワッサン、ドーナツ、デニッシュペストリーまたはコーヒーケーキ									１つ選んでください 1. 1 品又はそれ以下 2. 2 品 3. 3 品又はそれ以上
8.　パンケーキ、ワッフルまたはフレンチトースト									１つ選んでください 1. 1 品又はそれ以下 2. 2 品 3. 3 品又はそれ以上
9.　パンに塗るマーガリン									１つ選んでください 1. 薄く塗る 2. 厚く塗る
10.　パンに塗るバター									１つ選んでください 1. 薄く塗る 2. 厚く塗る
11.　パンに塗るピーナッツバター									１つ選んでください 1. 薄く塗る 2. 厚く塗る
12.　パンに塗るジャム・ゼリー									１つ選んでください 1. 薄く塗る 2. 厚く塗る
13.　サンドイッチに使うマヨネーズ									１つ選んでください 1. 薄く塗る 2. 厚く塗る

13.　下記の項目のそれぞれの食物グループ（朝食のシリアル、牛乳、チーズ）について

<u>朝食のシリアル、牛乳、チーズ</u>	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２－３回	4 週に１回	5 週に２－３回	6 週に４－６回	7 日に１回	8 日に２回以上	
1.　高強化シリアル(Product19, Total, Most など)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は小分け箱で 1 箱 3. 1・1/2 カップ又はそれ以上
2.　ふすままたは高繊維シリアル									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は小分け箱で 1 箱 3. 1・1/2 カップ又はそれ以上
3.　その他冷たいシリアル(コーンフレーク、チェリオス、グラノーラ)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は小分け箱で 1 箱 3. 1・1/2 カップ又はそれ以上
4.　調理シリアル(オートミール、小麦粉クリーム、挽き割りトウモロコシ)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は小分け箱で 1 箱 3. 1・1/2 カップ又はそれ以上
5.　全乳(飲物としてまたはシリアルにかけて)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は 1/2 パイント箱で 1 箱 3. 2 カップ又はそれ以上
6.　低脂肪牛乳(1%または 2%)(飲物としてまたはシリアルにかけて-乳糖耐性牛乳、乳酸菌飲料を含む)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は 1/2 パイント箱で 1 箱 3. 2 カップ又はそれ以上
7.　無脂肪、スキムミルクまたはバターミルク(飲物としてまたはシリアルにかけて)									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ又は 1/2 パイント箱で 1 箱 3. 2 カップ又はそれ以上
8.　ヨーグルト(低脂肪および無脂肪のものを含む)									１つ選んでください 1. 1/2 カップ 2. 1 カップ 3. 2 カップ又はそれ以上
9.　チョコレートミルク、ココア、オバルティン									１つ選んでください 1. 1/2 カップ又はそれ以下 2. 1 カップ 3. 2 カップ又はそれ以上
10.　ミルクシェイクまたは麦芽飲料									１つ選んでください 1. 1/2 ミルクシェイク又は麦芽飲料 2. 1 ミルクシェイク又は麦芽飲料 3. 2 ミルクシェイク又は麦芽飲料
11.　コテージチーズ(ファーマーチーズ、リコッタチーズを含む)									１つ選んでください 1. 1/4 カップ又はそれ以下 2. 1/2 カップ又は 1 しゃくし 3. 1 カップ又はそれ以上
12.　低脂肪チーズ(低脂肪アメリカン、低脂肪スイス、モッツァレーラなど)									１つ選んでください 1. 1/2 切れ 2. 1 切れ(およそ 30ｇ) 3. 2 切れ(およそ 60ｇ)又はそれ以上
13.　その他のチーズ(アメリカンチーズ、チェダーチーズ、クリームチーズ等)									１つ選んでください 1. 1/2 切れ又は大さじ 1 2. 1 切れ(およそ 30ｇ) 3. 2 切れ(およそ 60ｇ)又はそれ以上

14.　下記の項目のそれぞれの食物グループ（デザートとスナック）について

デザートとスナック	昨年１年間に平均してどれくらいの頻度で食べましたか								あなたが通常摂取する一人前の量
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上	
1. アイスクリーム									１つ選んでください 1. 1 しゃくし(1/2 カップ)又はそれ以下 2. 2 しゃくし(1 カップ)又は 1 本 3. 3-4 しゃくし(およそ 500ｇ)又はそれ以上
2. アイスミルク、フローズンヨーグルトまたはシャーベット									１つ選んでください 1. 1 しゃくし(1/2 カップ)又はそれ以下 2. 2 しゃくし(1 カップ)又は 1 本 3. 3-4 しゃくし(およそ 500ｇ)又はそれ以上
3. クッキー、ブラウニーまたはフルーツバー									１つ選んでください 1. 標準サイズのクッキー1-2 個 2. 標準サイズのクッキー3-4 個、又は特大サイズのクッキー1 個、又はブラウニー1 個又はフルーツバー1 個 3. 大サイズのクッキー又はブラウニー1 個、又はそれ以上
4. ケーキ									１つ選んでください 1. 小サイズ 1 切れ又はカップケーキ 1 個 2. 標準サイズの 1 切れ（1 ケーキの 1/12） 3. 2 切れ又はそれ以上
5. リンゴまたはその他のフルーツパイ、タルト、コブラーまたはターンオーバー									１つ選んでください 1. 小サイズの 1 切れ 2. 1 切れ（1 パイの 1/8）又は 1 品 3. 1/6 パイ又はそれ以上
6. パンプキンパイ、スィートポテトパイ、キャロットパイ									１つ選んでください 1. 小サイズの 1 切れ 2. 標準サイズ 1 切れ（1 パイの 1/8） 3. 1/6 パイ又はそれ以上
7. クリームパイまたはカスタードパイ、エクレアまたはシュークリーム									１つ選んでください 1. 小サイズの 1 切れ 2. 標準サイズ 1 切れ又は 1 品 3. 1/6 パイ又はそれ以上
8. プリンまたはカスタード（フランを含む）									１つ選んでください 1. 1 個又は 1/2 カップ 2. 2 個又は 1 カップ 3. 3 個又は 1•1/2 カップ
9. チョコレートキャンディ									１つ選んでください 1. 1-3 切れ 2. 標準サイズのバー1 個 3. 特大サイズのバー1 個又はそれ以上
10. 点心、パオまたはマナプア(肉や野菜を包んだ中国風パン)									１つ選んでください 1. 1/2 個又はそれ以下 2. 1 個 3. 2 個又はそれ以上
11. その他の点心(しゅうまい、ぎょうざ、揚げワンタン、春巻)									１つ選んでください 1. 1-2 切れ 2. 3-4 切れ 3. 5 切れ又はそれ以上
12. クラッカーやプレッツェル（ソーダ、グラハム、おかき、Wheat Thins）									１つ選んでください 1. スナック 4ー5 個又は大きめのおかき 1 枚 2. スナック 6ー10 個又は大きめのおかき 2 枚 3. 大きめのおかき 3 枚又はそれ以上
13. ピーナツまたはその他のナッツ									１つ選んでください 1. 豆 12 粒又はそれ以下 2. 1/4 カップ 3. 1/2 カップ又はそれ以上
14. ポテトチップス、コーンチップス、トルティーヤ、その他のチップス、チッカローネ（ポークリンズ）									１つ選んでください 1. 1/2 カップ又はスナックバッグ 1 袋 2. 1 カップ又はオンスバッグ 1 袋 3. ツインパック 1/2 袋又はそれ以上
15. ポップコーン									１つ選んでください 1. 1-3 カップ又はそれ以下 2. 電子レンジ用バッグ 1 袋 3. 中サイズの映画館用の容器 1 杯又はそれ以上

15.　下記の項目のそれぞれの飲料グループ（アルコール飲料その他の飲物）について

アルコール飲料その他の飲物	昨年１年間に平均してどれくらいの頻度で食べましたか 1 食べない又はほとんど食べない	2 月に１回	3 月に2−3回	4 週に１回	5 週に2−3回	6 週に4−6回	7 日に１回	8 日に２回以上	あなたが通常摂取する一人前の量
1. レギュラービール、生ビール									１つ選んでください 1. 1缶または小瓶で1瓶、又はそれ以下 2. 2缶または小瓶で2瓶 3. 3缶または小瓶で3瓶 4. 4缶または小瓶で4瓶、又はそれ以上
2. ライトビール									１つ選んでください 1. 1缶または小瓶で1瓶、又はそれ以下 2. 2缶または小瓶で2瓶 3. 3缶または小瓶で3瓶 4. 4缶または小瓶で4瓶、又はそれ以上
3. 白ワイン、ロゼワイン(シャンパン、酒を含む)									１つ選んでください 1. グラス1杯またはそれ以下 2. グラス2杯 3. グラス3杯 4. グラス4杯またはそれ以上
4. 赤ワイン									１つ選んでください 1. グラス1杯またはそれ以下 2. グラス2杯 3. グラス3杯 4. グラス4杯またはそれ以上
ハードリカー（バーボン、スコッチ、ジン、ウォッカ、テキーラ、ラム、カクテル類）									１つ選んでください 1. 1杯またはそれ以下 2. 2杯 3. 3杯 4. 4杯またはそれ以上
6. 普通のソーダ（コカコーラ、ペプシ、7-Up）									１つ選んでください 1. 缶または小グラスに1/2杯 2. 缶または大グラスに1杯 3. 缶またはグラスに2杯 4. 缶またはグラスに3杯、又はそれ以上
7. ダイエットソーダ（ダイエットコーク、ダイエットペプシ、ダイエット7-Up）									１つ選んでください 1. 缶または小グラスに1/2杯 2. 缶または大グラスに1杯 3. 缶またはグラスに2杯 4. 缶またはグラスに3杯、又はそれ以上
8. カプチーノ；1杯またはマグカップ1杯（カフェ・オ・レを含む）									あてはまるものすべて選んでください 1. 砂糖またはハチミツ 2. 砂糖の代用品
9. レギュラーコーヒー；1杯またはマグカップ1杯（入れたものまたはインスタント）									あてはまるものすべて選んでください 1. クリームまたはハーフ アンド ハーフ 2. ミルク 3. 植物性クリーム 4. 砂糖またはハチミツ 5. 砂糖の代用品
10. デカフェコーヒー；1杯またはマグカップ1杯（入れたものまたはインスタント）									あてはまるものすべて選んでください 1. クリームまたはハーフ アンド ハーフ 2. ミルク 3. 植物性クリーム 4. 砂糖またはハチミツ 5. 砂糖の代用品
11. 紅茶；カップ1杯またはグラス1杯　（リプトン紅茶、ウーロン茶、アイスティーなど）									あてはまるものすべて選んでください 1. クリームまたはハーフ アンド ハーフ 2. ミルク 3. 植物性クリーム 4. 砂糖またはハチミツ 5. 砂糖の代用品
12. 緑茶、ハーブティー、その他のお茶；カップ1杯									
13. 強化ダイエット飲料；グラス1杯または　1缶(Slimfastなど)									

16. 次の食品をどのくらいの頻度で食べますか?	昨年１年間に平均してどれくらいの頻度で食べましたか							
	1 食べない又はほとんど食べない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上
1. 西洋ピクルスまたは薬味 （ディル味ピクルスや甘味ピクルスなど）								
2. オリーブ								
3. サルサまたはホットチリペッパー （赤または緑）								
4. ガーリック								
5. オニオン								
東洋漬け物 （キャベツや青菜の塩漬け、たくあん、キムチなど）								
7. 海草 （生または乾燥品）（海苔、ふりかけ）								
8. 肉、ポテト、ライスにかけるグレービーソース								

17. 次のものを食卓でどのくらいの頻度で使いますか?	昨年１年間に平均してどれくらいの頻度で使いましたか							
	1 使わない又はほとんど使わない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上
1. 塩								
2. 醤油または照り焼きソース								
3. マスタード								
4. ケチャップ								
5. サワークリーム								

18. 次のような調理法を、肉・鶏肉・魚にどのくらいの頻度でしますか?	昨年１年間に平均してどれくらいの頻度でしましたか							
	1 しない又はほとんどしない	2 月に１回	3 月に２−３回	4 週に１回	5 週に２−３回	6 週に４−６回	7 日に１回	8 日に２回以上
1. 炭焼き								
2. オーブン焼き								
3. フライ								
4. バーベキュー								

19. 次のものを、肉・鶏肉・魚の調理にどのくらいの頻度で使いますか?	昨年 1 年間に平均してどれくらいの頻度で使いましたか							
	1 使わない 又は ほとんど 使わない	2 月に 1回	3 月に2 −3回	4 週に 1回	5 週に2 −3回	6 週に4 −6回	7 日に 1回	8 日に 2回 以上
1. 植物油								
2. 塩漬け豚肉、ラードまたはベーコンオイル								
3. 植物性ショートニング(クリスコなど)								
4. マーガリン								
5. バター								
6. 植物油スプレー、水、こげつかないフライパン								

20. 次の事柄について昨年 1 年間にどのようであったか、お答え下さい。

20-1. 肉を食べたとき、通常それはどのように調理されてましたか？

1=生
2=中くらいに火が通っていた
3=よく火が通っていた
4=肉は食べない

20-2. 肉を食べたとき、脂肪の部分を食べましたか？

1=ほとんどの場合食べた
2=時々食べた
3=全く食べなかったか、めったに食べなかった
4=肉は食べない

20-3. 鶏肉を食べたとき、皮の部分を食べましたか？

1=ほとんどの場合食べた
2=時々食べた
3=全く食べなかったか、めったに食べなかった
4=鶏肉は食べない

20-4. どの種類のマーガリンを通常使っていましたか？（１つだけ選択）

1=標準の棒状のもの
2=標準の丸い容器入り
3=ダイエット型またはスプレッド型のもの
4=マーガリンは使わない
5=分からない

20-5. どの種類のバターを通常使っていましたか？（１つだけ選択）

1=標準型
2=ホイップ型
3=バターは使わない
4=分からない

20-6. どの種類の植物油を通常使っていましたか？（１つだけ選択）

1=大豆油またはコーン油
2=オリーブ油
3=カノーラ油
4=その他の油
5=油は使わない
6=分からない

ライフスタイルについて

次のセクションはライフスタイルについての質問です。とくにことわりのあるところ以外は、（　）内に実数字または文字を記入するか、あるいは番号をふってあるすべての答えの中から１つだけを選んでその番号を〇印で囲むか、またはその番号のある枠に〇印をおつけください。

21.　年齢は? *(一つだけ選び〇印をおつけください)*

1=18-24 歳　3=30-34 歳　5=40-44 歳　7=50-54 歳　9=60 歳もしくはそれ以上
2=25-29 歳　4=35-39 歳　6=45-49 歳　8=55-59 歳

22.　生まれた国は?　(国名:　　　　　　)

23.　何年日本に住んでいますか？　(　　　　　　) 年

24.　雇用形態は？
(あてはまるものすべてに〇印をおつけください.)

1 = フルタイムで雇用されている
2 = 期間契約、パートタイムまたはカジュアルで雇用されている
3 = 雇われていない（しかし退職していない）
4 = フルタイムで勉強する学生
5 = パートタイムで勉強する学生
6 = 家事に専念
7 = 退職している
8 = 永久的に働くことができない、または病気
9 = その他（具体的に:　　　　　　　　　　）

[質問 25-31 までは、中年の世代(40-60 歳)のみがお答えください。]

25.　社内における地位は？ *(一つだけ選び〇印をおつけください)*

1 = 一般職
2 = 下位管理職
3 = 中位管理職
4 = 上位管理職
5 = 専門職
6 = 自営業
7 = あてはまらない

26.　一週間に大体何日間くらいはたらきますか？（フルタイムの場合にも、またパートタイムの場合にも）

(　　　　　　　　) 日間

27.　一週間に大体何時間ぐらいはたらきますか？（
(注、休日出勤や残業があれば、給料支払いの有無にかかわらず、それを含めてお答えください)

(　　　　　　　　) 時間

28.　休日出勤することがありますか？

1 = ある　　　　2 = ない

29.　残業はありますか？　また多い月で月に大体何時間くらい残業しますか？休日出勤も含みます。

1 = ある（　　　　）時間　　　　2 = 残業はない

30. 仕事を自宅に持ち帰りますか？ *(一つだけ選び○印をおつけください)*

1 = いつも持ち帰る
2 = いつもではないがかなり持ち帰る
3 = 時々持ち帰る
4 = ほとんど持ち帰らない
5 = 決して持ち帰らない

31. 午後 10 時から翌朝午前 5 時までの時間帯に仕事をすることがありますか？
ある場合には月に何日くらいですか？

1 = ある (　　　　　　) 回くらい　　2 = ない

32. タバコを吸いますか？

1 = 現在吸っている　　2 = 吸っていたがやめた　　3 = もともと吸わない

（前問で「1=現在吸っている」とお答えの方々にお尋ねします）

31-2. 最近の喫煙本数は一日に何本ですか？　（　　　　　）本くらい

33. 最近の体重はどれくらいですか？

(　　　　　　　) kg

34. 身長はどれくらいですか？

(　　　　　　　) cm

35. ウエスト、ヒップサイズはどれくらいですか？

1 = ウエスト　(　　　　　) cm　　2 = ヒップサイズ　(　　　　　) cm

36. 最近の睡眠状態についてお聞きします。

最近の睡眠状態	そういうことはない	月に 1-3 日	月に 4-7 日	月に 8-14 日	月に 15-21 日	月に 22 日以上
5. 寝つきの悪いことがある	0	1	2	3	4	5
6. あまりに早く目が覚めることがある	0	1	2	3	4	5
7. 夜中に何度も目が覚めることがある	0	1	2	3	4	5
8. 疲れきって、睡眠がとれないことがある	0	1	2	3	4	5
5. ふだんの大体の睡眠時間は	5 時間以下	6 時間	7 時間	8 時間	9 時間	10 時間以上
	1	2	3	4	5	6

身体活動状況

37. 昨年１年間に、平均して１日にどれくらい、下記に示した座りながら行なう活動に時間を費やしましたか？　それぞれの項目についてあてはまる回答を１つ選び〇印をおつけください。

	行なわなかった	1 時間以下	1~2 時間	3~4 時間	5~6 時間	7~10 時間	11 時間又はそれ以上
1. 車やバスの中で座っていること							
2. 座っておこなう仕事							
3. テレビを見ること							
4. 座って（または椅子に腰掛けて）食事をすること							
5. その他の座って行なう活動（例えば、読書、トランプゲームコンピューターゲームなど）							
	1	2	3	4	5	6	7

38. 昨年１年間に、平均して一週間にどれくらい、下記に示した活動に時間を費やしましたか？　それぞれの項目についてあてはまる回答を１つ選び〇印をおつけください。

	行なわなかった	½ ~ 1 時間	2~3 時間	4~6 時間	7~10 時間	11~20 時間	21~30 時間	31 時間又はそれ以上
1. 体力を必要とするスポーツ（例えばジョギング、自転車で坂道を登る、テニス、水泳、エアロビクス）								
2. 体力の要る仕事（例えば重い家具の移動、トラックの荷積みまたは荷降ろし作業、シャベル作業、または同等の肉体労働）								
3. 適度の活動（例えばきびきびと歩く、平地で自転車に乗る、庭いじり）								
	1	2	3	4	5	6	7	8

これで質問は終わりです。お忙しいところご協力いただきまして本当にありがとうございました。お手数ですが、回答用紙に記入もれがないかもう一度確認し封筒に入れて担当者に郵送（または手渡し）してください。

APPENDIX 2.1 Food list and intake parameters used with the Nutritionist Five Software (NFS)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1. SOUP, RAMEN, AND JOOK				
0101	Cream Soup or Chowder			
25298	Cream of vegetable soup	1cup (284.697gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0102	Dried Bean or Pea (Legume) Soup (such as Portuguese bean, split pea)			
25296	Bean soup	1cup (300.939gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0103	Tomato or Vegetable Soup (may include meat, poultry, or fish)			
29635	Vegetable soup	1cup (234.000gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0104	Miso Soup			
30282	Soybean [miso] soup	1cup (240.000gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0105	Broth with Noodles or Rice (such as beef noodle, chicken rice, won tun mein)			
29575	Noodle soup [includes ramen, spaghetti soup]	1cup (233.000gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0106	Mexican Meat Soup or Stew (such as menudo, albondigas, cocido, pozole)			
16264	Norpac soup supreme international classics mexican corn and black bean soup	1cup (245.000gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
0107	Ramen or Saimin (Oriental Noodles with broth)			
16265	Norpac soup supreme International classics oriental style chicken noodle with ginger soup	1cup (245.000gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
0108	Jook (rice gruel – may include meat, poultry, fish, or vegetables)			
	6128 Instant rice porridge with fish [Bubur 1kan, segera]	1cup (226.400gm)	1. ½ cup or less OR	0.5
			2. Small bowl (about 1 cup) OR	1
			3. Large bowl (2 cups or more)	2
2. NOODLES, SPAGHETTI, AND MIXED DISHES				
0201	Chow Mein, Chow Fun, or Yakisoba (Oriental fried noodles)			
	449 Chinese chow mein noodles, prepared	1cup (45.000gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2
0202	Spaghetti, Ravioli, Lasagna, or other Pasta with Tomato Sauce			
	29573 Spaghetti with tomato sauce or meat sauce and meatballs	1cup (248.000gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2
0203	Macaroni and Cheese or other Pasta and Cheese Casseroles			
	25255 Macaroni and cheese	1cup (218.189gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2
0204	Macaroni or Potato Salad (with mayonnaise)			
	25272 Macaroni salad	1cup (104.783gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2
0205	Pasta or Somen Salad			
	25273 Pasta salad	1cup (199.266gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2
0206	Noodle Casseroles (with tuna, chicken or turkey)			
	16638 Tuna noodle casserole with peas and mushrooms	1cup (224.000gm)	1. Photo A (½ cup or less) OR	0.5
			2. Photo B (about 1 cup) OR	1
			3. Photo C (2 cups or more)	2

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
0207	Pasta with Cream Sauce (such as linguine with clam sauce, beef stroganoff)				
	30233	Beef stroganoff with noodles	1cup (256.000gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0208	Arroz Con Pollo (rice with chicken)				
	31191	Rice with chicken	1cup (163.000gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0209	Stew, Curry, Pot Pie or Empanada (with beef or lamb)				
	25103	Lamb stew	1cup (271.457gm)	1. Photo A (½ cup or 1 Empanada) OR	0.5
				2. Photo B (about 1 cup or 1 pie) OR	1
				3. Photo C (2 cups or more)	2
0210	Stew, Curry, Pot Pie or Empanada (with chicken or turkey)				
	7728	SWANSON MAIN DISH Chicken stew canned	1cup (227.000gm)	1. Photo A (½ cup or 1 Empanada) OR	0.5
				2. Photo B (about 1 cup or 1 pie) OR	1
				3. Photo C (2 cups or more)	2
3. MIXED DISHES					
0301	Stir-Fried Beef or Pork and Vegetables, or Fajitas (such as beef broccoli, pork tofu, chop suey, sukiyaki)				
	30028	TYSON RESTAURANT FAVORITES, Beef stir fry	1cup (145.455gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0302	Stir-Fried Chicken and Vegetables, or Fajitas (such as sukiyaki, nishime, chicken long rice)				
	30026	TYSON RESTAURANT FAVORITES, Chicken stir fry kit	1cup (145.455gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0303	Stir-Fried Shrimp or Fish and Vegetables				
	28579	Scallop and shrimp stir fry	1cup (145.455gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2

(cont.)

