School of Public Health

A cohort study of health beliefs, behaviours and information sources of Chinese mothers and their children living in Perth

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Declaration

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

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

Signature: ………………………………………….

Date: ………………………...

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Abstract

Introduction

Chinese people are one of the largest permanent immigrant populations to Australia. Parental influences on children's nutrition and health behaviour which have been investigated in Western countries may not apply to Asian cultures where belief systems differ from those of Western cultures. It is possible that additional or other cultural beliefs play a role in health belief, behaviours and information sources of Chinese mothers who live in Perth and these factors may influence their children's nutrition and health behaviours. There has been little research with a specific focus on cultural values concerning food choice, eating customs, physical activity and body shape among Chinese immigrant mothers and their children. There are no published studies of the way Chinese immigrants access health information in Australia, and specifically on growth and weight of their children, and the relationship of this information to their health behaviours and child care behaviours. Given the growing population of Chinese people in Australia, there is a need for research in this population group.

The aims of this study are to identify influences on Chinese mother's health information sources, beliefs and attitudes towards infant and child nutrition, physical activity, body shape and health behaviours and on the ways these influence the health services used and health promoting activities of their children.

Method

A longitudinal cohort study was conducted of Chinese mothers living in Perth Australia who have at least one pre-school child less than five years old. If the mother had more than one child under 5 years old, the youngest child was chosen as the "index child" for questions in the questionnaire. The data for this study was collected from October 2010 to October 2011 in Perth, Western Australia. Initially, a total of 239 mothers in Perth agreed to participate and returned the questionnaire. Two mothers were excluded from the analysis because their children were over five years old. This resulted in 237 participants in the cohort at the beginning of the study, with a response rate of 95.6%. The height and weight of mothers and children in Perth were measured during the interviews using standard anthropometric equipment and techniques(Marfell-Jones et al., 2006).

A cross-sectional survey was undertaken among mothers living in Chengdu, Sichuan Province and Wuhan, Hubei Province, PR China, for comparison. Data from China were collected from September to December 2011. The data was acquired by baseline questionnaire used in Perth. A total of 2400 questionnaires were distributed to mothers by kindergarten teachers in Chengdu and Wuhan. After excluding mothers with the 'index child' over five years, 1608 and 471 of mothers from Chengdu and Wuhan respectively, participated in this study, a response rate of 86.6% in China. The height and weight of mothers in China were self-reported and children's the height and weight were measured by trained health workers during the physical examination.

Data analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0 (SPSS, Chicago, IL, USA). Descriptive and univariate analysis were used to describe the socio-demographic characteristics of the participants, compare basic characteristics of mothers and children in Australia and China. Difference in demographic profiles between the groups of participants and non-participants was tested by Chi square (χ^2) test and an independent samples t-test is used to exam the group difference. Mann-Whitney U test was applied to compare the median age of children from two countries. Spearman's rank correlation coefficient was used to assess the association between the Health Belief Model dimensions and mother's child feeding behaviours and support for physical activities. One-way analysis of variance (ANOVA) was carried out to assess association between IIFAS scores and socio-demographic factors. A multiple binary logistic regression analysis was performed to evaluate the association between mother and child's characteristics and the use of dietary supplements controlling for potential confounders, such as age and family economic status. It was also used to evaluate the effects of potential risk factors on 'breastfeeding initiation', and 'any breastfeeding' at six months and twelve months, respectively. A backward elimination procedure was applied to obtain final models. Univariate binary logistic regression was applied to explore the association of the Iowa Infant Feeding Attitude Scale (IIFAS) score levels with breastfeeding duration. Cronbach's alpha was used to assess internal consistency of IIFAS items (Cronbach and Warrington, 1951). Internal reliability was acceptable if Cronbach's alpha was greater than 0.6 (Sim, 2000). All p values less than 0.05 were considered as statistically significant.

Results

The simplified Chinese version of the Iowa Infant Feeding Attitude Scale (IIFAS) had a moderate level of internal consistency with a Cronbach's alpha of 0.69 for mothers in Australia and 0.55 for mothers in China. The mean IIFAS scores in both country groups lay in the range of 'neutral breastfeeding attitudes'. Higher IIFAS scores were significantly associated with the likelihood of both breastfeeding (OR: 3.85; CI: 2.49, 5.96; $p<0.001$) and longer ($\geq$8 months) breastfeeding duration (OR: 2.52; CI: 1.87, 3.40; $p<0.001$). Chinese mothers in Perth tended to have more positive attitudes towards breastfeeding than mothers in Chengdu (mean attitudes score=57.7±5.1, $p<0.001$) and had a longer duration of 'any breastfeeding' (10.0±6.2 months in Perth compared to 7.4±4.3 months in Chengdu, $p<0.001$).

The breastfeeding initiation rate in Chinese Australian mothers (94.1%) was higher than it in mothers in China (86.2%, $P<0.001$). Chinese Australian mothers also had a longer breastfeeding duration, greater 'full breastfeeding' rate at 6 months and greater 'any breastfeeding' rates at 6 and 12 months. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that the location of the mother (in Australia or China) was associated with breastfeeding practices. Chinese mothers living in Chengdu were less likely to initiate breastfeeding (OR=0.47, 95%CI 0.25-0.89) and breastfeed their babies at 12 months (OR=0.48, 95%CI 0.33-0.69) than mothers in Perth.

A total of 22.6% and 32.4% of the Chinese children were taking dietary supplements in Australia and China respectively. In China, the most commonly used dietary supplements were calcium (58.5%) and zinc (40.4%), while in Australia, the most frequently used types were multi-vitamins/minerals (46.2%) and fish oil (42.3%). In Australia, not working, never breastfed, higher education level of the mother and older age of the child were associated with dietary supplement use in children. In China, being unwell during the past month and having a higher household income were significantly related to dietary supplementation.

More children were overweight or obese in China (16.7% in China compared to 8.0% in Australia) while more Chinese children were underweight in Australia (22.7% in Australia compared to 11.9% in China, $p<0.01$). The overall percentages of correct maternal perception of the child's weight were 35% in underweight children, 69.2% in normal weight children and 10.8% in overweight/obese children. Among those overweight/obese children, only 14.3% in Australia and 10.8% in China were classified as overweight/obese by their mothers.

Within the group of underweight children, normal weight mothers ($p=0.004$) and mothers with older age children ($p=0.015$) were more likely to correctly classify children's weight status. A higher percentage of overweight/obese mothers ($p=0.002$) and mothers who over-estimated her own weight status ($p<0.001$) have correct perception of the weight status of their overweight/obese children, compared to their counterparts.

Despite some differences in health beliefs between Chinese mothers in two countries (eg, higher 'general health motivation' and 'perceived barriers' in China), participants from both groups expressed a high general health concern for the child, high perceived severity of childhood obesity and benefits of taking weight control actions towards their child. Mean scores of 'mother's perceived susceptibility', 'self-efficacy' and 'cues to action' were relatively low in both countries compared to other Health Belief Model dimensions. There were significant associations between maternal health beliefs and mothers' child feeding behaviours or maternal support for the child's physical activities. After controlling for potential confounding variables, the results of the multiple binary logistic regression analysis showed that maternal overweight or obese (aOR=1.68, 95% CI 1.17-2.42), maternal 'general health motivation' (aOR=2.08, 95% CI 1.31-3.32) and 'perceived barriers' on controlling the child's weight (aOR=1.56, 95% CI 1.04-2.36) were significantly associated with childhood overweight or obesity in the study sample.

In general, the most mentioned health information sources for Chinese mothers in Australia were "the Internet", "health professionals" and "Chinese friends or relatives living in Australia". The main health information source for sickness of the child was health professionals (74.4%). Children in China (75.4%) were more likely to be sick or injured than children in Australia (53.8%, $p<0.001$). More Chinese mothers in China (75.0%) sought formal medical care for the child's illness or injuries than Chinese mothers in Australia (49.1%, $p<0.001$). Among children who were reported sick during the past four weeks, 44.3% mothers in Australia gave medicine brought from the local pharmacy. Nearly 20% of them gave their children traditional Chinese medicine or medicine brought from China. During the one-year follow up, 54.9% of Chinese Australian mothers had consulted with a health professional when their child was sick, while 41.8% only used home remedies. A mixed of Eastern and Western health care strategies were often used in Chinese mothers for their child's sickness.

Conclusion

This was the first reported cohort study on Chinese immigrants' health beliefs, behaviours and information sources regarding their children's health. It has advanced our understanding of Chinese immigrant mothers' health beliefs, child feeding attitudes and behaviours, health information seeking behaviours and factors that motivate or inhibit mothers from taking actions on promoting their children's health. Most importantly, this study has shown that the breastfeeding practices of Chinese immigrants in Australia are different to Chinese living in China and to other Australians. It has provided evidence of the 'healthy migrant effect' in breastfeeding practices of Chinese mothers in Australia and also revealed that the child feeding behaviours and beliefs of Chinese immigrant mothers in Australia were different to Chinese mothers living in China. Another important finding of this study was the maternal health beliefs and traditional attitudes toward body shape were important determinants of a child's body weight development. Despite mounting public concern about childhood obesity, there was a high prevalence of incorrect maternal perception of preschool children's weight status in Chinese mothers, especially those with overweight or obese children. Improved efforts to educate parents about childhood overweight/obesity and its health consequences for children in order to reduce misperceptions are imperative. In addition, the results showed that Chinese Australians were still living between Chinese and Western cultures and mainly relied on the Internet and non-professional social networks to get health information. The Australian health-care system will need to develop the infrastructure to provide culturally and linguistically appropriate care to Chinese immigrant children. Finally, the common use of home remedies, dietary supplements and mixture of different types of health care in Chinese children requires that professionals of all types be aware of, and able to evaluate, such behaviours during their health care interactions.

Definition of terms used in the thesis

Any breastfeeding: requires that the infant receives some milk and any quantity of food or liquid including non-human milk(World Health Organization, 2008).

Breastfeeding duration: the total length of time during which an infant receives any breastmilk at all, from initiation until breastfeeding has ceased(National Health and Medical Research Council, 2012).

Breastfeeding Initiation: an infant's first intake of breastmilk (or colostrum)(National Health and Medical Research Council, 2012).

Ever breastfed: requires that the infant received breastmilk or colostrum on at least one occasion(World Health Organization, 2008).

Exclusive breastfeeding: requires that the infant receive only breastmilk (including expressed milk) and medicines (including oral rehydration solutions, vitamins and minerals) but no infant formula or non-human milk(World Health Organization, 2008).

Predominant (Full) breastfeeding: requires that the infant receive breastmilk (including milk expressed or from wet nurse or breastmilk donor) as the predominant source of nourishment. And also allows the infant to receive liquids (water, and water-based drinks, fruit juice, oral rehydration solutions), ritual fluids and drops or syrups (vitamins, minerals, medicines). Does not allow the infant to receive anything else (in particular, non-human milk, food-based fluids)(World Health Organization, 2008).

Complementary food: any food, manufactured or locally prepared, suitable as a complement to breastmilk or infant formula, if either becomes insufficient to satisfy the nutritional requirements of the infant. In the Infant Feeding Guidelines for Health Workers the following working definition is used: any nutrient-containing foods or semi-solid given to infants in addition to breastmilk or commercial infant formula(National Health and Medical Research Council, 2012).

Infant: a child aged less than 12 months(National Health and Medical Research Council, 2012).

Healthy migrant effect: immigrants whether temporary or permanent, tend to be better educated, highly motivated and in better psychological and physical health than non-immigrants in the destination country and the population from which they originate (Feliciano, 2005, Marmot et al., 1984, Palloni and Arias, 2004, Rubalcava et al., 2008) .To some extent, the 'healthy migrant effect' can be partly explained by the fact that most immigrants are selected by the recipient country on the basis of their health and, in some cases, their relatively high socioeconomic status. The 'healthy migrant effect' is also due to a self-selection process as the chronically ill and disabled are less likely to migrate. People who are able to migrate and be mobile are more likely to be healthier when compared with native-born counterparts(Walsh, 2011).

Dietary supplement: the World Health Organization (WHO) and the United States (US) Dietary Supplements Health and Education Act (DSHEA) of 1994 both define dietary supplements as a product (other than tobacco) that is meant to supplement the diet. Both organizations include vitamins, minerals, herbs, botanical products, amino acids, or dietary substances in their definitions(World Health Organization, 2005, Chang, 1999). Dietary supplement may be intended to increase the total daily intake of concentrate, metabolite, constituent, extract or combination of these ingredients(Chang, 1999).

Estimated Average Requirement (EAR): a daily nutrient level estimated to meet the requirements of half the healthy individuals in a particular life stage and gender group(National Health and Medical Research Council and Ministry of Health, 2006).

Recommended Dietary Allowance (RDA): derived from the EAR and meets or exceeds the requirement for 97.5 percent of the population(Ross et al., 2011).

Adequate Intake (AI): the average daily nutrient intake level based on observed or experimentally-determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate(National Health and Medical Research Council and Ministry of Health, 2006).

Tolerable Upper Intake Level (UL): the highest average daily nutrient intake level likely to pose no adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects increases(National Health and Medical Research Council and Ministry of Health, 2006).

Recommended Nutrient Intake (RNI): it is the daily intake, which meets the nutrient requirements of almost all (97.5 percent) apparently healthy individuals in an age and sex-specific population group(Food and Agricultural Organization of the United Nations and World Health Organization, 2002).

Population Reference Intakes (PRI): the level of (nutrient) intake that is adequate for virtually all people in a population group(Scientific Committee on Food, 1993b).

Abbreviation

AI：Adequate Intake

aOR: Adjusted Odds Ratio

BMC：Bone Mineral Content

BMD：Bone Mineral Density

BMI: Body Mass Index

CV: Coefficient of Variation

DRI: Dietary Reference Values

EAR：Estimated Average Requirement

FAO: The Food and Agriculture Organization of the United Nations

Health Belief Model: HBM

IOM: Institute of Medicine

Iowa Infant Feeding Attitude Scale: IIFAS

NHMRC: The Australia National Health and Medical Research Council

NRV: Nutrient Reference Values

NS: Not Significant

NA: Not Available

OR: Odds Ratio

PRI：Population Reference Intakes

RDA：Recommended Dietary Allowance

RI：Recommended Intakes

RDI: Recommended Dietary Intakes

SIDS: Sudden infant death syndrome

SD: Standard Deviation

SCF: Scientific Committee on Food

TAFE: Technical and further education

UL： Tolerable Upper Intake Level

US: United States

UNICEF: The United Nations Children's Fund

WHO: World Health Organization

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Chapter 1
Introduction

This chapter provides background information about the study. It includes background information about Chinese immigrants in Australia and Perth, health beliefs of Chinese and parental influence on child health, the brief introduction of the cities where the studies conducted, significance of the study, the aims and objectives of the study and an outline of the thesis.

1.1 Background

1.1.1 The Health of Chinese immigrants in Australia

Australian has a high proportion of immigrants and nearly 29% of the population aged 15 years and over were born overseas(Australian Bureau of Statistics, 2010b). Over the past decade, Australia has experienced one of the largest waves of immigration in its history. According to figures released by the Australian Bureau of Statistics (ABS), Western Australia's population was about 2.5 million people at the end of March 2013 and continued to record the fastest growth rate in all states and territories at 3.4%. Net Overseas Migration continues to fuel Western Australia's population growth, accounting for 63% of the state's total growth in the year March 2012 to March 2013(Australian Bureau of Statistics, 2013a).

In recent decades the focus of Australian immigration has shifted from Europe to Asian and China is now one of the largest source of immigrants(Australian Bureau of Statistics, 2008c). People who were born in China are now the third largest group overseas-born residents. Over the last 10 years (to 30 June 2011), the proportion of the Australian population who were born in China increased from 0.8% to 1.8%(Australian Bureau of Statistics, 2012g). In the 2006 Australian Census 669,890 residents identified themselves as having Chinese ancestry and the number is increasing by 7.7% per year (Australian Bureau of Statistics, 2007). There were 53,390 Chinese born residents in Perth in 2006, including 5527 children about 2.9% of the city's population(Australian Bureau of Statistics, 2008a). According to the 2011 Australian Census in Greater Perth(Greater Capital City Statistical Areas), 61.5% of people had at least one parent born overseas. Approximate 2.5% population of greater Perth(Greater Capital City Statistical Areas) was Chinese(Australian Bureau of Statistics, 2012a).

Overseas-born people are admitted to hospital at lower rates than the Australian-born population(Australian Institute of Health and Welfare, 2008). In 2005–06, the age-standardized total hospital separation rate for Australian born patients was 20% higher than for the overseas-born population (367 compared to 300 per 1,000 population)(Australian Institute of Health and Welfare, 2007). Compared with other country-of-birth groups, those born in North-East Asia, which includes countries such as China, Japan, the Republic of Korea and Taiwan, had the lowest hospital separation rate at 225 per 1,000 population(Australian Institute of Health and Welfare, 2008). This may reflect a 'healthy migrant effect' and/or underutilization of "mainstream" health services because of language and cultural barriers.

1.1.2 Health beliefs and health behaviours in Chinese immigrants

Health has different meanings in different cultures and with better understanding of positive lifestyle actions and risk factors, understanding in Western societies have changed in recent decades. The WHO definition of "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" is frequently cited(World Health Organization, 1948). While the definition has not changed since 1948, in 1986, the Ottawa Charter for Health Promotion included the statement that health is "a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities."(World Health Organisation, 1986). This definition emphasizes the value of healthy lifestyles. Health beliefs, which are strongly influenced by cultural norms and values, provide a means of explaining how social structure might influence enabling resources and perceived needs(Aroian et al., 2005). Each culture has its own system of health beliefs, a collection of beliefs, perceptions and ideas about health and illness, which reinforce health-related behaviours. When immigrants enter a new cultural environment, they do not leave behind the concepts and attitudes of their original culture, and this has provided the rationale for many useful epidemiological studies of immigrants(Kataoka-Yahiro, 2010). The differences in health beliefs and lifestyle behaviours among people of European and Japanese ancestry who live in Hawaii have been the basis of numerous epidemiological studies(Meng et al., 1997, Gotay et al., 2002, Gotay et al., 2004). Gotay and colleagues reported that Hawaii residents of Japanese ancestry are intermediate between residents of Japan and Hawaiian residents of European descent in most of health-related beliefs, attitudes, screening behaviours and health outcomes(Gotay et al., 2004). An understanding of relevant health belief systems is crucial in developing culturally sensitive health promotion programs.

Traditional Chinese health beliefs emphasize the importance of environmental factors in understanding the risk of disease. The 'yin-yang dichotomy' is the underlying philosophical principle that ancient Chinese and many present day Chinese use to understand how things work, including an understanding of health(Kwan and Holmes, 1999). This philosophy suggests if 'yin and yang' are in balance, a person will be in good health, but if the energy is displaced in either direction, one becomes ill(Chu, 2005). In order to maintain health, traditional remedial practices may be needed to counter any imbalance that occurs in their bodies(Kwan and Holmes, 1999). These beliefs are deeply ingrained among the Chinese, and have been found to be unchanged following migration to Singapore(Quah, 1985), the US(Anderson, 1987, Chau, 1990), and UK(Chan et al., 2006).

Health-related behaviour is one of the most important elements in people's health and well-being (Glanz and Maddock, 2002). It includes a range of actions taken by a person to maintain, attain, or regain good health and to prevent illness. Health behaviour reflects a person's health beliefs. This study will investigate the health behaviours of physical activity and nutrition.

1.1.3 Health information of Chinese immigrants

The sources of health-related information of Chinese immigrants have not been sufficiently documented and examined, either in Australia or in other countries. Most recent scholarly research reporting on consumer health information has focused on patterns and characteristics of online health information seeking (Dart, 2008, Yan, 2010). Pandey et al. in a study in New Jersey of 1100 women found that women increasingly relied on the Internet to acquire health information, and this was particularly true for those with higher education levels (Pandey et al., 2003). A study of cultural influences on information sources and messages for breast health information among Hispanic women in New Mexico found that family sources, expert sources, fear messages, media channels, face-to-face channels and a 'desire for no information' were associated with subjective cultural variables in communication preferences (Oetzel et al., 2007). There have been no similar studies in Asian cultures on health information sources, specific types of health information for children, and their relationship to mother's parenting behaviours about child health. Culturally based studies are needed to understand how and why Chinese mothers obtain health information for their children, where they go to retrieve such information, what particular types of information they prefer, and how the health information sought is used.

1.1.4 Childhood obesity in Chinese children and maternal influence on child health

Because of the distinctive identity of immigrants, their multi-cultural background and the integration of western and eastern culture and lifestyle, the health belief, behaviours and information sources of Chinese immigrants in Australia may be different both to Chinese living in China and to other Australians. This leads to interesting questions about the dynamics of Chinese families in this new environment and how it may affect their children. Mothers, as the usual primary caregivers, provide their young children with meals and have more control over children’s lifestyle compared to fathers(Jiang et al., 2006, Klohe-Lehman et al., 2007). While it is important to study both parents, in this study more emphasis will be given to the mother’s influence on the child’s nutrition and health behaviours.

With the implementation of the “family planning policy” in China in the early 1980s, the single child tends to be over-cared for and often overfed by adult caregivers (Jiang et al., 2009b). While it would be expected that Chinese Australians may have more children as the one child policy does not apply in this country, in reality there is little difference in the total fertility rates between China and Australia, which are 1.8 and 1.82 respectively(UNICEF, 2008). A common Chinese cultural belief is that “gaining weight and being fat means affluence”(Jing, 2000) and Chinese parents often lack awareness of the increasing problem of obesity and its significance as a health issue. Traditional attitudes toward body shape (eg obesity levels) together with modernization, urbanization, globalization of food markets, improved food availability and sedentary lifestyle, are among the causes of the increase in obesity among Chinese children(Chunming, 2000, Popkin, 2001b). A national epidemiological survey of childhood obesity in 2006 in China found that the prevalence of obesity and overweight in 0-6 urban children was 7.2% and 19.8%, which is 3.6 and 4.7 times higher than that of 1996 respectively(Ding, 2008). The criteria used for screening overweight/obesity in this study were more than 1 Z-score/2 Z-score above the mean of reference value of weight for height made by WHO(World Health Organization, 2000).

Childhood obesity is likely to persist into adult life and puts individuals at risk for a range of chronic diseases(Freedman, 2002, Chen et al., 2008a). Because obesity is difficult to treat, it is more effective to develop healthy eating habits and active lifestyles in early childhood to avoid long-term, adverse comorbidities.

For young children the most influential aspect of the immediate social context is the family, as described in a study of influence of grandparents on eating behaviours of young children from Beijing(Jiang et al., 2007). Family environmental factors may work synergistically with genetic factors to produce intergenerational similarities in eating, physical activity and overweight(Jiang et al., 2006). Parents can influence their children's health by the example they set; having a healthy diet and lifestyle, by the food they provide and through education of their children about foods, dietary behaviour and an active lifestyle(Gibson et al., 1998, Cooke et al., 2004).

The mother's antenatal nutrition and subsequent childhood growth influence the child's later health and eating patterns(Birch and Fisher, 1998, Koivisto et al., 1994, Wardle et al., 2002). Healthy eating patterns of infants and young children may have immediate nutritional benefits, as well as reducing the risk of later obesity(Jiang et al., 2009c). Studies have suggested that the type and duration of infant feeding may have an important role in the development of biological and behavioural processes and epigenetic modification affecting subsequent growth and health (Oddy et al., 2006a, Savage et al., 2007, Tamashiro and Moran, 2010, Bruce and Hanson, 2010, Chivers et al., 2010). Recent reviews suggest that breastfeeding is associated with reduced risk of overweight and obesity in early-life when compared with formula feeding(Burke et al., 2005, Monasta et al., 2010, Chivers et al., 2010). The food environment that parents provide during early childhood undoubtedly helps shape children's food preference as well as their subsequent selection patterns and eating styles (Birch and Fisher, 1998).

Besides a balanced, nutritious diet, regular and appropriate physical activity is another very important aspect of health-related behaviour. The role of the family, especially parents, in understanding and promoting children's physical activity has received a lot of research attention(Barnett and Chick, 1986, Alderman et al., 2010). Studies from Australia, USA and China suggest that parental exercise is positively associated with children's sports participation(Cleland et al., 2005, Alderman et al., 2010, Lau et al., 2007). Parental participation and parental support were reported to be positively associated with physical activities of pre-school child(Loprinzi and Trost, 2010, Klesges et al., 1990). It is plausible that parents act as role models for children's extracurricular sports participation(Cleland et al., 2005).

In addition to role modeling, other socialization processes have been shown to influence children's behaviour, including parental attitudes, values, and beliefs about their children's body shape and physical activity(Kimiecik and Horn, 1998). Parents' beliefs that their child's weight was a health problem, correct identification of their child's weight category (as overweight or not) and expression of concern about it, are related to weight status(Eckstein et al., 2006b). Parental encouragement(Brustad, 1996), behaviours, and direct involvement in physical activity influence children's physical activity(Kimiecik and Horn, 1998, Alderman et al., 2010).

1.1.5 The Health Belief Model

This study will use the Health Belief Model(Becker et al., 1977) as a theoretical framework to help describe the role of parental behaviours in shaping child's nutrition and physical activity pattern. The Health Belief Model was selected as it is one of the most widely used health promotion frameworks focusing on the attitudes and beliefs of individuals, to understand and predict health behaviours(Glanz et al., 2008). The model emphasises perception and motivation and presumes that in order for an individual to take action to prevent a given disease, he/she would first have to perceive oneself to be personally susceptible to it(Liou and Contento, 2001). The model is helpful in understanding the role of background factors (ie, sociodemographic factors including age, sex, race), personal perceptions (ie, perceived expectations, such as benefits, barriers and self-efficacy; and perceived threat, such as susceptibility and severity), and cues to action (ie, methods to encourage behaviour) that explain and predict a behavioural outcome(Brinsley et al., 2005). This model has been tested in many different populations applying particularly to behaviour related to chronic illness and weight management(Stephen and Chih-Yuan, 2007, Deshpande et al., 2009, Daddario, 2007, Kartal and Ozsoy, 2007, Maiman et al., 1977). The Health Belief Model has been used to describe health behaviours in Asian populations including China(Sung et al., 2008, Wai et al., 2005, Al-Ali and Haddad, 2004). However there are no published reports of its use to assist understanding Chinese parents' behaviour relating to their children's health.

1.1.6 Perth, Western Australia

Western Australia is one of the Australian states situated in the southern hemisphere. It occupies around one-third of Australia's total landmass, with an area of 2.5 million square kilometers or 965,000 square miles(Tourism Western Australia Corporate Site).

Perth is the capital and largest city of Western Australia. The majority of the metropolitan area of Perth is located on the Swan Coastal Plain, a narrow strip between the Indian Ocean and the Darling Scarp (City of Perth, 2013). The climate averages in Perth region are around 18 to 29 degrees in summer and 8 to 18 degrees in the winter(Tourism WA Corporate Site, 2013).

Perth is the fourth most populous city in Australia, with an estimated population of almost 1.9 million living in the Greater Perth metropolitan area. That was 78% of the state's total population(Australian Bureau of Statistics, 2013d). Greater Perth had a population density of 300 people per square kilometers at June 2012, while the remainder of WA had just 0.2 people per square kilometers(Australian Bureau of Statistics, 2013d). Perth was the fastest growth of all capital cities in Australia. Between 2011 and 2012, the population in Greater Perth region increased by 3.6% (65,400 people). The Percentage of young children under five years old was about 3.0% of the total population at June 2013(Australian Bureau of Statistics, 2013c). As other Australia capital cities, Perth has a large population of immigrants. The overseas born population in Perth was 40.3% of total population and 61.5% of total population had parents born overseas (Australian Bureau of Statistics, 2012a).

Of the families in Greater Perth (Greater Capital City Statistical Areas), 45.5% were couple families with children. For couple families with two incomes, the median income for those with children was $2,564 per week(Australian Bureau of Statistics, 2013c).

Figure 1.1 Location of Perth, Western Australia

(Note area shown in the Perth map is almost 200km north-south)

(Source: http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/0?opendocument&navpos=220)

1.1.7 Chengdu and Wuhan, PR China

The People's Republic of China has a land of approximately 9.6 million square kilometers with a population of 1.351 billion (National Bureau of Statistics of China, 2011, The World Bank, 2012). With the economic development, population health has improved. In 2011, The overall life expectancy at birth was 75.0 years reported by the World Bank (The World Bank, 2012).

As shown in the map, Sichuan Province is in the south west of China (Figure 1.2). Sichuan Province is a predominantly agricultural province in the west of China, known as the 'Province of Abundance'. Sichuan is famous for its natural beauty and historical places, with a history over thousands of years, and an abundance of plants and animals. The panda, which is popular around the world, lives in the mountains of Sichuan Province. At the end of 2010, the population of Sichuan Province was 80.4 million (National Bureau of Statistics of China, 2011). The majority of residents (approximately 93.9%) are from the Han ethnic group, with a population of 4.91 million from another 55 ethnic groups.

Chengdu, located in the central of Sichuan Province, is the capital city of Sichuan (Figure 1.2). It has a recorded history of over 2500 years. Chengdu had a population of 14.18 million at the end of 2012. The average population density was 1015.3 people per square kilometers. Chengdu is the economic centre and transportation hub of South-western China. In 2012, the GDP of Chengdu was $US 1252.1 billion. The per capita GDP of Chengdu was $US 8865.2 (1 USD= 6.5 CNY) in 2012 (Chengdu Bureau of Statistics, 2013). The birth rate in 2010 was 8.6 per thousand; the death rate was 8.7 per thousand; and the natural growth rate was -0.1 per thousand (Chengdu Bureau of Statistics, 2012). Chengdu has a humid subtropical climate. The daily average temperature in winter is around 5.6 °C (42.1 °F). The summer is hot and humid. The 24-hour daily average temperature in summer is around 25 °C (77 °F). The annual mean is 16.14 °C (61.1 °F) (2013).

Hubei is a province of the PR China, located in the central part of the country (Figure 1.3). The name of the province means "north of the lake", referring to its position north of Lake Dongting. The provincial capital is Wuhan, a major transportation thoroughfare and the political, cultural, and economic hub of Central China.

Wuhan is the most populous city in Central China. It lies in the eastern Jianghan Plain at the intersection of the middle reaches of the Yangtze and Han rivers. The city of Wuhan, first termed as such in 1927, has a population of 10,020,000 people (as of 2011), with about 6,434,373 residents in its urban area. In 2012, the GDP of Wuhan was $US 1231.4 billion and the per capita GDP was over $US 10,000 (Hubei Provincial Bureau of Statistics, 2013). The birth rate in 2012 was 10.72 per thousand; the death rate was 5.54 per thousand; and the natural growth rate was -4.58 per thousand (Hubei Provincial Bureau of Statistics, 2013). The monthly 24-hour average temperature ranges from 3.7 °C (38.7 °F) in January to 28.7 °C (83.7 °F) in July(China Meteorological Administration, 2009).

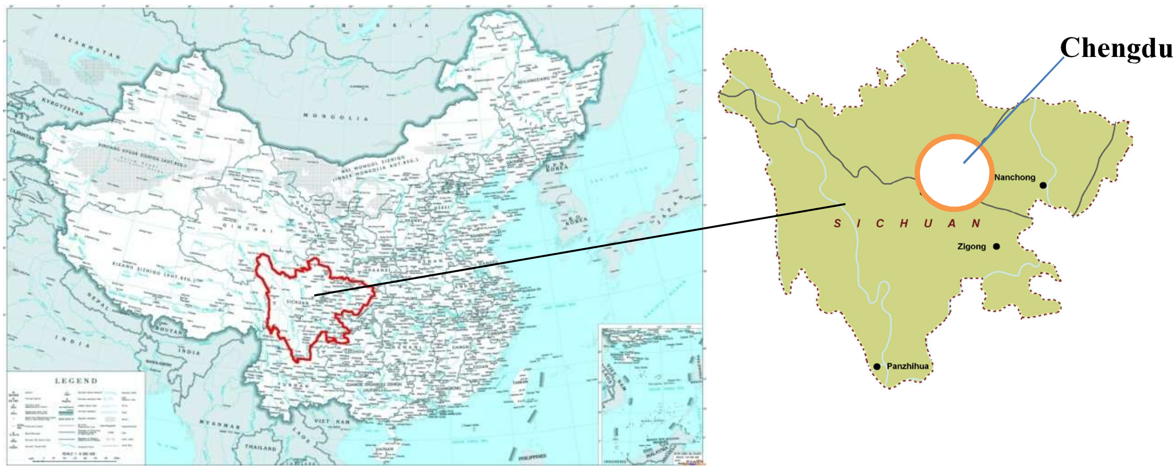

Figure 1.2 Locations of Chengdu and Sichuan Province

(Source: http://www.cnto.org.au/china-map-in-english, http://www.chinatouristmaps.com/provinces/sichuan/simple-map.html)

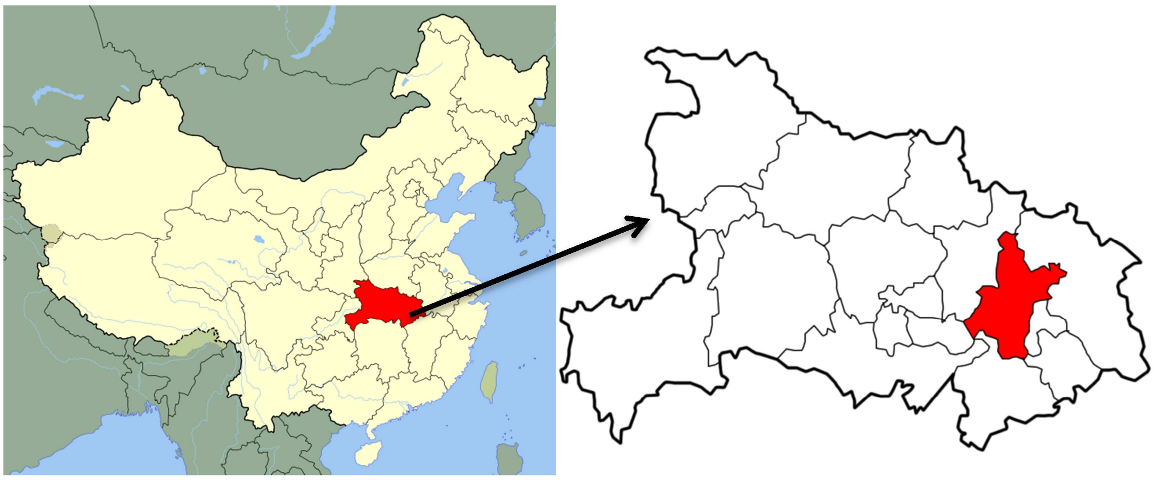

Figure 1.3 Locations of Wuhan and Hubei Province

(Source: http://en.wikipedia.org/wiki/Wuhan)

1.2 Statement of significance

Chinese people comprise one of the largest permanent migrant populations in Australia. Parental influences on children's nutrition and health behaviour which have been investigated in Western countries may not apply to Asian cultures where belief systems differ from those of Western cultures. It is possible that additional or other cultural beliefs play a role in health belief, behaviours and information sources of Chinese mothers who live in Perth and these factors may influence their children's nutrition and health behaviours. There has been little research with a specific focus on cultural values concerning food choice, eating customs, physical activity and body shape among Chinese migrant mothers and their children. There are no published studies of the way Chinese immigrants access health information in Australia, and specifically on growth and weight of their children, and the relationship of this information to their health behaviours and child care behaviours. Given the growing population of Chinese people in Australia, there is a need for research in this population group.

1.3 Aim

This study will aim to identify influences on Chinese mother's health information sources, beliefs and attitudes towards infant and child nutrition, physical activity, body shape and health behaviours and on the ways these influence the health services used and health promoting activities of their children.

1.4 Objectives

1. To compare the infant feeding attitudes and practices in Chinese mothers in China and Australia.

2. To compare the initiation and duration of breastfeeding between Chinese Australian immigrants and Chinese mothers in mainland China and test the "healthy migrant effect" in Chinese Australian immigrants in Perth, Western Australia.

3. To identify the prevalence of overweight/obesity in the study cohort (mothers and children) compared to Chinese and Australian national data.

4. To translate and validate a Chinese version of Iowa Infant Feeding Attitude Scale (simplified Chinese).

5. To document the prevalence and types of dietary supplements used and characteristics of Chinese pre-school children using dietary supplement in Australia and China and assessed the factors related to dietary supplement use in two countries.

6. To evaluate perceptions about breastfeeding, infant feeding and child obesity among Chinese mothers living in Perth.

7. To describe sources of information used by Chinese mothers about health, child nutrition and healthy lifestyles.

8. To examine if the health belief model useful in understanding the health promoting behaviours of Chinese mothers for their children's health.

9. To describe the incidence of illness, including minor illnesses, in Chinese children living in Perth.

1.5 Outline of thesis

This thesis is presented in twelve chapters, including the introduction, a review of literature, methodology, seven chapters describing different aspects of the results, discussion and the conclusion chapter.

Chapter one provides the background information on the place where study was conducted and the background information about Chinese immigrants in Australia and Perth, health beliefs of Chinese and parental influence on child health. Besides a brief background of the study, the first chapter includes the objectives of study and the significance of the study.

Chapter two includes a review of the literature related to the main topics of this study. Illness rates in children in Australia and China are described and breastfeeding rates and factors influencing breastfeeding are presented. Themes of obesity in children in Australia and China, health information seeking and health behaviours and health beliefs are also included in the literature review chapter.

Chapter three describes the methodology of the study. This chapter includes the study design, data collection processes and management of the study, questionnaires development and components of the questionnaires used in the study, data analysis methods applied in the study, and the ethics consideration of the study.

Chapter four provides detailed descriptive and univariate results of the study in accordance of aims, which includes demographic information about the participants, breastfeeding practices and related factors, infant feeding attitudes of the mothers, maternal perceptions of their children's weight, parental beliefs about child health, health information sources and health services used.

Chapters five to ten are results of multivariate analysis presented in the following published papers: "Attitudes towards breastfeeding – the Iowa Infant Feeding Attitude Scale in Chinese mothers living in China and Australia", "The 'Healthy Migrant Effect' in Breastfeeding

Practices of Chinese Mothers in Australia and China", "Prevalence and characterisation of dietary supplement use in healthy pre-school Chinese children in Australia and China", "Calcium supplementation in young children in Asia – prevalence, benefits and risks", "Chinese Mothers' Perceptions of their child's weight", "The more she cares the more overweight her child: a population-based survey on health belief model in child care behaviours of Chinese mothers in China and Australia".

Chapter eleven provides further discussion of the results from data analysis. The results are discussed and compared with the existing literature of previous studies.

Chapter twelve concludes the conclusions of the key findings of the study and suggestions on the promotion and further research. The limitations of the study are also discussed in this chapter.

The Appendix includes the letter giving ethics approval, participants information sheet, consent form and questionnaires used in the study.

Chapter 2

Literature review

This chapter presents a review of the literature covering five themes: (i) illness rates in children in Australia and China, (ii) breastfeeding in Australia and China – rates and factors influencing breastfeeding, (iii) obesity in children in Australia and China, (iv) health information seeking by Chinese immigrants, (v) health behaviours and the health belief model.

2.1 Illness rates in children in Australia and China

Health, particularly child health, is not just a narrow definition of the presence or absence of diseases, disabilities and deficits but a product of the complex interconnectedness of prenatal, social, cultural, demographic, family, neighbourhood, and economic and political factors (Australian Institute of Health and Welfare, 2012). This is well represented by the definition of health by the World Health Organization: "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (World Health Organization, 1948).

The health and development in the early years of life provide the foundation for future (Australian Institute of Health and Welfare, 2012). Good health is essential to a child's quality of life as it can influence participation in many aspects of life, including schooling and recreation (Australian Institute of Health and Welfare, 2010). Infants and young children are particularly vulnerable to malnutrition and infectious diseases, many of which can be effectively prevented or treated. Evidence from research indicates that many childhood disadvantage can adversely affect health in adulthood (Graham and Power, 2004). The health of young children can have far-reaching consequences, not just throughout their lives but potentially for successive generations.

2.1.1 Children and families in Australia and China

The number of Australian children has increased over the past four decades, and is projected to increase to 5.2 million by 2038(Australian Institute of Health and Welfare, 2012). At 30 June 2011, it is estimated that there could be 4.3 million children aged 0–14 living in Australia, with a slightly higher proportion of boys making up of the child population than girls (51% compared with 49%)(Australian Institute of Health and Welfare, 2012). The most recent data source on where Australian children live shows that 6.0% of children under five years old are living in Western Australia(Australian Bureau of Statistics, 2011b).

With a high proportion of immigrants (nearly 29% of the total Australian population aged 15 years and over were born overseas), Australia is one of the most culturally diverse countries in the world(Australian Bureau of Statistics, 2010b). Based on 2006 Census data, almost one-fifth of children (17% or 625,000) aged 0–14 had both parents born overseas while a further 16% (601,000) of children had one parent born overseas (9% or 333,000 with overseas-born fathers and 7% or 268,000 with overseas-born mothers)(Australian Bureau of Statistics, 2007). The proportion of children aged 0–14 born overseas is considerably lower than for the total Australian population—at 8.3%, or 351,500 children, in 2010 (Australian Bureau of Statistics, 2011g). Overseas-born children come from more than 169 different countries (Australian Institute of Health and Welfare, 2012). More than half of overseas-born children were born in mainly non-English-speaking countries (56%). Of these children, the largest groups were from India (7% of the total overseas-born), the Philippines (5%), and China (excluding Special Administrative Regions and Taiwan Province) (4%)(Australian Institute of Health and Welfare, 2012).

China has a much larger population of 1.35 billion at the end of 2012, with 0.22 billion children aged 0-14 (16.5% of the total population) and about 81.6 million under five years (World Health Organization, 2012, National Bureau of Statistics of China, 2012). The birth rate was reported to be 12.10 per 1000 in 2012, with a sex ratio of 117.70. The average household size in China was 3.1 at the end of 2012, whereas the average number of persons per household was 2.6 in 2006 in Australia(Australian Bureau of Statistics, 2010a, National Bureau of Statistics of China, 2012). The estimated fertility rate in China was 1.5 from the 2010 national demographic census while the fertility rate was estimated to be 1.9 in 2011 in Australia based on results from the 2006 Census(Liu, 2012, Australian Bureau of Statistics, 2012d).

2.1.2 Mortality in children in Australia and China

Mortality rates and causes, especially the mortality of infants in their first year of life are commonly viewed as key indicators of the general health and wellbeing of a population. They not only reflect circumstances around the time of death but also provide insight into changes in social and environmental conditions, medical interventions, health behaviours and trends in underlying risk factors(Australian Institute of Health and Welfare, 2012).

2.1.2.1 Infant mortality rate in Australia

There was significant progress in improving survival of babies in Australia in the twentieth century, as in many other developed countries. The infant mortality rate decreased from 103 deaths per 1,000 live births in 1900 to 5.2 deaths per 1,000 live births in 2000. By 2011, it had declined to 3.8 infant deaths per 1,000 live births, a further decrease from the rate in 2010 (4.1 infant deaths per 1,000 live births)(Australian Bureau of Statistics, 2012f). The substantial decline of infant and child deaths is a factor in the steady increase in life expectancy in Australia. It is estimated that a boy born in 2011 could expect to live 79.7 years while a girl could expect to live 84.2 years(Australian Bureau of Statistics, 2012f).

The dramatic decline in the deaths of infants aged less than one during the first half of the century was linked to public sanitation improvements, improved nutrition and health education. After the 1940s, the development of vaccines and effective use of antibiotics, led to further gains in decreasing the infant mortality rate resulting from the decline of infectious diseases and reductions in vaccine-preventable diseases through national childhood immunisation programs(Australian Institute of Health and Welfare, 2012). Improved medical technology, including improvements in neonatal intensive care in the 1970s contributed to the more modest declines in the second half of the century. Also contributing were increased community awareness of the risk factors for sudden infant death syndrome (SIDS), and growing preventative health measures, public health programs and improving nutrition(United Nations, 1988, Australian Bureau of Statistics, 2002).

Improvements in both access to quality antenatal health care, and maternal health through improved nutrition and reduction in risk behaviours during pregnancy, may serve to reduce the infant mortality rate in Australia further(Council, 2011, Australian Institute of Health and Welfare, 2009, Drevenstedt et al., 2008, Centers for Disease Control and Prevention, 2006).

2.1.2.2 Leading causes of infant mortality in Australia

The three leading causes of infant death in Australia between 1997 and 2010 were: perinatal conditions; congenital anomalies; and “symptoms, signs and abnormal findings”, including Sudden infant death syndrome (SIDS)(Australian Institute of Health and Welfare, 2012). Among infants in 2008–2010, perinatal conditions were the leading cause of death, accounting for almost half of all infant deaths (46%). Of these perinatal conditions, more than one-quarter were due to the effects of maternal complications during pregnancy on the infant.

Congenital anomalies accounted for around one-quarter (26%) of all infant deaths. Of these deaths, the leading condition was congenital malformations of the circulatory system, accounting for 8% of all infant deaths. “Symptoms, signs and abnormal findings” was the third leading cause of death (10%), with more than two-thirds of these due to SIDS. The death rate was higher for male infants than for females for all leading causes of death(Australian Institute of Health and Welfare, 2012).

Sudden infant death syndrome (SIDS) refers to the sudden and unexpected death of an infant aged less than 1 year during sleep, which cannot be explained after a thorough case investigation, including a scene investigation, autopsy, and review of the clinical history(Willinger et al., 1991). The number of SIDS deaths per 100,000 live births has declined in Australia since the beginning of national public education campaigns about risk factors associated with SIDS in 1991. Between 1986 and 2003 the SIDS death rate decreased by 86%, from 203 per 100,000 live births to 29. In 2010, among infants aged less than 1, there were 81 deaths due to SIDS, a rate of 27 deaths per 100,000 live births, and 7% of all infant deaths.

The risk factors associated with SIDS include prone or side sleep position, soft sleeping surfaces or objects and loose bedding, not breastfeeding, overheating, alcohol and illicit drug use during pregnancy and after birth, smoking and bed sharing(Task Force on Sudden Infant Death Syndrome, 2011). Mothers are encouraged to breastfeed if they can as a protective measure against SIDS(Young et al., 2012). Breastfeeding is associated with a reduced risk of SIDS (Ip et al., 2009, Vennemann, 2009, Hauck et al., 2011). Mothers are encouraged to exclusively breastfeed or feed with expressed human milk for 6 months. The protective effect of breastfeeding increases with exclusivity(Chapman, 2011, Hauck et al., 2011). However, any breastfeeding has been shown to be more protective against SIDS than no breastfeeding(Hauck et al., 2011).

2.1.2.3 Child mortality in Australia

According to the ABS deaths registrations collection, the death rate among children aged 1-14 was 13 per 100,000 children in 2010(Australian Institute of Health and Welfare, 2012). The death rate for children 1 to 4 years old was 19 per 100,000 children. Boys accounted for more deaths than girls (59% compared to 41% of child deaths)(Australian Institute of Health and Welfare, 2012). Between 1986 and 2010, the child mortality rate decreasd from 30 to 13 deaths per 100,000 children between 1986 and 2006. The improvement in cihld survival was largely due to a decrease in deaths from transport accidents(Australian Institute of Health and Welfare, 2012).

2.1.2.4 Leading causes of child death in Australia

The three leading causes of child death have remained the same between 1997 and 2010: injuries, cancer and diseases of the nervous system(Australian Institute of Health and Welfare, 2012). In 2008–2010, the leading causes of death among children aged 1 to 14 were injuries (34%), cancer (17%) and diseases of the nervous system (11%)—rates of 4.5, 2.2 and 1.5 per 100,000 children, respectively(Australian Institute of Health and Welfare, 2012). Young children (1–4 years) had higher rates of injury, diseases of the nervous system, congenital anomalies and circulatory conditions than children of other age group(Australian Institute of Health and Welfare, 2012).

2.1.2.5 Infant mortality rate in China

China has also shown significant progress in reducing infant and child death. Based on data of the sixth national population census in 2010，the life expectancy at birth in China was 74.83 years (males 72.38 years，females 77.37 years)(National Bureau of Statistics of China, 2012). It has increased by 3.43 years in the decade since 2000. The decreasing infant mortality rate was a major contributor to the increased life expectancy. In the recent decade, the infant mortality rate in China was halved from 28.38 per 1000 in 2000 to 13.93 per 1000 in 2010. In the previous decade from 1990 to 2000, it declined by 4.51 per 1000 live births(National Bureau of Statistics of China, 2012). As the economy is growing in China, the improved living conditions and health services for mothers and babies has speeded up the rate of decrease of the infant mortality rate in China.

2.1.2.6 Under-five-mortality in China

Nationwide under-five-mortality rate in 2010 was 16.4 per 1000 children (7.3 and 20.1 deaths per 100 children in urban and rural areas respectively)(Feng et al., 2012). It dropped by 58.7% compared to that in 2000. The deaths among 0-4 years children in 2000 was 3.3 times greater in rural areas of China than in urban areas. It decreased to 2.8 times as large in 2010(Feng et al., 2012).

2.1.2.7 Leading causes of child death under five years in China

The leading causes of death for children under five years old in China during 2000 to 2010 were premature birth or low birth weight, pneumonia, birth asphyxia, congenital heart disease and accidental suffocation(Feng et al., 2012). Diarrhoea was the fifth leading cause of death for children under five in 2000, dropping to be the seventh leading cause in 2010. There was a significant decrease in child mortality caused by diarrhoea in rural areas of China: from 236.8 deaths per 1000 children to 68.2 deaths per 1000 children in the last decade(Feng et al., 2012). This was largely due to the improving sanitary conditions in rural area of China.

Several studies have reported that infant and child mortality in both developed and developing countries are closely linked to social and economic factors(Collison et al., 2007, Marmot, 2006). Infant and child mortality have been shown to be associated with family factors, including parental leave benefits and household earnings(Ferrarini, 2010). These patterns may be explained by the strong association between infant and child mortality and the accessibility and effectiveness of maternal and child health services, which are also influenced by the economic conditions of families(Freemantle et al., 2006). Child survival can also be affected by maternal factors (including age, number of prior pregnancies resulting in birth, birth interval), environmental pollution, nutritional deficiency, injury, health-seeking behaviours and access to medical treatment(Mosley and Chen, 2003).

2.1.3 The 'healthy migrant effect'

Immigrants bring a rich cultural heritage to the host country with their different beliefs, values, and customs. Understanding the determinants of health in this population of Australians is important for many reasons including promoting the overall health and welfare of the population and obtaining insights into how exposure to the Australian social, cultural and physical environment might be associated with health. Most studies have found that Australian immigrants, particularly immigrants from non-English-speaking countries, are generally in as good health as, or even better than, the Australian-born population on their arrival in Australia(Biddle, 2007, Australian Institute of Health and Welfare, 2010). Statistics have shown that overseas-born people are admitted to hospital at lower rates than the Australian-born population(Australian Institute of Health and Welfare, 2008). In 2005–06, the age-standardized total hospital separation rate for Australian born patients was 20% higher than for the overseas-born population (367 compared to 300 per 1,000 population)(Australian

Institute of Health and Welfare, 2007). Compared with other ‘country of birth’ groups, those born in North-East Asia, which includes China, Japan, the Republic of Korea and Taiwan, had the lowest hospital separation rate at 225 per 1,000 population(Australian Institute of Health and Welfare, 2008). This could reflect the “healthy migrant effect”, which is commonly observed, and is probably due to the fact that immigrants tend to be better educated, highly motivated and in better psychological and physical health than the host population(Rubalcava et al., 2008). There is also evidence that immigrants, whether temporary or permanent, tend to be healthier than the population from which they originate(Feliciano, 2005, Marmot et al., 1984, Palloni and Arias, 2004, Rubalcava et al., 2008).

This ‘healthy migrant effect’ has been well documented for immigrants in many western countries, especially in the USA and Canada. The existence of a ‘healthy migrant effect’ is now well accepted in the literature. It can be seen across a range of health-related outcomes. For example, some studies indicate that immigrants present a higher level of breastfeeding initiation and longer duration rates(Merten et al., 2007, Singh et al., 2007, Chen et al., 2013b), lower drinking and smoking(Kimbro, 2009, Lopez Gonzalez, 2005, O'Loughlin, 2010), less overweight and obesity(Antecol and Bedard, 2006, Bates et al., 2008, Ade et al., 2011, Goel et al., 2004), less heart and circulatory disease(Singh and Siahpush, 2002, Jasso et al., 2004, Steffen, 2006), less likely to suffer or die from some cancers(Steffen, 2006, Singh and Hiatt, 2006, Kumar et al., 2009), better self-reported health(Read and Reynolds, 2012, Lucas et al., 2003), lower disability(Cho, 2004, Weigel et al., 2013, Mutchler et al., 2007), and lower mortality rates(Barona-Vilar et al., 2012, Ng, 2011, Okamoto, 2008, Singh and Miller, 2004). These results include studies documenting improved health by gender, countries or origin, years of stay in host country and age at migration.

To some extent, the ‘healthy migrant effect’ may be partly explained by the rigorous health checks immigrants are subjected to be eligible for migration by the recipient country. In some cases, immigrants are selected on the basis of their relatively high socioeconomic status, which is also related to better health. The ‘healthy migrant effect’ is also due to a self-selection process as the chronically ill and disabled are less likely to migrate. People who are able to migrate and be mobile are more likely to be healthier when compared with native-born counterparts(Walsh, 2011). Moreover, studies reporting the ‘healthy migrant effect’ generally contend that healthy lifestyles before and immediately following migration than the native-born populations contributed to better health of immigrants(Kumar et al., 2009, Goel et al., 2004, Argeseanu Cunningham et al., 2008)

Another explanation for the 'healthy migrant effect' may be that it is actually an artifact due to the underutilization of 'mainstream' health services or disease under-reporting by immigrants because of language and cultural barriers(Palloni and Arias, 2004). The literature suggests that beliefs and norms concerning health behavior change due to acculturation(Abraido-Lanza et al., 2006). Language is a proxy for acculturation. Furthermore, it has repeatedly been shown that language is an important predictor of health care utilization and health status(Carter-Pokras and Bethune, 2009). Jasso and Massey et al. (2004) illustrate this explanation in their US study when they note that there are no differences between immigrants and the native-born in self-assessed health status, but that there are differences for specific chronic diseases. In contrast, some studies report equal or even higher access to health services of immigrants comparing with native-born population(Muggah et al., 2012, McDonald and Kennedy, 2004).

However, migration to a new country can represent a substantial shift in a range of issues including diet, physical environment, stress, and health behaviours such as exercise. These changes can result in modifications in disease risks. Eventually, the exposure of immigrants to a new culture and adoption of some new lifestyles leads to steadily approximating to native-born population in health with time in the new country. The advantage in health of immigrants gradually disappeared in their offspring(Tarnutzer and Bopp, 2012, Argeseanu Cunningham et al., 2008).

In Australia, the nature of any 'healthy migrant effect' is less well understood. Australian immigration policy plays an important role in determining who migrates. As discussed before, few immigrants are denied entry to destination countries on the basis of poor health. Australia attempts to attract younger and more educated immigrants via a skilled immigrant intake based on a points system that explicitly considers age, education level and language fluency(Kennedy et al., 2006). This positive selection by immigration means that better educated and skilled immigrants gain entry, and it may also induce positive self-selection to apply for migration by individuals who believe they have the greatest chance of gaining entry(Kennedy et al., 2006).

2.1.4 Asthma and allergy diseases in Chinese children in Australia

Studies have shown that for many conditions immigrants, particularly immigrants from non-English-speaking countries, have better health status and use fewer health services upon arrival than the Australian-born population. It has also been shown that the 'healthy migrant effect' for some conditions wanes with time in Australia. That is, there is a process of assimilation in the health of immigrants to Australia. However, there are significant variations for different immigrant groups and in the assimilation profiles of particular chronic diseases such as heart disease, asthma and diabetes(Biddle, 2007). Asthma and allergies is an example that shows environmental effects after immigrating and is well documented in literature.

2.1.4.1 Asthma and allergy diseases morbidity in children in Australia and China

Over the past decade, the International Study of Asthma and Allergic Diseases in Children (ISAAC) has demonstrated the higher prevalence of asthma and allergy in more developed countries compared to developing countries(ISAAC, 1998). Although the trends vary from country to country and in different ethnic populations, the overall prevalences are higher in developed than in developing countries with asthma rates in children varying by up to 12 fold, and higher in urban than in rural areas(ISAAC, 1998, Zhao et al., 2000, Wang et al., 2008, Australian Centre for Asthma Monitoring, 2011).

Australia, as a developed country, has one of the highest prevalences of asthma and allergies (Palmer et al., 1999). In the nationally representative Longitudinal Study of Australian Children (LSAC), reported in 2008, the prevalence of ever having been diagnosed with asthma was 31.0% among children aged 8–9 years and 21.8% among those aged 4–5 years(Australian Centre for Asthma Monitoring, 2011). The prevalence of ever-diagnosed and current asthma in children (aged 0–15 years) in 2009 in Western Australia was 13.0% and 8.2% respectively(Australian Centre for Asthma Monitoring, 2011). A large proportion of the burden of asthma is attributed to children and adolescents. The proportion of total health expenditure attributed to asthma care was highest among children(Australian Centre for Asthma Monitoring, 2005).

In contrast, China has one of the lowest prevalences of asthma and allergies(Wang et al., 2008). A survey done in eleven major cities in China found the prevalence of self-reported allergic rhinitis was 11% and asthma was 9.2% during 2004 to 2005(Zhang et al., 2009a). The prevalence of wheeze was 5.8, 3.8 and 3.4 in 10 years school children in Hong Kong, Beijing and Gugangzhou, respectively(Wong et al., 2004). Environmental factors and diet may explain the differences in prevalence of asthma between children living in different regions of China(Wong et al., 2004).

2.1.4.2 Asthma and allergy disease morbidity in Chinese children in Australia

Many epidemiological studies have consistently shown that immigrants from developing to developed countries were at an increased risk for asthma and allergies, with gradually increasing prevalences related to their years of residence in the developed countries(Rottem et al., 2005). A cross-sectional survey of school age children in Australia reported that residence for five to nine years was associated with a two fold increase in reported wheeze, and after 10 to 14 years a three and half fold increase, relative to those with 0 to 4 year residence (Powell et al., 1999). Several studies conducted in American Chinese immigrants and their children reported a similar finding with place of birth as a significant risk factor for asthma and allergy(Brugge et al., 2007, Greenfield et al., 2005). It is reported that asthma in Asian immigrants increased significantly with length of stay in Australia, independent of age at arrival, sex and atopic status(Leung et al., 1994). Immigrant children tended to initially develop asthma several years after arriving in Australia and with every year of residence there was an 11% increase in the prevalence of asthma symptoms(Gibson et al., 2003).

After immigration to Australia, Chinese immigrants have a gradual increase in prevalence of asthma and allergy to the same level as in the local population or even higher(Leung et al., 1994, Leung, 1996). The reasons for the large differences in asthma prevalences between countries, and why the rates have increased differentially in some locations or populations, have remained largely unknown. However, these different prevalences cannot be explained by genetic dissimilarity between ancestral populations or rapid genetic changes. Undoubtedly, environmental factors such as indoor pollutants and dietary pattern changes play a critical role in triggering the onset of allergy diseases and have been proposed to be responsible for this disproportionate prevalence of allergic conditions(Miller and Ho, 2008, Kabesch et al., 2010).

2.1.4.3 Risk factors of asthma and allergies in children

Migration involves exposure individual to a new set of pollutants and allergens and they assimilate new dietary habits and lifestyles. Epidemiological studies in immigrants suggest that the different environmental factors and lifestyles in Western industrialized countries are responsible for the increased risk of asthma and allergies(Leung, 1996, van Amsterdam et al., 2004).

Prenatal environmental and nutritional exposures

Evidence from multiple large prospective studies indicates that prenatal exposure to environmental tobacco smoke is associated with impaired respiratory function, transient wheeze, asthma, and/or respiratory infections in infants and young children(Magnusson et al., 2005, Alati et al., 2006). This body of work provides the most convincing evidence that prenatal environmental exposures can influence the risk for subsequent asthma(Miller and Ho, 2008). In addition, low maternal intake of foods containing vitamin E and zinc, or use of antibiotics during pregnancy, may increase the risk for childhood asthma(Devereux, 2006, Jedrychowski, 2006). In contrast, maternal intake of probiotics, and higher levels of fruits, vegetables, and oily fish during pregnancy, may decrease the risk(Kukkonen et al., 2007, Fitzsimon, 2007).

House dust mite allergens

In addition to prenatal exposures, multiple cohort studies suggest that early postnatal exposures modify the risk for developing later childhood or adult-onset asthma. As an example, exposure to dust mite allergen during infancy may be an important determinant of later childhood asthma(Sporik et al., 1990). Exposure during infancy to indoor combustion-related pollutants has been associated with later childhood sensitization to dust mite and a reduction in FEV1(Ponsonby, 2001).

House dust mite allergens are the most common domestic allergens in Australia, with concentrations amongst the highest in the world(Zhang et al., 2006a, Thomas et al., 2010). Numerous studies have shown that response to house dust mite allergens is an important marker for childhood asthma(Arshad, 2010, Kuehr et al., 1995, Maestrelli et al., 2001). Most asthmatic children are sensitized to house dust mite allergen, which is associated with increased airway responsiveness(Kuehr et al., 1995, Maestrelli et al., 2001). House dust mite allergens are also common in China(Wen and Wang, 1991).

Other allergens in indoor environments

Domestic animals (cats and dogs) are another important source of allergens in Australia. Both cat and dog allergens can be passively transferred from one environment to another(Zhang et al., 2006b) and are found in nearly all homes, with much higher levels in homes with pets(Almqvist et al., 2001, Zhang et al., 2005, Zhang et al., 2004).

Exposure to dog or cat allergen is associated with protection from later childhood wheeze in some but not all cohort studies(Remes et al., 2001, Lau et al., 2005). Although pet ownership has been shown to reduce the risk of asthma and allergy in some populations, several studies have directly linked animal allergen exposure to poorer asthma outcomes among animal-sensitized patients(Lewis et al., 2002, McConnell et al., 2006). In addition, cockroaches are an important source of allergens for children in inner-city environments(Platts-Mills, 2007).

Endotoxin and hygiene hypothesis of asthma

Bacterial endotoxin, a lipopolysaccharide (LPS) which is a major component of the outer membrane of gram-negative bacteria, is present ubiquitously in domestic environments (Liu, 2002). It has been extensively studied to determine associations between environmental exposure and allergic disease(Braun-Fahrlander et al., 2002). There is evidence that endotoxin may have two sided effects on allergic disorders, by exacerbating pre-existing respiratory symptoms, or even likely inducing new asthma, while also being responsible for the protective effect of microbial agents with regard to atopy(Liu, 2002).

Bottcher et al (2003) found the protective effect of endotoxin on atopy in a comparison study between children from Estonia and Sweden(Bottcher et al., 2003). Gehring et al reported that exposure to endotoxin decreased the risk of atopic eczema in infancy and atopy in children(Gehring et al., 2002, Gehring et al., 2001). Another study reported that prenatal exposure to an environment rich in microbial compounds might confer protection against the development of atopic sensitization in school-age children with upregulation of TLR receptors(Ege et al., 2006). In addition, an animal study conducted by Telethon Institute for Child Health Research found that only early LPS exposure prevented allergen sensitization, which suggested that timing of exposure to LPS also played an important role in the development of sensitization(Tulic et al., 2000).

Breastfeeding and dietary patterns

Breastfeeding duration and timing of complementary food introduction are also reported to be associated with allergy and asthma in childhood(Miyake et al., 2008, Xu, 2009, Zutavern, 2008, Kull et al., 2010). Recent evidence from a population based cohort study in Finland found that longer duration of breastfeeding was protective against the development of asthma(Nwaru et al., 2013). Besides, epidemiologic studies suggest that deficiencies of the nutrients selenium; zinc; vitamins A, C, D, and E; and low fruit and vegetable intake may be associated with the development of asthma and allergic disorders(Kull et al., 2010). Processed meat, red meat, high-fat dairy products and eggs, that are common in Western diets, have been indicated to be associated with an increased risk for allergic conditions.

The global increase in prevalence of asthma and allergy coincided with changes in Western dietary habits, which are thought to be a contributory factor. Westernised diets are associated with low antioxidant and high saturated fat intake and have been associated with an increased risk for asthma and allergy(Wood and Gibson, 2009). Epidemiological studies have reported that Western dietary patterns are detrimental to respiratory health. A prospective cohort study reported that high adherence to the Western dietary pattern was associated with increased risk for frequent wheeze(Tromp et al., 2012). In the UK, intake of a Western compared to an Eastern diet was associated with an increased asthma risk(Carey et al., 1996). Another study found that a diet high in fast foods, containing high levels of animal fats and protein, was associated with increased childhood asthma prevalence(Huang et al., 2001). Contrasting with the Western dietary pattern, traditional Mediterranean diets have been found to be protective against asthma-like symptoms and atopy in childhood(Chatzi and Kogevinas, 2009, Chatzi et al., 2008). Chinese immigrants moving to Australia will gradually experience dietary pattern changes, which potentially result in the increase of allergic conditions in them.