Item no. / Questionnaire food label		Closest equivalent in NFS	Standard measures	Serving Size	Ratio used
0304	Stir-Fried Vegetables (no meat)				
	30611	GREEN GIANT AMERICAN MIXTURES, Broccoli, carrots & water chestnut stir fry	1cup (122.388gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0305	Pork and Greens or Laulaus				
	16656	Lau Lau (Pork/Fish in Taro/Spinach leaves)	1cup (214.000gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (2 cups or more)	2
0306	Chili				
	29615	Chili con carne	1cup (254.000gm)	1. ½ cup or less OR	0.5
				2. Small bowl (1 cup) OR	1
				3. Large bowl (2 cups or more)	2
0307	Hamburgers (on a bun)				
	739	McDonald’s hamburger	1item (107.000gm)	1. 1 regular size burger OR	1
				2. 1 quarter-pound burger OR	1.6
				3. 1 large double burger	2
0308	Cheeseburgers (on a bun)				
	738	McDonald’s cheeseburger	1item (121.000gm)	1. 1 regular size burger OR	1
				2. 1 quarter-pound burger OR	1.6
				3. 1 large double burger	2
0309	Meat Loaf, Meatballs, or Patties (not fast-food hamburgers)				
	25105	Meat loaf	1slice (115.690gm)	1. 1 to 2 meatballs OR	0.5
				2. 1 patty or slice or 3 meatballs OR	1
				3. 1 large patty or 5 meatballs	2
0310	Pizza				
	6115	Cheese pizza	1slice (63.000gm)	1. 1 piece or slice or less OR	1
				2. 2 to 3 pieces OR	2.5
				3. 4 pieces or more	4

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
4. MEATS (NOT PART OF MIXED DISHES)					
0401	Beef Steak or Roast, Veal or Lamb (includes beef teriyaki, chile colorado and carne asada)				
	29592	Beef steak, lean only, fried	1ounce (28.333gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (3 oz or 1 lamb chop) OR	3
				3. Photo C (5 ounces or more)	5
0402	Shortribs				
	25066	Braised beef shortribs	1ounce (28.350gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (or 2 shortribs) OR	2
				3. Photo C (or 3 ribs or more)	3
0403	Corned Beef (fresh or canned)				
	10380	Libby's corned beef	1ounce (28.350gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (or ¼ 12-oz. Tin) OR	3
				3. Photo C (or ½ 12-oz. Tin or more)	6
0404	Corned Beef Hash				
	10379	Libby's corned beef hash	1ounce (28.350gm)	1. Photo A or 1 patty OR	1
				2. Photo B or 2 patties OR	3
				3. Photo C or 3 patties or more	6
0405	Pork Chops or Roasts, Kalua Pig, or Carnitas (includes chile verde)				
	5706	Pork loin, tenderloin chop, lean, roasted	1ounce (28.350gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (3 ounces) OR	3
				3. Photo C (5 ounces or more)	5
0406	Ham (includes baked, fried, or sandwich)				
	16558	Ham, fried, lean & fat	1ounce (28.350gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (3 ounces) OR	3
				3. Photo C (5 ounces or more)	5
0407	Ham Hocks or Pig's Feet				
	30275	Pork, whole leg or ham, separable lean only, roasted	1ounce (28.333gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (3 ounces) OR	3
				3. Photo C (5 ounces or more)	5

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
0408	Spareribs				
	25056	Roasted pork spareribs	1serving (176.360gm)	1. 3 small or 1 long rib or less OR	1
				2. 2 to 3 long ribs (5-7 inches) OR	2.5
				3. 4 long ribs or more	4
0409	Liver				
	1270	Chicken liver, simmered	1ounce (28.333gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B or 3 chicken livers OR	3
				3. Photo C (5 ounces or more)	5
0410	Chicken or Turkey Wings				
	1283	Chicken wing, meat and skin, roasted	2items (68.000gm)	1. 2 chicken wings or less OR	1
				2. 3 chicken wings OR	1.5
				3. 1 turkey or 4 chicken wings or more	2
5. POULTRY AND FISH (NOT PART OF MIXED DISHES)					
0501	Fried Chicken (includes fried chicken sandwich, nuggets)				
	1280	Chicken thigh, meat and skin, flour coated, fried	2items (248.000gm)	1. Photo A (or 1 drumstick) OR	0.5
				2. Photo B (or 1 breast, 2 thights, 3 wings, or 1 sandwich) OR	1
				3. Photo C (or 2 breasts or 4 thighs)	2
0502	Roasted, Baked, Grilled or Stewed Chicken (includes grilled chicken sandwich)				
	1273	Chicken breast, meat and skin, roasted	1item (198.000gm)	1. Photo A (or 1 drumstick) OR	0.5
				2. Photo B (or 1 breast, 2 thights, 3 wings, or 1 sandwich) OR	1
				3. Photo C (or 2 breasts or 4 thighs)	2
0503	Turkey (includes roast, ground, deli-style, or sandwich)				
	3241	Turkey, (all parts) meat & skin, roasted	1ounce (28.333gm)	1. Photo A (1 ounce or less) OR	1
				2. Photo B (3 ounces) OR	3
				3. Photo C (5 ounces or more)	5
0504	Fried Shrimp or other Shellfish (includes tempura, fried calamari or squid)				
	158	Shrimp, mixed species, breaded, fried	1item (7.500gm)	1. 1 to 3 items OR	2
				2. 4 to 5 items or ½ cup OR	4.5
				3. 6 items or more	6

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
0505	Cooked, Canned, or Raw Shellfish (such as crab, squid, shrimp)			
	6044 Atlantic snow, spider or queen crab, canned drained	1cup (134.953gm)	1. 5-6 shrimp or ¼ cup OR	0.25
			2. 1 crab or ½ cup OR	0.5
			3. 1 lobster tail or 1 cup or more	1
0506	Fried Fish (includes pan-fried fish, frozen fish sticks, fried fish sandwich)			
	7746 SWANSON Fish'N chips dinner, battered, fried	1ounce (28.350gm)	1. Photo A (about 1 ounce) OR	1
			2. Photo B (3 oz. Or 1 sandwich OR	3
			3. Photo C (5 ounces or more)	5
0507	Baked, Broiled, Boiled or Raw Fish (such as red snapper, salmon, sashimi)			
	1594 Salmon, broiled or baked with butter	1ounce (28.333gm)	1. Photo A (about 1 ounce) OR	1
			2. Photo B (3 ounces) OR	3
			3. Photo C (5 ounces or more)	5
0508	Canned Tunafish (plain, salad, or sandwich)			
	159 Light tuna, canned in oil, drained	1cup (146.000gm)	1. ¼ cup or ½ sandwich OR	0.25
			2. ½ cup or 1 sandwich OR	0.5
			3. 1 cup or 2 sandwiches	1
0509	Other Canned Fish (such as salmon, mackerel, sardines)			
	1587 Jack mackerel, solids, canned, drained	1cup (190.000gm)	1. 3 small sardines or ¼ cup OR	0.25
			2. ½ cup fish OR	0.5
			3. 1 cup fish or more	1
0510	Salted and Dried Fish (such as ike, cuttlefish, iriko)			
	6527 Cuttlefish, dried	1slice(25gm)(24.956gm)	1. 1 slice or strip or piece OR	1
			2. 2 slices OR	2
			3. 4 slices or more	4
6. PROCESSED MEATS AND MEXICAN DISHES				
0601	Bacon (includes Canadian bacon)			
	161 Bacon pork, cooked	1slice (6.300gm)	1. 1 slice or strip or piece OR	1
			2. 2 slices OR	2
			3. 3 slices or more	3

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
0602	Regular Hot Dogs (beef or pork)			
29660	Hot dog on bun	1items (85.000gm)	1. ½ hot dog OR	0.5
			2. 1 hot dog OR	1
			3. 2 hot dogs or more	2
0603	Chicken or Turkey Hot Dogs or Luncheon Meats			
13556	OSCAR MAYER FREE Hot Dog, Made with turkey & beef	1item (50.000gm)	1. ½ hot dog or 1 slice OR	0.5
			2. 1 hot dog or 2 slices OR	1
			3. 2 hot dogs or 3 slices or more	2
0604	Spam, Bologna, Salami, Pastrami or other Luncheon Meats			
17386	Composite-Lunch Meats, Bologna/salami	1ounce (28.400gm)	1. 1 slice (1 ounce or less) OR	1
			2. 2 slices OR	2
			3. 3 slices or more	3
0605	Sausage (such as pork, beef, chorizo, polish, Vienna, Portuguese, hot links)			
204	Pork sausage, link, cooked	1item (13.000gm)	1. 1 piece or link OR	1
			2. 2-3 pieces or links or 1 patty OR	2.5
			3. 4 pieces or links or more	4
0606	Tacos, Tostadas, Sopes, or Taco Salad (with beef or pork)			
14440	MIGHTY TACO, Beef taco salad	1item (403.000gm)	1. 1 item or less OR	1
			2. 2 items OR	2
			3. 3 items or more	3
0607	Tacos, Tostadas, Sopes, or Taco Salad (with chicken)			
14441	MIGHTY TACO, Chicken taco salad	1item (388.000gm)	1. 1 item or less OR	1
			2. 2 items OR	2
			3. 3 items or more	3
0608	Meat Burritos (includes beef and bean and other combinations)			
28507	Beef burritos	1item (358.621gm)	1. 1 fast-food burrito OR	0.75
			2. 1 medium burrito OR	1
			3. 1 large or 2 fast-food burritos	1.5

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
0609	Vegetable or Bean Burritos, Tacos, or Tostadas (no meat)				
	14439	MIGHTY TACO, Vegetarian burrito	1item (232.000gm)	1. 1 item or less OR	1
				2. 2 items OR	2
				3. 3 items or more	3
0610	Enchiladas with Chicken				
	9375	HEALTHY CHOICE, Chicken enchiladas suiza entree	1item (284.000gm)	1. 1 enchilada or less OR	1
				2. 2 enchiladas OR	2
				3. 3 enchiladas or more	3
0611	Enchiladas with Beef				
	14784	BANQUET, Beef enchilada meal	1item (312.000gm)	1. 1 enchilada or less OR	1
				2. 2 enchiladas OR	2
				3. 3 enchiladas or more	3
0612	Enchiladas with Cheese, Quesadillas, or Nachos with Cheese				
	14785	BANQUET, Cheese enchilada meal	1item (312.000gm)	1. 1 enchilada or small quesadilla OR	1
				2. 2 enchiladas or 1 serving nachos OR	2
				3. 3 enchiladas	3
0613	Tamales				
	15131	DERBY, Tamales	1serving (186.000gm)	1. ½ tamale or less OR	0.5
				2. 1 tamale OR	1
				3. 2 tamales or more	2
0614	Chili Rellenos				
	32141	Cheese stuffed chilies (Chiles Rellenos)	1item (141.775gm)	1. ½ chili relleno or less OR	0.5
				2. 1 chili relleno OR	1
				3. 2 chili rellenos or more	2
7. RICE, POTATOES, TARO AND POI					
0701	White Rice (includes musubi)				
	484	Long grain white rice, boiled	1cup (158.000gm)	1. ½ cup or 1 scoop or less OR	0.5
				2. 1 rice bowl (1 cup) or 1 musubi OR	1
				3. 2 rice bowls or 2 musubi or more	2

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
0702	Sushi or Barazushi			
	16820 Sushi with vegetables in seaweed	1piece (26.000gm)	1. 1-2 pieces or small cone OR	1.5
			2. 3-4 pieces or 1 large cone or ½ cup	3.5
			3. 5 pieces or 1 cup or more	5
0703	Brown or Wild Rice			
	1994 Wild brown rice, cooked	1cup (164.000gm)	1. ½ cup or 1 scoop or less OR	0.5
			2. 1 cup or 2 scoops OR	1
			3. 2 cups or more	2
0704	Mexican or Spanish Rice			
	1685 Spanish rice	1cup (243.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup OR	1
			3. 2 cups or more	2
0705	Fried Rice			
	25177 Fried rice	1cup (223.124gm)	1. ½ cup or less OR	0.5
			2. 1 cup OR	1
			3. 2 cups or more	2
0706	French-Fried, Hash-Browned or other Fried Potatoes			
	1091 Hashed brown potatoes	1cup (156.000gm)	1. fast-food small order or 1 cup OR	1
			2. fast-food medium order OR	1.5
			3. fast-food large order or more	2
0707	Mashed, Scalloped or Au Gratin Potatoes			
	1089 Au gratin potatoes	1cup (245.000gm)	1. ½ cup or 1 scoop or less OR	0.5
			2. 1 cup or 2 scoops OR	1
			3. 2 cups or more	2
0708	Baked or Boiled White Potatoes			
	5791 Potatoes flesh and skin, baked	1item (202.000gm)	1. 1 small or ½ medium or less OR	0.5
			2. 1 medium (about 5 inches) OR	1
			3. 1 large potato or more	2

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
0709	Yellow-Orange Sweet Potatoes or Yams				
	29265	Yams	1item (130.000gm)	1. 1 small or ½ medium or less OR	0.5
				2. 1 medium (about 5 inches) OR	1
				3. 1 large potato or more	2
0710	White or Purple Sweet Potatoes				
	29262	Sweet potato	1item (130.000gm)	1. 1 small or ½ medium or less OR	0.5
				2. 1 medium (about 5 inches) OR	1
				3. 1 large potato or more	2
0711	Taro				
	1117	Taro root, cooked	1cup (131.343gm)	1. ¼ taro or less OR	0.25
				2. ½ taro OR	0.5
				3. 1 whole taro or more	1
0712	Poi				
	1087	Poi	1cup (242.424gm)	1. ¼ cup or less OR	0.25
				2. ½ cup OR	0.5
				3. 1 cup or more	1
8. SALAD ITEMS, EGGS, AND OTHER NON-MEAT ITEMS					
0801	Light Green Lettuce or Tossed Salad (such as iceberg or head lettuce)				
	626	Iceberg lettuce	1cup (55.000gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (1- ½ cups or more)	1.5
0802	Dark Green Lettuce (such as romaine, red, butter, manoa, endive)				
	1665	Romaine lettuce, shredded	1cup (56.000gm)	1. Photo A (½ cup or less) OR	0.5
				2. Photo B (about 1 cup) OR	1
				3. Photo C (1- ½ cups or more)	1.5
0803	Tomatoes				
	671	Tomato, red	1item (123.000gm)	1. 2 slices or wedges or 2 cherry tomatoes or less OR	0.25
				2. 4 slices or ½ medium tomato OR	0.5
				3. 1 medium tomato or more	1

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
0804	Coleslaw			
1062	Coleslaw	1cup (120.000gm)	1. ¼ cup or less OR	0.25
			2. ½ cup OR	0.5
			3. 1 cup or more	1
0805	Regular Salad Dressings or Mayonnaise added to Salads			
144	Salad dressing, cooked	1TBSP (16.000gm)	1. 2 teaspoons or less OR	0.7
			2. 1 tablespoon OR	1
			3. 2 tablespoons or more	2
0806	Low-Calorie or Diet Dressings added to Salads			
135	Low fat French salad dressing	1TBSP (16.300gm)	1. 2 teaspoons or less OR	0.7
			2. 1 tablespoon OR	1
			3. 2 tablespoons or more	2
0807	Eggs, Cooked or Raw (includes egg salad)			
100	Hard boiled egg	1item (50.000gm)	1. ½ egg OR	0.5
			2. 1 egg or 1 sandwich OR	1
			3. 2 eggs or more	2
0808	Egg Substitute			
30302	Egg substitute, cooked	0.25cup (52.500gm)	1. 2 tablespoons OR	0.5
			2. ¼ cup (= 1 egg) OR	1
			3. ½ cup (= 2 eggs) or more	2
0809	Tofu (soybean curd)			
1816	Tofu, raw, firm	0.5cup (126.000gm)	1. 2 cubes or ¼ cup OR	0.5
			2. ¼ block or ½ cup OR	1
			3. ½ block or more	2
0810	Vegetarian Meat Loaf, Meatballs or Patties			
17376	Composite-vegetarian meat substitute, low fat	1meatball (14.000gm)	1. 1 to 2 meatballs OR	1.5
			2. 1 patty or slice or 3 meatballs OR	3
			3. 1 large patty, 5 meatballs or more	5

(cont.)

Item no. / Questionnaire food label		Closest equivalent in NFS	Standard measures	Serving Size	Ratio used
9. RAW OR COOKED VEGETABLES (NOT IN SOUPS OR MIXED DISHES)					
0901	Broccoli (raw or cooked)				
	588	Broccoli, chopped, boiled, drained	1cup (156.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0902	Cabbage (such as head, Chinese or Napa cabbage, Brussels sprouts)				
	8850	Cabbage	1cup (89.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0903	Dark Leafy Greens (such as spinach, collard, mustard or turnip greens, bok choy, watercress, chard)				
	1135	Watercress	1cup (34.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0904	Green Beans or Peas				
	2725	Green beans	1cup (110.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0905	Other Green Vegetables (such as zucchini, celery, asparagus,, green pepper, okra)				
	1111	Zucchini	1cup (113.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0906	Cauliflower				
	5770	Cauliflower	1cup (99.965gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0907	Carrots (raw or cooked)				
	600	Carrots	1cup (121.393gm)	1. Photo A (or 4-5 sticks or less) OR	0.25
				2. Photo B (½ cup or 1 med.) OR	0.5
				3. Photo C (1 cup or more)	1

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS			Standard measures	Serving Size	Ratio used
0908	Corn (fresh, frozen, or canned)				
	29614	Yellow corn, fresh, cooked	1cup (164.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (½ cup or 1 cob) OR	0.5
				3. Photo C (1 cup or more)	1
0909	Pumpkin or Yellow-Orange Winter Squash				
	1705	Pumpkin	1cup (116.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
0910	Other Vegetables (such as white or summer squash, beets, eggplant)				
	5760	Beets	1cup (135.804gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
10. DRIED BEANS (NOT IN SOUPS OR MIXED DISHES)					
1001	Refried Beans (not in burritos or tostadas)				
	25309	Refried beans	1cup (316.500gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
1002	Baked Beans or Pork and Beans				
	25300	Baked beans	1cup (349.936gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
1003	Boiled Dried Beans or Peas (such as red, lima, pinto or soy beans, black-eyed peas, frijoles de la olla)				
	1670	Soybeans, boiled	1cup (172.000gm)	1. Photo A (¼ cup or less) OR	0.25
				2. Photo B (about ½ cup) OR	0.5
				3. Photo C (1 cup or more)	1
11. FRUITS AND JUICES					
1101	Oranges				
	273	Orange	1item (131.000gm)	1. ½ orange or ½ cup or less OR	0.5
				2. 1 orange or 1 cup OR	1
				3. 2 oranges or more	2

(cont.)

Item no. / Questionnaire food label		Closest equivalent in NFS	Standard measures	Serving Size	Ratio used
1102	Tangerines or Mandarin Oranges				
	316	Tangerine	1item (84.000gm)	1. 1 tangerine or ½ cup or less OR	1
				2. 2 tangerines or 1 cup OR	2
				3. 3 tangerines or more	3
1103	Grapefruit or Pomelo				
	3021	Grapefruit	1cup (228.855gm)	1. ¼ cup or less OR	0.25
				2. ½ grapefruit or ½ cup OR	0.5
				3. 1 cup or more	1
1104	Papaya				
	282	Papaya	1item (304.000gm)	1. ¼ papaya or less OR	0.25
				2. ½ papaya OR	0.5
				3. 1 papaya or more	1
1105	Pineapple (fresh or canned)				
	295	Pineapple	1cup (155.000gm)	1. 1 slice or wedge or less OR	0.25
				2. ½ cup or 2 slices or wedges OR	0.5
				3. 1 cup or more	1
1106	Peaches (fresh, canned, or dried)				
	284	Peaches	1cup (343.433gm)	1. ½ peach or less OR	0.25
				2. 1 peach or 2 halves or ½ cup OR	0.5
				3. 2 peaches or 1 cup or more	1
1107	Apricots (fresh, canned, or dried)				
	228	Apricots	1cup (155.000gm)	1. 1 apricot or less OR	0.25
				2. 2 apricots or ½ cup OR	0.5
				3. 3 apricots or more	1
1108	Pears (fresh, canned, or dried)				
	291	Pear	1cup (165.000gm)	1. ½ pear or ½ cup OR	0.5
				2. 1 pear or 1 cup OR	1
				3. 2 pears or more	2

(cont.)

Item no. / Questionnaire food label		Closest equivalent in NFS	Standard measures	Serving Size	Ratio used
1111	Cantaloupe (in season)				
	8451	Cantaloupe without seeds and rind	1item (630.360gm)	1. ¼ cantaloupe or less OR	0.25
				2. ½ cantaloupe OR	0.5
				3. 1 cantaloupe or more	1
1112	Watermelon (in season)				
	8468	Watermelon without rind or seeds	1cup (160.000gm)	1. 1 quarter slice or ½ cup OR	0.5
				2. 1 half slice or 1 cup OR	1
				3. 1 whole slice or more	2
1113	Mangoes (in season)				
	999	Mango	1cup (165.000gm)	1. ½ cup slices OR	0.5
				2. 1 medium or Pirie or 1 cup OR	1
				3. 1 large or Hayden or more	2
1114	Avocados and Guacamole				
	29648	Avocado, fresh	0.5cup (73.000gm)	1. 2 slices or 2 tablespoons OR	0.25
				2. ¼ avocado or ¼ cup OR	0.5
				3. ½ avocado or ½ cup or more	1
1116	Orange or Grapefruit Juice (not orange drinks or orange soda)				
	275	Orange juice	8ounce (226.800gm)	1. Small juice glass (½ cup) OR	0.5
				2. Large glass (8ounces) OR	1
				3. 12-ounce can or more	1.5
1117	Tomato or V-8 Juice				
	675	Tomato juice, canned	8ounce (226.800gm)	1. Small juice glass (½ cup) OR	0.5
				2. Large glass (8ounces) OR	1
				3. 12-ounce can or more	1.5
12. BREAD ITEMS					
1201	White Bread (includes sandwich, French, sourdough, pan dulce, Portuguese sweet bread)				
	25190	White bread	1slice (33.689gm)	1. 1 slice or less OR	1
				2. 2 slices OR	2
				3. 3 slices or more	3

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1202	Whole Wheat or Rye Bread (includes pumpernickel, whole wheat pita bread)			
	4928 Whole wheat bread	1slice (28.350gm)	1. 1 slice or less OR	1
			2. 2 slices OR	2
			3. 3 slices or more	3
1203	Other Bread (such as mixed grain, oat bran, raisin bread)			
	1393 Mixed grain bread	1slice (26.000gm)	1. 1 slice or less OR	1
			2. 2 slices OR	2
			3. 3 slices or more	3
1204	Rolls, Buns, Biscuits, or Flour Tortillas (includes bagels, English muffins)			
	29122 WONDER, English muffins	1item (57.000gm)	1. 1 item or less OR	1
			2. 2 items or 1 bagel or English muffin	2
			3. 3 items or more	3
1205	Corn Tortillas, Corn Muffins, or Cornbread (includes cornbread stuffing)			
	1391 Corn tortilla	1item (26.000gm)	1. 1 tortilla or 1 piece cornbread or ½ cup stuffing OR	1
			2. 2 tortillas or 1 muffin OR	2
			3. 3 tortillas or 2 muffins or more	3
1206	Bran, Blueberry or other Muffins, Banana or Mango Bread			
	28092 Blueberry muffins	1item (84.247gm)	1. 1 regular muffin or 1 slice OR	1
			2. 1 large muffin or 2 slices OR	2
			3. 3 muffins or slices or more	3
1207	Sweet Rolls, Croissants, Doughnuts, Danish Pastry, or Coffee Cake			
	434 Plain Danish pastry	1item (57.000gm)	1. 1 item or less OR	1
			2. 2 items OR	2
			3. 3 items or more	3
1208	Pancakes, Waffles, or French Toast			
	25182 Pancakes	1item (58.608gm)	1. 1 item or less OR	1
			2. 2 items OR	2
			3. 3 items or more	3

(cont.)