2.2 Breastfeeding in Australia and China – rates and factors influencing breastfeeding

The type and duration of infant feeding may have an important role in the development of biological and behavioural processes and epigenetic modification affecting subsequent growth and health(Chivers et al., 2010, Savage et al., 2007, Oddy et al., 2006b, Tamashiro and Moran, 2010, Bruce and Hanson, 2010). Breastfeeding is the optimal way of providing the best nutrition for the healthy growth and development of infants and closely related to health benefits to mothers(Ip et al., 2007, Binns et al., 2001). The WHO and most public organisations recommend exclusively breastfeeding for the first six months of life followed by breastfeeding supplemented with appropriate complementary foods for one year or longer(American Academy of Pediatrics, 2012, National Health and Medical Research Council, 2003, World Health Organization, 2001). Breastmilk promotes sensory and cognitive development in the infant, and confers protection against infections, Sudden infant death syndrome (SIDS), and chronic diseases, including obesity and diabetes(Allen and Hector, 2005, Wen et al., 2012). There are also maternal benefits, with evidence for a reduced risk of ovarian and breast cancer, hypertension, as well as a reduced risk of developing type 2 diabetes amongst women with a history of gestational diabetes(Lupton et al., 2013, National Health and Medical Research Council, 2003). In addition, breastfeeding is a cost-effective way to prevent disease, because it both improves infant health and continues to reduce chronic disease risk throughout the life cycle(Ma et al., 2013, Calnen, 2007, Saunders, 2010).

2.2.1 Breastfeeding in Australia

Australia has a long and successful history of providing prenatal and postnatal care through a network of community health nurses and general practitioners. The infant mortality declined from 82 deaths per 1000 live births in 1904 to 3.8 deaths per 1000 live births in 2011 by improving health, health care and nutrition(Australian Bureau of Statistics, 2012f, Australian Bureau of Statistics, 2010c).

Because of the potential beneficial effects on health of the infant and the mother, breastfeeding is recognised as one of the most important health initiatives. The Australian dietary guidelines and infant feeding guidelines recommend exclusive breastfeeding of infants to around six months of age, with the introduction of solid foods at around six months and continued breastfeeding for 6 to 12 months and beyond, if both mother and infant wish(National Health and Medical Research Council, 2013, National Health and Medical Research Council, 2012).

The breastfeeding rate and duration in Australia increased significantly over the last few decades. The 'any breastfeeding' rate was around 50-60% at discharged from hospital and less than a quarter of mothers were still breastfeeding at three months in the 1960s of Victoria, Australia (Lester, 1994). In the 1970s, breastfeeding rates started to rise in the higher socioeconomic mothers in Australia(National Health and Medical Research Council, 2012). By 1983, the 'any breastfeeding' rate at discharge of 85% and 54-55% at three months made Australia one of the highest in the western world(Palmer, 1985). The prevalence and duration of breastfeeding remained around this level for the next two decades(Donath and Amir, 2005).

Around 2005, the breastfeeding initiation rate in Australia was just above average among the Organisation for Economic Co-operation and Development (OECD) countries(Organisation for Economic Co-operation and Development, 2009). There has been a gradual increase in initiation and duration rates of breastfeeding in recent years. A longitudinal study of Australian children conducted by Australian Institute of Family Studies and funded by the Australian Government reveal a 92% of breastfeeding initiation in 2004(Australian Institute of Family Studies, 2008). However, the rate of 'any breastfeeding' decreased steadily from month to month. By the time the children were aged one month, the full breastfeeding rate was 71% and it fell to 62% at age 2 months, 56% at age 3 months and 46% at age 4 months, then it dropping to 28% at 5 months and 14% at 6 months(Australian Institute of Family Studies, 2008). At 12 months, only 28% of children were still breastfed; at 18 months, 9% of children; and at 24 months, 5% were still being breastfed(Australian Institute of Family Studies, 2008). Beyond this study, it is estimated from the combination of the results of several studies that 90-94% of mothers in Australia initiate breastfeeding, that is, the percentage ever breastfed(Graham, 2005, Centre for Epidemiology and Research, 2010, Australian Institute of Family Studies, 2008). The 'any breastfeeding' rate at six months of age is approximately 50%(Centre for Epidemiology and Research, 2010, Graham, 2005). The most recent national data are from 2010 Australian National Infant Feeding Survey which reported a breastfeeding initiation rate of 95.9% in children aged 0-2 years(Australian Institute of Health and Welfare, 2011). There were 68.7% infants receiving any breastmilk at four months, and at six months 60.1% infants were still breastfed(Australian Institute of Health and Welfare, 2011).

2.2.2 Breastfeeding in China

In China, the 'any breastfeeding' rates in the majority of cities and provinces including minority areas have been above 80% at four months since the mid-1990s(Xu et al., 2009). The mean duration of 'any breastfeeding' in the majority of cities or provinces was between seven and nine months, but only a small portion of Chinese mothers are still exclusively breastfeeding their infants at six months(Xu et al., 2009). It was reported that the 'exclusive breastfeeding' rates in Han, Uygur and 'other ethnic groups' at six months in Xinjiang

Province, P.R. China were 4.8%, 0.4% and 16.8% respectively(Xu et al., 2006). Another cohort study undertaken in Zhejiang Province, P.R. China reported the ‘exclusive breastfeeding’ rates by sixth months were 0.2%, 0.5% and 7.2% in city, suburb and rural areas respectively(Qiu et al., 2010). The breastfeeding initiation rate in Chengdu was reported as 92.6 % to 96.5 % in different studies, which was similar to the average level in large cities in China(Xu et al., 2009, Cui, 1999, Ran et al., 2008). At four months, about 40%-54% infants had been introduced to foods other than breastmilk in Chengdu(Xu et al., 2009, Cui, 1999, Ran et al., 2008). A recent cohort study from Chengdu reported that 96.5% of mothers gave their infants prelacteal feeds, which means the “exclusive breastfeeding” was less than 3.5% at discharge(Cui, 1999) .

2.2.3 Breastfeeding in Chinese immigrants in Australia

Australia has a culturally diverse population of 22.5 million, with 27% (6.0 million people) of the estimated resident population born overseas in 2011(Australian Bureau of Statistics, 2012g, Australian Bureau of Statistics, 2012b). During the period of 2006 to 2011, net overseas migration made a significant contribution (61.3%) to population growth in the five most populous states of Australia, New South Wales (73.0%), Victoria (64.5%), Queensland (46.4%), Western Australia (60.9%) and South Australia (80.5%)(Australian Bureau of Statistics, 2012b).

Australians come from a variety of backgrounds, helping to shape and enrich the nation through their varied contributions. In 2010, nearly 31% of people aged 18 years or over living in Australia were born overseas(Australian Bureau of Statistics, 2011d). Of these 5.1 million people, two third (67%) were born in a non-English-speaking country and the rest were born in main English-speaking country. The proportion of people born in either Australia or in other main-English speaking countries has declined slightly across each of the three iterations of the survey (from 83% in 2002 to 82% in 2006 to 80% in 2010)(Australian Bureau of Statistics, 2011d).

The most common overseas-born residents originated from United Kingdom, New Zealand, China, India and Vietnam and Italy, with China proportionally the fastest growing of these groups(Australian Bureau of Statistics, 2012g). In recent decades the focus of Australian immigration has shifted from Europe to Asian and China is now the largest source of immigrants(Australian Bureau of Statistics, 2008c). In all overseas-born residents, people born in the China is the third largest group, accounting for 1.8% of Australia's total population at 30 June 2011(Australian Bureau of Statistics, 2012g). In the 2006 Australian Census 669,890 residents identified themselves as having Chinese ancestry and the number is increasing by 7.7% per year(Australian Bureau of Statistics, 2007). There were 53,390 Chinese born residents in Perth in 2006, including 5527 children about 2.9% of the city's population(Australian Bureau of Statistics, 2008a) .

In Australia the majority of women choose to breastfeed, however, initiation rates are not consistent across all ethnic groups(Australian Institute of Health and Welfare, 2011). Researchers have found that non-English speaking backgrounds women had lower breastfeeding initiation rates than their Australian-born counterparts(Scott et al., 2001, Williams and Carmichael, 1983). A study reported a breastfeeding rate of 88.9% with women born outside Australia having lower odds of having breastfed (aOR 0.78, 99% CI 0.72-0.84, $p<0.001$) compared to women born in Australia(Lupton et al., 2013). In particular, Chinese-speaking women were reported to have a lower initiation of breastfeeding compared with other ethnic groups of women(Homer et al., 2002). A survey on the initiation and duration of breastfeeding in Chinese mothers in Perth, Western Australia revealed that fewer than 7% of Chinese mothers were still fully breastfeeding at 6 months(Li et al., 2004).

2.2.4 Benefits of breastfeeding

Breastfeeding has long-lasting health benefits for mothers and infants and it also brings economic benefits to the family and to society. The protective effects of breastfeeding have been demonstrated by epidemiological evidence in both developed and developing countries(Ip et al., 2007, Horta et al., 2007). There is no deficit in growth among infants who are exclusively breastfed for six months or longer compared to those who are not exclusively breastfed(Kramer and Kakuma, 2002, Kramer and Kakuma, 2012, Nielsen et al., 2011, Wells et al., 2012).

These facts provide the basis for the recommendations of exclusive breastfeeding for about 6 months, made by many national authorities. In 2001, the report of a WHO Expert Consultation recommended exclusive breastfeeding for the first six months of life(World Health Organization, 2001). This was followed by the United Nations Children's Fund (2003), the American Academy of Pediatrics (AAP) Section on Breastfeeding (2001), the American College of Obstetricians and Gynecologists (2005), the Canadian Paediatric Society (CPS) (2005), the American Academy of Family Physicians (2007), the Academy of

Breastfeeding Medicine (2008), the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) (2009)(American Academy of Pediatrics, 2005, World Health Organization and United Nations Children's Fund, 2003, American College of Obstetricians and Gynecologists, 2005, Boland, 2005, American Academy of Family Physicians, 2007, Academy of Breastfeeding Medicine, 2008, Agostoni, 2009).

The Australian National Health and Medical Research Council (NHMRC) recommended exclusive breastfeeding to around 6 months of age in 2003. It further advised women to continue breastfeeding with appropriate complementary foods until 12 months of age and beyond, for as long as the mother and child desire(NHMRC, 2003). A similar recommendation has been endorsed by the Chinese government(National Health and Family Planning Commission, 2012).

Although infants should still be managed individually so that to prevent insufficient growth or other adverse outcomes and provide appropriate interventions, the available evidence demonstrates no apparent risks in recommending, as a general policy, exclusive breastfeeding for the first 6 months of life in both developing and developed countries(Kramer and Kakuma, 2012).

2.2.4.1 Benefits to the infant

Breastmilk is the ideal and preferred food for all preterm and term infants for the first year of life. Breastfeeding has a range of positive effects on the nutritional, physical and psychological health and development of the infant.

Better cognitive and motor development

Since the first report in 1929, many observational studies have shown that the method of feeding in early life affects cognitive development and that breastfeeding was associated with higher scores at tests on cognitive abilities than formula feeding(Hoefer and Hardy, 1929, Whitehouse et al., 2011, Anderson et al., 1999). A meta-analysis reported a benefit of 3.16 (95% CI: 2.35, 3.98) points in cognitive function for breastfed compared with formula-fed children. The significantly higher levels of cognitive function were observed in breastfed than in formula-fed children at 6–23 months of age and these differences were stable across successive ages(Anderson et al., 1999). Another meta-analysis indicated similar results that children who were breastfed for at least 1 month had higher scores on intelligence tests (mean difference 4.9; 95% CI 2.97 – 6.92) than those who were never breastfed or breastfed for less than 1 month(Horta et al., 2007).

The cognitive benefit from breastmilk becomes more pronounced with longer duration of breastfeeding and exclusive breastfeeding. A large cluster-randomized trial of breastfeeding performed from 1996 to 2005 concluded that the promotion of breastfeeding, resulting in a longer exclusive breastfeeding and 'any breastfeeding' duration and improved cognitive development in children(Kramer et al., 2008). A recent birth-cohort study from France also provided evidence for causality(Bernard et al., 2013). It reported that longer breastfeeding duration was associated with better cognitive and motor development in 2 and 3 years old children and a dose–response relationship was suggested(Bernard et al., 2013). Exclusive-breastfeeding duration was also associated with problem solving and tended to be associated with both gross and fine motor domains. The fine motor domain was the domain most strongly associated with any-breastfeeding duration(Bernard et al., 2013).

The benefits in cognitive development from breastmilk are more obvious in preterm infants than full-term infants(Anderson et al., 1999). Cohort studies at 8 years of age through adolescence suggest that intelligence test results and total brain volumes are greater in children who had received breastmilk as infants in the neonatal intensive care unit (NICU)(Lucas et al., 1998, Isaacs et al., 2010). Extremely low birth weight infants receiving more proportion of breastmilk in the NICU had significantly greater scores for mental, motor, and behavior ratings at ages 18 months and 30 months(Vohr et al., 2006, Vohr et al., 2007). These results remain significant after adjustment for confounding factors, such as maternal age, education, marital status, race, and infant morbidities. This response of greater cognitive gain in preterm infants than full-term infants may be due to the higher concentration of the polyunsaturated long-chain fatty acid docosahexaenoic acid (DHA) in breastmilk(Fleith and Clandinin, 2005).

Reduce mortality and morbidity

Exclusive breastfeeding for 6 months and weaning after 1 year is the most effective intervention, with the potential of preventing more than 1 million infant deaths per year, equal to preventing 13% of the world's childhood mortality(Jones, 2003). It was estimated that 45% of neonatal infectious deaths, 30% of diarrhoeal deaths and 18% of acute respiratory deaths in children under five years were due to suboptimal infant feeding globally(World Health Organization, 2009). A large number of studies have demonstrated that breastfeeding is associated with a reduced morbidity and mortality of a number of diseases or severity of conditions in childhood and later life, including:

• **Respiratory tract infections and otitis media：** Exclusive breastfeeding for more than 4 months is responsible for 72% reduced risk of hospitalization for lower respiratory tract infections in the first year(Ip et al., 2007, Ip et al., 2009). Nationally representative data from US shows that infants who fully breastfed for 4 to 6 months had a greater risk of pneumonia (6.5%) compared with infants who fully breastfed for 6 months (1.6%)(Chantry et al., 2006). Compared with never-breastfed infants, the risks of upper respiratory tract infections and lower respiratory tract infections reduced by 38% and 39% respectively in those who were breastfed for 6 months or longer(Duijts et al., 2010). The severity (the duration of hospitalization and the rate of requiring oxygen therapy) of respiratory syncytial virus infection is reduced by 74% in the 'full breastfed' infants compared with never or partially breastfed infants(Nishimura et al., 2009).

'Any breastfeeding' compared with never breastfeeding will reduce the incidence of otitis media by 23%(Ip et al., 2007). The risk of otitis media was reduced by 50% when comparing infants who were exclusively breastfed for at least 3 months with those who were not breastfed(Ip et al., 2007).

• **Physiological reflux:** Some studies have found that exclusively breastfed infants have less frequent physiological reflux and shorter episodes of reflux than partially breastfed infants, although further studies are needed to confirm this conclusion(Hegar et al., 2009, Owens, 2012)

• **Gastrointestinal infections:** 'Any breastfeeding' is associated with a 64% reduction in the incidence of nonspecific gastrointestinal tract infections, and this effect lasts for 2 months after cessation of breastfeeding(Ip et al., 2007, Ip et al., 2009, Duijts et al., 2010, Quigley et al., 2007, Gribble, 2011). Breastfeeding for 6 months or longer can reduce the gastrointestinal tract infections by 55% (Duijts et al., 2010).

• **Childhood Leukemia and Lymphoma:** A longer duration of breastfeeding has protective effect against leukemia in childhood(Ip et al., 2009, Kwan et al., 2004, Bener et al., 2008). There is a reduction of 20% in the risk of acute lymphocytic leukemia and 15% in the risk of acute myeloid leukemia that is associated breastfeeding for 6 months or longer(Rudant et al., 2010, Kwan et al., 2004). Whether the protective effect of breastfeeding is a direct associated with breastfeeding on malignancies or indirect through its reduction of early childhood infections has been unclear.

• **Necrotising enterocolitis in preterm infants:** The meta-analysis of four randomized clinical trials with a total of 476 preterm infants support the conclusion that feeding preterm infants breastmilk is associated with a significant reduction (58%) in the development of necrotizing enterocolitis (NEC)(Ip et al., 2007). A more recent study noted that extremely premature infants receiving exclusively breastmilk had significantly lower rates of NEC (50% reduction) and NEC requiring surgical intervention (90% reduction) compared with those receiving a diet containing milk - based infant formula products (Sullivan, 2010). It is estimated that one case of NEC could be prevented if 10 infants fed with an exclusively breastmilk, and 1 case of NEC requiring surgery or resulting in death could be prevented if 8 infants fed with an exclusively breastmilk(Sullivan, 2010).

• **Allergy disease and asthma:** There is a protective effect of exclusive breastfeeding for 3 to 4 months in reducing the incidence of clinical asthma, atopic dermatitis, and eczema by 27% in a low-risk population and up to 42% in infants with positive family history(Greer et al., 2008). There are conflicting studies that examine the timing of introducing solid food and the risk of allergic diseases, including food allergies, atopic dermatitis, and asthma(Zutavern et al., 2006, Zutavern et al., 2008, Greer et al., 2008, Ip et al., 2007, Symon and Bammann, 2012, Prescott and Nowak-Wegrzyn, 2011, Nwaru et al., 2013). One problem in analysing this research is the low prevalence of exclusive breastfeeding at 6 months in the study populations. Thus, research outcomes in studies that examine the development of allergy disease and the timing of introducing solid foods in partially breastfed infants may not be applicable to exclusively breastfed infants(American Academy of Pediatrics, 2012).

Most national organisations and the WHO recommend exclusive breastfeeding to 6 months of age, followed by continued breastfeeding while complementary foods are introduced, as the best way of optimising infant nutrition and health and reducing the risk of allergy(World Health Organization and United Nations Children's Fund, 2003, American Academy of Pediatrics, 2012, National Health and Medical Research Council, 2012). Recent statistics released by the Australian Institute of Health and Welfare (AIHW) show that the prevalence of current asthma among children are falling in the recent decades while the rates of exclusive breastfeeding in Australia are increasing and solid foods are being introduced later(Binns, 2013, Australian Institute of Health and Welfare, 2011). It is more likely that exclusive breastfeeding is protecting against asthma.

• **Type 1 and type 2 diabetes:** Breastfeeding was considered a modifiable risk factor for the development of diabetes(Owen et al., 2005). Both women with and without diabetes should be encouraged to breastfeed their children(Gouveri et al., 2011). Infants exclusively breastfed for at least 3 months are reported to have up to a 30% reduction in the incidence of type 1 diabetes mellitus(Rosenbauer et al., 2008, Ip et al., 2007). The mechanism for this apparent protective effect of breastfeeding is still unclear, but avoiding exposure to cow milk β-lactoglobulin, which stimulates an immune-mediated process cross reacting with pancreatic β cells, have been proposed(American Academy of Pediatrics, 2012).

Breastfeeding has been shown to be protective for type 2 diabetes mellitus, with a reduction of 37% in the incidence(Horta et al., 2007). The evidence linking breastfeeding and type 2 diabetes is inconclusive. The association was present in retrospective case-control studies relying on long-term recall but not in studies that used existing infant records to determine breastfeeding initiation and duration(Ip et al., 2007). However, there is an indirect relationship through infant growth. It possibly reflects the long-term positive effect of breastfeeding on weight control and feeding self-regulation(Eriksson et al., 2003, Knip et al., 2010).

• **Coeliac disease:** Breastfeeding at the time of gluten exposure, and increasing duration of breastfeeding were associated with reduced risk of developing coeliac disease(Akobeng et al., 2006). The risk of coeliac disease reduced by 52% in infants who were breastfed during the introduction of dietary gluten compared to infants who were not breastfed. It is not the timing of gluten introduction but the breastfeeding at the time of the gluten ingestion that appears to be the critical protective factor. Thus, gluten-containing foods should be introduced while continuing breastfeeding(American Academy of Pediatrics, 2012).

• **Inflammatory bowel disease:** Systematic review shows an association between breastfeeding and a 31% reduction in the risk of childhood inflammatory bowel disease(Barclay et al., 2009). It has been postulated that the mechanism in the development of inflammatory bowel disease results from the interaction of the immunomodulating effect of breastmilk and the underlying genetic susceptibility of the infant(Penders et al., 2006).

• **Cardiovascular disease risk factors:** There is evidence that breastfeeding is inversely associated with blood cholesterol concentration levels and blood pressure levels in later life, which are major risk factors for cardiovascular disease(Martin et al., 2005, Horta et al., 2007, Ip et al., 2007, Owen et al., 2008). Results from two meta-analyses concluded that a small reduction in systolic blood pressures among adults was associated with breastfeeding, although there was a possibility of publication bias and residual confounding(Martin et al., 2005, Ip et al., 2007).

Two systematic review of observational studies found breastfeeding is associated with lower blood cholesterol concentrations in later life after adjusting for potential confounders(Owen et al., 2008). The positive effect is stronger and more consistent in exclusively breastfed infants compared to nonexclusively breastfed infants(Owen et al., 2002, Owen et al., 2008).

• **Obesity in childhood and in later life:** There is convincing evidence that, compared to infants who are formula fed, the risk of becoming obese in childhood, adolescence and early adulthood is significant lower in breastfed infants(Owen et al., 2005, Horta et al., 2007, Ip et al., 2007). Although complex factors confound studies of obesity, 'any breastfeeding' is related to a 15% to 30% reduction in adolescent and adult obesity rates(Owen et al., 2005, Ip et al., 2007, Monasta et al., 2010). The protective effects of breastfeeding are positively related to the duration of breastfeeding and probably plateaus at 9 months, each month of breastfeeding being associated with a 4% reduction in risk of overweight(Harder et al., 2005, Ip et al., 2009, White House task Force on Childhood Obesity, 2010).

A clear definition of how breastmilk was given, by breastfeeding or by bottle, is of particular importance of the interpretation of these data. It is because infants can self-regulate intake while breastfeeding and bottle fed infants will have increased bottle empting, poorer self-regulation and excessive weight gain in late infancy (older than 6 months)(Dewey and Lonnerdal, 1986, Li et al., 2008, Li et al., 2010). Besides, familial factors may also confound associations between breastfeeding and obesity in later life(Burke et al., 2005).

• **Sudden Infant Death Syndrome**: Recent data support the protective effect of breastfeeding on SIDS even when taking into account potential confounding factors(Ip et al., 2009, Vennemann, 2009, Hauck et al., 2011). Meta-analyses with an objective definition of SIDS, a clear reporting of breastfeeding data, and adjusted for confounders and other known risks for SIDS note that breastfeeding is associated with a 36% reduced risk of SIDS(Ip et al., 2007). A recent meta-analysis reported that 45 % of SIDS could be prevent if infants had received 'any breastfeeding' after adjusting confounders(Hauck et al., 2011). It also found that the effect is stronger when breastfeeding is exclusive, with a univariable summary OR of 0.27 (95% CI: 0.24–0.31) for exclusive breastfeeding of any duration(Hauck et al., 2011).

2.2.4.2 Benefits to the mother

There is evidence that breastfeeding reduces the risk of ovarian and breast cancer in mothers (particularly in premenopausal breast cancer)(Ip et al., 2007). A meta-analysis of 47 epidemiological studies in 30 countries reported a relative risk of breast cancer reduction of 4.3% (95% CI 2.9－5.8) for every one year of breastfeeding in addition to a decrease of 7.0% (95% CI 5.0－9.0) for each birth(Collaborative Group on Hormonal Factors in Breast Cancer, 2002). The reduction of the risk did not differ significantly for women in developed and developing countries, and did not vary significantly by age, menopausal status, ethnic origin, the number of births a woman had, her age when her first child was born, or any of nine other personal characteristics examined(Collaborative Group on Hormonal Factors in Breast Cancer, 2002). A case-control study from Southern China found that prolonged breastfeeding was associated with a lower risk of ovarian cancer(Su, 2013). There is a 91% of reduction in the risk of ovarian cancer for women who breastfed more than 31 months compared with those who breastfed less than 10 months(Su, 2013).

Breastfeeding has been suggested to reduce the incidence of type 2 diabetes mellitus among women without a history of gestational diabetes(Stuebe et al., 2005, Ip et al., 2007, Gouveri et al., 2011). For each additional year of lactation, women who reported a birth in the past 15 years had a decrease in the risk of diabetes of 15% (95% CI 1%-27%) and of 14% (95% CI 7%-21%) in two national cohort studies from US, controlling for maternal body mass index and other relevant risk factors for type 2 diabetes (Stuebe et al., 2005). In models controlling for age and parity, each year of lifetime exclusive breastfeeding was associated with a 37% (95% CI 27%-46%) reduction of risk for type 2 diabetes, while each year of total breastfeeding was associated with a 24% (95% CI 19%-29%) reduction of risk for(Stuebe et al., 2005).

Early initiation and increased frequency of breastfeeding reduces the risk of postpartum haemorrhage (thus reducing maternal mortality)(Sobhy and Mohame, 2004). As well, preservation of postnatal haemoglobin stores through reduced blood loss leads to improved iron status(Sobhy and Mohame, 2004, Chan et al., 2001). Women with longer breastfeeding duration had lower rate of anemia(Pei et al., 2013).

There is also evidence that breastfeeding helps the mother return to her pre-pregnancy weight(Ip et al., 2007). Exclusive breastfeeding was associated with approximately 1 kg weight loss from pre-pregnancy to 1 year postpartum. Once breastfeeding was stopped, slower rates of weight loss were observed. Exclusively breastfeeding women regained their pre-pregnancy weights about 6 months earlier than women who exclusively bottle-fed their infants(Ip et al., 2007).

Although breastfeeding is not regarded as a reliable method of contraception for individual women, it does provide useful benefits on a population basis. There is probable evidence that women who exclusively breastfeed for 6 months experience longer lactational amenorrhoea(Lopez et al., 2010). Women who are in the periods of lactational amenorrhea and fully or nearly fully breastfeeding day and night in the first 6 months had cumulative pregnancy rates as low as 1.7%(Short et al., 1991, Heinig et al., 1994, World Health Organization, 1995). The WHO considers breastfeeding to be a potential family planning method in women's and children's health programs in developed and developing countries(Sunil and Sunil, 2001). It is estimated that if all women in the world stopped breastfeeding, 30 to 50% more children would be born in the following year(Becker et al., 2003, Labbok, 2006).

2.2.4.3 Psychological benefits

The desire to experience a sense of bonding or closeness is an important factor that a mother breastfeeds. The interdependence between the breastfeeding mother and infant, regular close interaction and skin-to-skin contact during breastfeeding encourage mutual responsiveness and attachment(Moore et al., 2009).

In addition, breastfeeding may help to lower the risk of postpartum depression, a serious condition that 10% to 15% of mothers experience after giving birth(Ohara, 1996, Mallikarjun and Oyebode, 2005). The prevalence of postpartum depression was reported even higher in Chinese women with a rate of 15.5% and 17.3% respectively from two studies in urban

China(Wan et al., 2009, Xie et al., 2007). This disorder poses risks not only to the mother's health but also to the health of the infant, because of impaired maternal-infant interactions and negative perceptions of infant behaviour(Ohara, 1996). Although no conclusion has been made in literature, some studies reported that more exclusively breastfeeding and longer durations of breastfeeding could reduce the risk of postpartum depression(Gaffney et al., 2012, Mancini et al., 2007, Green et al., 2006b). However, whether postpartum depression influences breastfeeding or vice versa remains equivocal(Dennis et al., 2009).

2.2.4.4 Economic effects

In addition to the health advantages of breastfeeding for mothers and their children, there are economic benefits associated with breastfeeding for families, communities and the whole society. As well as saving the expenditure on infant formula, better infant health from the impact of breastfeeding will led to fewer health costs and health insurance claims, less employee leave for caring sick children, and higher productivity for working parents. In 2002, it was calculated that formula feeding led to an extra cost of $1 to 2 million per year in Australian Capital Territory from five childhood diseases (gastrointestinal illness, respiratory illness, otitis media, eczema and necrotising enterocolitis)(Smith et al., 2002). A recent study has estimated that more than 900 infant deaths per year may be prevented and the $13 billion per year could be saved from treating a variety of illnesses in the United States if 90% of mothers exclusively breastfed for the first 6 months(Bartick and Reinhold, 2010).

2.2.5 Determinants of breastfeeding

Breastfeeding generally refers to a mother feeding an infant at her breast but may refer also to feeding breastmilk from a bottle(Weimer, 2001). Factors that have been reported to be associated with initiation and duration of lactation after birth are categorised and discussed below.

2.2.5.1 Socio-demographic factors

Maternal Age

Internationally, maternal age at the time of birth has been repeatedly reported to be associated with breastfeeding initiation and duration, but the direction of the association differs between cultures. Older women are more likely to initiate breastfeeding than younger women in most countries(Scott et al., 2001, Grjibovski et al., 2005, Kambale, 2011). According to a study in

Australia, a 30 years old mother was 1.5 times more likely to be breastfeeding at discharge compared to a 20 years old mother (OR=1.51, 95%CI 1.00–2.29)(Scott et al., 2001). However, studies in Chinese population regarding the determinants of breastfeeding initiation show different results. No association was reported between maternal age and breastfeeding initiation for Chinese immigrants who had given birth in Australia, but for those who had given birth before immigration, younger age was associated with higher rates of breastfeeding initiation (OR=0.80; 95% CI, 0.71-0.90)(Li et al., 2004). Similarly, a cohort study in Zhejiang Province, China found a significantly lower likelihood of 'exclusive breastfeeding' among mothers older than 24 years old(Qiu et al., 2009). The results of another cohort study among Chinese women in Xinjiang Uygur Autonomous Region indicated no association between maternal age at birth and breastfeeding at discharge(Xu et al., 2007a).

There were also conflicting results on association between breastfeeding duration and maternal age(Scott et al., 2006b, Kohlhuber et al., 2008). Some studies carried out in Chinese population showed an inverse association between maternal age and duration of 'any breastfeeding'(Qiu et al., 2010, Tarrant et al., 2010). Regarding the duration of 'exclusive breastfeeding', two cohort studies took place in Xinjiang and Zhejiang Province, China found no association between 'exclusive breastfeeding' within 6 months and maternal age(Xu et al., 2007b, Qiu et al., 2010).

Education

Several studies have found that maternal education is positively associated with breastfeeding initiation after adjusting potential confounders(Jones et al., 2011, Chuang et al., 2010). However, other studies have found no association between maternal education and breastfeeding at discharge(Scott et al., 2001, Kambale, 2011, Riva et al., 1999, Xu et al., 2007a).

Numerous studies have identified that mothers with higher education level are more likely to breastfeed for a longer duration(Scott et al., 2001, Riva et al., 1999, Grjibovski et al., 2005, Kohlhuber et al., 2008, Amin et al., 2011, Ladomenou et al., 2007, Kimani-Murage et al., 2011). Several studies carried out in Chinese populations also showed positive association between mother's education level and the duration of breastfeeding(Chuang et al., 2010, Tarrant et al., 2010). However, some studies from mainland China found no association between maternal education and breastfeeding duration(Qiu et al., 2010, Xu et al., 2007b). One study conducted in a rural area of Taiwan even found a negative association between maternal education level and breastfeeding duration. Employed mothers and those with higher education level were more likely to discontinue breastfeeding before infants were 4 months old(Chang and Chan, 2003). These results suggest that breastfeeding associations with education may be confounded by the working status of mothers.

Household income

Some studies in developed societies have found that women with higher family income are more likely to initiate breastfeeding and have longer breastfeeding duration(Meedya et al., 2010, McLeod et al., 2002, Riva et al., 1999). However, the relationship sometimes reverses in less developed societies. Women in developing countries may consider infant formula more valuable in nutrition, more fashionable and 'westernized'(Rogers et al., 1997). Studies did in Chinese population failed to find an association between family income and breastfeeding duration(Tarrant et al., 2010, Xu et al., 2007b, Qiu et al., 2010).

Maternal employment

The association between mother's employment (back to work) and breastfeeding initiation has been evaluated by many studies, but the results are not conclusive(Scott and Binns, 1999, Dennis, 2002). A large-population based prospective longitudinal study in Taiwan showed that returning to work within one month postpartum was negatively related with the initiation of breastfeeding(Chuang et al., 2010). It was also reported that unemployed mothers had a significant higher initiation rate of 'exclusive breastfeeding' compared with employed mothers(Pechlivani et al., 2005). However, a national survey in Italy revealed a positive relationship between employment status and breastfeeding initiation. This finding may be explained by bias in data collection or management, interaction with maternal education or most working mothers were part-time employees(Kambale, 2011).

Internationally, maternal employment has been consistently identified as a risk factor associated with prolonged duration of breastfeeding. A cohort study of 587 women in Australia found that early return to work was negatively associated with breastfeeding duration(Scott et al., 2006b). Another cross-sectional study in Saudi Arabia reported that more mothers without employment exclusively breastfed their babies in the first 6 months than those who were employed(Amin et al., 2011). Studies in China also showed that an early maternal return to work, especially within 6 months postpartum, was negatively related with breastfeeding duration(Qiu et al., 2010, Chuang et al., 2010). A recent study among Chinese populations found that compared to mothers who worked full-timely, unemployed mothers were 1.57 times likely to breastfeed at six months (95% CI: 1.07-2.28)(Chen et al., 2013b).

2.2.5.2 Biomedical factors

Parity

It was reported that multiparous women were less likely to breastfeed their babies than primiparous women(Scott et al., 2001). There are a few Chinese studies indicated influence of parity on breastfeeding initiation(Leung et al., 2002, Chuang et al., 2010). Conversely, not all the studies have found the association between birth order and breastfeeding initiation(Dashti et al., 2010, Riva et al., 1999, Grjibovski et al., 2005, Xu et al., 2007a).

There are conflicting studies that explore the number of births and the risk of early cessation of breastfeeding. A cohort study of 1399 mothers in Russia showed that ‘no previous deliveries’ was a protective factor for longer breastfeeding duration (OR=0.74, 95% CI: 0.62–0.90). However, some studies from other countries have the reported opposite results. A US national survey found that each increase in parity of one birth resulted in a 1.7 times greater likelihood of continuing breastfeeding for more than six months (OR=1.69, 95% CI 1.07–2.68)(Piper and Parks, 1996). Parity was also shown to contribute to longer ‘exclusive breastfeeding’ in a cross-sectional survey of 641 mothers in Saudi Arabia (OR=1.15, 95% CI 1.01–1.30)(Amin et al., 2011). There are other studies that found similar breastfeeding duration between primiparous and primiparous women(Riva et al., 1999, Scott et al., 2006b). No previous cohort studies undertaken in China have reported an association between parity and the duration of breastfeeding(Chuang et al., 2010, Tarrant et al., 2010, Qiu et al., 2010).

Caesarean section

The withdrawal of progesterone and changes in breastmilk composition following delivery by caesarean section are similar to those following normal delivery(Chapman and Perez-Escamilla, 1999, Kulski et al., 1981). There is limited evidence that delivery by caesarean section may be negatively associated with the initiation of breastfeeding, particularly exclusive breastfeeding, and to shorter breastfeeding duration(Scott et al., 2006a, Prior et al., 2012, Patel and Liebling, 2003, Zanardo et al., 2010). Not all studies have found differences between women with caesarean-section delivery and women with vaginal delivery for the initiation or duration of breastfeeding(Patel and Liebling, 2003, Scott et al., 2006b, Scott et al., 2001, Kohlhuber et al., 2008, Kambale, 2011, Riva et al., 1999, Grjibovski et al., 2005).

The results of association between method of delivery and breastfeeding initiation in studies among Chinese mothers were not consistent. Several studies reported that mothers with caesarean sections were not less likely to initiate breastfeeding compared with mothers with vaginal delivery(Xu et al., 2007a, Leung et al., 2002, Li et al., 2004). But a study carried out among Chinese in Taiwan found that caesarean deliveries are associated with a decreased rate of exclusive breastfeeding compared with vaginal delivery (OR=0.74, 95% CI 0.68–0.81)(Chuang et al., 2010).

It was suggested that a caesarean delivery may not influence breastfeeding duration once breastfeeding is established(Scott and Binns, 1999). However, a study in Germany found caesarean section delivered infants were more likely to have shorter breastfeeding duration (<4 months) than vaginal delivered infants (OR=1.69, 95% CI 1.36–2.10)(Kohlhuber et al., 2008). Based on the results of most studies carried out in China, caesarean section has not been shown to be a risk factor associated with the duration of either 'exclusive breastfeeding' or 'any breastfeeding'(Chang and Chan, 2003, Qiu et al., 2010, Xu et al., 2007b). However, a recent study carried out in Australia and China Chinese mothers found caesarean section delivery was responsible to a 35% and 47% of reduction in 'any breastfeeding' at 6 and 12 months respectively(Chen et al., 2013b).

These differences in lactation initiation and duration may be related to the type of anaesthesia used, the postpartum support for women who deliver by caesarean section and the prevalence of caesarean section in the population(Zanardo et al., 2010). For instance, the inability of women who have undergone a cesarean section to breastfeed comfortably in the delivery room may delay the first breastfeed, and it is suggested that initiating breastfeeding within 1 hour of birth is associated with improved breastfeeding outcomes(Rowe-Murray and Fisher, 2002, Rutishauser and Carlin, 1992). Where possible, management of breastfeeding after a caesarean section delivery should not be differ to that after a vaginal birth(National Health and Medical Research Council, 2012).

Maternal obesity

Maternal obesity adversely affects the initiation of breastfeeding and breastfeeding duration, and has been associated with a less adequate milk supply(Phillips et al., 2004, Sichieri et al., 2009, Turcksin et al., 2012, Nommsen-Rivers et al., 2010). Women who began pregnancy overweight or obese had up to almost four times (OR from 1.19 to 3.94) the risk of not initiating breastfeeding compared with other women after adjusting for potential confounders(Mehta et al., 2011, Turcksin et al., 2012). The biological reasons for the risk effect of obesity on breastfeeding initiation may include the higher concentrate of progesterone in adipose tissues in obese women leading to a reduced prolactin response and a subsequent delay in the onset of lactogenesis stage II(Sichieri et al., 2009, Nommsen-Rivers et al., 2010). An alternative explanation is that impaired suckling as a result of mechanical difficulties leads to the diminished prolactin response, suggesting a physical rather than a physiological mechanism(Stookey et al., 2007). Despite initial difficulties, with sufficient lactation guidance the vast majority of overweight women are able to successfully establish exclusive breastfeeding(Phillips et al., 2004). A systematic review of fifteen studies conducted in the USA, Australia, Denmark, Kuwait and Russia, have found that obese women breastfed for a shorter duration than normal weight women, even after adjusting for possible confounding factors(Amir and Donath, 2007). Obese women also have a significant higher risk of an early discontinuation of breastfeeding at any time, with hazard ratios ranging from 1.24 to 2.54(Turcksin et al., 2012).

Smoking

Postpartum smoking has been reported as a barrier to breastfeeding by numerous studies(Liu et al., 2006a, Yang et al., 2004, Bailey and Wright, 2011, Weiser et al., 2009, Brown et al., 2013, DiSantis et al., 2010). Population-based studies in Canada and US reached a similar conclusion that smoking mothers were half as likely as non-smokers to commence breastfeeding(Yang et al., 2004, Bailey and Wright, 2011). Few studies of breastfeeding among Chinese mothers have examined the association between mother's smoking and breastfeeding initiation, mainly because the rates of smoking Chinese women remain low. A study in Hong Kong found that maternal smoking was a significant barrier to initiate breastfeeding (OR=0.35, 95% CI 0.25–0.50)(Leung et al., 2002).

Maternal smoking has been shown to be strongly and associated with early weaning of breastfeeding(Liu et al., 2006a, Brown et al., 2013, Donath and Amir, 2004, Giglia et al., 2006, Horta, 1997, DiSantis et al., 2010). A population-based cohort study from Poland reported that persistent smokers (mothers who smoked before, during, and after pregnancy) were 2.18 times more likely to stop breastfeeding at 10 weeks (95% confidence interval=1.52, 2.97). Heavy persistent smokers (women who smoked 10 or more cigarettes per day postpartum) were 2.3–2.4 times more likely to wean their infants before 10 weeks than were nonsmokers(Liu et al., 2006a). Women who smoked during pregnancy had an aOR (adjusted odds ratio) of 1.5 (95% CI: 1.3–1.7) of not breastfeeding at 6 months compared to non-smokers(Donath and Amir, 2004). The reason that women who smoke are less likely to breastfeed their infants has been reported to be largely due to lower motivation to breastfeed rather than a physiological effect of smoking on their milk supply(Donath and Amir, 2004). However further research is needed to exclude the possibility that tobacco smoke has a direct suppressive effect on lactation.

Moreover, environmental tobacco smoke was also an independent risk factor for breastfeeding after adjustment for maternal smoking and other confounders(Jones et al., 2011, Horta, 1997). One cohort study from China reported that breastfeeding rate was significantly lower in the paternal smoking group than in the non-smoking group(Xu et al., 2010).

Efforts in smoking cessation and decreasing the number of cigarettes smoked postpartum may increase breastfeeding duration(Liu et al., 2006a, Giglia et al., 2006, Higgins et al., 2010, Brown et al., 2013). After controlling for confounders, mothers who quit smoking during pregnancy did not have significantly higher risk for early weaning than non-smokers(Liu et al., 2006a). Encouraging smoking cessation during pregnancy and postpartum is an area for considerable public health gain(Giglia et al., 2006).

2.2.5.3 Psychosocial factors

Prenatal intentions

Research has shown that the timing of decision to breastfeed was related to the initiation of breastfeeding. Based on a study in Australia, women who declared intentions prenatally to breastfeed were more likely to initiate breastfeeding than those who made the decision during the pregnancy or after the delivery (OR=3.27, 95% CI 1.72–6.04)(Scott et al., 1997). However, previous studies of breastfeeding among Chinese mothers failed to find the association between when feeding method decision was made and breastfeeding at discharge(Qiu et al., 2007).

Survival analysis of duration of breastfeeding in the first 6 months postpartum found that women who intended to breastfeed for less than 1 month were 78% more likely to stop at any given time than women planning to breastfeed for at least 4 months(Donath and Amir, 2004).

Maternal and paternal infant feeding attitudes

The factors influencing breastfeeding rates and duration are complex. In recent few decades, factors such as maternal and paternal breastfeeding knowledge and attitudes are getting increasing attention by researchers(Shaker et al., 2004, Sittlington et al., 2007, Arora et al., 2000, Cohen et al., 2002, Li et al., 2004, Dashti et al., 2010, Chen et al., 2013a). Maternal and paternal infant feeding attitudes are shown to be stronger predictors of choice of feeding method and breastfeeding duration than demographic characteristics(Dungy et al., 1994). Numerous studies have reported that mothers were more likely to initiate breastfeeding if they perceived positive support for breastfeeding from their partners, regardless of maternal age, education level and parity(Scott et al., 2001, Wolfberg et al., 2004, Kohlhuber et al., 2008). A recent randomized controlled trial from Perth, Western Australia reported that postnatal support from fathers significantly increased rate and duration of 'any breastfeeding'(Maycock et al., 2013). It was reported from two studies on Chinese mothers who gave birth in China that paternal attitude toward breastfeeding was not related to breastfeeding at discharge(Li et al., 2004, Qiu et al., 2007). However, father's preference for breastfeeding was positively associated with the initiation of breastfeeding among Chinese mothers who gave birth in Australia(Li et al., 2004). Another cross-sectional study carried out in a rural place of Taiwan showed that the perceived support of breastfeeding from fathers was positively associated with breastfeeding initiation(Chang and Chan, 2003).

Maternal knowledge and infant feeding attitude was directly related to breastfeeding outcomes. A recent study on infant feeding attitude of Chinese mothers living in China and Australia found that mothers with attitude towards breastfeeding (tested by the Iowa Infant Feeding Attitude Scale) were significantly more likely to breastfeed their babies. It also reported a longer breastfeeding duration in those mothers with more positive attitude towards breastfeeding(Chen et al., 2013a).

2.2.5.4 Health-service related factors

Antenatal classes

The effect of antenatal classes on the initiation of breastfeeding is inconsistent. Previous intervention studies have shown that prenatal breastfeeding education programs can exert a positive influence on the initiation of breastfeeding(Fairbank et al., 2000). A recent large population-based retrospective cohort study also demonstrated that women who did not attend prenatal classes were less likely to be exclusively breastfeeding at discharge than those who did (OR=0.80, 95% CI 0.76–0.83)(McDonald et al., 2012).

It has been suggested that though antenatal education may be associated with higher rates of breastfeeding, the positive effects may not continuable(Artieta-Pinedo et al., 2012). Because there were significant methodological limitations in studies on the effects of antenatal classes, and the observed effect sizes were small, it is not appropriate to recommend any antenatal breastfeeding education from current studies(Lumbiganon et al., 2011)

Rooming-in

In 1991, the WHO and the UNICEF (The United Nations Children's Fund) launched the Baby-Friendly Hospital Initiative (BFHI) to promote quality breastfeeding care and to increase breastfeeding rates worldwide(World Health Organization and UNICEF, 2007). The BFHI outlined Ten Steps of the BFHI, which includes rooming-in, keeping mothers and infants to remain together 24 hours a day. A number of studies have shown that rooming-in is positively associated with successful breastfeeding initiation(World Health Organization, 1998). A prospective cohort study in Germany found that following the rooming-in rule makes mothers nearly four times more likely to exclusively breastfed their babies at discharge than these mothers who spent less time in the maternity ward (OR=3.72, 95% CI 2.31–5.97)(Pechlivani et al., 2005). Rooming-in allows for early mother-infant contact and breastfeeding on demand, which have also been reported being related to higher rates of breastfeeding initiation(Scott and Binns, 1999, Dennis, 2002).

However, there is little evidence that rooming-in influences breastfeeding duration(Jaafar et al., 2012). A study from Hong Kong reported no effect of rooming-in on breastfeeding duration even in the unadjusted analysis(Tarrant et al., 2011).

Health care professional's support of breastfeeding

The results of breastfeeding studies concerning the impact of a health care professional on breastfeeding initiation and duration are limited(Dennis, 2002). A case-control study found that receiving breastfeeding guidance from doctors, nurses or nutritionists were not related with maternal decision on how to feed their babies(Giugliani et al., 1994). However, a study of Chinese mothers in Australia demonstrated that 'any breastfeeding' rate at discharge was higher among women who perceived doctor's support of breastfeeding than those who did not think their doctor were supportive of breastfeeding(Li et al., 2004). A study from Hong Kong reported that compared with mothers who experienced more supportive practices for breastfeeding in hospital, those who experienced one or fewer supportive practices were almost three times more likely to discontinue breastfeeding (OR: 3.13; 95% CI: 1.41–6.95)(Tarrant et al., 2011).

Generally, older, better educated, unemployed, non-smoking mothers, and/or those who are supported for breastfeeding are more likely to be lactating at discharge. However, making the breastfeeding decision during pregnancy or after delivery is inversely associated with breastfeeding at discharge. Caesarean section was once a risk factor for not commencing breastfeeding, but it became not significant according to recent studies. Furthermore, infants from wealthy families are more likely to be breastfed at discharge in developed countries whereas the relationship sometimes reverses in less developed societies.

The Prenatal intentions of the mother, maternal knowledge and mother's infant feeding attitude have also shown positive influence to breastfeeding duration. Nevertheless, only a few studies have identified the association between maternal beliefs and breastfeeding practices.

2.3 Obesity in Chinese and Australian children

Overweight and obesity in children is a growing problem worldwide and it has been identified as one of the most serious public health challenges of the 21st century(Lobstein et al., 2004). Monitoring childhood overweight and obesity is important because of associated comorbidities, including respiratory, orthopedic, endocrine, gastrointestinal, cardiovascular problems(Redline et al., 1999, von Mutius et al., 2001) and diabetes mellitus(Freedman, 2002, Chen et al., 2008b). It also has a negative effect on the psychological health of children(Davison and Birch, 2001, Hesketh et al., 2004, Hayden-Wade et al., 2005, Griffiths et al., 2006, Storch et al., 2007). Data indicate that a proportion of obese children become obese adults(Whitaker et al., 1997, Department of Health and Human Services et al., 1999). If the increasing prevalence of overweight and obesity cannot be controlled, the burden of chronic disease in future generations will cause a crisis in health and economic systems across the world(Institute of Medicine, 2010, Joint WHO/FAO Expert Consultation on Diet Nutrition and the Prevention of Chronic Diseases, 2003, World Health Organization, 2004, World Health Organization, 2000, Access Economics Pty Limited, 2008).

China, once been considered to have one of the leanest populations, is fast catching up with the West in the prevalence of overweight and obesity(Keil and Kuulasmaa, 1989, Cheng, 2004a, Ma et al., 2005). Despite the difficulties with classifying obesity, there is little doubt that childhood obesity in China is increasing(Ding, 2008). A national epidemiological survey of childhood obesity in 2006 in China found that the prevalence of overweight and obesity in 0-6 years old urban children was 19.8% and 7.2% respectively, which was 4.7 and 3.6 times higher than that of 1996 respectively(Ding, 2008). The definition of overweight/obesity used was more than one Z-score and two Z-scores above the mean reference value of weight for height made by WHO(Ding, 2008). Another epidemiological survey of obesity rates in children of same age group in nine cities of China, using cut-off points of >10% of median NCSH/WHO reference population as overweight and >20% as obesity gave rates of 6.2% and 3.2% respectively(Li, 2008).

At present, there is still no widely agreed standard for classifying overweight and obesity in children and adolescents. The prevalence of childhood obesity can vary considerably when using different definitions or reference populations(Goon et al., 2010, Monasta et al., 2010).

2.3.1 Definition of obesity and overweight in Chinese children

Obesity is defined as an excess of body fat mass and ideally a definition based on percentage of body fat would be used, but this is impracticable for epidemiological use(Cole et al., 2000). Body mass index (BMI; in kg/m^2) is widely accepted as a standard for the assessment of obesity in adults as it generally reflects body fat(Guillaume, 1999, Williams et al., 2008). In children, dynamic growth makes the choice of definitions more complex.

The absence of agreement on the definitions to be used in classifying obesity in Chinese has meant that the prevalence and trends of obesity have not been accurately documented for Chinese children. National and local surveys often give different rates of obesity and surveys from different parts of China which cannot be compared or combined within China or internationally because of the different criteria used.

Weight-for-height measurements using the NCHS/CDC/WHO growth charts as reference have been commonly used to diagnose childhood overweight and obesity(Wang and Lobstein, 2006). This has been used in three different ways. Firstly a set percentage above the median weight-for-height in the individual's age and sex group, with most commonly a cut-off point of >120%(Guillaume, 1999, Fu et al., 2003, Lahti-Koski and Gill, 2004, Wang and Lobstein, 2006, Inokuchi et al., 2009). The second approach is to select specific percentiles with the 85th percentile commonly used as the cut-off point for overweight and the 97th percentile for obesity(Lahti-Koski and Gill, 2004). As a further alternative the Z (or standard deviation) score is used, a Z score of plus 2 or more (i.e. 2 SD above the median) is usually taken to indicated obesity(Lahti-Koski and Gill, 2004, Wang and Lobstein, 2006).

In recent years, BMI has been increasingly used to classify weight status in children classification(Telford et al., 2008, Mei et al., 2002). Three datasets are used internationally to define overweight and obesity in children in terms of body mass index: USA CDC 2000 standard(Kuczmarski et al., 2002), the International Obesity Task Force (IOTF)(Cole et al., 2000) reference and the WHO 2006 standard(World Health Organisation, 2006). In 2012, the IOTF averaged the previously L, M and S curves for the six countries, and revised the international child cut-offs (Cole and Lobstein, 2012). The new cut-offs were virtually identical to the originals and can be expressed as BMI centiles (e.g. boys obesity = 98.9th centile), allowing them to be compared with other BMI references(Cole and Lobstein, 2012). The method used by the IOTF has the potential advantage that it can be adjusted to reflect different BMI cut-off levels recommended for adults of Asian ethnic groups.

Because the use of different criteria results in differing reports of prevalence rates, it is important to reach a consensus on diagnostic criteria(Goon et al., 2010, Monasta et al., 2010). Most studies conducted in Chinese preschool children after 2001 used the definition of exceeding 120% of the median weight-for-height of the reference population. About half of them subdivided obesity into 'light obesity' when weight-for-height was >120% ~130%, 'moderate obesity' when ≥130% ~150%, and 'severe obesity' when ≥150% of the median weight-for-height of the reference population. In 25 of the studies overweight was defined as exceeding 110% of the median weight-for-height of the reference population. In one study overweight was defined as exceeding 115% of the median weight-for-height(Xiao and Li, 2007).

Most studies used the NCHS/CDC reference population to define child obesity. One study used WHO 2006 growth charts as reference for children under 6 years old, but it also used NCHS/CDC reference population for children aged 6-7 years(Pang et al., 2008). Only one study used a Chinese reference population to classify obesity(Xue, 2009). Three studies did not indicate the growth reference that was used.

A further five studies classified obesity as exceeding the NCHS/WHO median weight-for-height plus two Z-score, including one paper which used 20% over median weight-for-height definition as well(Wu, 2005). Three papers referred to normalized NCHS growth curves recommended by WHO(Nie et al., 2005, Wu, 2005, Ding, 2008) and two studies referred to the WHO 2006 growth charts(Yu and Sun, 2009, Jiang et al., 2009b).

After 2004, some Chinese researchers reported the use of BMI to diagnose obesity in children, in 11 of the 75 studies reviewed. Four studies defined obesity in preschool children as BMI more than 20, 24, 25 or 28 kg/m^2(Sun et al., 2004, Guo et al., 2004, Kang et al., 2005, Liu et al., 2006b). In a study on risk factors of child obesity from the Tianjin area, children with BMI≥25 kg/m^2 and BMI ≥24 kg/m^2 were considered obese (Sun et al., 2004). Another study on obesity and risk factors for children aged 2-12 years diagnosed obesity using a BMI≥20kg/m^2 of children aged 2-5 years and BMI≥21kg/m^2 of children aged 6-12 years(Guo et al., 2004). In a study of children under 7 years, BMI between 18 to 20 kg/m^2 was considered overweight, between 20 to 22 kg/m^2 was considered as light obesity, between 22 to 25 kg/m^2 was considered as moderate obesity, and over 25 kg/m^2 was considered as severe obesity(Kang et al., 2005). In 2006, Liu and Huang investigated children from 3 to 16 years old in Chongqing and defined obesity as BMI over 28 kg/m^2(Liu et al., 2006b). No sources of the definition were indicated in these studies.

Three studies used the IOTF BMI criteria for diagnosis(Mi et al., 2006, Liu et al., 2007, Xi et al., 2009, Xiong et al., 2005), and in one study children were also classified using the CDC 2000 BMI curves(Mi et al., 2006).

A further four studies defined child overweight and obesity based on BMI, with the cut-off point set at the 85^{th} and 95^{th} percentiles. Two studies used the WHO 2006 BMI growth curves as reference. One study was based on the Chinese children's BMI curves to diagnose obesity(Jiang et al., 2009a) and one did not specify the reference population(Zhang et al., 2009b).

2.3.2 Indicators and datasets for defining childhood obesity

Reference growth curves were first used to assess under-nutrition. After obesity became a more important problem, they have been used in the assessment of overweight in children(World Health Organisation, 1995). In the early 1980s, the BMI was validated in children, and the first BMI charts were published(Rolland-Cachera et al., 1982). As in adult obesity, any definition of childhood overweight and obesity needs to be able to define not only the level of body adiposity but also the clinical relevance of this body adiposity(Stewart, 2011). Overweight/obesity as measured by BMI during childhood is a strong predictor of obesity and coronary heart disease risk factors in young adulthood(Janssen et al., 2005). BMI is a convenient and appropriate measure for defining and diagnosing childhood obesity and overweight(Reilly et al., 2000, Cole et al., 2005). BMI can be converted to a centile or z score adjusted for age and sex using the US CDC 2000 and WHO 2006 growth reference. Changes in adiposity over time can be assessed as a change in BMI, or the proportional (percentage) change in BMI, or the change in BMI z-score or centile(Cole et al., 2005).

Several reference data sets for BMI in childhood are available and three are in common use: IOTF, CDC 2000 and WHO 2006 BMI reference. The IOTF differs from the other as it is an extrapolation of adult BMI cut-off points to make them relevant for children and adolescents 2–18 years old(Must and Anderson, 2006). The IOTF cut-off values are chosen as the percentiles that matched the adult cut-offs of a BMI of 25 and 30 at age 18 years.

Many researchers have suggested replacing national reference curves with an international standard(de Onis and Habicht, 1996, Cole et al., 2005, Reilly et al., 2000). The WHO standard is the most recently developed data set and is being increasingly adopted and would seem preferable to a multiplicity of different growth references(Flegal et al., 2006).

Although no reference has provided risk-based values of BMI used to determine cut-off values, the IOTF reference provides a crude association with ill health later in life, namely the definition of overweight and obesity at age 18 years(Monasta et al., 2011). As such, the use of the IOTF data sets and cut-offs to screen for body mass status may seem an appropriate option. However, studies in China and other countries have found that the IOTF reference gave lower estimates of obesity for young children than the CDC references(Mi et al., 2006, Flegal and Ogden, 2010, Goon et al., 2010).

2.3.3 Overweight and obesity in children in Australia

Since the 1970s, the level of overweight and obesity has increased at alarming rates in most developed countries including Australia(World Health Organization, 2000, Medibank Private Ltd., 2010, World Health Organization, 2011). The number of overweight and obesity children in Australia has increased significantly over the past two decades, with a quarter of children and adolescents (21 – 25%) considered overweight or obese (with 5 – 8% classified as obese)(Commonwealth Scientific and Industrial Research Organisation and Preventative Health National Research Flagship, 2008, Australian Bureau of Statistics, 2009, Gill et al., 2009, Rokholm et al., 2010, Olds et al., 2010). Although the rate of increase appears to be slowing, the high prevalence remains of concern(Gill et al., 2009, Rokholm et al., 2010, Olds et al., 2010). The prevalence of obesity is higher for boys (9%) than girls (6%), although the prevalence of combined overweight and obesity is similar (26% for boys and 24% for girls)(Australian Bureau of Statistics, 2009).

2.3.4 Overweight and obesity in children in China

The prevalence of childhood obesity varies from different areas in studies using the same cut-off point of >120% of the median value of the reference population. In 1986, a national survey found the prevalence of obesity in Chinese children under 7 years old was 0.91%, increasing to 1.76% in 1996(Li et al., 2002). The highest rate from studies undertaken in 1990 to 2000 was 12.1%, in Shanghai in infants under 18 months old(Wei and Yuan, 2003). The lowest rate during this period was 2.3% in children under 7 years old, reported from Xi'an (Yang et al., 2001). In 2000, from the same age group of 3-7 years old children, the prevalence of obesity was 3.9% in Chaoyang, Liaoning province(Lin et al., 2001) and 7.1% in Beijing(Chen et al., 2002).

From 2001 to 2005, the lowest prevalence was 1.6% reported by a paper published in 2002 from Ji'nan in children aged from 2 to 7 years(Ji and Yang, 2002). The highest prevalence was 8% reported in Xinjiang province in 2001, a study on 3-12 year old children (n=1,815)(Zhang et al., 2003). A 15.5% rate of obesity was reported in a further study of children aged 3-7 years (n=2,367) from Xinjiang province(Reheman et al., 2005). Han children had a higher rate of obesity than Wei (one of the ethnic groups in China) children (18.1% compared to 9.3%)(Reheman et al., 2005). Except for Xinjiang province, the highest prevalence was 9.1% found in children under 5 years old in Shandong province in 2004, with a sample size of 9,590(Guan et al., 2008).

Between 2006 and 2010, the lowest reported obesity prevalence was 1.6% from Kunming (n= 11,172)(Zhu et al., 2008). The highest rate was 18.7% in 2006 in Tangshan city (n=651) and 7.6% in children under 7 years old in 2008 Dalian, (n= 10,017)(Pang et al., 2008, Li and Sun, 2010)

In studies using a cut-off of ±two Z scores the lowest rate was 3.7% in children under 7 years in Shandong province (n=3,569), 5.2% in the city and 1.8% in rural areas(Nie et al., 2005). The highest rate was 9.3% in Changchun, reported by a survey did in 2007 with a sample size of 4,468(Yu and Sun, 2009).

Using a definition of >120% of the median value of the reference population results in a lower prevalence of child obesity than using a cut-off of >2Z scores. Comparing the different growth references in use show the extent that results will vary depending on the age of the sample and the reference used.

Since none of the references have percentile curves that are parallel to each other, the proportion classified as obese will vary with the age distribution of the sample.

Using 95th percentile of BMI curve by sex gave a higher prevalence than using the IOTF BMI cut-off to classify child obesity. The lowest prevalence in studies using BMI reference to define child obesity was 1.01% from a national study in 2000 using the IOTF BMI cut-offs to defined childhood obesity(Liu et al., 2007). A further two studies using same definition found that in Chongqing (n=23292) and Beijing (n=21198) the prevalence of obesity in 2-18 years old children was 3.72% and 5.6% respectively(Mi et al., 2006, Xi et al., 2009). However when used the criterion of the CDC 2000 growth reference, the prevalence in Beijing was 9.0%(Mi et al., 2006). Mi and Cheng et al. also compared the rates in younger children aged 2-6 years age using the CDC 2000 criterion (6.8%) and the IOTF criterion (3.5%)(Mi et al., 2006).

CDC cut-off points gave the higher prevalence rates in both overweight and obesity. This result is consistent with other reports that compared estimates of overweight and obesity in children and adolescents with the CDC and IOTF references(Vidal et al., 2006, Goon et al., 2010, Mei and Grummer-Strawn, 2011). Additionally, the study of Kain et al. on 6-year-old Chilean children reported that the overall prevalence of obesity to be halved when using the IOTF cut-off point compared with the CDC's reference standard(Kain et al., 2002). As seen repeatedly, the various definitions do not give the same results.

Very few studies in China used the WHO BMI reference. A longitudinal study of 15852 children aged 3-6 years in Tianjin in 2005, found a prevalence of 8.0% using the WHO 2006 BMI curve(Zhang et al., 2009b). A study using the same criterion in Ningbo city in 2007 (n= 2,220) 3-7 years children reported 7.9% obesity(Lv et al., 2008). Four studies used 5 different BMI values to determine child obesity. A BMI of 25 kg/m^2 is recognised internationally as the definition of adult overweight while 30 kg/m^2 is recognised as obesity(World Health Organization, 2000). However, in growing children body fat and muscle mass varies with age and sex(Cole et al., 2000, Must and Anderson, 2006). Therefore BMI is meaningful only when it is plotted correctly on age- and sex-specific BMI percentile charts.

A study from the Tianjin area of 9,908 children aged 2 to 16 years old found a prevalence of 7.4% and 9.4% with BMI≥25 kg/m^2 and BMI ≥24 kg/m^2 as criteria respectively(Sun et al., 2004). A study in 2003 Zengcheng city of 2-6 years children and found an obesity prevalence of 5.5% using BMI≥20kg/m^2 as the criteria(Guo et al., 2004). In Tianjin a study of 1.5-6 years children found 3.8% (CI: 3.4-4.2%) obesity using the same definition of childhood obesity: BMI≥20kg/m^2(Kang et al., 2005).

A BMI of 28 kg/m^2 was used as definition of obesity for children 3-16 years in a study from Chongqing(Liu et al., 2006b). This is a high value for defining obesity in preschool children compare to 19.57 kg/m^2 for 3 years males and 19.36 kg/m^2 for 3 years females in the IOTF cut-off sets(Cole et al., 2000). The study reported a very high prevalence of 12.59% of obesity in children 3-16 years in Chongqing(Liu et al., 2006b).

2.3.5 Causes of overweight and obesity in children

Overweight and obesity main result from increased level of energy intake in relation to the level of energy expenditure (of which physical activity is a component) at the population and individual level(World Health Organization, 2004, Stubbs, 2004, National Preventative Health Taskforce, 2009). The excess in energy intake is stored in the body as adipose tissue. Excess weight gain is directly and indirectly influenced by a wide range of factors, including genetic factors and early life experiences (such as breastfeeding), as well as behavioural, environmental and social factors that influence individual behaviours. The relationships between these factors are complex and not yet fully understood(National Health and Medical Research Council, 2013). For children, the determinants of overweight and obesity include:

- **Food choices:** there have been many changes in the food supply over the past few decades. The availability and marketing of energy-dense, nutrient-poor foods and drinks has increased at the same time as the relative cost of these foods has decreased(Drewnowski and Specter, 2004, Cornwell et al., 2011). Choosing high fat and sugary foods instead of healthier options is one of the contributors to the current epidemic of childhood overweight and obesity(Cornwell et al., 2011, Keller et al., 2012). Optimum dietary patterns providing nutrient requirements with reasonable energy intake are important for achieving and maintaining a healthy weight.