Item no. / Questionnaire food label		Closest equivalent in NFS	Standard measures	Serving Size	Ratio used
1209	Margarine added to Bread Items				
	8500	CANNOLA Margarine, soft	1TBSP (14.000gm)	1. spread thin OR	0.5
				2. spread thick	1
1210	Butter added to Bread Items				
	104	Butter	1TBSP (15.000gm)	1. spread thin OR	0.5
				2. spread thick	1
1211	Peanut Butter added to Bread Items				
	1639	Peanut butter, smooth	1TBSP (16.000gm)	1. spread thin OR	0.5
				2. spread thick	1
1212	Jam or Jelly added to Bread Items				
	550	Jam	1TBSP (20.000gm)	1. spread thin OR	0.5
				2. spread thick	1
1213	Mayonnaise in Sandwiches				
	14616	HELLMAN'S Real Mayonnaise	1TBSP (14.000gm)	1. spread thin OR	0.5
				2. spread thick	1
13. BREAKFAST CEREALS, MILK, AND CHEESE					
1301	Highly Fortified Cereals (such as Product 19, Total, Most)				
	1964	Farina cereal, enriched, dry	1cup (81.000gm)	1. ½ cup or less OR	0.5
				2. 1 cup or individual box OR	1
				3. 1-½ cups or more	1.5
1302	Bran or High Fiber Cereals				
	10245	KELLOGGS ALL BRAN, Extra fiber cereal	1cup (52.000gm)	1. ½ cup or less OR	0.5
				2. 1 cup or individual box OR	1
				3. 1-½ cups or more	1.5
1303	Other Cold Cereals (such as corn flakes, Cheerios, granola)				
	371	Corn cereal, flakes	1cup (25.000gm)	1. ½ cup or less OR	0.5
				2. 1 cup or individual box OR	1
				3. 1-½ cups or more	1.5

(cont.)

Item no. / Questionnaire food label		Standard measures	Serving Size	Ratio used
	Closest equivalent in NFS			
1304	Cooked Cereals (such as oatmeal, cream of wheat, corn grits)			
8657	Oatmeal cereal, cooked with water	1cup (234.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup or individual box OR	1
			3. 1-½ cups or more	1.5
1305	Whole Milk (as beverage or added to cereal)			
50	Whole milk, 3.3%	1cup (244.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup or half-pint carton OR	1
			3. 2 cups or more	2
1306	Lowfat Milk (1% or 2%)(as beverage or added to cereal – includes lactaid and acidophilus milk)			
54	Lowfat milk, 1%	1cup (244.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup or half-pint carton OR	1
			3. 2 cups or more	2
1307	Nonfat or Skim Milk or Buttermilk (as beverage or added to cereal)			
17306	RALSTON SUN FLAKES, Cereal with skim milk	1cup (36.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup or half-pint carton OR	1
			3. 2 cups or more	2
1308	Yogurt (includes lowfat and nonfat)			
95	Plain yogurt with whole milk	1cup (245.000gm)	1. ½ cup or 4-6 oz. carton OR	0.5
			2. 1 cup or 8 oz. carton OR	1
			3.2 cups or more	2
1309	Chocolate Milk, Cocoa, or Ovaltine			
67	Whole chocolate milk	1cup (250.000gm)	1. ½ cup or less OR	0.5
			2. 1 cup OR	1
			3. 2 cups or more	2
1310	Milkshakes or Malts			
17395	Composite-milkshake	12oz.(340.200gm)	1. ½ milkshake or malt OR	0.5
			2. 1 milkshake or malt (12 oz.) OR	1
			3. 2 milkshakes or malts	2

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1311	Cottage Cheese (includes farmer's and ricotta cheese)			
9	Low fat cottage cheese, 1% fat	1cup (226.000gm)	1. ¼ cup or less OR	0.25
			2. ½ cup or 1 scoop OR	0.5
			3. 1 cup or more	1
1312	Lowfat Cheese (such as lowfat American, lowfat Swiss, mozzarella)			
16536	Low fat Swiss cheese, shredded	1ounce (28.400gm)	1. ½ slice OR	0.5
			2. 1 slice (1 ounce) OR	1
			3.2 slices (2 ounces) or more	2
1313	Other Cheese (such as American, cheddar, cream cheese)			
22	American cheese	1ounce (28.350gm)	1. ½ slice or 1 tablespoon OR	0.5
			2. 1 slice (1 ounce) OR	1
			3. 2 slices (2 ounces) or more	2
14. DESSERTS AND SNACKS				
1401	Ice Cream			
80	Vanilla ice cream, rich	1cup (148.000gm)	1. 1 scoop (½ cup) or less OR	0.5
			2. 2 scoops (1 cup) or 1 bar OR	1
			3. 3 to 4 scoops (1 pint) or more	1.75
1402	Ice Milk, Frozen Yogurt, or Sherbet			
5244	Frozen yogurt	1cup (190.200gm)	1. 1 scoop (½ cup) or less OR	0.5
			2. 2 scoops (1 cup) or 1 bar OR	1
			3. 3 to 4 scoops (1 pint) or more	1.75
1403	Cookies, Brownies, or Fruit Bars			
8876	Brownie, prepared	1item (24.000gm)	1. 1 to 2 average size cookies OR	0.5
			2. 3 to 4 average or 1 extra large cookie or 1 brownie or fruit bar OR	1
			3. 2 large cookies or brownies or more	2
1404	Cake			
411	Sponge, cake, prepared	1slice (63.000gm)	1. 1 small piece or cupcake OR	0.5
			2. 1 average piece (1/12 of cake) OR	1
			3. 2 pieces or more	2

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1405	Apple or other Fruit Pies, Tarts, Cobblers, or Turnovers			
454	Apple pie, prepared	1slice (155.000gm)	1. 1 small piece OR	0.5
			2. 1 piece (1/8 pie) or 1 item OR	1
			3. 1/6 pie or more	1.5
1406	Pumpkin, Sweet Potato, or Carrot pies			
25028	Pumpkin pie	1slice (145.677gm)	1. 1 small piece OR	0.5
			2. 1 average piece (1/8 pie) OR	1
			3. 1/6 pie or more	1.5
1407	Cream or Custard pies, Eclairs, or Cream Puffs			
8970	Egg custard pie, Ready to eat	1slice(105.000gm)	1. 1 small piece OR	0.5
			2. 1 average piece or 1 item OR	1
			3. 1/6 pie or more	1.5
1408	Puddings or Custards (includes flan)			
17391	Composite-pudding or custard	1cup (245.000gm)	1. 1 snack-size or ½ cup OR	0.5
			2. 2 snack-size or 1 cup OR	1
			3. 3 snack-size or 1- ½ cups	1.5
1409	Chocolate Candy			
11762	NESTLES, Plain milk chocolate candy bar	1items (41.100gm)	1. 1 to 3 pieces OR	0.5
			2. 1 regular-size bar OR	1
			3. 1 giant-size bar or more	1.5
1410	Dim Sum, such as Bao or Manapua (Chinese bun with meat and vegetables)			
16809	Manapua, Meat filled, Steamed	1item (93.000gm)	1. ½ bao or less OR	0.5
			2. 1 bao OR	1
			3. 2 bao or more	2
1411	Other Dim Sum (such as pork hash, gau gee, fried won ton, eggroll)			
16799	Dim sum with pork	1item (28.000gm)	1. 1 to 2 pieces OR	1.5
			2. 3 to 4 pieces OR	3.5
			3. 5 pieces or more	5

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1412	Crackers and Pretzels (such as soda, graham, Japanese rice crackers, wheat thins)			
9044	Soda crackers	5items (15.000gm)	1. 4 to 5 snack or 1 large cracker OR	1
			2. 6 to 10 snack or 2 large crackers OR	2
			3. 3 large crackers or more	3
1413	Peanuts or other Nuts			
2807	Peanuts, all types, dry roasted	1cup (146.000gm)	1. 12 nuts or less OR	0.1
			2. ¼ cup OR	0.25
			3. ½ cup or more	0.5
1414	Potato, Corn, Tortilla or other Chips, or Chicharrones (pork rinds)			
5790	Potato chips	1ounce (28.350gm)	1. 1 snack bag or ½ cup OR	0.5
			2. 1-ounce bag (1 cup) OR	1
			3. ½ twin-pack or more	1.5
1415	Popcorn			
15224	ORVILLE, Movie theater microwave popcorn	1cup (18.000gm)	1. 1 to 3 cups or less OR	2
			2. 1 microwave bag OR	4.75
			3. 1 medium theater tub or more	7.5
15. ALCOHOLIC AND OTHER BEVERAGES				
1501	Regular or Draft Beer			
686	Beer	375ml (376.715gm-for Aus.)/350ml (351.600gm-for Jap.)	1. 1 can or bottle or less OR	1
			2. 2 cans or bottles OR	2
			3. 3 cans or bottles OR	3
			4. 4 cans or bottles or more	4
1502	Light Beer			
869	Light beer	375ml (374.178gm-for Aus.)/350ml (349.233gm-for Jap.)	1. 1 can or bottle or less OR	1
			2. 2 cans or bottles OR	2
			3. 3 cans or bottles OR	3
			4. 4 cans or bottles or more	4

(cont.)

Item no. / Questionnaire food label		Standard measures	Serving Size	Ratio used
Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1503	White or Pink Wine (includes champagne and sake)			
1481	White wine	100ml (99.781gm)	1. 1 glass or less OR	1
			2. 2 glasses OR	2
			3. 3 glasses OR	3
			4. 4 glasses or more	4
1504	Red Wine			
691	Red table wine	100ml (99.781gm)	1. 1 glass or less OR	1
			2. 2 glasses OR	2
			3. 3 glasses OR	3
			4. 4 glasses or more	4
1505	Hard Liquor (such as bourbon, scotch, gin, vodka, tequila, rum, cocktails)			
6017	Gin	30ml (28.108gm)	1. 1 drink or less OR	1
			2. 2 drinks OR	2
			3. 3 drinks OR	3
			4. 4 drinks or more	4
1506	Regular Sodas (such as Coca-Cola, Pepsi, 7-Up)			
12010	COCA-COLA, Classic cola soda	375ml (380.520gm-for Aus.)/350ml (355.152gm-for Jap.)	1. ½ can or small glass OR	0.5
			2. 1 can or large glass OR	1
			3. 2 cans or glasses OR	2
			4. 3 cans or glasses or more	3
1507	Diet Sodas (such as Diet Coke, Diet Pepsi, Diet 7-Up)			
12031	COKE, Diet cola soda	375ml (380.520gm-for Aus.)/350ml (355.152gm-for Jap.)	1. ½ can or small glass OR	0.5
			2. 1 can or large glass OR	1
			3. 2 cans or glasses OR	2
			4. 3 cans or glasses or more	3

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1508	Cappuccino – 1 cup or mug (includes café au lait, caffe latte, café con leche)			
16882	Cappuccino	1cup (240.000gm)		1
	As additional			
	- Sugar or honey			
561	White granulated sugar	8g (8gm)		1
	- Sugar substitute			
1759	SWEET N LOW, Sugar substitute, packet	1item (1gm)		1
1509	Regular Coffee – 1 cup or mug (brewed or instant)			
732	Instant coffee, prepared	1cup (239.000gm)		1
	As additional			
	- Cream or half & half			
26	Half and Half cream	1TBSP (15gm)		1
	- Milk			
50	Whole milk, 3.3%	1TBSP (15.250gm)		1
	- Non-dairy cream			
3659	COFFEEMATE, Non-dairy creamer, Liquid	1TBSP (15.000gm)		1
	- Sugar or honey			
561	White granulated sugar	8g (8gm)		1
	- Sugar substitute			
1759	SWEET N LOW, Sugar substitute, packet	1item (1gm)		1

(cont.)

Item no. / Questionnaire food label Closest equivalent in NFS		Standard measures	Serving Size	Ratio used
1510	Decaffeinated (“Decaf”) Coffee – 1 cup or mug (brewed or instant)			
9520	Decaffeinated brewed coffee	1cup (236.800gm)		1
As additional				
-	Cream or half & half			
26	Half and Half cream	1TBSP (15gm)		1
-	Milk			
50	Whole milk, 3.3%	1TBSP (15.250gm)		1
-	Non-dairy cream			
3659	COFFEEMATE, Non-dairy creamer, Liquid	1TBSP (15.000gm)		1
-	Sugar or honey			
561	White granulated sugar	8g (8gm)		1
-	Sugar substitute			
1759	SWEET N LOW, Sugar substitute, packet	1item (1gm)		1
1511	Black Tea – 1 cup or glass (such as Lipton’s, oolong, iced tea)			
29404	LIPT0N, Lemon iced tea, sweetened	1cup (240.000gm)		1
As additional				
-	Cream or half & half			
26	Half and Half cream	1TBSP (15gm)		1
-	Milk			
50	Whole milk, 3.3%	1TBSP (15.250gm)		1
-	Non-dairy cream			
3659	COFFEEMATE, Non-dairy creamer, Liquid	1TBSP (15.000gm)		1
-	Sugar or honey			
561	White granulated sugar	8g (8gm)		1
-	Sugar substitute			
1759	SWEET N LOW, Sugar substitute, packet	1item (1gm)		1

(cont.)

Item no. / Questionnaire food label		Standard measures	Serving Size	Ratio used
	Closest equivalent in NFS			
1512	Green, Herbal, or Other Tea – 1 cup			
	1877 Herbal tea, Prepared	1cup (236.800gm)		1
1513	Fortified Diet Beverages – 1 glass or can (such as Slimfast)			
	16094 NESTEA COOL, Diet iced tea drink	375ml (380.520gm-for Aus.)/350ml (355.152gm-for Jap.)		1

APPENDIX 2.2
Selected food lists for the under-reporting analysis

1. Cereals

food items	
0701	White rice
0702	Sushi or barazushi
0703	Brown or wild rice
0704	Mexican or spanish rice
0705	Fried rice
1301	Highly fortified cereals
1302	Bran or high fiber cereals
1303	Other cold cereals [represented by corn flakes]
1304	Cooked cereals

2. Potatoes

food items	
0706	French-fried, hash-browned or other fried potatoes
0707	Mashed, scalloped or au gratin potatoes
0708	Baked or boiled white potatoes
0709	Yellow-orange sweet potatoes or yams
0710	White or purpie sweet potatoes
0711	Taro
0712	Poi

3. Confectioneries

food items	
1401	Ice cream
1402	Ice milk, frozen yogurt, or sherbet
1403	Cookies, brownies, or fruit bars
1404	Cake
1405	Apple or other fruit pies, tarts, cobblers, or turnovers
1406	Pumpkin, sweet potato, or carrot pies
1407	Cream or custard pies, eclairs, or cream puffs
1408	Puddings or custards
1409	Chocolate candy

4. Pulses

food items	
1001	Refried beans
1002	Baked beans or pork and beans
1003	Boiled dried beans or peas
1413	Peanuts or other nuts

5. Fruits

food items	
1101	Oranges
1102	Tangerines or mandarin oranges
1103	Grapefruit or pomelo
1104	Papaya
1105	Pineapple
1106	Peaches
1107	Apricots
1108	Pears
1111	Cantaloupe
1112	Watermelon
1113	Mangoes
1114	Avocados and guacamole

6. Vegetables

food items	
0801	Light green lettuce or tossed salad
0802	Dark green lettuce
0803	Tomatoes
0901	Broccoli
0902	Cabbage
0903	Dark leafy greens
0904	Green beans or peas
0905	Other green vegetables [represented by zucchini]
0906	Cauliflower
0907	Carrots
0908	Corn
0909	Pumpkin or yellow-orange winter squash
0910	Other vegetables [represented by beets]

7. Soft drinks, Sugar-containing

food items	
1506	Regular sodas
1507	Diet sodas

8. Soft drinks, Non-sugar-containing

food items	
1116	Orange or grapefruit juice
1117	Tomato or V-8 juice

9. Fish

food items	
0506	Fried fish
0507	Baked, broiled, boiled or raw fish
0508	Canned tunafish
0509	Other canned fish [represented by mackerel]
0510	Salted and dried fish

10. Meats

food items	
0401	Beef steak or roast, veal or lamb
0402	Shortribs
0403	Corned beef
0404	Corned beef hash
0405	Pork chops or roasts, kalua pig, or carnitas
0406	Ham
0407	Ham hocks or Pig's feet
0408	Spareribs
0409	Liver
0410	Chicken or turkey wings
0501	Fried chicken
0502	Roasted, baked, grilled or stewed chicken
0503	Turkey

11. Eggs

food items	
0807	Eggs, cooked or raw
0808	Egg substitute

12. Dairy products

food items	
1305	Whole milk
1306	Lowfat milk
1307	Nonfat or skim milk or buttermilk
1308	Yogurt
1311	Cottage cheese
1312	Lowfat cheese
1313	Other cheese [represented by American cheese]

APPENDIX 2.3 Selected food lists for the Diet Quality Index-International

1. Meat

	food items
0401	Beef steak or roast, veal or lamb
0402	Shortribs
0403	Corned beef (fresh or canned)
0404	Corned beef hash
0405	Pork chops or roasts, kalua pig or carnitas
0406	Ham
0407	Ham hocks or pig's feet
0408	Spareribs
0409	Liver
0410	Chicken or turkey wings

2. Poultry

	food items
0501	Fried chicken
0502	Roasted, baked, grilled or stewed chicken
0503	Turkey

3. Fish

	food items
0504	Fried shrimp or other shellfish
0505	Cooked, canned, or raw shellfish
0506	Fried fish
0507	Baked, broiled, boiled or raw fish
0508	Canned tunafish
0509	Other canned fish [represented by mackerel]
0510	Salted and dried fish

4. Eggs

	food items
0807	Eggs, cooked or raw
0808	Egg substitute

5. Dairy

	food items
1305	Whole milk
1306	Lowfat milk
1307	Nonfat or skim milk or buttermilk
1308	Yogurt
1309	Chocolate milk, cocoa, or ovaltine
1310	Milkshakes or malts
1311	Cottage cheese
1312	Lowfat cheese
1313	Other cheese [represented by American cheese]

6. Beans

	food items
1001	Refried beans
1002	Baked beans or pork and beans
1003	Boiled dried beans or peas

7. Vegetable group

	food items
0301	Stir-fried beef or pork and vegetables, or fajitas
0302	Stir-fried chicken and vegetables, or fajitas
0303	Stir-fried shrimp or fish and vegetables
0304	Stir-fried vegetables (no meat)
0305	Pork and greens or laulaus
0801	Light green lettuce or tossed salad
0802	Dark green lettuce
0803	Tomatoes
0804	Coleslaw
0901	Broccoli
0902	Cabbage
0903	Dark leafy greens
0904	Green beans or peas
0905	Other green vegetables [represented by zucchini]
0906	Cauliflower
0907	Carrots
0908	Corn
0909	Pumpkin or yellow-orange winter squash
0910	Other vegetables [represented by beets]

8. Fruit group

	food items
1101	Oranges
1102	Tangerines or mandarin oranges
1103	Grapefruit or pomelo
1104	Papaya
1105	Pineapple
1106	Peaches
1107	Apricots
1108	Pears
1111	Cantaloupe
1112	Watermelon
1113	Mangoes
1114	Avocados and guacamole
1116	Orange or grapefruit juice
1117	Tomato or V-8 juice

9. Grain group

	food items
0701	White rice
0702	Sushi or barazushi
0703	Brown or wild rice
0704	Mexican or spanish rice
0705	Fried rice
1201	White bread
1202	Whole wheat or rye bread
1203	Other bread [represented by mixed grain bread]
1204	Rolls, buns, biscuits, or flour tortillas
1205	Corn tortillas, corn muffins, or cornbread
1206	Bran, blueberry or other muffins, banana or mango bread
1207	Sweet rolls, croissants, doughnuts, danish pastry, or coffee cake
1208	Pancakes, waffles, or french toast
1301	Highly fortified cereals
1302	Bran or high fiber cereals
1303	Other cold cereals [represented by corn flakes]
1304	Cooked cereals

10. Empty calorie foods

	food items
1501	Regular or draft beer
1502	Light beer
1503	White or Pink wine
1504	Red wine
1505	Hard liquor
1506	Regular sodas

Appendix 2.4 Food groupings used for the dietary pattern analysis[1]

	Foods/food Groups	Food items
1	Soups and related items	Cream soup or chowder; Dried bean or pea soup; Tomato or vegetable soup; Miso soup; Broth with noodles or rice; Mexican meat soup or stew; Ramen or saimin; Jook.
2	Noodles, spaghetti and related dishes	Chow mein, chow fun, or yakisoba; Spaghetti, ravioli, lasagna, or other pasta with tomato sauce; Macaroni and cheese or other pasta and cheese casseroles; Macaroni or potato salad; Pasta or somen salad; Noodle casseroles; Pasta with cream sauce; Arroz con pollo; Stew, curry, pot pie or empanada (with beef or lamb); Stew, curry, pot pie or empanada (with chicken or turkey).
3	Mixed dishes	Stir-fried beef or pork and vegetables, or fajitas; Stir-fried chicken and vegetables, or fajitas; Stair-fried shrimp or fish and vegetables; Stir-fried vegetables; Pork and greens or laulaus; Chili con carne; Hamburgers; Cheeseburgers; Meat loaf, meatballs, or patties; Pizza.
4	Meat	Beef steak or roast, veal or lamb; Shortribs; Corned beef; Corned beef hash; Pork chops or roasts, kalua pig, or camitas; Ham; Ham hocks or pig's feet; Spareribs; Liver; Chicken or thrkey wings.
5-1	Poultry	Fried chicken; Roasted, baked, grilled or stewed chicken; Turkey.
5-2	Fish and seafood	Fried shrimp or other shellfish; Cooked, canned, or raw shellfish; Fried fish; Baked, broiled, boiled or raw fish; Canned tunafish; Other canned fish; Salted and dried fish.
6	Processed meats and Mexican dishes	Bacon; Regular hot dogs; Chicken or turkey hot dogs or luncheon meats; Spam, bologna, salami, pastrami or other luncheon meats; Sausage; Tacos, tostadas, sopes, or taco salad (with beef or pork); Tacos, tostadas, sopes, or taco salad (with chicken); Meat burritos; Vegetable or bean burritos, tacos, or tostadas; Enchiladas with chicken; Enchiladas with beef; Enchiladas with cheese, quesadillas, or nachos with cheese; Tamales; Chili rellenos.
7-1	Rice	White rice; Sushi or barazushi; Brown or wild rice; Mexican or spanish rice; Fried rice.
7-2	Potatoes and related items	French-fried, hash-browned or other fried potatoes; Mashed, scalloped or au gratin potatoes; Baked or boiled white potatoes; Yellow-orange sweet potatoes or yams; White or purple sweet potatoes; Taro; Poi.
8	Salad items, eggs and other non-meat items	Light green lettuce or tossed salad; Dark green lettuce; Tomatoes; Coleslaw; Regular salad dressings or mayonnaise added to salads; Low-calorie or diet dressings added to salads; Eggs, cooked or raw; Egg substitute; Tofu; Vegetarian meat loaf, meatballs or patties.
9	Raw or cooked vegetables	Broccoli; Cabbage; Dark leafy greens; Green beans or peas; Other green vegetables; Cauliflower; Carrots; Corn; Pumpkin or yellow-orange winter spuash; Other vegetables.
10	Dried beans and related items	Refried beans; Baked beans or pork and beans; Boiled dried beans or peas.

(cont.)

Foods/food Groups		Food items
11	Fruit and juices	Oranges; Tangerines or mandarin oranges; Grapefruit or pomelo; Papaya; Pineapple; Peaches; Apricots; Pears; Cantaloupe; Watermelon; Mangoes; Avocados and guacamole; Orange or grapefruit juice; Tomato or V-8 juice.
12	Bread items	White bread; Whole wheat or rye bread; Other bread; Rolls, buns, biscuits, or flour tortillas; Corn tortillas, corn muffines, or cornbread; Bran, blueberry or other muffins, banana or mango bread; Sweet rolls, croissants, doughnuts, danish pastry, or coffee cake; Pancakes, waffles, or french toast; Margarine added to bread items; Butter added to bread items; Peanut butter added to bread items; Jam or jelly added to bread items; Mayonnaise in sandwiches.
13-1	Breakfast cereals	Highly fortified cereals; Bran or high fiber cereals; Other cold cereals; Cooked cereals.
13-2	Dairy products	Whole milk; Lowfat milk; Nonfat or skim milk or buttermilk; Yogurt; Chocolate milk, cocoa, or ovaltine; Milkshakes or malts; Cottage cheese; Lowfat cheese; Other cheese.
14	Desserts and snacks	Ice cream; Ice milk, frozen yogurt, or sherbet; Cookies, brownies, or fruit bars; Cake; Apple or other fruit pies, tarts, cobblers, or turnovers; Pumpkin, sweet potato, or carrot pies; Cream or custard pies, eclairs, or cream puffs; Puddings or custards; Chocolate candy; Dim sum, such as bao or manapua; Other dim sum; Crackers and pretzels; Peanuts or other nuts; Potato, corn, tortilla or other chips, or chicharrones; Popcorn.
15-1	Alcoholic beverages	Regular or draft beer; Light beer; White or pink wine; Red wine; Hard liquor.
15-2	Non-alcoholic beverages	Regular sodas; Diet sodas; Cappuccino; Regular coffee; Decaffeinated; Black tea; Green, herbal, or other tea; Fortified diet beverages.

[1] Foods were grouped based on 165 food items.

Appendix 3.1 Comparison of scores of the Lifestyle Index (LI) and its components for the young and middle-aged men in Japan and Australia

			Japan				Australia				Total		ANOVA	P
			JY [a]		JM [a]		AY [a]		AM [a]				Tukey HSD	P
		Scoring criteria	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**		
Component	**Score**	Subgroups of sections	%		%		%		%		%			
1. VARIETY														
Various food groups (meat, poultry, fish, eggs; dairy, beans; grain; fruit; vegetable)	0-15 points	at least 1 serving from each food group per day = 15	**7.8**	**0.23**	**7.8**	**0.20**	**9.8**	**0.26**	**10.0**	**0.24**	**8.9**	**0.12**	**ANOVA**	*P* <0.001
			5.5		*2.7*		*19.5*		*18.2*		*11.8*		**Tukey HSD**	
		any 1 food group missing = 12	*15.9*		*13.3*		*27.7*		*27.1*		*21.3*		JY:JM	*P* =1.000
		any 2 food groups missing = 9	*24.9*		*35.1*		*22.3*		*32.0*		*28.3*		AY:AM	*P* =0.860
		any 3 food groups missing = 6	*41.8*		*41.5*		*20.0*		*17.2*		*29.7*		JY:AY	*P* <0.001
		≥4 food groups missing = 3	*11.4*		*6.4*		*10.5*		*4.4*		*8.3*		JM:AM	*P* <0.001
		none from any food groups = 0	*0.5*		*1.1*		*0.0*		*1.0*		*0.6*			
Within-group variety for protein source (meat, poultry, fish, dairy, beans, eggs)	0-5 points		**1.4**	**0.13**	**1.4**	**0.12**	**2.1**	**0.14**	**1.7**	**0.14**	**1.7**	**0.07**	**ANOVA**	*P* <0.001
		≥3 different sources per day = 5	*14.4*		*12.2*		*24.1*		*20.2*		*18.0*		**Tukey HSD**	
		2 different sources per day = 3	*12.9*		*13.8*		*27.3*		*22.2*		*19.3*		JY:JM	*P* =0.999
		from 1 source per day = 1	*24.4*		*35.6*		*8.6*		*6.9*		*18.3*		AY:AM	*P* =0.194
		none = 0	*48.3*		*38.3*		*40.0*		*50.7*		*44.3*		JY:AY	*P* <0.001
													JM:AM	*P* =0.235
TOTAL VARIETY	0-20 points		**9.2**	**0.33**	**9.2**	**0.30**	**11.9**	**0.37**	**11.8**	**0.35**	**10.6**	**0.18**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* =1.000
													AY:AM	*P* =0.996
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
2. ADEQUACY														
Vegetable group [c] (Based on 1700, 2200, and 2700 kcal diet)	0-5 points	≥3 to 5 servings = 5, 0 servings = 0	**1.3**	**0.06**	**1.6**	**0.07**	**1.4**	**0.07**	**1.9**	**0.07**	**1.5**	**0.04**	**ANOVA**	*P* <0.001
		≥100%	*0.5*		*0.0*		*1.8*		*2.0*		*1.1*		**Tukey HSD**	
		99-50%	*10.4*		*17.0*		*10.6*		*21.2*		*14.7*		JY:JM	*P* <0.05
		<50%	*89.1*		*83.0*		*87.6*		*76.8*		*84.2*		AY:AM	*P* <0.001
													JY:AY	*P* =0.601
													JM:AM	*P* <0.05

(cont.)

Component	Score	Scoring criteria Subgroups of sections	Japan JY [a] Mean	JY [a] SE [b]	Japan JM [a] Mean	JM [a] SE [b]	Australia AY [a] Mean	AY [a] SE [b]	Australia AM [a] Mean	AM [a] SE [b]	Total Mean	Total SE [b]	ANOVA / Tukey HSD	P
			%		%		%		%		%			
Fruit group [c]	0-5 points	≥2 to 4 servings = 5, 0 servings = 0	**1.1**	**0.07**	**0.9**	**0.06**	**1.9**	**0.10**	**1.9**	**0.10**	**1.5**	**0.05**	**ANOVA**	*P* <0.001
(Based on 1700, 2200, and		≥100%	*1.6*		*1.1*		*8.4*		*6.0*		*4.5*		**Tukey HSD**	
2700 kcal diet)		99-50%	*7.4*		*5.6*		*22.8*		*23.4*		*15.3*		JY:JM	*P* =0.701
[Apple and Banana were		<50%	*91.0*		*93.3*		*68.8*		*70.6*		*80.2*		AY:AM	*P* =0.936
omitted]													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
Grain group [c]	0-5 points	≥6, ≥9, ≥11 servings = 5, 0 servings = 0	**2.3**	**0.07**	**2.3**	**0.07**	**2.8**	**0.08**	**2.7**	**0.09**	**2.5**	**0.04**	**ANOVA**	*P* <0.001
(Based on 1700, 2200, and		≥100%	*2.5*		*1.1*		*8.2*		*7.4*		*4.9*		**Tukey HSD**	
2700 kcal diet)		99-50%	*32.3*		*35.6*		*47.3*		*40.9*		*39.3*		JY:JM	*P* =0.987
		<50%	*65.2*		*63.3*		*44.5*		*51.7*		*55.8*		AY:AM	*P* =0.484
													JY:AY	*P* <0.001
													JM:AM	*P* <0.01
Protein	0-5 points	≥10% of energy = 5, 0% of energy = 0	**5.0**	**0.00**	**5.0**	**0.01**	**5.0**	**0.00**	**5.0**	**0.01**	**5.0**	**0.00**	**ANOVA**	*P* =0.264
		≥100%	*99.0*		*98.4*		*100.0*		*97.5*		*98.8*		**Tukey HSD**	
		99-50%	*1.0*		*1.6*		*0.0*		*2.5*		*1.2*		JY:JM	*P* =0.922
		<50%	*0.0*		*0.0*		*0.0*		*0.0*		*0.0*		AY:AM	*P* =0.233
													JY:AY	*P* =0.906
													JM:AM	*P* =0.951
Iron	0-5 points	≥100% RDA/RDI = 5, 0% RDA/RDI = 0	**4.9**	**0.03**	**4.9**	**0.03**	**4.9**	**0.03**	**4.9**	**0.03**	**4.9**	**0.01**	**t-test**	
(Combined results use		≥100%	*95.0*		*93.6*		*95.5*		*91.1*		*93.8*		JY:JM	*P* = 0.650
RDA-J & RDI-A)		99-50%	*4.0*		*5.3*		*4.1*		*7.4*		*5.2*		AY:AM	*P* = 0.390
		<50%	*1.0*		*1.1*		*0.5*		*1.5*		*1.0*			
Calcium	0-5 points	≥100% AI/RDI = 5, 0% AI/RDI = 0	**4.1**	**0.08**	**3.8**	**0.09**	**4.5**	**0.06**	**4.1**	**0.08**	**4.1**	**0.04**	**t-test**	
(Combined results use		≥100%	*46.3*		*35.6*		*69.1*		*44.3*		*49.5*		JY:JM	*P* <0.01
AI-J & RDI-A)		99-50%	*42.3*		*43.6*		*26.4*		*43.8*		*38.7*		AY:AM	*P* <0.001
		<50%	*11.4*		*20.7*		*4.5*		*11.8*		*11.8*			

(cont.)

Component	Score	Scoring criteria	Japan				Australia				Total		ANOVA	*P*
			JY [a]		JM [a]		AY [a]		AM [a]				Tukey HSD	*P*
		Scoring criteria	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**	**Mean**	**SE [b]**		
Component	**Score**	Subgroups of sections	%		%		%		%		%			
Vitamin C	0-5 points	≥100% RDA/RDI = 5, 0% RDA/RDI = 0	**3.5**	**0.09**	**3.1**	**0.10**	**4.9**	**0.04**	**4.9**	**0.04**	**4.1**	**0.04**	**t-test**	
(Combined results use		≥100%	*26.9*		*20.2*		*91.4*		*90.6*		*58.7*		JY:JM	*P* <0.05
RDA-J & RDI-A)		99-50%	*41.8*		*44.7*		*5.5*		*8.4*		*24.3*		AY:AM	*P* = 0.829
		<50%	*31.3*		*35.1*		*3.2*		*1.0*		*17.0*			
Fiber [c]	0-5 points	>20 g, >25 g, >30 g = 5, 0 g = 0	**3.0**	**0.07**	**2.8**	**0.07**	**4.1**	**0.07**	**4.2**	**0.08**	**3.5**	**0.04**	**ANOVA**	*P* <0.001
(Based on 1700, 2200, and		≥100%	*7.0*		*2.1*		*44.1*		*47.3*		*26.0*		**Tukey HSD**	
2700 kcal diet)		99-50%	*61.2*		*54.3*		*48.2*		*41.4*		*51.1*		JY:JM	*P* =0.071
		<50%	*31.8*		*43.6*		*7.7*		*11.3*		*22.9*		AY:AM	*P* =0.958
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
TOTAL ADEQUACY	0-40 points		**25.4**	**0.30**	**24.5**	**0.33**	**29.7**	**0.28**	**29.4**	**0.30**	**27.4**	**0.17**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* =0.178
													AY:AM	*P* =0.910
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
3. MODERATION														
Total fat	0-6 points		**1.8**	**0.12**	**2.7**	**0.13**	**1.4**	**0.11**	**2.3**	**0.12**	**2.0**	**0.06**	**ANOVA**	*P* <0.001
		≤20% of total energy = 6	*5.0*		*13.8*		*2.3*		*7.4*		*6.9*		**Tukey HSD**	
		>20-30% of total energy = 3	*48.3*		*61.7*		*41.8*		*60.1*		*52.6*		JY:JM	*P* <0.001
		>30% of total energy = 0	*46.8*		*24.5*		*55.9*		*32.5*		*40.5*		AY:AM	*P* <0.001
													JY:AY	*P* =0.156
													JM:AM	*P* =0.066

(cont.)

Component	Score	Scoring criteria Subgroups of sections	Japan JY [a] Mean	SE [b]	Japan JM [a] Mean	SE [b]	Australia AY [a] Mean	SE [b]	Australia AM [a] Mean	SE [b]	Total Mean	SE [b]	ANOVA / Tukey HSD	P
			%		%		%		%		%			
Saturated fat	0-6 points		**1.9**	**0.15**	**3.2**	**0.16**	**1.0**	**0.12**	**1.9**	**0.15**	**2.0**	**0.08**	**ANOVA**	*P* <0.001
		≤7% of total energy = 6	*11.9*		*29.8*		*5.0*		*13.3*		*14.5*		**Tukey HSD**	
		>7-10% of total energy = 3	*40.3*		*46.3*		*23.2*		*36.5*		*36.1*		JY:JM	*P* <0.001
		>10% of total energy = 0	*47.8*		*23.9*		*71.8*		*50.2*		*49.4*		AY:AM	*P* <0.001
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
Cholesterol	0-6 points		**3.5**	**0.19**	**3.9**	**0.18**	**3.1**	**0.18**	**4.3**	**0.16**	**3.7**	**0.09**	**ANOVA**	*P* <0.001
		≤300 mg = 6	*47.8*		*52.7*		*41.4*		*62.1*		*50.7*		**Tukey HSD**	
		>300-400 mg = 3	*21.4*		*23.4*		*20.0*		*20.7*		*21.3*		JY:JM	*P* =0.514
		>400 mg = 0	*30.8*		*23.9*		*38.6*		*17.2*		*28.0*		AY:AM	*P* <0.001
													JY:AY	*P* =0.313
													JM:AM	*P* =0.236
Sodium	0-6 points		**2.1**	**0.17**	**3.1**	**0.18**	**1.5**	**0.15**	**3.0**	**0.17**	**2.4**	**0.09**	**ANOVA**	*P* <0.001
		≤2400 mg = 6	*20.4*		*36.2*		*13.6*		*32.5*		*25.2*		**Tukey HSD**	
		>2400-3400 mg = 3	*27.9*		*30.9*		*22.3*		*33.5*		*28.4*		JY:JM	*P* <0.001
		>3400 mg = 0	*51.7*		*33.0*		*64.1*		*34.0*		*46.3*		AY:AM	*P* <0.001
													JY:AY	*P* =0.064
													JM:AM	*P* =0.937
Empty calorie foods	0-6 points		**4.9**	**0.12**	**3.0**	**0.18**	**2.6**	**0.15**	**2.9**	**0.17**	**3.3**	**0.08**	**ANOVA**	*P* <0.001
		≤3% of total energy per day = 6	*68.2*		*35.1*		*20.5*		*29.6*		*37.9*		**Tukey HSD**	
		>3% to 10% of total energy per day = 3	*27.9*		*29.8*		*44.1*		*38.9*		*35.5*		JY:JM	*P* <0.001
		>10% of total energy per day = 0	*4.0*		*35.1*		*35.5*		*31.5*		*26.6*		AY:AM	*P* =0.264
													JY:AY	*P* <0.001
													JM:AM	*P* =0.993

(cont.)

Component	Score	Scoring criteria Subgroups of sections	Japan JY [a] Mean	Japan JY [a] SE [b]	Japan JM [a] Mean	Japan JM [a] SE [b]	Australia AY [a] Mean	Australia AY [a] SE [b]	Australia AM [a] Mean	Australia AM [a] SE [b]	Total Mean	Total SE [b]	ANOVA / Tukey HSD	P
			%		%		%		%		%			
TOTAL MODERATION	0-30 points		**14.2**	**0.47**	**15.8**	**0.50**	**9.5**	**0.41**	**14.4**	**0.45**	**13.3**	**0.24**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* =0.060
													AY:AM	*P* <0.001
													JY:AY	*P* <0.001
													JM:AM	*P* =0.129
4. OVERALL BALANCE														
CPF ratio (C:P:F) [d]	0-6 points		**0.8**	**0.11**	**0.8**	**0.11**	**0.5**	**0.09**	**1.0**	**0.12**	**0.8**	**0.05**	**ANOVA**	*P* <0.05
		(55-65) : (10-15) : (15-25) = 6	*2.5*		*3.2*		*2.3*		*3.9*		*3.0*		**Tukey HSD**	
		(52-68) : (9-16) : (13-27) = 4	*10.0*		*8.0*		*4.1*		*11.8*		*8.4*		JY:JM	*P* =0.977
		(50-70) : (8-17) : (12-30) = 2	*10.4*		*15.4*		*11.4*		*15.3*		*13.1*		AY:AM	*P* <0.01
		otherwise = 0	*77.1*		*73.4*		*82.3*		*69.0*		*75.6*		JY:AY	*P* =0.411
													JM:AM	*P* =0.581
Fatty acid ratio	0-4 points		**0.5**	**0.08**	**1.0**	**0.10**	**0.0**	**0.02**	**0.1**	**0.03**	**0.4**	**0.04**	**ANOVA**	*P* <0.001
(PUFA : MUFA : SFA) [e]		P/S = 1-1.5 and M/S = 1-1.5 = 4	*5.5*		*12.8*		*0.0*		*0.5*		*4.4*		**Tukey HSD**	
		Else if P/S = 0.8-1.7 and M/S = 0.8-1.7 = 2	*11.9*		*25.5*		*1.8*		*3.4*		*10.2*		JY:JM	*P* <0.001
		otherwise = 0	*82.6*		*61.7*		*98.2*		*96.1*		*85.3*		AY:AM	*P* =0.935
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
TOTAL OVERALL BALANCE	0-10 points		**1.2**	**0.14**	**1.8**	**0.15**	**0.6**	**0.09**	**1.1**	**0.12**	**1.2**	**0.07**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* <0.01
													AY:AM	*P* <0.05
													JY:AY	*P* <0.01
													JM:AM	*P* <0.001

(cont.)

Component	Score	Scoring criteria Subgroups of sections	Japan JY [a] Mean	SE [b]	Japan JM [a] Mean	SE [b]	Australia AY [a] Mean	SE [b]	Australia AM [a] Mean	SE [b]	Total Mean	SE [b]	ANOVA / Tukey HSD	*P*
			%		%		%		%		%			
DIET QUALITY INDEX-INTERNATIONAL	0-100 points		**47.9**	**0.63**	**57.0**	**0.90**	**57.4**	**0.74**	**62.6**	**0.87**	**56.4**	**0.44**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* <0.001
													AY:AM	*P* <0.001
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
Diet Quality Index-International	0-20 points		**9.6**	**0.13**	**11.4**	**0.18**	**11.5**	**0.15**	**12.5**	**0.17**	**11.3**	**0.09**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* <0.001
													AY:AM	*P* <0.001
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001
Physical Activity Index	0-30 points		**13.7**	**0.66**	**10.6**	**0.63**	**19.8**	**0.54**	**17.3**	**0.60**	**15.5**	**0.33**	**ANOVA**	*P* <0.001
1. Level of physical activity		very active = 30	*8.6*		*5.9*		*16.4*		*10.2*		*10.5*		**Tukey HSD**	
		active = 24	*24.2*		*13.4*		*43.4*		*33.5*		*29.3*		JY:JM	*P* <0.01
		moderate = 15	*18.2*		*16.1*		*22.8*		*33.5*		*22.8*		AY:AM	*P* <0.05
		light = 6	*42.4*		*53.2*		*16.9*		*19.3*		*32.3*		JY:AY	*P* <0.001
		sedentary = 0	*6.6*		*11.3*		*0.5*		*3.6*		*5.3*		JM:AM	*P* <0.001
Smoking Index	0-30 points		**24.0**	**0.75**	**14.3**	**0.93**	**26.9**	**0.48**	**21.8**	**0.69**	**22.0**	**0.39**	**ANOVA**	*P* <0.001
1. Smoking status		nonsmokers = 30	*73.5*		*26.6*		*78.5*		*43.3*		*56.4*		**Tukey HSD**	
		former smokers = 21	*3.5*		*26.1*		*13.2*		*40.3*		*20.5*		JY:JM	*P* <0.001
		current smokers:	*23.0*		*47.3*		*8.2*		*16.4*		*23.0*		AY:AM	*P* <0.001
2. Smoking amount		light smokers (1-4 cigarettes/day) = 15	*5.0*		*2.1*		*1.8*		*1.0*		*2.5*		JY:AY	*P* <0.05
(average number of		light-medium smokers (5-9) = 9	*2.5*		*2.7*		*0.9*		*0.5*		*1.6*		JM:AM	*P* <0.001
cigarettes smoked per day)		medium smokers (10-19) = 3	*7.5*		*8.5*		*4.6*		*5.5*		*6.4*			
		heavy smokers (≥20) = 0	*8.0*		*34.0*		*0.9*		*9.5*		*12.5*			

(cont.)