- **Lack of physical activity:** lack of physical activity during childhood is widely assumed to contribute to the development and maintenance of childhood obesity(Janz et al., 2009). Australian children are less active than they were in the past. A range of socio-environmental factors including urban design which reduces energy expenditure during daily activities, increased reliance on less active school transport and the changing nature of school-ground facilities have resulted in the reduction or removal of many physical activities in children(Swinburn and Egger, 2004, Badland et al., 2005, Hills et al., 2011, Faulkner et al., 2009). It has been reported that about one-thirds (37%) of children aged 5-14 years had never participated in organised sport or dancing during 12 months in 2009 and the rate was 40% in 2012(Australian Bureau of Statistics, 2012c, Australian Bureau of Statistics, 2012e). Compared with children born in Australia, children who had been born overseas in a primarily non-main English speaking countries were 9% less likely to participate in organised sport or dancing(Australian Bureau of Statistics, 2012c).

- **Sedentary lifestyle:** studies have shown that sedentary pursuits adversely affect physical and mental health in children independent of physical activity levels(Tremblay et al., 2011). Australian children spend considerable time watching television (TV) as well as using computers and other electronic games. Spending a lot of time watching TV, DVDs or videos is associated with lower participation in physical activities. In 2009, children who spent 40 or more hours in the fortnight watching TV, DVDs or videos were 10% less likely to participate in organised sport or dancing when compared with children who spent less than 20 hours watching(Australian Bureau of Statistics, 2011c). The amount of time spend watching television in early childhood is of concern because of potential consequences for later muscular fitness and waist circumference in children during the school years(Christakis et al., 2004, Fitzpatrick et al., 2012).

Information technology is also changing the way Australia children live and adding to their daily sedentary time. In 2008-09, nine in ten households (91%) with children had access to a home computer and an estimated 2.2 million children (79%) aged 5-14 years reported accessing the internet, up from 65% in 2006(Australian Bureau of Statistics, 2011c). In 2009, two in five children (42%) who used the internet at home reported that they spent two hours or less online at home per week, while 17% spent 3-4 hours online, 21% spent 5-9 hours online and 13% spent 10-19 hours online(Australian Bureau of Statistics, 2011c).

- **Overweight parents:** the primary social environment influencing children is the family. Consequently, many overweight and obesity risk factors in childhood are likely to have roots within the family context(Ventura and Birch, 2008). Many studies have shown that having overweight/obese parents is strongly associated with the child being overweight or obese(Mangrio et al., 2010, Jääskeläinen et al., 2011, McMullan and Keeney, 2013). A family's eating patterns can have a major influence on whether a child maintains a healthy weight. Parental health beliefs, preference of specific foods, maternal feeding practices, parental instrumental behaviours and nutritional knowledge may influence child intake through food accessibility and availability and/or parental modeling has been shown to be related to child's dietary intake(Patrick and Nicklas, 2005, Wardle and Cooke, 2008, Rhee, 2008, Pearson et al., 2009, Raynor et al., 2011). Besides, a recent study reported that stress in parents (the number of parent stressors) was directly related to child obesity and child fast-food consumption, an important behavioural indicator of obesity risk, in unadjusted and adjusted models(Parks et al., 2012).

- **Genetics:** twin and family studies have suggested that a large part of the variability in obesity risk and BMI can be attributed to genetic factors, or at least familial influences(Stunkard et al., 1986, Turula et al., 1990, Rankinen et al., 2006). A Finnish longitudinal twin study found that the effect of common environment on BMI variation disappears in adolescence(Lajunen et al., 2009). On the other hand, genetic factors had a strong effect on BMI from early childhood through adulthood. Groups of genes acting together make some children more susceptible to obesity. A study based on 501 white infants in 164 nuclear and extended families of the Fels Longitudinal Study showed that additive genetic effects explained a high proportion of the variance in infant weight status and change in weight z-score(Demerath et al., 2007). Another study on 672 twin pairs reported that most of the variance in weight at 5 months and at 5 years was accounted for by genetic factors, with heritability estimates in the range of 84–88%(Dubois et al., 2007). Recently, common variants in three genes have been found to be associated with risk of obesity(Hofker and Wijmenga, 2009). Gene-environment interaction studies suggest that the effects of predisposing genes can be enhanced or diminished by exposure to relevant behaviours(Bouchard and Bouchard, 2009).

- **Fetal nutrition and early-life development**: epigenetics studies found that the early environment in both pregnancy and early childhood can determine physiologic, structural, immune, metabolic, and behavioural development and modify response patterns that influence risk of future disease(Hanson and Gluckman, 2011, Hanson et al., 2011). A range of chronic diseases, including those associated with obesity (like cardiovascular disease and type 2 diabetes) and certain cancers (for example breast cancer) are the result of the changing nutrients supply of fetus and early-life development(Barker, 2012, Barker et al., 2005). A baby's growth and nutrition depend both on the placenta's ability to transfer nutrients from mother to baby, and on the mother's metabolism, reflected in her height and weight (Barker and Thornburg, 2013). The Helsinki Birth Cohort found that a long breadth of the placental surface was associated with overweight in adults whose mothers were tall and who carried the Pro12pro genotype of the PPARg2 gene(Eriksson et al., 2012). Many babies in the womb today are receiving unbalanced and inadequate diets. Protecting the nutrition and health of girls and young women should be the cornerstone of public health, because it not only will prevent chronic disease, but also will produce new generations with better health and wellbeing through their lives.

There is now clear evidence that people who grow slowly in utero and remain small throughout infancy but gained weight rapidly and became obesity after that, have highest risk for cardiovascular disease and type 2 diabetes(Barker, 2012). The rapid 'compensatory' growth in young children who had experienced malnutrition or other adversity in fetus period and infancy, may have a wide range of physiological and metabolic costs that include premature death(Barker, 2012). Thus, preventing overweight and obesity from low birth weight infants and malnutrition children are of utmost importance as they are most vulnerable to chronic disease.

2.4 Health information seeking by Chinese immigrants

Current trends in the study and practice of medical communication emphasise the incorporation of values into decision-making processes and the participation of informed patients in medical interactions(Emanuel and Emanuel, 1992, Epstein et al., 2004). Shared decision-making and active involvement in health-related decisions are stressed in contemporary models of patient–provider communication(Moumjid et al., 2007, Arnetz et al., 2008). Health information seeking is crucial for patients to participate in healthcare. Not only is health information seeking common, the WHO e-Health survey indicates that 29% received used information from the internet helping them to decide whether they needed to see a doctor, and of those that did attend, one in four used the internet in conjunction with the doctor's appointment(Fox, 2008). The latest Pew Internet Project survey reported that 59% of newly diagnosed patients had accessed the Internet and this prompted them to ask questions of the doctor or seek a second opinion(Fox, 2008). Information seeking is noted as a critical component of shared decision-making and patients are encouraged to share information with their healthcare practitioners(Charavel et al., 2001, Ballard-reisch, 1990). Skills in understanding and applying information about health issues may have a substantial impact on health behaviours and health outcomes.

People of all ages, races, incomes, and education levels, are affected by limited health literacy. The impact of limited health literacy disproportionately affects immigrants whom English is a second language(Kreps and Sparks, 2008, Reitmanova et al., 2008, Mesch et al., 2012). Given the prevalence of health information seeking behaviours and the trend toward patient involvement in healthcare, a review of the methods and measures utilized for immigrants to study health information seeking is both necessary and timely. This part of the review aims to provide (a) the definition of health literacy (b) an overview of health information seeking behaviours (c) and health information sources of immigrants.

2.4.1 Health literacy

In general, literacy is the ability to read, write, and speak a language to understand and solve problems with sufficient proficiency to function at work and in society, achieve goals, and develop knowledge and individual potential(Ishikawa and Kiuchi, 2010). Literacy is important on many levels, but it is increasingly being seen as important for an individual participating fully in modern society. The notion of health literacy refers to literacy in the context of health and healthcare(Ishikawa and Kiuchi, 2010).

Several definitions of health literacy that are currently used share the basic concept of literacy, but vary in scope. Health literacy, an important determinant of health, has been defined by WHO as "the cognitive and social skills, which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health"(Nutbeam and Nutbeam, 2000). It means more than being able to read patient information leaflets and successfully make appointments with doctors. Health literacy entails a level of knowledge, personal skills, and confidence that enables making changes in personal lifestyles and living conditions to improve personal and community health. Defined this way, health literacy goes beyond a narrow concept of health education and individual behaviour-oriented communication, and addresses the environmental, political and social factors that determine health(Nutbeam, 2008).

The USA Centers for Disease Control and Prevention state that health literacy is the capacity for individual to obtain, process, and understand basic health information and services to make appropriate health decisions.

The USA Institute of Medicine defined that health literacy as a "shared function that is dependent on social and individual factors, including an individuals' health and literacy skills and capacities"(Institute of Medicine, 2004). As levels of education and literacy are now acknowledged by policy researchers and policy makers as being important determinants of health, health literacy is perceived as being increasingly important for social and economic development(Kickbusch, 2001).

Another commonly cited definition of health literacy is one that emphasises the skills of individuals: “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions”(USA Department of Health and Human Services, 2000). This definition acknowledges the fact that health literacy operates within the “complex group of reading, listening, analytical and decision making skills” and is dependent upon “the ability to apply these skills to health situations”(National Network of Libraries, 2007). It is an interaction between ability and application. Compared with earlier definitions of health literacy that focus on patients in healthcare settings and their understanding of medical information, this definition includes individuals outside of clinical settings and also links health literacy to the promotion of health and preventive behaviours.

Health literacy in the 2006 Adult Literacy and Life Skills Survey (ALLS) funded by The Australian Government Department of Health and Ageing, is defined as: “the knowledge and skills required to understand and use information relating to health issues such as drugs and alcohol, disease prevention and treatment, safety and accident prevention, first aid, emergencies, and staying healthy”(Australian Bureau of Statistics, 2008b).

The definition proposed by the Canadian Council on Learning is “the ability of individuals to access and use health information to make appropriate health decisions and maintain basic health.” According to the Canadian Council on Learning (2007), education and health literacy have an integral relationship with the overall health of a society's population as well as disparities within the population. It emphasizes the broad reach of health literacy which “includes whether individuals can read and act upon written health information, as well as whether they possess the speaking skills to communicate their health needs to physicians and the listening skills to understand and act on the instructions they receive”(Canadian Council on Learning, 2007).

The extent to which individuals are well informed about health care matters such as nutrition, sanitation, and the availability of health care resources can affect the prevalence of preventable disease and other health outcomes(Kim et al., 2011, Salmon and Charles T. Salmon, 1996, Schwarte et al., 2010). Given that basic literacy skills are required for health literacy, it is reasonable to assume that individuals with limited literacy also have limited health literacy. Previous studies have reported immigrants often have significant language and health literacy difficulties, which are further exacerbated by cultural barriers and economic challenges to accessing and making sense of relevant health information(Kreps and Sparks, 2008, Reitmanova et al., 2008, Mesch et al., 2012). On the other hand, it has been noted that even individuals with adequate general literacy might not have adequate health literacy because the literacy demands in the context of healthcare are frequently more complex than those in the context of everyday life(Nielsen-Bohlman et al., 2004).

2.4.2 Health Information sources

While knowledge alone cannot predict the adoption of healthy behaviours, exposure to health information plays a vital role in changing such behaviours. Health information is formulated with the goal of improving health outcomes by encouraging behaviour modification and social change through the continuum of knowledge, beliefs and attitudes, and behaviours(Bettinghaus, 1986, Schiavo, 2007). Health information has been shown to affect behavioural skills and thereby health behaviour itself according to the information-motivation-behaviour skills model(Amico et al., 2005, Fisher et al., 1994, Misovich et al., 2003). Access to and utilization of relevant health information sources is essential to make informed health-related decisions(Maguire et al., 2011). Utilizing mass media (e.g., TV, newspapers, magazines and Internet), health information leaflets and interpersonal sources on various aspects (i.e., healthcare providers, friends and family/relatives) as health information source have been associated with health beliefs and behaviours(Hay et al., 2009, Dutta Bergman and Dutta, 2004a, Berkman and Kawachi, 2000, Redmond et al., 2010). A recent study on Health Communication Behaviours of U.S. Latinos revealed that diversified health information sources was related to health care access (regular doctor visits, uninterrupted health insurance, and regular health care location) and favorable health outcomes (self-ratings of general health, health-related efficacy, and knowledge of diabetes symptoms)(Katz et al., 2012).

2.4.2.1 Interpersonal health information sources

Interpersonal health information sources, including both lay social networks (friends and family and community organizations) and healthcare providers may be more strongly associated with desired health behaviours because of their potential to provide not only information but also social support(Cohen, 2004, Christakis and Fowler, 2007, Christakis and Fowler, 2008, Ford and Kaphingst, 2009, Redmond et al., 2010).

- **Healthcare providers:** healthcare providers are a central resource for information or support during serious health episodes(Fox and Duggan, 2013). They continue to be the frequent health information source for most people even as many of them deepen their engagement with the online world(Rutten et al., 2005, Fox and Jones, 2009, Fox and Duggan, 2013). The Pew Internet & American Life Project reported that 86% of all American adults asked a health professional, such as a doctor when they need information or assistance in dealing with health or medical issues(Fox and Jones, 2009). Physicians, nurses, and other health care professionals play a crucial role in meeting patients' information needs. During the diagnosis and treatment phase, patients rely heavily upon their physicians for information about their illness(Rutten et al., 2005).

- **Non-professional social networks:** the role of non-professional social networks consisting of friends/family and community organizations as a health information source on prevention and treatment to the health conscious consumer is well established. Family and friends can be resources for individuals gaining information about health issues, identifying symptoms, determining possible treatments, and making particular lifestyle changes(Kreps and Thornton, 1992, Brashers et al., 2002, Dutta Bergman and Dutta, 2004b). Individuals who mostly learn about health issues from non-professional social networks may also be surrounded by health-oriented people who gather information from other sources. The presence of health-oriented people in one's social network is likely to trigger the participation in health behaviours(Dutta Bergman and Dutta, 2004b). Those individuals who learn health information primarily from interpersonal networks are also more likely to have a stronger health orientation(Dutta Bergman and Dutta, 2004b).

2.4.2.2 Mass media health information sources

Although health care professionals have historically been the primary sources of health and medical information, the increase in media reports and the rapid expansion of the Internet have made other sources more available to the general public(Couper et al., 2010). Mass media sources include magazines, newspapers, other printed publications, television, radio, street signs/billboards, and in recent years, the Internet(Cotten and Gupta, 2004).

- **Newspapers and magazines:** some studies have shown that newspapers and magazines serve as reliable and credible sources of health information to the public, but others showed the reverse that newspapers and magazine articles were among the least reliable health information(Worsley and Worsley, 1989, Atkin and Wallack, 1990, Kreps and Thornton, 1992, Dutta-Bergman, 2003). A random population mail survey of 677 respondents indicated that young people rated newspapers and magazines more highly than other respondents(Worsley and Worsley, 1989).

- **The Internet:** in 2010-11, 6.2 million households, almost three quarters (73%) of all households had broadband internet access, according to the ABS (Australian Bureau of Statistics, 2011a). With the rapid growth of Internet use in the past decade, the Internet has emerged as a valuable source for acquiring health information and health services(Gerber et al., 2001, Helft, 2008, Couper et al., 2010). According to the Pew Internet & American Life Project, 72% of Internet users say they looked online for health information of one kind or another within the past year. This includes searches related to serious conditions, general information searches, and searches for minor health problems(Fox and Duggan, 2013). The Internet is becoming an increasingly important source for communicating about health issues, linking individuals in need of specific information and support with similar others and health care professionals(Fox and Duggan, 2013). Online access to information and communication about health is associated with improved knowledge about health issues, better lifestyle choices and better compliance with physician recommendations(Iverson et al., 2008, Shim et al., 2006). Women, younger people, white adults, those who have higher households earning, and those with a college or advanced degrees are more likely than men to go online to figure out a possible diagnosis(Fox and Duggan, 2013). It has assumed that the online access of immigrants to health and medical information might result in increased use of online health information sources and other healthcare technologies by them(Lustria et al., 2011).

2.4.2.3 Health information leaflets

During the diagnosis and treatment phase, health information leaflet is the most commonly used health information sources for patients and the general public(Rutten et al., 2005, Pander Maat and Lentz, 2010). Patients are often provided with information leaflets during or after a healthcare consultation. The information leaflet consolidates the information provided in the consultation and this information can be consulted by the patient long after the consultation is over. Providing written information has been shown to be more effective in improving patient recall and knowledge(Coulter et al., 2006). Health information leaflet aimed at health promotion often rely on theories of health behaviour, for example the Health Belief Model (HBM) and the Theory of Planned Behaviour (TPB)(Glanz and Maddock, 2000, Kok et al., 2004, Abraham et al., 2011). These theories or their components are used to design health information leaflets to maximize their motivational effect, and to provide practical assistance, with the aim of encouraging the reader to adhere to the health information leaflet's recommendations for behaviour change, screening uptake and so on(Doyle et al., 2013).

2.4.3 Health information seeking behaviour

Information seeking has been demonstrated to play a critical role in individuals' efforts to cope with the disruption of quality of life associated with disease diagnosis and treatment(Arora et al., 2002). It was narrowly defined as information seeking activities to obtain specific information in response to a relevant event by some researchers, such Niederdeppe(Niederdeppe et al., 2007). Information seeking is viewed as a purposeful and goal-oriented activity, rather than the result of passive exposure to information in one's environment. However, some researchers use it more broadly to describe "those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way, and using or transferring that information"(Wilson and Wilson, 1999). Wilson later rephrased it as "the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use."(Wilson, 2000) Similarly, Pettigrew et al. defined information seeking as "how people need, seek, give, and use information in different contexts". Currently, health information seeking behaviour is broadly viewed as ways individuals obtain and use information about health, illness, health promotion, and risks to health(Cutilli, 2010).

From the late 1980s to mid-1990s, only a few studies addressed the concept of health information seeking behaviour(Lenz, 1984, Miller, 1987). However, the increased amount of information potentially available, an enhanced focus on self-monitoring and self-care, as well as renewed interest in predictors of health promotion and illness prevention activities, contributed to health information seeking behaviour's taking centre stage(Johnson, 2003, Loiselle and Dubois, 2003). Since the mid-1990s, studies examining health information seeking behaviour abound in the health-related scientific literature(Lambert et al., 2007).

The main focus in previous research on a "disease and illness" motive for health information seeking behaviour has left the hypothesis that healthy individuals may pursue information to maximize positive health outcomes essentially unexplored(Ayers et al., 2007, Pandey et al., 2003). A growing body of findings suggests, however, that many individuals actively seek out wellness information (e.g., information promoting a healthy lifestyle)(Dutta-Bergman, 2004, Renahy et al., 2008, Fox and Jones, 2009).

Health information seeking is associated with a wide variety of factors and individual’s search behaviour varies depending on type of information sought, reasons for searching and experience levels(Lorence et al., 2006). Studies have shown that females are more likely than males to search for health information and online health consumers tend to be more educated, earn more and have high-speed Internet access at home and at work(Atkinson et al., 2009, Chou et al., 2009, Fox and Duggan, 2013).

2.4.4 Health information sources and health care services used by Chinese immigrants

The sources of health information for immigrants seem to vary depending on their level of acculturation and English fluency. The literature suggests that beliefs and norms concerning health behaviour change after immigration due to acculturation(Abraido-Lanza et al., 2006). Language is an important predictor of health care utilization and health status(Carter-Pokras and Bethune, 2009). A study examining how Chinese immigrant women in England engage with Western and Chinese healthcare systems when seeking treatment, revealed that women who are more connected with majority English culture are more successful in their consultations with Western health service practitioners(Green et al., 2006a). A qualitative study on attitude, knowledge and health seeking behaviours of immigrant communities in cancer prevention found that 80% of Chinese immigrants considered themselves as having a ‘limited’ or ‘very limited’ proficiency in English. When they were unclear about medical information, instead of having the provider repeat or attempt to clarify his/her statements, Chinese immigrants compensated by asking family, friends, social workers, or other personnel at the hospital/clinic to interpret(Pang et al., 2003, Gany et al., 2006). It was reported that Chinese participants found doctors through newspapers, radio, and the Internet(Gany et al., 2006).

While health information can come from a variety of sources, having regular access to doctors and other professional health care providers increases the likelihood of prevention and treatment of chronic illness among immigrants(Documet and Sharma, 2004, Doty and Holmgren, 2006). Studies have indicated that Chinese immigrants used a mixed method of health care(Ma and Ma, 1999, Pang et al., 2003). Studies in Asian-American women found that Chinese women used primarily alternative medicines, others regularly used conventional Western medicine, and most of them used both forms of medicine(Lee et al., 2000b, Pang et al., 2003). Another study of American Chinese revealed high rates of self-treatment and home remedies (balanced diets and other alternative medicines), medium rates of utilization of integrated Western and traditional health services (including travel to China for care) and low rates of exclusive utilization of Western or traditional Chinese treatments(Ma and Ma, 1999).

There were several barriers to health care services for Chinese immigrants. Financial barriers to health care were powerful. Chinese participants stated that many uninsured, low income and undocumented individuals in the Chinese community visit unlicensed doctors for medical care because of their lower charges for medical services(Ma and Ma, 1999, Gany et al., 2006). A cultural reluctance to seek help from outsiders such as health care professionals is another barrier for Chinese immigrants(Pang et al., 2003). For immigrants from non-English-speaking backgrounds, the language barrier is also one of the major factors affecting immigrants' use of health care services(Chan and Quine, 1997, Pang et al., 2003, Chu, 2005, Green et al., 2006a). Further, the health care system in the new country was confusing and intimidating to some Chinese immigrants(Pang et al., 2003).

Because the majority of Chinese in the Australia are foreign-born, strong Chinese culture values, beliefs and traditional health practices are still evident in their overall behaviour (Chan and Quine, 1997, Chu, 2005, Xue et al., 2008). According to the biennial health report of the Australian Institute of Health and Welfare, the use of doctors in Australia by ethnic Chinese was one of the lowest of any group in society(Australian Institute of Health and Welfare, 2008). There were problems with access, and some had chosen other sources of health service(Australian Institute of Health and Welfare, 2008). Women from China appeared to have a low utilisation of general practitioner services compared to their Australian counterparts(Chan and Quine, 1997). It was reported that the majority of the

Chinese immigrants women in Brisbane found that their English was not adequate in communicating health matters and had to see Chinese-speaking doctors(Chu, 2005). Most of them were reported to have difficulties in understanding the health system in Australia and have limited access to existing health services and relevant information. Due to a lack of English proficiency and perhaps cross-cultural misunderstanding, many Chinese women in Australia were not aware of existing services available to them(Chu, 2005).

2.5 Health behaviours and the Health Belief Model

Health is multifaceted and complex. Health-related behaviour is one of the most important elements in people's health and well-being(Glanz and Maddock, 2002). It includes a range of actions taken by a person to maintain, attain, or regain good health and to prevent illness. Health behaviour can be classified into health behaviour (aimed at preventing disease), illness behaviour (aimed at seeking a remedy) and sick-role behaviour (aimed at getting well)(Kasl and Cobb, 1966). Health behaviour reflects a person's health beliefs. This section of the review will cover parental behaviours regarding child health and health belief model.

2.5.1 Health behaviours related to child health

Promoting healthy behaviours as well as preventing health-risk behaviours in children can shape a child’s life course and the future of an entire society. Inappropriate eating and sleeping habits and a sedentary lifestyle affect how children grow and develop(Troiano and Flegal, 1998). It has been widely believed that parents have a strong influence on children’s health behaviours, including children’s eating behaviours and active lifestyle(Cooke et al., 2004, Gibson et al., 1998). Parents are gatekeepers and can serve as role models for their children’s health-related behaviours(Golan and Crow, 2004, Savage et al., 2007). Childhood is a critical period in the development of obesity and other chronic disease(Jiang et al., 2009c). Efforts to promote healthy eating behaviours in younger children may be more effective, and parents should the main ones to be involved in these efforts(Wang et al., 2002). Data tracking dietary intake patterns of Chinese children over six years revealed that children are likely to maintain their dietary intake patterns from childhood into adolescence even under conditions of rapid socioeconomic change(Wang et al., 2002). Family income, urban-rural residence, mother’s education and baseline dietary intakes were important predictors of children’s dietary intake patterns(Wang et al., 2002). Data from adopted children in China found that the mother’s education is an important determinant of the health children even after we control for income, the number of siblings, health environments, and other socioeconomic variables(Chen et al., 2009).

Studies in Chinese immigrants also show evidence of parents' influences on children's health behaviours. A cross-sectional study examining factors associated with obesity in Chinese-American children indicated that a more democratic parenting style could predict children's BMI(Chen and Kennedy, 2005). Children whose mothers had a low level of acculturation were also more likely to be overweight than were children whose mothers were highly acculturated(Chen and Kennedy, 2005). Another study of dietary habits of Chinese children (aged 0–5 years) living in France found that first-generation Chinese immigrants were still followed traditional ways of child feeding, but some Westernization of dietary habits such as reduced breastfeeding and high consumption of soft drinks were observed(Roville-Sausse, 2005). A randomized controlled study of the culturally sensitive and family-focused behavioural program has shown to ne effective in promoting healthy behaviour among Chinese American children, leading to reduced BMI and healthier lifestyles (adequate dietary intake and improved physical activity)(Chen et al., 2010).

Besides a balanced, nutritious diet, regular and appropriate physical activity is a very important aspect of health-related behaviour. It has reported that Chinese children are significantly less active than children from Western countries outside of school hours, which have been attributed to the societal focus on scholastic achievement(Johns et al., 1999, Tudor-Locke et al., 2003). For Chinese immigrants, the acculturation of Western lifestyle patterns following immigration to countries such as Australia or the USA potentially increases the risk of developing overweight and obesity (Harrison et al., 2005). Educating Chinese parents of preschool children about the importance of creative, free play on reinforcing the child's inherent nature to be active was suggested by a study among Chinese communities in the Sydney(Dwyer et al., 2008). Studies from Australia, USA and China all suggest that parental exercise is positively associated with children's sports participation(Cleland et al., 2005, Lau et al., 2007, Alderman et al., 2010). Parental participation and parental support were reported to be positively associated with physical activities of pre-school child (Klesges et al., 1990, Loprinzi and Trost, 2010). It is plausible that parents act as role models for children's extracurricular sports participation(Cleland et al., 2005). In addition, maternal education was inversely associated with high inactivity patterns and high family income was associated with increased moderate to vigorous physical activity and decreased inactivity(Gordon Larsen et al., 2000).

To sum up, parental beliefs, health-related behaviours such as eating and sleeping habits and lifestyle have a strong influence on children's growth and development. The acculturation and lifestyle changes of the immigrant parents also impact their children's health.

2.5.2 The Health Belief Model

A number of social psychological theories have been developed in an attempt to understand the health beliefs and motivations of individuals for changing behaviour to minimise chronic disease risk and maximise health gain. Many different models have been used widely to explain health and diet-related behaviour but the Health Belief Model (HBM) is one of the most widely applied psychological theories to assist in understanding and predicting health behaviour(Clarke et al., 2000). It was developed by a group of social psychologists (Hochbaum, Leventhal, Kegeles and Rosenstock) in the US in the early 1950s to explain why people did or did not accept disease preventives or use health services (Becker, 1974a). In this theoretical model, health behaviour is a function of knowledge, beliefs and attitudes (Figure 1). It has continued to be used to predict, describe and explain health behaviour based on a person's perceptions and belief patterns. During the past five decades, the model has been applied to predict a wide range of health-related behaviours including disease preventing, illness behaviour and sick-role behaviour(Becker, 1974a, Becker et al., 1974, Pirzadeh and Mazaheri, 2012, Scarinci et al., 2012, Asare et al., 2013).

The basic dimensions of HBM are as follows(Rosenstock, 1974, Janz and Becker, 1984, Rosenstock et al., 1994).

Perceived Threat: consists of two parts: perceived susceptibility and perceived severity of a health condition.

Perceived Susceptibility: one's subjective feeling of the personal risk of contracting a health condition.

Perceived Severity: feelings concerning the seriousness of contracting an illness or of leaving it untreated. This dimension includes evaluations of both medical or clinical consequences and possible social consequences.

Perceived Benefits: the acceptance of personal susceptibility to a condition was believed to be serious to produce a force leading to behaviour. It was hypothesized that the believed effectiveness of the various actions available can reduce the illness threat.

Perceived Barriers: the potential negative consequences of taking recommended health behaviours that may act as impediments. It may be expensive, dangerous (e.g., side effects, iatrogenic outcomes), upsetting, inconvenient, time-consuming, and so on.

Cues to Action: events, either internal (e.g., physical symptoms of a health condition) or external (e.g., media publicity, interpersonal interactions) that motivate people to take action. 'Cues to action' is an aspect of the HBM that has not been systematically studied.

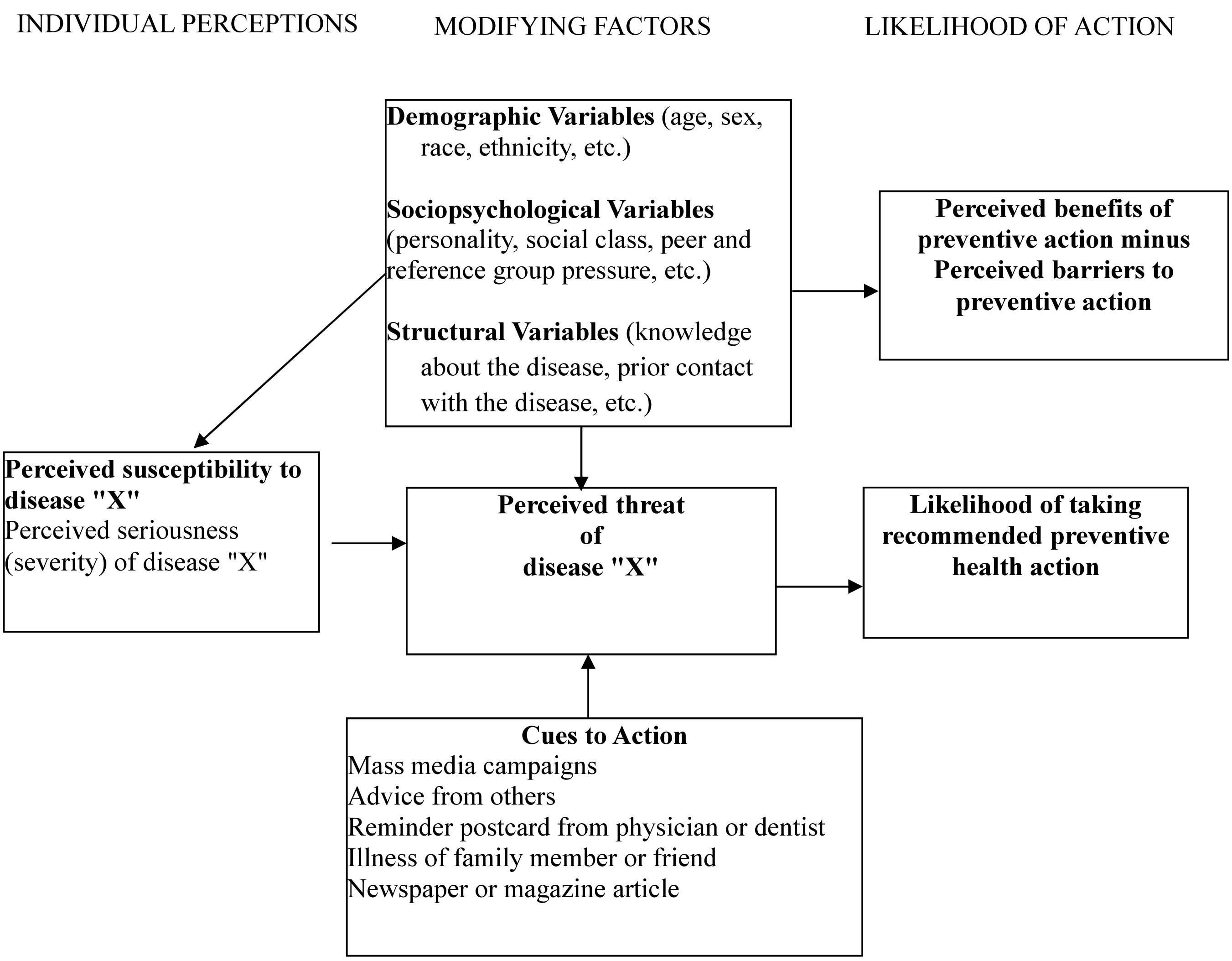

Figure 2.1 Health Belief Model

(Source: Becker *et al*. - in Rosenstock, 1974, p 7)

2.5.3 Modifications from the original Health Belief Model

Early applications of HBM focused on short-term preventive actions, such as taking an immunization or a screening test(Liou, 2006). However, later applications extended HBM to lifestyle behaviours requiring long-term changes such as changes in eating patterns. The challenges involved in promoting lifelong healthy habits such as dietary behaviours are usually more difficult to surmount than are those for participating in a screening test. Consequently, other constructs have incorporated in HBM.

One of the earliest modifications to the HBM involved the concept of "General health motivation" (i.e. different degrees of readiness to undertake actions) that was seen as "a necessary condition for action" and motives were seen to "selectively determine an individual's perceptions of the environment"(Maiman, 1974).

Rosenstock, Strecher and Becker (1988) realised that there were deficiencies in the original model when applied to the modification of lifestyle habits and the additional component of "self-efficacy" was added(Rosenstock et al., 1988). The self-efficacy component was based on social learning (or cognitive) theory and was incorporated as a separate independent variable(Bandura, 1997). Since then many studies have modified the HBM to incorporate social cognitive theory to make it more applicable in other cultures.

Other dimensions that have incorporated in the HBM are including:

Other Variables: diverse demographic, sociopsychological, and structural variables that affect an individual's perceptions and thus indirectly influence health-related behaviour. It was assumed that diverse demographic, sociopsychological, and structural variables may, in any given instance, affect the individual's perception and thus indirectly influence health-related behaviour(Janz and Becker, 1984).

Self-Efficacy: an individual's belief or confidence in being able to successfully perform a specific behaviour required to produce the desired outcomes(Bandura, 1997).

General Health motivation: one's concern about health practices and beliefs about prevention that are primarily nonspecific and stable across situations (Becker, 1974b, Becker, 1978).

Translation: if the HBM is used in a non-English context, language and the choice of articles (or messages) to be translated can be an important issue in the acquisition of health knowledge(Lee et al., 2000a). Health knowledge is important in forming perceived susceptibility, perceived benefits, structural variables and cues to action. The literature in section 2.4 shows that language is one of the major barriers for non-English speaking immigrants to access and use health information as most health sciences knowledge is originally published in English or less frequently in another language. In most cases of getting health information, it involves translation from the original. Thus selection of health information for translation and the accuracy of translation into language acceptable in a different culture become important determinants of health knowledge. As such, translation becomes an important part of the context of the HBM.

2.5.4 Applications of the Health Belief Model

The HBM has been applied throughout public health to explain why people adopt behaviours that lead to healthy lives since the initial studies of the prediction of health behaviour assessing the utilisation of health services (e.g. medical examinations, detection tests, immunisations and vaccinations, medical, dental and hospital services, etc.)(Rosenstock, 1966, Maiman et al., 1977, Becker, 1974a).

Several reviews have analysed the ability of the HBM to predict behaviour across different health behaviours(Harrison et al., 1992, Janz and Becker, 1984, Carpenter, 2010). The Janz and Becker's review found "perceived barriers" was the most powerful of the HBM dimensions and "perceived benefits" and "perceived susceptibility" were good predictors of behaviour whereas "perceived severity" was weakly associated with preventive health behaviour(Janz and Becker, 1984). Harrison et al. (1992) conducted a meta-analysis of the relationships between four HBM dimensions (Susceptibility, Severity, Benefits and Costs) and health behaviour on 16 studies(Harrison et al., 1992). It concluded that retrospective studies have significantly larger effect sizes for benefit and costs and smaller effects sizes for severity than prospective studies(Harrison et al., 1992). A recent meta-analysis of longitudinal studies found that benefits and barriers were consistently the strongest predictors. The length of time between measurement of the HBM beliefs (susceptibility, severity, and benefits) and behaviour was associated with a decreasing likelihood of finding effects in the predicted direction. Benefits and barriers were detected to be a better predictor when the goal is the prevention of a negative health outcome instead of treatment behaviours(Carpenter, 2010).

Current use of the HBM covers a wide range of health problems across many different cultures, including Vietnamese, Chinese, Korean, Filipino, Turkish(Jenkins et al., 1996, Quah, 1985, Sung et al., 2008, Lee, 2002, Wu et al., 2006, Karayurt, 2007). This has been a feature of the use of the HBM since its early days(Rosenstock, 1966, Becker, 1974a, Maiman et al., 1977). The cultural differences among ethnic groups might be crucial in the perception of seriousness and susceptibility to disease. The predictability of the HBM may vary among different ethnic groups or within multicultural societies. For example, its predictability of preventive health behaviour was detected to be different between three ethnic groups in Singapore(Quah, 1985). However, a study exploring the effects of the HBM on screening mammography utilisation in multi-ethnic older women in the US, found that ethnicity had no direct effect on utilisation nor confound the relation between health beliefs, concerns and utilisation(Thomas et al., 1996). Similarly, in assessing HIV risk behaviour in 1,390 adults from three different ethnic groups (Anglo-Americans, African-Americans and Mexican-Americans), ethnicity was not a strong predictor for risk behaviour in all groups but there was a strong gender difference in minority populations(Neff and Crawford, 1998).

A review of studies using the HBM on cervical cancer screening among immigrant and ethnic minorities in the US found that health-related beliefs and health care utilization were influenced by various sociocultural factors among immigrant and ethnic minorities(Johnson et al., 2008). There were some unique beliefs to specific cultural groups: body-focused notions among Hispanics were considered to play a role in one's susceptibility to cancer; administrative processes in establishing health care was identified as barriers to screening by African Americans, whereas Asian immigrants held a variety of misconceptions concerning one's susceptibility to cancer(Johnson et al., 2008). In some immigrant groups, their traditional beliefs and practices do not act as barriers to access to Western medical care or utilization of preventive services, but poverty status, health insurance coverage were the predictors of preventive health care utilization(Jenkins et al., 1996, Ma and Ma, 1999, Gany et al., 2006).

In conclusion, the HBM has been used throughout public health topics and across many different cultures. It helps to understand the health beliefs and behaviours among immigrant and ethnic minorities.

2.5.5 The Use of the Health Belief Model in Chinese

The HBM has been widely used in Chinese population and appears to have grown in usage in recent years. The internal consistency of the Chinese HBM had been examined for sub-scales with a Cronbach's alpha of coefficients ranged from 0.56 to 0.99 in some studies and its test–retest reliabilities ranging from 0.47 to 0.86(Sun et al., 2006, Sung et al., 2008).

It also has proved to have good predictive validity in many studies in China. Results of a study assessing preventive health behaviours after launching SARS community prevention activities indicated that higher rates of preventive health behaviours were significantly related to greater perceived susceptibility to contracting SARS (OR 1.468, 95% CI 1.09-1.98), greater self-efficacy in performing the preventive health behaviours (OR 2.304, 95% CI 1.67-3.18)(Tang, 2003). In a cross-sectional study identifying variables predicting the intention of iron-fortified soy sauce consumption in Guangzhou, the HBM explained 35% to 55% of the variance of behavioural intention(Sun et al., 2006). The behaviour was impacted by women's health value and perception of perceived susceptibility and severity. Cues to action, as an external factor, was also greatly affected the intention(Sun et al., 2006). Five of the variables pertaining to the HBM were significant correlates of colorectal cancer screening in a telephone survey of 1,004 randomly selected Chinese residents of Hong Kong: perceived severity (aOR 0.28, 95% CI 0.13–0.65), perceived health and psychological barriers (aOR 0.42, 95% CI 0.21–0.84, 95% CI 0.21–0.85), perceived access barriers (aOR 0.22, 95% CI 0.05–0.85), physician's recommendation (indicator of cues to action) (aOR 23.50, 95% CI 10.66–51.80), and having health insurance (indicator of cues to action) (aOR 2.06, 95% CI 1.01–4.19) (Sung et al., 2008). In different groups of people, the support of the predictive power of the HBM was found to be different. In a sample of 124 Chinese women in Hong Kong, logistic regression showed that women who did breast self-examination perceived health as important, having fewer barriers and higher susceptibility to breast cancer(Fung, 1998).

The HBM has also emerged as a useful framework for categorizing data and predicting health behaviours from studies of Chinese immigrants. For example, there was a qualitative study using the HBM to describing how cultural beliefs and understandings may influence participation in early detection of cancer for Chinese women living in the United States(Hoeman et al., 1996). A study of Health beliefs and practices related to breast cancer screening in three ethnic groups in the U.S. indicated strong influence of ethnicity on perceptions of susceptibility, seriousness related to breast cancer and perceived barriers. It found two unique barriers that were more frequently identified by Chinese (i.e. do not need mammogram if I feel ok [OR = 5.450, 95%; CI = (1.643, 18.081)] and waiting time is too long [OR = 5.070, 95%; CI = (1.674, 15.351)]) (Wu et al., 2006).

In summary, maternal health beliefs and bahaviours are shown by many studies to be strong predictors of child health. However, the health beliefs, child feeding attitudes and practices might be influenced by migration to another country. In spite of the popularity of the healthy immigrant hypothesis, evidence for it in child feeding practices and child health is weak. A greater understanding of maternal health beliefs that influence child health could advance the design and delivery of effective nutrition and activity interventions. Although many researchers have applied the Health Belief Model to understand and predict health behaviours, it has rarely been applied to parenting behaviours and predicting health of children. There is a need for a comparison of health beliefs and child feeding practices between Australian-Chinese immigrants and Chinese mothers in mainland China to assess Chinese mother's health beliefs and test whether their beliefs affect their parenting behaviours and child health.

Chapter 3

Methodology

3.1 Study design

A longitudinal cohort study was conducted of Chinese mothers living in Perth Australia who have at least one pre-school child less than five years old. If the mother had more than one child under 5 years old, the youngest child was chosen as the “index child” for questions in the questionnaire.

Data collection methods included questionnaires (self-reported and interviews), mobile phone text message questions and anthropometric measurements. A focus group interview was carried out before the main study to ensure that the study design, follow up methodology and questionnaires are culturally appropriate.

The baseline questionnaire was administered by interview and the intermediate follow-up questionnaires were administered by telephone at 3, 6, 9 and 12 months. The baseline questionnaire included demographic information, perinatal health, details of breastfeeding, health information sources, mother and child’s lifestyle behaviours, mothers’ perceptions and practice about child feeding, variables of health belief model, child’s health status, etc. The follow-up questionnaires included information on child’s health status, use of health services and sources of health information.

In addition to the main questionnaires mobile phone text messages were sent to participant mothers every two weeks asking about any illness experienced by their child and absence from usual daily activities. Details of any reported episodes were then recorded in the questionnaires.

The Health Belief Model was used to assess Chinese mother’s health beliefs and test whether their beliefs affect their parenting behaviours on child health and child weight. It could help inform the development of a culturally sensitive health promotion program for Chinese parents.

A cross-sectional survey was undertaken among mothers living in Chengdu, Sichuan Province and Wuhan, Hubei Province, PR China, for comparison. The data was acquired by baseline questionnaire used in Perth.

3.2 Recruitment and follow-up of sample

The participants in Perth were recruited from the Perth Chinese community, including Chinese weekend schools, childcare centers and community organizations (churches, child playgroups and so on). Flyers were distributed in appropriate places and recruiting information was published on the Chinese newspapers, posted on Chinese Network Community and broadcasted on the radio.

Appointments of the interviews with mothers were made via telephone. Mothers interested in taking part in this study were given an information sheet containing project details and were asked to sign the consent form. The participant mothers were informed that they could decline to participant and may withdraw from the study at any time without prejudice.

All the Perth mothers were followed up using the mobile phone technology:

1. Obtained a mobile phone number, home phone number, as well as their email and address of the participant mothers.
2. Sent mobile phone text messages asking questions about their child's health every two weeks.
3. Provided a mobile phone number where mothers can call or send text messages in reply.

Participants in China were recruited from four kindergartens in four districts of Wuhan and 14 kindergartens in seven districts of Chengdu. Permission for undertaking the cross-sectional survey in Chengdu and Wuhan was given by the local education authorities, who then notified the kindergartens that the research had been approved. Questionnaires were distributed and collected by kindergarten teachers. Mothers were asked to complete the questionnaire.

3.3 Procedure

The procedure of this study shows in the following research technology diagram.

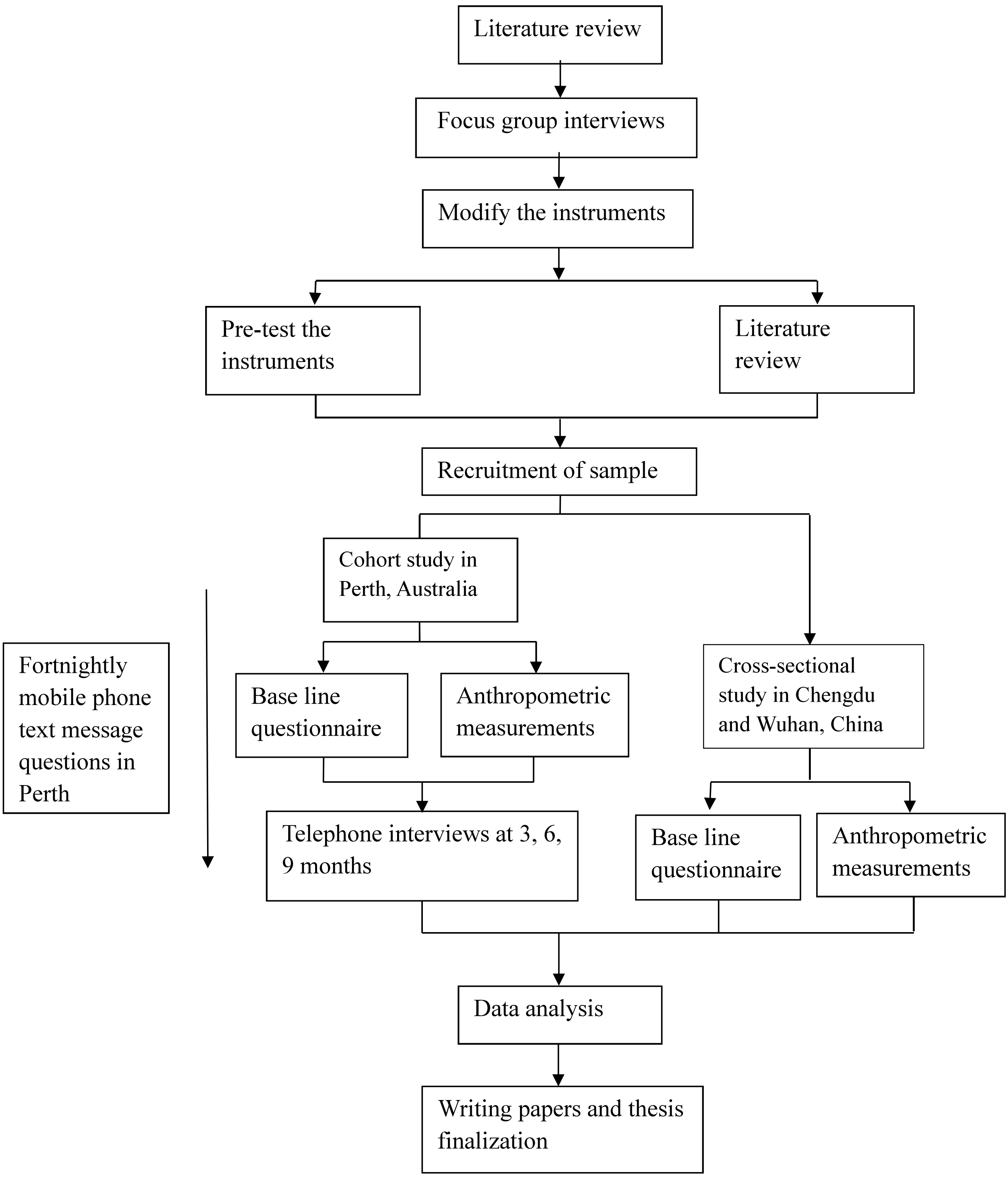

Figure 3.1 Research procedures

3.4 Measurements

The height and weight of mothers and children in Perth were measured during the interviews using standard anthropometric equipment and techniques(Marfell-Jones et al., 2006). The height and weight of mothers in China were self-reported and children's the height and weight were measured by trained health workers during the physical examination in September or October 2011.

The BMI was defined as weight (kg)/height (m)^2. The 2012 revised international child cut-offs developed by the International Obesity Task Force (IOTF) were used to classify thinness, overweight and obesity in children in this study (Cole and Lobstein, 2012). The international cut-offs are in terms of underlying LMS curves and the resulting curves provide age and sex specific cut off points from 2-18 years(Cole and Lobstein, 2012, Cole et al., 2000). They are based on BMI data from six countries, corresponding to the BMI cut-offs at 18 years, which are BMI 25 (overweight), 30 (obesity) and 18.5 (thinness grades 1) (Cole and Lobstein, 2012).

The mother's BMI was calculated and classified according to the Chinese adult cut-off points(Cheng, 2004b). The normal means a BMI score between 18.5 to 23.9, the underweight means less than 18.5, the overweight means 24 to 27.9 and the obesity means over 28(Cheng, 2004b).

3.5 Questionnaire development

Demographic and breastfeeding information was collected by validated and reliable questionnaire previously used in Chinese breastfeeding studies(Li et al., 2003b). Precoded questions were asked to classify income into three groups using categories were based on local annual household income surveys (Australian Bureau of Statistics, 2010c, Sichuan Bureau of Statistics, 2012b).

'Full breastfeeding' was defined by the WHO as "exclusive (no other liquid or solid is given to the infant) or almost exclusive (vitamins, mineral water, juice, or ritualistic feeds are given infrequently in addition to breastfeeds)"(Joint WHO/UNICEF Informal Interagency Meeting et al., 1993, Labbok et al., 1997).

The mothers' attitudes toward infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS) which is a measure of attitudes towards infant feeding(De la Mora, 1999). The IIFAS contains 17 items with a five-point Lickert scale that ranged from 'strongly disagree' to 'strongly agree' for each item. Total attitude scores range from 17 to 85 with higher scores reflecting attitudes more positive to breastfeeding(De la Mora, 1999). The reliability and validity of the scale has been assessed by studies undertaken in English-speaking populations(Scott et al., 2004, Scott et al., 2006b, Sittlington et al., 2007, Dungy et al., 2008, De la Mora, 1999). It has been translated into Romanian and traditional Chinese and showed good reliability and validity. In this study, the IIFAS was translated into simplified Chinese by three bilingual translators and subsequently back-translated(Chen et al., 2013a).

The Health Belief Model (HBM) assessment instrument designed and tested by Maiman et al. and modified for its relevance to Chinese culture and beliefs was used(Liou et al., 2006, Maiman et al., 1977). Each major component of the HBM was operationalized by multiple questionnaire items, with responses permitted along a five-choice rating scale of agreement (from "not at all" to "completely"), except two questions about special health practices for the child ("yes" or "no"). These single items were then combined on the basis of manifest content to construct index measures for the different HBM dimensions. An index measure was derived by adding the responses by an individual on two or more items related to a particular dimension, and then dividing the sums score by the number of items included in the index to obtain a mean score.

The validated Child Feeding Questionnaire (CFQ) developed by Johnson and Birch based on Costanzo and Woody's theory was used to assess parental attitudes and practices towards child feeding, including perception of child weight, restriction, pressure to eat, and monitoring(Costanzo et al., 1985, Birch et al., 2001a, Geng et al., 2009, Birch et al., 2001b).

Children's 24 hours food record was based on questionnaires that have been previously used in other Curtin University studies(Li et al., 2003b, Li et al., 2004). It is also used to collect information on the participant's use of medicine, vitamins, minerals, herbals, and other supplements over the past two weeks. Detailed information about type, consumption frequency, and amount taken is also collected for each reported dietary supplement use.

Child's health status was collected using the Australian National Health Survey questionnaire(Australian Bureau of Statistics, 2005).

The pre-school child's physical activity was obtained by the 2006 child questionnaire used in The China Health and Nutrition Survey(University of North Carolina and Chinese Center for Disease Control and Prevention, 2006).

3.6 Components of the survey questionnaire

The components of the survey questionnaire show in the following table.

Table 3.1 The questionnaires and components for this study

Components		**Questionnaire and reference**
Independent variables	Demographic information, perinatal, health information sources	Chinese Mother's Questionnaire(Li et al., 2003b, Li et al., 2004)
	Mothers' general health motivations, perceptions of child health and obesity, self-efficacy, cues to action, etc.	Health Belief Model Questionnaire(Maiman et al., 1977, Liou and Contento, 2001, Liou et al., 2006)
	Mother's physical activities	Chinese Mother's Questionnaire(Li et al., 2003b, Li et al., 2004), Mothers with Young Children Study Questionnaire (Jones et al., 2008)
	Mother's encouragement of physical activities, participation in physical activities, instrumental support	Parenting styles, Self-Rated Health(Elder et al., 2010)
	Breastfeeding attitudes	Iowa Infant Feeding Attitude Scale (IIFAS)(Mora and Russell, 1999)
	Parental attitudes and practices towards child feeding, perceptions and concerns of the child's weight status.	The Child Feeding Questionnaire(Birch et al., 2001b, Geng et al., 2009)
	Child's physical activity	2006 child questionnaire from The China Health and Nutrition Survey(University of North Carolina and Chinese Center for Disease Control and Prevention, 2006)
Dependent variables	The child's diet	Chinese Mother's Questionnaire(Li et al., 2003b, Li et al., 2004)

	Incident of illness of children	National Health Survey Questionnaire(Australian Bureau of Statistics, 2005)

3.7 Sample size and power calculations

In establishing the hypotheses to be tested in this study, it is considered that the practice of breastfeeding reflects mothers' beliefs and attitudes regarding child feeding and has a lot of benefits to children. The breastfeeding rate of Chinese mothers is used to estimate the sample size. It is assumed that 50% of mothers will still be breastfeeding at 6 months (Xu et al., 2009). With 95% confidence intervals of 45% to 55%, a sample of 384 mothers was calculated using the following formula:

$$n = \frac{Z_{\alpha/2}^{2}\pi(1-\pi)}{\delta^{2}}$$

Where: $Z_{\alpha/2}$=1.96, is a Z value corresponding to the tail area of α/2 to its right under a standard normal curve corresponding to the alpha level 0.05;

π=0.5, is the estimated prevalence of breastfeeding at 6 months;

δ=0.05, is acceptable margin of error for prevalence being estimated,

Considering a 10% non-response rate and a 10% attrition, the sample size was rounded up to 480.

3.8 Data analysis

Data was entered into Epidata 3.0 (The EpiData Association, Denmark). After the data has been logically checked, all statistical analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0 (SPSS, Chicago, IL, USA).

Descriptive statistics was calculated for variables of interest. Continuous variables (e.g., mother's age, mother's weight gain during pregnancy, child's BMI, etc) were presented as mean ± standard deviation and median (IQR) when the distribution of a variable was skewed. Categorical variables (e.g., mother's main sources of information about the child nutrition and healthy lifestyle, child's illness rate, etc) were presented as number (%) in relevant categories.

Difference in demographic profiles between the groups of participants and non-participants was tested by chi square (χ^2) test and an independent samples t-test is used to exam the group difference.

An independent samples t-test was used to compare means differences between two groups (Australia and China). Mann-Whitney U test was applied to compare the median age of children from two countries. Chi square (χ^2) test was used to compare basic characteristics of mothers and children between Australia and China.

Spearman's rank correlation coefficient was used to assess the association between the Health Belief Model dimensions and mother's child feeding behaviours and support for physical activities.

One-way analysis of variance (ANOVA) was carried out to assess association between IIFAS scores and socio-demographic factors.

A multiple binary logistic regression analysis was performed to evaluate the association between mother and child's characteristics and the use of dietary supplements controlling for potential confounders, such as age and family economic status. It was also used to assess/evaluate the influence of potential risk factors on 'breastfeeding initiation', and 'any breastfeeding' at six months and twelve months, respectively. A backward elimination procedure was applied to obtain final models.

All mothers were split into two groups: those with an IIFAS score at or above the median (58) and those with a score below the median (58) and a binary variable (1 = at or above the median, 0 = below the median) was created to indicate mother's IIFAS levels. A univariate binary logistic regression was then applied to explore the association of the Iowa Infant Feeding Attitude Scale (IIFAS) score levels with breastfeeding duration.

Cronbach's alpha was used to assess internal consistency of IIFAS items (Cronbach and Warrington, 1951). Internal reliability was acceptable if Cronbach's alpha was greater than 0.6 (Sim, 2000).

All tests were two-sided and a p value less than 0.05 was considered as statistically significant.

3.9 Ethics

An information letter, which includes an explanation of the study, was given to each mother from Perth, Chengdu or Wuhan. The mothers were informed about the purpose of the study and asked to sign a consent form. They were informed that the participation in the study was entirely voluntary and all the participants had the right to withdraw at any stage. The study was approved by the Curtin University Human Research Ethics Committee (approval number: HR 96/2010) and the local education authorities in China (District Departments of Education of Longquanyi, Chenghua, Jinjiang, Gaoxin and Jinniu, Wenjiang and County Department of Education of Shuangliu in Chengdu, and Department of Education of Wuhan).

3.9.1 Confidentiality and data storage

All data are kept confidential and no identifiable data was released to anyone. All electronic data are password protected, the password restricted to the principal investigators. Subjects were not identified by name in any publication or report. The questionnaires were stored in the secure office space and have been transferred in a locked room at School of Public Health, Curtin University. They will be kept secured by Curtin University for seven years.

Chapter 4

Descriptive and univariate results

In this chapter, the results of the two studies are described and the main issues will be highlighted. Further detailed analysis is provided in the specific results chapters of the thesis. This chapter is divided into sections in accordance with the aims of the study. Results of descriptive and univariate analysis including demographic information about the participants, breastfeeding practices and related factors, infant feeding attitudes of the mothers, maternal perceptions of their children's weight, parental beliefs about child health, health information sources and health services used, are presented first. Results of multivariate analysis are then presented in the following published papers: "Attitudes towards breastfeeding – the Iowa Infant Feeding Attitude Scale in Chinese mothers living in China and Australia", "the 'Healthy Migrant Effect' in Breastfeeding Practices of Chinese Mothers in Australia and China", "Prevalence and characterisation of dietary supplement use in healthy pre-school Chinese children in Australia and China", "Calcium supplementation in young children in Asia – prevalence, benefits and risks", "Chinese Mothers' Perceptions of their child's weight", "The more she cares the more overweight her child: a population-based survey on health belief model in child care behaviours of Chinese mothers in China and Australia", illnesses of Chinese young children, health information sources of Chinese mothers living in Perth and health services used by Chinese young children in Perth.

4.1 Response rates of studies in Australia and China

The data for this study was collected from October 2010 to October 2011 in Perth, Western Australia and from September to December 2011 in Chengdu and Wuhan, PR China. Initially, a total of 239 mothers in Perth agreed to participate and returned the questionnaire. Two mothers were excluded from the analysis because their children were over five years old. This resulted in 237 participants in the cohort at the beginning of the study, with a response rate of 95.6%. A total of 2400 questionnaires were distributed to mothers by kindergarten teachers in Chengdu and Wuhan. After excluding mothers with the 'index child' over five years, 1608 and 471 of mothers from Chengdu and Wuhan respectively, participated in this study, a response rate of 86.6% in China. Some mothers declined and the reasons given included time constraints, privacy and or they simply did not want to participate.

The total number of questionnaires analysed for each visit in the Perth cohort are shown in Table 4.1 below.

Table 4.1 Response rates in Perth cohort

Visit	Number of respondents	Response rate
Baseline	237	95.56%
3 months	181	72.98%
6 months	166	66.94 %
9 months	161	64.92 %
12 months	145	58.47%

The response rate decrease with time due to the mothers moving to other cities or sending their child back to China and privacy concern (some mothers do not want to talk about their children's illness). Almost 60% of the mothers recruited in the baseline survey were interviewed at 12 months and a total of 135 mothers attended all the five interviews.

4.1.1 Differences between respondents and non-respondents

Comparisons have been made for differences in age, education, working status and household income between respondents who attended the baseline interview and those who attended the 1 month, 3 months, 6 months and 12 months visits. The results of this comparison shown in Table 4.2 found that the follow-up samples did not significantly differ from the baseline sample on these three variables.

Table 4.2 Test of differences on response rate between general characteristics of the baseline samples and follow-up samples in Perth

	3 months		6 months		9 months		12 months	
	n (%)	*p*	n (%)	*p*	n (%)	*p*	n (%)	*p*
Age		0.269		0.509		0.307		0.295
≤30	55 (78.6)		51 (72.9)		51 (72.9)		47 (67.1)	
>30	116 (71.6)		111 (68.5)		107 (66.0)		97 (59.9)	
Education level		0.873		0.439		0.654		0.409
High school diploma or less	22 (75.9)		23 (79.3)		21 (72.4)		21 (72.4)	
TAFE certificate/diploma	24 (75.0)		22 (68.8)		23 (71.9)		20 (62.5)	
University degree or higher	126 (72.0)		118 (67.4)		115 (65.7)		104 (59.4)	
Working status		0.766		0.957		0.792		0.321
Full-time work	32 (71.1)		30(66.7)		30 (66.7)		28 (62.2)	
Part-time work	28 (80.0)		25 (71.4)		26 (74.3)		25 (71.4)	
Casual	20 (74.1)		18 (66.7)		17 (63.0)		13 (48.1)	
Unemployed	92 (71.3)				86 (66.7)		79 (61.2)	
Household income		0.943		0.84		0.53		0.256
Low income	81 (73.6)		77 (70.0)		77 (70.0)		72 (65.5)	
High income	82 (73.2)		77 (68.8)		74 (66.1)		65 (58.0)	

4.2 General characteristics of mothers and their children

This section describes the general characteristics that are associated with mothers, children and their families, particularly the variables related to the socio-demographic status of the mothers and children.

The distribution analysis shows no difference in age, education attainment, marital status, working status and delivery method of the child between participants in Chengdu and Wuhan. The only statistically significant difference between participants in Wuhan and Chengdu is the age of the child (see Table 4.3). The median age of the 'index child' in the Chengdu and Wuhan were both four years old, but the interquartile range was wider in Wuhan (2 years in Wuhan and 1 years in Chengdu, Mann-Whitney U test U=317866.5, p<0.001). The average age of the 'index child' was 3.7 years in Chengdu and 3.5 years in Wuhan. Because the differences in demographic characteristics are so small in Wuhan and Chengdu samples, and these cities have many similarities, their data have been pooled into one data or further analysis.

Table 4.3 General characteristics of mothers and their children in Chengdu and Wuhan

Characteristic	Chengdu (n*=1608)	Wuhan (n*=471)	*p*
	n (%)	n (%)	
Age (years)			0.235
≤30	603 (52.3)	238 (55.6)	
>30	551 (47.7)	190 (44.4)	
Marital status			
Married/de facto	1172 (97.7)	434 (97.3)	0.603
Separated/devoiced	27 (2.3)	12 (2.7)	
Educational attainment			0.520
High school diploma or less	379 (32.0)	147 (33.4)	
TAFE certificate/diploma	295 (24.9)	124 (28.2)	
University degree or higher	511 (43.1)	169 (38.4)	
Working status			0.070
Full-time work	734 (61.8)	300 (67.9)	
Part-time work	52 (4.4)	20 (4.5)	
Casual	203 (17.1)	54 (12.2)	
Not employed	198 (16.7)	68 (15.4)	
Household income			0.089
Low income	581 (57.9)	225 (56.8)	
High income	423 (42.1)	171 (43.2)	
Age of the child (years)			<0.001
0-1	2 (0.1)	15 (3.3)	

1-2	92 (0.6)	20 (4.3)	
2-3	274 (17.8)	89 (19.3)	
3-4	714 (46.5)	196 (42.5)	
4-5	537 (35.0)	141 (30.6)	
Gender of the child			0.031
Boy	803 (51.9)	268 (57.6)	
Girl	743 (48.1)	197 (42.4)	
Delivery method			0.160
Vaginal delivery	447 (29.2)	151 (32.6)	
Caesarean section	1084 (70.8)	312 (67.4)	

* The missing values vary for each variable in both cities.

General characteristics of the study population are presented in Table 4.4. Australian mothers had a higher education level compared to China mothers and higher economic status according to the local household economic standard (p<0.05) (Table 4.4). The majority of Australian mothers (74.2%) had a university degree compared to 41.8% in China (p<0.001). Only 19.1% of Perth mothers had full-time work compared to 63.5% in China (<0.001) (see Table 4.4).

The median age of the "index child" in the Chengdu and Wuhan sample (median age=3.70 years, interquartile range=1.11 years) was older than in Perth (median age=1.59 years, interquartile range=1.88 years, Mann-Whitney U=66319, p<0.001).