Component	Score	Scoring criteria Subgroups of sections	Japan JY [a] Mean	Japan JY [a] SE [b]	Japan JM [a] Mean	Japan JM [a] SE [b]	Australia AY [a] Mean	Australia AY [a] SE [b]	Australia AM [a] Mean	Australia AM [a] SE [b]	Total Mean	Total SE [b]	ANOVA / Tukey HSD	P
			%		%		%		%		%			
Alcohol Consumption Index	0-20 points		**19.9**	**0.10**	**17.6**	**0.38**	**18.3**	**0.30**	**17.0**	**0.40**	**18.2**	**0.16**	**ANOVA**	*P* <0.001
1. Drinking amount		moderate drinking = 20	*99.0*		*78.7*		*85.0*		*75.4*		*84.6*		**Tukey HSD**	
		more than moderate drinking:	*1.0*		*21.4*		*15.0*		*24.6*		15.3		JY:JM	*P* <0.001
		(<14 to 21) = 12	*0.5*		*12.8*		*9.5*		*11.8*		*8.6*		AY:AM	*P* <0.05
		(<21 to 28) = 6	*0.0*		*4.3*		*2.7*		*6.9*		*3.4*		JY:AY	*P* <0.01
		(<28 to 35) = 2	*0.0*		*2.7*		*0.5*		*3.4*		*1.6*		JM:AM	*P* =0.534
		heavy drinking (>35) = 0	*0.5*		*1.6*		*2.3*		*2.5*		*1.7*			
LIFESTYLE INDEX	0-100 points		**67.1**	**0.93**	**53.9**	**1.23**	**76.4**	**0.77**	**68.6**	**1.01**	**67.0**	**0.57**	**ANOVA**	*P* <0.001
													Tukey HSD	
													JY:JM	*P* <0.001
													AY:AM	*P* <0.001
													JY:AY	*P* <0.001
													JM:AM	*P* <0.001

[a] Based on sample size of 201 for Japanese young adult men (JY), 188 for Japanese middle-aged men (JM), 220 for Australian young adult men (AY), and 203 for Australian middle-aged men (AM).
[b] SE = Standard error of mean.
[c] Based on 1700, 2200, and 2700 kcal diet.
[d] CPF ratio : a ratio of energy intake from carbohydrate : protein : fat.
[e] PUFA : MUFA : SFA : a ratio of an intake of polyunsaturated fatty acids - monounsaturated fatty acids - saturated fatty acids.
RDA-J = Recommended Dietary Allowances for the Japanese (Ministry of Health Labour and Welfare 2005).
AI-J = Adequate Intake for the Japanese (Ministry of Health Labour and Welfare 2005).
RDI-A = Recommended Dietary Intakes for use in Australia (Commonwealth of Australia 2006).

APPENDIX 3.2

DIET AND LIFESTYLE RELATIONSHIPS WITH OBESITY INDICES

Appendix 3.2.1 BMI category relationships with other anthropometric measures, physical activity and diet for the combined-aged Japanese men

Items of diet and lifestyle	BMI Pearson correlation (n=385) (kg/m^2)	BMI categories[1] Underweight (n=29) (<18.5 kg/m^2)	Normal (n=283) (≥18.5 - <25.0 kg/m^2)	Overweight & obese (n=73) (≥25.0 kg/m^2)
Physical activity				
Physical activity (kJ), US[3]	0.218 **[2]	7339.8 ± 2235.4	8692.3 ± 2152.8	9375.1 ± 2298.7
Physical activity (kJ/kg), US[3]	-0.400 **	139.5 ± 41.6	139.2 ± 34.3	123.3 ± 30.1
Physical activity (kJ), Aus[4]	0.210 **	7548.0 ± 2246.6	8791.1 ± 2068.2	9423.8 ± 2254.6
Physical activity (kJ/kg), Aus[4]	-0.482 **	143.5 ± 41.7	140.8 ± 33.0	123.9 ± 29.3
Sleeping hours/day	0.061	6.3 ± 0.8	6.6 ± 0.9	6.6 ± 0.8
Current smokers	0.004	0.2 ± 0.4	0.4 ± 0.5	0.3 ± 0.5
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	-0.027	10526.7 ± 7036.5	8811.3 ± 4334.7	9695.1 ± 4477.1
Carbohydrate (% of energy)	-0.092	52.0 ± 8.4	52.2 ± 6.8	49.9 ± 6.7
Protein (% of energy)	0.050	17.5 ± 2.9	17.3 ± 3.0	18.0 ± 2.7
Fat (% of energy)	-0.028	29.3 ± 6.5	27.2 ± 5.6	28.0 ± 5.4
Saturated fat (% of energy)	-0.062	10.3 ± 2.9	8.9 ± 2.6	9.2 ± 2.4
Sugar (% of energy)	-0.033	11.8 ± 4.1	10.7 ± 4.3	10.8 ± 4.1
Alcohol (% of energy)	0.135 **	1.2 ± 1.9	3.3 ± 4.9	4.1 ± 5.0
Fiber (1000 kJ)	0.085	1.4 ± 0.3	1.6 ± 0.3	1.6 ± 0.4
Food groups (g/day)				
Soups and related items	-0.012	322.9 ± 173.6	308.0 ± 189.6	346.6 ± 204.5
Noodles, spaghetti and related dishes	0.041	107.8 ± 72.4	128.3 ± 102.6	150.9 ± 136.2
Mixed dishes	0.029	103.8 ± 81.7	91.0 ± 77.8	103.7 ± 101.6
Meat (not part of mixed dishes)	-0.023	46.6 ± 87.9	22.4 ± 20.7	31.8 ± 37.2
Poultry (not part of mixed dishes)	-0.141 **	53.1 ± 72.9	22.5 ± 30.1	22.5 ± 31.9
Fish and seafood (not part of mixed dishes)	0.039	39.2 ± 48.3	34.0 ± 32.0	43.8 ± 42.5
Processed meats and Mexican dishes	-0.054	201.7 ± 601.4	136.1 ± 276.6	127.3 ± 294.7
Rice	0.009	396.1 ± 208.4	350.0 ± 185.6	368.8 ± 168.8
Potatoes and related items	-0.076	38.0 ± 51.5	22.1 ± 28.3	24.9 ± 29.0
Salad items, eggs and other non-meat items	0.182 **	105.6 ± 97.2	98.1 ± 77.9	144.9 ± 107.3
Raw or cooked vegetables (not in soups or mixed dishes)	0.223 **	46.6 ± 36.6	63.7 ± 52.3	97.7 ± 76.4
Dried beans and related items (not in soups or mixed dishes)	0.064	1.0 ± 2.0	3.7 ± 12.0	4.3 ± 7.2
Fruit and juices	-0.008	138.3 ± 177.7	100.3 ± 142.1	119.9 ± 146.7
Bread items	-0.064	65.5 ± 67.7	52.2 ± 71.5	46.6 ± 38.1
Breakfast cereals	-0.056	0.3 ± 1.7	2.0 ± 19.0	0.3 ± 1.5
Dairy products	0.036	284.7 ± 395.4	206.8 ± 234.0	295.6 ± 358.8
Desserts and snacks	-0.078	92.7 ± 65.0	73.7 ± 120.3	65.8 ± 51.3
Alcoholic beverages	0.132 **	78.2 ± 120.8	219.2 ± 359.0	295.0 ± 377.1
Non-alcoholic beverages	0.124 *	535.6 ± 337.6	565.6 ± 322.3	653.3 ± 320.7

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.2 BMI category relationships with other anthropometric measures, physical activity and diet for young Japanese men

Items of diet and lifestyle	BMI Pearson correlation (n=201) (kg/m^2)	BMI categories[1] Underweight (n=24) (<18.5 kg/m^2)	Normal (n=158) (≥18.5 - <25.0 kg/m^2)	Overweight & obese (n=19) (≥25.0 kg/m^2)
Physical activity				
Physical activity (kJ), US[3]	0.338 **[2]	7396.2 ± 2459.5	8836.0 ± 2158.3	10485.8 ± 1301.4
Physical activity (kJ/kg), US[3]	-0.232 **	138.5 ± 45.2	142.8 ± 33.9	136.0 ± 17.4
Physical activity (kJ), Aus[4]	0.335 **	7571.6 ± 2477.7	8995.1 ± 2068.9	10534.1 ± 1160.9
Physical activity (kJ/kg), Aus[4]	-0.304 **	141.8 ± 45.5	145.4 ± 32.8	136.6 ± 15.3
Sleeping hours/day	0.042	6.3 ± 0.9	6.5 ± 1.0	6.5 ± 1.1
Current smokers	-0.086	0.2 ± 0.4	0.3 ± 0.4	0.1 ± 0.3
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	-0.061	11287.8 ± 7503.3	9470.5 ± 4945.8	9967.0 ± 4903.0
Carbohydrate (% of energy)	0.007	50.7 ± 6.5	52.7 ± 6.6	51.2 ± 6.2
Protein (% of energy)	0.083	18.1 ± 2.6	17.5 ± 2.8	19.0 ± 3.1
Fat (% of energy)	-0.023	30.3 ± 4.7	28.6 ± 5.2	29.0 ± 4.2
Saturated fat (% of energy)	-0.040	10.6 ± 2.4	9.6 ± 2.4	9.7 ± 2.0
Sugar (% of energy)	0.023	11.7 ± 3.8	11.3 ± 4.0	11.6 ± 4.1
Alcohol (% of energy)	-0.081	1.0 ± 1.6	1.2 ± 2.1	0.8 ± 1.4
Fiber (1000 kJ)	0.068	1.5 ± 0.2	1.6 ± 0.3	1.6 ± 0.4
Food groups (g/day)				
Soups and related items	-0.057	354.7 ± 168.4	337.3 ± 205.1	366.3 ± 178.2
Noodles, spaghetti and related dishes	0.098	120.2 ± 72.7	156.2 ± 118.5	184.3 ± 197.8
Mixed dishes	0.078	117.7 ± 82.9	106.5 ± 87.4	132.2 ± 159.3
Meat (not part of mixed dishes)	-0.077	53.2 ± 95.6	22.8 ± 20.6	35.7 ± 50.6
Poultry (not part of mixed dishes)	-0.098	61.1 ± 77.1	27.5 ± 35.9	41.6 ± 53.5
Fish and seafood (not part of mixed dishes)	0.013	42.8 ± 51.9	30.5 ± 28.4	46.2 ± 58.7
Processed meats and Mexican dishes	-0.131	240.2 ± 656.6	150.4 ± 275.5	60.5 ± 72.0
Rice	0.020	399.9 ± 200.8	347.9 ± 196.2	399.5 ± 185.3
Potatoes and related items	-0.026	43.0 ± 55.2	27.4 ± 30.5	36.3 ± 26.8
Salad items, eggs and other non-meat items	0.114	112.1 ± 105.1	89.4 ± 77.7	142.2 ± 101.5
Raw or cooked vegetables (not in soups or mixed dishes)	0.201 **	51.5 ± 38.3	58.3 ± 52.3	96.1 ± 74.7
Dried beans and related items (not in soups or mixed dishes)	0.073	1.2 ± 2.2	3.4 ± 14.5	4.8 ± 6.2
Fruit and juices	-0.050	150.0 ± 189.8	109.9 ± 146.5	118.6 ± 119.9
Bread items	-0.054	65.9 ± 73.2	59.3 ± 87.9	46.3 ± 51.8
Breakfast cereals	-0.052	0.4 ± 1.8	2.9 ± 25.0	0.1 ± 0.3
Dairy products	0.100	308.8 ± 428.6	239.1 ± 258.1	407.7 ± 504.9
Desserts and snacks	-0.076	94.2 ± 63.0	90.9 ± 151.1	64.9 ± 36.6
Alcoholic beverages	-0.051	65.2 ± 101.4	84.4 ± 175.3	42.9 ± 67.4
Non-alcoholic beverages	-0.004	547.9 ± 349.7	460.4 ± 310.7	545.8 ± 198.5

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.3 BMI category relationships with other anthropometric measures, physical activity and diet for middle-aged Japanese men

Items of diet and lifestyle	BMI Pearson correlation (n=184) (kg/m^2)	BMI categories[1] Underweight (n=5) (<18.5 kg/m^2)	Normal (n=125) (≥18.5 - <25.0 kg/m^2)	Overweight & obese (n=54) (≥25.0 kg/m^2)
Physical activity				
Physical activity (kJ), US[3]	0.173 *[2]	7069.4 ± 289.3	8510.6 ± 2140.7	8984.3 ± 2450.5
Physical activity (kJ/kg), US[3]	-0.461 **	144.4 ± 17.2	134.7 ± 34.3	118.8 ± 32.4
Physical activity (kJ), Aus[4]	0.184 *	7434.8 ± 106.7	8533.2 ± 2046.6	9033.1 ± 2418.8
Physical activity (kJ/kg), Aus[4]	-0.535 **	151.6 ± 13.6	135.0 ± 32.5	119.5 ± 31.8
Sleeping hours/day	-0.005	6.4 ± 0.5	6.7 ± 0.8	6.6 ± 0.8
Current smokers	-0.118	0.4 ± 0.5	0.5 ± 0.5	0.4 ± 0.5
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.164 *	6873.3 ± 1643.4	7978.0 ± 3241.4	9599.4 ± 4362.4
Carbohydrate (% of energy)	-0.127	58.3 ± 13.7	51.6 ± 7.0	49.4 ± 6.8
Protein (% of energy)	0.101	14.9 ± 3.5	17.1 ± 3.3	17.6 ± 2.4
Fat (% of energy)	0.159 *	24.6 ± 11.4	25.4 ± 5.5	27.7 ± 5.8
Saturated fat (% of energy)	0.123	8.4 ± 4.8	8.1 ± 2.5	9.0 ± 2.5
Sugar (% of energy)	0.030	12.5 ± 5.8	9.9 ± 4.4	10.5 ± 4.1
Alcohol (% of energy)	-0.053	2.2 ± 3.0	5.9 ± 6.0	5.3 ± 5.3
Fiber (1000 kJ)	0.121	1.2 ± 0.2	1.6 ± 0.3	1.7 ± 0.4
Food groups (g/day)				
Soups and related items	0.160 *	169.9 ± 112.7	270.9 ± 161.3	339.6 ± 214.1
Noodles, spaghetti and related dishes	0.223 **	48.6 ± 32.3	93.0 ± 62.6	139.2 ± 106.7
Mixed dishes	0.188 *	37.0 ± 20.5	71.4 ± 58.3	93.7 ± 70.7
Meat (not part of mixed dishes)	0.119	14.8 ± 8.2	21.9 ± 20.8	30.4 ± 31.6
Poultry (not part of mixed dishes)	0.024	14.5 ± 28.1	16.2 ± 18.9	15.8 ± 15.3
Fish and seafood (not part of mixed dishes)	0.005	21.9 ± 19.3	38.4 ± 35.7	42.9 ± 35.8
Processed meats and Mexican dishes	0.063	16.9 ± 34.1	117.9 ± 278.0	150.8 ± 337.8
Rice	0.009	377.9 ± 267.6	352.6 ± 171.9	358.1 ± 163.0
Potatoes and related items	0.053	14.0 ± 14.6	15.3 ± 23.7	20.9 ± 28.9
Salad items, eggs and other non-meat items	0.177 *	74.4 ± 34.9	109.1 ± 77.1	145.8 ± 110.2
Raw or cooked vegetables (not in soups or mixed dishes)	0.171 *	23.2 ± 10.3	70.4 ± 51.8	98.3 ± 77.7
Dried beans and related items (not in soups or mixed dishes)	0.035	0.3 ± 0.6	4.1 ± 7.9	4.1 ± 7.5
Fruit and juices	0.090	81.9 ± 95.8	88.2 ± 135.9	120.4 ± 156.1
Bread items	0.033	63.8 ± 36.4	43.2 ± 41.3	46.7 ± 32.6
Breakfast cereals	-0.035	0.0 ± 0.0	0.9 ± 5.5	0.4 ± 1.7
Dairy products	0.088	169.5 ± 135.3	165.9 ± 193.0	256.1 ± 286.8
Desserts and snacks	0.099	85.9 ± 81.8	51.9 ± 56.3	66.1 ± 55.9
Alcoholic beverages	-0.040	140.6 ± 192.6	389.6 ± 449.2	383.7 ± 401.1
Non-alcoholic beverages	0.001	476.4 ± 298.9	698.6 ± 286.6	691.1 ± 347.5

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.4 BMI category relationships with other anthropometric measures, physical activity and diet for the combined-aged Australian men

Items of diet and lifestyle	BMI Pearson correlation (n=409) (kg/m²)	BMI categories[1] Underweight (n=7) (<18.5 kg/m²)	Normal (n=233) (≥18.5 - <25.0 kg/m²)	Overweight & obese (n=169) (≥25.0 kg/m²)
Physical activity				
Physical activity (kJ), US[3]	0.111 *[2]	8728.5 ± 1081.0	9366.1 ± 3490.8	9873.4 ± 3732.2
Physical activity (kJ/kg), US[3]	-0.472 **	146.4 ± 14.8	130.1 ± 47.7	111.4 ± 41.9
Physical activity (kJ), Aus[4]	0.109 *	8688.3 ± 900.4	9406.2 ± 3401.0	9897.3 ± 3684.2
Physical activity (kJ/kg), Aus[4]	-0.527 **	146.0 ± 14.1	130.7 ± 46.7	111.7 ± 41.5
Sleeping hours/day	-0.271 **	7.9 ± 0.9	7.5 ± 1.0	7.1 ± 1.0
Current smokers	0.187 **	0.0 ± 0.0	0.1 ± 0.3	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	-0.129 **	9069.7 ± 1688.9	11212.1 ± 5366.3	10075.6 ± 5029.1
Carbohydrate (% of energy)	-0.131 **	52.7 ± 4.3	50.2 ± 7.0	49.1 ± 6.8
Protein (% of energy)	0.084	15.5 ± 2.0	16.2 ± 2.8	16.4 ± 3.0
Fat (% of energy)	-0.076	31.0 ± 4.2	29.7 ± 5.9	28.6 ± 5.4
Saturated fat (% of energy)	-0.102 *	12.1 ± 2.6	11.1 ± 3.1	10.5 ± 2.8
Sugar (% of energy)	-0.076	17.4 ± 5.6	16.9 ± 6.1	16.5 ± 6.5
Alcohol (% of energy)	0.202 **	0.8 ± 0.6	3.9 ± 4.4	5.9 ± 6.5
Fiber (1000 kJ)	0.042	3.1 ± 1.6	2.8 ± 1.4	3.0 ± 1.8
Food groups (g/day)				
Soups and related items	-0.011	44.8 ± 71.2	60.4 ± 101.4	64.5 ± 191.0
Noodles, spaghetti and related dishes	-0.169 **	131.8 ± 102.9	184.5 ± 133.3	152.9 ± 124.4
Mixed dishes	-0.008	67.9 ± 35.1	105.6 ± 92.3	104.9 ± 137.2
Meat (not part of mixed dishes)	-0.005	17.3 ± 13.0	49.0 ± 46.8	44.3 ± 34.3
Poultry (not part of mixed dishes)	0.003	34.4 ± 29.5	38.2 ± 55.9	35.8 ± 38.7
Fish and seafood (not part of mixed dishes)	0.144 **	8.9 ± 7.7	15.6 ± 20.2	21.3 ± 22.9
Processed meats and Mexican dishes	-0.088	34.2 ± 58.7	58.6 ± 93.9	40.8 ± 74.1
Rice	-0.023	17.5 ± 10.2	69.8 ± 82.4	57.4 ± 71.2
Potatoes and related items	0.053	118.4 ± 53.8	98.9 ± 118.1	105.4 ± 104.2
Salad items, eggs and other non-meat items	0.006	93.4 ± 107.1	58.3 ± 52.6	65.3 ± 50.9
Raw or cooked vegetables (not in soups or mixed dishes)	0.044	103.4 ± 70.1	80.8 ± 74.8	90.0 ± 77.6
Dried beans and related items (not in soups or mixed dishes)	0.034	9.6 ± 18.9	14.6 ± 24.7	16.3 ± 30.0
Fruit and juices	-0.118 *	255.0 ± 251.4	231.5 ± 234.9	205.4 ± 211.5
Bread items	-0.136 **	160.5 ± 77.9	163.4 ± 119.1	138.5 ± 90.4
Breakfast cereals	-0.135 **	70.8 ± 95.1	54.0 ± 69.2	42.6 ± 64.0
Dairy products	-0.115 *	339.0 ± 235.1	413.5 ± 386.9	343.5 ± 429.1
Desserts and snacks	-0.101 *	107.6 ± 91.1	89.1 ± 111.0	73.0 ± 76.9
Alcoholic beverages	0.086	39.8 ± 46.2	320.6 ± 435.9	397.4 ± 511.6
Non-alcoholic beverages	0.175 **	373.7 ± 421.0	496.7 ± 574.6	642.0 ± 462.7

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.5 BMI category relationships with other anthropometric measures, physical activity and diet for young Australian men

Items of diet and lifestyle	BMI Pearson correlation (n=216) (kg/m^2)	BMI categories[1] Underweight (n=4) (<18.5 kg/m^2)	Normal (n=165) (≥18.5 - <25.0 kg/m^2)	Overweight & obese (n=47) (≥25.0 kg/m^2)
Physical activity				
Physical activity (kJ), US[3]	0.287 **[2]	8748.8 ± 1360.6	9429.8 ± 3705.3	11421.6 ± 2978.6
Physical activity (kJ/kg), US[3]	-0.283 **	148.9 ± 11.7	131.1 ± 50.7	129.9 ± 33.6
Physical activity (kJ), Aus[4]	0.291 **	8706.4 ± 1166.4	9479.2 ± 3604.1	11407.4 ± 2896.5
Physical activity (kJ/kg), Aus[4]	-0.330 **	148.4 ± 8.4	131.9 ± 49.6	129.8 ± 33.2
Sleeping hours/day	-0.075	8.0 ± 0.8	7.7 ± 1.0	7.6 ± 1.0
Current smokers	0.230 **	0.0 ± 0.0	0.1 ± 0.3	0.1 ± 0.3
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	0.018	9000.2 ± 1985.8	11987.3 ± 5636.8	12174.4 ± 5922.0
Carbohydrate (% of energy)	-0.137 *	50.0 ± 3.4	49.9 ± 6.6	48.1 ± 5.7
Protein (% of energy)	0.103	15.3 ± 2.7	16.4 ± 2.8	16.8 ± 2.7
Fat (% of energy)	0.000	33.9 ± 1.5	30.2 ± 5.5	30.9 ± 4.5
Saturated fat (% of energy)	-0.001	13.4 ± 1.7	11.6 ± 2.9	11.9 ± 2.5
Sugar (% of energy)	-0.062	15.7 ± 5.2	16.7 ± 6.0	17.1 ± 7.1
Alcohol (% of energy)	0.156 *	0.9 ± 0.8	3.5 ± 3.9	4.2 ± 3.5
Fiber (1000 kJ)	-0.071	3.0 ± 1.7	2.6 ± 1.3	2.5 ± 1.7
Food groups (g/day)				
Soups and related items	0.121	28.1 ± 46.6	55.7 ± 74.1	77.1 ± 114.8
Noodles, spaghetti and related dishes	-0.050	130.3 ± 143.9	199.4 ± 136.4	195.4 ± 121.1
Mixed dishes	0.140 *	82.7 ± 25.1	111.0 ± 82.9	141.1 ± 85.1
Meat (not part of mixed dishes)	0.066	14.4 ± 10.0	52.8 ± 50.3	56.8 ± 37.2
Poultry (not part of mixed dishes)	0.038	35.6 ± 38.8	40.5 ± 60.6	43.5 ± 41.7
Fish and seafood (not part of mixed dishes)	0.140 *	3.9 ± 4.6	14.9 ± 19.8	20.6 ± 23.7
Processed meats and Mexican dishes	0.045	57.1 ± 72.5	68.4 ± 103.8	76.8 ± 106.6
Rice	0.007	15.2 ± 12.8	70.2 ± 85.1	63.5 ± 78.8
Potatoes and related items	0.013	115.0 ± 70.4	100.6 ± 123.8	102.0 ± 87.0
Salad items, eggs and other non-meat items	-0.058	125.0 ± 139.6	57.2 ± 56.0	58.3 ± 43.1
Raw or cooked vegetables (not in soups or mixed dishes)	-0.090	109.5 ± 94.1	74.4 ± 75.2	67.0 ± 64.7
Dried beans and related items (not in soups or mixed dishes)	-0.005	4.3 ± 8.6	15.2 ± 26.9	17.0 ± 29.2
Fruit and juices	-0.097	315.7 ± 327.3	247.2 ± 258.7	234.2 ± 234.4
Bread items	-0.082	194.3 ± 90.1	175.0 ± 129.8	150.3 ± 100.0
Breakfast cereals	-0.139 *	17.7 ± 24.3	56.6 ± 70.3	32.5 ± 45.7
Dairy products	0.054	256.2 ± 203.0	481.0 ± 414.4	540.7 ± 610.3
Desserts and snacks	-0.026	91.5 ± 81.8	96.2 ± 119.3	85.4 ± 90.5
Alcoholic beverages	0.101	34.4 ± 59.7	314.7 ± 397.2	368.4 ± 476.6
Non-alcoholic beverages	0.150 *	83.0 ± 66.0	466.4 ± 631.8	581.9 ± 537.5

[1] mean ± sd (all such values).
*[2] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] Refer to the National Academy of Sciences (1989).
[4] Refer to Truswell et al. (1990).

Appendix 3.2.6 BMI category relationships with other anthropometric measures, physical activity and diet for middle-aged Australian men

Items of diet and lifestyle	BMI Pearson correlation (n=193) (kg/m²)	BMI categories[1] Underweight (n=3) (<18.5 kg/m²)	Normal (n=68) (≥18.5 - <25.0 kg/m²)	Overweight & obese (n=122) (≥25.0 kg/m²)
Physical activity				
Physical activity (kJ), US[3]	0.073	8701.5 ± 852.6	9211.7 ± 2924.8	9277.0 ± 3831.0
Physical activity (kJ/kg), US[3]	-0.532 **[2]	143.1 ± 20.5	127.7 ± 39.6	104.3 ± 42.8
Physical activity (kJ), Aus[4]	0.071	8664.2 ± 624.5	9229.1 ± 2865.5	9315.6 ± 3798.5
Physical activity (kJ/kg), Aus[4]	-0.593 **	142.9 ± 21.6	128.0 ± 39.0	104.8 ± 42.4
Sleeping hours/day	-0.225 **	7.7 ± 1.2	7.2 ± 0.8	6.9 ± 1.0
Current smokers	0.097	0.0 ± 0.0	0.2 ± 0.4	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)				
Energy (kJ)	-0.059	9162.3 ± 1618.6	9331.1 ± 4107.4	9267.0 ± 4406.0
Carbohydrate (% of energy)	-0.189 **	56.3 ± 2.2	51.0 ± 7.9	49.5 ± 7.1
Protein (% of energy)	0.144 *	15.9 ± 0.7	15.9 ± 2.7	16.2 ± 3.0
Fat (% of energy)	0.036	27.1 ± 2.9	28.4 ± 6.6	27.7 ± 5.5
Saturated fat (% of energy)	0.053	10.3 ± 2.6	10.0 ± 3.1	9.9 ± 2.7
Sugar (% of energy)	-0.102	19.7 ± 6.3	17.5 ± 6.3	16.2 ± 6.3
Alcohol (% of energy)	0.116	0.7 ± 0.5	4.7 ± 5.4	6.6 ± 7.2
Fiber (1000 kJ)	-0.038	3.4 ± 1.8	3.2 ± 1.5	3.2 ± 1.8
Food groups (g/day)				
Soups and related items	-0.068	67.1 ± 103.2	71.9 ± 148.3	59.6 ± 213.4
Noodles, spaghetti and related dishes	-0.117	133.7 ± 26.2	148.2 ± 118.8	136.5 ± 122.3
Mixed dishes	0.004	48.2 ± 41.6	92.3 ± 111.4	91.0 ± 150.6
Meat (not part of mixed dishes)	0.096	21.2 ± 17.8	39.8 ± 35.3	39.5 ± 32.0
Poultry (not part of mixed dishes)	0.057	33.0 ± 18.5	32.8 ± 42.1	32.8 ± 37.2
Fish and seafood (not part of mixed dishes)	0.099	15.5 ± 5.5	17.3 ± 21.4	21.6 ± 22.6
Processed meats and Mexican dishes	-0.016	3.7 ± 3.6	34.7 ± 58.2	26.9 ± 51.2
Rice	-0.004	20.4 ± 6.6	68.8 ± 75.9	55.0 ± 68.2
Potatoes and related items	0.094	122.9 ± 34.5	94.6 ± 103.7	106.7 ± 110.4
Salad items, eggs and other non-meat items	0.005	51.2 ± 21.8	61.0 ± 43.3	67.9 ± 53.5
Raw or cooked vegetables (not in soups or mixed dishes)	0.015	95.2 ± 36.0	96.5 ± 71.8	98.9 ± 80.5
Dried beans and related items (not in soups or mixed dishes)	0.080	16.6 ± 28.8	13.2 ± 18.2	16.0 ± 30.4
Fruit and juices	-0.063	174.0 ± 108.4	193.4 ± 158.3	194.3 ± 201.9
Bread items	-0.071	115.5 ± 26.6	135.3 ± 81.9	133.9 ± 86.5
Breakfast cereals	-0.147 *	141.6 ± 114.5	47.5 ± 66.5	46.5 ± 69.5
Dairy products	-0.046	449.4 ± 268.3	249.6 ± 244.0	267.6 ± 305.1
Desserts and snacks	-0.097	129.2 ± 116.9	72.1 ± 86.2	68.2 ± 70.8
Alcoholic beverages	0.046	47.0 ± 30.0	334.7 ± 521.2	408.6 ± 525.9
Non-alcoholic beverages	0.122	761.1 ± 361.9	570.2 ± 397.8	665.1 ± 430.6

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.7 WC categories relationships with other anthropometric measures, physical activity and diet for the combined-aged Japanese men

Items of diet and lifestyle	WC Pearson correlation (cm), (n=344)	WC categories[1] Categories (<85.0 cm), (n=257)	(≥85.0 cm), (n=87)
Physical activity			
Physical activity (kJ), US[3]	0.204 **[2]	8515.9 ± 2472.3	9308.5 ± 1694.4
Physical activity (kJ/kg), US[3]	-0.335 **	137.9 ± 38.8	129.8 ± 25.2
Physical activity (kJ), Aus[4]	0.196 **	8611.3 ± 2402.5	9377.2 ± 1612.5
Physical activity (kJ/kg), Aus[4]	-0.405 **	139.5 ± 38.0	130.7 ± 23.7
Sleeping hours/day	0.056	6.5 ± 0.9	6.7 ± 0.9
Current smokers	0.143 **	0.3 ± 0.5	0.5 ± 0.5
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.119 *	9089.2 ± 4870.2	8977.2 ± 3990.7
Carbohydrate (% of energy)	-0.055	52.0 ± 7.1	50.9 ± 6.9
Protein (% of energy)	-0.056	17.3 ± 3.1	17.6 ± 2.9
Fat (% of energy)	-0.124 *	27.7 ± 5.7	26.6 ± 5.4
Saturated fat (% of energy)	-0.130 *	9.2 ± 2.6	8.6 ± 2.3
Sugar (% of energy)	-0.030	11.0 ± 4.1	10.4 ± 4.3
Alcohol (% of energy)	0.256 **	3.0 ± 4.6	4.9 ± 5.5
Fiber (1000 kJ)	-0.003	1.6 ± 0.3	1.6 ± 0.3
Food groups (g/day)			
Soups and related items	-0.093	318.0 ± 185.3	307.8 ± 210.0
Noodles, spaghetti and related dishes	-0.079	136.0 ± 115.1	117.2 ± 96.0
Mixed dishes	-0.076	99.0 ± 88.3	80.2 ± 63.4
Meat (not part of mixed dishes)	-0.052	26.1 ± 38.1	25.8 ± 23.8
Poultry (not part of mixed dishes)	-0.163 **	26.4 ± 40.3	17.6 ± 17.0
Fish and seafood (not part of mixed dishes)	0.016	34.9 ± 35.7	40.5 ± 33.7
Processed meats and Mexican dishes	-0.131 *	137.6 ± 320.9	122.5 ± 287.6
Rice	0.030	346.3 ± 185.9	380.3 ± 172.9
Potatoes and related items	-0.157 **	24.6 ± 30.2	18.3 ± 20.3
Salad items, eggs and other non-meat items	0.146 **	94.2 ± 73.9	147.8 ± 110.2
Raw or cooked vegetables (not in soups or mixed dishes)	0.121 *	63.5 ± 54.0	86.2 ± 69.1
Dried beans and related items (not in soups or mixed dishes)	0.053	3.7 ± 12.5	3.5 ± 6.3
Fruit and juices	-0.030	104.9 ± 136.1	114.8 ± 184.5
Bread items	-0.118 *	51.5 ± 69.8	47.5 ± 47.2
Breakfast cereals	-0.114 *	2.0 ± 19.9	0.7 ± 3.4
Dairy products	0.002	220.8 ± 237.3	223.0 ± 280.5
Desserts and snacks	-0.164 **	79.3 ± 125.3	60.5 ± 54.5
Alcoholic beverages	0.247 **	200.1 ± 352.4	340.2 ± 386.0
Non-alcoholic beverages	0.161 **	562.7 ± 319.5	669.8 ± 301.6

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.8 WC categories relationships with other anthropometric measures, physical activity and diet for young Japanese men

Items of diet and lifestyle	WC Pearson correlation (cm), (n=170)	WC categories[1] Categories (<85.0 cm), (n=155)	(≥85.0 cm), (n=15)
Physical activity			
Physical activity (kJ), US[3]	0.266 **[2]	8694.6 ± 2426.8	9877.0 ± 1249.6
Physical activity (kJ/kg), US[3]	-0.131	141.7 ± 37.4	140.8 ± 24.3
Physical activity (kJ), Aus[4]	0.262 **	8857.8 ± 2366.5	9871.0 ± 962.7
Physical activity (kJ/kg), Aus[4]	-0.180 *	144.4 ± 36.8	140.6 ± 19.3
Sleeping hours/day	-0.123	6.4 ± 0.9	6.3 ± 1.2
Current smokers	0.079	0.2 ± 0.4	0.3 ± 0.5
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.119	9872.4 ± 5653.0	8732.4 ± 2975.7
Carbohydrate (% of energy)	0.075	52.0 ± 6.9	54.9 ± 5.2
Protein (% of energy)	-0.103	17.7 ± 3.0	17.1 ± 1.9
Fat (% of energy)	-0.028	29.0 ± 5.3	27.3 ± 4.1
Saturated fat (% of energy)	0.003	9.7 ± 2.4	9.3 ± 1.9
Sugar (% of energy)	0.113	11.3 ± 3.9	12.6 ± 3.3
Alcohol (% of energy)	-0.027	1.3 ± 2.2	0.7 ± 1.1
Fiber (1000 kJ)	-0.002	1.6 ± 0.3	1.6 ± 0.4
Food groups (g/day)			
Soups and related items	-0.138	344.3 ± 198.0	289.1 ± 197.6
Noodles, spaghetti and related dishes	0.019	163.2 ± 132.7	105.7 ± 58.8
Mixed dishes	0.009	115.5 ± 99.6	81.4 ± 41.2
Meat (not part of mixed dishes)	-0.079	29.1 ± 45.3	18.4 ± 20.9
Poultry (not part of mixed dishes)	-0.082	34.6 ± 48.8	20.3 ± 22.0
Fish and seafood (not part of mixed dishes)	-0.045	33.9 ± 36.3	29.0 ± 17.6
Processed meats and Mexican dishes	-0.151 *	157.9 ± 358.5	96.0 ± 169.5
Rice	0.002	351.6 ± 199.9	385.1 ± 166.4
Potatoes and related items	-0.038	30.5 ± 33.0	28.1 ± 21.0
Salad items, eggs and other non-meat items	0.019	92.0 ± 76.1	139.7 ± 135.6
Raw or cooked vegetables (not in soups or mixed dishes)	0.079	58.2 ± 52.6	86.0 ± 63.9
Dried beans and related items (not in soups or mixed dishes)	0.062	3.6 ± 14.7	1.6 ± 3.4
Fruit and juices	-0.050	118.9 ± 159.5	90.4 ± 100.6
Bread items	-0.086	56.6 ± 84.7	63.5 ± 74.4
Breakfast cereals	-0.133	3.0 ± 25.2	0.2 ± 0.8
Dairy products	0.124	234.9 ± 255.1	348.6 ± 328.3
Desserts and snacks	-0.137	94.7 ± 152.3	69.9 ± 44.1
Alcoholic beverages	-0.025	86.6 ± 174.3	42.0 ± 68.9
Non-alcoholic beverages	0.043	475.4 ± 306.3	558.2 ± 275.3

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.9 WC categories relationships with other anthropometric measures, physical activity and diet for middle-aged Japanese men

	WC	WC categories[1]	
	Pearson correlation	Categories	
Items of diet and lifestyle	(cm), (n=174)	(<85.0 cm), (n=102)	(≥85.0 cm), (n=72)
Physical activity			
Physical activity (kJ), US[3]	0.252 **[2]	8244.3 ± 2527.8	9190.0 ± 1757.0
Physical activity (kJ/kg), US[3]	-0.384 **	132.1 ± 40.4	127.5 ± 24.9
Physical activity (kJ), Aus[4]	0.273 **	8236.8 ± 2420.1	9274.3 ± 1704.3
Physical activity (kJ/kg), Aus[4]	-0.426 **	132.0 ± 38.7	128.7 ± 24.2
Sleeping hours/day	0.092	6.6 ± 0.8	6.8 ± 0.8
Current smokers	-0.050	0.5 ± 0.5	0.5 ± 0.5
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	0.071	7899.1 ± 3003.9	9028.2 ± 4186.7
Carbohydrate (% of energy)	-0.122	52.1 ± 7.4	50.0 ± 7.0
Protein (% of energy)	0.084	16.7 ± 3.0	17.7 ± 3.0
Fat (% of energy)	0.050	25.6 ± 5.7	26.4 ± 5.6
Saturated fat (% of energy)	0.021	8.3 ± 2.6	8.4 ± 2.4
Sugar (% of energy)	-0.023	10.5 ± 4.4	10.0 ± 4.3
Alcohol (% of energy)	0.061	5.6 ± 5.9	5.8 ± 5.7
Fiber (1000 kJ)	-0.009	1.6 ± 0.4	1.6 ± 0.3
Food groups (g/day)			
Soups and related items	0.094	278.0 ± 156.7	311.7 ± 213.6
Noodles, spaghetti and related dishes	0.115	94.8 ± 62.1	119.6 ± 102.2
Mixed dishes	0.100	73.9 ± 59.7	80.0 ± 67.3
Meat (not part of mixed dishes)	0.089	21.5 ± 22.7	27.3 ± 24.3
Poultry (not part of mixed dishes)	0.093	13.8 ± 15.0	17.1 ± 15.9
Fish and seafood (not part of mixed dishes)	-0.010	36.3 ± 34.9	42.9 ± 35.8
Processed meats and Mexican dishes	-0.069	106.6 ± 251.9	128.0 ± 307.1
Rice	0.077	338.1 ± 163.0	379.3 ± 175.3
Potatoes and related items	-0.020	15.6 ± 22.7	16.2 ± 19.7
Salad items, eggs and other non-meat items	0.172 *	97.6 ± 70.6	149.5 ± 105.2
Raw or cooked vegetables (not in soups or mixed dishes)	0.034	71.5 ± 55.3	86.2 ± 70.6
Dried beans and related items (not in soups or mixed dishes)	0.028	3.8 ± 8.2	3.9 ± 6.7
Fruit and juices	0.064	83.7 ± 86.0	119.9 ± 197.7
Bread items	-0.059	43.8 ± 36.5	44.1 ± 39.3
Breakfast cereals	0.017	0.6 ± 5.1	0.8 ± 3.8
Dairy products	-0.028	199.3 ± 206.6	196.9 ± 264.6
Desserts and snacks	-0.003	56.0 ± 58.9	58.6 ± 56.5
Alcoholic beverages	0.085	372.5 ± 467.5	402.4 ± 396.1
Non-alcoholic beverages	-0.076	695.2 ± 293.7	693.0 ± 303.4

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.10 WC categories relationships with other anthropometric measures, physical activity and diet for the combined-aged Australian men

Items of diet and lifestyle	WC Pearson correlation (cm), (n=348)	WC categories[1] Categories (<94.0 cm), (n=256)	WC categories[1] Categories (≥94.0 cm), (n=92)
Physical activity			
Physical activity (kJ), US[3]	0.142 **[2]	9112.0 ± 3956.7	10195.3 ± 2960.8
Physical activity (kJ/kg), US[3]	-0.434 **	123.9 ± 52.8	111.5 ± 32.5
Physical activity (kJ), Aus[4]	0.140 **	9128.4 ± 3869.6	10248.8 ± 2936.8
Physical activity (kJ/kg), Aus[4]	-0.490 **	124.2 ± 51.9	112.1 ± 32.1
Sleeping hours/day	-0.205 **	7.5 ± 1.0	7.0 ± 1.0
Current smokers	0.165 **	0.1 ± 0.3	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.142 **	10860.1 ± 4984.4	9358.7 ± 3969.8
Carbohydrate (% of energy)	-0.117 *	50.3 ± 6.8	48.3 ± 7.4
Protein (% of energy)	0.091	16.0 ± 2.9	16.6 ± 3.1
Fat (% of energy)	-0.088	29.3 ± 5.6	29.2 ± 6.2
Saturated fat (% of energy)	-0.144 **	11.0 ± 2.9	10.5 ± 3.0
Sugar (% of energy)	-0.092	17.0 ± 6.1	15.8 ± 6.4
Alcohol (% of energy)	0.186 **	4.3 ± 5.1	5.9 ± 7.0
Fiber (1000 kJ)	0.048	2.9 ± 1.6	3.0 ± 1.7
Food groups (g/day)			
Soups and related items	-0.074	57.6 ± 101.7	46.9 ± 59.1
Noodles, spaghetti and related dishes	-0.126 *	173.4 ± 126.4	146.4 ± 109.5
Mixed dishes	-0.068	99.2 ± 82.6	92.7 ± 76.0
Meat (not part of mixed dishes)	-0.010	46.4 ± 44.8	43.6 ± 36.9
Poultry (not part of mixed dishes)	0.065	33.6 ± 38.7	36.9 ± 39.3
Fish and seafood (not part of mixed dishes)	0.086	16.9 ± 20.3	16.5 ± 17.1
Processed meats and Mexican dishes	-0.098	52.3 ± 70.1	35.0 ± 63.7
Rice	0.000	62.1 ± 72.7	54.3 ± 62.7
Potatoes and related items	0.072	102.5 ± 116.2	108.2 ± 113.3
Salad items, eggs and other non-meat items	0.041	62.1 ± 53.4	62.2 ± 47.6
Raw or cooked vegetables (not in soups or mixed dishes)	0.129 *	81.2 ± 71.5	90.1 ± 78.2
Dried beans and related items (not in soups or mixed dishes)	-0.036	16.0 ± 26.9	13.1 ± 25.3
Fruit and juices	-0.152 **	235.2 ± 228.9	164.5 ± 201.7
Bread items	-0.090	158.1 ± 114.3	134.6 ± 87.6
Breakfast cereals	-0.060	52.3 ± 65.0	47.2 ± 79.6
Dairy products	-0.157 **	392.7 ± 379.2	293.4 ± 321.3
Desserts and snacks	-0.104	85.8 ± 103.4	68.4 ± 72.6
Alcoholic beverages	0.078	355.2 ± 498.3	356.1 ± 461.0
Non-alcoholic beverages	0.149 **	521.1 ± 481.4	660.9 ± 421.8

[1] mean ± sd (all such values).
*[2] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] Refer to the National Academy of Sciences (1989).
[4] Refer to Truswell et al. (1990).