Table 4.4 General characteristics of Chinese mothers and their children in Australia and China

Characteristic	Australia (n*=237)	China (n*=2078)	*p*
	n (%)	n (%)	
Age (years)			<0.001
≤30	70 (30.2)	841 (53.2)	
>30	162 (69.8)	741 (46.8)	
Marital status			
Married/de facto	235 (99.6)	1606 (97.6)	0.053
Separated/devoiced	1 (0.4)	39 (2.4)	
Mother's birth place			
Mainland China	190 (80.2)		
Hong Kong	3 (1.3)		
Malaysia	28 (11.8)		
Singapore	9 (3.8)		
Other countries	7 (3.0)		
Duration in Australia (years)			
<5	108 (45.2)		
5-10	79 (33.1)		
>10	48 (20.1)		

Educational attainment			<0.001
High school diploma or less	29 (12.3)	650 (40.0)	
TAFE certificate/diploma	32 (13.6)	295 (18.2)	
University degree or higher	175 (74.2)	680 (41.8)	
Working status			<0.001
Full-time work	45 (19.1)	1034 (63.5)	
Part-time work	35 (14.8)	72 (4.4)	
Casual	27 (11.4)	257 (15.8)	
Not employed	129 (54.7)	266 (16.3)	
Household income			0.025
Low income	110 (49.5)	806 (57.6)	
High income	112 (50.5)	594 (42.4)	
Age of the child (years)			<0.001
0-1	66 (27.8)	17 (0.8)	
1-2	82 (34.6)	29 (1.5)	
2-3	39 (16.5)	363 (18.2)	
3-4	30 (12.7)	910 (45.6)	
4-5	20 (8.4)	678 (34.0)	
Gender of the child			0.737
Boy	125 (53.0)	1071 (53.3)	
Girl	111 (47.0)	940 (46.7)	
Delivery method			<0.001
Vaginal delivery	152 (64.1)	530 (30.3)	
Caesarean section	85 (35.9)	1221 (69.7)	

* The missing values vary for each variable in both countries.

4.3 Breastfeeding practices and attitudes towards breastfeeding of Chinese mothers

4.3.1 Breastfeeding initiation and duration

In total, more than 90% of mothers initiated breastfeeding with an initiation rate of 94.1% in Australia and 86.2% in China. There was no difference in the mean ‘exclusive breastfeeding’ duration between Australia (3.9±2.7 months) and China (3.7±2.7 months), and nor in the ‘full breastfeeding’ duration between the two country groups (the median ‘full breastfeeding’ duration of 4 months and the interquartile range of 5 months for both countries). However, Australian mothers were more likely to initiate breastfeeding ($\chi 2$=11.7, df=1, P=0.001) and they had longer ‘any breastfeeding’ duration (P<0.001) (see Table 4.5). In Australia, the median duration of ‘any breastfeeding’ was 9.25 months (interquartile range=7 months) compared to 8 months in China (interquartile range=5.62 months). Australian mothers also had a greater ‘full breastfeeding’ rate at 6 months and greater ‘any breastfeeding’ rates at 6 and 12 months (P<0.001) (see Figure 4.1).

Table 4.5 Breastfeeding practices of Chinese mothers in Australia and China

	Australia (n*=237) n (%)	China (n*=2078) n (%)	*p*
Breastfeeding initiation			0.001
Breastfed	225 (94.1)	1531 (86.2)	
Never breastfeed	14 (5.9)	245 (13.8)	
'Full breastfeeding' at 6 months			0.016
Yes	76 (33.8)	385 (26.1)	
No	149 (66.2)	1089 (73.9)	
'Any breastfeeding' at 6 months			0.046
Yes	168 (75.7)	1033 (69.1)	
No	54 (24.3)	462 (30.9)	
'Any breastfeeding' at 12 months			<0.001
Yes	85 (38.3)	244 (16.3)	
No	137 (61.7)	1251 (83.7)	

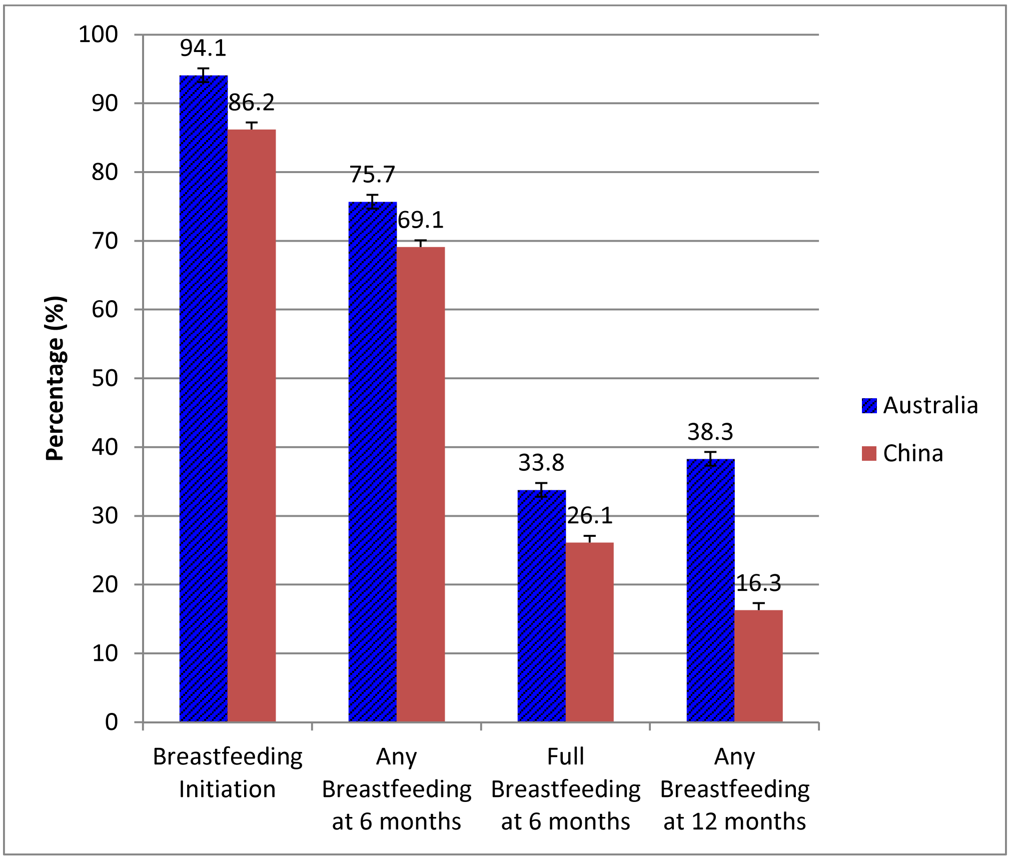

Figure 4.1 Breastfeeding rates in Chinese mothers in Australia and China (%, 95% confidence interval)
(The differences are all significant, p<0.05)

4.3.2 Reasons of stop breastfeeding

The mothers were asked about their reasons for stopping breastfeeding at baseline. Table 4.6 lists the reasons for stopping breastfeeding that mothers gave. More than 30% of mothers gave as their first reason ‘did not have enough breastmilk’ and about 30% mothers in both country groups gave as a reason “the child was old enough” for stopping breastfeeding. The third most mentioned reason for stopping breastfeeding was ‘return to work’ (14.3% and 17.2% in Australia and China respectively).

A follow-up was asked where applicable “why did you think that you did not have enough breastmilk”. The most mentioned reasons were “the baby cried often”, “the baby cried more after being breastfed”, “woke up often at night”, “My breasts no longer feel ‘full’ when it was time for a feeding” in both country groups.

There were four mothers in Australia (1.6%) and 24 mothers (1.2%) in China reported stopping breastfeeding due to mastitis. In several cases mothers stopped breastfeeding because their baby was ill, one case of diarrhoea and one pulmonary infection in the Australian sample. In the China resident mothers the main illnesses resulting in breastfeeding cessation were ‘having cold/fever’ (n=27) and diarrhoea (n=8). Other reasons for stopping breastfeeding in mothers in Australia included “the baby refused”, “milk was getting watery”, “the baby was separated from the mother (for example, sent back to China)”, “hurt after the baby grew teeth”, and “pregnant again”. Except the reasons mentioned by Australian mothers, a great portion of mothers in China stopped breastfeeding because they thought “breastmilk is not nourishing after several (6 or 8 or 10 or 12) months”.

Table 4.6 Reasons for stopping breastfeeding

Reasons	Australia (n=237)		China (n=2078)	
	N	%	N	%
The child was old enough	76	32.0	599	28.8
Did not have enough breastmilk	74	31.2	741	35.7
Nipple or breast problems	12	5.0	55	2.7
Return to work	34	14.3	357	17.2
Baby sick	3	1.3	47	2.3
Mother tired	21	8.8	33	1.6
Mother sick or unwell	8	3.4	67	3.2
Other reasons	34	14.3	102	4.9

*Percentages may add up to more than 100 as respondents may have given multiple responses.

4.3.3 Infant feeding attitude: the Iowa Infant Feeding Attitude Scale in Chinese mothers

The Iowa Infant Feeding Attitude Scale (IIFAS) was completed by 233 mothers in Australia and 1988 mothers in China. Tables 4.7 and 4.8 show the mothers' responses (percentages) for each item in the IOWA Infant Feeding Attitude Scale (IIFAS). More mothers in China (57.2%) disagreed with the statement "formula feeding is more convenient than breastfeeding" (57.2% in China compare to 51.1% in Australia) and "breastmilk is lacking in iron" than mothers in Australia (58.2% in China compare to 52% in Australia). China mothers (72%) were more likely to support formula feeding if they went back to work than Australian mothers (66.1%). In both country groups, the highest percentages for "neutral" response were for the statements of "formula is as healthy for an infant as breastmilk", "breastmilk is lacking in iron" and two statements about "overfeeding".

Table 4.7 Item responses of the IIFAS of mothers in Australia （n=233）

Attitude Item	Percentages				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The benefits of breastfeeding last only as long as the baby is breast-fed.	9.9	33.5	24.0	25.8	6.9
2. Formula feeding is more convenient than breastfeeding.	14.6	36.5	22.7	22.3	3.9
3. Breastfeeding increase mother infant bonding.	0.9	0.4	7.3	38.6	52.8
4. Breastmilk is lacking in iron.	11.2	40.8	39.9	6.9	1.3
5. Formula fed babies are more likely to be overfed than breastfed babies.	1.7	22.3	39.5	34.3	2.1
6. Formula feeding is the better choice if the mother plans to go back to work.	2.6	11.2	20.2	55.4	10.7
7. Mothers who formula feed miss one of the great joys of motherhood.	6.9	28.8	26.6	28.8	9.0
8. Women should not breastfeed in public places such as restaurants.	19.7	37.3	23.6	15.9	3.4
9 Breastfed babies are healthier than formula fed babies.	1.7	8.2	26.6	38.6	24.9
10. Breastfed babies are more likely to be overfed than formula fed babies.	5.2	41.2	43.3	9.4	0.9
11. Fathers feel left out if a mother breast-feeds.	12	57.9	24.5	4.7	0.9
12. Breastmilk is the ideal food for babies.	0.9	2.1	4.3	36.5	56.2
13. Breastmilk is more easily digested than formula.	0.4	1.7	10.3	39.9	47.6
14. Formula is as healthy for an infant as breastmilk.	3.0	27.5	42.1	26.2	1.3
15. Breastfeeding is more convenient than	0.4	9.9	15.9	45.5	28.3

formula.					
16. Breastmilk is cheaper than formula.	2.1	6.9	12.0	39.5	39.5
17. A mother who occasionally drinks alcohol should not breastfeed her baby.	3.0	20.6	29.6	32.6	14.2

Table 4.8 Item responses of the IIFAS of mothers in China (n=1988)

Attitude Item	**Percentages**				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. The benefits of breastfeeding last only as long as the baby is breast-fed.	5.2	32.9	28.3	29.1	4.4
2. Formula feeding is more convenient than breastfeeding.	12.8	44.4	24.2	17.5	1.2
3. Breastfeeding increase mother infant bonding.	0.7	2.6	6.2	51.7	38.8
4. Breastmilk is lacking in iron.	10.5	47.4	35.5	6.1	0.6
5. Formula fed babies are more likely to be overfed than breastfed babies.	5.0	35.9	32.9	24.7	1.4
6. Formula feeding is the better choice if the mother plans to go back to work.	0.8	5.9	21.3	68	4.0
7. Mothers who formula feed miss one of the great joys of motherhood.	5.1	26.0	24.6	35.8	8.5
8. Women should not breastfeed in public places such as restaurants.	6.6	26.3	32.8	29.5	4.9
9 Breastfed babies are healthier than formula fed babies.	0.8	8.8	24.8	48.0	17.7
10. Breastfed babies are more likely to be overfed than formula fed babies.	3.1	33.3	45.9	16.5	1.2
11. Fathers feel left out if a mother breast-feeds.	11.2	61.5	20.6	5.7	1.0
12. Breastmilk is the ideal food for babies.	0.5	1.6	7.4	54.6	35.9
13. Breastmilk is more easily digested than formula.	0.6	2.9.0	15.6	53.7	27.2
14. Formula is as healthy for an infant as breastmilk.	3.3	24.0	49.2	22.5	1.0
15. Breastfeeding is more convenient than formula.	0.4	4.3	18.5	60.1	16.8
16. Breastmilk is cheaper than formula.	3.7	11.4	20	45.5	19.4
17. A mother who occasionally drinks alcohol should not breastfeed her baby.	1.8	11.1	24.1	45.9	17.1

The mean IIFAS scores in both groups lay in the range of 'neutral breastfeeding attitudes'. Chinese mothers in Australia tended to have more positive attitudes towards breastfeeding (IIFAS mean score = 59.95±6.21) compared to the mothers in China (IIFAS mean score = 57.65±5.06, $p<0.001$) (Table 4.9).

The responses to each IIFAS item were compared between mothers in Australia and mothers who were in China (Table 4.9). The mean scores of the item "formula feeding is the better choice if the mother plans to go back to work" and "a mother who occasionally drinks alcohol should not breastfeed her baby" were negative for breastfeeding (with mean scores less than 3). Chinese mothers in both groups tended to stop breastfeeding if they planned to go back to work or occasionally drank alcohol. Australian mothers had higher scores in 10 items. The highest mean difference appears on the item "women should not breastfeed in public places such as restaurants" and Australian mothers were less likely to agree with this than the China-resident mothers ($p<0.01$) (Table 4.9).

Table 4.9 Item-response comparisons between Chinese mothers in Australia and in China

	Australia （n=233） mean±SD	China (n=1988) mean±SD	Mean difference	p
1. The benefits of breastfeeding last only as long as the baby is breast-fed ⋆	3.14±1.12	3.05±1.00	0.09	0.003
2. Formula feeding is more convenient than breastfeeding ⋆	3.36±1.10	3.50±0.96	-0.14	<0.001
3. Breastfeeding increase mother infant bonding	4.42±0.72	4.25±0.75	0.17	0.321
4. Breastmilk is lacking in iron ⋆	3.54±0.83	3.61±0.78	-0.07	0.111
5. Formula fed babies are more likely to be overfed than breastfed babies	3.13±0.83	2.82±0.78	0.31	0.008
6. Formula feeding is the better choice if the mother plans to go back to work ⋆	2.39±0.91	2.31±0.68	0.08	<0.001
7. Mothers who formula feed miss one of the great joys of motherhood	3.04±1.10	3.17±1.07	-0.13	0.878
8. Women should not breastfeed in public places such as restaurants ⋆	3.54±1.08	3.00±1.01	0.54	0.002
9 Breastfed babies are healthier than formula fed babies	3.77±0.97	3.73±0.88	0.04	0.019
10. Breastfed babies are more likely to be overfed than formula fed babies ⋆	3.40±0.77	3.20±0.79	0.20	0.611
11. Fathers feel left out if a mother breast-feeds ⋆	3.76±0.76	3.76±0.76	0.00	0.695
12. Breastmilk is the ideal food for babies	4.45±0.75	4.24±0.70	0.21	0.017
13. Breastmilk is more easily digested than formula	4.33±0.76	4.04±0.77	0.29	0.002
14. Formula is as healthy for an infant as breastmilk ⋆	3.05±0.84	3.06±0.80	-0.01	0.104
15. Breastfeeding is more convenient than formula	3.91±0.93	3.89±0.74	0.02	<0.001
16. Breastmilk is cheaper than formula	4.07±0.99	3.66±1.03	0.41	0.015
17. A mother who occasionally drinks alcohol should not breastfeed her baby ⋆	2.66±1.05	2.35±0.95	0.31	0.002
Mean IIFAS score	59.95 ± 6.21	57.65 ±5.06	2.30	<0.001

⋆ Reverse scored items

There were no significant differences in infant feeding attitudes by marital or working status (see Table 4.10). Higher educational attainment and higher economic status were significantly associated with mother's positive attitude towards breastfeeding in both countries (p<0.001) (Table 4.10).

Table 4.10 Differences in demographic factors and attitudes scores

	Australia			China		
Demographic factors	n	Mean±SD	*p*	n	Mean±SD	*p*
Age (years)			0.403			0.735
30≤	70	59.44±6.44		815	57.75±5.11	
>33	159	60.20±6.20		715	57.84±5.12	
Education attendance			<0.001			<0.001
High school diploma or less	26	56.38±4.74		625	57.03±4.59	
TAFE certificate/diploma	32	58.06±7.42		286	57.20±4.86	
University degree or higher	175	60.83±5.92		659	58.37±5.09	
Marital status			0.331			0.245
Married/de facto	232	59.93±6.21		1552	57.74±5.12	
Separated/devoiced	1	66.00		37	56.76±4.61	
Working status			0.993			0.173
Full-time	45	60.04±6.40		999	57.90±5.26	
Part-time	62	59.95±6.38		322	57.29±4.61	
Not employed	126	59.92±6.11		255	57.72±5.18	
Economic status			0.027			0.020
Low	109	59.36±6.19		778	57.51±4.84	
High	111	61.14±5.66		579	58.17±5.54	

There were 13 mothers in Australia who used the English version of the IIFAS. They were excluded from the reliability analysis of the simplified Chinese version of IIFAS.

The simplified Chinese version of IIFAS had moderate internal consistency with a Cronbach's alpha of 0.58 in the combined sample (mothers in China and in Australia), 0.69 for mothers in Australia and 0.55 for mothers in China. Analysis of subgroup differences in reliability revealed strengthened reliability in university educated mothers in (α = 0.63) and in higher household economic mothers in China (α = 0.62).

The predictive validity of the simplified Chinese version of IIFAS is reflected in the finding that mothers with higher attitude scores were more likely to initialise breastfeeding (χ^2=25.03, df=3, p<0.001) and also tended to have longer breastfeeding duration (χ^2=25.33, df=3, p<0.001) (see Figure 4.2, Figure 4.3). The mean IIFAS scores were classified into four groups by quartiles. Breastfeeding duration was divided into two groups by the median duration (8 months) as ‘breastfed≥8 months’ and ‘breastfed<8 month’.

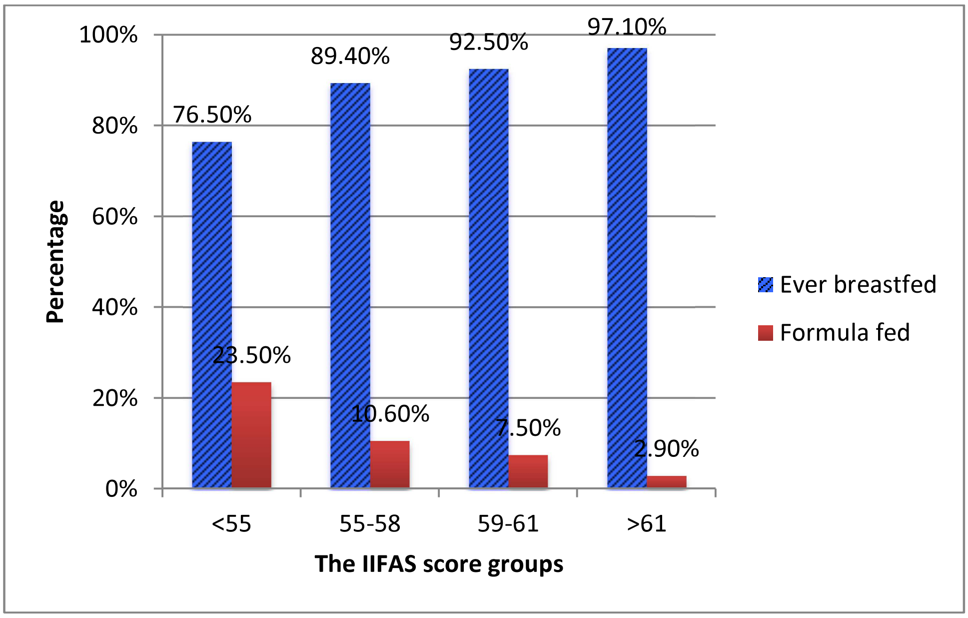

Figure 4.2 Infant feeding choice by different IIFAS score groups (p<0.001)

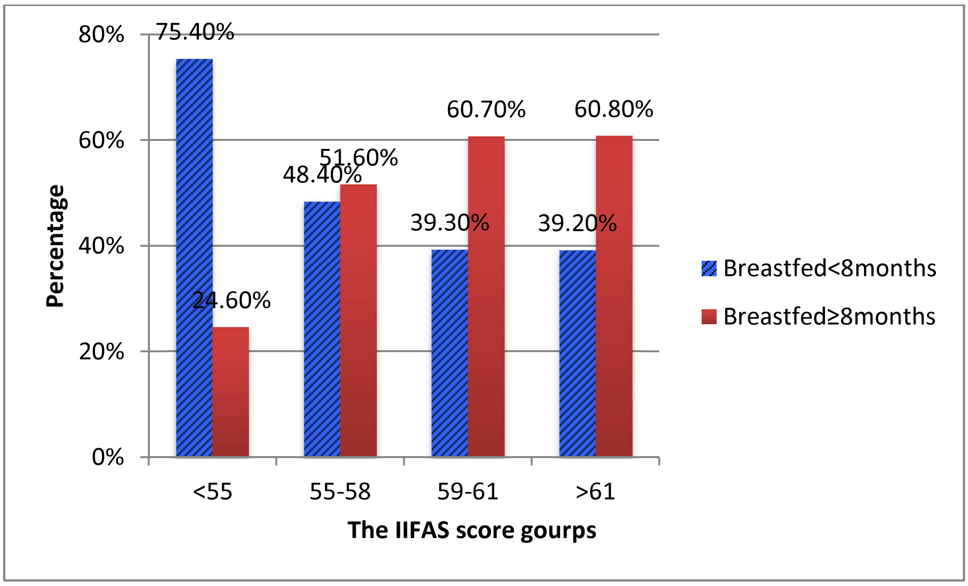

Figure 4.3 Breastfeeding duration by different IIFAS score groups (p<0.001)

4.4 Weight status and physical activity of Chinese mothers and children

This section describes the variables associated with the child's growth and weight status, including variables of weight, height, BMI and physical activities of Chinese mothers and children.

4.4.1 Weight, height and BMI of Chinese mothers and children

The weight and height range of Chinese boys and girls living in Perth, Australia, and those living in China are show in Tables 4.11 to 4.18 respectively. The age range for Chinese boys in the Australian sample was from one week to 57 months and for girls was from 3 weeks to 57.7 months (Table 4.11, 4.12). The age range for Chinese boys in China was from about two months to 60.0 months and it for girls was from 5.5 months to 60 months (Table 4.15, 4.16).

The average weights of Chinese boys and girls in Australia by age approximated the 50th percentile of the WHO standard of 2006 (see Figure 4.4 and 4.5). The average weights of boys under three years old were higher than the 50th percentile while girls' were slightly lower than the 50th percentile of the WHO standard before four years of age (Figure 4.4 and 4.5). Chinese boys in China had higher weights than the WHO 50th percentile from one to five years while the average weights of Chinese girls dropped to the 50th percentile after three years (Figure 4.4 and Figure 4.5). Boys and girls in China had higher weights than boys in Australia under three years of age. After three years old the weights of boys in China were still higher while the weights of girls in China became lower than girls in Australia (Figure 4.4 and Figure 4.5).

The average heights of Chinese boys in Australia were above the 50th WHO percentile before three years old and under it after (see Figure 4.6). The average heights for age of the boys in China under four years old were above the 50th WHO percentile and overlap with it after four years (Figure 4.6). Chinese boys in China were taller than Chinese boys in Australia in all age groups but the differences became smaller after four years of age (Figure 4.6). The average heights for age of Chinese girls in Australia were close to the 50th WHO percentile, while the girls in China were above the 50th WHO percentile and taller than the heights of Chinese girls in Australia under three years old but lower after three years (Figure 4.7).

Table 4.11 Weight of Chinese boys in Perth, Australia

Age (years)	Age（months）	Mean age (months)	N	Minimum (kg)	Maximum (kg)	Mean (kg)	Std. Deviation
0-1	0.2-11.9	7.3	33	3.70	12.20	8.32	1.94
~2	12.1-23.6	17.4	43	8.80	13.50	11.29	1.15
~3	24.2-35.8	29.6	21	12.00	17.50	13.95	1.40
~4	36.3-46.7	40.5	17	12.00	17.50	15.40	1.80
~5	48.7-57.0	53.0	11	15.50	19.50	17.18	1.35

Table 4.12 Weight of Chinese girls in Perth, Australia

Age (years)	Age（months）	Mean age (months)	N	Minimum (kg)	Maximum (kg)	Mean (kg)	Std. Deviation
0-1	0.9-11.9	7.3	31	4.00	9.50	7.07	1.49
~2	12.2-23.8	17.4	39	8.50	15.50	10.85	1.33
~3	25.0-35.8	29.6	18	10.00	16.00	12.70	1.61
~4	36.8-47.2	40.4	13	12.50	25.00	15.65	3.16
~5	48.5-57.7	53.0	9	15.50	22.50	18.72	2.44

Table 4.13 Height of Chinese boys in Perth, Australia

Age (years)	Age（months）	Mean age (months)	N	Minimum (cm)	Maximum (cm)	Mean (cm)	Std. Deviation
0-1	0.2-11.9	7.3	33	52.00	80.00	68.95	6.65
~2	12.1-23.6	17.4	42	72.00	90.50	81.39	4.30
~3	24.2-35.8	29.6	21	86.50	99.00	92.69	3.51
~4	36.3-46.7	40.5	17	87.50	103.70	97.12	4.21
~5	48.7-57.0	53.0	11	101.00	112.40	105.66	3.10

Table 4.14 Height of Chinese girls in Perth, Australia

Age (years)	Age（months）	Mean age (months)	N	Minimum (cm)	Maximum (cm)	Mean (cm)	Std. Deviation
0-1	0.9-11.9	7.3	31	53.00	80.00	65.19	6.35
~2	12.2-23.8	17.4	38	72.00	98.00	81.15	5.97
~3	25.0-35.8	29.6	18	82.00	104.50	91.28	5.70
~4	36.8-47.2	40.4	13	88.50	108.20	99.62	6.06
~5	48.5-57.7	53.0	9	101.50	115.00	106.83	4.25

Table 4.15 Weight of Chinese boys in China

Age (years)	Age（months）	Mean age (months)	N	Minimum (kg)	Maximum (kg)	Mean (kg)	Std. Deviation
0-1	0.4-12.0	7.4	5	8.00	10.00	9.20	1.10
~2	12.9-24.0	17.7	13	10.00	15.00	12.58	1.63
~3	24.3-36.0	32.3	181	11.00	28.00	14.71	1.99
~4	36.1-48.0	42.1	422	11.00	32.00	16.53	2.55
~5	48.1-60.0	53.5	347	13.00	28.70	18.18	2.44

Table 4.16 Weight of Chinese girls in China

Age (years)	Age （months）	Mean age (months)	N	Minimum (kg)	Maximum (kg)	Mean (kg)	Std. Deviation
0-1	5.5-10.7	8.13	7	8.70	11.00	9.31	0.78
~2	12.8-23.5	19.30	14	9.50	16.00	11.86	2.01
~3	25.0-35.8	32.07	138	10.00	27.00	13.94	2.12
~4	24.3-36.0	42.62	405	11.00	31.00	15.60	2.40
~5	48.1-60.0	53.47	281	13.00	29.80	17.46	2.49

Table 4.17 Heights of Chinese boys in China

Age (years)	Age （months）	Mean age (months)	N	Minimum (cm)	Maximum (cm)	Mean (cm)	Std. Deviation
0-1	0.4-12.0	7.4	9	68.00	78.00	71.60	3.85
~2	12.9-24.0	17.7	13	76.00	97.00	86.28	5.93
~3	24.3-36.0	32.3	180	80.00	108.00	94.25	4.34
~4	36.1-48.0	42.1	415	82.20	112.00	99.58	5.04
~5	48.1-60.0	53.5	338	90.00	120.00	106.17	5.33

Table 4.18 Heights of Chinese girls in China

Age (years)	Age （months）	Mean age (months)	N	Minimum (cm)	Maximum (cm)	Mean (cm)	Std. Deviation
0-1	5.5-10.7	8.13	7	65.00	85.00	72.43	6.48
~2	12.8-23.5	19.30	14	75.00	97.00	84.68	6.26
~3	25.0-35.8	32.07	133	80.00	102.80	92.15	4.47
~4	24.3-36.0	42.62	397	81.00	120.00	98.31	5.08
~5	48.1-60.0	53.47	277	89.00	120.00	105.06	5.82

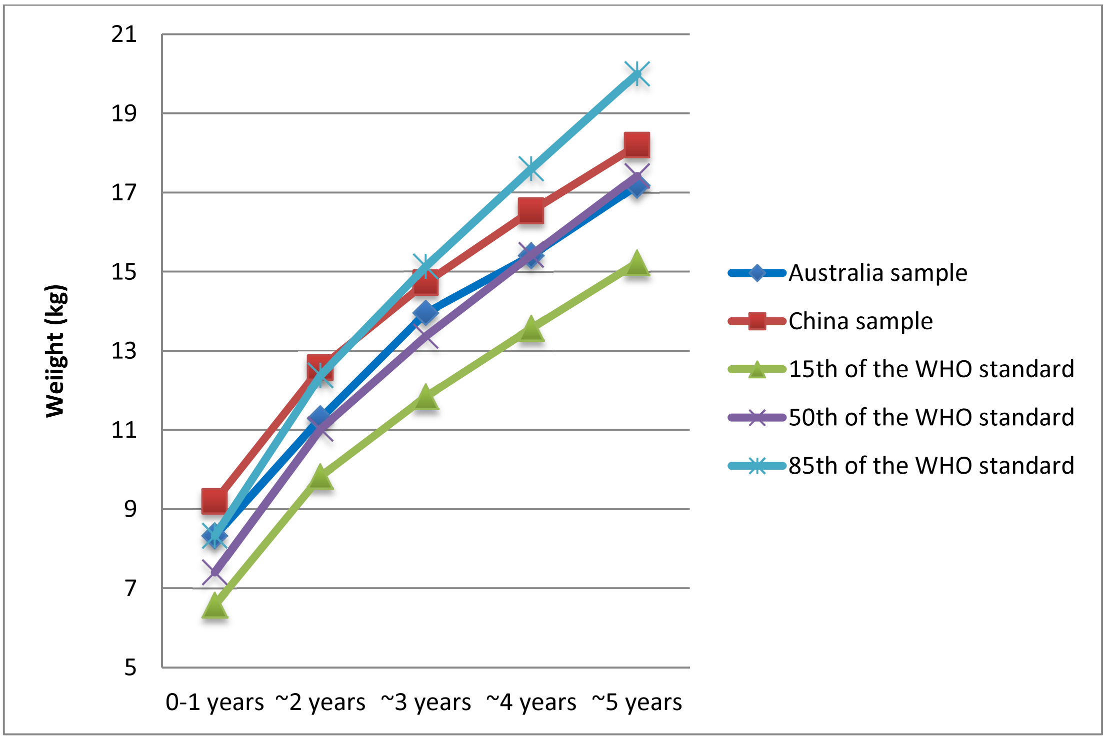

Figure 4.4 Comparison of the average weight of Chinese boys with WHO weight-for-age percentile for boys

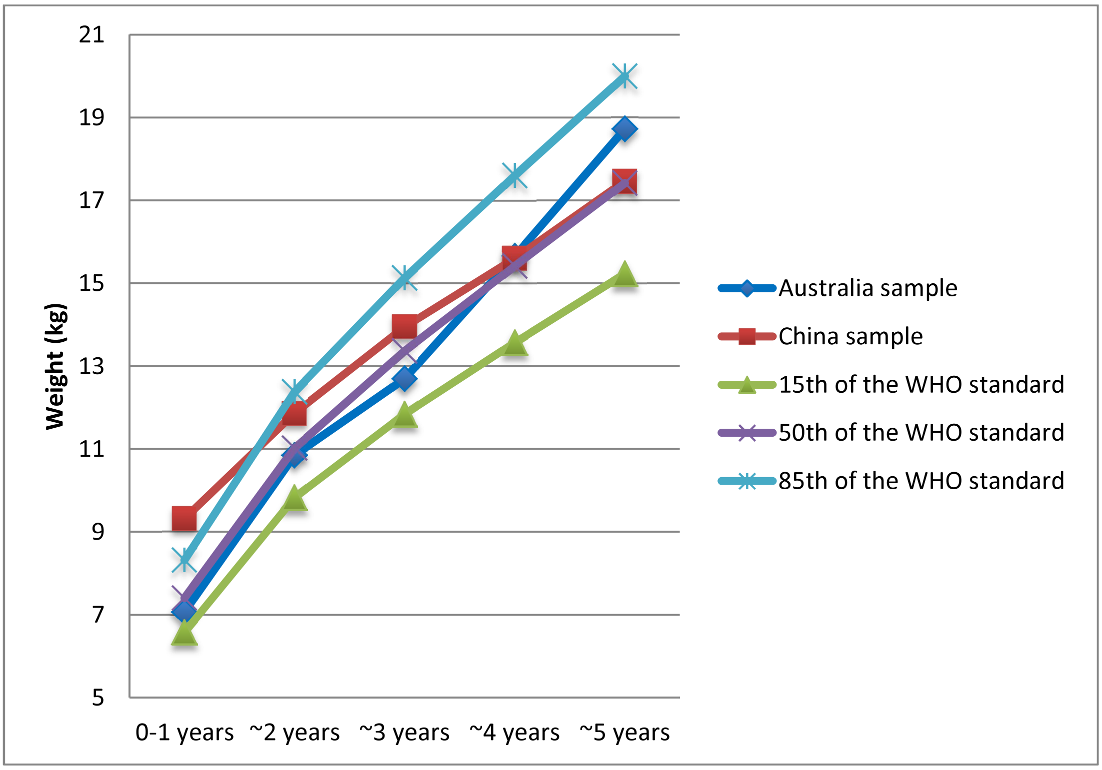

Figure 4.5 Comparison of the average weight of Chinese girls with WHO weight-for-age percentile for girls

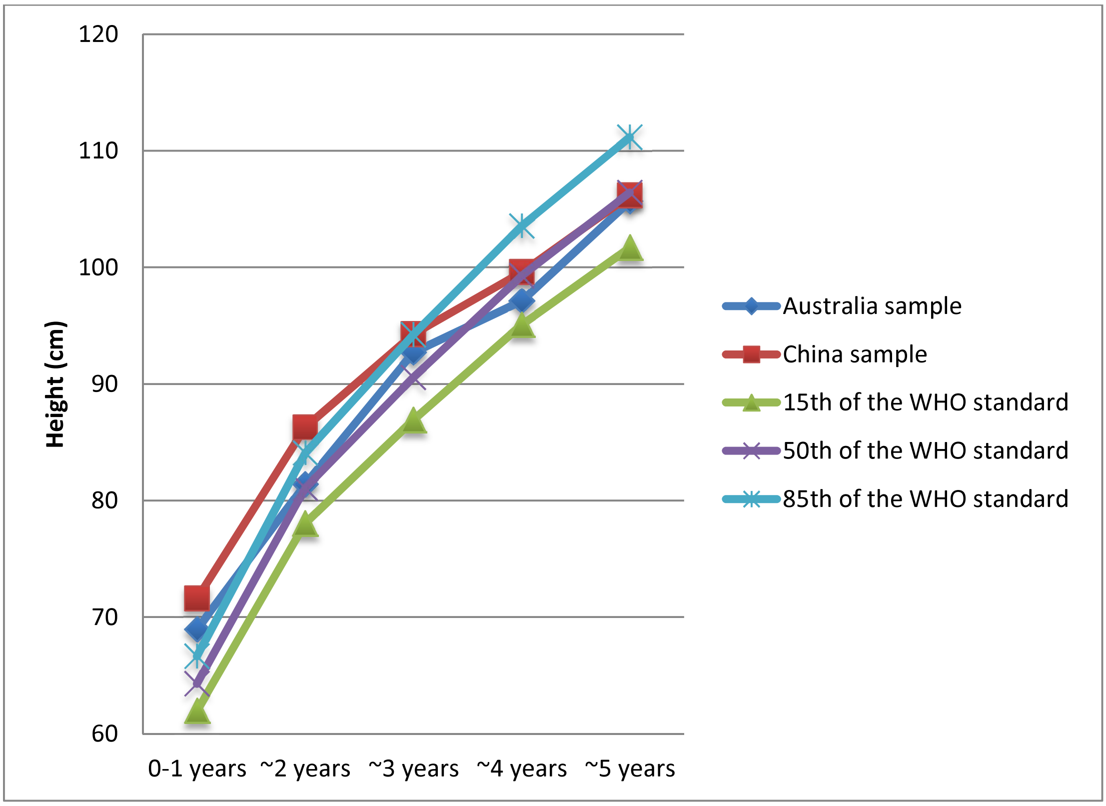

Figure 4.6 Comparison of the average height of Chinese boys with WHO height-for-age percentile for boys

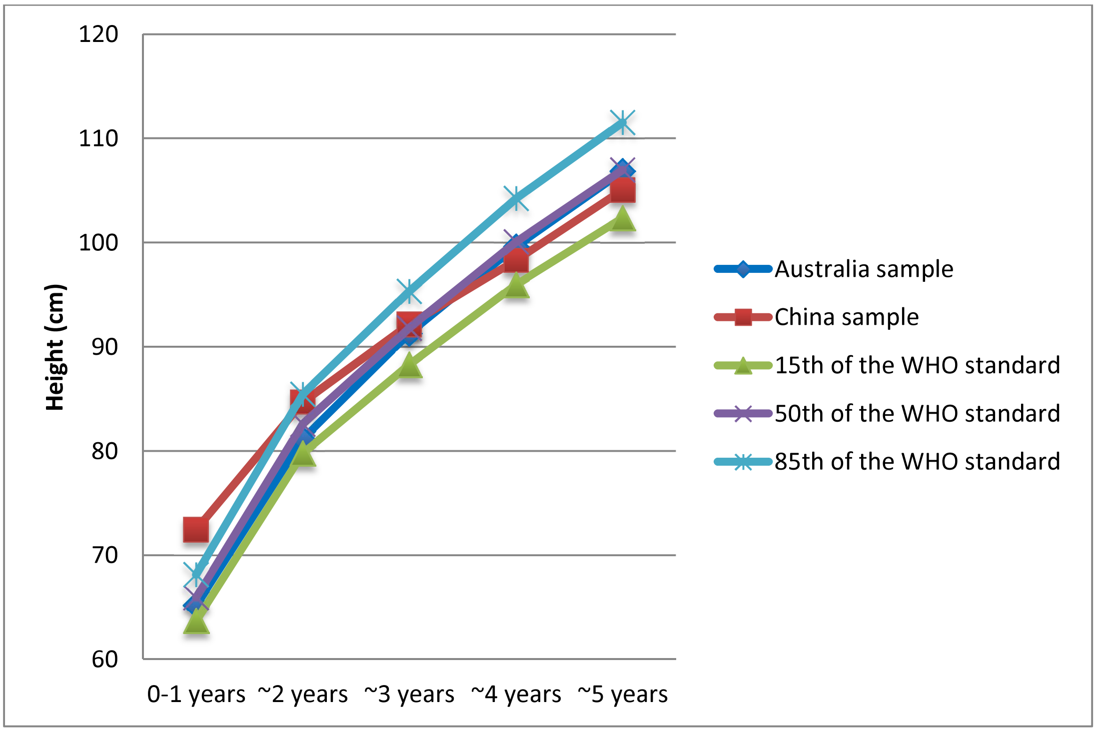

Figure 4.7 Comparison of the average height of Chinese girls with WHO height-for-age percentile for girls

More mothers were overweight or obese in Australia (24.4%) compared with mothers in China (9.0%, P <0.001). The majority of children between 2 to 4 years old had a normal weight (69.3% in Australia and 71.4% in China). More children were overweight or obese in China (16.7% in China compared to 8.0% in Australia, p=0.007) while more Chinese children were underweight in Australia (22.7% in Australia compared to 11.9% in China, p=0.007) (Table 4.19).

Table 4.19 The BMI of Chinese mothers and children in Australia and China

Characteristic	Australia (n*=237) n (%)	China (n*=2078) n (%)	*p*
Maternal BMI (kg/m^2)			<0.001
<18.5 kg/m^2 (Underweight)	9 (10.5)	272 (15.8)	
18.5≤BMI<24 kg/m^2 (Normal)	56 (65.1)	1294 (75.2)	
24≤BMI <28 kg/m^2 (Overweight)	14 (16.3)	139 (8.1)	
≥28 kg/m^2 (Obesity)	7 (8.1)	16 (0.9)	
IOTF category of the child (age over two years)			0.007
Underweight	20 (22.7)	210 (11.9)	
Normal	61 (69.3)	1259 (71.4)	
Overweight	5 (5.7)	189 (10.7)	
Obesity	2 (2.3)	106 (6.0)	

4.4.2 Physical activity of Chinese mothers and children

Chinese children in China undertook physical activity more often (p<0.05) (see Table 4.20). This was probably due to the older age of samples in China. In total, children in Australia had shorter average time of sedentary activities (212 minutes) than children in China (224 minutes) per day (Table 4.21).

Table 4.20 Physical activity of Chinese children in Australia and China

	Australia (n=237) n (%)	China (n=2078) n (%)	*p*
Regular physical activity for the child			0.026
Yes	121 (54.0)	1167 (62.5)	
No	79 (35.3)	353 (26.9)	
Do not know	24 (10.7)	197 (10.6)	

Table 4.21 Average minutes of sedentary activity for Chinese children under age five living in Australia and China

Activity type	Australia	China	*p*
	Mean±SD (Minutes)	Mean±SD (Minutes)	
TV	50.10±55.6	65.70±50.9	0.032
DVD	23.47±36.0	23.71±37.0	0.698
Video games	2.00±10.0	3.78±15.2	0.001
Surfing the Internet	1.92±12.2	1.47±8.4	0.141
Participating in chat rooms	1.31±9.4	0.12±2.2	<0.001
Playing computer games, etc.	2.79±13.2	4.02±14.7	0.053
Reading (books, newspapers and magazines), writing, drawing	34.48±45.1	36.22±42.0	0.313
Toy cars, puppets, board games	88.92±86.5	64.02±56.4	<0.001
TOTAL	212.11±155.1	224.81±121.1	<0.001

More mothers in China were taking vigorous activity (86.5%) and moderately intensity activity (43.2%) than mothers in Australia (vigorous activity: 13.5%, $p<0.001$; Moderate intensity activity: 29.5%, $p<0.01$) (Table 4.22). Within the group of mothers who did regular vigorous intensity activity, there were no differences between the frequency and duration (minutes or hours) of their vigorous activity. However, on average mothers in Australia spent longer time (37.2 minutes) on moderate intensity activities each time than mothers in China (29.0 minutes, $p<0.001$) (Table 4.23).

Table 4.22 Physical activity of Chinese mothers in Australia and China

	Australia (n=237)	China (n=2078)	*p*
	n (%)	n (%)	
Vigorous activities			<0.001
Yes	32 (13.5)	606 (29.6)	
No	205 (86.5)	1439 (70.4)	
Moderate intensity activities			0.001
Yes	70 (29.5)	865 (43.2)	
No	167 (70.5)	1138 (56.8)	

Table 4.23 Frequency and duration of physical activity of Chinese mothers in Australia and China

	Australia	China	
	Mean±SD	Mean±SD	*p*
How many times do you do vigorous activity in a normal week?	2.19±2.0	2.24±2.0	0.708
How many minutes do you do vigorous activity in each time?	30.5±21.6	27.7±20.1	0.481
How many times do you do moderate intensity activity in a normal week?	2.42±2.2	3.34±2.5	0.181
How many minutes do you do moderate intensity activity each time?	37.2±40.8	29.0±22.9	<0.001
How many hours in a day do you spend in walking in different places?	2.12±2.7	2.29±2.5	0.631
How many hours in a day do you spend in sitting activity?	5.52±3.0	6.06±2.8	0.136

4.5 Dietary supplement use in Chinese children in Australia and China

There is a growing use of dietary supplements in many countries including China. This section documents the prevalence and characteristics of dietary supplements use in healthy pre-school Chinese children living in Australia and China.

There were 230 Chinese mothers living in Perth Australia and 1156 mothers living in Chengdu, Sichuan Province and 308 mothers living in Wuhan, Hubei Province, PR China completed the supplement questionnaire.

4.5.1 The prevalence of dietary supplement use in Chinese children

A total of 22.6% of the Chinese children living in Perth (n=52) were taking dietary supplements, including multi-vitamins/minerals, fish oil, protein, probiotics, colostrum, calcium, zinc and vitamin AD (or cod liver oil) and Chinese herbs (Table 4.24). In Chengdu and Wuhan, China, 32.4% of young children (n=475) were having dietary supplements, including multivitamins/minerals, calcium, zinc, iron, magnesium, fish oil, probiotics, vitamin A and/or vitamin D, Chinese herbs or other botanicals (Table 4.24).

Compared to Chinese Australians, Chinese parents living in China were more likely to give their children dietary supplements (χ^2=9.2, df=1, p<0.01). However, in children aged over 12 months, there is no statistical difference in the prevalence of dietary supplements between

Australia (28.6%) and China (32.7%, p=0.284). Higher percentage of children over three years old living in Australia were taking dietary supplement (40.8%) compare to Chinese children living in China (31.5%). In age group of 4 to 5 years of children in Australia, nearly half (47.4%) were taking at least one dietary supplement.

Table 4.24 Dietary supplements type used by Chinese children in Australia and China

	Australia			China		
Supplements type	N	% supplement users	% total population (n=231)	N	% supplement users	% total population (n=1464)
Any supplements	52	100	22.5	475	100	32.4
Minerals	32	61.5	13.9	390	82.1	26.6
Vitamins	36	69.2	15.6	228	48.0	15.6
Macronutrients	27	51.9	11.7	60	12.6	4.1
Others	7	13.5	3.0	61	12.8	4.2

4.5.2 The types and intakes of dietary supplements used by Chinese children

In China, the use of calcium supplements was very common in the supplement users (58.5%). About half of the Chinese children taking calcium supplements were also taking Vitamin D (n=140, including the use of multi-vitamins). In Australia, only four children were given specific calcium supplements. The dosage of calcium supplements ranged from 54 to 725 mg/day (Table 4.25). When calculated the average intake, the intakes from multi-vitamins/minerals were also summed if they were reported. The most common forms of supplemental calcium used in Chinese children up to five years old are gluconate (51.8%) and carbonate (37.5%). The average intake for calcium carbonate users (307.4 mg/day) is higher than gluconate calcium users (81 mg/day).

The prevalence of the use of zinc supplementation was also high in China. Nearly half of supplements users were using zinc supplements (40.4%). Almost all the zinc supplements were in the form of gluconate (93.2%) and the average intake of zinc was 4.4 mg/day (n=166, range from 2.15 mg to 8.6 mg) (Table 4.25).

In Australia, the types most frequently used in those supplements users were multi-vitamins/minerals (46.2%) and fish oil (42.3%). The average intake of fish oil was 859.6 mg per day (n=13) with the range from 300 mg to 1000 mg per day (Table 4.25).

Chinese herbal supplements were used by children in both countries, especially in China, where 10.7% of supplements users were taking herb supplements (Table 4.25). Some herbal supplements were used for “better appetite” and some were believed to be beneficial to the immune system or to bring an improvement of health or well-being. In this study, traditional Chinese medicines including cinnabar, as arum, isatis root, kaladana, mangnolia officinalis, scaphium scaphigerum, coltsfoot, coptis chinensis and realgar were included as ingredients in child’s dietary supplements or medicines for (preventing) coughs or colds.

Excluding dietary supplements, 7.6% of children in China were reported to take medicine during the last two weeks and 82.9% of them (n=92, 6.3% of all the samples) were taking herbal products for medical reasons, such as cough or upper respiratory tract infection. In China a total of 16.1% of supplements users (8.6% of all samples) were having herbal products as dietary supplement or medicine and 7.7% of supplements users (2.2% of all samples) in Australia were reported to take herbal products.

Table 4.25 Main dietary supplements used by Chinese children in Australia and China

	Australia				China			
Supplement	n	% supplement users (n=52)	Average intake * (mg/day)	Intake range (mg/day)	n	% supplement users (n=475)	Average intake * (mg/day)	Intake range (mg/day)
Calcium	4	9.6	105 (n=5)	75-200	278	58.5	131.4 (n=264)	54-725
Zinc	1	1.9	3.1 (n=12)	1-7.5	192	40.4	4.4 (n=166)	1.62-8.6
Multi-vitamins/minerals	24	46.2	NA	NA	94	19.8	NA	NA
Vitamin A	4	7.7	1026** (n=7)	582.5-1617[b]	83	17.5	1695* * (n=71)	600-2800[b]
Vitamin D	4	7.7	177* * (n=5)	85-200[b]	91	19.2	568 * * (n=75)	80-780[b]
Vitamin C	10	19.2	62.1 (n=12)	20-125	33	6.9	61.4 (n=23)	30-200
Fish oil	22	42.3	859.6 (n=13)	300-1000	4	0.8	NA	NA
Probiotics	2	3.9	NA	NA	22	4.6	NA	NA
Herbs	4	7.7	NA	NA	51	10.7	NA	NA

* When calculated the average intake, the intakes from multi-vitamins/minerals were also summed if they were reported.
** IU/day, IU: international unit
NA: not available

4.5.3 The related maternal and child characteristic variables of dietary supplement use

In Australia, older children (χ^2=19.22, df=4, p<0.01), children who were never breastfed (χ^2=4.32, df=1, p<0.05) and children who did regular physical exercises in pre-school or at home (χ^2=10.88, df=2, p=0.001) were more likely to take dietary supplements than their counterparts. Mothers who had migrated from other Asian regions (including Hong Kong) were more likely to give their children dietary supplements than mothers from mainland China (χ^2=4.47, df=1, p<0.05) (Table 4.26).

In China, the prevalence of dietary supplements was higher in children who had been sick during the past four weeks (χ^2=6.97, df=1, p<0.01) and children who had regular exercises (χ^2=4.13, df=1, p<0.05) than in their counterparts. Higher household income was significantly related to the use of child supplements (χ^2=19.29, df=1, p<0.001) (Table 4.26).

Table 4.26 Dietary supplement use of children by demographic variables

	Australia		China	
	n (%)	*p*	n (%)	*p*
Age (year)		0.201		0.551
<30	12 （17.6）		206 (34.4)	
≥30	40 （25.5）		171 (32.8)	
Education of the mother		0.283		0.942
<University	10（17.5）		217 （33.1）	
≥University	42 （24.4）		163 （33.3）	
Working status		0.690		0.645
working	25 (23.8)		321 (33.2)	
Not employed	27 (21.6)		62 (31.5)	
Household income		0.692		<0.001
Low	26 (24.1)		161 (28.1)	
High	24 (21.8)		186 (41.2)	
Mother's birth place		0.034		
Mainland China	37 (19.9)			
Other Asian regions	15 (34.9)			
Duration in Australia		0.160		
≤5	21 (17.6)			
5-10	21 (28.8)			
>10	9 (27.3)			
Gender of the child		0.868		0.201
Male	28 (23.1)		267 (34.2)	
Female	24 (22.2)		204 (31.1)	
Child's age (year)		0.001		0.427
<1 year	4 (6.6)		6 (40.0)	

1-2	20 (24.7)		8 (33.3)	
2-3	8 (21.1)		100 (37.5)	
3-4	11 (36.7)		203 (31.8)	
4-5	9 (47.4)		155 (31.2)	
Infant feeding		0.038		0.272
Ever breastfed	46 (21.3)		402 (33.2)	
Never breastfed	6 (46.2)		62 (29.4)	
Child's BMI		0.406		0.596
Underweight	4 (20.0)		45 (31.7)	
Normal	20 (33.9)		310 (34.3)	
Overweight or obesity	3 (42.9)		64 (31.1)	
Regular exercises		0.001		0.042
Yes	37 (31.6)		306 (35.5)	
No	9 (11.5)		104 (29.5)	
Illness during the past 4 weeks		0.208		0.008
Yes	27 (26.7)		354 (34.8)	
No	25 (19.7)		113 (27.6)	

4.6 Health beliefs and Child feeding behaviours of Chinese mothers

The increase in rates of obesity has raised concerns for public health. Education and changing the eating habits within families are commonly advocated for tackling the obesity problem(West et al., 2010). However the cooperation of the mother, as gatekeeper to the family's nutrition is essential, especially for pre-school children. Mothers' health beliefs in the care of their children and child feeding practices play a major part in most successful childhood obesity interventions(Rhee and Rhee, 2005). This section assesses Chinese mother's health beliefs using the Health Belief Model and records Chinese mother's perceptions of their child's weight, and their child feeding behaviours.

4.6.1 The Health Belief Model in Chinese mothers

In most dimensions of the Health Belief Model, Chinese mothers in both countries tended to possess negative attitudes toward childhood obesity (Table 4.27). Both groups of participants expressed a high general health concern for their children (mean± S.D =4.57±0.8 in Australia and mean± S.D =4.79±0.4 in China). They also perceived a relatively high level of severity for childhood obesity and the benefits of controlling over their children's weight. Mean scores of 'mother's perceived susceptibility', 'self-efficacy' and 'cues to action' were low in both countries compared to other Health Belief Model dimensions (Table 4.27).

Findings from this study show that the health beliefs regarding child health of Chinese mothers in Australia are different in about half of the dimensions of the Health Belief Model from the beliefs of the mothers in China (Table 4.27). Mothers from China have higher 'general health motivation' (mean score=3.14±0.4 in China compare to 3.02±0.5 in Australia, p=0.001) and higher 'general health concern for child' (mean score=4.79±0.4 in China compare to 4.57±0.8 in Australia, p<0.001) than mothers from Australia. Australian mothers also have lower perceived barriers on controlling their children's weight (mean score=2.78±0.5 in Australia compare to 2.88±0.4 in China, p=0.008), lower perceived susceptibility of their children becoming overweight (mean score=2.45±0.6 in Australia compare to 2.71±0.7 in China, p=0.039) (Table 4.27).

Table 4.27 Comparison between health beliefs in Chinese mothers in Australia and in China regarding to their children's weight status

	Australia (n=237)	China (n=2078)	
	Mean±SD	Mean±SD	*p*
General Health Motivation	**3.02±0.5**	**3.14±0.4**	**0.001**
General health concern for child	**4.57±0.8**	**4.79±0.4**	**<0.001**
How concerned are you about your child's health?	4.64±0.8	4.81±0.5	**<0.001**
How concerned are you about the possibility of your child getting sick?	4.51±0.9	4.78±0.5	**<0.001**
Special Health Practices for child	**0.66±0.4**	**0.72±0.4**	**0.057**
Do you ever buy special foods to improve or protect your family's health?	0.68±0.5	0.72±0.5	0.035
Besides things involving food, do you do any special things to help keep your child well?	0.63±0.5	0.72±0.4	**<0.001**
Mother's Concern about Own Health	**3.84±0.8**	**3.92±0.8**	**0.376**
How concerned are you about your own health?	3.94±0.9	3.99±0.9	0.653
How concerned are you about the chance of getting sick?	3.74±1.0	3.84±1.0	0.904
Perceived benefits	**3.85±0.5**	**3.62±0.5**	**0.736**
Balancing my child's intake of "hot" and "cold" (yin and yang) foods can benefit the health of her/him?	3.77±0.7	3.72±0.7	0.407
Moderate exercise can protect my child from getting sick.	4.02±0.6	3.84±0.6	0.602
If your child is kept closely on the special diet, it will help the problem of obesity.	3.76±0.8	3.31±0.8	0.010
Perceived barriers	**2.78±0.5**	**2.88±0.4**	**0.008**
How difficult would you say it will be for you to do something to keep your child healthy?	2.16±0.8	2.33±0.8	**<0.001**
Foods without rich sauces are extremely tasteless.	**2.53±0.9**	**2.52±0.7**	**<0.001**
Sometimes I worry that going on a diet can cause health problems.	3.66±0.8	3.80±0.6	**<0.001**
Self-efficacy	**3.04±0.6**	**2.99±0.6**	**0.219**
How confident are you that you can influence your child's dietary behaviour?	3.35±0.9	3.07±0.9	0.007
How confident are you that you can influence your child's physical activity?	3.33±0.9	3.12±0.9	0.011

There isn't much anyone can do about how much he/she weights.	2.43±0.9	2.80±0.7	0.000
Perceived susceptibility	**2.45±0.6**	**2.71±0.7**	**0.039**
How easily would you say your child getting sick?	2.63±0.8	3.02±1.0	0.691
When your child grows up, how much chance do you feel there is that he/she will be overweight?	2.28±0.8	2.4±0.9	0.249
Perceived severity	**3.80±0.9**	**3.53±1.0**	**0.168**
Suppose your child was to become overweight, how much do you think you would be worry about it?	4.09±0.9	3.87±1.1	0.000
How much would you say your child's weight problem interferes with his/her normal activities?	3.52±1.3	3.19±1.2	0.373
Cues to action	**3.07±0.9**	**3.11±0.8**	**0.178**
When I read about any disease, I start worrying about the chances of my child getting it.	3.13±1.0	3.23±0.9	0.180
When I read about people who have obesity related disease (e.g. heart disease, diabetes), I start worrying about the chances of my child getting it.	3.00±1.0	3.01±0.9	0.153

4.6.2 Maternal perceptions of Chinese Children's weight

The overall percentages of correct maternal perception of the child's weight were 35.2% in underweight children, 69.2% in normal weight children and 10.8% in overweight/obese children. Chinese mothers' perceptions of their child's weight status in Australia and China are presented in Table 4.28. Most mothers could correctly classify their children's weight if the child was of normal weight. The percentage of correct perception for normal weight children was higher in Australia mothers (83.6% in Australia and 68.4% in China, p=0.024) (Table 4.28). The percentages of correctly classified underweight children were 35.0% in both countries and very few underweight children were incorrectly classified as overweight/obese. Among those overweight or obese children, only 14.3% in Australia and 10.8% in China were classified as overweight/obese by their mothers (Table 4.28). Most overweight or obese children were viewed as normal weight by their mothers and 14.3% of them in Australia and 13.9% of them in China were even considered as underweight (Table 4.28).

Table 4.29 presents the percentages of Chinese mothers' correct classifications of the child's weight status by mother and child characteristic variables using pooled Australia and China data. Within the group of underweight children, normal weight mothers (p=0.006) and mothers with older age children (p=0.043) were more likely to correctly classify children's weight status (Table 3). A higher percentage of overweight/obese mothers (23.2%, p=0.002) and mothers who over-estimated her own weight status (20.6%, p<0.001) classified their child's weight status correctly in overweight/obese group, compared to their counterparts.

Table 4.28 Maternal perception of child's weight status by IOTF category of the Chinese child in Australia and China

IOTF category of the child	Maternal perception	Australia		China		
		n	%	n	%	*p*
Underweight	Underweight	7	35.0	70	35.2	0.729
	Normal	13	65.0	123	61.8	
	Overweight/obese	0	0	6	3.0	
Normal	Underweight	8	13.1	201	17.9	0.024
	Normal	51	83.6	767	68.4	
	Overweight/obese	2	3.3	153	13.6	
Overweight/obese	Underweight	1	14.3	40	13.9	0.956
	Normal	5	71.4	216	75.3	
	Overweight/obese	1	14.3	31	10.8	

Table 4.29 Correct maternal perception of child's weight status by Chinese mother and child characteristic variables

	Correct maternal perceptions					
	In underweight children		In normal weight children		In overweight/obese children	
	n (%)	*p*	n (%)	*P*	n (%)	*p*
Weight status of the mother		0.006		0.382		0.002
Underweight	11 (20.4)		111 (67.7)		2 (8.7)	
Normal	56 (44.8)		568 (67.)		12 (6.2)	
Overweight/obese	4 (28.6)		60 (75.0)		8 (22.2)	
Mother's perception of her own weight status		0.140		0.660		<0.001
Correct assessment	47 (39.5)		434 (68.0)		7 (4.2)	
Under-estimated	0 (0)		61 (64.2)		0 (0)	
Over-estimated	24 (35.3)		244 (69.1)		21 (20.6)	
Mother's age (years)		0.049		0.466		0.191
<30	26 (29.2)		303 (68.2)		18 (14.1)	
>30	35 (43.8)		327 (70.5)		10 (8.7)	
Mother's education level		0.601		0.065		0.341
High school or less	34 (34.0)		345 (66.9)		18 (12.9)	
University or higher	28 (37.8)		300 (72.5)		9 (9.0)	
Mother's working status		0.367		0.970		0.041
Full-time working	33 (31.4)		396 (69.6)		19 (12.7)	
Part-time or casual work	12 (35.3)		141 (70.5)		1 (1.9)	
Not employed	16 (44.4)		110 (69.6)		8 (16.7)	
Household income		0.765		0.350		0.276
Low	32 (35.2)		309 (70.4)		12 (9.1)	
High	22 (33.8)		262 (73.4)		11 (13.9)	

Child's age (years)		0.043		0.381		0.928
2	15 (28.8)		157 (66.5)		5 (11.9)	
3	24 (28.2)		384 (71.4)		15 (10.0)	
4	35 (45.5)		270 (67.3)		11 (11.0)	
Child's gender		0.937		0.832		0.213
Male	36 (35.0)		440 (69.3)		21 (12.7)	
Female	39 (35.1)		369 (68.7)		10 (8.1)	

4.6.3 Child feeding behaviours in Chinese mothers

In regard to the mothers' child feeding behaviours, Australian mothers have same level of 'restrictions' as China mothers, and have higher 'pressure' (mean score=3.31±0.60 in Australia and 3.32±0.53 in China, p=0.014), and 'monitoring' (mean score=3.47±0.96 in Australia and 3.23±0.84 in China, p<0.001) on their children's eating behaviours than China mothers (Table 4.30).

Table 4.30 Mothers' child feeding behaviours in Australia and China

	Australia	**China**	
	Mean±SD	Mean±SD	*p*
Restrictions	**3.61±0.42**	**3.40±0.44**	**0.644**
I have to be sure that my child does not eat too many sweets	4.16±0.67	3.74±0.73	0.130
I have to be sure that my child does not eat too much high-fat foods	4.03±0.71	3.57±0.71	<0.001
I have to be sure that my child does not eat too much of her/his favourite foods	3.44±0.78	3.18±0.76	0.059
I intentionally keep some foods out of my child's reach	3.75±0.88	3.41±0.91	0.001
I offer sweets to my child as a reward for good behaviour	2.97±1.06	3.14±0.93	0.003
I offer my child her favourite foods in exchange for good behaviour	3.18±0.93	3.21±0.89	0.250
If I did not guide or regulate, she/he would eat too much of favourite foods	3.73±0.80	3.58±0.80	0.223
Pressure	**3.31±0.60**	**3.32±0.53**	**0.014**
My child should always eat all of the food on her	3.14±0.93	3.15±0.85	0.030
I have to be especially careful to make sure my child eats enough	3.56±0.82	3.30±0.79	0.648
If my child says "I'm not hungry", I try to get him/her to eat anyway	3.15±0.94	3.28±0.89	0.330
If I did not guide or regulate my child's eating, she/he would eat much less than should	3.44±0.89	3.58±0.76	<0.001
Monitoring	**3.47±0.96**	**3.23±0.84**	**<0.001**
How much do you keep track of the sweets	3.52±1.03	3.29±0.94	0.006
How much do you keep track of the snack food	3.55±1.06	3.40±0.97	0.053
How much do you keep track of the high-fat foods that your child eats	3.38±1.09	3.00±1.00	<0.001

Australian mothers offer more support for physical activities for their children (Table 4.31). On average, 4 days during a typical week, an Australia mother while 3.5 days a mother in China would encourage her child to participate in physical activities (p=0.001). Mothers in Australia also participated in physical activities with their children (p<0.001) and provide transportation for their children to participate in physical activities more often than the mothers in China (p<0.001).

Table 4.31 Mothers' support for children's physical activities in Australia and China

	Australia	**China**	
	Mean (days) ±SD	Mean (days) ±SD	*p*
How often during a typical week do you encourage your child to participate in physical activities?	4.03±2.55	3.54±2.25	0.001
How often during a typical week do you participate in physical activities with your child?	2.90±2.42	2.52±1.82	<0.001
How often during a typical week do you provide transportation to where the child can be physically active?	2.82±2.20	2.04±1.56	<0.001

4.6.4 The associations between health beliefs and child feeding behaviours

There was a weak association between maternal health beliefs and mothers' child feeding behaviours (restriction, pressure to eat and monitoring) or their support for children's physical activities (encouragement for physical activities, participation physical activities with the child and providing opportunity of physical activities for the child) (Table 4.32 and Table 4.33). The correlation scores ranged from -0.197 (p<0.01) to 0.252 (p<0.01). Most health belief model dimensions were significantly positively related to mother's child feeding behaviours and parental support for the child's physical activities, except 'perceived barriers' and 'perceived susceptibility' were negative associated with parental support for children's physical activities.