Appendix 3.2.11 WC categories relationships with other anthropometric measures, physical activity and diet for young Australian men

	WC	WC categories[1]	
	Pearson correlation	Categories	
Items of diet and lifestyle	(cm), (n=170)	(<94.0 cm), (n=155)	(≥94.0 cm), (n=15)
Physical activity			
Physical activity (kJ), US[3]	0.246 **[2]	9543.0 ± 3940.1	11421.8 ± 1108.9
Physical activity (kJ/kg), US[3]	-0.243 **	131.4 ± 52.6	125.3 ± 13.3
Physical activity (kJ), Aus[4]	0.251 **	9568.0 ± 3826.5	11473.5 ± 1080.2
Physical activity (kJ/kg), Aus[4]	-0.285 **	131.9 ± 51.4	125.7 ± 11.7
Sleeping hours/day	0.110	7.8 ± 1.0	7.9 ± 0.8
Current smokers	0.086	0.1 ± 0.2	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.091	11887.8 ± 5405.0	9641.6 ± 2928.4
Carbohydrate (% of energy)	-0.146	49.9 ± 6.5	46.2 ± 5.7
Protein (% of energy)	0.073	16.2 ± 2.8	17.1 ± 3.0
Fat (% of energy)	0.014	30.2 ± 5.1	33.1 ± 4.4
Saturated fat (% of energy)	0.011	11.6 ± 2.8	12.9 ± 2.6
Sugar (% of energy)	-0.116	16.8 ± 6.2	16.0 ± 5.5
Alcohol (% of energy)	0.171 *	3.6 ± 4.1	3.5 ± 2.9
Fiber (1000 kJ)	-0.043	2.7 ± 1.5	2.2 ± 1.1
Food groups (g/day)			
Soups and related items	-0.059	56.3 ± 83.5	64.0 ± 63.2
Noodles, spaghetti and related dishes	-0.023	195.6 ± 129.4	192.4 ± 99.9
Mixed dishes	-0.007	112.3 ± 80.2	128.9 ± 98.6
Meat (not part of mixed dishes)	0.011	51.4 ± 50.8	54.3 ± 42.0
Poultry (not part of mixed dishes)	0.042	35.4 ± 38.4	41.3 ± 32.5
Fish and seafood (not part of mixed dishes)	-0.034	14.6 ± 16.1	7.3 ± 9.6
Processed meats and Mexican dishes	0.088	62.4 ± 74.7	85.0 ± 102.7
Rice	-0.015	66.2 ± 76.3	30.2 ± 20.7
Potatoes and related items	0.002	102.4 ± 124.3	91.8 ± 67.6
Salad items, eggs and other non-meat items	-0.021	60.1 ± 59.9	39.8 ± 27.3
Raw or cooked vegetables (not in soups or mixed dishes)	0.021	73.1 ± 69.6	49.4 ± 44.2
Dried beans and related items (not in soups or mixed dishes)	-0.053	16.0 ± 28.5	2.3 ± 4.1
Fruit and juices	-0.200 **	257.9 ± 263.6	105.5 ± 93.7
Bread items	-0.031	173.3 ± 128.8	118.8 ± 62.6
Breakfast cereals	-0.086	54.7 ± 67.0	42.3 ± 98.7
Dairy products	-0.086	472.3 ± 423.3	333.7 ± 232.6
Desserts and snacks	-0.089	95.1 ± 117.9	65.6 ± 52.2
Alcoholic beverages	0.103	335.2 ± 456.4	232.7 ± 216.4
Non-alcoholic beverages	0.014	461.8 ± 527.0	545.3 ± 396.0

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.12 WC categories relationships with other anthropometric measures, physical activity and diet for middle-aged Australian men

Items of diet and lifestyle	WC Pearson correlation (cm), (n=178)	WC categories[1] Categories (<94.0 cm), (n=101)	(≥94.0 cm), (n=77)
Physical activity			
Physical activity (kJ), US[3]	0.170 *[2]	8450.4 ± 3909.5	9956.4 ± 3148.8
Physical activity (kJ/kg), US[3]	-0.428 **	112.2 ± 51.1	108.8 ± 34.4
Physical activity (kJ), Aus[4]	0.165 *	8453.7 ± 3856.7	10010.2 ± 3123.9
Physical activity (kJ/kg), Aus[4]	-0.498 **	112.3 ± 50.7	109.4 ± 34.2
Sleeping hours/day	-0.178 *	7.1 ± 0.9	6.9 ± 1.0
Current smokers	0.099	0.2 ± 0.4	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	0.035	9282.9 ± 3770.1	9303.6 ± 4155.9
Carbohydrate (% of energy)	-0.144	50.9 ± 7.1	48.7 ± 7.7
Protein (% of energy)	0.163 *	15.7 ± 2.9	16.5 ± 3.2
Fat (% of energy)	0.001	28.0 ± 5.9	28.4 ± 6.2
Saturated fat (% of energy)	-0.041	10.1 ± 2.9	10.1 ± 2.9
Sugar (% of energy)	-0.091	17.4 ± 5.9	15.8 ± 6.6
Alcohol (% of energy)	0.083	5.4 ± 6.2	6.4 ± 7.5
Fiber (1000 kJ)	-0.046	3.3 ± 1.7	3.2 ± 1.8
Food groups (g/day)			
Soups and related items	-0.079	59.7 ± 125.1	43.6 ± 58.1
Noodles, spaghetti and related dishes	-0.020	139.4 ± 114.3	137.5 ± 109.7
Mixed dishes	0.056	79.2 ± 82.7	85.6 ± 69.4
Meat (not part of mixed dishes)	0.125	38.8 ± 32.5	41.5 ± 35.8
Poultry (not part of mixed dishes)	0.131	30.9 ± 39.1	36.0 ± 40.7
Fish and seafood (not part of mixed dishes)	0.057	20.4 ± 25.2	18.3 ± 17.7
Processed meats and Mexican dishes	-0.069	36.9 ± 59.7	25.3 ± 48.2
Rice	0.055	55.7 ± 66.8	59.0 ± 67.0
Potatoes and related items	0.131	102.7 ± 103.1	111.5 ± 120.3
Salad items, eggs and other non-meat items	0.039	65.1 ± 41.6	66.5 ± 49.6
Raw or cooked vegetables (not in soups or mixed dishes)	0.086	93.5 ± 72.9	98.0 ± 81.0
Dried beans and related items (not in soups or mixed dishes)	-0.046	16.1 ± 24.5	15.2 ± 27.2
Fruit and juices	-0.013	200.5 ± 156.8	176.0 ± 215.1
Bread items	-0.016	134.7 ± 82.6	137.7 ± 91.7
Breakfast cereals	-0.016	48.6 ± 61.9	48.2 ± 76.0
Dairy products	-0.009	270.5 ± 256.4	285.5 ± 336.5
Desserts and snacks	-0.025	71.4 ± 74.3	69.0 ± 76.2
Alcoholic beverages	0.027	385.9 ± 557.4	380.1 ± 492.2
Non-alcoholic beverages	0.135	612.1 ± 386.5	683.4 ± 425.4

[1] mean ± sd (all such values).
*[2] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] Refer to the National Academy of Sciences (1989).
[4] Refer to Truswell et al. (1990).

Appendix 3.2.13 WHR categories relationships with other anthropometric measures, physical activity and diet for the combined-aged Japanese men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=301)	WHR categories[1] Categories (≤0.90), (n=215)	(>0.90), (n=86)
Physical activity			
Physical activity (kJ), US[3]	0.062	8781.0 ± 2435.1	8820.1 ± 1911.8
Physical activity (kJ/kg), US[3]	-0.161 **[2]	139.1 ± 37.8	133.6 ± 28.6
Physical activity (kJ), Aus[4]	0.064	8859.0 ± 2377.6	8916.5 ± 1747.0
Physical activity (kJ/kg), Aus[4]	-0.183 **	140.4 ± 37.0	135.3 ± 26.7
Sleeping hours/day	0.045	6.5 ± 0.9	6.6 ± 0.9
Current smokers	0.041	0.3 ± 0.5	0.4 ± 0.5
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.168 **	9404.2 ± 4936.9	8476.0 ± 4082.9
Carbohydrate (% of energy)	-0.005	51.9 ± 7.1	51.6 ± 6.8
Protein (% of energy)	-0.114 *	17.4 ± 3.0	17.3 ± 3.0
Fat (% of energy)	-0.003	27.5 ± 5.5	27.3 ± 5.9
Saturated fat (% of energy)	0.086	9.0 ± 2.4	9.1 ± 3.0
Sugar (% of energy)	0.059	10.8 ± 4.2	11.2 ± 4.4
Alcohol (% of energy)	0.081	3.3 ± 4.9	3.8 ± 4.7
Fiber (1000 kJ)	-0.030	1.6 ± 0.3	1.6 ± 0.3
Food groups (g/day)			
Soups and related items	-0.097	318.5 ± 187.7	313.8 ± 199.4
Noodles, spaghetti and related dishes	-0.177 **	139.1 ± 116.3	114.1 ± 70.0
Mixed dishes	-0.164 **	99.2 ± 85.7	78.7 ± 60.6
Meat (not part of mixed dishes)	-0.058	26.6 ± 39.0	23.5 ± 20.0
Poultry (not part of mixed dishes)	-0.127 *	24.8 ± 35.7	18.2 ± 19.5
Fish and seafood (not part of mixed dishes)	-0.030	34.6 ± 30.7	35.7 ± 33.0
Processed meats and Mexican dishes	-0.089	149.7 ± 342.1	117.7 ± 285.4
Rice	-0.068	360.1 ± 184.2	348.4 ± 183.8
Potatoes and related items	-0.159 **	23.6 ± 24.6	21.8 ± 28.9
Salad items, eggs and other non-meat items	0.044	109.4 ± 91.5	103.8 ± 80.5
Raw or cooked vegetables (not in soups or mixed dishes)	-0.009	70.2 ± 56.1	66.9 ± 58.5
Dried beans and related items (not in soups or mixed dishes)	0.046	3.4 ± 7.4	5.1 ± 19.1
Fruit and juices	-0.080	113.9 ± 159.8	100.2 ± 133.3
Bread items	-0.081	55.0 ± 74.9	45.7 ± 45.9
Breakfast cereals	-0.072	2.2 ± 21.5	0.8 ± 5.6
Dairy products	-0.016	224.1 ± 246.8	241.8 ± 280.1
Desserts and snacks	-0.130 *	82.5 ± 135.1	60.3 ± 53.6
Alcoholic beverages	0.111	214.6 ± 326.6	299.1 ± 469.7
Non-alcoholic beverages	0.072	576.0 ± 331.8	653.5 ± 302.4

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.14 WHR categories relationships with other anthropometric measures, physical activity and diet for young Japanese men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=150)	WHR categories[1] Categories (≤0.90), (n=122)	(>0.90), (n=28)
Physical activity			
Physical activity (kJ), US[3]	0.086	8925.6 ± 2272.8	8917.2 ± 2240.3
Physical activity (kJ/kg), US[3]	-0.057	144.1 ± 34.4	141.5 ± 34.0
Physical activity (kJ), Aus[4]	0.087	9076.9 ± 2204.0	9033.1 ± 2069.2
Physical activity (kJ/kg), Aus[4]	-0.075	146.7 ± 33.8	143.5 ± 31.9
Sleeping hours/day	-0.076	6.5 ± 0.9	6.1 ± 1.0
Current smokers	-0.022	0.2 ± 0.4	0.1 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.193 *[2]	9938.2 ± 5775.5	8634.7 ± 4176.3
Carbohydrate (% of energy)	0.078	52.5 ± 6.4	52.9 ± 7.5
Protein (% of energy)	-0.172 *	17.6 ± 2.7	17.4 ± 3.6
Fat (% of energy)	0.008	28.7 ± 4.9	28.8 ± 6.3
Saturated fat (% of energy)	0.121	9.6 ± 2.1	10.0 ± 3.4
Sugar (% of energy)	0.082	11.5 ± 3.9	12.1 ± 4.3
Alcohol (% of energy)	-0.035	1.2 ± 1.8	0.9 ± 1.5
Fiber (1000 kJ)	0.047	1.6 ± 0.3	1.7 ± 0.3
Food groups (g/day)			
Soups and related items	-0.195 *	346.5 ± 201.7	314.4 ± 181.7
Noodles, spaghetti and related dishes	-0.184 *	161.3 ± 126.2	127.4 ± 75.5
Mixed dishes	-0.152	114.1 ± 98.0	86.8 ± 54.0
Meat (not part of mixed dishes)	-0.072	27.5 ± 46.4	19.7 ± 16.9
Poultry (not part of mixed dishes)	-0.121	32.1 ± 44.6	19.8 ± 21.5
Fish and seafood (not part of mixed dishes)	-0.161 *	30.7 ± 25.9	31.8 ± 28.7
Processed meats and Mexican dishes	-0.054	157.5 ± 375.5	167.1 ± 305.7
Rice	-0.106	363.3 ± 198.7	322.8 ± 193.6
Potatoes and related items	-0.131	28.2 ± 23.2	33.7 ± 41.9
Salad items, eggs and other non-meat items	-0.020	95.4 ± 84.3	90.2 ± 59.1
Raw or cooked vegetables (not in soups or mixed dishes)	-0.022	59.3 ± 45.7	58.7 ± 48.4
Dried beans and related items (not in soups or mixed dishes)	0.069	2.8 ± 5.9	7.8 ± 32.3
Fruit and juices	-0.158	121.4 ± 164.5	90.7 ± 88.1
Bread items	-0.071	60.8 ± 92.4	55.2 ± 62.6
Breakfast cereals	-0.093	3.5 ± 28.4	0.4 ± 1.0
Dairy products	0.016	248.5 ± 251.0	280.9 ± 340.5
Desserts and snacks	-0.119	96.1 ± 168.8	76.2 ± 58.0
Alcoholic beverages	-0.020	74.3 ± 121.9	60.6 ± 112.0
Non-alcoholic beverages	0.022	479.6 ± 309.1	563.3 ± 321.7

[1] mean ± sd (all such values).
*[2] ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] Refer to the National Academy of Sciences (1989).
[4] Refer to Truswell et al. (1990).

Appendix 3.2.15 WHR categories relationships with other anthropometric measures, physical activity and diet for middle-aged Japanese men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=151)	WHR categories[1] Categories (≤0.90), (n=93)	(>0.90), (n=58)
Physical activity			
Physical activity (kJ), US[3]	0.069	8591.3 ± 2633.4	8773.2 ± 1750.9
Physical activity (kJ/kg), US[3]	-0.181 *[2]	132.4 ± 41.1	129.8 ± 25.1
Physical activity (kJ), Aus[4]	0.088	8573.1 ± 2571.8	8860.1 ± 1585.3
Physical activity (kJ/kg), Aus[4]	-0.174 *	132.1 ± 39.6	131.3 ± 23.1
Sleeping hours/day	0.163 *	6.5 ± 0.8	6.8 ± 0.8
Current smokers	-0.027	0.5 ± 0.5	0.5 ± 0.5
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.058	8703.7 ± 3456.6	8399.5 ± 4071.8
Carbohydrate (% of energy)	-0.040	51.1 ± 7.9	50.9 ± 6.3
Protein (% of energy)	-0.016	17.0 ± 3.3	17.3 ± 2.8
Fat (% of energy)	0.103	25.9 ± 5.9	26.5 ± 5.6
Saturated fat (% of energy)	0.196 *	8.2 ± 2.4	8.7 ± 2.8
Sugar (% of energy)	0.123	9.9 ± 4.4	10.8 ± 4.3
Alcohol (% of energy)	-0.044	6.0 ± 6.2	5.3 ± 5.1
Fiber (1000 kJ)	-0.116	1.6 ± 0.4	1.6 ± 0.3
Food groups (g/day)			
Soups and related items	0.099	281.7 ± 161.5	313.5 ± 208.9
Noodles, spaghetti and related dishes	-0.042	110.0 ± 94.8	107.7 ± 66.9
Mixed dishes	-0.075	79.7 ± 61.5	74.8 ± 63.7
Meat (not part of mixed dishes)	-0.029	25.4 ± 26.6	25.4 ± 21.2
Poultry (not part of mixed dishes)	0.031	15.3 ± 13.8	17.4 ± 18.6
Fish and seafood (not part of mixed dishes)	0.028	39.9 ± 35.5	37.5 ± 35.1
Processed meats and Mexican dishes	-0.117	139.4 ± 294.3	93.8 ± 274.6
Rice	-0.019	356.0 ± 164.3	360.7 ± 179.2
Potatoes and related items	-0.078	17.5 ± 25.2	16.0 ± 17.5
Salad items, eggs and other non-meat items	0.041	127.8 ± 97.6	110.5 ± 88.7
Raw or cooked vegetables (not in soups or mixed dishes)	-0.084	84.5 ± 64.9	70.8 ± 62.9
Dried beans and related items (not in soups or mixed dishes)	-0.012	4.2 ± 8.9	3.8 ± 6.5
Fruit and juices	0.035	104.1 ± 153.6	104.7 ± 150.9
Bread items	-0.024	47.3 ± 41.5	41.1 ± 34.9
Breakfast cereals	0.105	0.5 ± 3.1	1.0 ± 6.8
Dairy products	-0.006	192.0 ± 238.7	222.9 ± 246.9
Desserts and snacks	-0.065	64.7 ± 66.3	52.6 ± 50.1
Alcoholic beverages	0.022	398.6 ± 410.1	414.2 ± 530.7
Non-alcoholic beverages	-0.032	702.6 ± 319.3	697.0 ± 285.4

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.16 WHR categories relationships with other anthropometric measures, physical activity and diet for the combined-aged Australian men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=276)	WHR categories[1] Categories (≤0.90), (n=82)	(>0.90), (n=194)
Physical activity			
Physical activity (kJ), US[3]	-0.067	9108.4 ± 4070.4	9723.5 ± 3433.1
Physical activity (kJ/kg), US[3]	-0.079	121.2 ± 51.9	123.5 ± 44.6
Physical activity (kJ), Aus[4]	-0.065	9074.4 ± 3949.8	9768.9 ± 3364.2
Physical activity (kJ/kg), Aus[4]	-0.080	120.8 ± 50.7	124.1 ± 43.8
Sleeping hours/day	-0.104	7.7 ± 1.0	7.3 ± 1.0
Current smokers	0.043	0.1 ± 0.3	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	0.055	10052.3 ± 4809.1	10861.6 ± 4978.3
Carbohydrate (% of energy)	-0.131 *[2]	50.8 ± 6.8	49.3 ± 6.9
Protein (% of energy)	0.156 **	16.0 ± 2.7	16.2 ± 3.0
Fat (% of energy)	0.053	29.4 ± 6.3	29.7 ± 5.7
Saturated fat (% of energy)	0.000	11.1 ± 3.3	11.1 ± 2.9
Sugar (% of energy)	-0.094	17.2 ± 6.3	16.7 ± 6.5
Alcohol (% of energy)	0.026	3.8 ± 4.7	4.8 ± 5.6
Fiber (1000 kJ)	-0.036	2.9 ± 1.8	2.9 ± 1.6
Food groups (g/day)			
Soups and related items	-0.034	63.5 ± 83.0	51.9 ± 94.6
Noodles, spaghetti and related dishes	-0.029	173.8 ± 111.4	162.6 ± 126.7
Mixed dishes	0.003	95.5 ± 80.8	100.6 ± 85.1
Meat (not part of mixed dishes)	0.053	42.8 ± 42.5	47.5 ± 44.8
Poultry (not part of mixed dishes)	0.062	30.2 ± 28.9	36.4 ± 43.4
Fish and seafood (not part of mixed dishes)	0.061	14.7 ± 13.9	16.2 ± 19.2
Processed meats and Mexican dishes	0.032	38.4 ± 53.1	51.6 ± 73.6
Rice	-0.005	56.6 ± 62.7	60.7 ± 73.8
Potatoes and related items	0.055	94.3 ± 140.6	109.4 ± 109.1
Salad items, eggs and other non-meat items	0.082	50.3 ± 45.3	63.5 ± 52.9
Raw or cooked vegetables (not in soups or mixed dishes)	0.029	73.1 ± 70.0	85.7 ± 70.3
Dried beans and related items (not in soups or mixed dishes)	0.044	14.8 ± 28.0	15.0 ± 26.8
Fruit and juices	0.030	203.9 ± 233.0	223.5 ± 234.1
Bread items	0.024	153.1 ± 136.4	155.6 ± 104.0
Breakfast cereals	0.015	52.3 ± 68.3	52.5 ± 71.8
Dairy products	0.024	350.3 ± 331.0	409.5 ± 405.9
Desserts and snacks	0.087	75.3 ± 81.1	88.2 ± 106.5
Alcoholic beverages	0.066	239.0 ± 315.0	364.0 ± 479.5
Non-alcoholic beverages	-0.022	535.8 ± 516.6	570.1 ± 491.4

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.17 WHR categories relationships with other anthropometric measures, physical activity and diet for young Australian men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=149)	WHR categories[1] Categories (≤0.90), (n=51)	WHR categories[1] Categories (>0.90), (n=98)
Physical activity			
Physical activity (kJ), US[3]	-0.069	9074.7 ± 4489.8	9993.7 ± 3342.6
Physical activity (kJ/kg), US[3]	0.043	122.1 ± 57.1	135.0 ± 44.6
Physical activity (kJ), Aus[4]	-0.066	8994.8 ± 4315.9	10060.3 ± 3248.9
Physical activity (kJ/kg), Aus[4]	0.059	121.3 ± 55.5	135.9 ± 43.4
Sleeping hours/day	-0.091	8.0 ± 0.9	7.7 ± 1.0
Current smokers	-0.039	0.0 ± 0.2	0.1 ± 0.3
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	-0.010	11249.1 ± 5320.0	12068.6 ± 5463.3
Carbohydrate (% of energy)	-0.146	50.9 ± 6.8	48.9 ± 6.4
Protein (% of energy)	0.163 *[2]	16.3 ± 2.4	16.2 ± 3.1
Fat (% of energy)	0.055	30.4 ± 5.5	30.9 ± 4.7
Saturated fat (% of energy)	-0.007	11.8 ± 2.9	11.9 ± 2.6
Sugar (% of energy)	-0.051	16.9 ± 6.2	17.1 ± 6.3
Alcohol (% of energy)	0.054	2.4 ± 3.2	3.9 ± 4.0
Fiber (1000 kJ)	0.044	2.6 ± 1.5	2.7 ± 1.4
Food groups (g/day)			
Soups and related items	-0.043	61.7 ± 76.8	55.0 ± 89.5
Noodles, spaghetti and related dishes	-0.066	196.0 ± 122.2	190.3 ± 129.1
Mixed dishes	-0.081	113.6 ± 87.9	113.2 ± 84.2
Meat (not part of mixed dishes)	-0.009	47.6 ± 46.3	53.3 ± 53.5
Poultry (not part of mixed dishes)	-0.064	35.8 ± 32.4	36.4 ± 42.3
Fish and seafood (not part of mixed dishes)	0.055	12.6 ± 10.8	13.3 ± 15.2
Processed meats and Mexican dishes	0.085	45.5 ± 62.3	72.5 ± 83.7
Rice	-0.004	61.0 ± 66.1	61.3 ± 75.0
Potatoes and related items	-0.015	105.3 ± 168.4	104.4 ± 94.6
Salad items, eggs and other non-meat items	0.050	47.1 ± 44.2	60.1 ± 59.8
Raw or cooked vegetables (not in soups or mixed dishes)	0.030	58.1 ± 55.5	78.6 ± 76.6
Dried beans and related items (not in soups or mixed dishes)	-0.025	18.5 ± 33.9	12.9 ± 24.2
Fruit and juices	0.055	211.6 ± 275.7	261.5 ± 250.9
Bread items	-0.075	181.0 ± 157.5	165.3 ± 115.2
Breakfast cereals	-0.001	57.8 ± 77.2	51.3 ± 65.2
Dairy products	0.001	446.7 ± 366.2	498.9 ± 455.7
Desserts and snacks	0.094	81.4 ± 83.7	102.5 ± 130.0
Alcoholic beverages	0.103	189.7 ± 244.1	380.4 ± 511.3
Non-alcoholic beverages	-0.089	505.5 ± 611.2	463.6 ± 504.9

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.18 WHR categories relationships with other anthropometric measures, physical activity and diet for middle-aged Australian men