Table 4.32 Pearson Correlation coefficient between mothers' health beliefs and child feeding behaviours

	Restriction	Pressure to eat	Monitoring
General health Motivation	0.080**	0.120**	0.189**
Perceived benefits	0.252**	0.086**	0.224**
Perceived barriers	0.079**	0.116**	-0.05*
Self-efficacy	0.103**	-0.110	0.146**
Perceived susceptibility	0.039	0.054*	-0.011
Perceived severity	0.197**	0.036	0.195**
Cues to action	0.176**	0.125**	0.106**

*p<0.05
**p<0.01

Table 4.33 Pearson correlation coefficient between mothers' health beliefs and their support for children's physical activities

	Encourage physical activities	Participate physical activities with the child	Provide opportunity of physical activities
General health motivation	0.133**	0.084	0.076
Perceived benefits	0.120*	0.153**	0.127**
Perceived barriers	-0.120**	-0.114*	-0.197**
Self-efficacy	0.081	0.075	0.089
Perceived susceptibility	-0.130*	-0.137**	-0.180**
Perceived severity	0.035	0.055	0.014
Cues to action	-0.017	-0.005	-0.022

*p<0.05
**p<0.01

4.7 Health information sources used by Chinese mothers in Perth

This section presents the health information sources and the main health information sources, including general health, nutrition, physical activity and 'when the child was sick' information, used by Chinese mothers in Perth.

4.7.1 Health information sources of Chinese mothers in Perth

The top three general health information sources were the Internet (68.8%), health professionals (65.7%), 'Chinese friends or relatives living in Australia' (61.6%). The other most mentioned general health information source was 'friends or relatives living in China' (43.0%). The number of reasons that mothers gave for initiating breastfeeding ranged from one to eight. About 86.9% of mothers gave more than one reasons (Table 4.34).

The Internet was the number one information source for nutrition (64.6%) and physical activities (53.2%) as well. The most mentioned three information sources for nutrition were the Internet (64.6%), 'Chinese friends or relatives living in Australia' (51.9%) and health professionals (50.4%) (Table 4.35). The most mentioned three information sources for physical activity were the Internet (53.2%), 'Chinese friends or relatives living in Australia' (46.0) and newspaper or brochure (39.7%) (Table 4.36).

Table 4.37 lists the information sources used by Chinese mothers in Perth when the child was sick. More than 92% of mothers consulted 'health professionals' when their children being unwell. The other most mentioned sources were the Internet (44.1%), 'Chinese friends or relatives living in Australia' (42.6%), and 'friends or relatives living in China' (35.9%) (Table 4.37).

Table 4.34 General health information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	155	65.7
Non-professional social networks		
Chinese friends or relatives living in Australia	146	61.6
Non-Chinese friends or relatives	63	26.6
Friends or relatives living in China	103	43.0
Mass media or leaflets health information sources		
The Internet	163	68.8
TV or movies	52	21.9
Newspaper or brochure	128	54.0
Other sources	18	7.6
Books/magazine	18	7.6
Total number of information sources		
1	30	12.7
2	46	19.4
3	61	25.7
4	33	13.9
5	32	13.5
6	19	8.0
7	11	4.6
8	4	1.7
Missing value	1	0.4

*Percentages may add up to more than 100 as respondents may have given multiple responses.

Table 4.35 Nutrition information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	119	50.4
Non-professional social networks		
Chinese friends or relatives living in Australia	123	51.9
Non-Chinese friends or relatives	54	22.8
Friends or relatives living in China	102	43.0
Mass media or leaflets health information sources		
The Internet	153	64.6
TV or movies	44	18.6
Newspaper or brochure	111	46.8
Other sources	19	8.1

Books	19	8.1
Total number of information sources		
1	42	17.7
2	56	23.6
3	53	22.4
4	46	19.4
5	22	9.3
6	13	5.5
7	4	1.7
Missing value	1	0.4

*Percentages may add up to more than 100 as respondents may have given multiple responses.

Table 4.36 Physical activities information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	67	28.3
Non-professional social networks		
Chinese friends or relatives living in Australia	109	46.0
Non-Chinese friends or relatives	57	24.1
Friends or relatives living in China	46	19.4
Mass media or leaflets health information sources		
The Internet	126	53.2
TV or movies	39	16.5
Newspaper or brochure	94	39.7
Other sources	18	7.6
Books	11	4.7
Baby gym/ trainer	3	1.3
School	2	0.8
Community activities (playgroup, library)	2	0.8
Total number of information sources		
0	7	3.0
1	68	28.7
2	72	30.4
3	47	19.8
4	19	8.0
5	12	5.1
6	9	3.8
7	2	0.8
Missing value	1	0.4

*Percentages may add up to more than 100 as respondents may have given multiple responses.

Table 4.37 Health information sources for child sickness used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	218	92.4
Non-professional social networks		
Chinese friends or relatives living in Australia	101	42.6
Non-Chinese friends or relatives	45	19.1
Friends or relatives living in China	85	35.9
Mass media or leaflets health information sources		
The Internet	104	44.1
TV or movies	13	5.5
Newspaper or brochure	38	16.1
Other sources	10	4.2
Books	10	4.2
Total number of information sources		
1	60	25.2
2	75	31.6
3	52	21.9
4	19	8.0
5	19	8.0
6	6	2.5
7	3	1.3
8	1	0.4
Missing value	2	0.8

*Percentages may add up to more than 100 as respondents may have given multiple responses.

4.7.2 The Main health information sources of Chinese mothers in Perth

The main information sources for general health, nutrition and physical activities were the Mass media or leaflets health information sources (55.3%, 55.1%, and 56.5% respectively) (see Figure 4.8-4.11).

Chinese mothers in Perth were mainly use the Internet to find out health information (37.1%, 35.4% and 34.6% for general health, nutrition and physical activities respectively), while the main information source for sickness of the child was health professionals (74.4%) (see Table 4.38-4.41).

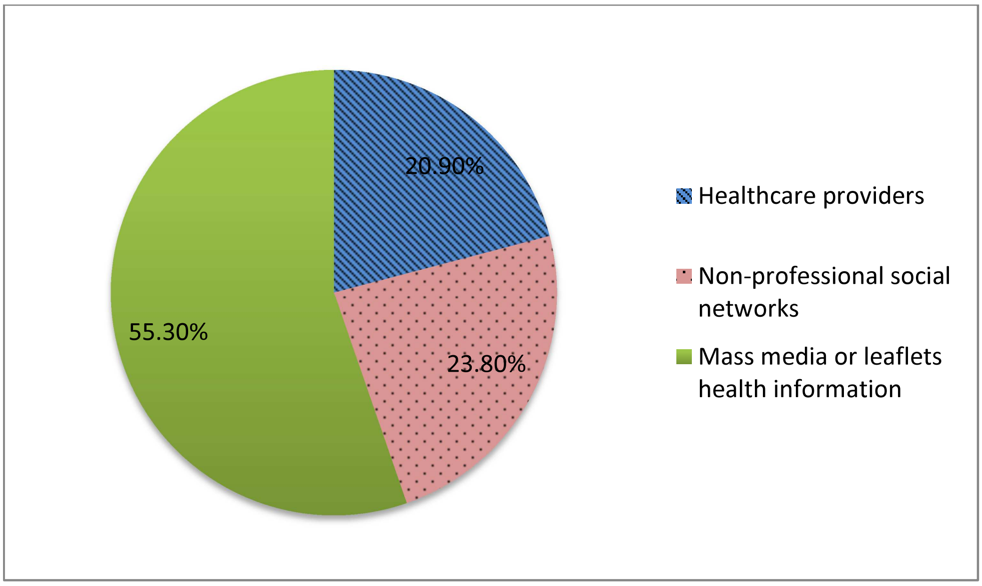

Figure 4.8 The main general health information sources used by Chinese mothers in Perth (n=234)

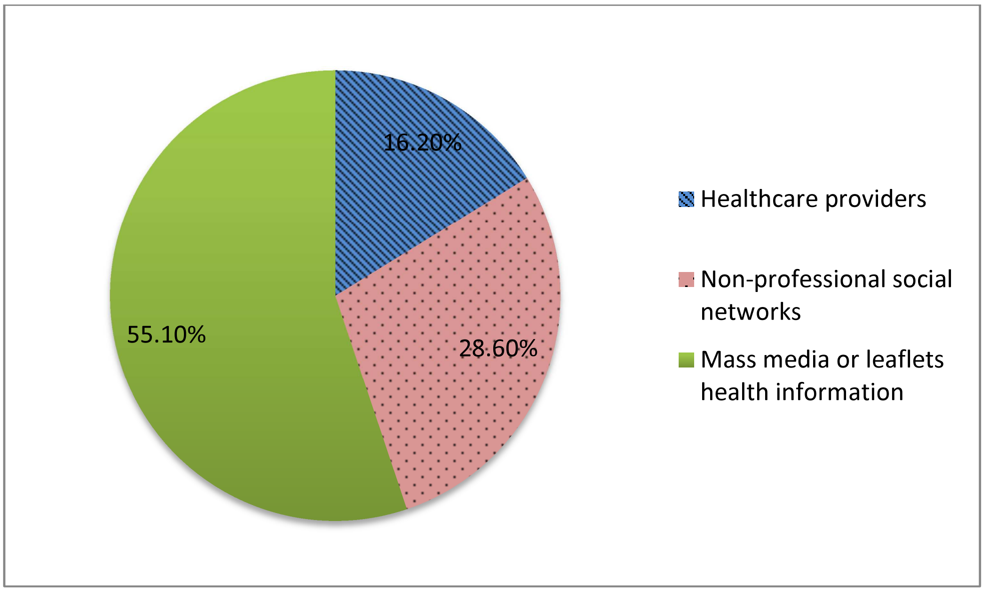

Figure 4.9 The main nutrition information source used by Chinese mothers in Perth (n=233)

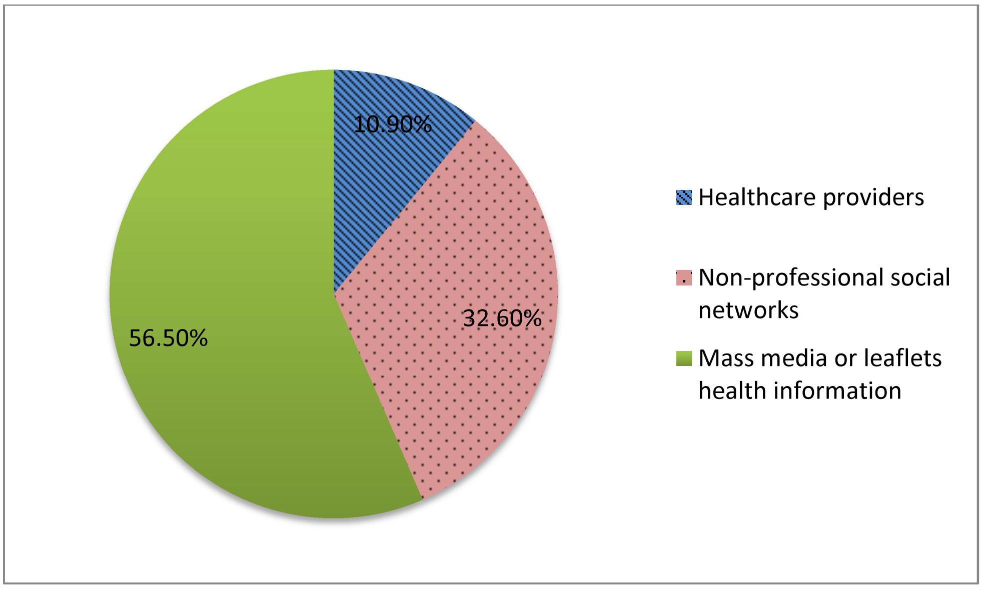

Figure 4.10 The main physical activity information source used by Chinese mothers in Perth (n=229)

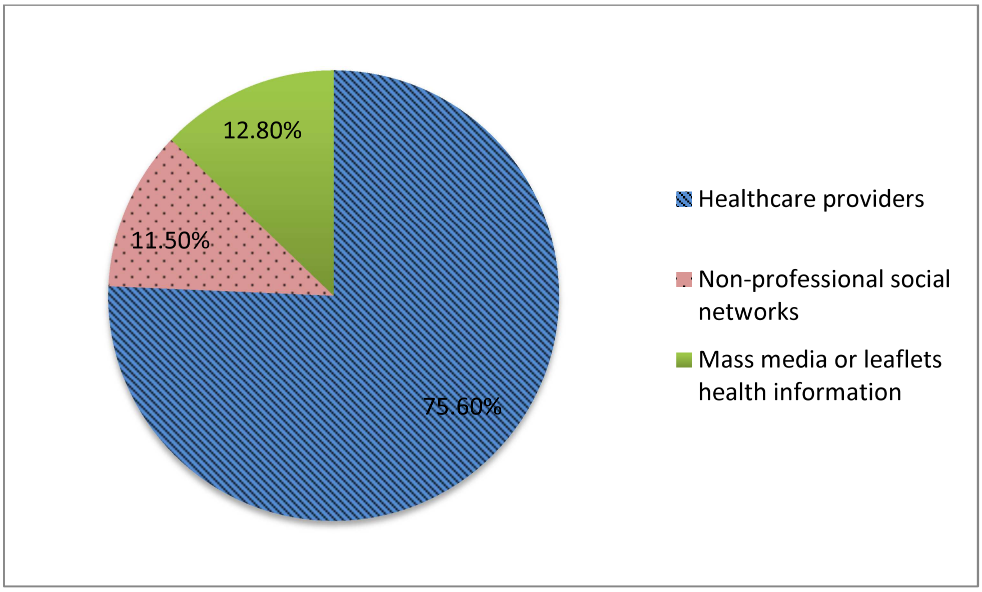

Figure 4.11 The main information source for child sickness used by Chinese mothers in Perth (n=234)

Table 4.38 The main general health information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	49	20.7
Non-professional social networks		
Chinese friends or relatives living in Australia	31	13.1
Non-Chinese friends or relatives	2	0.8
Friends or relatives living in China	23	9.7
Mass media or leaflets health information sources		

The Internet	88	37.1
TV or movies	3	1.2
Newspaper or brochure	31	13.1
Other sources	9	3.8
Books/magazine	9	3.8
Missing value	3	1.3

Table 4.39 The main nutrition information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	39	16.5
Non-professional social networks		
Chinese friends or relatives living in Australia	30	12.7
Non-Chinese friends or relatives	2	0.8
Friends or relatives living in China	33	13.9
Mass media or leaflets health information sources		
The Internet	84	35.4
TV or movies	4	1.7
Newspaper or brochure	30	12.7
Other sources	11	4.6
Books	11	4.6
Missing value	4	1.7

Table 4.40 The main physical activity information sources used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	25	10.5
Non-professional social networks		
Chinese friends or relatives living in Australia	46	19.4
Non-Chinese friends or relatives	13	5.5
Friends or relatives living in China	14	5.9
Mass media or leaflets health information sources		
The Internet	82	34.6
TV or movies	13	5.5
Newspaper or brochure	30	12.7
Other sources	5	2.1
Books	5	2.1
Missing values	8	3.4

Table 4.41 The main information sources for child sickness used by Chinese mothers in Perth (n=237)

Information sources	N	%
Interpersonal health information sources		
Healthcare providers		
Health professionals	177	74.7
Non-professional social networks		
Chinese friends or relatives living in Australia	9	3.8
Non-Chinese friends or relatives	3	1.3
Friends or relatives living in China	15	5.9
Mass media or leaflets health information sources		
The Internet	22	9.4
TV or movies	0	0
Newspaper or brochure	4	1.7
Other sources	2	0.8
Books	2	0.8
Missing value	3	1.3

4.7.3 Related variables of the main health information sources of Chinese mothers in Perth

The related variables of the main health information sources for general health, nutrition, physical activity and child sickness were analysed. The results are presented in Table 4.42 to Table 4.45.

The mother's education level was significantly associated with the health information source for general health ($p<0.001$), nutrition ($p<0.001$) and child sickness ($p<0.01$). Higher educated mothers were more likely to choose mass media or leaflets health information as their main information source. The higher household income was also associated with the use of the mass media or leaflets health sources for nutrition information ($p<0.05$).

Table 4.42 The main health information sources for general health of Chinese mothers in Perth by mothers characteristic variables (n=237)

	Healthcare providers	Nonprofessional social networks	Mass media or leaflets	*p*
Age				0.245
≤30	17 (24.6)	20 (29.0)	32 (25.4)	
>30	31 (19.3)	36 (22.4)	94 (58.4)	
Education level				**<0.001**
Less than university degree	15 (25.0)	28 (46.7)	17 (28.3)	

University degree or higher	33 (19.0)	28 (16.1)	113 (64.9)	
Working status				0.877
Working	21 (19.8)	27 (25.5)	58 (54.7)	
Not employed	27 (21.1)	29 (22.7)	72 (56.2)	
Household income				0.248
Low household income	24 (22.0)	30 (27.5)	55 (51.5)	
High household income	21 (18.9)	22 (19.8)	68 (61.3)	
Duration in Australia				0.697
≤5 years	22 (17.7)	32 (25.8)	70 (56.5)	
5-10 years	17 (23.3)	18 (24.7)	38 (52.1)	
>10 years	9 (26.5)	6 (17.6)	19 (55.9)	

Table 4.43 The main health information sources for nutrition information of Chinese mothers in Perth by mothers characteristic variables (n=237)

	Healthcare providers	Non-professional social networks	Mass media or leaflets	*p*
Age				0.559
≤30	12 (17.4)	23 (33.3)	34 (49.3)	
>30	25 (15.6)	44 (27.5)	91 (56.9)	
Education level				**<0.001**
Less than university degree	15 (25.4)	25 (42.4)	19 (32.2)	
University degree or higher	22 (12.6)	42 (24.1)	110 (63.2)	
Working status				0.954
Working	16 (15.1）	31 （29.2）	59 （55.7）	
Not employed	21（16.5）	36 （28.3）	70 （55.1）	
Household income				**0.035**
Low household income	21 （19.4）	36 （33.3）	51 （47.2）	
High household income	12 （10.8）	28 （25.2）	71 （64.0）	
Duration in Australia				0.502
≤5 years	16 (13.0)	40 (32.5)	67 (54.5)	
5-10 years	15 (20.5)	18 (24.7)	40 (54.8)	
>10 years	7 (20.6)	8 (23.5)	19 (55.9)	

Table 4.44 The main health information source for physical activity of Chinese mothers in Perth by mothers characteristic variables (n=237)

	Healthcare providers	Non-professional social networks	Mass media or leaflets	*p*
Age				0.455
≤30	9 （13.2）	25 （36.8）	34 （50.0）	
>30	15 （9.6）	50 （31.8）	92 （58.6）	
Education level				0.197

Less than university degree	7 (12.5)	23 (41.1)	26 (46.4)	
University degree or higher	17 (9.8)	52 (30.1)	104 (60.1)	
Working status				0.856
Working	12 (11.3)	33 (31.1)	61 (57.5)	
Not employed	12 (9.8)	42 (34.1)	69 (56.1)	
Household income				0.178
Low household income	14 (13.3)	38 (36.2)	53 (50.5)	
High household income	8 (7.2)	35 (31.5)	68 (61.3)	
Duration in Australia				0.774
≤5 years	13 (10.9)	38 (31.9)	58 (57.1)	
5-10 years	10 (13.7)	25 (34.2)	38 (52.1)	
>10 years	2 (5.9)	11 (32.4)	21 (61.8)	

Table 4.45 The main health information sources for child sickness Chinese mothers in Perth by mothers characteristic variables (n=237)

	Healthcare providers	Non-professional social networks	Mass media or leaflets	*p*
Age				0.102
≤30	56 (81.2)	9 (13.0)	4 (5.8)	
>30	117 (72.7)	18 (11.2)	26 (16.1)	
Education level				**0.004**
Less than university degree	44 (73.3)	13 (21.7)	3 (5.0)	
University degree or higher	132 (76.3)	14 (8.1)	27 (15.6)	
Working status				0.585
Working	78 (74.3)	11 (10.5)	16 (15.2)	
Not employed	98 (76.6)	16 (12.5)	14 (10.9)	
Household income				0.470
Low household income	86 (78.9)	10 (9.2)	13 (11.9)	
High household income	80 (72.1)	15 (13.5)	16 (14.4)	
Duration in Australia				0.946
≤5 years	95 (77.2)	14 (11.4)	14 (11.4)	
5-10 years	53 (72.6)	9 (12.3)	11 (15.1)	
>10 years	25 (73.5)	4 (11.8)	5 (14.7)	

4.8 Illness rates of Chinese children and health services utilisation

In this section, the illness rates of Chinese children and health services used at baseline and 3, 6, 9, 12 months follow-ups were described.

4.8.1 Illness rates of Chinese children and health services utilisation at baseline

Table 4.46 presents the illness rates during the past four weeks of Chinese children living in Australia and China at baseline. Even though some mothers did not perceive that the child was sick or injured, they mentioned some symptoms of the child during the past four weeks. If any symptoms had been mentioned, we classified the child as "being sick or injured during the past four weeks".

Children in China were more likely to be sick or injured (75.4%) than children in Australia (53.8%, p<0.001) (Table 4.46). Chinese children in China have higher rates of 'fever, sore throat, cough', 'headache, dizziness' and 'joint pain, muscle pain' than children in Australia. However, Chinese Australian children were more likely to have 'rash, dermatitis' than Chinese children in China (p<0.01) (Table 4.46). There were no differences between the rated severity of the sickness or injury by the mothers from two country groups (Table 4.46).

Table 4.46 The illness rates during the past four weeks of Chinese children living in Australia and China at baseline

	Australia	China	
	N (%)	N (%)	*p*
Sick or injured	126 (53.8)	1510 (75.4)	**<0.001**
Fever, sore throat, cough	67 (28.9)	1298 (65.0)	**<0.001**
Diarrhea, stomachache	17 (7.3)	101 (5.1)	0.145
Headache, dizziness	0 (0)	54 (2.7)	**0.011**
Joint pain, muscle pain	0 (0)	69 (3.5)	**0.004**
Rash, dermatitis	37(15.9)	190 (9.5)	**0.002**
Eye/ear disease	5 (2.2)	65 (3.3)	0.365
Heart disease/chest pain	0 (0)	2 (0.1)	0.629
Other infectious disease	9 (3.9)	27 (1.4)	**0.004**
Other non-communicable disease	2 (0.9)	45 (2.3)	0.162
Bruising	31 (13.5)	186 (9.4)	0.046
Bleeding injury	24 (10.6)	228 (11.5)	0.709
Severity			0.089
Not severe	50 (46.7)	443 (44.8)	
Somewhat severe	49 (45.8)	511 (51.7)	
Quite severe	8 (7.5)	34 (3.4)	

Table 4.47 and Table 4.48 present the types of medication used for illnesses of Chinese children in Australia and in China at baseline respectively. Among children who were

reported sick during the past four weeks, 44.3% mothers in Australia gave medicine brought from the local pharmacy. Nearly 20% of them gave their children traditional Chinese medicine or medicine brought from China (Table 4.47). More than half (52.6%) of Chinese children in China took traditional Chinese medicine or Chinese patent medicine for their illness, including 19.2% of them took modern medicine as well (Table 4.48).

Table 4.47 Types of medication used for illnesses of Chinese children in Australia at baseline

	N	Percent (%)
Traditional Chinese medicine or Chinese patent medicine	14	12.2
Medicine brought from China	6	5.2
Medicine from local pharmacy	51	44.3
None medicine	44	38.3
Total	115	100

*Some respondents had given multiple responses.

Table 4.48 Types of medication used for illnesses of Chinese children in China at baseline

	N	Percent (%)
Traditional Chinese medicine or Chinese patent medicine	360	33.0
Modern Medicine	425	39.0
Both traditional Chinese medicine and modern medicine	209	19.2
None medicine	97	8.9
Total	1091	100

*Some respondents had given multiple responses.

Mothers were asked the question "Did you seek care from a formal medical provider for your child's illness or injury during the past 4 weeks?" at baseline. More Chinese mothers in China sought formal medical care for the child's illness or injuries (75.0%) than Chinese mothers in Australia (49.1%, p<0.001) (Table 4.49).

Table 4.49 Healthcare services used for illnesses of Chinese children in China at baseline

	Australia		China		
	N	%	N	%	*p*
Did you seek care from a formal medical provider for your child's illness or injury during the past 4 weeks?					
Yes	54	49.1	815	75.0	<0.001
No	56	50.9	272	25.0	
Was it an outpatient or inpatient visit?					0.485
Outpatient	48	98.0	785	96.0	
Inpatient	1	2.0	33	4.0	

4.8.2 Illness rates of Chinese children and health services utilisation in the follow-ups

During the one-year of follow up, 139 Chinese mothers in Perth had reported at least one illness episode of their children. The numbers of sickness episode for one child ranged from zero to fourteen (Table 4.50). There were 16 children who had at least one injury during the one year of the follow up, including four children had injuries twice in one year (Table 4.51).

When their child was sick, 54.9% of mothers consulted with a health professional including doctors, nurses and pharmacist, while 41.8% did not seek any helps and took care of their children by themselves. The other most mentioned information source for the child's illness was "Chinese friends or relatives living in Australia" (15.6%) (Table 4.52).

There were 68% of children (n=100) had medical treatments for their illnesses or injuries (Table 4.53). The times of seeking medical treatments ranged from zero to eleven. There were 32.1% of children had medical treatments more than one time during the one year (Table 4.53).

Most children in the cohort had medication for at least one illness during the year of the follow up (80.1%) (Table 4.54). Most children took medicine brought from local pharmacy (64.5%). About 30% of children had traditional Chinese medicine or medicine their parents bought from China. There were 12 children who were (5.9%) reported to have injection or transfusion for their illness (Table 4.55).

Table 4.50 Times of sickness of their child reported in the one year by Chinese mothers in Perth

Times of illness	N	Percent (%)	Valid percent (%)
0	21	8.9	11.6
1	49	20.7	27.1
2	34	14.3	18.8
3	33	13.9	18.2
4	15	6.3	8.3
5	12	5.1	6.6
6	4	1.7	2.2
7	3	1.3	1.7
8	5	2.1	2.8
9	2	0.8	1.1
11	1	0.4	0.6
13	1	0.4	0.6

14	1	0.4	0.6
Missing value	56	23.6	
Total	237	100	100

Table 4.51 Times of injuries of their child reported in the one year by Chinese mothers in Perth

Times of injuries	N	Percent (%)	Valid percent (%)
0	165	69.6	91.2
1	12	5.1	6.6
2	4	1.7	2.2
Missing value	56	23.6	
Total	237	100	100

Table 4.52 The person from whom the mother most often sought help for the illness of their child during the one year

Person(s) you talk to or get help from for the illness of the child?	N	%
Self treatment by the mother	99	41.8
Chinese friends or relatives living in Australia	37	15.6
Non-Chinese friends or relatives	5	2.1
Friends or relatives living in China	10	4.2
Health professionals	130	54.9

*Percentages may add up to more than 100 as respondents may have given multiple responses.

Table 4.53 Times of seeking medical treatments for the child's illness or injury

Times of outpatient visits	Frequency	Percent (%)	Valid percent (%)
0	58	24.5	32.0
1	65	27.4	35.9
2	31	13.1	17.1
3	11	4.6	6.1
4	6	2.5	3.3
5	4	1.7	2.2
6	1	0.4	0.6
7	2	0.8	1.1
8	1	0.4	0.6
9	1	0.4	0.6
11	1	0.4	0.6
Missing System	56	23.6	
Total	237	100	100

Table 4.54 Times of having medication(s) for the child's illness

Times of having medication	Frequency	Percent (%)	Valid Percent (%)
0	36	15.2	19.9
1	56	23.6	30.9
2	34	14.3	18.8
3	26	11	14.4
4	12	5.1	6.6
5	5	2.1	2.8
6	4	1.7	2.2
7	2	0.8	1.1
8	2	0.8	1.1
9	2	0.8	1.1
11	1	0.4	0.6
12	1	0.4	0.6
Missing value	56	23.6	
Total	237	100	100

Table 4.55 Types of medication used for illnesses or injuries of Chinese children in Perth in the one year

	Frequency	Percent (%)
Traditional Chinese medicine or Chinese patent medicine	26	12.8
Medicine brought from China	34	16.7
Medicine from local pharmacy	131	64.5
Injection or transfusion	12	5.9
Total	203	100

4.9 Summary of the descriptive and univariate results

In summary, there were 237 mothers in Perth, Western Australia and 2079 of mothers from Chengdu and Wuhan PR China who participated in this study. Australian mothers had a higher education level compared to China mothers and higher economic status according to the local household economic standard. The majority of China mothers (63.5%) had full-time work compared to19.1% in Australia. The median age of the "index child" in the China sample was older than in Australia.

The breastfeeding initiation rate in Chinese Australian mothers (94.1%) was higher than it in mothers in China (86.2%, $P<0.001$). Chinese Australian mothers also had a longer breastfeeding duration, greater 'full breastfeeding' rate at 6 months and greater 'any breastfeeding' rates at 6 and 12 months. In Australia, the median duration of 'any breastfeeding' was 9.25 months (interquartile range=7 months) compared to 8 months in China (interquartile range=5.62 months).

The simplified Chinese version of the Iowa Infant Feeding Attitude Scale had a moderate level of internal consistency with a Cronbach's alpha of 0.69 for mothers in Australia and 0.55 for mothers in China. The mean Iowa Infant Feeding Attitude Scale scores in both country groups lay in the range of 'neutral breastfeeding attitudes'. Chinese mothers in Australia tended to have more positive attitudes towards breastfeeding than mothers in China (a mean score of the Iowa Infant Feeding Attitude Scale of 59.95±6.21 in Australia compared to 57.65±5.06 in China, $p<0.001$).

More children were overweight or obese in China (16.7% in China compared to 8.0% in Australia) while more Chinese children were underweight in Australia (22.7% in Australia compared to 11.9% in China, $p<0.01$). Chinese children and mothers in China undertook physical activities more often ($p<0.05$ and $p<0.01$ respectively).

A total of 22.6% and 32.4% of the Chinese children were taking dietary supplements in Australia and China respectively. In China, the most commonly used dietary supplements were calcium (58.5%) and zinc (40.4%), while in Australia, the most frequently used types were multi-vitamins/minerals (46.2%) and fish oil (42.3%).

The overall percentages of correct maternal perception of the child's weight were 35.2% in underweight children, 69.2% in normal weight children and 10.8% in overweight/obese children. Among those overweight/obese children, only 14.3% in Australia and 10.8% in China were classified as overweight/obese by their mothers.

Despite some differences in health beliefs between Chinese mothers in two countries (eg, higher 'general health motivation' and 'perceived barriers' in China), participants from both groups expressed a high general health concern for the child, high perceived severity of childhood obesity and benefits of taking weight control actions towards their child. Mean scores of 'mother's perceived susceptibility', 'self-efficacy' and 'cues to action' were relatively low in both countries compared to other Health Belief Model dimensions.

In general, the most mentioned health information sources for Chinese mothers in Australia were "the Internet", "health professionals" and "Chinese friends or relatives living in Australia". The main health information sources for general health, nutrition and physical activities were the Internet (37.1%, 35.4% and 34.6% respectively), while the main information source for sickness of the child was health professionals (74.4%).

Children in China were more likely to be sick or injured than children in Australia ($p<0.001$). More Chinese mothers in China sought formal medical care for the child's illness or injuries than Chinese mothers in Australia ($p<0.001$). Among children who were reported sick during the past four weeks, 44.3% mothers in Australia gave medicine brought from the local pharmacy. Nearly 20% of them gave their children traditional Chinese medicine or medicine brought from China (Table 4.37). More than half (52.6%) of Chinese children in China took traditional Chinese medicine or Chinese patent medicine for their illness, including 19.2% of them took modern medicine as well.

During the one-year follow up, 54.9% of Chinese Australian mothers had consulted with a health professionals when their child was sick, while 41.8% did not seek any help and took care of their children by themselves. The other most mentioned information source for the child's illness was "Chinese friends or relatives living in Australia".

Chapter 5

Attitudes to breastfeeding – the Iowa Infant Feeding Attitude Scale in Chinese mothers living in China and Australia

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Abstract

This study aimed to translate and validate a Chinese (simplified) version of the Iowa Infant Feeding Attitude Scale (IIFAS) and compare the infant feeding attitudes of Chinese mothers living in Perth Australia and in Chengdu P.R. China. A survey was undertaken of 200 Chinese mothers living in Perth and 1620 mothers living in Chengdu. The simplified Chinese version of IIFAS had a moderate level of internal consistency with a Cronbach's alpha of 0.69 for mothers in Australia and 0.55 for mothers in China. The mean IIFAS scores in both country groups lay in the range of 'neutral breastfeeding attitudes'. Higher IIFAS scores were significantly associated with the likelihood of both breastfeeding (OR: 3.85; CI: 2.49, 5.96; $p<0.001$) and longer ($\geqslant$8 months) breastfeeding duration (OR: 2.52; CI: 1.87, 3.40; $p<0.001$). Chinese mothers in Perth tended to have more positive attitudes towards breastfeeding than mothers in Chengdu (mean attitudes score=57.7±5.1, $p<0.001$) and had a longer duration of 'any breastfeeding' (10.0±6.2 months in Perth compared to 7.4±4.3 months in Chengdu, $p<0.001$). In conclusion, higher scores on the Iowa Infant Feeding Attitude Scale in simplified Chinese are associated with breastfeeding initiation and duration in Chinese populations.

Key words: breastfeeding, Iowa Infant Feeding Attitude Scale, attitudes, infant feeding, migrants

5.1 Introduction

Breastfeeding is the optimal way of providing the best nutrition for the healthy growth and development of infants(Ip et al., 2007, Binns et al., 2001). In China, only a small portion of Chinese mothers are still exclusively breastfeeding their infants at six months(Xu et al., 2009). A cohort study undertaken in Zhejiang Province, P.R. China reported the 'exclusive breastfeeding' rates by sixth months were 0.2%, 0.5% and 7.2% in city, suburb and rural areas respectively(Qiu et al., 2010). In Australia, Chinese-speaking women were reported to have a lower initiation of breastfeeding compared with other ethnic groups(Homer et al., 2002). A survey of the initiation and duration of breastfeeding in Chinese mothers in Perth, Western Australia revealed that less than 7% of Chinese mothers were still fully breastfeeding at 6 months(Li et al., 2004). The Iowa Infant Feeding Attitude Scale (IIFAS) developed by De la Mora et al. is a measure of attitudes towards infant feeding(De la Mora, 1999). There have been no studies of infant feeding attitudes among Chinese in mainland China and overseas Chinese mothers published in English. The aim of this study was to translate and validate a Chinese version of IIFAS (simplified Chinese), and to compare the infant feeding attitudes and practices in Chinese mothers in China and Australia.

5.2 Methods

Participants were asked to respond to all 17 IIFAS items with a five-point scale that ranged from 'strongly disagree' to 'strongly agree' for each item. Approximately half of the items that worded in manner of favourable to formula feeding were reverse scored. Total attitude scores range from 17 to 85 with higher scores reflecting attitudes more positive to breastfeeding(De la Mora, 1999). The IIFAS was translated into Chinese by three bilingual translators and subsequently back-translated. The translated IIFAS was pretested with 10 Chinese women who were breastfeeding to evaluate the readability of each item(Copies of the translated IIFAS are available from the authors).

A survey was undertaken of 200 Chinese mothers living in Perth Australia and 1620 mothers living in Chengdu Sichuan Province, PR China, with a response rate of 94.8% and 77.1% respectively. The participants were mothers with children under 5 years old recruited from kindergartens and social groups in Perth and from 14 kindergartens in Chengdu. The study was approved by the Curtin University Human Research Ethics Committee.

Data were analysed using IBM Statistical Package for Social Sciences (SPSS) Version 20.0. Descriptive statistics were calculated for variables of interest. Independent samples t-test was used to compare means between groups. Chi-square (χ^2) test was used to test associations between categorical variables. One-way analysis of variance (ANOVA) was carried out to assess association between IIFAS scores and socio-demographic factors. To facilitate the analysis, we define the longer breastfeeding as breastfed 8 months or longer. Also IIFAS score was categorized into 4 levels according to its quartiles. Binary logistic regression was applied to explore the association of the IIFAS score levels with breastfeeding outcome and with longer breastfeeding duration. Cronbach's alpha was used to assess internal consistency of IIFAS items(Cronbach and Warrington, 1951). Internal reliability was acceptable if Cronbach's alpha was greater than 0.6(Sim, 2000). P values <0.05 were considered statistically significant.

5.3 Results

There was no significant difference in marital status between the two countries. The average age of Chinese mothers in Perth (33.5±5.0 years) was slightly older than the mothers in Chengdu (31.3±4.3 years, p<0.001). The majority of Australia mothers (76%) have a university degree while only 44.3% mothers in China had attended to university (χ^2=70.3, df=2, p<0.001). Australia mothers also have higher economic status compared to Chinese mothers according to the local household economic standard (χ^2=81.1, df=2, p<0.001). Only 18.5% of Perth mothers had full-time work while in China, 62.3% mothers worked full-time (χ^2=180.5, df=2, p<0.001).

Most Chinese mothers had initiated breastfeeding in Australia (93.6%) and in China (82.9%). There was no difference between the mean 'exclusive breastfeeding' duration in Australia (3.9±2.7 months) and in China (3.7±2.7 months). However, Australia mothers had longer mean 'any breastfeeding' duration (10.0±6.2 months in Australia and 7.4±4.3 months in China, p<0.001).

The mean IIFAS scores in both groups lay in the range of 'neutral breastfeeding attitudes'. The responses to each IIFAS item were compared between mothers who were in Australia and mothers who were in China, with Chinese mothers in Perth having a more positive attitudes towards breastfeeding (p<0.001) (Table 4.9). Australia mothers had higher scores in

8 items and the highest mean difference appears on the item "women should not breastfeed in public places such as restaurants" (p<0.001).

Infant Feeding attitudes and demographic factors

There were no significant differences in infant feeding attitudes by marital or working status. Higher educational attainment was significantly associated with mother's positive attitude towards breastfeeding (p<0.001) in both countries. In China, mothers aged between 30-33 years old were more likely to have higher IIFAS scores (p<0.05). Higher economic status was showed to be associated with higher IIFAS scores among Chinese-Australian mothers.

Infant feeding attitudes and feeding practices

The simplified Chinese version of IIFAS had moderate internal consistency with a Cronbach's alpha of 0.58 in the combined sample (mothers in China and in Australia), 0.69 for mothers in Australia and 0.55 for mothers in China. Analysis of subgroup differences in reliability revealed strengthened reliability in university educated mothers (α = 0.63) and in higher household economic mothers in China (α = 0.62).

The predictive validity of the simplified Chinese version of IIFAS is reflected in the finding that mothers with higher attitude scores were more likely to initiate breastfeeding (p>0.001) and to have longer breastfeeding duration (p>0.001). Compared to those women who had a IIFAS mean score less than 55, mothers who had a IIFAS mean score over 61 were almost 4 times more likely to breastfeed (OR =3.85, 95%CI: 2.49, 5.96; p <0.001). Also mothers who had a IIFAS mean score over 61 were two and half times as likely (OR = 2.52, 95% CI 1.87, 3.40; p <0.001) to have a breastfeeding duration at least 8 months or longer than those who had a IIFAS mean score less than 55.

5.4 Discussion

This is the first study to report on the use of a simplified Chinese version of IIFAS to describe the infant feeding attitudes in Chinese mothers in mainland China and Australia. The internal reliability of the simplified Chinese version of IIFAS in this study was good for a self-administered questionnaire for mothers in Australia (α=0.69) and university educated (α=0.63) or high-household-income mothers (α=0.62) in China. This is comparable to the original IIFAS Cronbach's alpha of 0.68 in the sample of breastfeeding women and more robust than for the Romanian version of IIFAS(De la Mora, 1999, Wallis et al., 2008). These findings may show a lack of infant feeding information among lesser educated and/or low-household-income Chinese mothers in China.

The mean item-responses show an inconsistency between the item “formula fed babies are more likely to be overfed than breast-fed babies” and the item “breastfed babies are more likely to be overfed than formula fed babies”. It is more significant in mothers in China with the mean score of the former item of 2.8±0.9 and the latter of 3.2±0.8 (Table 4.9). This might be explained by the common Chinese culture belief that “gaining weight and being fat means affluence”(Jing, 2000). In Chinese culture, there is no concept of being “overfed”. Compared to mothers in China, there was less inconsistency between this pair of items in the responses of mothers in Australia. This might be explained by the better infant feeding information that mothers in Australia received.

The low mean scores of the item “formula feeding is the better choice if the mother plans to go back to work” (2.3±0.9 in Australia and 2.3±0.7 in China) may reflect a lack of support for breastfeeding mothers in the workplace (Table 4.9). Also the item of “a mother who occasionally drinks alcohol should not breastfeed her baby” was negative to breastfeeding with a mean score of 2.7±0.8 in Australia and 2.4±0.9 in China (Table 4.9). Thus future projects promoting breastfeeding in Chinese women should include information on the “overfeeding” infants, breastfeeding and drinking alcohol and on providing more support for mothers in the workplace.

5.5 Conclusion

This is the first use of a simplified Chinese version of IIFAS to describe and compare the infant feeding attitudes in Chinese immigrant mothers and also in Chinese mothers in their homeland. The IIFAS in simplified Chinese is a reliable and valid instrument to measure the infant feeding attitudes in these populations.

Chapter 6

Breastfeeding by Chinese mothers in Australia and China: the healthy migrant effect

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Abstract

Background: Breastfeeding is the optimal way of infant feeding. The breastfeeding practices might be influenced by migration to another country. In spite of the popularity of the healthy migrant hypothesis, evidence for it in breastfeeding practices is weak.

Objectives: This study aimed to compare the initiation and duration of breastfeeding between Chinese Australian migrants and Chinese mothers in mainland China and test the 'healthy migrant effect' in Chinese Australian migrants in Perth, Western Australia.

Methods: A survey was undertaken of 239 Chinese mothers living in Perth Australia and 1844 mothers living in Chengdu, Sichuan Province, PR China, with a response rate of 96.7% and 87.8% respectively.

Results: The breastfeeding initiation rate in Chinese Australian mothers (94.1%) was higher than it in mothers in China (86.2%, $P<0.001$). Chinese Australian mothers also had a longer breastfeeding duration, greater 'full breastfeeding' rate at 6 months and greater 'any breastfeeding' rates at 6 and 12 months. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that the location of the mother (in Australia or China) was associated with breastfeeding practices. Chinese mothers living in Chengdu were less likely to initiate breastfeeding (OR=0.47, 95%CI 0.25-0.89) and breastfeed their babies at 12 months (OR=0.48, 95%CI 0.33-0.69) than mothers in Perth.

Conclusion: The higher breastfeeding initiation and longer breastfeeding duration in Chinese migrants mothers in Perth than mothers in Chengdu suggests a 'healthy migrant effect'.

Key words: breastfeeding, healthy migrant effect, migrants, Chinese

6.1 Background

The type and duration of infant feeding may have an important role in the development of biological and behavioural processes and epigenetic modification affecting subsequent growth and health(Oddy et al., 2006b, Savage et al., 2007, Chivers et al., 2010, Tamashiro and Moran, 2010, Bruce and Hanson, 2010). The WHO recommends exclusively breastfeeding for the first six months of life and continued breastfeeding up to two years of age or beyond(World Health Organization, 2001) .

The Australian population has a high proportion of migrants and nearly 29% aged 15 years and over who born overseas(Australian Bureau of Statistics, 2010b). In recent decades the focus of Australian immigration has shifted from Europe to Asian and China is now the largest source of migrants(Australian Bureau of Statistics, 2008c). In the 2006 Australian Census 669,890 residents identified themselves as having Chinese ancestry and the number is increasing by 7.7% per year(Australian Bureau of Statistics, 2007). There were 53,390 Chinese born residents in Perth in 2006, including 5527 children about 2.9% of the city's population(Australian Bureau of Statistics, 2008a).

A review of health statistics has found that most migrants enjoy health that is as good as, if not better than, that of the Australian-born population(Australian Institute of Health and Welfare, 2010). Overseas-born people are admitted to hospital at lower rates than the Australian-born population(Australian Institute of Health and Welfare, 2008). In 2005–06, the age-standardized total hospital separation rate for Australian born patients was 20% higher than for the overseas-born population (367 compared to 300 per 1,000 population)(Australian Institute of Health and Welfare, 2007). Compared with other ‘country of birth’ groups, those born in North-East Asia, which includes China, Japan, the Republic of Korea and Taiwan, had the lowest hospital separation rate at 225 per 1,000 population(Australian Institute of Health and Welfare, 2008). This could reflect either ‘healthy migrant effect’; that is, migrants tend to be better educated, highly motivated and in better psychological and physical health than non-migrants, or underutilization of “mainstream” health services because of language and cultural barriers or a mixture of both(Rubalcava et al., 2008, Palloni and Arias, 2004).

There is also evidence that migrants, whether temporary or permanent, tend to be healthier than the population from which they originate(Feliciano, 2005, Marmot et al., 1984, Palloni and Arias, 2004, Rubalcava et al., 2008). To some extent, the ‘healthy migrant effect’ can be partly explained by the fact that most migrants are selected by the recipient country on the basis of their health and, in some cases, their relatively high socioeconomic status. The 'healthy migrant effect' is also due to a self-selection process as the chronically ill and disabled are less likely to migrate. People who are able to migrate and be mobile are more likely to be healthier when compared with native-born counterparts(Walsh, 2011).

In China, the 'any breastfeeding' rates in the majority of cities and provinces including minority areas have been above 80% at four months since the mid-1990s(Xu et al., 2009). The mean duration of 'any breastfeeding' in the majority of cities or provinces was between seven and nine months, but only a small portion of Chinese mothers are still exclusively breastfeeding their infants at six months(Xu et al., 2009). It was reported that the 'exclusive breastfeeding' rates in Han, Uygur and 'other ethnic groups' at six months in Xinjiang Province, P.R. China were 4.8%, 0.4% and 16.8% respectively(Xu et al., 2006). Another cohort study undertaken in Zhejiang Province, P.R. China reported the 'exclusive breastfeeding' rates by sixth months were 0.2%, 0.5% and 7.2% in city, suburb and rural areas respectively(Qiu et al., 2010). The breastfeeding initiation rate in Chengdu was reported as 92.6 % to 96.5 % in different studies, which was similar to the average level in large cities in China(Xu et al., 2009, Cui, 1999, Ran et al., 2008). At four months, about 40%-54% infants had been introduced to foods other than breastmilk in Chengdu(Xu et al., 2009, Cui, 1999, Ran et al., 2008). A recent cohort study from Chengdu reported that 96.5% of mothers gave their infants prelacteal feeds, which means the "exclusive breastfeeding" was less than 3.5% at discharge(Cui, 1999).

Migration to another country has potential influences on breastfeeding practices(Groleau et al., 2006). In Australia approximately 96% of women initiate breastfeeding, but initiation rates are not consistent across all ethnic groups(Australian Institute of Health and Welfare, 2011). Mothers from non-English speaking backgrounds had lower breastfeeding initiation rates than their Australian-born counterparts(Williams and Carmichael, 1983, Scott et al., 2001). In particular, Chinese-speaking women were reported to have a lower initiation of breastfeeding compared with other ethnic groups(Homer et al., 2002). A survey of the initiation and duration of breastfeeding in Chinese mothers in Perth, Western Australia revealed that less than 7% of Chinese mothers were still fully breastfeeding at 6 months(Li et al., 2004).

The aim of this study was to compare the initiation and duration of breastfeeding between Chinese Australian migrants and Chinese mothers in mainland China. We hypothesized that a 'healthy migrant effect' would be reflected in the Chinese mothers in Australia who would have greater 'any breastfeeding' rates and longer 'any breastfeeding' duration.

6.2 Methods

A self-reporting survey was undertaken of Chinese mothers living in Perth Australia and mothers living in Chengdu, Sichuan Province, PR China. The participants in Perth were mothers with children under 5 years old who were recruited from the Perth Chinese community, including Chinese schools and community organizations. If the mother had more than one child under 5 years old, the youngest child was chosen as the "index child" for questions in the questionnaire. A total of 239 mothers agreed to participate with a response rate of 96.7%. Participants in China were recruited from 14 kindergartens in seven districts of Chengdu. A total of 2100 questionnaires were distributed to mothers whose child was under 5 years old by kindergarten teachers and 1844 were returned by the mothers, a response rate of 87.8%.

The study was approved by the Curtin University Human Research Ethics Committee. An information letter in English and/or Chinese, with an explanation of the project, was given to each mother.

Demographic and breastfeeding information was collected by validated and reliable questionnaire previously used in Chinese breastfeeding studies(Li et al., 2003b). Precoded questions were asked to classify income into three groups using categories were based on local annual household income surveys(Sichuan Bureau of Statistics, 2012b, Australian Bureau of Statistics, 2010c). 'Full breastfeeding' was defined by the WHO as "exclusive (no other liquid or solid is given to the infant) or almost exclusive (vitamins, mineral water, juice, or ritualistic feeds are given infrequently in addition to breastfeeds)". The average recall period for mothers in Chengdu was 3.7±0.7 years and for mothers in Perth was 1.9±1.2 years. Those mothers who were still breastfeeding were all followed until they stop breastfeeding. The mothers' attitudes toward infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS) which is a measure of attitudes towards infant feeding(De la Mora, 1999). The IIFAS contains 17 items with a five-point Lickert scale that ranged from 'strongly disagree' to 'strongly agree' for each item. Total attitude scores range from 17 to 85 with higher scores reflecting attitudes more positive to breastfeeding(De la Mora, 1999). The reliability and validity of the scale has been assessed by studies undertaken in English-speaking populations(Scott et al., 2004, Scott et al., 2006b, Sittlington et al., 2007, Dungy et al., 2008, De la Mora, 1999). It has been translated into Romanian and traditional Chinese and showed good reliability and validity. In this study, the IIFAS was translated into simplified Chinese by three bilingual translators and subsequently back-translated(Chen et al., 2013a). For the purposes of the bivariate regression analysis, mothers were split into two groups: those with an IIFAS score at or above the median (58) and those with a score less than the median (58).

Data were analysed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0. Descriptive statistics were calculated for variables of interest. Continuous variables (e.g., mother's age and breastfeeding duration, etc) are presented as mean ± standard deviation and categorical variables (e.g., mother's working status, household economic status, infant feeding methods, etc) as number (%) in relevant categories.

Independent samples t-test was used to compare means between groups and Mann-Whitney U test was applied when the distribution of variables were not normal. Chi-square (χ^2) test was used to test associations between categorical variables. Potential influencing variables were chose basing on previous studies(Scott et al., 2006b, Scott et al., 2001, Donaldson, 2010). A multiple binary logistic regression model was performed to evaluate the influence of potential risk factors on 'breastfeeding initiation', and 'any breastfeeding' at six months and twelve months, respectively. A backward elimination procedure was then applied to obtain final models. P values <0.05 were considered statistically significant.

6.3 Results

There was no differences in marital status between the two countries and the average age of Chinese mothers in Perth, West Australia was 33.5±5.0 years, significantly older than mothers in Chengdu, P.R. China (31.3±4.3 years, P<0.001). Australia mothers had a higher education level compared to China mothers and higher economic status according to the local household economic standard (Table 6.1). The majority of Perth mothers were not employed, but in Chengdu the majority of mothers worked full-time. The percentage of caesarean delivery was nearly double in Chengdu compared to that of the Perth Chinese mothers. The result of Mann-Whitney U test shows that the average age of the "index child" in the

Chengdu sample (median age=1.59 years, interquartile range=1.88 years) was older than it in Perth (median age=3.70 years, interquartile range=1.11 years, $P<0.001$).

Most Chinese mothers initiated breastfeeding, both in Australia (94.1%) and in China (86.2%). There was no difference between the 'full breastfeeding' duration in Australia and in China, both with the median 'full breastfeeding' duration of 4 months and the interquartile range of 5 months. However, Australia mothers were more likely to initiate breastfeeding (χ^2=11.7, df=1, P=0.001) and they had longer 'any breastfeeding' duration ($P<0.001$). In Australia, the median duration of 'any breastfeeding' was 9.25 months (interquartile range=7 months) compared to 8 months in China (interquartile range=5.62 months). Australian mothers also had a greater 'full breastfeeding' rate at 6 months and greater 'any breastfeeding' rates at six and twelve months ($P<0.001$) (see Figure 4.1).

Mother's age, mother's location (in Australia or China), infant feeding attitudes, marital status, household economic, working status, level of education and delivery method were entered into a binary logistic regression model using backward elimination. After controlling for potential confounding variables (e.g., mother's age, education level, infant feeding attitude, etc), the results of the binary logistic regression analysis showed that the location of the mother (Australia or China) was associated with breastfeeding practices. Chinese mothers living in Chengdu were less likely to initiate breastfeeding (OR=0.48, 95%CI 0.33-0.69) and breastfeed their babies at twelve months (OR=0.48, 95%CI 0.33-0.69) than mothers in Perth (Table 6.2). Chinese women with higher IIFAS scores (mean IIFAS score>58) that favoured breastfeeding were more likely to initiate breastfeeding (OR=2.22, 95%CI 1.52-3.24), and continue breastfeeding at six months (OR=2.18, 95%CI 1.64-2.90) and at twelve months (OR=1.97, 95%CI 1.39-2.80) than those with lower scores (Table 6.2).

6.4 Discussion

These results demonstrate a 'healthy migrant effect' for breastfeeding by Chinese migrant mothers now living in Australia. In the present study we found that the initiation rate of breastfeeding of Perth Chinese mothers (94%) was higher than Chengdu mothers (86.2%, $P<0.01$) and close to the rate of Australia women (approximately 96%)(Scott et al., 2006b). The 'any breastfeeding ' rate at 6 months for Chinese mothers in Perth was 75.7% in this study, which is higher than the rate of 45.9% reported for all Australian mothers in Perth(Scott et al., 2006b, Australian Institute of Health and Welfare, 2011). It is also higher than the rate for Chinese mothers living in Chengdu, China (69.1%, $P<0.05$). The 'full breastfeeding' rate in Chinese mothers in Australia in this study was 33.8% compared to the 7% found in an earlier study(Li et al., 2003b). This difference may be due to a combination of increased emphasis on breastfeeding in Australian hospitals, the availability of multicultural health education programs and to sampling errors.

The findings from this study show that after controlling for potential confounders, Chinese mother's location (in Australia or in China) was still a predictor for breastfeeding initiation (OR=0.48, 95%CI 0.33-0.69) and 'any breastfeeding' after twelve months (OR=0.48, 95%CI 0.29-0.67). This could be partly explained by the "health selection process" when these mothers migrate to Australia. Mothers in Perth might be healthier than mothers in Chengdu with a healthier lifestyle, which would affect their children's health. This could also reflect the benefits of their higher household income than participants in Chengdu reflecting the local economic levels in Perth and Chengdu respectively. Many studies have reported that health, including child health, is positively related to household income(De Mheen and van de, 1998, Strauss, 1998, Case, 2002).

It also could be explained by the influence of the new environment including better infant feeding education and information that is available to mothers in Australia. Both Australian and Chinese mothers are officially encouraged to exclusively breastfeed their infants to around six months of age, although antenatal care and education would appear to be more intensive in Australia. In this study, the 'healthy migrant effect' and the breastfeeding education in Australia were reflected in the higher 'any breastfeeding' rate in Chinese-Australian mothers compared to Australian-born mothers, and the higher breastfeeding initiation and duration of Chinese mothers in Australia compared to those living in China.

There are several limitations that need to be considered when interpreting the results of this study. This is a cross sectional study and is subject to recall bias, but this applies to both samples. Because of the possibility of recall bias, we did not measure exclusive breastfeeding in this study, instead, we use the term 'full breastfeeding' where an infant may also receive small amounts of culturally valued supplements—water, water-based drinks, fruit juice, or ritualistic fluids(Binns et al., 2009). Although it also has the potential of recall errors, the use of 'full breastfeeding' is less misleading. Another limitation of this study is that the percentage of missing values in the "China" group in some variables is higher than the "Australian" group.

6.5 Conclusion

Because of the distinctive identity of migrants, their multi-cultural background and the integration of western and eastern culture and lifestyle, the breastfeeding practices of Chinese migrants in Australia were different both to Chinese living in China and to other Australians. The higher breastfeeding initiation and longer breastfeeding duration in Perth Chinese mothers than in Chengdu mothers and/or Australian mothers in Perth also suggest a ‘healthy migrant effect’ on breastfeeding for Chinese mothers living in Perth.

6.6 Funding and Conflict of Interest

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Table 6.1 Characteristics of Chinese mothers in Australia and China

Characteristic	Australia (n*=239)	China (n*=1844)	*p*
	n (%)	n (%)	
Age (years)			<0.001
≤30	71 (30.3)	658 (50.2)	
>30	164 (70.1)	653 (49.8)	
Marital status			0.040
Married	237 (99.6)	1332 (97.4)	
Devoiced /single/widow	1 (0.4)	35 (2.6)	
Educational attainment			<0.001
High school diploma or less	29 (12.2)	438 (32.6)	
TAFE certificate/diploma	32 (13.4)	334 (24.9)	
University degree or higher	176 (74.4)	572 (42.6)	
Working status			<0.001
Full-time work	46 (19.3)	824 (60.8)	
Part-time or casual work	63 (26.5)	304 (22.4)	
Not employed	128 (54.2)	227 (16.8)	
Household income			<0.001
Low income	41 (18.3)	217 (19.1)	
Average income	69 (30.8)	640 (56.2)	
High income	114 (50.9)	228 (24.8)	
Mother's birth place			
Mainland China	190 (79.8)		
Hong Kong	3 (1.3)		
Malaysia	29 (12.2)		
Singapore	9 (3.8)		
Other countries	7 (2.9)		
Duration in Australia (years)			
<5	108 (45.2)		
5-10	79 (33.1)		
>10	48 (20.1)		
Delivery method			<0.001
Vaginal delivery	152 (64.1)	530 (30.3)	
Caesarean section	85 (35.9)	1221 (69.7)	
Age of the child			<0.001
≤3 years	186 (79.1)	279 (18.4)	
3-5 years	49 (20.9)	1237 (81.6)	
Infant feeding attitude (IIFAS score)			<0.001
<58	79 (33.6)	904 (51.1)	
≥58	156 (66.4)	865 (48.9)	
Breastfeeding initiation			0.001
Breastfed	225 (94.1)	1531 (86.2)	
Never breastfeed	14 (5.9)	245 (13.8)	
'Full breastfeeding' at 6 months			0.016

Yes	76 (33.8)	385 (26.1)	
No	149 (66.2)	1089 (73.9)	
‘Any breastfeeding’ at 6 months			0.046
Yes	168 (75.7)	1033 (69.1)	
No	54 (24.3)	462 (30.9)	
‘Any breastfeeding’ at 12 months			<0.001
Yes	85 (38.3)	244 (16.3)	
No	137 (61.7)	1251 (83.7)	

* The missing values vary for each variable in both countries.

Table 6.2 Odds ratios of factors for breastfeeding initiation, ‘any breastfeeding’ at 6 and 12 month

		Breastfeeding initiation		'any breastfeeding' at 6 month		'any breastfeeding' at 12 month	
Variables[a]	N	OR	95% CI	OR	95% CI	OR	95% CI
Age		NS		NS			
≤30	727					1	
>30	816					1.49	1.06-2.09
Breastfeeding Attitude							
<58	983	1		1		1	
≥58	1021	2.22	1.52-3.24	2.18	1.64-2.90	1.97	1.39-2.80
Location				NS			
In Australia	239	1				1	
In China	1844	0.47	0.25-0.89			0.48	0.33-0.69
Education		NS				NS	
High school diploma or less	467			1			
TAFE certificate/diploma	366			0.49	0.32-0.74		
University degree or higher	749			0.63	0.44-0.91		
Working status		NS				NS	
Full time	870			1			
Part time	367			NS			
Not employed	356			1.57	1.07-2.28		
Delivery method		NS					
Vaginal delivery	682			1		1	
Caesarean section	1306			0.65	0.48-0.88	0.53	0.38-0.75

Variables in full model included mother’s age, mother’s location (in Australia or China), infant feeding attitudes, marital status, household economic, working status, level of education and delivery method.

OR, odds ratio; NS, not significant.

Chapter 7

Prevalence and characterisation of dietary supplement use in healthy pre-school Chinese children in Australia and China

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Abstract

There is a growing use of dietary supplements in many countries including China. This study aimed to document the prevalence and types of dietary supplements used and characteristics of Chinese pre-school children using dietary supplement in Australia and China. A survey was carried out in Perth, Western Australia of 237 mothers with children under 5 years old and 2079 in Chengdu and Wuhan, China. A total of 22.6% and 32.4% of the Chinese children were taking dietary supplements in Australia and China respectively. In China, the most commonly used dietary supplements were calcium (58.5%) and zinc (40.4%), while in Australia, the most frequently used types were multi-vitamins/minerals (46.2%) and fish oil (42.3%). In Australia, not working, never breastfeed, higher education level of the mother and older age of the child were associated with dietary supplement use in children. In China, being unwell during the past month and having a higher household income were significantly related to dietary supplementation. Because of the unknown effects of many supplements on growth and development and the potential for adverse drug interactions, parents should exercise caution when giving their infants or young children dietary supplements. Wherever possible it is preferable to achieve nutrient intakes from a varied diet rather than from supplements.

Key words: complementary and alternative medicine, dietary supplement, Chinese, migrates, child nutrition

7.1 Introduction

Infant nutrition is important for short term and long term health. A balanced variety of nutritious foods are emphasized by the Australian and Chinese governments and other professional organizations as the best source of nutrition for healthy children(American Dietetic Association, 2005, National Health and Medical Research Council, 2003, Chinese Nutrition Society, 2010). However, the Chinese diet has been reported to be low in calcium, riboflavin, vitamin A, and zinc(Ge, 1999). A national survey in 2004 found that the average calcium intake among the city and suburban populations was 430 mg per day, well below the recommended intake(Zhai et al., 2009). The iron intake appears to be adequate in amount, but its bioavailability is very low and consequently the prevalence of iron deficiency and iron deficiency anemia was 43.7% and 7.8%, respectively among children aged 1-3 years in 2001(Ge, 1999, Zhu and Liao, 2004).

The consumption of fortified foods and/or supplements can help some children meet their nutritional needs as specified in science-based nutrition standards such as the Dietary Reference Intakes(Marra and Boyar, 2009). The American Academy of Pediatrics recommends oral vitamin D supplementation for exclusively breastfed infants and, under certain conditions, for specific older infants and toddlers(Wagner and Greer, 2008). However other countries, such as Australia, have different climatic conditions and do not recommend universal use of vitamin D. On the other hand, excessive intakes of single nutrients may have potential risk of adverse effects(National Health and Medical Research Council and Ministry of Health, 2006, Institute of Medicine, 2011b).

Dietary supplements enriched with vitamins, minerals, and other substances have received increasing attention worldwide. The North America and the Asia Pacific regions are the dominant markets for vitamins and dietary supplements(Crossley, 2007). The prevalence of supplement use varies in different ethnic groups for diversity of dietary, cultural reasons and economic conditions. Most studies on the use of supplements in children were conducted in the US, only a small number of studies have been conducted in Asian countries. It is reported that approximately 49% of the U.S. population take dietary supplements and the prevalence of supplement use was 35% among 1-13 years children(Bailey, 2011, Bailey et al., 2010). In South Korea, approximately 34% of Korean children and adolescents were taking dietary supplements in a national survey in 2007 to 2009(Yoon et al., 2012). A survey d of urban

Japanese found that 20.4% of children and adolescents between 3 to 17 years were using supplements, or have used in the past year(Mori, 2011). A cross-sectional survey carried out in Zhejiang Province, PR China in 1999 reported a prevalence of 18% of vitamins supplements and 31% of other nutritional supplements in adolescents(Hesketh et al., 2002). A recent study from Taiwan reported that 34.9% of the infants had been given a dietary supplement before six months(Chuang et al., 2012).

Australians have a high prevalence of taking dietary supplements. A representative population survey conducted in 2004 in South Australia reported the use of vitamin supplements by 39.2% respondents and mineral supplements by 13.6% of the population(MacLennan, 2006). No recent data is available on the use of supplements by infants or young children in Australia.

Until recently, there have been no reported studies of dietary supplementation among Chinese young children in mainland China or overseas. The aim of this study was to document the prevalence of use of dietary supplements in these populations. A survey was carried out of Chinese mothers living in Perth, Australia and Chengdu and Wuhan, PR China.

7.2 Methods

This data was collected from October 2010 to October 2011 in Perth, Western Australia and from September to December 2011 in Chengdu and Wuhan, China. Participants in Perth were mothers who have at least one pre-school child under 5 years old. They were recruited from the Perth Chinese community, including Chinese schools and community organizations. Mothers interested in taking part in this study will receive an information sheet containing project details and will be asked to sign the consent form. A total of 237 mothers agreed to participate with a response rate of 95.6%. There were 230 mothers completed the dietary supplementation questionnaire. Participants in China were recruited from 4 kindergartens in in four districts of Wuhan and 14 kindergartens in seven districts of Chengdu. Both private and public kindergartens were included. A total of 2400 questionnaires were distributed to mothers by kindergarten teachers and 1608 and 471 were returned by the mothers in Chengdu and Wuhan respectively, a response rate of 86.6% in China. The dietary supplementation questionnaire was completed by 1156 mothers in Chengdu and 308 mothers in Wuhan. The study was approved by the Curtin University Human Research Ethics Committee and the local education authorities in China.