Items of diet and lifestyle	WHR Pearson correlation (cm), (n=127)	WHR categories[1] Categories (≤0.90), (n=31)	(>0.90), (n=96)
Physical activity			
Physical activity (kJ), US[3]	-0.060	9163.8 ± 3336.3	9447.5 ± 3519.1
Physical activity (kJ/kg), US[3]	-0.239 *[2]	119.7 ± 42.9	111.8 ± 41.6
Physical activity (kJ), Aus[4]	-0.060	9205.4 ± 3323.9	9471.3 ± 3469.6
Physical activity (kJ/kg), Aus[4]	-0.259 **	120.1 ± 42.6	112.2 ± 41.1
Sleeping hours/day	-0.098	7.2 ± 1.0	6.9 ± 0.9
Current smokers	0.100	0.2 ± 0.4	0.2 ± 0.4
Energy and nutrients (% of energy include alcohol)			
Energy (kJ)	0.203 *	8083.3 ± 2971.9	9629.4 ± 4103.2
Carbohydrate (% of energy)	-0.117	50.7 ± 7.1	49.7 ± 7.5
Protein (% of energy)	0.150	15.6 ± 3.1	16.2 ± 2.9
Fat (% of energy)	0.073	27.7 ± 7.1	28.5 ± 6.4
Saturated fat (% of energy)	0.033	9.9 ± 3.6	10.2 ± 2.9
Sugar (% of energy)	-0.142	17.7 ± 6.4	16.3 ± 6.8
Alcohol (% of energy)	-0.008	6.0 ± 5.9	5.6 ± 6.8
Fiber (1000 kJ)	-0.134	3.5 ± 1.9	3.2 ± 1.7
Food groups (g/day)			
Soups and related items	-0.022	66.5 ± 93.7	48.6 ± 100.0
Noodles, spaghetti and related dishes	0.046	137.3 ± 79.9	134.4 ± 118.4
Mixed dishes	0.132	65.6 ± 57.0	87.8 ± 84.5
Meat (not part of mixed dishes)	0.189 *	34.8 ± 34.5	41.6 ± 33.1
Poultry (not part of mixed dishes)	0.215 *	21.1 ± 19.1	36.3 ± 44.7
Fish and seafood (not part of mixed dishes)	0.057	18.1 ± 17.6	19.1 ± 22.2
Processed meats and Mexican dishes	-0.031	26.7 ± 30.3	30.3 ± 54.4
Rice	-0.004	49.5 ± 57.0	60.0 ± 73.0
Potatoes and related items	0.149	76.2 ± 74.9	114.4 ± 122.4
Salad items, eggs and other non-meat items	0.123	55.5 ± 47.2	66.9 ± 44.8
Raw or cooked vegetables (not in soups or mixed dishes)	0.012	97.7 ± 84.2	93.0 ± 62.7
Dried beans and related items (not in soups or mixed dishes)	0.132	8.7 ± 11.5	17.1 ± 29.1
Fruit and juices	0.005	191.1 ± 140.3	184.8 ± 209.9
Bread items	0.223 *	107.2 ± 73.4	145.7 ± 90.7
Breakfast cereals	0.036	43.3 ± 50.3	53.7 ± 78.3
Dairy products	0.096	191.8 ± 174.7	318.3 ± 325.7
Desserts and snacks	0.097	65.2 ± 76.9	73.5 ± 73.3
Alcoholic beverages	0.017	320.0 ± 397.2	347.2 ± 446.9
Non-alcoholic beverages	0.059	585.5 ± 306.2	678.8 ± 454.6

[1] *mean ± sd (all such values).*
[2] *** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.*
[3] *Refer to the National Academy of Sciences (1989).*
[4] *Refer to Truswell et al. (1990).*

Appendix 3.2.19 Group differences

Standard (z) values for the differences of correlations between the anthropometric measures and lifestyle items for the indicated group comparisons

Anthropometric measure: BMI

Lifestyle Item	Group comparisons				
	J:A	JY:JM	AY:AM	JY:AY	JM:AM
Physical activity (kJ), US[2]	1.5895	1.7737	2.2898 *	0.5622	0.9782
Physical activity (kJ/kg), US[2]	1.2135	2.5584 *	3.0304 **	0.5419	0.8935
Physical activity (kJ), Aus[3]	1.4422	1.6735	2.2898 *	0.5622	1.0774
Physical activity (kJ/kg), Aus[3]	0.9414	2.8657 **	3.3561 **	0.3373	0.7076
Sleeping hours/day	4.7278 **	0.4862	1.5432	1.2176	2.1586 *
Current smokers	2.6978 **	0.2956	1.3418	3.2861 **	2.1268 *

Anthropometric measure: WC

Lifestyle Item	Group comparisons				
	J:A	JY:JM	AY:AM	JY:AY	JM:AM
Physical activity (kJ), US[2]	0.8093	0.1976	0.7737	0.1965	0.7784
Physical activity (kJ/kg), US[2]	1.3855	2.4763 *	1.9884 *	1.0426	0.5561
Physical activity (kJ), Aus[3]	0.8093	0.0993	0.7737	0.0978	0.9784
Physical activity (kJ/kg), Aus[3]	1.3161	2.5544 *	2.3175 *	1.0655	0.8314
Sleeping hours/day	3.5790 **	1.9376	2.7030 **	2.1108 *	2.5314 *
Current smokers	0.4033	1.1968	0.0934	0.0914	1.3978

Anthropometric measure: WHR

Lifestyle Item	Group comparisons				
	J:A	JY:JM	AY:AM	JY:AY	JM:AM
Physical activity (kJ), US[2]	1.5541	0.1726	0.0819	1.3719	1.0695
Physical activity (kJ/kg), US[2]	0.9692	1.0468	2.3321 *	0.8567	0.5158
Physical activity (kJ), Aus[3]	1.5541	0.0000	0.0819	1.3719	1.2346
Physical activity (kJ/kg), Aus[3]	1.2151	0.7858	2.6711 **	1.2008	0.7754
Sleeping hours/day	1.7940	2.0748 *	0.0827	0.0856	2.1496 *
Current smokers	0.0000	0.0859	1.1488	0.1712	1.0703

*[1] ** $z > 2.58$: 1% significance, * $z > 1.96$: 5% significance.*
[2] Refer to the National Academy of Sciences (1989).
[3] Refer to Truswell et al. (1990).

APPENDIX 3.3.1 Alternative factor analysis using raw data intake with no energy-adjustments

Food Groups	KMO measure	Bartlett's test	Anti-image diagonal correlations G1	G2	G3	G4	G5-1	G5-2	G6	G7-1	G7-2	G8	G9	G10	G11	G12	G13-1	G13-2	G14	G15-1	G15-2
Japan	0.763	0.000	0.827	0.778	0.826	0.778	0.750	0.826	0.761	0.785	0.867	0.813	0.748	0.684	0.872	0.837	0.599	0.861	0.649	0.458	0.692
JY	0.739	0.000	0.762	0.717	0.836	0.737	0.771	0.831	0.692	0.754	0.801	0.783	0.711	0.524	0.845	0.801	0.576	0.753	0.613	0.559	0.774
JM	0.749	0.000	0.779	0.809	0.788	0.779	0.790	0.816	0.730	0.651	0.791	0.789	0.812	0.819	0.704	0.701	0.483	0.802	0.786	0.470	0.652
Australia	0.741	0.000	0.662	0.831	0.703	0.743	0.717	0.705	0.804	0.784	0.686	0.792	0.726	0.726	0.822	0.846	0.649	0.730	0.781	0.582	0.609
AY	0.739	0.000	0.757	0.738	0.804	0.724	0.606	0.630	0.837	0.767	0.671	0.785	0.782	0.778	0.766	0.843	0.597	0.751	0.748	0.674	0.540
AM	0.662	0.000	0.618	0.776	0.636	0.639	0.719	0.742	0.601	0.633	0.536	0.746	0.655	0.539	0.770	0.736	0.572	0.636	0.695	0.545	0.733

APPENDIX 3.3.2 Factor analysis with SQRT transformation, energy-adjustment and zero-intake-adjustment

Food Groups	KMO measure	Bartlett's test	Anti-image diagonal correlations G1	G2	G3	G4	G5-1	G5-2	G6	G7-1	G7-2	G8	G9	G10	G11	G12	G13-1	G13-2	G14	G15-1	G15-2
Japan	0.592	0.000	0.543	0.507	0.653	0.614	0.616	0.663	0.487	0.437	0.631	0.582	0.610	0.621	0.536	0.670	0.627	0.595	0.577	0.570	0.578
JY	0.575	0.000	0.573	0.471	0.683	0.650	0.585	0.709	0.513	0.453	0.680	0.507	0.572	0.587	0.476	0.639	0.584	0.570	0.552	0.465	0.623
JM	0.537	0.000	0.435	0.512	0.635	0.574	0.632	0.613	0.451	0.391	0.589	0.563	0.599	0.545	0.567	0.555	0.496	0.499	0.554	0.470	0.369
Australia	0.598	0.000	0.737	0.649	0.629	0.598	0.571	0.596	0.498	0.618	0.529	0.679	0.594	0.622	0.500	0.660	0.570	0.592	0.584	0.644	0.435
AY	0.558	0.000	0.628	0.526	0.642	0.543	0.530	0.587	0.540	0.571	0.456	0.662	0.568	0.644	0.543	0.566	0.470	0.542	0.526	0.605	0.483
AM	0.583	0.000	0.744	0.598	0.628	0.623	0.556	0.536	0.443	0.612	0.554	0.583	0.526	0.461	0.558	0.686	0.529	0.640	0.616	0.531	0.430

APPENDIX 3.4 Alternative rotated factor loadings using raw data intake with no energy-adjustments

Japan

	Factor 1	Loadings	Factor 2	Loadings	Factor 3	Loadings	Factor 4	Loadings
Jap	Desserts & cereals		Mixed foods		Vegetarian		Meat	
	Desserts	0.92	Mixed dishes	0.77	Salad items	0.71	Meat	0.76
	Cereals	0.85	Noodles	0.75	Vegetables	0.70	Proc. Meats	0.74
	Bread items	0.79	Potatoes	0.57	Non-alcohol	0.56	Poultry	0.66
	Fruit & juices	0.49	Poultry	0.48	Fish/seafood	0.51		
	Dairy	0.46	Fish/seafood	0.45	Alcohol	0.46		
			Soups	0.41				
	Variance %	14.62	Variance %	12.85	Variance %	11.70	Variance %	10.69
JY	Desserts & cereals		Vegetarian		Meat		Mixed foods	
	Desserts	0.95	Salad items	0.67	Meat	0.85	Noodles	0.70
	Cereals	0.89	Fish/seafood	0.61	Proc. Meats	0.76	Mixed dishes	0.67
	Bread items	0.79	Potatoes	0.55	Poultry	0.74	Alcohol	0.55
	Fruit & juices	0.50	Rice	0.54			Soups	0.53
	Dairy	0.42	Vegetables	0.50			Vegetables	0.41
			Non-alcohol	0.45				
			Dairy	0.41				
	Variance %	14.93	Variance %	12.90	Variance %	12.82	Variance %	11.11
JM	Vegetarian		Bread & support		Meat		Alcohol & cereals	
	Vegetables	0.69	Bread items	0.76	Poultry	0.75	Alcohol	0.74
	Fish/seafood	0.69	Fruit & juices	0.70	Potatoes	0.70	Cereals	0.67
	Salad items	0.67	Desserts	0.68	Meat	0.57	Rice	-0.46
	Mixed dishes	0.54	Dairy	0.54	Proc. Meats	0.57		
	Soups	0.54	Non-alcohol	0.48				
	Noodles	0.51						
	Variance %	15.30	Variance %	13.44	Variance %	11.20	Variance %	7.65

Australia

	Factor 1	Loadings	Factor 2	Loadings	Factor 3	Loadings	Factor 4	Loadings
Aus	Dairy & Desserts		Mixed foods		Vegetarian		Beverages & chips	
	Dairy	0.72	Mixed dishes	0.82	Vegetables	0.65	Alcohol	0.56
	Desserts	0.70	Soups	0.78	Dried beans	0.62	Potatoes	0.54
	Bread items	0.65	Rice	0.64	Salad items	0.58	Meat	0.50
	Proc. Meats	0.51	Salad items	0.45	Fish/seafood	0.53	Poultry	0.47
	Fruit & juices	0.49					Cereals	-0.45
	Cereals	0.47					Non-alcohol	0.43
	Meat	0.44						
	Variance %	13.85	Variance %	12.62	Variance %	9.71	Variance %	8.59
AY	Meat & salad items		Mixed foods		Dairy & desserts		Beverages & chips	
	Fruit & juices	0.65	Soups	0.69	Dairy	0.76	Non-alcohol	0.68
	Meat	0.63	Rice	0.64	Desserts	0.69	Alcohol	0.66
	Vegetables	0.61	Noodles	0.59	Bread items	0.57	Potatoes	0.57
	Poultry	0.59	Salad items	0.51	Cereals	0.54		
	Salad items	0.43	Fish/seafood	0.50				
	Proc. Meats	0.42						
	Variance %	12.38	Variance %	11.73	Variance %	10.74	Variance %	9.77
AM	Mixed foods		Meat & desserts		Vegetarian		Dairy & cereals	
	Mixed dishes	0.90	Meat	0.73	Vegetables	0.69	Cereals	0.82
	Soups	0.86	Poultry	0.70	Dried beans	0.64	Dairy	0.72
	Rice	0.73	Desserts	0.69	Fish/seafood	0.64	Bread items	0.51
	Salad items	0.55	Proc. Meats	0.50	Potatoes	0.45	Alcohol	-0.42
			Bread items	0.44	Noodles	0.42		
					Salad items	0.42		
	Variance %	14.77	Variance %	11.94	Variance %	10.78	Variance %	10.21

APPENDIX 4.1

(Nutrition Society of Australia National Conference 2000)

Meal Patterns in Japanese and Australian men

Kayo Yasuda[1], Colin W Binns[1], Mikio Ouchi[2]

[1]School of Public Health, Curtin University of Technology, WA 6845
[2]Faculty of Engineering, Himeji Institute of Technology, Hyogo, Japan

Australia and Japan are now recognized as having the two highest disability adjusted life expectancies (DALES) in the world. In both Japan and Australia nutrition and other lifestyle factors have an important role in morbidity and mortality, yet lifestyles and disease patterns are quite different. Exploring the similarities and differences between the two countries may assist in understanding the difference in disease patterns. Given the rapid change in nutrition and eating patterns in recent years it was hypothesized that there would be more affinity in eating habits between age groups than between countries.

Methodology:

A study was undertaken of the eating habits of male university students and their fathers living in Perth and in Himeji, a Japanese city with close links to Perth. Where for logistic reasons the father could not be interviewed an equivalent adult male was substituted, selected at random, from the same locality.

•Sample

The sample consisted of a total of 814 men; 220 Australian students, 202 Japanese students, 204 Australian fathers and 188 Japanese fathers. Almost all of the Japanese students (99.0%) were in the 18-24 year-old age group, while 11.4% of Australian students were older. The median age for Australian fathers was 50.5, and for Japanese fathers was 51.5 years. The entire Japanese sample had been born in Japan, compared to 84.5% and 57.8% of Australian students and fathers respectively, born in Australia. Each person was asked to complete a food frequency and a detailed lifestyle questionnaire.

Results:

On the questions pertaining to eating habits, Australians considered themselves to be healthier than the Japanese, and in both countries the students considered themselves less healthy than their fathers (Figure 1). In both countries about 80% of respondents ate breakfast regularly, but the Japanese students (73.3%) were the group least likely, and Japanese fathers the group most likely (88.8%), to eat breakfast. With the exception of the Japanese students, there was not much difference in the proportion of respondents who ate their evening meal at home, although the proportion that watched television while eating was higher in both Japanese groups. There were significant differences (χ^2=362.229, df=15, P=0.000) between the groups in food habits relating to preparation of food using oil. Australians were more likely to use olive and canola oil, while Japanese used more soy or corn oil (Figure 2).

Figure 1 : Self-evaluation of eating habits by groups

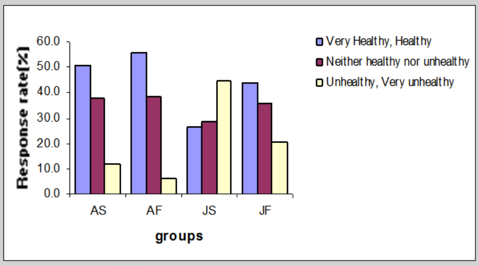
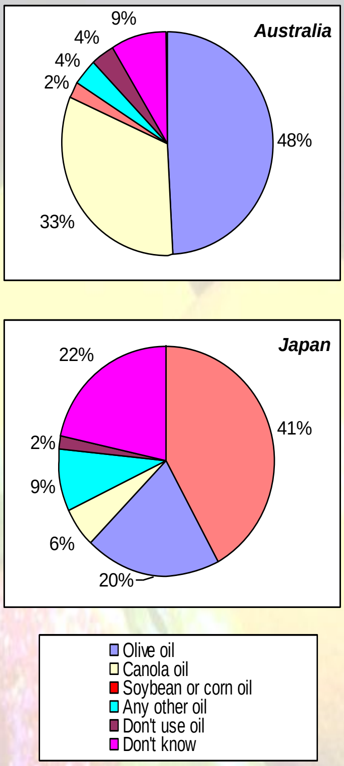


Figure 2 : Types of oil they use by groups



Discussion:

Overall, the differences in eating habits differed more between countries than they did between generations. Further health gains will require health and nutrition promotion programs based on detailed knowledge of lifestyles. Comparative studies can provide useful information as a basis of these programs.

APPENDIX 4.2 (Mark Liveris Research Seminar 2002 & Himeji Curtin Seminar 2002)

A Comparison of Physical Activity of Men in Japan and Australia

Presented by: Kayo Cruickshank, School of Public Health, Curtin University
Supervisor: Professor C Binns, Curtin University
Professor M Ouchi, Professor N Hiramatsu, Himeji Institute of Technology

Australia and Japan have the longest healthy life expectancies (HALE) in the world (World Health Organization 2001). In both countries the greatest burden of disability, morbidity and mortality is due to chronic disease, with prevalence and outcomes closely linked to lifestyle and environmental influences. However detailed patterns of disease and lifestyle habits differ between the two countries and an understanding of these differences may lead to insights into causation and potential prevention strategies. Regular outdoor leisure activities would greatly help in reducing stress and increasing physical fitness, and individuals are encouraged to undertake moderate exercise to improve general health and cardiovascular fitness (Mustaffa 1999). Exploring the similarities and differences in physical activity patterns between the two countries and between generations may assist in understanding the differences in disease patterns.

Aim:

To profile the prevalence and patterns of physical activity of Japanese and Australian male students and their respective fathers, and highlight important similarities and differences between these groups.

Method:

A study was undertaken of the physical activity of male university students and their fathers living in Perth and in Himeji. Wherever possible the student's natural father was sought out and included in the sample, but where not available males of equivalent age were substituted to ensure approximately equal sample sizes. The sample consisted of 220 Australian and 200 Japanese students mainly in the 18-24 age group, and 203 older Australians, and 188 older Japanese between 50-54 years. Each was asked to complete a detailed questionnaire containing a physical activity and lifestyle section. The results were analyzed using Cross-tabulation, Chi-square tests, Kruskal-Wallis tests and Mann-Whitney tests.

Results:

The proportion of Australians who undertook between 1/2 and 3 hours vigorous work per week was about double that of the Japanese, in both generations (Table 1). On average both Australian generations spent 2-3 hours per week on moderate activity compared with the Japanese who mostly spent 1/2 to 1 hour. In both generations, the proportion of Australians spending 4 to 6 hours moderately active was also very much higher than the Japanese (Table 2).

The most common frequency of vigorous activity for young Australians (AY) was 3 times per week (27.3%) followed by once per week (19.5%). For young Japanese (JY) the 28.5% never exercised and a further 26.5% only once per week (Figure 1). The average frequency of vigorous physical activity for middle-aged Australian males (AM) was 2.56, which was almost double that of middle aged Japanese (JM). In every age group the proportion of Australians who did more vigorous physical activity was considerably higher than for the Japanese of comparable age (Figure 2).

Table 1: Vigorous Work

			GROUPING				Total
			AY	AM	JY	JM	
Vigorous work	Never	Count	40	70	128	126	364
		% within GROUPING	18.2	34.7	64.0	67.0	44.9
	1/2 to 1 hr	Count	77	72	35	30	214
		% within GROUPING	35.0	35.6	17.5	16.0	26.4
	2 to 3 hrs	Count	41	36	17	9	103
		% within GROUPING	18.6	17.8	8.5	4.8	12.7
	4 to 6 hrs	Count	26	9	7	10	52
		% within GROUPING	11.8	4.5	3.5	5.3	6.4
	7 to 10 hrs	Count	18	5	4	6	33
		% within GROUPING	8.2	2.5	2.0	3.2	4.1
	11 to 20 hrs	Count	9	1	6	2	18
		% within GROUPING	4.1	0.5	3.0	1.1	2.2
	21 to 30 hrs	Count	4	2	2	2	10
		% within GROUPING	1.8	1.0	1.0	1.1	1.2
	31 hrs or mo	Count	5	7	1	3	16
		% within GROUPING	2.3	3.5	0.5	1.6	2.0
Total		Count	220	202	200	188	810
		% within GROUPING	100.0	100.0	100.0	100.0	100.0

Table 2: Moderate Activity

			GROUPING				Total
			AY	AM	JY	JM	
Moderate activity	Never	Count	9	8	35	45	97
		% within GROUPING	4.1	4.0	17.5	24.1	12.0
	1/2 to 1 hr	Count	55	33	94	79	261
		% within GROUPING	25.0	16.3	47.0	42.2	32.3
	2 to 3 hrs	Count	75	70	37	37	219
		% within GROUPING	34.1	34.7	18.5	19.8	27.1
	4 to 6 hrs	Count	51	50	16	14	131
		% within GROUPING	23.2	24.8	8.0	7.5	16.2
	7 to 10 hrs	Count	18	17	11	7	53
		% within GROUPING	8.2	8.4	5.5	3.7	6.6
	11 to 20 hrs	Count	6	17	4	2	29
		% within GROUPING	2.7	8.4	2.0	1.1	3.6
	21 to 30 hrs	Count	6	4	1	2	13
		% within GROUPING	2.7	2.0	0.5	1.1	1.6
	31 hrs or mo	Count		3	2	1	6
		% within GROUPING		1.5	1.0	0.5	0.7
Total		Count	220	202	200	187	809
		% within GROUPING	100.0	100.0	100.0	100.0	100.0

* The blank cell indicates 0 cases in that combination of categories.

Figure 1: Students' Frequency of Vigorous Activity

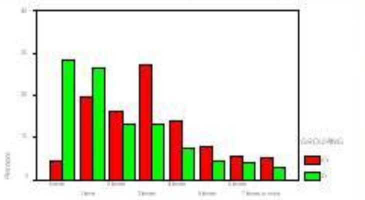
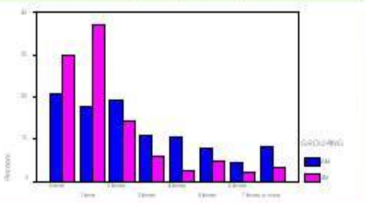


Figure 2: Fathers' Frequency of Vigorous Activity



Conclusion:

There appear to be much greater differences in physical activity between the countries than between the generations. Clearly the Japanese are much less physically active than the Australians. This greater tendency towards a more sedentary lifestyle may have serious implications for future disease patterns among Japanese people.

References
Mustaffa, B. E. (1999). "Healthy Lifestyles in the New Millennium." Asia-Pacific Journal of Public Health 11(1): 1-3.
World Health Organization (2001). 2001 World Health Report.