Demographic and dietary supplement use was collected using a validated and reliable questionnaire previously used in Chinese population studies(Li et al., 2003b). Precoded questions were asked to classify income into three groups using categories were based on local annual household income surveys(Sichuan Bureau of Statistics, 2012b, Australian Bureau of Statistics, 2010c). The Dietary Supplement Questionnaire is used to collect information on the participant's use of medicine, vitamins, minerals, herbals, and other supplements over the past two weeks. Detailed information about type, consumption frequency, and amount taken is also collected for each reported dietary supplement use. Child's health status was collected using the Australian National Health Survey questionnaire(Australian Bureau of Statistics, 2005).

BMI was defined as weight (kg)/height (m)^2. The 2012 revised international child cut-offs developed by the International Obesity Task Force (IOTF) were used to classify thinness, overweight and obesity in children in this study(Cole and Lobstein, 2012). The international cut-offs are in terms of underlying LMS curves and the resulting curves provide age and sex specific cut off points from 2-18 years(Cole and Lobstein, 2012, Cole et al., 2000). They are based on BMI data from six countries, corresponding to the BMI cut-offs at 18 years, which are BMI 25 (overweight), 30 (obesity) and 18.5 (thinness grades 1)(Cole and Lobstein, 2012).

All statistical analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0. Independent samples t-test was used to compare means between groups. Mann-Whitney U test was applied to compare the average age of children from two countries. Chi-square (χ^2) test was used to compare basic characteristics of mothers and children in Australia and China. A multiple binary logistic regression model was performed to evaluate the association between mother and child's characteristics and the use of dietary supplements. A backward elimination procedure was applied to obtain final models. P values <0.05 were considered statistically significant.

7.3 Results

A total of 230 Chinese mothers living in Perth Australia and 1156 mothers living in Chengdu, Sichuan Province and 308 mothers living in Wuhan, Hubei Province, PR China completed the supplement questionnaire. The distribution analysis shows no difference in age, education attainment, marital status, working status, family income status, breastfeeding initiation and duration, between mothers who completed the supplement questionnaire and mothers who did not. There was also no difference in education attainment, marital status, family income status, breastfeeding initiation and duration, between mothers in Chengdu and Wuhan. The only statistically significant difference between mothers in Wuhan and Chengdu was the average age (31.0 years in Chengdu and 30.8 years in Wuhan, $p<0.001$). Because the difference is so small in Wuhan and Chengdu mothers, their data have been combined into one group.

The average age of Chinese mothers in Australia was older than mothers in China (33.8 ± 4.9 years compared to 31.0±4.1 years, $p<0.001$). The mothers in Australia also had higher education level. The median age of the "index child" in the China study population (median age=3.7 years, the interquartile range=1.1 years) was older than it in Perth (median age=1.6 years, the interquartile range=1.9 years, U=47600, $p<0.001$). More Chinese children were underweight (23.0%) and less overweight and obese (9.2%) in Perth than children in China (11.6% underweight and 17.0% overweight and obese) (Table 7.1).

A total of 22.6% of the Chinese children living in Perth were taking dietary supplements, including multi-vitamins/minerals, fish oil, protein, probiotics, colostrum, calcium, zinc and vitamin AD (or cod liver oil) and Chinese herbs (Table 4.24). In Chengdu and Wuhan, China, 32.4% of young children were having dietary supplements, including multivitamins/minerals, calcium, zinc, iron, magnesium, fish oil, probiotics, vitamin A and/or vitamin D, Chinese herbs or other botanicals (Table 4.24). Compared to Chinese Australians, Chinese parents living in China were more likely to give their children dietary supplements ($\chi^2=9.2$, df=1, $p<0.01$). However, in children aged over 12 months, there is no statistical difference in the prevalence of dietary supplements between Australia (28.6%) and China (32.7%, $p=0.284$). Higher percentage of children over three years old living in Australia were taking dietary supplement (40.8%) compare to Chinese children living in China (31.5%). In age group of 4 to 5 years of children in Australia, nearly half (47.4%) were taking at least one dietary supplement (Table 4.26).

In China, the use of calcium supplements was very common in the supplement users (58.5%). About half of the Chinese children taking calcium supplements were also taking Vitamin D (n=140, including the use of multi-vitamins). In Australia, only four children were given specific calcium supplements. The dosage of calcium supplements ranged from 54 to 725 mg/day (Table 4.25). When calculated the average intake, the intakes from multi-vitamins/minerals were also summed if they were reported. The most common forms of supplemental calcium used in Chinese children up to five years old are gluconate (51.8%) and carbonate (37.5%). The average intake for calcium carbonate users (307.4 mg/day) is higher than gluconate calcium users (81 mg/day).

The prevalence of the use of zinc supplementation was also high in China. Nearly half of supplements users were using zinc supplements (40.4%). Almost all the zinc supplements were in the form of gluconate (93.2%) and the average intake of zinc was 4.4 mg/day (n=166, range from 2.15 mg to 8.6 mg) (Table 4.25).

In Australia, the types most frequently used in those supplements users were multi-vitamins/minerals (46.2%) and fish oil (42.3%). The average intake of fish oil was 859.6 mg per day (n=13) with the range from 300 mg to 1000 mg per day (Table 4.25).

Chinese herbal supplements were used by children in both countries, especially in China, where 10.7% of supplements users were taking herb supplements (Table 4.25). Some herbal supplements were used for "better appetite" and some were believed to be beneficial to the immune system or to bring an improvement of health or well-being. In this study, traditional Chinese medicines including cinnabar, as arum, isatis root, kaladana, mangnolia officinalis, scaphium scaphigerum, coltsfoot, coptis chinensis and realgar were included as ingredients in child's dietary supplements or medicines for (preventing) coughs or colds.

Excluding dietary supplements, 7.6% of children in China were reported to take medicine during the last two weeks and 82.9% of them (n=92, 6.3% of all the samples) were taking herbal products for medical reasons, such as cough or upper respiratory tract infection. In China a total of 16.1% of supplements users (8.6% of all samples) were having herbal products as dietary supplement or medicine and 7.7% of supplements users (2.2% of all samples) in Australia were reported to take herbal products.

In Australia, older children (χ^2=19.22, df=4, $p<0.01$), children who were never breastfed (χ^2=4.32, df=1, $p<0.05$) and children who did regular physical exercises in pre-school or at home (χ^2=10.88, df=2, p=0.001) were more likely to take dietary supplements than their counterparts. Mothers who had migrated from other Asian regions (including Hong Kong) were more likely to give their children dietary supplements than mothers from mainland China (χ^2=4.47, df=1, $p<0.05$) (Table 4.26).

In China, the prevalence of dietary supplements was higher in children who had been sick during the past four weeks (χ^2=6.97, df=1, p<0.01) and children who had regular exercises (χ^2=4.13, df=1, p<0.05) than in their counterparts. Higher household income was significantly related to the use of child supplements (χ^2=19.29, df=1, p<0.001) (Table 4.26).

Mother's age, education level, working status, household income, the child's age, BMI, regular exercise, 'illness during the last month' were entered into a binary logistic regression model using backward elimination. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that mother with higher education level (OR=2.51, 95% CI 1.19-5.27), who were not employed (OR=3.83, 95% CI 1.09-13.44) and did not breasted their children (OR=6.75, 95% CI 1.29-35.31) were more likely to give their child dietary supplements in Australia. There was also a trend of giving children dietary supplements as they were getting older (OR=3.11, 95% CI 1.42-6.83). In China, higher household income (OR=1.53, 95% CI 1.13-2.08) and 'having illness during the past month' (OR=1.44, 95% CI 1.05-1.97) were associated with dietary supplement use in China (Table 7.2).

7.4 Discussion

With the increasing prevalence of chronic disease throughout the world and the public's rising health awareness, complementary and alternative medicine has attracted more attention(Mullie, 2009). It was reported that dietary supplements were the most frequently used complementary and alternative medicine for children(Crawford, 2006). All varieties of dietary supplements are now marketed in China and also in Australia, including single-ingredient products and various combinations of vitamins, minerals, botanicals, and other constituents. The purposes of their use in healthy children are treatment on non-clinical deficiencies, or to achieve optimal status of specific nutrients and the promotion or maintenance of health status(Woodside, 2005, Mori, 2011).

This study investigated the prevalence of dietary supplement use in Chinese children in mainland China and in Australia. This is the first report, to our knowledge, on the use of dietary supplements in young Chinese children under the age of five years. The most commonly used dietary supplement types and their intakes were documented. The factors related to dietary supplement use in two countries were also assessed.

In this study, one fifth of Chinese children in Perth and one third of children in Chengdu and Wuhan were taking at least one nutritional supplement with no gender differences. There have been several studies on dietary supplement use in children in different countries. The results of prevalence vary from study to study because of the definition of supplements, demographic characters of the target population, time of studies, and methods used in the surveys. However, the prevalence of dietary supplement use in Chinese young children in China was similar to that of the US (35%) and South Korea (34%), but higher than Japan (20.4%)(Mori, 2011, Bailey et al., 2010, Yoon, 2012, Bailey, 2011). However the comparison populations in these reports involved older populations or different observation periods. The lower prevalence of dietary supplement use in Chinese immigrant children in Australia than children in China is probably due to the age difference of the subjects. In Australia, most children were under three years old. It was found that older children in Australia were more likely to take dietary supplements.

The types of supplements commonly used in Chinese children in China and in Australia were quite different. In China, calcium and zinc supplements were most commonly used, with many of children taking both. Although 58.5% of supplements users were taking calcium supplementation, the average intake was still only 131 mg per day, which is about 20% of the Adequate Intake set for calcium for Chinese children in this age group(Chinese Nutrition Society, 2010). It is less than half of calcium consumption that can be provided from one serve (250 ml) of milk, besides milk can provide other nutrients like protein to support child growth (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). A meta-analysis on randomised controlled trials reported little effectiveness of calcium supplementation on bone density in healthy children, either in childhood or later life(Winzenberg et al., 2006a). The calcium dose was of 300-1200 mg per day in nineteen studies included in the meta-analysis, which was much higher than the average calcium intake from supplements in this study (131 mg in China and 105mg in Australia). Since the level of intake of calcium supplements in China is so low, it is not possible that intake from supplements would be likely to have a positive effect on bone mineral density in Chinese children.

It has been reported in many studies that Chinese children have a low daily zinc intake(Chen et al., 1985, Penland et al., 1997). This may be due to the higher reference value used to define the adequate daily intake in those studies. The Recommended Nutrient Intakes (RNIs) for zinc for 1-7 years old Chinese children (9-13.5mg/day) are much higher than that for Japanese (5-7mg/day), Americans (3-5mg/day) and Australians and New Zealanders (3-4mg/day)(U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010, Department of Health and Ageing and National Health and Medical Research Council, 2005, National Institute of Health and Nutrition, 2010, Chinese Nutrition Society, 2010). The recommended intake for Chinese children along is even higher than the upper level of zinc intakes for those age groups in Australia and New Zealand, which is 7mg/day for 1-3 years and 12mg/day for 4-8 years(Department of Health and Ageing and National Health and Medical Research Council, 2005). The 2002 China National Nutrition and Health Survey found that the median intake of zinc in 2 to 8 years Chinese children ranged from 5.1 to 7.1 mg/day (the interquartile range: 3.9-9.3 mg/day)(Ma et al., 2007). However, the adequacy of zinc intake depends not only on the amount, but also its bioavailability. People consuming a diet that provides marginal zinc intake may not absorb an adequate amount of zinc if they are also consuming foods high in phytate together with high calcium(World Health Organization, 1996). Although, the average population phytate intake of people in China (1186mg/day) is relatively high compared to their western counterparts, it also believed that Chinese diets are low in calcium, which reduces the possibility of low zinc availability(Ma et al., 2007). The elevation of calcium intake by increasing consumption of milk is not affected by the inhibitory effect of phytate because animal sources of protein in milk appears to promote zinc release from its phytate complex and also provides intrinsic zinc in a highly available form(World Health Organization, 1996). For young children from this study, their calcium intakes from calcium supplements were low and because of their young age, they still rely on milk products as their main calcium source. Considering the amount of zinc intake from their diet, they may not need to take zinc supplements. Together with the amount of zinc from supplements (ranged from 2.15mg to 8.6 mg/day), it is a concern that some children might have reached the upper level of intakes for their age. Adverse events associated with chronic intake of supplemental zinc may include suppression of immune response, decrease in high density lipoprotein cholesterol and reduced copper status(Department of Health and Ageing and National Health and Medical Research Council, 2005).

In Australia, the most popular supplements were multi-minerals and/or vitamins, which is consistent with previous studies in children and adolescents(Yoon et al., 2012, Mori, 2011). Fish oil supplements (42.3%) were almost as popular as multi-minerals and vitamins

(46.2%). Few children were on calcium supplement in Australia. This may due to higher consumption of milk and milk products in Australia than in China. Commercial advertisement may also influence the choice of dietary supplement.

Herbal products are widely used both in China and by Chinese Australians. Most herbal traditional products not only have plant-derived materials or preparations, but also include animal products (including scorpions, cicadas and centipedes) and mineral compounds (including cinnabar and realgar)(Phua et al., 2009). There is a public perception that these products are inherently safe, however, the therapeutic basis of many ingredients is still not clear. Some traditional ingredients can be toxic when used for inappropriate indications, or prepared inappropriately, or used in excessive dosages, or for a prolonged duration(Levy, 2002, Haddad et al., 2005, Cupp, 1999, Phua et al., 2009). It is known that some Chinese medicines can have nephrotoxicity or hepatotoxicity effects and some cause increased risk of bleeding(Ulbricht et al., 2006, Liu, 2008, Hintelmann, 2003, Nortier and Vanherweghem, 2002). The use of herbal medicines that can produce side effects should be avoided by everyone, especially infants and young children. There is a need to increase the awareness of toxic effects of some herbal products in the public and health care professions.

There are several limitations that need to be considered when interpreting the results of the present study. First, our results may not be representative of all Chinese children in China or in Australia because of the location of the sample and the number of subjects. Secondly, the age distribution of the subjects from two countries in this study was slightly different and this may have a small influence on the results. Nevertheless we believe our present study to be important for understanding the present status of supplement use in Chinese pre-school children, and in monitoring future trends of supplement use.

7.5 Conclusion

It is important for preschool children to meet their energy and nutrient needs for growth and development. Consuming a healthy diet is important to achieve adequate nutrient intakes. Dietary supplements only need to be considered when individuals of populations are not able to obtain an adequate nutrient status from their diet alone. A large number of healthy Chinese children both in China and in Australia use dietary supplements, which for most may not be medically indicated. Such supplements contribute significantly to total dietary intakes of vitamins and minerals, and studies of nutrition should include their assessment evaluate.

Calcium and zinc are the two most popular dietary supplements in young children in China, while multi-vitamin and/or minerals and fish oil are the most frequently used in Australian Chinese. The low average amount of calcium in calcium supplements in Chinese children may not have any significant health benefit to them, and milk and other dairy products are believed to be more economic and effective than taking calcium supplements. For some other nutrients such as zinc, the potential over-nutrient of taking supplement should be concerned.

There are many reports in the literature that suggest that unnecessary or reckless use of dietary supplements can lead to problems. Parents should exercise caution when giving their infants or young children dietary supplements and be aware of the potential toxicity of inappropriate use or excessive dosages. Before providing dietary supplements, parents should seek advice from appropriate health professionals. For all infants and young children wherever possible it is preferable to achieve nutrient intakes from a varied diet rather than from supplements.

7.6 Acknowledgements

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Table 7.1 Characteristics of Chinese mothers and their children in Australia and China

Characteristic	Australia (n*=230)	China (n*=1464)	*p*
	n (%)	n (%)	
Age (years)			<0.001
≤30	68 (30.1)	604 (53.3)	
>30	158 (69.9)	530 (46.7)	
Marital status			0.116
Married	229 (99.6)	1151 (98.1)	
Divorced /single/widow	1 (0.4)	22 (1.9)	
Educational attainment			<0.001
High school diploma/ TAFE certificate/diploma or less	57 (24.8)	661 (57.1)	
University degree or higher	173 (75.2)	496 (42.9)	
Working status			<0.001
Working	105 (45.7)	968 (83.1)	
Not employed	125 (54.3)	197 (16.9)	
Household income			0.086
Low income	108 (49.5)	572 (55.9)	
High income	110 (50.5)	451 (44.1)	
Mother's birth place			
Mainland China	187 (81.3)		
Other Asian countries	43 (18.7)		
Duration in Australia (years)			
<5	126 (53.1)		
5-10	73 (32.3)		
>10	33 (14.6)		
Age of the child (years)			<0.001
0-1	62 (27.0)	15 (1.0)	
1-2	81 (35.2)	24 (1.7)	
2-3	38 (16.5)	268 (18.6)	
3-4	30 (13.0)	638 (44.2)	
4-5	19 (8.3)	497 (34.5)	
Gender of the child			0.737
Boy	122 (53.0)	782 (54.2)	
Girl	108 (47.0)	660 (45.8)	
Weight status of the child (aged 2-5 years old)			0.003
Underweight	20 (23.0)	147 (11.6)	
Normal	59 (67.8)	905 (71.4)	
Overweight/obesity	8 (9.2)	216 (17.0)	
Ever breastfed			
Yes	217 (94.3)	1210 (85.2)	
No	13 (5.7)	211 (14.8)	
Regular exercises			0.002
Yes	117 (60.0)	861 (70.9)	
No	78 (40.0)	353 (29.1)	

Illness during the past 4 weeks			<0.001
Yes	85 (37.3)	790 (55.4)	
No	143 (62.7)	636 (44.6)	

* The missing values vary for each variable in both countries.

Table 7.2 Odds ratios of factors for dietary supplement use in Chinese children in Australia and China

	China		Australia	
	OR	95% CI	OR	95% CI
Household income			NS	
Low	1			
High	1.53	1.13-2.08		
Education of the mother	NS			
<University			1	
≥University			2.51	1.19-5.27
Working status	NS			
Working			1	
Not employed			3.83	1.09-13.4
Child age (year)			3.11	1.42-6.83
Breastfed	NS			
Yes			1	
Never			6.75	1.29-35.31
Illness during the past 4 weeks				
Yes	1			
No	1.44	1.05-1.97		

NS: not significant

Chapter 8

Calcium supplementation in young children in Asia – prevalence, benefits and risks

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Abstract

Calcium is essential for maintaining bone health in infants and young children. The calcium intakes of weaning infants and children in Asia are relatively low in comparison to their Western counterparts. This is an increasing concern for Asian parents and is one reason the Asia Pacific region is becoming a large market for vitamins and dietary supplements. However, there is a lack of data on the long-term benefits to early calcium supplementation of healthy infants and young children.

The objective of this chapter is to discuss the appropriate calcium intakes for infants and young children, the risks and benefits of calcium supplementation and to review the proportion of children in Asia who are taking calcium supplements. To achieve our objective a literature review was undertaken of the English language databases PubMed and Web of Knowledge. Studies were selected that reported outcomes of calcium intake in infants and young children, as well as systematic reviews of such studies.

Studies were undertaken of children in China and a comparison group of Chinese children living in Australia to document the use of calcium supplements. The prevalence of dietary supplementation among children under five years old in China (30.0%) was higher than in Australia (21.6%). In supplement users in China, 60.3% of them took calcium supplementation while only a small number in Australia (8%) took calcium supplements. Age and feeding method of the child (ever breastfed or not) were associated with nutritional supplementation in Australia, while household income and mother's educational status were significantly related to the use of dietary supplements including calcium supplements in China. More than half of the children took supplemental calcium in the form of calcium gluconate (51.8%) and the average intake from supplements was 131 mg per day.

There is little evidence to support the general use of calcium supplements in infants who were exclusively breastfed or formula fed. Evidence from recent studies does not support the use of calcium supplementation in healthy children as a public health intervention. However, for weaning infants and children with low calcium intakes, increased intake of calcium-rich foods should be encouraged. If adequate calcium cannot be achieved through food sources, supplementation may be an effective alternative. More studies are required in infants and young

children with low calcium intakes, particularly those living in Asian countries or children of Asian ethnic origin.

8.1 Introduction

Adequate calcium intake is important for bone health throughout the lifespan(Lee and Jiang, 2008). It is required for the normal development and maintenance of the skeleton as well as for the proper functioning of neuromuscular and cardiac function(National Health and Medical Research Council and Ministry of Health, 2006). Providing adequate dietary intakes of calcium during infancy and early childhood may not only prevent diseases influence immediate health but may also delay or prevent osteoporosis in the elderly(Thacher and Abrams, 2010, Voloc et al., 2010, Baker et al., 1999, Abrams, 2011, Frontela et al., 2009).

Although calcium is essential for maintaining bone health in infants and young children, the calcium intakes of weaning infants and children in Asia are relatively low in comparison to their Western counterparts. This could be partly attributable to the high incidence of lactase deficiency in Asia children, non-milk based diets, poor dietary habits in some family, inadequate information and knowledge on calcium rich foods of parents(Lee and Jiang, 2008, Gong et al., 2008b, Yang et al., 2000). The prevalence of primary lactase deficiency is almost 100% in Asian adults and approximately 20% of Asian children younger than 5 years of age have evidence of lactase deficiency and lactose malabsorption(Sahi, 1994, Woteki et al., 1976, Novotny, 1999, Vesa, 2000). Dietary lactose enhances calcium absorption and, conversely, lactose-free diets generally have lower overall calcium content and also lower calcium absorption (Abrams et al., 2002). Thus, lactose intolerance (and lactose-free diets) theoretically may predispose to inadequate bone mineralization (Di Stefano et al., 2002, Stallings et al., 1994). It is reported that about 20% of 1-2 years old and 45% of 3-5 years old children fail to achieve the recommended intake of calcium in the USA(Greer and Krebs, 2006). Considering the high prevalence of lactose intolerance and low consumption of calcium-rich food in Asia, it is very difficult to achieve recommended intakes without calcium supplementation for Asian children. The pattern of complementary feeding in many Chinese infants and young children, especially in rural areas, does not conform to current WHO recommendations for complementary feeding, including in achieving calcium intakes(Chang et al., 2008).

Dietary supplements enriched with vitamins, minerals, and other substances have received increasing attention worldwide. The North America and the Asia Pacific regions are the dominant markets for vitamins and dietary supplements(Crossley, 2007). A cross-sectional study of infants aged 6-12 months (n=251) in Beijing found that calcium supplements and cod liver oil were prescribed by health care providers for prevention of rickets in 71.6% and 49% of infants, respectively(Li et al., 2003a). However, evidence for the association between calcium supplementation and bone changes are insufficient at present to make general recommendations for widespread use. There is also a lack of data proving long-term benefits to early calcium supplementation of healthy infants and young children(Abrams, 2011). A recent meta-analysis showed that although there is a small benefit of giving calcium supplements to children, it is unlikely to substantially reduce fracture risk in later life or even result in a clinically significant decrease in fracture risk in children(Winzenberg et al., 2006b). In this chapter, we consider normal and abnormal patterns of bone mineralization in infants and sources of calcium in infants and pre-school children aged from 0 to 60 months. We further consider long-term effects of potential interventions related to calcium. To achieve our objective a literature review was undertaken of the English language databases PubMed and Web of Knowledge. Studies were selected that reported outcomes of calcium intake in infants and young children, as well as systematic reviews of such studies. All abstracts were read and relevant full text publications were then retrieved to include in this review.

8.2 Review of calcium recommendations in infants and young children

Calcium requirements vary in different ethnic groups for dietary, genetic, body size, physical activity, lifestyle, and geographical reasons(World Health Organization and Food and Agricultural Organization of the United Nations, 2004, Lee et al., 1994b). Different bone mass and its accretion rate are evident among Asian, African, Caucasian and Hispanic adolescents(Gilsanz et al., 1991, Bhudhikanok et al., 1996, Bachrach et al., 1999). Ethnic differences in fractional calcium absorption were also found in studies. Comparing to Caucasian counterparts, Chinese children and adolescents have higher fractional calcium absorption(Lee et al., 1994a, Abrams and Stuff, 1994, Lee et al., 1995, Abrams et al., 1995).

A recent study compared calcium and bone accretion between Chinese adolescents and American Caucasian populations. Although habitual calcium intakes and vitamin D status were found to be lower in Chinese adolescents, bone mineralisation from age 10-15 years was similar between the two groups(Lee et al., 2010). It further suggested more efficient calcium utilization, calcium absorption, excretion, and retention among the Chinese and calcium absorption efficiency decreased with increasing calcium intakes for the Chinese girls, but not the Caucasian girls. This suggested that bone accretion could be matched between the different ethnic groups at higher calcium intakes(Lee et al., 2010).

However after considering the ethnic differences in calcium metabolism and bone accretion in skeletal development, different calcium allowance recommendations were developed for different populations. Definitions for the terms used including Dietary Reference Values (DRIs)/ Recommended Dietary Intakes (RDIs)/Nutrient Reference Values (NRVs) for calcium requirements are given below (Scientific Committee on Food, 1993a, Food and Agricultural Organization of the United Nations: World Health Organization, 2002, Institute of Medicine, 2011a):

Figure 8.1 Definitions given to DRIs/RDIs/NRVs

Estimated Average Requirement (EAR) – Reflects the estimated median requirement and is particularly appropriate for applications related to planning and assessing intakes for groups of persons.
Recommended Dietary Allowance (RDA) – Derived from the EAR and meets or exceeds the requirement for 97.5 percent of the population.
Adequate Intake (AI) – Used when an EAR/RDA cannot be developed; average intake level based on observed or experimental intakes.
Tolerable Upper Intake Level (UL) – As intake increases above the UL, the potential risk of adverse effects may increase. The UL is the highest average daily intake that is likely to pose no risk of adverse effects to almost all individuals in the general population.
Recommended Nutrient Intake (RNI) – It is the daily intake, which meets the nutrient requirements of almost all (97.5 percent) apparently healthy individuals in an age and sex-specific population group.
Population Reference Intakes (PRI) – the level of (nutrient) intake that is adequate for virtually all people in a population group.

Calcium as a nutrient is most commonly associated with the formation and metabolism of bone (Institute of Medicine, 2011a). At full-term birth, the human infant has accrued about 26 to 30g of calcium, most of which is in the skeleton (Institute of Medicine, 2011a). When calcium transfer from the placenta ceases at birth, the newborn infant is dependent on dietary calcium(Institute of Medicine, 2011a). Human milk is recognized as the optimal source of nourishment for infants and the optimum source of calcium(Gartner, 2005, Medicine, 1991).

The 2011 Institute of Medicine committee stated that there were no reports of any full-term, vitamin D–replete infants developing calcium deficiency when exclusively fed human milk(Institute of Medicine, 2011a). The breastfed full-term infant is assumed to have a sufficient calcium intake regardless of what that intake is exactly(Abrams, 2011). Therefore, AIs for calcium for infants up to 6 months old are based on average intake of breastmilk during the first half year of life and the studies that have determined average concentration of calcium in breastmilk(Atkinson et al., 1995, Institute of Medicine, 2011a). Reasonable estimations of calcium absorption, accretion and excretion is also taken into account(Institute of Medicine, 2011a).

In formula-fed infants, it is assumed that calcium is less bioavailable from infant formula compared to breastmilk(Abrams, 2011). Statutory guidance in the United States, and common practice throughout the world, is to provide 30% to 100% more calcium in infant formula than in breastmilk(Abrams, 2011). Therefore, the AIs for infants 7–12 months were set by not only considering the calcium intake from breastmilk or infant formula at this age but also an estimate of intake from supplementary foods(National Health and Medical Research Council and Ministry of Health, 2006).

The EARs for young children under 5 years old were set by estimating calcium requirements from data on daily rates of calcium accretion from a typical diet and then evaluating, on the basis of available balance data of the target population, the amount of calcium needed in the diet to achieve the requirements(Abrams, 2011). The RDAs were set by additional considering the variability of this intake to achieve the accretion in nearly all children(Abrams, 2011).

The UL for calcium is not a recommended intake. Rather, it is intended to specify the level above which the risk for harm begins to increase. It is defined as the highest average daily intake of a nutrient that is likely to pose no risk of adverse health effects for nearly all persons in the general population(Institute of Medicine, 2011a). As intake increases above the UL, the potential risk for adverse effects increases. Only a limited number of studies have reported the toxicity doses of calcium of children 1 to 5 years. Values for the UL were not set for infants or young children for all the populations. In the US the ULs were set on the basis of limited available safety data and suggested that calcium toxicity was extremely unlikely to occur in healthy infants unless high-dose supplementation would be provided(Institute of Medicine, 2011a).

8.2.1 Australia and New Zealand calcium recommendations

The Australia National Health and Medical Research Council (NHMRC) and the New Zealand Ministry of Health developed the Australian/New Zealand RDIs in 2006, which were based on an update of the 2001 USA values. The AI of calcium for Australian and New Zealand for 0–6 months was set based on the estimated average intake of breastmilk (780 ml/day) and the average concentration of calcium in breastmilk (264 mg/L). After considering the lower bioavailability of calcium in infant formula, 350 mg/day was recommended for formula-fed babies (Table 8.1).

In the 2006 Australian/New Zealand RDIs, a mean intake of breastmilk was considered to be 600 ml/day at 7–12 months with an average concentration of 210 mg/L(National Health and Medical Research Council and Ministry of Health, 2006). Based on this data an intake of 140 mg/day calcium from complementary foods is required during the second six months of life. This resulted in a calculated calcium intake of 266 mg/day, which was rounded up to 270 mg/day(National Health and Medical Research Council and Ministry of Health, 2006) (Table 8.1).

For children 1–8 years, the daily net absorbed calcium need was estimated to be 220 mg/day. By assuming absorption rates of one standard deviation (SD) above those of adults and considering an approximate body weight for this age group, a figure of 360 mg/day was given as the EARs for 1–3 year-olds and 520 mg/day to the older group to provide this level of absorbed calcium(National Health and Medical Research Council and Ministry of Health, 2006).

The RDI was set assuming a coefficient of variation (CV) of 15% for the EAR and after rounding, giving an RDI of 500 mg/day for 1–3 year-olds and 700 mg/day for 4–8 year-olds(National Health and Medical Research Council and Ministry of Health, 2006) (Table 8.1).

As there is little evidence of toxicity in children, the UL was set at 2,500 mg/day by considering the calcium dosage when adverse effects are found in adults with renal stones and considering the need to prevent interference with zinc and iron absorption(National Health and Medical Research Council and Ministry of Health, 2006) (Table 8.1).

Table 8.1 Current Dietary Reference Intake values for calcium for infants and young children (mg/day)

			0–6 months	6–12 months	1-2 years	3 years	4-5 years
Australia and New Zealand 2006	AI		Breastmilk 210 Formula 350	270	360	360	520
	UL				2500	2500	2500
WHO 2002	RNI		Breastmilk 300 Formula 400	400	500	500	600
United States and Canada 2011	AI		200	260			
	EAR				500	500	800
	RDA				700	700	1000
	UL		1000	1500	2500	2500	2500
European Union 1993	PRI			400	400	400	450
Japan 2010	AI		200	250			
	EAR	Males			350	500	500
		Females			350	450	450
	RDA	Males			400	600	600
		Females			400	550	550
China 2010	AI		300	400	600	600	800
	UL				2000	2000	2000

AI, adequate intake; UL, tolerable upper intake level; RNI, recommended nutrient intake; EAR, estimated average requirement; RDA, recommended dietary allowance; and PRI, Population Reference Intake

8.2.2 The World Health Organization calcium recommendations

The Food and Agriculture Organization (FAO) of the United Nations and the WHO expert consultation had produced a publication on defining standards for micronutrient requirements in 1998(Food and Agricultural Organization of the United Nations: World Health Organization, 2002). The recommendations for calcium allowances were based on Western European, American and Canadian data(Food and Agricultural Organization of the United Nations: World Health Organization, 2002). For infants, the concentration of calcium in breastmilk formed the basis of recommendations of calcium intakes in infants(World Health Organization and Food and Agricultural Organization of the United Nations, 2004).

The FAO/WHO determined the daily calcium increment in the skeleton is about 100 mg in the first two years of life using data from American Academy of Pediatrics Committee on Nutrition(Nutrition, 1978, World Health Organization and Food and Agricultural Organization of the United Nations, 2004). Together with information on the urinary calcium of infants and insensible losses of 20 mg/day, infants calcium absorption need was calculated as 120 mg daily to allow for normal growth(World Health Organization and Food and Agricultural Organization of the United Nations, 2004). For breastfed babies, a mean intake of 240 mg was assumed to meet the need of 120 mg net absorption. Based on the average daily breastmilk production of 750 ml, the calcium recommended intake of 300 mg for breastfed babies can be achieved. With cow milk, calcium intake needs to be set at about 300 mg to meet the requirement of 120 mg net calcium absorption and 400 mg of calcium intake was the recommended (Table 8.1).

From age 2 to 9, as whole-body calcium increases with skeletal growth, the daily rate of calcium accumulation rises to 120 mg and urinary calcium increases to 60 mg. A dermal loss of 40 mg is added to these figures leading to an average daily net absorbed calcium requirement of 220 mg during this period(World Health Organization and Food and Agricultural Organization of the United Nations, 2004). Assuming that the net absorption of calcium by children is one SD above that of adults, the average daily requirement during this period is about 440 mg and the average recommended intake is 600 mg(World Health Organization and Food and Agricultural Organization of the United Nations, 2004) (Table 8.1).

8.2.3 The United States and Canada calcium recommendations

The National Academy of Sciences, Institute of Medicine (IOM) released their new DRIs for calcium and vitamin D intake for the United States and Canada in 2011 (Institute of Medicine, 2011a). Using estimates of a mean calcium concentration in breastmilk (259 mg/ml) and the amount of milk consumed per day (780 ml), the AI for calcium for infants 0 to 6 months of age is 200 mg/day (Table 8.1). It is a value reflective of the calcium provided to exclusively breastfed infants and to be considered as sufficient amounts of calcium to meet most infant's growth needs by 2011 IOM committee(Institute of Medicine, 2011a).

From 6 to 12 months of age, the intake of calcium from solid foods becomes more significant. The IOM 2011 committee determined that the mean calcium intake from solid foods was about 140 mg/day for formula fed infants based on the limited data and assumed that breastfed babies had similar intakes of solid food to those of formula fed infants of the same age. Based on the mean breastmilk intake during the second 6 months of life (600 ml/day) and a calcium concentration (200 mg/L) in breastmilk during this age span, the calcium intake from breastmilk would be approximately 120 mg/day. Adding those figures together gives a total intake of 260 mg/day(Institute of Medicine, 2011a) (Table 8.1).

From the results of studies that used children as subjects, the 2011 IOM committee used the average bone calcium accretion to set an EAR rather than an AI for young children older than one year(Institute of Medicine, 2011a). An estimated EAR is established as 500 mg of calcium per day, rounded from 474 mg/day by the 2011 DRI panel for children 1 through 3 years of age. An additional 30% calcium retention would meet the needs of 97.5% of age group 4 to 8 years. This results in an estimated RDA for calcium of 700 mg/day calcium, with rounding(Institute of Medicine, 2011a) (Table 8.1).

Studies of Abrams et al. and Ames et al., indicate a calcium intake of 800 mg/day could be expected to achieve the levels of calcium needed for bone accretion for Children 4 through 8 years of age(Abrams et al., 1999, Ames et al., 1999). Again, the assumption that another approximately 30% is needed to cover about 97.5% of the population results in a calculated and rounded RDA value for calcium of 1,000 mg/day(Institute of Medicine, 2011a) (Table 8.1).

Within the confines of the limitations of the data, a 'no observed adverse effect' level of 1750 mg/day was established for infants(Institute of Medicine, 2011a). To reduce the uncertainty factor, the UL for the life stage group of 0 to 6 months was adjusted for weight difference and rounded to 1,000 mg/day(Institute of Medicine, 2011a). Given the limitation of data, a slight uncertainty correction is warranted, and the UL is set at 1,500 mg/day for infants 7 to 12 months of age(Institute of Medicine, 2011a) (Table 8.1).

A UL of 2,500 mg of calcium per day was continually used for children between the age of 1 and 8 years as it was established in 1997(Institute of Medicine, 1997) (Table 8.1). New data on adverse outcomes due to over-dose of calcium intake among children have not emerged since then. Given the expected body weight and metabolic capacities increases for old ages, the level of 2500 mg/day is a reasonable compared with the new UL set for infants(Institute of Medicine, 2011a).

8.2.4 European Union calcium recommendations

The population reference intakes defined by the Scientific Committee on Food (SCF) in 1993 are based on a factorial approach without considering measurements of bone mineral accretion under different calcium intakes(Scientific Committee on Food, 1993a). The 1993 SCF estimated the mean calcium retention needed per day for skeletal growth was 150 mg/day. The PRI is 400 mg/day for infants in the second half of the first year and for children up to age 3 years, 450 mg/day for children between 4 and 6 years (Scientific Committee on Food, 1993a). Those figures were based on the assumption that the net absorption of dietary calcium is 35% and 30% were added to the calculated amount to allow for individual variation(Scientific Committee on Food, 1993a). Because of the absence of reliable data, the PRI for 6-11 months old infants was taken as the same as for 1-3 years olds(Scientific Committee on Food, 1993a).

Possible adverse health effects of individual micronutrients at intakes in excess of dietary requirements have been evaluated in European population groups. It was reported that European infants and young had a high intake of calcium(Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006). Although there are no data to set a numerical UL for children and adolescents and no appreciable risk has been identified even with the extreme levels of calcium intake in this age group(Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006).

8.2.5 China calcium recommendations

At present insufficient evidence is available to establish EARs for calcium intake from which RDAs would be determined. Therefore, the AIs were established, based on maximal calcium retention for different age groups. The AI for calcium is 300 mg/day for infants before 6 months and 400 mg/day for infants 6 to 11 months. A calcium intake of 600 mg/day is recommended to children aged 1 to 3 years. An AI of 800 mg/day was given for 4-10 year-olds(Chinese Nutrition Society, 2010) (Table 1). The UL for calcium was set at 2000mg/day for Children aged 1-6 years old by Chinese Nutrition Society(Chinese Nutrition Society, 2010) (Table 1).

8.2.6 Japan calcium recommendations

The AI for calcium is 200 mg/day for infants of 0-5 months and 250 for infants of 6-11 months. The EAR and RDA for calcium for 1-2 years old children is 350 mg/day and 400 mg/day respectively. The EAR and RDA of calcium for boys in 3-5 years are 50 mg higher than that for girls in the same age group(National Institute of Health and Nutrition, 2010) (Table 1).

8.3 Calcium intakes of children in Asia

Calcium intakes vary between countries, generally following the different dietary habits and depending largely on dairy product consumption(World Health Organization and Food and Agricultural Organization of the United Nations, 2004). The FAO/WHO reported the daily protein and calcium intakes in different regions of the world during 1987 and 1989, the lowest calcium intakes occur in Asia, and the highest in North America and Europe(World Health Organization and Food and Agricultural Organization of the United Nations, 2004). Some study results further indicate variation in calcium intake among child and adolescent ethnic groups. Asians as the ethnic group were found with relatively low calcium intakes in comparison to the Western counterparts(Wang et al., 1997, Novotny et al., 2003, Ta et al., 2003, Gibson et al., 2007).

Milk or milk products are a good source of many nutrients and the most known food source for calcium. They can provide calcium in a readily absorbable and convenient form. Human milk is the best source of calcium for infants, averagely providing the infant with 202 mg of calcium per day in the first half year and 120 mg per day in the second half(Institute of Medicine, 2011a).

The calcium concentration in milk is 120 mg per 100 g and up to 1100 mg/100 g milk products, from which about 32% is absorbable(Weaver, 2001). The average calcium contribution from milk differed among ethnic groups. Lactose restriction reduces milk consumption in Asians who have the highest prevalence of lactase deficiency in the world, close to 100%(Vesa, 2000, Novotny, 1999). The incidence of lactase malabsorption in Shanghai children aged 0～6 years was reported to be 47.4% and lactase intolerance was 16.5%, which were increasing with the age of children(GONG et al., 2008a).

Only a small number of studies have examined sources of calcium from foods and beverages as consumed by Asian populations especially in the child age group. A study in the US on ethnic diversity and calcium intakes found that vegetables and legumes were a major source of non-dairy calcium for Asian Americans, who generally had lower dairy consumption when compared to other population groups. The Asian Americans were reported to consume only 10% to 11% calcium from dairy products(Wang et al., 1997).

Similar results were found in China, where the main sources of calcium were vegetables (35.2%), bean and bean products (13.9%), wheat (11.2%) and rice (9.1%) and less than 5% of calcium came from dairy foods(He et al., 2007). Those figures were extracted from 2002 China National Nutrition and Health Survey where it was reported that the deficiency of calcium was a common problem in Chinese residents(He et al., 2007).

In children aged 2 and 3 years, only 3.7% males and 5.1% females met the AI for calcium intake (600 mg/day), which were the highest in all age groups of each gender. In 4-6 years age group, the percentage of meeting the AI (800 mg/day) dropped to 1.8% for males and 1.1% for females(He et al., 2007).

8.4 Prevalence of use of calcium supplements in Australia and China

Although calcium intake can be increased by dietary means, long-term adherence to high-calcium diets is difficult to achieve for Asians, as they were often reported to have a low dairy consumption(Du et al., 2002, Wang et al., 1997, He et al., 2007, Chang et al., 2008).

Calcium supplements may be a useful way of helping Asians to obtain sufficient calcium and enhance health and wellness(Sanders, 2009).

Most studies on calcium supplements have focused on adults or older persons and little is known regarding the intake of calcium supplements by infants and young children. A recent study from Taiwan reported that 34.9% of the infants had been given a dietary supplement and 15.5% took calcium supplement between birth and 6 months of age(Chuang et al., 2012). A survey of infant feeding practices (n=251) in Beijing, China found that 71.6% infants aged 6-12 months were taking calcium supplementation(Li et al., 2003a). In Hubei, PR. China, a survey reported a prevalence of 90.2% (1523/1688) of calcium supplementation in pre-school children in four kindergartens and more than half of them were taking calcium supplements without medical prescriptions(Zhang and Song, 2010).

Australians have a high prevalence of taking dietary supplements. A representative population survey conducted in 2004 in South Australia reported the use of vitamin supplements by 39.2% respondents and mineral supplementations by13.6% of the population(MacLennan, 2006). No recent data is available on the use of calcium supplements by infants or young children in Australia.

Until recently, few studies have investigated the intake of calcium dietary supplement by infants and young children under five years old. And there have been no studies of calcium supplementation among Chinese children under five years in mainland China or overseas published in English. To document the prevalence of use of calcium supplements in these populations, a survey was carried out of Chinese mothers living in Perth, Australia and Chengdu and Wuhan, PR China.

8.5 The China Australia supplements study (CASS study)

A survey was undertaken of 231 Chinese mothers living in Perth Australia, 360 mothers living in Wuhan and 1335 in Chengdu, PR China. The participants in Perth were mothers with children under 5 years old who were recruited from the Perth Chinese community, including Chinese schools and community organizations. A total of 238 mothers agreed to participate with a response rate of 96.0% and 231 mothers completed the dietary supplementation questionnaire, a final response rate of 93.1%. Participants in China were recruited from kindergartens in Wuhan and Chengdu. A total of 2800 questionnaires were distributed by kindergarten teachers and 1702 and 556 were returned by the mothers in Chengdu and Wuhan respectively. The dietary supplementation questionnaire was completed by 1335 mothers in Chengdu and 360 mothers in Wuhan, a total response rate of 60.5% in China. The study was approved by the Curtin University Human Research Ethics Committee.

Demographic and breastfeeding information was collected using a validated and reliable questionnaire previously used in Chinese population studies(Li et al., 2003b). Mothers were classified into three groups to compare their economic status based on the local annual household income(Australian Bureau of Statistics, 2011e, Sichuan Bureau of Statistics, 2012a).

Data were analysed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0. Independent samples t-test was used to compare means between groups. Chi-square (χ^2) test was used to test associations between basic characteristics and factors potentially related to the use of supplements among young children. P values <0.05 were considered statistically significant.

8.5.1 Results of the CASS study

A total of 231 Chinese mothers living in Perth Australia and 1355 mothers living in Chengdu, Sichuan Province and 360 mothers living in Wuhan, Hubei Province, PR China completed the supplement questionnaire. The distribution analysis shows no difference in age, education attainment, marital status, working status, family income status, breastfeeding initiation and duration, between mothers who completed the supplement questionnaire and mothers who did not. There was also no difference in education attainment, marital status, family income status, breastfeeding initiation and duration, between mothers in Chengdu and Wuhan. The only two statistically significant differences between mothers in Wuhan and Chengdu were the average age (31.2 years in Chengdu and 30.8 years in Wuhan, $p<0.001$) and working status (68.7%Wuhan mothers have full-time work compared to 60.1% in Chengdu, $\chi^2=8.1$, df=2, $p<0.05$). Because the differences are so small in Wuhan and Chengdu mothers, their data have been combined into one group.

A total of 21.6% of the Chinese children living in Perth were taking dietary supplements, including multivitamins/minerals, fish oil, probiotics, calcium and vitamin D (Table 8.2).

In Chengdu and Wuhan, China, 30.0% of young children were having dietary supplements and 60.3% of those supplement users were taking calcium supplements. Compared to Chinese Australians, Chinese parents living in China were more likely to give their children dietary supplements (χ^2=6.9, df=1, p<0.001) and especially calcium supplements (χ^2=40.3, df=1, p<0.001). About half of the Chinese children taking calcium supplements were also taking Vitamin D (including the use of multi-vitamins) (Table 8.2).

In Australia, only four children were given specific calcium supplements. One was taking calcium carbonate tablets, the other calcium lactate, and two were unknown. The most common forms of supplemental calcium used in Chinese children up to five years old are gluconate (51.8%) and carbonate (37.5%) (Table 8.3).

Table 8.2 Prevalence of supplements use by type in Chinese children under 5 years living in Australia and China

	Australia			China		
Supplement type	n	% (n=231)	% Supplement users	n	% (n=1695)	% Supplement users
Any supplement	50	21.6	100	509	30.0	100
Calcium	4	1.7	8	307	18.1	60.3
Calcium + Vitamin D	2	0.9	4	160	9.7	31.4

Table 8.3 Calcium supplement form and dosage used by Chinese children under five years in China

Supplements form	Number	% Calcium supplement users	Average intake (mg/day)	Intake range (mg/day)
Carbonate	115	37.5	307.4 (n=106)	85-725
Gluconate	159	51.8	81 (n=154)	54-360
Lactate	11	3.6	-	-
Others	9	2.9	116.7 (n=3)	100-150
Unknown	13	4.2	-	-
Total	307	100	131.4 (n=264)	54-725

The dosage range of calcium supplements for Chinese children is 54 to 725 mg/day. The average intake for carbonate users (307.4 mg/day) is higher than gluconate calcium users (81 mg/day) (Table 8.3).

In Australia, older children (χ^2=12.24, df=4, p<0.05) and children who were never be breastfed (χ^2=4.88, df=1, p<0.05) were more likely to take dietary supplements (Table 8.4). In China, no specific child characteristics where associated with taking supplements. However higher household income and higher education of the mother were significantly related to the use of all types of child supplements as well as calcium supplements (Table 8.4).

Table 8.4 Calcium supplement use by maternal and child characteristic variables

	Australia		China			
	Any supplement		Any supplement		Calcium	
	n (%)	*p*	n (%)	*p*	n (%)	*p*
Age (year)		0.221		0.675		0.776
≥31	39 (24.5)		194 (30.6)		121 (19.1)	
<31	11 (16.2)		212 (31.8)		122 (18.3)	
Education		0.268		0.035		0.351
≥University	41 (23.6)		190 (33.7)		109 (19.4)	
≤High school	9 (15.8)		216 (28.3)		122 (17.4)	
Household income		0.477		0.000		0.001
High	15 (26.3)		93 (35.5)		60 (22.9)	
Middle	27 (21.8)		242 (34.6)		139 (19.9)	
Low	6 (15.8)		37 (17.3)		22 (10.3)	
Gender of the child		0.635		0.549		0.374
Male	28 (23.0)		285 (31.9)		173 (19.4)	
Female	22 (20.2)		221 (29.3)		133 (17.6)	
Child's age (year)		0.016		0.724		0.687
<1 year	0		8 (29.6)		5 (18.5)	
1-2	13 (14.8)		8 (34.8)		6 (26.1)	
2-3	11 (21.6)		72 (34.4)		46 (22.0)	
3-4	10 (26.3)		201 (32.5)		119 (19.2)	
4-5	11 (39.3)		160 (29.7)		97 (18.0)	
Infant feeding		0.038		0.192		0.083
Ever breastfed	44 (20.2)		436 (30.8)		267 (18.9)	
Never breastfed	6 (46.2)		62 (26.4)		33 (14.0)	

8.5.2 Discussion of the CASS study

The CASS study assessed the intake of calcium supplements used by Chinese young children in China and in Australia. It appears to be the first study reporting on the use of calcium supplements in Chinese young children up to five years old.

In this study, one fifth of Chinese children in Perth were taking at least one nutritional supplement. Older children and formula fed children were more likely to be given nutritional supplements, but relatively few were on specific calcium supplements. This may be due to higher rates of dairy consumption in Australia than in China and less emphasis on calcium supplements in the lay press. Data from the Australian nationally representative 1995 National Nutrition Survey shows that the mean calcium intakes were 833 mg/day in children aged 2-3 years and 769 mg/day in children aged 4-7 years, which is higher than the Australian and New Zealand AI for calcium for those age group and suggest no need for calcium supplementation(Webb et al., 2006).

In China 30.0% of young children were taking nutritional supplements and 60.3% of these supplements users were on calcium supplementation. It was found that nutritional supplementation including calcium supplementation was more likely to occur among those children from a higher income family and with higher educated mother. However, the average intake of calcium from supplementation was only 131.4 mg per day, which is about 20% of the AI for calcium for Chinese children in this age group. It is less than half of calcium consumption that can be provided from one serve (250 ml) of milk, besides milk can provide other nutrients like protein to support child growth(Weaver, 2001).

Studies in children regarding calcium supplementation and bone changes indicate that BMD changes are influenced by baseline calcium intake, stage of development, and the sites evaluated for BMD(Sanders et al., 2009). When baseline habitual calcium consumption is low, larger increments in BMD occur with increased dietary calcium intake(Lau et al., 2004).

The average calcium intake from supplements in Chinese young children (131.4 mg) is lower that all randomized controlled trials studies (nineteen studies) included in a meta-analysis assessing effects of calcium supplementation on BMD in healthy children. Calcium supplementation was with a calcium dose of 300-1200 mg per day in those nineteen studies(Winzenberg et al., 2006a). Thus, it is not likely that the low calcium intake from supplements would result a significant change in BMD in children.

8.6 Calcium supplement forms and absorption

The most common forms of supplemental calcium used in Chinese children are calcium gluconate and calcium carbonate. More than half of the supplements users choose the oral solution of calcium gluconate. Elemental calcium is less concentrated in this form, containing only 9% elemental calcium(Straub, 2007). Because calcium gluconate contains a lower proportion of elemental calcium, it is not considered practical for clinical practice. One popular brand of calcium gluconate contained 54 mg of elemental calcium in a 10 ml bottle. Chinese children taking calcium gluconate only take an average of 81 mg calcium a day, which is less than calcium contained in 100 ml milk(Weaver, 2001).

Calcium carbonate is the most common and least expensive form of calcium(Straub, 2007). Generally calcium carbonate provides more elemental calcium with the same number of pills(Heaney et al., 2001). It contains 40% calcium and well-absorbed and tolerated in most individuals when taken with a meal(Heaney, 1999). The bioavailability of calcium carbonate depends on the dosage and whether they are taken with a meal(National Institute of Health and Nutrition, 2010). It was found to be equivalent to skim milk and orange juice fortified with calcium-citrate malate(Martini and Wood, 2002). Calcium can compete or interfere with the absorption of iron, zinc, and magnesium. Therefore, for persons with known deficiencies of these other minerals who require calcium supplementation, taking calcium supplements between meals is advisable(Straub, 2007).

8.7 Benefits of calcium supplantation

8.7.1 Increased bone density and bone strength

Low bone mineral density is an important risk factor for osteoporotic fractures(Marshall et al., 1996). Calcium deficiency leads to a reduction in bone mass by increasing bone resorption to preserve the level of ionised calcium in the extracellular fluid(Sanders et al., 2009).

Dietary calcium deficiency may also be a major cause of rickets in children in developing countries(Sanders et al., 2009). Although nutritional rickets has long been considered a disease caused by vitamin D deficiency, calcium deficiency has also been reported as an important cause of rickets by recent studies in Nigeria, Bangladesh, India and the US(Fischer et al., 1999, Balasubramanian et al., 2003, DeLucia et al., 2003, Thacher and Abrams, 2010). Study did in Europe also found that low 25-(OH) D level combined with low calcium intakes and possibly digestive disorders, were associated with an increased risk of genu valgum in children(Voloc et al., 2010).

Optimal calcium intake is especially important during childhood, when most mineral accretion occurs(Davies et al., 2005). Evidence has shown that increased calcium intakes, with and without vitamin D, increases BMC/BMD in children(Huncharek et al., 2008, Chan et al., 1995, Lanou et al., 2005). Studies did in Asia children also suggest that higher long-term habitual calcium intake and physical activity may lead to higher BMC in children(Liao et al., 2005, Lee et al., 1993). A review on calcium supplementations in children reported that almost all studies (seventeen out of nineteen) resulted a statistically significant improvement of supplementation on BMD in children(Nkansah et al., 2009). Subjects in eight of the seventeen studies had a baseline daily calcium intake of 800–1300 mg. Those studies (eight of the seventeen) concluded that calcium supplementation was efficient even if baseline calcium intake was adequate(Nkansah et al., 2009).

However, evidence for an association between calcium supplementation and bone changes in children is conflicting(Lanou et al., 2005, Winzenberg et al., 2006a). A systematic review evaluated the effect of calcium supplementation on BMD and concluded that such supplementation has little effect on BMD in children(Winzenberg et al., 2006a). The only site with a significant increase in BMD was the upper limb. This effect translated into a 1.7% greater increase in BMD in the supplemented groups compared with non-supplemented groups. The review does not support the use of calcium supplementation in healthy children as a public health intervention(Winzenberg et al., 2006a).

Considering few Asian children can meet the recommended calcium intakes for their ages and low BMD is a risk factor for fracture in childhood, increasing their calcium intake and optimising age appropriate bone mass may have a immediate beneficial effect(Goulding et al., 1998, Goulding et al., 2001).

8.7.2 Lower body fat

Calcium intake has been associated with a reduction of body weight or weight gain in several studies(Carruth and Skinner, 2001, Novotny, 2004, Albala et al., 2008, Hanks, 2010). Although the effect of calcium intake on body composition remains unclear, it may due to the reduced consumption of sugar-sweetened drinks and increased resting energy expenditure(Albala et al., 2008, Hanks, 2010). A study of a multiethnic sample of children on calcium intakes and body fat suggested that calcium intake may play a role in fat accumulation and energy balance through its effects on resting energy expenditure(Hanks, 2010).

However clinical, longitudinal, retrospective and cross-sectional studies in children show inconsistent findings regarding calcium intake and bone changes. Some studies reported no association between calcium and/or dairy intake in children and weight and/or body composition(Tanasescu et al., 2000, Moreira et al., 2005, Venti et al., 2005). A systematic review of placebo-controlled randomized controlled trials of calcium supplementation found no statistically significant effects of calcium supplementation on weight, body fat or lean mass(Winzenberg et al., 2007).

Although the results do not exclude an effect of calcium supplementation with dairy products on weight gain or body composition, at the present time there is insufficient evidence to recommend taking dairy products or calcium supplements as a means of population weight control(Winzenberg et al., 2007).

8.7.3 Decreased osteoporosis in later in life

Bone loss in later life is related to the quality of peak bone mass established over the first two decades of life(Hernandez et al., 2003). Considerable studies have been carried out over the past several decades to discuss whether osteoporosis originates in childhood and if providing high dietary intakes of calcium may delay or prevent this disease in the elderly(Abrams, 2011).

Calcium is the primary bone-forming mineral that must be supplied to the diet and is the most important during childhood when approximately 200 mg/day is accreted into the skeleton(Bonjour et al., 1997). Postmenopausal BMD is a function of peak bone mass formed during the first two decades of life and the rate of subsequent bone loss index during the aging process, which are equally important risk factors for fracture in later life(Hansen et al., 1991, Riis et al., 1996). One of the recommended primary preventions of osteoporosis is the adequate calcium intake during infancy and childhood to optimize the gain in bone mass(Baker et al., 1999). Thus, efforts to maximise peak bone mass through calcium supplementation during childhood have been encouraged.

However, there has been no intervention study long enough to test the effect of nutritional factors to maximize peak bone mass(Lee and Jiang, 2008). It remains unclear that whether increases of BMD benefited from calcium supplements would persist into later life after supplementation stopped.

8.8 Risks of excess consumption of calcium

There was no report of excess intake of calcium from food sources, however, as the use of calcium supplements increasing, excess consumption of calcium may occur(Riedt et al., 2005). Calcium plays a major role in the metabolism of virtually every cell in the body and interacts with a large number of other nutrients, like iron, zinc, magnesium and phosphorus, and as a result, disturbances of calcium metabolism may give rise to a variety of adverse effects(Medicine, 1997, Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006).

There is no data on children taking calcium from dietary sources or from the usual level of supplements that provides reliable information on adverse effects. Data from European populations indicate that the intakes of calcium from all sources in infants can be close to the UL in a small percentage of the population(Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006). In British infants the 97.5th percentile of calcium intake was 1400 mg/day. In German non-breastfed infants the 90th percentile of calcium intake was 700 to 900 mg/day(Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006). And it was reported by European Commission of SCF and the Scientific Panel on Dietetic Products, Nutrition and Allergies that no adverse effects of calcium citrate-malate supplements or extra dairy foods (500 to 1000 mg extra calcium over 1 to 3 years) were reported in 217 children between 6 and 14 years, in comparison to un-supplemented controls(Scientific Committee on Food and Nutrition and Allergies of Scientific Panel on Dietetic Products, 2006).

Hypercalciuria, as a secondary outcome to high calcium intake, can occur in children. However, the incidence of kidney stones in children is rare. There is limited evidence concerning high calcium intakes in young children relative to calcium excretion. In a study undertaken in 4 to 9 months infants, three infants (6%) who received a calcium-enriched formula (1700 to 1560 mg calcium per day), developed hypercalciuria(Dalton et al., 1997). Another study tested the effects of 1,800 mg/day total calcium (supplementation adjusted on the basis of dietary calcium questionnaire) in children ages 1 to 6 years reported no diffrence in urinary calcium/creatinine ratios between children who took 1,800 mg/day calcium and those of placebo controls(Markowitz et al., 2004).

A study by Sargent et al. (1999) provides information relevant to infants and calcium excretion. Formula with added calcium glycerophosphate (1800 mg of calcium and 1390 mg of phosphate /L) for 9 months were given to infants aged 3.5-6 months old(Sargent et al., 1999). Together with calcium from solid foods, those infants had a mean calcium intake of 1,563 ± 703 mg/day at 9 months. Although the focus of the study was lead absorption, the data demonstrated that total calcium intakes of about 1,550 to 1,750 mg/day did not affect urinary calcium excretion. However, these data were insufficient to rule out or conclude that a definate risk exists for calcium supplements use in infants or young children.

8.9 Food sources of calcium

Compared to calcium from dietary supplements, calcium from food sources may be preferable for the evidence of better health outcomes. Two recent meta-analysis from same group on the effect of calcium supplementation on myocardial infarction and cardiovascular events suggested that calcium supplements in adults in higher doses with or without vitamin D have been associated with a modest increased risk of cardiovascular events(Bolland et al., 2010, Bolland, 2011). However, the effect of an equivalent dose of calcium from dairy products has a lower risk than calcium supplements and result in lower peaks of serum calcium levels(Green et al., 2003). Additionally， calcium intake from dairy is often reported as a possible factor that may reduce body weight or weight gain(Carruth and Skinner, 2001, Novotny, 2004, Albala et al., 2008, Hanks, 2010). A meta-analysis on twenty-one randomized controlled trials (RCTs) found out increased dietary calcium/dairy products, with and without vitamin D, significantly increases total body and lumbar spine BMC in children with low base-line intakes(Huncharek et al., 2008). However, another systematic review reported no evidence to support the use of calcium supplementation as a public health intervention to reduce weight gain or body fat in healthy children(Winzenberg et al., 2007).

Calcium is present in many foods, but is most concentrated in dairy products. Although lactose intolerance can be a barrier to milk consumption among Asians, studies have shown that subjects with lactose intolerance can consume milk and dairy foods without developing symptoms, if amounts are divided into smaller doses throughout the day(Novotny, 1999, Lomer et al., 2008). It was reported that dairy-rich diets up to 1500 mg/day of calcium can be consumed by lactose maldigesters without significant symptoms(Suarez, 1998). A recent study comparing calcium intake and bone mass between children with (n=47) and without (n=29) lactose malabsorption reported no statistically significant difference between the groups with respect to the intake of total calcium, milk calcium, milk, cheese, yogurt, ice cream, and calcium density of the diet(Medeiros et al., 2012). The American Academy of Pediatrics Committee on Nutrition has stated that milk and dairy-product avoidance has a negative effect on calcium and vitamin D intake in infants, children, and adolescents. Other nutrients such as protein make dairy products an important source of nutrition for growing children(Heyman, 2006). Therefore, it is important to encourage all Asian children, have lactose intolerance or not, to take dairy products as a primary determinant of calcium intake.

For those who avoid cow milk protein or lactose or low-lactose milks, other available calcium sources should be considered(Abrams, 2011). Some common Asian foods have been identified as containing an appreciable amount of calcium. Non-dairy foods such as tofu, tempeh, sea weeds, nuts and seeds dishes and green leafy vegetables etc. have been tested for calcium bioavailability in human studies. Low-oxalate greens (eg, bok choy, broccoli, Chinese cabbage, collards, and kale) and fruit juices fortified with calcium citrate or malate are good sources of highly bioavailable calcium, while calcium-set tofu have good bioavailability of calcium, and foods rich in oxalic acid (eg spinach, rhubarb, beans) or phytic acid (seeds, nuts, grains, certain raw beans and soy isolates) have a lower bioavailability(Weaver et al., 1999). Compared to milk, calcium absorption from dried beans is about 50% and from spinach, 10%(National Health and Medical Research Council and Ministry of Health, 2006). The calcium absorption is equivalent for soymilk and cow's milk at similar calcium loads, if the soymilk is fortified with calcium carbonate, not tricalcium phosphate which have lower calcium bioavailability(Zhao et al., 2005).

8.10 Conclusion

Breastmilk provides adequate calcium to meet the needs of all full-term infants. There is no need to recommend giving calcium supplements to infants who are exclusively breastfed or formula fed. Achieving adequate calcium is important in maximizing bone accretion during growth, preventing child rickets, and perhaps preventing fragility fractures in childhood or even preventing future osteoporosis. For all weaning infants and young children, calcium intake from calcium-rich foods especially from dietary sources should be encouraged at home, schools, and by parents, paediatricians, dietitians and by other health professionals. Current evidence from recent studies does not support the general use of calcium supplementation in healthy young children as a public health intervention. However, given that infancy and childhood are critical periods for the acquisition of bone mass, if adequate calcium cannot be achieved through food sources, supplementation is a useful alternative.

More studies related to the clinical effectiveness and/or safety of dietary supplements in infants and children are required, especially over the longer term. Because little data are available in this area, we suggest that parents exercise caution when giving their infants or young children dietary supplements. Before providing dietary supplements for them, parents should communicate with health professionals, such as pediatric doctors or dietitians. Wherever possible it is preferable to achieve nutrient intakes, including calcium from a varied diet rather than from supplements.

Chapter 9

Chinese mothers' perceptions of their child's weight and obesity status

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Abstract

Aim: This study recorded maternal perceptions of preschool children's weight in Chinese mothers living in Australia and China.

Methods: A survey was undertaken of Australia of 1951 mothers living in Chengdu and Wuhan, PR China and 89 Chinese mothers living in Perth. All participants were mothers with children aged 2-4 years. The children's weight and height were measured and their weight status were classified using the International Obesity Task Force 2012 revised international child BMI cut-offs.

Results: More children were overweight or obese in China (16.7% in China compared to 8% in Australia) while more Chinese children living in Australia were underweight (22.7% in Australia compared to 11.9% in China, p=0.007). The overall percentages of correct maternal perception of the child's weight were 35% in underweight children, 69.2% in normal weight children but only 10.8% in overweight/obese children. Among the overweight/obese children, only 14% in Australia and 10.8% in China were classified as overweight/obese by their mothers. Within the group of underweight children, normal weight mothers (p=0.004) and mothers with older age children (p=0.015) were more likely to correctly classify children's weight status. A higher percentage of overweight/obese mothers (p=0.002) and mothers who over-estimated her own weight status (p<0.001) have correct perception of the weight status of their overweight/obese children, compared to their counterparts.

Conclusion: There was a high prevalence of incorrect maternal perception of preschool children's weight status in Chinese mothers, especially those with overweight/obese children.

To address the obesity epidemic in children, future health promotion programs should put improved efforts to educate parents about obesity and its health consequences in order to reduce misperceptions.

Keywords: Children, overweight, obesity, parental perceptions, China, Australia.

9.1 Introduction

Overweight and obesity in children is a growing problem worldwide and it has been identified as one of the most serious public health challenges of the 21st century(De Onis et al., 2010). Childhood overweight and obesity is associated with a range of immediate and long-term health comorbidities, including an increased risk of cardiovascular disease and diabetes and premature mortality(Nadeau et al., 2011, Reilly and Kelly, 2011).

Many behaviour change models used in health promotion include as a first stage, awareness of the issue or problem in the community or the individual(Maycock et al., 2001). For example the emphasis in recent health promotion programs for tobacco control has been on awareness of the pathology associated with tobacco usage and awareness of alcohol problems has been a part of many health promotion programs(Wakefield et al., 2013, Howat et al., 2004, Jones et al., 2005, Conigrave et al., 2012). Swinburn has noted that the child obesity epidemic began internationally about three decades ago, but it took another two decades before governments and international organizations became concerned(Swinburn and de Silva-Sanigorski, 2010). A number of studies have found that adults often do not perceive themselves as obese, a first stage in taking action to lose weight and an earlier Australian study found that Australian mothers often do not recognize their child as being obese(Campbell et al., 2006). However there have been no reported studies of parental perceptions obesity in Chinese children living in China and Australia.

China, once been considered to have one of the leanest populations and despite differences in classifying obesity, there is little doubt that childhood obesity in China is fast catching up with the West(Cheng, 2004a, Ding, 2008). A national epidemiological survey of childhood obesity in 2006 in China found that the prevalence of overweight and obesity in 0-6 years old urban children was 19.8% and 7.2% which was 4.7 and 3.6 times higher than that of 1996 respectively (Ding, 2008).

In Australia, the number of overweight and obese children has increased significantly over the past two decades, with a quarter of children and adolescents (21–25%) considered overweight or obese (5–8% classified as obese)(Australian Bureau of Statistics, 2009). It was reported that immigrants in Australia had a lower age-standardised rate of obesity (11% to 15%) compared to the adult obesity rate of 18% in Australia, and the difference decreased with longer periods of residence(Australian Bureau of Statistics, 2008a). A cross-sectional survey of children aged 4–13 years found an independent effect of ethnicity on overweight and obesity, over and above the effect of socioeconomic status (Waters et al., 2008). In the 2006 Australian Census, 669,890 residents identified themselves as having Chinese ancestry and the number is increasing by 7.7% per year(Australian Bureau of Statistics, 2007). There were 53,390 Chinese born residents in Perth in 2006, including 5527 children about 2.9% of the city's population(Australian Bureau of Statistics, 2008a). To date, there have been no studies reporting the overweight and obesity prevalence in Chinese preschool children in Perth.

The increase in rates of obesity has raised concerns for public health. Education and modifying eating habits within families is commonly advocated for tackling the obesity problem(West et al., 2010). The role of the mother, as gatekeeper to the family's nutrition is essential, especially for pre-school children. Mothers' willingness to make the lifestyle changes necessary to help their children lose weight plays a major part in most successful childhood obesity interventions(Rhee and Rhee, 2005). If the mother does not perceive that her child is overweight then the program will not be effective. Little is known about how Chinese mothers of preschool children perceive their children's weight. The objective of this article was to record Chinese mother's perceptions of their child's weight in Australia and China.

9.2 Method

Chinese mothers and their children living in in Perth, Western Australia and in Chengdu and Wuhan, PR China were studied between October 2010 and December 2011(Chen et al., 2013a, Chen et al., 2013b),. The study investigated the influences on Chinese mother's beliefs and attitudes towards health promoting activities of their children aged 2 to 4 years. Perth mothers were recruited from the Perth Chinese community through Chinese schools and community organizations. A total of 237 mothers agreed to participate with a response rate of 95.6%. There were 89 children in the study age group (2-4 years). Mothers interested in taking part in this study received an information sheet containing project details and were asked to sign the consent form. Participants in China were recruited from four kindergartens in four districts of Wuhan and 14 kindergartens in seven districts of Chengdu. A total of 2400 questionnaires were distributed to mothers by kindergarten teachers and 1607 and 471 were returned by the mothers in Chengdu and Wuhan respectively, a response rate of 86.6% in

China. After excluding mothers with children under two years old, the final sample in China included 1951 mother and child pairs. The study was approved by the Curtin University Human Research Ethics Committee (approval number: HR 96/2010) and the local education authorities in China.

Demographic data were collected using a validated and reliable questionnaire previously used in Chinese population studies(Li et al., 2003b). Pre-coded questions were asked to classify income into two groups using categories based on local annual household income surveys and mothers' education level(Australian Bureau of Statistics, 2010c, Sichuan Bureau of Statistics, 2012b). The height and weight of mothers and children in Perth were measured during the interviews using standard anthropometric equipment and techniques(Marfell-Jones et al., 2006). The Chinese children's height and weight were measured by trained health workers during the physical examination in September or October 2011.

The BMI was defined as weight (kg)/height (m^2). The 2012 revised international child cut-offs developed by the International Obesity Task Force (IOTF) were used to classify thinness, overweight and obesity in children in this study(Cole et al., 2000, Cole and Lobstein, 2012). These international cut-offs are based on BMI data from six countries, corresponding to the standard adult BMI classifications of >25 (overweight), >30 (obesity) and <18.5 (thinness grade 1)(Cole and Lobstein, 2012). The mothers' BMI were defined according to the Chinese adult cut-off points(Cheng, 2004b).

The mother's perception of her own and her child's weight were assessed with the question: 'How would you describe your current weight status? (underweight, normal weight, overweight or obese)' and 'How would you describe your child's weight at the moment? (underweight, normal weight, overweight or obese)'.

All statistical analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0. Chi-square (χ^2) test were used to compare basic characteristics of mothers and children in Australia and China, maternal perception of child's weight status in two countries and correct maternal perception of child's weight status by mother and child characteristic variables. P values <0.05 were considered statistically significant.

9.3 Results

The general characteristics of the study populations are presented in Table 1. Australian mothers had a higher education level compared to China mothers. Half of the Australia mothers (51.7%) were not employed, while 63.4% of China mother had full-time work (Table 1). More mothers were overweight or obesity in Australia (24.4%) compared with mothers in China (9.0%, P <0.001). The majority of children between 2 to 4 years old were in the normal weight range (68.5% in Australia and 70.5% in China). More children were overweight or obese in China (16.7% in China compared to 8.0% in Australia) but the proportion underweight was higher in Australia (23% compared to 11.9% in China, p<0.01) (Table 9.1).

The overall percentages of correct maternal perception of the child's weight were 35% in underweight children, 69.2% in normal weight children and 10.8% in overweight/obese children. Chinese mothers' perceptions of their child's weight status in Australia and China are presented in Table 4.28. Most mothers could correctly classify their children's weight if the child was normal weight; with slightly more Australia mothers (83.6% in Australia and 68.4% in China, p=0.024) (Table 4.28). The percentages who correctly classified underweight children were 35.0% in both countries and very few underweight children were incorrectly classified as overweight/obese. Among the overweight or obese children, only 14.3% in Australia and 10.8% in China were classified as overweight/obese by their mothers (Table 9.2). Most overweight or obese children were viewed as being normal weight by their mothers and 14.3% in Australia and 13.9% in China were actually considered by their mothers to be underweight (Table 4.28).

Table 4.29 presents the percentages of correct mothers' classifications of the child's weight status by mother and child characteristic variables. Within the group of underweight children, normal weight mothers (p<0.004) and mothers with older age children (p<0.05) were more likely to correctly classify children's weight status (Table 4.29). A higher percentage of overweight/obese mothers (p=0.002) and mothers who over-estimated her own weight status (p<0.001) classified their child's weight status correctly in overweight/obese group, compared to their counterparts.

9.4 Discussion

There was a high prevalence of overweight and obesity in the two to four years old children from in Chengdu and Wuhan, P.R. China (16.7%), and was significantly higher than Chinese children in Perth Australia (8.0%). The prevalence rates based on the new IOTF cut-offs are extremely close to those used previously and can be compared directly with the WHO cut-offs (Cole and Lobstein, 2012). Two national studies based on the old IOTF cut-offs in China reported that the overall prevalence of overweight/ obesity was increased from 4.2% in 1989 to 7.4% in 2000 in preschool children (Luo and Hu, 2002, Liu et al., 2007). A further study using the same definition found that the prevalence of overweight and obesity in 2-18 years old children in Chongqing (n=23292) was 16.2% in 2004(Xiong et al., 2005).

The results of this study indicate a high rate of maternal misclassification of child weight status in Chinese mothers: 65.0% of underweight and 30.8% of normal weight and 89.2% of overweight/obese children. Although over-perception of underweight can lead to unhealthy dieting and eating disorders, underestimation on weight status can lead to overfeeding and may increase the risk of these children becoming overweight or obese(Lopes et al., 2013). Consequently, it is important that parents have an accurate perception of their child's weight status.

Only 10% of mothers with an overweight or obese preschool-aged child correctly classified their children as overweight. Chinese parents often lack awareness of the increasing problem of obesity and its significance as a health issue. The increasing prevalence of overweight children may have "normalised" this condition and contributed to the inability of mothers to recognise when their own child is overweight. Further, there is a traditional Chinese belief that "gaining weight and being fat means affluence" and this belief may predispose mothers to view weight gain in a positive light. Before the 1980s and the advent of the 'one child policy', Chinese women often had several children and larger infants were more likely to survive. However with the rapid changes in the amount and composition of Chinese diets and activity/inactivity patterns and the obesity levels in Chinese children rose to Western levels(Popkin, 2001a). The nutrition transition happened so rapidly that parents still kept their traditional culture beliefs while they and their children were becoming overweight or even obese.

In the present study, 75% of overweight/obese Chinese children were classified by their mothers as being of normal weight, suggesting that Chinese parents perceive a larger body size of their children to be healthy. Parents who recognise their children's weight as a health problem are more likely to take action on changing their children's lifestyle habits(Rhee and Rhee, 2005). Traditional cultural beliefs are often based in historical circumstance that may no longer be applicable. Even though public health professionals try to increase public awareness about health risks, the general public may not translate this awareness into an individual level of concern(Campbell, 2006). In the case of Chinese mothers, the level of misclassification of their perceptions of overweight and obese child deserves special consideration in relation to development of communication and other health promotion strategies.

The present findings have implications for program to reduce the prevalence of overweight and obesity among Chinese children. Parental education and involvement have been found to be critical in successful programs to change children's dietary and physical activity behaviours, and there is evidence that public education campaigns to foster such involvement among families can yield benefits for the children(Eckstein et al., 2006a). The first stage in any health promotion intervention has to be recognition of the problem, in this case recognition of the objective evidence that the child is overweight or obese and identification of contributing factors including, behavioural and environmental factors(Howat et al., 2004). Parents who understand the severity of childhood overweight/obesity and are aware that their child's weight is in the overweight or obese range, it may motivate them to consult their health care provider and take ameliorative action.

Our findings also have important implications for early childhood educators and health professionals. Regular assessment of growth, including BMI are important as a part of normal monitoring by health professionals to provide an objective measure of potential overweight or obesity(National Health and Medical Research Council, 2012). However health professional often neglect to discuss a child's obesity with the parents as it can be a sensitive topic particularly if the parents are obese(Perrin and Skinner, 2012). Other research has suggested that mothers of obese children believed that concern was not indicated if their children were otherwise happy, and there was fear of stigmatisation or blame(Jain et al., 2001, Callahan, 2013). Childhood obesity once established often carries over into adulthood and is difficult to treat. Early identification of obesity in childhood offers the best strategy for preventing disease progression with its associated comorbidities. Health professionals should support parents and provide counselling on childhood overweight and obesity.

There are some limitations that need to be considered with interpreting the results of this study. The height and weight of mothers China were self-reported and it is known that women may underestimate their weight status(Yun et al., 2006). This may partly explain the lower prevalence of overweight and obesity in mothers from China than their counterparts. However, those limitations do not affect the results of maternal perceptions of children's weight status. Future studies should investigate in more detail how parents assess the weight status of their children and effective strategies for increasing parents' awareness of the importance of prevention of child obesity.

9.5 Conclusions

Our study revealed a high prevalence of incorrect maternal perception of preschool Chinese children's weight status, especially in overweight or obese children. Improved efforts to educate parents about childhood overweight/obesity and its health consequences for children in order to reduce misperceptions are important in addressing the obesity epidemic, whether in a clinical or community setting.

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Conflicts of Interest

There are no potential conflicts of interest to be reported.

Table 9.1 Characteristics of Chinese mothers and their children in Australia and China

Characteristic	Australia (n*=89) n (%)	China (n*=1951) n (%)	*p*
Age (years)			<0.001
≤30	13 (14.9)	788 (53.2)	
>30	74 (85.1)	703(46.8)	
Educational attainment			<0.001
High school diploma or less	25 (28.1)	895 (58.6)	
University degree or higher	64 (71.9)	632 (41.4)	
Working status			<0.001
Full-time working	20 (22.5)	974 (63.4)	
Part-time or casual work	23 (25.8)	312 (20.3)	
Not employed	46 (51.7)	250 (16.3)	
Household income			0.070
Low income	40 (47.6)	760 (57.7)	
High income	44 (52.4)	557 (42.3)	
Weight status of the mother			<0.001
<18.5 kg/m^2 (Underweight)	9 (10.5)	272 (15.8)	
18.5≤BMI<24 kg/m^2 (Normal)	56 (65.1)	1294 (75.2)	
24≤BMI <28 kg/m^2 (Overweight)	14 (16.3)	139 (8.1)	
≥28 kg/m^2 (Obesity)	7 (8.1)	16 (0.9)	
Age of the child (years)			<0.001
2	39 (16.5)	363 (18.2)	
3	30 (12.7)	910 (45.6)	
4	20 (8.4)	678 (34.0)	
Gender of the child			0.759
Boy	49 (55.1)	1037 (53.4)	
Girl	40 (44.9)	905 (46.6)	
IOTF category of the child			0.007
Underweight	20 (22.7)	210 (11.9)	
Normal	61 (69.3)	1259 (71.4)	
Overweight	5 (5.7)	189 (10.7)	
Obesity	2 (2.3)	106 (6.0)	

* The missing values vary for each variable in both countries.

Chapter 10

The more she cares the more overweight her child: a population-based survey on the Health Belief Model in Chinese children

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Abstract

Background: A greater understanding of maternal health beliefs that influence child weight could advance the design and delivery of effective nutrition and activity interventions. The aims of this study are to assess Chinese mother's health beliefs and test whether their beliefs affect their child care behaviours and child's weight by the Health Belief Model.

Methods: Data were collected in Perth, Australia and Chengdu and Wuhan, PR China. Participants were Chinese mothers who have at least one pre-school child under five years old. A total of 237 mothers in Australia and 2078 mothers in China agreed to participate.

Results: There was a high prevalence of overweight and obesity in the Chinese children (17.3% in China and 9% in Australia). Despite some differences in health beliefs between Chinese mothers in two countries (eg, higher 'general health motivation' and 'perceived barriers' in China), participants from both groups expressed a high general health concern for the child, high perceived severity of childhood obesity and benefits of taking weight control actions towards their child. Mean scores of 'mother's perceived susceptibility', 'self-efficacy' and 'cues to action' were relatively low in both countries compared to other Health Belief Model dimensions. There were significant associations between maternal health beliefs and mothers' child-feeding behaviours or maternal support for the child's physical activities. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that maternal overweight or obese (aOR=1.68, 95% CI 1.17-2.42), maternal 'general health motivation' (aOR=2.08, 95% CI 1.31-3.32) and 'perceived barriers' on controlling the child's weight (aOR=1.56, 95% CI 1.04-2.36) were significantly associated with childhood overweight or obesity in the study sample.

Conclusions: The Health Belief Model assists in explaining parenting behaviours and provides a basis for future childhood obesity preventionstudies. In the case of Chinese population, parental 'perceived susceptibility', 'self-efficacy' and 'cues to action' deserves special consideration in relation to development of effective nutrition and activity interventions to address the childhood obesity epidemic.

Keywords

Chinese, child, overweight, obesity, parents, health belief model

10.1 Background

The prevalence of pediatric overweight and obesity has increased dramatically worldwide in recent years and China is no exception. Once considered to have one of the leanest populations(Keil and Kuulasmaa, 1989, Cheng, 2004a), Chinese is fast catching up with the West in the prevalence of overweight and obesity(Ma et al., 2005). With the implementation of the "family planning policy" in China in the early 1980s, the single child tends to be over-cared for and often overfed by adult caregivers(Jiang et al., 2009b). A national epidemiological survey of childhood obesity in 2006 in China found that , the prevalence of overweight in children increased 4.7 fold between 1996 and 2006(Ding, 2008).

The estimated fertility rate in China was 1.5 from the 2010 national demographic census while the fertility rate was estimated to be 1.9 in 2011 in Australia(Australian Bureau of Statistics, 2012c, Liu, 2012). It would be expected that Chinese Australians might have more children as the 'one child policy' does not apply in Australia. In Australia, a quarter of children and adolescents (21–25%) were considered overweight or obese (with 5–8% classified as obese)(Commonwealth Scientific and Industrial Research Organisation and Preventative Health National Research Flagship, 2008, Gill et al., 2009, Australian Bureau of Statistics, 2009, Rokholm et al., 2010, Olds et al., 2010). It was reported that immigrants in Australia had a lower age-standardised rate of obesity compared to Australians(Australian Bureau of Statistics, 2008a). A cross-sectional survey of children living in Australia found an independent effect of ethnicity on overweight and obesity, over and above the effect of socioeconomic status(Waters et al., 2008). In the 2006 Australian Census, 669,890 residents identified themselves as having Chinese ancestry and the number is increasing by 7.7% per year(Australian Bureau of Statistics, 2007). There were 53,390 Chinese born residents in Perth in 2006, including 5527 children about 2.9% of the city's population(Australian Bureau of Statistics, 2008a). Because of the distinctive identity of Chinese immigrants, their integration of western and eastern culture and lifestyle, the health beliefs and health promoting activities of their children could be different both to Chinese living in China and to other Australians.

A number of biological, psychological, cultural, and economic factors have been associated with increased childhood obesity(Drewnowski and Specter, 2004, Swinburn and Egger, 2004, Badland et al., 2005, Hills et al., 2011, Faulkner et al., 2009, Tremblay et al., 2011, McMullan and Keeney, 2013, Demerath et al., 2007). Although it is difficult to show a conclusive link between specific risk factors and population-wide obesity increases, many experts agree that for young children the most influential aspect of the immediate social context is the family(Jiang et al., 2007, Wardle and Cooke, 2008, Patrick and Nicklas, 2005, Raynor et al., 2011, Pearson et al., 2009, Rhee, 2008, Reifsnider et al., 2013). Mothers are gatekeepers to the family's nutrition, especially for pre-school children. Mothers can influence their children's health by the example they set, having a healthy diet and lifestyle, by the food they provide and through education of their children about foods, dietary behaviour and active lifestyle(Cooke et al., 2004, Gibson et al., 1998, Biehl et al., 2013). Mother's attitudes, values, and beliefs about child's body shape and physical activity have also been shown to influence child's behaviour(Kimiecik and Horn, 1998, Birch et al., 2001b, Kalinowski et al., 2012). Maternal beliefs that their child's weight was a health problem, correct identification of the child's weight category (as overweight or not) and expression of concern about it, are related to child's weight status(Eckstein et al., 2006b, Brodsgaard et al., 2011, Lopes et al., 2013).

The Health Belief Model (HBM) is a widely applied social psychological model used to understand and predict health behaviour(Clarke et al., 2000). In this theoretical model, health behaviour is a function of knowledge, beliefs and attitudes. Guided by HBM, we thought that mothers would be more likely to take health action to promote their children's health and prevent overweight or obesity if they perceive that (a) their children are susceptible to overweight or obesity, (b) that the condition is serious if their children become overweight or obese, (c) that taking action will result in benefits, preventing their children from being overweight or obese, (d) that the benefits of taking health actions like keeping a certain diet and encourage physical activities to prevent overweight or obesity exceed the barriers or costs. Whether or not a mother takes a preventive action towards the child's health depends largely on her rational estimate of costs and benefits represented by the four dimensions. Other variables in the HBM that could motivate mothers to take actions are if (e) they were confidence in being able to affect their children's dietary patterns and physical activities, (f) there were cues that motivate them to control their children's weight and (g) they were generally concerned about family member's health and believed in that certain preventions can affect their children's weight status (see figure 2).

Although many researchers have applied HBM to understand and predict health behaviours, it has rarely been applied to parenting behaviours and predicting health of children. To date, there have been no studies using HBM describing the maternal health beliefs on childhood overweight and obesity in Chinese population. A greater understanding of maternal health beliefs that influence child weight could advance the design and delivery of effective nutrition and activity interventions. The aims of this study are to assess Chinese mother's health beliefs and test whether their beliefs affect their child care behaviours and child's weight by HBM. Mothers with children under five years old living in Australia and China were studied.

10.2 Methods

Data were collected from October 2010 to October 2011 in Perth, Western Australia and from September to December 2011 in Chengdu and Wuhan, China. Participants in Perth were mothers who have at least one pre-school child under five years old. They were recruited from the Perth Chinese community via Chinese schools and community organizations. Mothers interested in taking part in this study received an information sheet containing project details and were asked to sign the consent form. Participants in China were recruited from four kindergartens in in four districts of Wuhan and 14 kindergartens in seven districts of Chengdu. Both private and public kindergartens were included. A total of 2400 questionnaires were distributed to mothers by kindergarten teachers. The study was approved by the Curtin University Human Research Ethics Committee (approval number: HR 96/2010) and the local education authorities in China (District Departments of Education of Longquanyi, Chenghua, Jinjiang, Gaoxin and Jinniu, Wenjiang and County Department of Education of Shuangliu in Chengdu, and Department of Education of Wuhan).

Demographic data were collected using a validated and reliable questionnaire previously used in Chinese population studies(Li et al., 2003b). Pre-coded questions were asked to classify income into two groups using categories based on local annual household income surveys(Sichuan Bureau of Statistics, 2012b, Australian Bureau of Statistics, 2011f).

A HBM assessment instrument designed and tested by Maiman et al. and modified for its relevance to Chinese culture and beliefs was used(Liou et al., 2006, Maiman et al., 1977). Each major component of the HBM was operationalized by multiple questionnaire items, with responses permitted a five-choice rating scale of agreement (from "not at all" to “completely”), except two questions about special health practices for the child (“yes” or “no”). These single items were then combined on the basis of manifest content to construct index measures for the different HBM dimensions. An index measure was derived by adding the responses by an individual on two or more items related to a particular dimension, and then dividing the sums score by the number of items included in the index to obtain a mean score.

Outcome variables include mothers’ child feeding behaviours, their support for physical activity and the child’s BMI. The validated Child Feeding Questionnaire (CFQ) developed by Johnson and Birch based on Costanzo and Woody’s theory was used to assess parents' perception of child weight, restriction, pressure to eat, and monitoring(Costanzo et al., 1985, Birch et al., 2001a).

The BMI was defined as weight (kg)/height (m)^2. The 2012 revised international child cut-offs developed by the International Obesity Task Force (IOTF) were used to classify thinness, overweight and obesity in children in this study (Cole and Lobstein, 2012). The international cut-offs are in terms of underlying LMS curves and the resulting curves provide age and sex specific cut off points from 2-18 years(Cole and Lobstein, 2012, Cole et al., 2000). They are based on BMI data from six countries, corresponding to the BMI cut-offs at 18 years, which are BMI 25 (overweight), 30 (obesity) and 18.5 (thinness grades 1)(Cole and Lobstein, 2012).

The mother’s height and weight was assessed by the questionnaire and BMI was then calculated and classified according to the Chinese adult cut-off points(Cheng, 2004b). The normal means a BMI score between 18.5 to 23.9, the underweight means less than 18.5, the overweight means 24 to 27.9 and the obesity means over 28(Cheng, 2004b).

All statistical analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.0. An independent samples t-test was used to compare means differences between two countries. Mann-Whitney U test was applied to compare the median age of children between two countries. Chi-square (χ^2) test was used to compare basic characteristics of mothers and children in Australia and China. Spearman’s rank correlation coefficient was used to assess the association between HBM dimensions and mother’s child feeding behaviours and support for physical activities. A multiple binary logistic regression analysis was performed to evaluate the association between mother and child’s characteristics and the use of dietary supplements controlling for potential confounders. A backward elimination procedure was applied to obtain final models. P values <0.05 were considered statistically significant.

10.3 Results

A total of 237 mothers in Perth agreed to participate with a response rate of 95.6%. In China, 1607 and 471 questionnaires were returned by the mothers in Chengdu and Wuhan respectively, a response rate of 86.6%. General characteristics of the study population are presented in Table 1. Australia mothers had a higher education level compared to China mothers and higher economic status according to the local household economic standard (Table 10.1). More mothers were overweight or obese in Australia (21.8%) compared with mothers in China (9.3%, $p < 0.001$). The result of Mann-Whitney U test shows that the median age of the "index child" in the Chengdu and Wuhan sample (median age=3.70 years, interquartile range=1.11 years) was larger than it in Perth (median age=1.59 years, interquartile range=1.88 years, $U=66319$, $p<0.001$). The majority of children between 2 to 4 years old had a normal weight (68.5% in Australia and 70.5% in China). More children were overweight or obese in China (17.3% in China and 9% in Australia) while more Chinese children were underweight in Australia (22.5% in China and 12.2% in Australia, $p=0.003$) (Table 10.1).

In most dimensions of the HBM, Chinese mothers in both countries tended to possess negative attitudes toward childhood obesity with mean scores higher than three (Table 4.27). Both groups of participants expressed a high general health concern for their children (mean=4.57±0.8 in Australia and mean=4.79±0.4 in China). They also perceived a relatively high level of severity of childhood obesity and benefits of taking action on controlling the child's weight. Mean scores of mother's 'perceived susceptibility', 'self-efficacy' and 'cues to action' were low in both countries compared to other HBM dimensions (Table 4.27).

Findings from this study show that the health beliefs regarding child health of Chinese mothers in Australia are different in about half of the dimensions of the HBM compared to mothers in China (Table 4.27). Mothers from China have higher 'general health motivation' (mean score=3.14±0.4 in China compare to 3.02±0.5 in Australia, $p=0.001$), including higher 'general health concern for child' (mean score=4.79±0.4 in China compare to 4.57±0.8 in Australia, $p<0.001$) than mothers from Australia. Australia mothers also have lower 'perceived barriers' of taking weight control action toward their children (mean score=2.78±0.5 in Australia compared to 2.88±0.4 in China, p=0.008), lower 'perceived susceptibility' of their children becoming overweight or obese (mean score=2.45±0.6 in Australia compare to 2.71±0.7 in China, p=0.039) (Table 4.27).

Mother's perception of the child's current weight was acquired as additional "cues to action" in the HBM. Among those overweight or obese children, only 12.5% in Australia and 11% in China were classified as overweight by their mothers. No mothers prospected their children as obesity in either Australia or China. Most overweight or obese children were viewed as normal weight by their mothers and 12.5% of them in Australia and 14.0% of them in China were even considered as underweight.

With regards to mothers' child feeding behaviours, Australia mothers have same level of 'restrictions' as China mothers, and have higher 'pressure' (mean score=3.31±0.60 in Australia and 3.32±0.53 in China, p=0.014), and 'monitoring' (mean score=3.47±0.96 in Australia and 3.23±0.84 in China, p<0.001) on their children's eating behaviours than China mothers (Table 4.30). Australia mothers also have more support for physical activities for their children (Table 4.31).

The Pearson Correlation analysis shows weak associations between maternal health beliefs and mothers' child feeding behaviours (restriction, pressure to eat and monitoring) or their support for child's physical activities (encouragement for physical activities, participation physical activities with the child and providing opportunity of physical activities for the child). The correlation coefficients ranged from -0.197 (p<0.01) to 0.252 (p<0.01) (Table 4.32-4.33). Most of health belief model dimensions were significantly positively related to mother's child feeding behaviours or their support for child's physical activities, except 'perceived barriers' and 'perceived susceptibility' were negatively associated with parental support for child's physical activities.

General health motivation, perceived benefits, perceived barriers, self-efficacy, susceptibility, perceived severity, cue to action, mother's age group, mother's BMI, education level, working status, household income and 'full breastfeeding at 6 months' were entered into a multiple binary logistic regression model to explore their effect on childhood overweight or obesity using a backward elimination regression method. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that maternal overweight or obese (aOR=1.68, 95% CI 1.17-2.42), maternal 'general health motivation' (aOR=2.08, 95% CI 1.31-3.32) and 'perceived barriers' on controlling the child's weight (aOR=1.56, 95% CI 1.04-2.36) were significantly associated with childhood overweight or obesity.

10.4 Discussion

The level of overweight and obesity has increased significantly over the past two decades in China. The prevalence of overweight and obesity was high in 2 to 4 years old children in Chengdu and Wuhan, P.R. China (17.3%), which was significantly higher than Chinese children in Perth Australia (9%). Because the prevalence rates based on the new IOTF cut-offs are extremely close to those based on the old and can be compared directly with the WHO cut-offs, the results from this study are comparable with other studies using IOTF(Cole and Lobstein, 2012). Two national studies based on the IOTF cut-offs in China reported that the overall prevalence of overweight and obesity was increased from 4.2% in 1989 to 7.4% in 2000 in preschool children(Luo and Hu, 2002, Liu et al., 2007).

Australia has a high prevalence of overweight/obesity in preschoolers (>20%) (Wake et al., 2007). This study reports a lower prevalence of overweight/obesity in Chinese preschool children in Perth than the national level. However, it identifies a high prevalence of underweight in Chinese children (22.5%) in Australia.

The Health Belief Model (HBM) results show that Chinese mothers in both countries have a relatively low 'perceived susceptibility' of their children becoming overweight/obesity, with a mean score under three (2.45 in Australia and 2.71 in China). The HBM is a sequential function model that is that if a person does not perceive there is sufficient severity and susceptibility of the disease, he/she would not perceived a high threat. This would then nullify the 'perceived benefits' and 'perceived barriers' of taking health actions. The low 'perceived susceptibility' in Chinese mothers might have interrupted the sequential functioning of the model from the beginning: if the mother failed to perceive that her child was susceptible to obesity, she would not be aware of the threat from childhood obesity and, so would not take weight control action (Figure 10.1).

In addition, mothers neither of gourps (in Australia or China) have enough 'cues to action' to strengthen their awareness of the threat, with mean scores just about three (3.07 in Australia and 3.11 in China). The incorrect perception of their child's weight status also shows that their cues about controlling child's weight were weak. Moreover, the 'self-efficacy' of mothers was low, which means they were not confidence in being able to affect their child's weight status. The impaired dimensions in the HBM weaken the likelihood of mothers taking preventive actions on childhood obesity, therefore, the correlations between mothers' health beliefs and their parenting behaviours were not strong. In order to carry out successful preventive campaign on childhood overweight/obesity in this Chinese population, 'perceived susceptibility', 'cues to action' and 'self-efficacy' should be enhanced.

The present findings suggest that maternal health beliefs might be an important determinant of a child's body weight development. Children with mothers who have higher 'general health motivation' (including dimensions of 'general health concern for child', 'special health practices for child' and 'mother's own general health concern') and higher 'perceived barriers' are more likely to be overweight or obese. In terms of cultural health beliefs, Chinese mothers in China seem to have health beliefs that tend to lead to obesity in their children with higher 'general health motivation', and higher 'perceived barriers' on controlling their children's weight. Although Chinese Australian mothers were more likely to be overweight or obese (21.8% in Australia and 9.3% in China, $p<0.001$), which was a significant factor for childhood overweight, with healthier beliefs, the prevalence of overweight in Chinese children in Australia was lower than it in China.

The result that the more Chinese mothers cared about their children's general health, the more likely their children would become overweight or obese, was contrary to our preliminary hypothesis. This may be explained by the inconsistence between maternal weight perception and the truth of the child weight status. As discussed in Chapter 4, Chinese has culture belief that heavier is healthier. Only about 10% of mothers with an overweight or obese preschool-aged child correctly recognised their children as overweight. China was considered to have one of the leanest populations in history, however, changes in diet and activity patterns are fuelling the obesity epidemic in China(Keil and Kuulasmaa, 1989, Cheng, 2004a, Popkin, 2001a). The traditional culture belief that "gaining weight and being fat means affluence" is based in historical circumstance that may no longer be true. Before the 'one child policy' applied, Chinese women normally had more than one child, and the bigger children had more chance to survive. However, rapid changes in the levels and composition of Chinese diets and activity/inactivity patterns in undergoing in China(Popkin, 2001a). The transition of nutrition and life patterns happened so quickly that Chinese parents may still keep to the traditional culture belief about body size ("heavier is healthier") while their children are becoming overweight. In addition to the tradition Chinese culture belief, the increased prevalence of childhood obesity may shift the perception of what is normal and contributed to the low maternal 'perceived susceptibility' of their child becoming overweight and the inability of mothers to recognise when their own child is overweight. Ironically, mothers show higher 'general health motivation' may introduce special health practices to their families, such as the provision of special high calorie diets and thus increase the likelihood of their children being overweight. Overweight children may appear better nourished and be considered as "better eaters" by those mothers.

The findings from this study have implications for interventions to reduce the prevalence of overweight among Chinese children. Parental education and involvement is critical in successful programs to change children's dietary behaviours and physical activities, and public education campaigns to foster such involvement among families have been found to be considerable beneficial to their children(Eckstein et al., 2006a, Melbye et al., 2013). In the case of Chinese mothers, the low 'perceived susceptibility' of childhood overweight and level of misclassification of their overweight and obese child deserves special consideration in development of communication and other health promotion strategies. Once the parents perceive the likelihood of childhood overweight in their child and are aware of it when the child becomes overweight, it may motivate them to take actions to control their child's weight.

Our findings have important implications for early childhood educators, since most Chinese children were sent to kindergartens on weekdays, kindergarten staffs can educate parents about childhood overweight/obesity and its health consequences for children. School principals and teachers working with parents in promoting healthy eating and active play have been found to be critical in successful intervention programs(Pagnini, 2007). On the other hand, paediatricians and family physicians, especially those working in China, should be encouraged to provide parents counselling on childhood overweight and obesity and use the child BMI charts as a part of normal practice to provide an objective measure of weight status.

There are several limitations that need to be considered when interpreting the results of this study. This is a cross sectional study and is subject to recall bias, but this applies to both samples. Because the number of overweight children in the "Australian" group is relatively small, the multivariable analyses could not be applied in this group. Additional research with larger samples is needed to gain a more complete understanding of effects of maternal health beliefs, education, BMI and children's age in perceiving child overweight status in Chinese immigrants. Because this survey was not weighted, researchers should cautiously make inferences about the whole Chinese population. It would also be desirable to identify datasets for analysis that include additional relevant variables such as child diet and activities.

10.5 Conclusion

Our study revealed a high prevalence of overweight and obesity in a large Chinese pediatric population. Maternal health beliefs and traditional attitudes toward body shape might be important determinants of a child's body weight development. The HBM helped explain the inter-relationships between beliefs and mother's parenting behaviours and could be applied to child obesity preventions in future studies. Despite mounting public concern about childhood obesity, most Chinese mothers of 2–4 year olds did not perceive high susceptibility of their children being overweight or obese, did not have enough cues about controlling their children's weight, and had low self-efficacy relating to their ability of affect their children's weight. Improved efforts to discern parents' health beliefs and factors that motivate or inhibit them from taking action are imperative if we are to begin to address the obesity epidemic, whether in clinical or public health settings. Further qualitative studies in a variety of social settings are needed to fill these gaps.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

BM participated in the study design and drafting and revising the manuscript. CB participated in the design of the study and involved in revising the manuscript. YZ participated in the design of the study and performed the statistical analysis. All authors read and approved the final manuscript.

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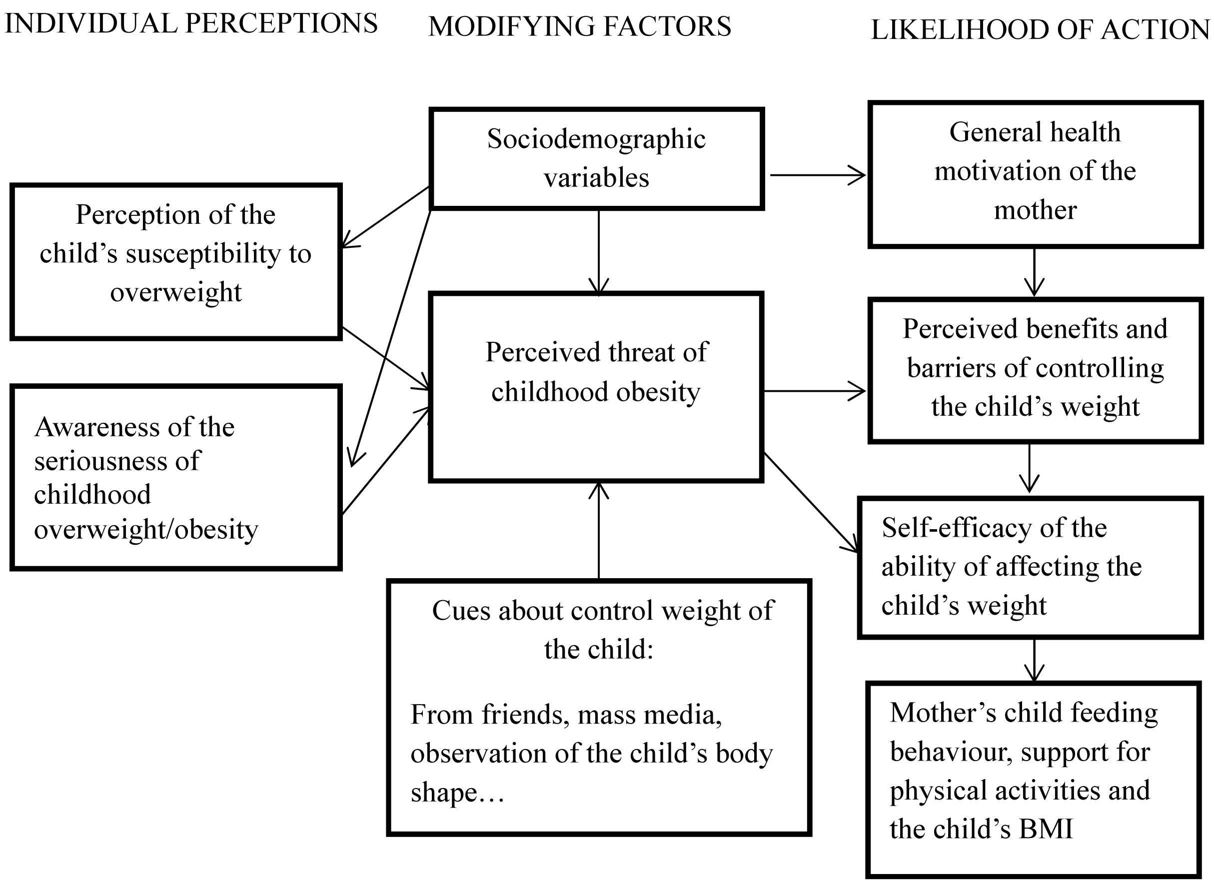

Figure 10.1 The Health Belief Model applied to mother's health beliefs and child's body mass

Table 10.1 Characteristics of Chinese mothers and their children in Australia and China

Characteristic	Australia (n*=237) n (%)	China (n*=2078) n (%)	2-sided *p*-value
Age (years)			<0.001
≤30	70 (30.2)	841 (53.2)	
>30	162 (69.8)	741 (46.8)	
Educational attainment			<0.001
High school diploma/ TAFE certificate/diploma or less	61 (25.8)	945 (58.2)	
University degree or higher	175 (74.2)	680 (41.8)	
Working status			<0.001
Working	107 (45.3)	1363 (83.7)	
Not employed	129 (54.7)	266 (16.3)	
Household income			0.025
Low income	110 (49.5)	806 (57.6)	
High income	112 (50.5)	594 (42.4)	
Maternal BMI			<0.001
BMI<18.5 kg/m^2 (Underweight)	25 (10.9)	281 (15.4)	
≤18.5 BMI<24 kg/m^2 (Normal)	155 (67.4)	1371 (75.3)	
BMI ≥24 kg/m^2 (Overweight or obesity)	50 (21.8)	169 (9.3)	
Age of the child (years)			<0.001
0-1	66 (27.8)	17 (0.8)	
1-2	82 (34.6)	29 (1.5)	
2-3	39 (16.5)	363 (18.2)	
3-4	30 (12.7)	910 (45.6)	
4-5	20 (8.4)	678 (34.0)	
Gender of the child			0.737
Boy	125 (53.0)	1071 (53.3)	
Girl	111 (47.0)	940 (46.7)	
BMI of the child (children aged 2-4 years old)			0.003
Underweight	20 (22.5)	217 (12.2)	
Normal	61 (68.5)	1260 (70.5)	
Overweight/obesity	8 (9.0)	309 (17.3)	
Breastfeeding initiation			0.001
Breastfed	223 (94.1)	1709 (85.1)	
Never breastfeed	14 (5.9)	299 (14.9)	
'Full breastfeeding' at 6 months			0.016
Yes	75 (33.6)	438 (26.8)	
No	148 (66.4)	1194 (73.2)	

* The missing values vary for each variable in both countries.

Chapter 11

Discussion

In this chapter, the results of the study will be discussed in more detail. The chapter is divided into nine sections, which reflect the nine main aims of the project, which are:

- Infant feeding attitudes:

    1. To translate and validate a Chinese version of IIFAS (simplified Chinese).

    2. To compare the infant feeding attitudes and practices in Chinese mothers in China and Australia.

- Breastfeeding practices:

    3. To compare the initiation and duration of breastfeeding between Chinese Australian immigrants and Chinese mothers in mainland China and test the 'healthy migrant effect' in Chinese Australian immigrants in Perth, Western Australia.

- Childhood obesity prevalence and child feeding practices

    4. To identify the prevalence of overweight/obesity in the study cohort (mothers and children) compared to Chinese and Australian national data.

    5. To document the prevalence and types of dietary supplements used and characteristics of Chinese pre-school children using dietary supplement in Australia and China and assessed the factors related to dietary supplement use in two countries.

- Health beliefs and child health

    6. To evaluate perceptions about child obesity among Chinese mothers living in Perth.

    7. To examine if the health belief model useful in understanding the health promoting behaviours of Chinese mothers for their children's health.

- Health information sources, illness rates and health services used by Chinese children

    8. To describe sources of information used by Chinese mothers about health, child nutrition and healthy lifestyles.

    9. To describe the incidence of illness, including minor illnesses, in Chinese children living in Perth.

11.1 Reliability and validity of the simplified Chinese version of the Iowa Infant Feeding Attitude Scale

This is the first study report on the use of the simplified Chinese version of the Iowa Infant Feeding Attitude Scale（IIFAS）to describe and compare the infant feeding attitudes of Chinese mothers in Mainland China and Australia. The internal reliability of the simplified Chinese version of IIFAS in this study was not excellent, but it was reasonably good for self-administered questionnaire with a Cronbach's alpha of 0.69 for mothers in Australia, 0.63 for university educated mothers and 0.62 high-household-income mothers in China. It is comparable to the original IIFAS Cronbach's alpha of 0.68 in the sample of breastfeeding women and more robust than it of Romanian version of IIFAS tested in Romania (De la Mora, 1999, Wallis et al., 2008).

The internal consistency was slightly better in Australia mothers (α=0.69) than China mothers (α=0.55). Subgroup analysis revealed more robust reliability for university-educated (α=0.63) and higher household economic mothers in China (α=0.62). Wallis, A. B., A. Brinzaniuc, et al. had suggested the weaker reliability observed may reflect the lack of exposure to infant feeding information and perhaps lack of consideration of infant feeding issues in the participants (Wallis et al., 2008). These findings might highlight the lack of infant feeding information among parents with less education and/or low-household-income Chinese mothers in China.

In 2011, the IIFAS had been translated into Chinese by Ho et al. and tested in a convenience sample of 140 women hospitalized for childbirth in Taiwan (Ho and McGrath, 2011). The simplified Chinese IIFAS used in this study is different with the one used in Taiwan. The Taiwan version is in traditional Chinese and the one used in this study is in simplified Chinese that is used in Mainland China. Many expressions are also different due to linguistic and cultural differences. For example, "母奶" "餵食""哺餵母奶", "缺乏鐵質" and "母乳對嬰兒是理想的食物" were used to in Taiwan version as "breastmilk", "breastfed", "breastfeeding", "lack of iron" and "breastmilk is the ideal food for babies" respectively. "母乳", "喂养", "母乳喂养", "缺铁" and "母乳是婴儿的理想食物" were used instead in this version. The simplified Chinese version used in this study is easier to read and understand for Chinese living in or who came from Mainland China.

The questionnaires were completed by face-to-face interviews in the previous Taiwan study and it had reported internal consistency with the Cronbach's alpha of 0.74 (Ho and McGrath, 2011). In this study, the data was collected by self-administered questionnaire. The internal consistence reliability of self-administered questionnaires was often weaker than it of interviewer administered questionnaires (Bergner et al., 1981, Siddiqui et al., 1999, Sullivan et al., 1995). The Cronbach's alpha can be biased by the presence of inconsistent responses, typically in self-administered questionnaires when participants are unmotivated (Siddiqui et al., 1999, Fong et al., 2010). The inconsistent responses by fixed or random answers in self-administered IIFAS should be considered by future researchers. Despite its greater cost, the face-to-face interview mode is more valid than the self-administered questionnaire, particularly as the latter may not be so reliable for less-educated and/or lower-income participants (Sullivan et al., 1995).

This study also indicated that the simplified Chinese version of IIFAS is a valid instrument for predicting the infant feeding method and the breastfeeding duration in Chinese mothers. Mothers with higher IIFAS scores were significantly more likely to breastfeed their babies and in those mothers who ever breastfed their babies, mothers in higher IIFAS score group were more likely to have a longer breastfeeding duration. The simplified Chinese IIFAS could be used clinically to identify Chinese mothers at high risk for formula feeding or discontinuing breastfeeding.

The simplified Chinese IIFAS is proved to be a reliable and valid instrument of infant feeding attitudes and can be used to predict infant feeding choice (breastfeeding or formula feeding) and breastfeeding duration in these Chinese populations. It can be administered as an assessment tool to understand infant feeding attitudes and breastfeeding promotion programs can then be planned to target relevant groups and issues. Further exploratory research should be conducted in Chinese population to further establish predictive validity through a longer follow-up in the postpartum period as well as using the tool in the prenatal period to assess attitudes toward breastfeeding initiation.

11.2 Infant feeding attitudes in Chinese mothers in China and Australia

The mean item-response also shows an inconsistence between the item "formula fed babies are more likely to be overfed than breast-fed babies" and the item "breastfed babies are more likely to be overfed than formula fed babies". It is more significant in mothers in China with the mean score of the former item of 2.79 and the latter of 3.24 (Table 4.9). This might be explained by the common Chinese culture belief that "gaining weight and being fat means affluence" (Jing, 2000). In Chinese culture, there is no such concept of "overfed" and Chinese parents often lack awareness of "overfed". Especially for less-educated women and/or have lower-household-income, they may never heard of the concept of "overfed" and could not understand those two items properly. Compare to mothers in China, the inconsistence of this pair of items was less robust among mothers in Australia. This might be explained by the culture difference between China and Australia and better infant feeding information that mothers in Australia received.

Moreover, the low mean scores of the item "Formula feeding is the better choice if the mother plans to go back to work" (2.33 in Australia and 2.32 in China) may reflect a lack of support for breastfeeding mothers in the workplace (Table 4.9). Also, the item "A mother who occasionally drinks alcohol should not breastfeed her baby" was negative to breastfeeding with a mean score of 2.70 in Australia and 2.41 in China (Table 4.9). Thus, the future projects promoting breastfeeding in Chinese women should pay more attention to the concept of "overfed", information about breastfeeding mothers who occasionally drink alcohol and providing more support to mothers who decided to go back to work.

The simplified Chinese IIFAS when completed by Chinese mothers in Australia gives different results to the mothers in China. The infant feeding attitudes and knowledge of Chinese mothers in Australia were better than mothers in China ($p<0.001$). In half of the items (eight), Chinese mothers in Australia have higher scores than mothers in China ($p<0.001$). Higher educational attainment may explain Australia mothers' positive attitude towards breastfeeding. Because higher educational attainment was significantly associated with mother's positive attitude towards breastfeeding ($p<0.001$) and mothers in Australia have higher educational attainment than mothers in China ($p<0.001$). The more positive infant feeding attitudes in Australia Chinese mothers together with a higher 'any breastfeeding rate' and longer breastfeeding duration may suggest a 'healthy migrant effect'.

11.3 Breastfeeding practices in Chinese mother in China and Australia

These results demonstrate a 'healthy migrant effect' for breastfeeding by Chinese immigrant mothers now living in Australia. In the present study we found that the initiation rate of breastfeeding of Perth Chinese mothers (94%) was higher than Chengdu mothers (86.2%, $P<0.01$) and close to the rate of Australia women (approximately 96%)(Scott et al., 2006b).The 'any breastfeeding ' rate at 6 months for Chinese mothers in Perth was 75.7% in this study, which is higher than the rate of 45.9% reported for all Australian mothers in Perth(Scott et al., 2006b, Australian Institute of Health and Welfare, 2011). It is also higher than the rate for Chinese mothers living in Chengdu, China (69.1%, $P<0.05$). The 'full breastfeeding' rate at six months in Chinese mothers in Australia in this study was 33.8% compared to the 7% found in an earlier study(Li, 2003). This difference may be due to a combination of increased emphasis on breastfeeding in Australian hospitals, the availability of multicultural health education programs and to sampling errors.

The findings from this study show that after controlling for potential confounders, Chinese mother's location (in Australia or in China) was still a predictor for breastfeeding initiation (OR=0.48, 95%CI 0.33-0.69) and 'any breastfeeding' after twelve months (OR=0.48, 95%CI 0.29-0.67). This could be partly explained by the "health selection process" when these mothers migrate to Australia. Mothers in Perth might be healthier than mothers in Chengdu with a healthier lifestyle, which would affect their children's health. This could also reflect the benefits of their higher household income than participants in Chengdu reflecting the local economic levels in Perth and Chengdu respectively. Many studies have reported that health, including child health, is positively related to household income(De Mheen and van de, 1998, Strauss, 1998, Case, 2002).

It also could be explained by the influence of the new environment including better infant feeding education and information that is available to mothers in Australia. Both Australian and Chinese mothers are officially encouraged to exclusively breastfeed their infants to around six months of age, although antenatal care and education would appear to be more intensive in Australia. In this study, the 'healthy migrant effect' and the breastfeeding education in Australia were reflected in the higher 'any breastfeeding' rate in Chinese-

Australian mothers compared to Australian-born mothers, and the higher breastfeeding initiation and duration of Chinese mothers in Australia compared to those living in China.

There are several limitations that need to be considered when interpreting the results of this study. This is a cross sectional study and is subject to recall bias, but this applies to both samples. Because of the possibility of recall bias, we did not measure exclusive breastfeeding in this study, instead, we use the term 'full breastfeeding' where an infant may also receive small amounts of culturally valued supplements—water, water-based drinks, fruit juice, or ritualistic fluids(Binns et al., 2009). Although it also has the potential of recall errors, the use of 'full breastfeeding' is less misleading. Another limitation of this study is that the percentage of missing values in the "China" group in some variables is higher than the "Australian" group.

11.4 Prevalence of childhood obesity in Chinese pre-school children

The level of overweight and obesity has increased significantly over the past two decades in China. The prevalence of overweight and obesity was high in 2 to 4 years old children in Chengdu and Wuhan, P.R. China (17.3%), which was significantly higher than Chinese children in Perth Australia (9%). Because the prevalence rates based on the new IOTF cut-offs are extremely close to those based on the old and can be compared directly with the WHO cut-offs, the results from this study are comparable with other studies using IOTF(Cole and Lobstein, 2012). Two national studies based on the IOTF cut-offs in China reported that the overall prevalence of overweight and obesity was increased from 4.2% in 1989 to 7.4% in 2000 in preschool children(Luo and Hu, 2002, Liu et al., 2007).

Australia has a high prevalence of overweight/obesity in preschoolers (>20%) (Wake et al., 2007). This study reports a lower prevalence of overweight/obesity in Chinese preschool children in Perth than the national level. However, it identifies a high prevalence of underweight in Chinese children (22.5%) in Australia.

11.5 Dietary supplements use in healthy pre-school Chinese children

With the increasing prevalence of chronic disease throughout the world and the public's rising health awareness, complementary and alternative medicine has attracted more attention(Mullie, 2009). It was reported that dietary supplements were the most frequently used complementary and alternative medicine for children(Crawford, 2006). All varieties of dietary supplements are now marketed in China and also in Australia, including single-ingredient products and various combinations of vitamins, minerals, botanicals, and other constituents. The purposes of their use in healthy children are treatment on non-clinical deficiencies, or to achieve optimal status of specific nutrients and the promotion or maintenance of health status(Woodside, 2005, Mori, 2011).

This study investigated the prevalence of dietary supplement use in Chinese children in mainland China and in Australia. This is the first report, to our knowledge, on the use of dietary supplements in young Chinese children under the age of five years. The most commonly used dietary supplement types and their intakes were documented. The factors related to dietary supplement use in two countries were also assessed.

In this study, one fifth of Chinese children in Perth and one third of children in Chengdu and Wuhan were taking at least one nutritional supplement with no gender differences. There have been several studies on dietary supplement use in children in different countries. The results of prevalence vary from study to study because of the definition of supplements, demographic characters of the target population, time of studies, and methods used in the surveys. However, the prevalence of dietary supplement use in Chinese young children in China was similar to that of the US (35%) and South Korea (34%), but higher than Japan (20.4%)(Mori, 2011, Bailey et al., 2010, Yoon, 2012, Bailey, 2011). However the comparison populations in these reports involved older populations or different observation periods. The lower prevalence of dietary supplement use in Chinese immigrant children in Australia than children in China is probably due to the age difference of the subjects. In Australia, most children were under three years old. It was found that older children in Australia were more likely to take dietary supplements.

The types of supplements commonly used in Chinese children in China and in Australia were quite different. In China, calcium and zinc supplements were most commonly used, with many of children taking both. Although 58.5% of supplements users were taking calcium supplementation, the average intake was still only 131 mg per day, which is about 20% of the Adequate Intake set for calcium for Chinese children in this age group(Chinese Nutrition Society, 2010). It is less than half of calcium consumption that can be provided from one serve (250 ml) of milk, besides milk can provide other nutrients like protein to support child growth(U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). A meta-analysis on randomised controlled trials reported little effectiveness of calcium supplementation on bone density in healthy children, either in childhood or later life (Winzenberg et al., 2006a). The calcium dose was of 300-1200 mg per day in nineteen studies included in the meta-analysis, which was much higher than the average calcium intake from supplements in this study (131 mg in China and 105mg in Australia). Since the level of intake of calcium supplements in China is so low, it is not possible that intake from supplements would be likely to have a positive effect on bone mineral density in Chinese children.

It has been reported in many studies that Chinese children have a low daily zinc intake(Chen et al., 1985, Penland et al., 1997). This may be due to the higher reference value used to define the adequate daily intake in those studies. The Recommended Nutrient Intakes (RNIs) for zinc for 1-7 years old Chinese children (9-13.5mg/day) are much higher than that for Japanese (5-7mg/day), Americans (3-5mg/day) and Australians and New Zealanders (3-4mg/day) (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010, Department of Health and Ageing and National Health and Medical Research Council, 2005, National Institute of Health and Nutrition, 2010, Chinese Nutrition Society, 2010). The recommended intake for Chinese children along is even higher than the upper level of zinc intakes for those age groups in Australia and New Zealand, which is 7mg/day for 1-3 years and 12mg/day for 4-8 years (Department of Health and Ageing and National Health and Medical Research Council, 2005). The 2002 China National Nutrition and Health Survey found that the median intake of zinc in 2 to 8 years Chinese children ranged from 5.1 to 7.1 mg/day (the interquartile range: 3.9-9.3 mg/day)(Ma et al., 2007). However, the adequacy of zinc intake depends not only on the amount, but also its bioavailability. People consuming a diet that provides marginal zinc intake may not absorb an adequate amount of zinc if they are also consuming foods high in phytate together with high calcium(World Health Organization, 1996). Although, the average population phytate intake of people in China (1186mg/day) is relatively high compared to their western counterparts, it also believed that Chinese diets are low in calcium, which reduces the possibility of low zinc availability(Ma et al., 2007). The elevation of calcium intake by increasing consumption of milk is not affected by the inhibitory effect of phytate because animal sources of protein in milk appears to promote zinc release from its phytate complex and also provides intrinsic zinc in a highly available form(World Health Organization, 1996). For young children from this study, their calcium intakes from calcium supplements were low and because of their young age, they still rely on milk products as their main calcium source. Considering the amount of zinc intake from their diet, they may not need to take zinc supplements. Together with the amount of zinc from supplements (ranged from 2.15mg to 8.6 mg/day), it is a concern that some children might have reached the upper level of intakes for their age. Adverse events associated with chronic intake of supplemental zinc may include suppression of immune response, decrease in high density lipoprotein cholesterol and reduced copper status(Department of Health and Ageing and National Health and Medical Research Council, 2005).

In Australia, the most popular supplements were multi-minerals and/or vitamins, which is consistent with previous studies in children and adolescents(Yoon et al., 2012, Mori, 2011). Fish oil supplements (42.3%) were almost as popular as multi-minerals and vitamins (46.2%). Few children were on calcium supplement in Australia. This might due to higher consumption of milk and milk products in Australia than in China. Commercial advertisement may also influence the choice of dietary supplement.

Herbal products are widely used both in China and by Chinese Australians. Most herbal traditional products not only have plant-derived materials or preparations, but also include animal products (including scorpions, cicadas and centipedes) and mineral compounds (including cinnabar and realgar)(Phua et al., 2009). There is a public perception that these products are inherently safe, however, the therapeutic basis of many ingredients is still not clear. Some traditional ingredients can be toxic when used for inappropriate indications, or prepared inappropriately, or used in excessive dosages, or for a prolonged duration(Levy, 2002, Haddad et al., 2005, Cupp, 1999, Phua et al., 2009). It is known that some Chinese medicines can have nephrotoxicity or hepatotoxicity effects and some cause increased risk of bleeding(Ulbricht et al., 2006, Liu, 2008, Hintelmann, 2003, Nortier and Vanherweghem, 2002). The use of herbal medicines that can produce side effects should be avoided by everyone, especially infants and young children. There is a need to increase the awareness of toxic effects of some herbal products in the public and health care professions.

11.6 Maternal perception of Chinese child's weight

There was a high prevalence of overweight and obesity in the two to four years old children from in Chengdu and Wuhan, P.R. China (16.7%), and was significantly higher than Chinese children in Perth Australia (8.0%). The prevalence rates based on the new IOTF cut-offs are extremely close to those used previously and can be compared directly with the WHO cut-offs(Cole and Lobstein, 2012). Two national studies based on the old IOTF cut-offs in China reported that the overall prevalence of overweight/ obesity was increased from 4.2% in 1989 to 7.4% in 2000 in preschool children (Luo and Hu, 2002, Liu et al., 2007). A further study using the same definition found that the prevalence of overweight and obesity in 2-18 years old children in Chongqing (n=23292) was 16.2% in 2004(Xiong et al., 2005).

The results of this study indicate a high rate of maternal misclassification of child weight status in Chinese mothers: 65.0% of underweight and 30.8% of normal weight and 89.2% of overweight/obese children. Although over-perception of underweight can lead to unhealthy dieting and eating disorders, underestimation on weight status can lead to overfeeding and may increase the risk of these children becoming overweight or obese(Lopes et al., 2013). Consequently, it is important that parents have an accurate perception of their child's weight status.

Only 10% of mothers with an overweight or obese preschool-aged child correctly classified their children as overweight. Chinese parents often lack awareness of the increasing problem of obesity and its significance as a health issue. The increasing prevalence of overweight children may have "normalised" this condition and contributed to the inability of mothers to recognise when their own child is overweight. Further, there is a traditional Chinese belief that "gaining weight and being fat means affluence" and this belief may predispose mothers to view weight gain in a positive light. Before the 1980s and the advent of the 'one child policy', Chinese women often had several children and larger infants were more likely to survive. However with the rapid changes in the amount and composition of Chinese diets and activity/inactivity patterns and the obesity levels in Chinese children rose to Western levels (Popkin, 2001a). The nutrition transition happened so rapidly that parents still kept their traditional culture beliefs while they and their children were becoming overweight or even obese.

In the present study, 75% of overweight/obese Chinese children were classified by their mothers as being of normal weight, suggesting that Chinese parents perceive a larger body size of their children to be healthy. Parents who recognise their children's weight as a health problem are more likely to take action on changing their children's lifestyle habits(Rhee and Rhee, 2005). Traditional cultural beliefs are often based in historical circumstance that may no longer be applicable. Even though public health professionals try to increase public awareness about health risks, the general public may not translate this awareness into an individual level of concern(Campbell, 2006). In the case of Chinese mothers, the level of misclassification of their perceptions of overweight and obese child deserves special consideration in relation to development of communication and other health promotion strategies.

The present findings have implications for program to reduce the prevalence of overweight and obesity among Chinese children. Parental education and involvement have been found to be critical in successful programs to change children's dietary and physical activity behaviours, and there is evidence that public education campaigns to foster such involvement among families can yield benefits for the children(Eckstein et al., 2006a). The first stage in any health promotion intervention has to be recognition of the problem, in this case recognition of the objective evidence that the child is overweight or obese and identification of contributing factors including, behavioural and environmental factors(Howat et al., 2004). Parents who understand the severity of childhood overweight/obesity and are aware that their child's weight is in the overweight or obese range, it may motivate them to consult their health care provider and take ameliorative action.

Our findings also have important implications for early childhood educators and health professionals. Regular assessment of growth, including BMI are important as a part of normal monitoring by health professionals to provide an objective measure of potential overweight or obesity(National Health and Medical Research Council, 2012). However health professional often neglect to discuss a child's obesity with the parents as it can be a sensitive topic particularly if the parents are obese(Perrin and Skinner, 2012). Other research has suggested that mothers of obese children believed that concern was not indicated if their children were otherwise happy, and there was fear of stigmatisation or blame(Jain et al., 2001, Callahan, 2013). Childhood obesity once established often carries over into adulthood and is difficult to treat. Early identification of obesity in childhood offers the best strategy for preventing disease progression with its associated comorbidities. Health professionals should support parents and provide counselling on childhood overweight and obesity.

11.7 The Health Belief Model and Chinese mothers

The Health Belief Model results show that Chinese mothers in both countries have a relatively low 'perceived susceptibility' of their children becoming overweight/obesity, with a mean score under three (2.45 in Australia and 2.71 in China). The Health Belief Model is a sequential function model that is that if a person does not perceive there is sufficient severity and susceptibility of the disease, he/she would not perceived a high threat. This would then nullify the 'perceived benefits' and 'perceived barriers' of taking health actions. The low 'perceived susceptibility' in Chinese mothers might have interrupted the sequential functioning of the model from the beginning: if the mother failed to perceive that her child was susceptible to obesity, she would not be aware of the threat from childhood obesity and, so would not take weight control action (Figure 10.1).

In addition, mothers in China and in Australia did not have enough 'cues to action' to strengthen their awareness of the threat, with mean scores just about three (3.07 in Australia and 3.11 in China). The incorrect perception of their child's weight status also shows that their cues about controlling child's weight were weak. Moreover, the 'self-efficacy' of mothers was low, which means they were not confidence in being able to affect their child's weight status. The impaired dimensions in the HBM weaken the likelihood of mothers taking preventive actions on childhood obesity, therefore, the correlations between mothers' health beliefs and their parenting behaviours were not strong. In order to carry out successful preventive campaign on childhood overweight/obesity in this Chinese population, 'perceived susceptibility', 'cues to action' and 'self-efficacy' should be enhanced.

The present findings suggest that maternal health beliefs might be an important determinant of a child's body weight development. Children with mothers who have higher 'general health motivation' (including dimensions of 'general health concern for child', 'special health practices for child' and 'mother's own general health concern') and higher 'perceived barriers' are more likely to be overweight or obese. In terms of cultural health beliefs, Chinese mothers in China seem to have health beliefs that tend to lead to obesity in their children with higher 'general health motivation', and higher 'perceived barriers' on controlling their children's weight. Although Chinese Australian mothers were more likely to be overweight or obese (21.8% in Australia and 9.3% in China, $p<0.001$), which was a significant factor for childhood overweight, with different beliefs, the prevalence of overweight in Chinese children in Australia was lower than it in China.

The result that the more Chinese mothers cared about their children's general health, the more likely their children would become overweight or obese, was contrary to our preliminary hypothesis. This may be explained by the inconsistence between maternal weight perception and the truth of the child weight status. It discussed in the Chapter two that Chinese have a culture belief that a larger child is the healthier one. Only about 10% of mothers with an overweight or obese preschool-aged child correctly recognised their children as overweight. China was considered to have one of the leanest populations in history, however, changes in diet and activity patterns are fuelling the obesity epidemic in China(Keil and Kuulasmaa, 1989, Cheng, 2004a, Popkin, 2001a). The traditional culture belief that "gaining weight and being fat means affluence" is based in historical circumstance that may no longer be true. Before the 'one child policy' applied, Chinese women normally had more than one child, and the bigger birth weight or growth children had more chance to survive. However, rapid changes in the levels and composition of Chinese diets and activity/inactivity patterns in undergoing in China (Popkin, 2001a). The transition of nutrition and life patterns happened so quickly that Chinese parents may still keep to the traditional culture belief about body size ("heavier is healthier") while their children are becoming overweight. In addition to the tradition Chinese culture belief, the increased prevalence of childhood obesity may shift the perception of what is normal and contributed to the low maternal 'perceived susceptibility' of their child becoming overweight and the inability of mothers to recognise when their own child is overweight. Ironically, mothers show higher 'general health motivation' may introduce special health practices to their families, such as the provision of special high calorie diets and thus increase the likelihood of their children being overweight. Overweight children may appear better nourished and be considered as "better eaters" by those mothers.

The findings from this study have implications for interventions to reduce the prevalence of overweight among Chinese children. Parental education and involvement is critical in successful programs to change children's dietary behaviours and physical activities, and public education campaigns to foster such involvement among families have been found to be considerable beneficial to their children(Eckstein et al., 2006a, Melbye et al., 2013). In the case of Chinese mothers, the low 'perceived susceptibility' of childhood overweight and level of misclassification of their overweight and obese child deserves special consideration in development of communication and other health promotion strategies. Once the parents perceive the likelihood of childhood overweight in their child and are aware of it when the child becomes overweight, it may motivate them to take actions to control their child's weight.

Our findings have important implications for early childhood educators, since most Chinese children were sent to kindergartens on weekdays, kindergarten staffs can educate parents about childhood overweight/obesity and its health consequences for children. School principals and teachers working with parents in promoting healthy eating and active play have been found to be critical in successful intervention programs(Pagnini, 2007). On the other hand, paediatricians and family physicians, especially those working in China, should be encouraged to provide parents counselling on childhood overweight and obesity and use the child BMI charts as a part of normal practice to provide an objective measure of weight status.

11.8 Health information sources used by Chinese mothers

While immigrants often have better health and lower hospital rates than those born in the country, the 'healthy migrant effect', there are some areas in which immigrant populations experience worse health outcomes than other segments of society(Kreps and Sparks, 2008). Optimising the health and minimising the risks to immigrants' children demands effective health communication by the parents to help them recognize, minimize, and respond effectively to potential health problems.

In this study the health information sources used by Chinese immigrant mothers for their children's health were documented. The most common lifestyle issue that Chinese mothers discussed with a health professional were issues related to child illnesses. For other health issues, such as nutrition and physical activities, Chinese mothers were most likely to seek information online. The most mentioned general health information sources of Chinese Australian mothers were the Internet (68.8%), health professionals (65.7%), 'Chinese friends or relatives living in Australia' (61.6%) and 'friends or relatives living in China' (43.0%). The results show that Chinese Australians were still living between two cultures and mainly relied on the Internet and non-professional social networks to get health information. Their non-professional social networks were dominated by Chinese relatives and Chinese friends. In the interviews, some Chinese mothers mentioned that they called their relatives or friends in China to consult them when their children had health problems. Health information they received from community health centers, clinics and other health professionals like pharmacists was limited or lacked the cultural and religious specificity to meet their needs for child health. There were also significant gaps between existing immigrant child health services and parents' needs for culturally and linguistically appropriate information.

Health information seeking practices are determined by a number of factors and an individual's search behaviour varies depending on type of information sought, reasons for searching and experience levels(Lorence et al., 2006). Consistent with the literature, online health consuming mothers tend to be more educated and have a higher household income(Atkinson et al., 2009, Fox and Duggan, 2013, Chou et al., 2009).

11.9 The incidence of illness and health services utilisation

The regularly monitoring children's health may help prevent illness or injury and promote healthy development. Consultations with health professionals may assist in many ways, including the monitoring of growth and development, avoiding lifestyle risk factors, the treatment and management illness and injury, and the maintenance of good health(Documet and Sharma, 2004, Doty and Holmgren, 2006).

The results of this study show that Chinese children in Australia were more likely to encounter difficulties with access to care compared to Chinese children in China. When the child was sick or injured, only half of the mothers in Australia had consulted health professionals while 75% mothers in China did ($p<0.001$). There was a high rate of treatment by parents using home remedies (balanced diets and other alternative medicines) in Chinese Australian children, as 45% children had not visited a doctor in the last year. Similar to their children, other studies have also found that women from China had a low utilisation of general practitioner services after immigration(Ma and Ma, 1999, Chan and Quine, 1997). The 2011–13 Australian Health Survey revealed that in 2011-12, around 20.1 million people (91.1% of the Australian population) had consulted a health professional in the last 12 months. However, only about 79% of overseas born people had visited healthcare provider in the year. Within those people who had consulted a health professional in the last 12 months, only 3.2% people born in South-East Asia(Australian Bureau of Statistics, 2013b). It has reported by the Australian Institute of Health and Welfare that Chinese was one of the lowest group in society in use of doctors in Australia(Australian Institute of Health and Welfare, 2008). Chinese immigrants' children from this study had a lower rate of health care service usage than the average usage of all immigrants, and lower than Chinese children in China.

Children's access to care may be limited by their parents' knowledge and understanding of health care needs and resources, as well as language barriers (Yu et al., 2004). "Chinese friends or relatives living in Australia" were the other most mentioned persons whom the Chinese mothers had spoken to when their child was sick. It indicates a cultural reluctance to seek help from outsiders such as health care professionals may still a barrier for Chinese immigrants.

For Chinese immigrant parents, language may be the main barrier that keeps their children from health care access. It also reported that the health care system in the new country was confusing and intimidating to some Chinese immigrants(Pang et al., 2003). The majority of the Chinese immigrants women in Brisbane thought their English was not adequate for communicating health matters with English speaking doctors(Chu, 2005). Most of Chinese women in this study reported having difficulties in understanding the health system in Australia and hadlimited access to existing health services and relevant information. Due to a lack of English proficiency and perhaps cross-cultural misunderstanding, many Chinese women in Australia were not aware of existing services available to them(Chu, 2005). According to the results from this study, they may also lack knowledge of existing services available to their children.

This study also indicated that Chinese Australian children used a mixture of different types of health care. About half of mothers (55%) had consulted with health professionals regarding their children's health during the last year. Most children (64.5%) had been given medicine brought from the local pharmacy and about 30% of them were given traditional Chinese medicine or medicine brought from China (Table 4.37). The results were consisted with other studies of Chinese immigrant women(Pang et al., 2003, Lee et al., 2000b, Ma and Ma, 1999). Most of the immigrant Chinese mothers studied had university education level (74.2%) and came from places where their health care systems were fairly well established and where their health care needs had been met successfully. They have a complex knowledge of illnesses and home remedies because they have been exposed to a uniquely modern orientation toward health care that integrates traditional Chinese medicine and Western medicine (Pang et al., 2003). This probably explains why many of them had mixed strategies for health care of their children.

This study reports the important sources of health care for the Chinese children, including traditional Chinese medicine. Many Chinese mothers used it to complement or integrate with Western medicine for their children. Therefore, health care professionals should consider patterns of use of traditional Chinese medicine, as well as other forms of alternative medicine, rather than focus only on conventional Western medicine. This will help with understanding how Chinese mothers care for their children and improve compliance with conventional therapy.

Chapter 12

Conclusions and recommendations

This chapter provides conclusions of the key findings of the study and recommendations for health promotion and further study directions are also suggested. Limitations of the study are also present in this chapter.

12.1 Conclusions

In this section, the main results of this study are summarized and conclusions are presented following the objectives of the study, which were listed in Chapter one.

12.1.1 Reliability and validity of the Chinese (simplified) version of the Iowa Infant Feeding Attitude Scale (IIFAS) (Chapter 5)

One of the objectives of this study was to translate and validate a Chinese (simplified) version of the Iowa Infant Feeding Attitude Scale (IIFAS). The simplified Chinese translation of IIFAS had a moderate level of internal consistency with a Cronbach's alpha of 0.69 for mothers in Australia and 0.55 for mothers in China. Higher IIFAS scores were significantly associated with the likelihood of both breastfeeding (OR: 3.85; CI: 2.49, 5.96; $p<0.001$) and longer ($\geqslant$8 months) breastfeeding duration (OR: 2.52; CI: 1.87, 3.40; $p<0.001$).

This is the first translation of the IIFAS into simplified Chinese. It showed that the IIFAS in simplified Chinese is a reliable and valid instrument to measure the infant feeding attitudes in Chinese population. The more positive infant feeding attitudes and longer any breastfeeding duration in Perth Chinese mother may reflect a 'healthy migrant effect'.

12.1.2 Infant feeding attitudes in Chinese mothers in China and Australia (Chapter 5)

Infant feeding attitudes in Chinese mothers in China and Australia were described and compared by the Chinese (simplified) version of the Iowa Infant Feeding Attitude Scale (IIFAS). The mean IIFAS scores in both country groups lay in the range of 'neutral breastfeeding attitudes'. Chinese mothers in Perth tended to have more positive attitudes towards breastfeeding than mothers in Chengdu (mean attitudes score=57.7±5.1, $p<0.001$) and had a longer duration of 'any breastfeeding' (10.0±6.2 months in Perth compared to 7.4±4.3 months in Chengdu, $p<0.001$).

An understanding of mothers' attitudes towards infant feeding is necessary to inform the design of effective breastfeeding promotion interventions in Chinese population. More emphasize should be put on the concept of 'overfed' and information about breastfeeding mothers who occasionally drink alcohol. More support should be provided to mothers who decide to return to paid employment. This study also revealed the lack of infant feeding information among low education attendance and/or low-household-income Chinese mothers in China. More breastfeeding education programs should be targeted in this population.

12.1.3 Breastfeeding practices in Chinese mother in China and Australia

(Chapter 6)

The breastfeeding initiation rate in Chinese Australian mothers (94.1%) was higher than it in mothers in China (86.2%, $P<0.001$). Chinese Australian mothers also had a longer breastfeeding duration, greater 'full breastfeeding' rate at 6 months and greater 'any breastfeeding' rates at 6 and 12 months. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that the location of the mother (in Australia or China) was associated with breastfeeding practices. Chinese mothers living in Chengdu were less likely to initiate breastfeeding (OR=0.47, 95%CI 0.25-0.89) and breastfeed their babies at 12 months (OR=0.48, 95%CI 0.33-0.69) than mothers in Perth.

Because of the distinctive identity of immigrants, their multi-cultural background and the integration of western and eastern culture and lifestyle, the breastfeeding practices of Chinese immigrants in Australia were different both to Chinese living in China and to other Australians. The higher breastfeeding initiation and longer breastfeeding duration in Perth Chinese mothers compared to the Chengdu mothers and/or Australian mothers in Perth also suggests that a 'healthy migrant effect' applies to breastfeeding for Chinese mothers living in Perth.

12.1.4 Prevalence of childhood obesity in Chinese pre-school children

(Chapter 7, 9, 10)

There was a high prevalence of overweight and obesity in the Chinese pediatric populations in this study (17.3% in China and 9% in Australia).

Our study revealed a high prevalence of overweight and obesity in this large sample of Chinese children. The level of overweight and obesity has increased significantly over the past two decades in China. Although Australia has a high prevalence of overweight/obesity in preschoolers (>20%), this study found a lower prevalence of overweight/obesity in Chinese preschool children in Perth than the national level. However, it identifies a high prevalence of underweight in Chinese children (22.5%) in Australia.

12.1.5 Dietary supplements use in healthy pre-school Chinese children

(Chapter 7, 8)

A total of 22.6% and 32.4% of the Chinese children were taking dietary supplements in Australia and China respectively. In China, the most commonly used dietary supplements were calcium (58.5%) and zinc (40.4%), while in Australia, the most frequently used types were multi-vitamins/minerals (46.2%) and fish oil (42.3%). In Australia, not working, never breastfed, higher education level of the mother and older age of the child were associated with dietary supplement use in children. In China, being unwell during the past month and having a higher household income were significantly related to dietary supplementation.

It is important for preschool children to meet their energy and nutrient needs for growth and development. Consuming a healthy diet is important to achieve adequate nutrient intakes. Dietary supplements only need to be considered when individuals of populations are not able to obtain an adequate nutrient status from their diet alone. A large number of healthy Chinese children both in China and in Australia use dietary supplements, which for most may not be medically indicated. Such supplements contribute significantly to total dietary intakes of vitamins and minerals, and studies of nutrition should include their assessment evaluate.

Calcium and zinc are the two most commonly used dietary supplements in young children in China, while multi-vitamin and/or minerals and fish oil are the most frequently used in Australian Chinese. The low average amount of calcium in calcium supplements in Chinese children may not have any significant health benefit to them, and milk and other dairy products are believed to be more economic and effective than taking calcium supplements. For some other nutrients such as zinc, the potential over-nutrient of taking supplement should be concerned.

There are many reports in the literature that suggest that unnecessary or reckless use of dietary supplements can lead to problems. Parents should exercise caution when giving their infants or young children dietary supplements and be aware of the potential toxicity of inappropriate use or excessive dosages. Before providing dietary supplements, parents should seek advice from appropriate health professionals. For all infants and young children wherever possible it is preferable to achieve nutrient intakes from a varied diet rather than from supplements.

12.1.6 Maternal perceptions of Chinese children's weight (Chapter 9)

The overall percentages of correct maternal perception of their child's weight were 35% in underweight children, 69.2% in normal weight children and 10.8% in overweight/obese children. Among those overweight/obese children, only 14.3% in Australia and 10.8% in China were classified as overweight/obese by their mothers. Within the group of underweight children, normal weight mothers ($p<0.004$) and mothers with older age children ($p<0.05$) were more likely to correctly classify children's weight status. A higher percentage of overweight/obese mothers ($p=0.002$) and mothers who over-estimated her own weight status ($p<0.001$) have correct perception of the weight status of their overweight/obese children, compared to their counterparts.

Our study revealed a high prevalence of incorrect maternal perception of preschool Chinese children's weight status, especially in overweight or obese children. Improved efforts to educate parents about childhood overweight/obesity and its health consequences for children in order to reduce misperceptions are important in addressing the obesity epidemic, whether in a clinical or community setting.

12.1.7 The Health Belief Model in Chinese mothers (Chapter 10)

Despite some differences in health beliefs between Chinese mothers in two countries (eg, higher 'general health motivation' and 'perceived barriers' in China), participants from both groups expressed a high general health concern for the child, high perceived severity of childhood obesity and benefits of taking weight control actions towards their child. Mean scores of 'mother's perceived susceptibility', 'self-efficacy' and 'cues to action' were relatively low in both countries compared to other Health Belief Model dimensions. There were significant associations between maternal health beliefs and mothers' child feeding behaviours or maternal support for the child's physical activities. After controlling for potential confounding variables, the results of the binary logistic regression analysis showed that maternal overweight or obese (aOR=1.68, 95% CI 1.17-2.42), maternal 'general health motivation' (aOR=2.08, 95% CI 1.31-3.32) and 'perceived barriers' on controlling the child's weight (aOR=1.56, 95% CI 1.04-2.36) were significantly associated with childhood overweight or obesity in the study sample.

Our study provided evidence that maternal health beliefs and traditional attitudes toward body shape were important determinants of a child's body weight development. The HBM helped explain the inter-relationships between beliefs and mother's parenting behaviours and could be applied to child obesity preventions in future studies. Despite mounting public concern about childhood obesity, most Chinese mothers of 2–4 year old children did not perceive that their children could be overweight or obese, did not have enough cues about controlling their children's weight, and had low self-efficacy relating to their ability of affect their children's weight. Improved efforts to understand parents' health beliefs and factors that motivate or inhibit them from taking action are imperative if we are to begin to address the obesity epidemic, whether in clinical or public health settings. Further qualitative studies in a variety of social settings are needed to fill these gaps.

12.1.8 Health information sources used by Chinese mothers (4.7, Chapter 4)

The most common lifestyle issue that Chinese mothers discussed with a health professional was related to their children's illnesses. For other health issues, such as nutrition and physical activities, Chinese mothers were most likely to search the internet. The most mentioned general health information sources of Chinese Australian mothers were the Internet (68.8%), health professionals (65.7%), 'Chinese friends or relatives living in Australia' (61.6%) and 'friends or relatives living in China' (43.0%).

This study explores the health information of Chinese immigrant mothers. It has advanced our understanding of the health information seeking behaviours of Chinese immigrants living in Perth Australia. To this group of mothers, the Internet and non-professional networks including their Chinese relatives and friends in the community played an important role in their daily life, including the use of health care resources.

12.1.9 The incidence of illness and health services utilisation of Chinese children living in Perth (4.8, Chapter 4)

The results of this study show that Chinese children in Australia were less likely to use health care services compared to Chinese children in China. The rates of health care services utilisation were lower than the average usage of the overall Australia population and lower than Chinese children in China. In relation to the method of health care service, Chinese Australian children used a mixed method of health care. About half of mothers (54.9%) had consulted with health professionals regarding their children's health during the last year. Most children (64.5%) had been given medicine brought from the local pharmacy and about 30% of them were given traditional Chinese medicine or medicine brought from China.

This study suggests that the ability of Chinese immigrant mothers to access and utilize health care for their children is limited. The health-care system will need to develop the infrastructure to provide culturally and linguistically appropriate care. This may include providing trained medical interpreters and a more diverse health care services, and training health providers to consider the social and cultural context of health when caring for patients. In addition, the common use of home remedies and mixed of Eastern and Western health care strategies in Chinese children requires that professionals of all types be aware of, and able to evaluate, such behaviours during their health care interactions.

12.1. 10 Summary of the conclusions

This was the first reported cohort study on Chinese immigrants' health beliefs, behaviours and information sources regarding their children's health. This study provides information on Chinese immigrant mothers' health beliefs, child feeding attitudes and behaviours, health information sources, as well as illness rate and health services utilisation of their children. It has advanced our understanding of Chinese mother's health beliefs, child feeding attitudes and behaviours, Chinese immigrants' health information seeking behaviours and factors that motivate or inhibit Chinese mothers from taking actions on promoting their children's health.

Most importantly, this study has shown that the breastfeeding practices of Chinese migrant in Australia are different to Chinese living in China and to other Australians. It provided evidence of a 'healthy migrant effect' in breastfeeding practices as Chinese mothers in

Australia have higher breastfeeding initiation and longer duration than mothers in China. The child feeding behaviours and beliefs of Chinese immigrant mothers in Australia were different to Chinese mothers living in China. Further qualitative and quantitiative studies are required to discover the other health behaviours of Chinese immigrants and the health consequences of immigration to children.

Other important findings of this study include that maternal health beliefs and traditional attitudes toward body shape are important determinants of a child's body weight development. Despite mounting public concern about childhood obesity, there was a high prevalence of incorrect maternal perception of preschool children's weight status in Chinese mothers, especially those with overweight or obese children. Improved efforts to educate parents about childhood overweight/obesity and its health consequences for children in order to reduce misperceptions are imperative.

In addition, the results showed that Chinese Australians were still living between Chinese and Western cultures and mainly relied on the Internet and non-professional social networks to get health information. The Australian health-care system needs to further develop the infrastructure to provide culturally and linguistically appropriate care to Chinese immigrant children. Finally, the common use of home remedies, dietary supplements and mixture of different types of health care in Chinese children requires that professionals of all types be aware of, and able to evaluate, such behaviours during their health care interactions.

12.2 Limitations

There are several limitations that need to be considered when interpreting the results of the present study.

Firstly, the study undertaken in China and the baseline survey of the Perth cohort are cross sectional studies and are subject to recall bias, but this applies to both samples in Australia and China. Because of the possibility of recall bias, we did not measure exclusive breastfeeding in this study, instead, we use the term 'full breastfeeding' where an infant may also receive small amounts of culturally valued supplements—water, water-based drinks, fruit juice, or ritualistic fluids(Binns et al., 2009). Although it also has the potential of recall errors, the use of 'full breastfeeding' is less likely to be misleading.

Secondly, the number of Perth mother and child pairs was smaller than that for mother and child pairs in China. Statistically it may bring some bias to the study when comparing variables between two countries. Because the number of overweight children in the "Australian" group is relatively small, some of the multivariable analyses could not be applied in this group. Additional research with larger samples is needed to gain a more complete understanding of effects of maternal health beliefs, education, BMI and children's age in perceiving child overweight status in Chinese immigrants.

The age distribution of the subjects from two countries in this study was slightly different and this may have a small influence on the results.

Our results may not be representative of all Chinese children in China or in Australia because of the location of the sample and the number of subjects. Researchers should cautiously make inferences about the whole Chinese population. It would also be desirable to identify datasets for analysis that include additional relevant variables such as child diet and activities.

Another limitation of this study is that the height and weight of mothers China were self-reported and it is known that women may underestimate their weight status (Yun et al., 2006). This may partly explain the lower prevalence of overweight and obesity in mothers from China than their counterparts. However, those limitations do not affect the main results of the study like maternal perceptions of children's weight status. Future studies should investigate factors of wrong parental weight assessment and effective strategies for increasing parents' awareness of their child's weight status.

Nevertheless we believe our present study to be important for understanding the health beliefs, behaviours of Chinese immigrant mothers and in monitoring the health of Chinese pre-school children overseas.

12.3 Recommendations

The comparison study of the infant feeding attitudes in Chinese immigrant mothers and Chinese mothers in their homeland shows the IIFAS in simplified Chinese is a reliable and valid instrument to measure the infant feeding attitudes in these Chinese populations. The infant feeding attitudes of Chinese mothers point out a lack of support for breastfeeding in the workplace, an absence of information about breastfeeding and drinking alcohol, and an unawareness of "overfeeding" in Chinese mothers. Future projects promoting breastfeeding in Chinese women should include information on the "overfeeding" infants, breastfeeding and drinking alcohol and on providing more support for mothers in the workplace.

It is important for preschool children to meet their energy and nutrient needs for growth and development. Consuming a healthy diet is important to achieve adequate nutrient intakes. Dietary supplements only need to be considered when individuals of populations are not able to obtain an adequate nutrient status from their diet alone. A large number of healthy Chinese children both in China and in Australia use dietary supplements, which for most may not be medically indicated. Such supplements contribute significantly to total dietary intakes of vitamins and minerals, and studies of nutrition should include their assessment evaluate.

Breastmilk provides adequate calcium to meet the needs of all full-term infants. There is no need to recommend giving calcium supplements to infants who are exclusively breastfed or formula fed. Achieving adequate calcium is important in maximizing bone accretion during growth, preventing child rickets, and perhaps preventing fragility fractures in childhood or even preventing future osteoporosis. For all weaning infants and young children, calcium intake from calcium-rich foods especially from dietary sources should be encouraged at home, schools, and by parents, paediatricians, dietitians and by other health professionals. Current evidence from recent studies does not support the general use of calcium supplementation in healthy young children as a public health intervention. However, given that infancy and childhood are critical periods for the acquisition of bone mass, if adequate calcium cannot be achieved through food sources, supplementation is a useful alternative. In the case of Chinese young children, the low average amount of calcium in calcium supplements in Chinese children may not have any significant health benefit to them, and milk and other dairy products are believed to be more economic and effective than taking calcium supplements.

For some other nutrients such as zinc, the potential over-nutrient of taking supplement should be concerned. There are many reports in the literature that suggest that unnecessary or reckless use of dietary supplements can lead to problems. More studies related to the clinical effectiveness and/or safety of dietary supplements in infants and children are required, especially over the longer term. There is also a need to increase the awareness of toxic effects of some herbal products in the public and health care professions. Because little data are available in this area, we suggest that parents exercise caution when giving their infants or young children dietary supplements. Before providing dietary supplements for them, parents should communicate with health professionals, such as pediatric doctors or dietitians.

Wherever possible it is preferable to achieve nutrient intakes, including calcium from a varied diet rather than from supplements.

Mothers' willingness to make the lifestyle changes necessary to help their children lose weight plays a major part in most successful childhood obesity interventions (Rhee and Rhee, 2005). It is important that motherss have an accurate perception of their children's weight status. In the case of Chinese mothers, the level of misclassification of their overweight and obese child deserves special consideration in relation to development of communication and other strategies. Parental education and involvement have been found to be critical in successful programs to change children's dietary and physical activity behaviours, and there is evidence that public education campaigns to foster such involvement among families can yield benefits for the children (Eckstein et al., 2006a). The first stage in any health promotion intervention has to be recognition of the problem, in this case recognition of the objective evidence that the child is overweight or obese and identification of contributing factors including, behavioural and environmental factors (Howat et al., 2004). Once the parents understand the severity of childhood overweight/obesity and are aware that their child's weight is in the overweight or obese range, it may motivate them to consult their health care provider and take ameliorative action.

Our findings also have important implications for early childhood educators, school principals and teachers, pediatricians and family physicians, especially those working in China. Since most Chinese children were sent to kindergartens on weekdays, kindergarten staffs can help parents improve recognition of unhealthy weight of children and should work with parents to solve the problems. School principals and teachers working with parents in promoting healthy eating and active play have been found to be critical in successful intervention programs (Pagnini, 2007).

The charting of child BMI should be encouraged as a part of normal practice for health professionals to provide an objective measure of weight status. However, only a few of physicians even mention a child's obesity to the parents (Perrin and Skinner, 2012). It is a sensitive topic particularly if the parents are obese or resistant to talk. Other research has suggested that mothers of obese children believed that concern was not indicated if children were otherwise happy, and that there was a fear of stigmatisation or blame (Jain et al., 2001, Callahan, 2013). Childhood obesity once established often carries over into adulthood and is difficult to treat. Early identification of obesity in childhood offers the best hope for preventing disease progression with its associated comorbidities. Health professionals should support parents and provide counselling on childhood overweight and obesity.

Knowledge, attitudes, and beliefs about obesity for Chinese immigrant morthers may have important implications for prevention. Prevention or treatment messages that fail to acknowledge such cultural differences are unlikely to achieve success. Despite mounting public concern about childhood obesity, most Chinese mothers of 2–4 year olds did not perceive high susceptibility of their children being overweight or obese, did not have enough cues about controlling their children's weight, and had low self-efficacy relating to their ability of affect their children's weight. Improved efforts to discern parents' health beliefs and factors that motivate or inhibit them from taking action are imperative if we are to begin to address the obesity epidemic, whether in clinical or public health settings. Further qualitative studies in a variety of social settings are needed to fill these gaps.

Because more than half of Chinese mothers consulted their families and friends on their child's health, future studies should focus on members of the non-professional networks and examine their perceptions, practices, and opinions about optimal health care for their children.

Finally, there are policy and practice implications regard to issues of language and cultural competency for Chinese immigrants. As Chinese immigrant mothers in our study rely heavily on the Internet to gain health information for themselves and their families, we suggest the official website of health department provide multi-language health information online for those immigrants from non-English speaking countries. Besides, as a way to improve access to health care providers, information on health services can be provided in Chinese-language newspapers, magazines, and television. Public education campaigns could be designed in Australia to educate Chinese parents the right perception of child weight, to promote physical activity in Chinese mothers and their children, and deliver the knowledge of how to use health services for their children.

We suggest that cultural competency training for physicians and other health service personnel is needed to improve communication with immigrant patients. As much as possible, bilingual clerical staff should be available to provide direct service or translation for Chinese clients. In addition, because of the common use of home remedies and mixed health care method, health professionals need to have more knowledge of complementary and alternative medicine, and be able to guide Chinese parents on their proper use, especially when used in combination with Western medical remedies.

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Appendices

Appendix 1 Ethics approval letters

Curtin University

Memorandum

To	Professor Colin Binns, Public Health
From	A/Prof Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 96/2010**
Date	3 November 2010
Copy	Dr Shu Chen, Public Health Graduate Studies Officer, Faculty of Health Sciences

Office of Research and Development

Human Research Ethics Committee

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Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*A cohort study of health beliefs, behaviours and information sources of Chinese mothers and their children living in Perth*". Your application has been reviewed by the HREC and is **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 96/2010.** *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **02-11-2010** to **02-11-2011**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **02-11-2011.**
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 96/2010). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards,

A/Professor Stephan Millett
Chair Human Research Ethics Committee

Curtin University

Memorandum

To	Professor Colin Binns, Public Health
From	Miss Linda Teasdale, Manager, Research Ethics
Subject	Protocol Extension Approval **HR 96/2010**
Date	19 September 2011
Copy	Dr Shu Chen, Public Health, Public Health Graduate Studies, Faculty of Health Sciences

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report and indication of modifications / changes for the project *"A COHORT STUDY OF HEALTH BELIEFS, BEHAVIOURS AND INFORMATION SOURCES OF CHINESE MOTHERS AND THEIR CHILDREN LIVING IN PERTH"*. Your application has been ***approved***.

The Committee notes the following amendments have been approved:

1. We will add a cross section study in Chengdu, China for comparison. The questionnaire for China study will be the same as we used in Perth except cancelling few questions e.g., years of staying in Australia and form of information sources in Perth.

Approval for this project is extended for the year to **02-11-2012.**

Your approval number remains **HR96/2010**. Please quote this number in any further correspondence regarding this project.

Please note: An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Thank you.

Miss Linda Teasdale
Manager, Research Ethics
Office of Research and Development

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SAGE

Title: Breastfeeding by Chinese Mothers in Australia and China:The Healthy Migrant Effect

Author: Shu Chen, Colin W. Binns, Yun Zhao, Bruce Maycock, Yi Liu

Publication: Journal of Human Lactation

Publisher: SAGE Publications

Date: 05/01/2013

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May 17, 2013

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Chen, S., C. W. Binns and B. Maycock, et al. (2013). "Attitudes towards breastfeeding - the Iowa Infant Feeding Attitude Scale in Chinese mothers living in China and Australia." *Asia Pac J Clin Nutr* 22(2): 266-269

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Signed:

Name: Mark L Wahlqvist

Position: Editor-in-Chief

Date: 17th May 2013

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SAGE

Title: The Importance of Definition in Diagnosing Obesity:A Review of Studies of Children in China

Author: Shu Chen, Colin W. Binns, Yuexiao Zhang

Publication: ASIA-PACIFIC JOURNAL OF PUBLIC HEALTH

Publisher: SAGE Publications

Date: 03/01/2012

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Appendix 3 Information letter and consent form

CURTIN UNIVERSITY OF TECHNOLOGY, PERTH, AUSTRALIA

Study of the Health, Health Beliefs and Information Sources of Chinese Mothers and their Children

The School of Public Health at Curtin University is studying health patterns and information sources of Chinese mothers and the ways these influence their children's nutrition and health behaviours. As part of this project, Chinese mothers with at least one child aged 1 to 5 years living in Perth will be interviewed on 5 occasions over a 12 month period. We would like to record your and the child's height and weight twice during this study. A SMS will be sent to you every 2 weeks asking about any illness experienced by your child. The research will help us to plan better health programs for the Chinese community living in Australia. If you are able to help us with our research, please sign the consent form below and provide us with your name, address and telephone number.

Thank you in anticipation of your assistance.

Yours sincerely

Shu Chen
PhD Candidate
School of Public Health
Curtin University of Technology
GPO Box U1987
Perth WA 6845
Tel: 0422216787
July 2010

Colin Binns
Professor of Public Health
Curtin University of Technology
GPO Box U1987
Perth WA 6845
Tel: 9266-4341 or 0401 103 639
Fax: 9266-2958
July 2010

_ _

Curtin University Health Belief, Behaviours and Information Sources Study - Consent Form

I agree to participate in the study of health beliefs, behaviours and information sources. I understand that my participation is completely voluntary and I may withdraw from the study at any time. I understand that my participation will be limited to completing a few questionnaires during a period of twelve months. I understand that all interviewers working on the study are qualified health professionals and that all individual data will be kept strictly confidential.

____________________________ _____________________
Signature Date

____________________________ _____________________
Name (please print) Email

____________________________ _____________________
Mobile 1 Mobile 2/telephone number

____
Address

Appendix 4 Baseline questionnaire in Perth (English version)

A cohort study of health beliefs, behaviours and information sources of Chinese mothers and their children living in Perth

Dear Mother

We know this questionnaire will take a little time, but it will help us understand important health issues in the Chinese community in Perth. Your individual information will be kept confidential. We will only use information from the group answers to help improve health services in WA.

Thank you so much for your cooperation!

Yours sincerely,

Shu Chen

Curtin University of Technology

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University of Technology
Western Australia

-- *Office use only* ------------------------------

ID: ________________________

Complete date: ________________________

Mother's weight without shoes and only light clothing _____ (kg), height without shoes_____ (cm)

Child's weight without shoes and only light clothing _______ (kg), height without shoes_____ (cm)

Your name: ____________ Address: ______________________________________

Mobile 1: ______________ Mobile 2/telephone: ______________

Email address: ____

Your birthplace: ______________(state or province)_______________(country)

Years of Australia residency: ______year and _____months

Where do you get most of your health information from?

1. Which **health information sources** do you usually use for you and your child **since living in Perth**? (Tick **<u>ONE OR MORE boxes</u>** for each information type)

Table1. the health information sources of Chinese mothers living in Perth

Information type	news paper or brochure	online	movies/ TV	Chinese friends or relatives living in Australia	non-Chinese friends or relatives	friends or relatives living in China	physicians	other (please indicate
general health								
nutrition								
physical activities								
when your child is sick								

2. Which source is the **main health information source** for you and your child **since living in Perth**? (Tick **<u>ONLY ONE box</u>** for each information type)

Table2. the main health information source of Chinese mothers living in Perth

Information type	news paper or brochure	online	movies/ TV	Chinese friends or relatives living in Australia	non-Chinese friends or relatives	friends or relatives living in China	physicians	other (please indicate
general health								
nutrition								
physical activities								
when your child is sick								

Mother's physical activity

3. In a normal week do you do **vigorous activities** (take hard physical effort and make you breathe much harder than normal. e.g. jogging and running, fast cycling or cycling on hills, fast swimming, aerobics, moving heavy furniture)?

   1. yes 2. no (skip to Q7)

4. How many times do you do **vigorous activities** in a normal week?

___________ times/week

5. On average, how many hours do you do **vigorous activities** in each time?

___________hours

6. In a normal week do you do **moderate intensity activities** (make you breathe somewhat harder than normal and increase your heart rate, e.g. paced cycling, swimming, slow jogging, playing table tennis)?

1. yes 2. no (skip to Q9)

7. How many times do you do **moderate intensity activities** in a normal week?

___________ times/week

8. On average, how many hours do you do **moderate intensity activities** each time?

___________ hours

9. On average, how many hours in a day do you spend in **walking in different places** (including walking at work, to and from work, running errands and leisure, etc.)?

__________ hours/day

10. On average, how many hours in a day do you spend in sitting activities (including sitting in a car or bus, sitting at work, watching TV, sitting at meals, etc.)?

__________ hours/day

Child feeding experience

11. Your weight gain during the most recent pregnancy:

____________kg

12. Did you smoke while pregnant？

1. yes 2. no

13. Did you smoke while breastfeeding?

1. yes 2. no

14. Did you drink alcohol while pregnant?

1. yes 2. no

15. Did you drink alcohol while breastfeeding?

1. yes 2. No

16. Whether this child ever breastfed?

1. yes 2. no

17. Whether the child currently being breastfed?

1. yes 2. no

18. How long for exclusive breastfeeding? (Nothing but breastmilk)

_______________months

19. How long for any breastfeeding (till now if you are still breastfeeding your child)?

_______________months

20. What is the main reason you stopped breastfeeding？

1. child grow old enough to eat adult food
2. did not have enough breastmilk (How did you know this?__________________________)
3. nipple problems (What is the problem? ___________________________)
4. breast problems (What is the problem? ____________________________)
5. return to work
6. baby sick (Name of the disease ____________________________)
7. mother tired
8. mother sick (Name of the disease _____________________________)
9. other reasons (please specify) ____

21. Whether the child ever given infant breastmilk substitutes regularly?

1. yes 2. no (skip to Q 23)

22. Which breastmilk substitutes do you give to your child regularly? (you can choose more than one options)

1. infant formula 2. cow's milk 3. other _______(please indicated)

23. Age of the child first given infant breastmilk substitutes regularly?

________months old

24. Age of this child when first given solid food?

________months old

25. Compared to other people of your age, would you say your health is?

1. poor 2 3 4 5.excellent

Iowa Infant Feeding Attitude Scale

For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion (1=strong disagreement [SD], 2=disagreement [D], 3=neutral [N], 4=agreement [A], 5=strong agreement [SA].) You may choose any number from 1 to 5.

Table 3. Iowa Infant Feeding Attitude Scale

statements	SD	D	N	A	SA
26. The benefits of breastfeeding last only as long as the baby is breast fed.	1	2	3	4	5
27. Formula feeding is more convenient than breastfeeding.	1	2	3	4	5
28. Breastfeeding increase mother infant bonding.	1	2	3	4	5
29. Breastmilk is lacking in iron.	1	2	3	4	5
30. Formula fed babies are more likely to be overfed than breastfed babies.	1	2	3	4	5
31. Formula feeding is the better choice if the mother plans to go back to work.	1	2	3	4	5
32. Mothers who formula feed miss one of the great joys of motherhood.	1	2	3	4	5
33. Women should not breastfeed in public places such as restaurants	1	2	3	4	5
34. Breastfed babies are healthier than formula fed babies.	1	2	3	4	5
35. Breastfed babies are more likely to be overfed than formula fed babies.	1	2	3	4	5
36. Fathers feel left out if a mother breastfeeds.	1	2	3	4	5
37. Breastmilk is the ideal food for babies	1	2	3	4	5
38. Breastmilk is more easily digested than formula.	1	2	3	4	5
39. Formula is as healthy for an infant as breastmilk	1	2	3	4	5
40. Breastfeeding is more convenient than formula.	1	2	3	4	5
41. Breastmilk is cheaper than formula.	1	2	3	4	5
42. A mother who occasionally drinks alcohol should not breastfeed	1	2	3	4	5

her baby.	

Child Feeding Questionnaire

43. When your child is at home, how often are you responsible for feeding her/him?

    1. never   2. seldom   3. half of the time   4. most of the time   5. always

44. How often are you responsible for deciding what your child's portion sizes are?

    1. never   2. seldom   3. half of the time   4. most of the time   5. always

45. How often are you responsible for deciding if your child has eaten the right kind of foods?

    1. never   2. seldom   3. half of the time   4. most of the time   5. always

What do you think about your weight and your child's weight?

Please indicate what do you think you and your child's weight by circling the number that most closely corresponds to your opinion (1= Markedly underweight [MU], 2= Underweight [U], 3= Normal [N], 4=Overweight [O], 5=Obesity [OB].) You may choose any number from 1 to 5.

Table 4. mother's evaluation of her and her child's weight

	MU	U	N	O	OB
46. Your weight in your childhood (0-12 years)	1	2	3	4	5
47. Your weight as a teenager (13-19 years)	1	2	3	4	5
48. Your weight in your 20s	1	2	3	4	5
49. Your current weight	1	2	3	4	5
50. Your child's current weight	1	2	3	4	5

51. How concerned are you about your child eating too much when you are not around him or her?

    1.unconcerned 2 3 4 5. very concerned

52. How concerned are you about your child having to diet to maintain a desirable weight?

    1.unconcerned 2 3 4 5. very concerned

53. How concerned are you about your child becoming overweight?

    1.unconcerned 2 3 4 5. very concerned

Do you have any restrictions or put any pressure to the child on his/her eating behaviours?

For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion (1=Strong disagreement [SD], 2=Disagreement [D], 3=Neutral [N], 4=Agreement [A], 5=Strong agreement [SA].) You may choose any number from 1 to 5.

Table 5. restrictions and pressure on the eating behaviours of the child

	SD	D	N	A	SA
54. I have to be sure that my child does not eat too many sweets (candy, ice cream, cakes or pastries).	1	2	3	4	5
55. I have to be sure that my child does not eat too much high-fat foods.	1	2	3	4	5
56. I have to be sure that my child does not eat too much of her/his favourite foods.	1	2	3	4	5
57. I intentionally keep some foods out of my child’s reach.	1	2	3	4	5
58. I offer sweets (candy, ice cream, cakes or pastries) to my child as a reward for good behaviour.	1	2	3	4	5
59. I offer my child her favourite foods in exchange for good behaviour.	1	2	3	4	5
60. If I did not guide or regulate my child’s eating, she/he would eat too much of her favourite foods.	1	2	3	4	5
61. My child should always eat all of the food on her plate.	1	2	3	4	5
62. I have to be especially careful to make sure my child eats enough.	1	2	3	4	5
63. If my child says “I’m not hungry”, I try to get him/her to eat anyway.	1	2	3	4	5
64. If I did not guide or regulate my child’s eating, she/he would eat much less than she/he should.	1	2	3	4	5

65. How much do you keep track of the sweets (candy, ice cream, cakes, pies and pastries) that your child eats?

1. never 2. rarely 3. sometimes 4. mostly 5. Always

66. How much do you keep track of the snack food (e.g. potato chips, Doritos, cheese puffs) that your child eats?

1. never 2. rarely 3. sometimes 4. mostly 5. Always

67. How much do you keep track of the high-fat foods that your child eats?

1. never 2. rarely 3. sometimes 4. mostly 5. always

Encouragement of Physical Activity (PA), Participation in PA, Instrumental Support for PA

68. How often during a typical week do you encourage your child to participate in physical activities?

_________ days/ week

69. How often during a typical week do you participate in physical activities with your child?

_________ days/ week

70. How often during a typical week do you provide transportation to where the child can be physically active?

_________ days/week

Health beliefs

71. How concerned are you about your child's health? (circle the number you think fit your concern degree)

1. not at all 2 3 4 5. completely

72. How concerned are you about the possibility of your child getting sick? (circle the number you think fit your concern degree)

1. not at all 2 3 4 5. completely

73. Do you ever buy special foods to improve or protect your family's health?

1. yes 2. no

74. Besides things involving food, do you do any special things to help keep your child well?

1. yes 2. no

75. Some people are quite concerned about health, while others are not as concerned. How concerned are you about your own health? (circle the number you think fit your concern degree)

1. not at all 2 3 4 5. completely

76. Some people are quite concerned about the chance of getting sick, while others are not as concerned. How concerned are you about the chance of getting sick? (circle the number you think fit your concern degree)

1. not at all 2. 3 4 5 .completely

77. Balancing my child's intake of "hot" and "cold" (yin and yang) foods can benefit the health of her/him.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

78. Moderate exercise can protect my child from getting sick.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

79. If your child is kept closely on the special diet, it will help the problem of obesity.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

80. How difficult would you say it will be for you to do something to keep your child healthy?

1. impossible 2. 3 4 5. not a problem at all

81. Foods without rich sauces are extremely tasteless.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

82. Sometimes I worry that going on a diet can cause health problems.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

83. How confident are you that you can influence your child's dietary behaviour?

1. extremely 2. 3 4 5. not at all

84. How confident are you that you can influence your child's physical activity?

1. extremely 2. 3 4 5. not at all

85. There isn't much anyone can do about how much he/ she weights.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

86. How easily would you say your child getting sick?

1. not at all 2. 3 4 5. very easily

87. When your child grows up, how much chance do you feel there is that he/she will be overweight?

1. not at all 2. 3 4 5. completely

88. Suppose your child was to become overweight, how much do you think you would be worry about it?

1.not at all 2. 3 4 5. completely

89. How much would you say your child's weight problem interferes with his/ her normal activities?

|---------|---------|---------|---------|

1. not at all 2. 3 4 5. completely

90. When I read about any disease, I start worrying about the chances of my child getting it.

    1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. Agree

91. When I read about people who have obesity related disease (e.g. heart disease, diabetes), I start worrying about the chances of my child getting it.

    1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

Could you please tell me more about your Child?

92. The gender of the child: 1. male 2. female

93. Where born : ____________

94. Ethnicity : ___________

95. Date your baby was born (DD/MM/YY) : ___ ___ / ___ ___ / ___ ___

96. Birth weight of the child ___________(kg), length _________(cm)

97. Delivery method :

    1. vaginal delivery 2. caesarean section

Children Physical Activity

98. How much time each day does your child usually spend in bed either sleeping or lying there, including nighttimes?

    __________ hours. If "don't know", tick the box here ☐

99. Does your child do any regular physical exercises (e.g., running, using playground equipment, playing soccer, swimming or other sports) in preschool facilities, athletic schools, or at home?

    1. yes 2. no (skip to Table 6) 3. don't know (skip to Table 6)

100. How many hours does your child spend doing physical exercises each week?

    __________ hours. If "don't know", tick the box here ☐

Please answer questions about each activity in Table.

Table 6. sedentary activities for children under age 6

Activity type	Does your child participate in this activity?	How much time does your child spend during a typical day? (hours: minutes) If "don't know", record 00:00.	
		Monday-Friday	Saturday-Sunday
101. TV	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
102. Watch videos, VCD, DVD	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
103. Video games	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
104. Surfing the internet	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
105. Participating in chat rooms	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
106. Playing computer games, etc.	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
107. Reading (books, newspapers and magazines), writing, drawing	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
108. Toy cars, puppets, board games	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐

Use of health care and medical services

109. <u>During the past 4 weeks</u>, has your child been sick or injured? Does your child suffer from any disease?

1. yes   2. no   3. don't know

110. Have you noticed any of these symptoms of your child during <u>the past 4 weeks</u>?

1) fever, sore throat, cough	1. yes	2. no	3. don't know
2) diarrhea, stomachache	1. yes	2. no	3. don't know
3) headache, dizziness	1. yes	2. no	3. don't know
4) joint pain, muscle pain	1. yes	2. no	3. don't know
5) rash, dermatitis	1. yes	2. no	3. don't know
6) eye/ear disease	1. yes	2. no	3. don't know
7) heart disease/chest pain	1. yes	2. no	3. don't know
8) other infectious disease (specify:____________)	1. yes	2. no	3. don't know
9) other noncommunicable disease (specify:____________)	1. yes	2. no	3. don't know
10) bruising	1. yes	2. no	3. don't know
11) bleeding, injury (by what reason: ____)	1. yes	2. no	3. don't know

If no symptoms or injury, skip to Question 120. Otherwise, ask Question 112-119 about the most recent illness or injury. Then answer Question 120.

111. How severe was the illness or injury?

1. not severe   2. somewhat severe   3. quite severe

112. For how many days <u>during the past 4 weeks</u> was your child unable to carry out normal activities due to this illness or injury?

_________ days. If "don't know", tick the box here ☐

113. What did you do when your child was not well or injured?

1. care for him/her by yourself
2. ask for help or advices from Chinese relatives or friends living in China
3. ask for help or advices from Chinese relatives or friends living in Australia
4. ask for help or advices from non-Chinese relatives
5. saw a doctor (clinic, hospital)
6. saw other health professionals

114. Did you give any kind of medication to your child for this illness?

1. Chinese traditional （patent）medicine
2. Western medicine brought from China
3. Western medicine brought in Australia
4. none
5. other__________

115. Did you seek care from a formal medical provider for your child's illness or injury during the past 4 weeks?

1. yes   2. no (skip to Q120)

116. Where did your child see a doctor when your child was sick or injured?

1. at home
2. private clinic (GP)
3. local hospital
4. other (specify:_______)
5. don't know

117. Was it an outpatient or inpatient visit?

1. outpatient (skip to Question 120)   2. inpatient

118. For how many days during the past 4 weeks were your child or have your child been hospitalized?

________ days.

119. What was the doctor's diagnosis of your child's illness or injury?

____

Could you tell me more about yourself?

120. Your current age: ______

121. Educational attainment：

1. high school diploma or less
2. TAFE certificate/diploma
3. university degree or higher

122. marital status：

1. married / de facto   2. separated / devoiced   3. single / widow

123. working status:

1. full-time work   2. part-time work   3. casual   4. not employed

124. What is your yearly household income (before tax) from all sources (including pension, allowances, financial support from parents/others)?

1. Less than $20,000
2. $20,001 to $40,000
3. $40,001 to $70,000
4. $70,001 to $100,000
5. More than $100,000

Children's diet

24 Hour Food Record

Please record all of the food and drink eaten by this child within the 24 hour period. Please try not to forget any drinks or foods eaten between meals. Please include all of the drinks consumed, including water, juice, milk and soft drinks.

Please remember to list as much detail as possible; record brand names where you know them. Serve sizes (portion sizes) are important - please give us as much detail as you can. We would like you to think about a 250 ml measuring cup to give us an indication of size e.g. mashed pumpkin and potato – half cup.

BEFORE BREAKFAST

Time	Food / Drink	Description, Preparation	Amount

BREAKFAST

Time	Food / Drink	Description, Preparation	Amount

MID-MORNING- between breakfast time and lunch time

Time	Food / Drink	Description, Preparation	Amount

LUNCH

Time	Food / Drink	Description, Preparation	Amount

AFTERNOON TEA- between lunch and dinner

Time	Food / Drink	Description, Preparation	Amount

EVENING MEAL

Time	Food / Drink	Description, Preparation	Amount

LATER EVENING- and through the night

Time	Food / Drink	Description, Preparation	Amount

Please list any medication, vitamins, minerals or food supplements and when they were taken		
Brand	Name (in full)	Number : pills, capsules, teaspoons

Appendix 5 Baseline questionnaire in Perth (Chinese version)

生活在珀斯的华人母亲和小孩的健康信念、行为和信息来源队列研究

您好！

感谢您对“生活在珀斯的华人母亲和小孩的健康信念、行为和信息来源的队列研究”的支持。我们了解此问卷将会耽误您一些时间，但是这将帮助我们理解生活在珀斯的华人的健康问题，以便为您和您的小孩设计更好的健康促进方案。

非常感谢您的合作！

您真诚的，

陈舒

Curtin University of Technology

---------------------------------- *调查人员填写* --------------------------------

编号: ____________________________

招募时间: ____________________________

仅穿轻薄衣物和脱掉鞋子时的重量 _______ *(kg)，脱鞋后的身高* __________ *(cm)*

小孩穿轻薄衣物和脱鞋后的的体重 _______ *(kg)，脱鞋后的身高* __________ *(cm)*

您的基本信息

请圈出与您的情况相符合的选项或在横线上填写您的情况

母亲姓名：____________ 住址：______________________________________

手机：______________________________ 电话：____________________________

电子邮箱：____

您的出生地：____________(国家) ____________ (省/自治区)

您在澳洲居住的时间：______年又_____月

您的健康信息来源

请在表格里打勾，选出您所采用的信息来源。

1. 到珀斯居住以来，您是通过哪里渠道获得您和你小孩的健康信息**(可多选项)**？

表 1. 珀斯华人妈妈的健康信息来源

信息类型	报纸或传单	网络	电视	珀斯的华人朋友	非华人朋友	在中国的亲戚朋友	医生	其他（请指明）
一般健康信息								
营养								
运动								
孩子生病时								

2. 以下哪种信息渠道是您到珀斯居住以来，获得健康信息的**主要渠道(单选)**？

表 2. 珀斯华人妈妈的主要健康信息来源

信息类型	报纸或传单	网络	电视	珀斯的华人朋友	非华人朋友	在中国的亲戚朋友	医生	其他（请指明）
一般健康信息								
营养								
运动								
孩子生病时								

您的运动量

3. 您平常是否参加一些**剧烈运动**（让你很费劲并且会呼吸急促的运动，如跑步，快速骑自行车或骑自行车上坡，快速游泳，健身操，篮球，排球，搬运重物）？

   1. 是　　　　　2. 否（跳至 6 题）

4. 平均来说，您一周有几次做**剧烈运动**？

   ________次/周

5. 平均来说，您每次会花多长时间做**剧烈运动**？

________分钟/次

6. 您是否参加一些**中等强度的运动**（让你呼吸和心跳比平常加快的运动，如骑自行车，慢跑，游泳等）？

1. 是　　　　　　　　2. 否（跳至 9 题）

7. 平均来说，您一周有几次做**中等强度运动**？

________次/周

8. 平均来说，您每次会花多长时间做**中等强度运动**？

________分钟/次

9. 平均来说，您每天要花多少时间**走路**（包括在工作中，上下班，跑腿，散步等）？

__________小时/天

10. 平均来说，您一天要花多少时间**坐着**（请包括坐在车里，坐着工作，看电视，坐着吃饭）？

__________小时/天

围产期健康，母乳喂养和您的健康自我评述

11. 您怀这个孩子时的体重增加是多少？

____________kg

12. 您在怀孕期间吸烟吗？

1. 是　　　　　　　　2. 否

13. 您在哺乳期间吸烟吗?

1. 是　　　　　　　　2. 否

14. 您在怀孕期间喝酒吗?

1. 喝　　　　　　　　2. 不喝

15. 您在哺乳期间喝酒吗?

1. 喝　　　　　　　　2. 不喝

16. 您的小孩是否母乳喂养过?

1. 是　　　　　　　　2. 否 （跳至 21 题）

17. 目前您的小孩还在喂母乳吗?

1. 是　　　　　　　　2. 否

18. 完全母乳喂养（除了母乳什么也不喂）的时间？

________月

19. 喂养母乳的总时间（如果您仍在母乳喂养，则回答到至今的时间）

_______________月

20. 停止/未能母乳喂养的原因？

1. 孩子大了
2. 奶不够　　（如何做出判断的？______________________________）
3. 乳头问题　（具体问题是？______________________________）
4. 乳房问题　（具体问题是？______________________________）
5. 回去工作
6. 小孩生病　(疾病名称？　______________________________)
7. 母亲太累
8. 母亲生病　(疾病名称？　______________________________)
9. 其他原因　(请指明)：______________________________

21. 您的小孩是否有规律地喂母乳替代品?

1. 是　　　　2.否（跳至25题）

22. 您规律地喂养小孩哪种母乳替代品（可多选）？

1. 配方奶粉　　　2. 牛奶　　　3. 其他__________(请指出)

23. 规律地喂母乳替代品的年龄?

________月龄

24. 给小孩喂固体食物的年龄？

________月龄，若还未添加固体食物请填写“0”

25. 比起您的同龄人，您如何评价您的健康状况？

1.差　　2　　3　　4　　5.非常好

您对婴儿喂养的态度

对于以下陈述，您是否同意？请勾出最符合您看法的数字。 (1=强烈反对, 2=反对, 3=中立, 4=同意, 5=强烈同意) 你可以选择从 1 到 5 的数字。

表 3. Iowa 婴儿喂养态度问卷

	强烈反对	反对	中立	同意	强烈同意
26. 母乳喂养的好处仅持续到小孩母乳喂养结束。	1	2	3	4	5
27. 配方奶喂养比母乳喂养方便很多。	1	2	3	4	5
28. 母乳喂养增强母婴的感情联系。	1	2	3	4	5
29. 母乳缺铁。	1	2	3	4	5
30. 喂配方奶比母乳喂养更容易让婴儿喂得过多。	1	2	3	4	5
31. 如果妈妈决定回到工作岗位，配方奶喂养是一个更好的选择。	1	2	3	4	5
32. 给婴儿喂配方奶的母亲将失去作为母亲的一大快乐。	1	2	3	4	5
33. 女性不应该在公共场所比如餐馆里母乳喂养婴儿。	1	2	3	4	5
34. 母乳喂养的婴儿比喂配方奶的婴儿更健康。	1	2	3	4	5
35. 母乳喂养比喂配方奶更容易让婴儿喂得过多。	1	2	3	4	5
36. 如果母亲母乳喂养婴儿，父亲会觉得被冷落。	1	2	3	4	5
37. 母乳是婴儿的理想食品。	1	2	3	4	5
38. 母乳比配方奶更容易消化。	1	2	3	4	5
39. 配方奶对婴儿来说和母乳一样健康。	1	2	3	4	5
40. 母乳喂养比喂配方奶方便。	1	2	3	4	5
41. 母乳比配方奶便宜。	1	2	3	4	5
42. 偶尔喝酒的母亲不应该母乳喂养她的小孩。	1	2	3	4	5

您喂养孩子的方式

43.当您的小孩在家时，有多少时候您负责喂他/她?

1. 从不　　2. 很少　　3. 一半的时间　　4. 大多数时候　　5. 总是

44.有多少时候您决定您小孩的食物分量？

1. 从不　　2. 很少　　3. 一半的时间　　4. 大多数时候　　5. 总是

45. 有多少时候您决定您的小孩吃什么好？

1. 从不　　2. 很少　　3. 一半的时间　　4. 大多数时候　　5. 总是

您认为您和您的小孩的体重的情况

请指出您认为您和您孩子的体重情况，对表格里最符合您的看法的数字打勾。(1=显著低体重, 2= 低体重, 3= 正常, 4= 超重, 5=肥胖) 您可选择从 1 到 5 的任何数字。

表 4. 母亲对自己和孩子体重的评估

	显著低体重	低体重	正常	超重	肥胖
46. 您在童年时期的体重情况 (0-12 岁)	1	2	3	4	5
47. 您在青少年时期的体重情况 (13-19 岁)	1	2	3	4	5
48. 您二十几岁时的体重情况	1	2	3	4	5
49. 您现在的体重情况	1	2	3	4	5
50. 您的孩子的体重情况	1	2	3	4	5

51.当您不在小孩身边的时候，您有多关心您的小孩吃了多少?

1.不关心　2　3　4　5.非常关心

52. 您有多关心您的小孩的饮食以保持他/她的理想体重？

1.不关心　2　3　4　5.非常关心

53. 您有多关心您的小孩变肥胖？

1.不关心　2　3　4　5.非常关心

您是否对孩子吃东西有任何限制或在这方面给他/她任何压力？

对于以下陈述，您是否同意？请勾出您认为最符合你看法的数字。(1=强烈反对 [SD], 2=反对 [D], 3=中立 [N], 4=同意 [A], 5=强烈同意 [SA].) 您可以选择从 1 到 5 的任何数字。

表 5. 对孩子吃东西行为的限制和施加的压力

	强烈反对	反对	中立	同意	强烈同意
54. 我必须保证我的小孩没有吃太多的甜食（糖、冰欺凌、蛋糕等）。	1	2	3	4	5
	强烈反对	反对	中立	同意	强烈同意
55. 我必须保证我的小孩没有吃太多高脂的食物。	1	2	3	4	5
56. 我必须保证我的小孩没有吃太多他/她最喜欢吃的食物。	1	2	3	4	5
57. 我故意把某些食物放在我小孩拿不到的地方。	1	2	3	4	5
58. 我给小孩甜食（糖，冰欺凌，蛋糕，甜点）作为他/她某些好的行为的奖励。	1	2	3	4	5
59. 我给小孩他/她喜欢吃的东西作为好的行为的交换。	1	2	3	4	5
60. 如果我不指导或规范小孩吃东西，他/她就会吃太多他/她喜欢的东西。	1	2	3	4	5
61. 我的小孩必须总是吃完他/她碗里的食物。	1	2	3	4	5
62. 我必须非常小心确保我的孩子吃够了。	1	2	3	4	5
63. 如果小孩说“我不饿”，我还是会试着让他/她吃些。	1	2	3	4	5
64. 如果我不指导或规范孩子吃饭，他/她会吃得比需要吃的少。	1	2	3	4	5

65.您有多少时候会追踪您的孩子吃了多少甜食（糖，冰激凌，蛋糕，甜点）？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

66. 您有多少时候会追踪您的孩子吃了多少零食（如薯条，玉米片，奶酪泡芙）？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

67. 您有多少时候会追踪孩子吃了多少高脂食物？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

您对孩子运动鼓励、参与以及支持

68. 一周里有多少天您会鼓励您的小孩参与体力活动或做运动？

_________ 天/周

69. 一周里有多少天您会同您的小孩一起参与运动？

_________天/周

70. 一周里有多少天您会带您的小孩去他/她能进行运动的地方？

_________天/周

您的健康信念

71. 您有多关心您小孩的健康？

1.不关心 — 2 — 3 — 4 — 5.非常关心

72. 您有多关心您小孩的生病的概率？

1.不关心 — 2 — 3 — 4 — 5.非常关心

73. 您是否买过专门的食物来提高或保护您家人的健康？

1. 是　　2. 否

74. 除了食物，您有没有做任何特别的事来保持小孩的健康？

1. 是　　2. 否

75. 某些人非常关注健康，而某些人不那么关注。您有多关注自身的健康呢？

1. 完全不 — 2. — 3 — 4 — 5. 非常关心

76. 某些人非常关注得病的几率，而某些人不那么关注。您有多关注您得病的几率呢？

1. 完全不 — 2. — 3 — 4 — 5. 非常关心

77. 平衡食物的“热”和“凉”（阴和阳）对孩子的健康有好处。

1. 强烈反对　　2. 反对　　3.中立　　4. 赞同　　5. 强烈赞同

78. 中等强度的锻炼可以避免孩子生病。

1. 强烈反对　　2. 反对　　3.中立　　4. 赞同　　5. 强烈赞同

79. 如果您的孩子保持专门的饮食能在很大程度上避免肥胖。

1. 强烈反对　　2. 反对　　3.中立　　4. 赞同　　5. 强烈赞同

80. 您认为要保持小孩的健康对您来说有多困难？

1. 不可能　　2.　　3　　4　　5 . 完全没问题

81. 没有很多酱料的食物就不好吃。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

82.有时候我会担心节食会导致健康问题。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

83.您有多大把握能影响您的小孩的饮食习惯？

1. 绝对能　　2.　　3　　4　　5. 完全不能

84. 您有多大把握能影响您小孩的运动量？（请圈出您的把握度）

1. 绝对能　　2.　　3　　4　　5. 完全不能

85. 没有谁能做什么影响他/她的体重(请圈出您认为的赞同程度）

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

86. 您认为您的小孩有多容易生病？

1. 完全不会　　2.　　3　　4　　5. 非常容易

87. 当您的小孩长大时，您感觉他/她有多大可能变肥胖？

1. 完全不会　　2.　　3　　4　　5. 绝对会

88. 假设您的小孩变肥胖了，您认为您会有多担心？

1. 完全不会　　2.　　3　　4　　5. 非常担心

89. 您认为您的小孩的体重问题会在多大程度上影响他/她的正常活动？

1. 完全不会　　2.　　3　　4　　5. 绝对会

90.当我读到或看到别人得某些疾病，我便开始担心我的小孩得这些病。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

91. 当我读到肥胖相关疾病的时候（如心脏病，糖尿病），我便开始担心我的小孩会因肥胖而得这些病。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

请再告诉我一些关于您的孩子的情况

92. 孩子的性别：　1. 男　2. 女

93. 出生地：___________

94. 民族：__________

95. 出生日期：___ ___ / ___ ___ / ___ ___

96. 出生时的体重 __________(kg)，　身长 ________(cm)

97. 分娩方式：

1. 自然产　2. 剖宫产

您的孩子的运动情况

98. 包括晚上睡觉，您的孩子每天躺在床上的时间有多少？

_________ 小时。如果不知道，请在这个框里打勾☐

99. 您的孩子平时是否在学前机构、体校或家中进行体育活动（如跑步、使用操场器械、踢足球或其他运动）？

2. 是　2. 否 (跳到表6)　3. 不知道（跳到表6）

100. 您的孩子平均每周进行多长时间的体育活动？

_________小时。如果不知道，请在这个框里打勾☐

请就您孩子的下列各活动回答提问，并将答案记入表6.

表 6. 6 岁以下儿童的静坐活动

活动的类型	**是否参加?**			**每天花多少时间？（小时：分钟）若不知道，则记录-9:99**	
				周一-周五	**周六-周日**
101. 看电视	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
102. 看录像，VCD, DVD	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
103. 玩游戏机	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
104. 网上浏览	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
105. 网上聊天	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
106. 电脑游戏	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
107. 读书（报纸，杂志）、写字或画画	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐
108. 玩玩具车、木偶、棋类等	是 ☐	否 ☐	不知道 ☐	☐☐:☐☐	☐☐:☐☐

卫生保健和医疗服务的利用

109. 在过去四周中， 您的孩子是否生过病或受过伤？是否患有慢性病或急性病？

2. 是　　2. 否　　3. 不知道

110. 过去四周种，您的孩子是否有以下症状（包括今天）？

12) 发烧，咽喉痛，咳嗽　　1. 有　　2. 无　　3. 不知道

13) 腹泻，胃痛　　1. 有　　2. 无　　3. 不知道

14) 头痛，眩晕　　1. 有　　2. 无　　3. 不知道

15) 关节痛，肌肉酸痛　　1. 有　　2. 无　　3. 不知道

16) 皮疹，皮炎　　1. 有　　2. 无　　3. 不知道

17) 眼/耳疾病　　1. 有　　2. 无　　3. 不知道

18) 心脏病/心口痛　　1. 有　　2. 无　　3. 不知道

19) 其他感染或疾病　　1. 有　　2. 无　　3. 不知道

(注明：____________)

20) 其他慢性病 1. 有 2. 无 3. 不知道

(注明：____________)

21) 淤青或红肿 1. 有 2. 无 3. 不知道

（注明原因：____）

22) 受伤，流血 1. 有 2. 无 3. 不知道

(注明原因：____)

如果无症状，跳到问题 120，否则，就最近疾病回答问题 112-119。

111. 疾病的严重程度?

2. 不严重 2. 一般 3. 相当重

112. 在过去四周，您的孩子由于这种病有多少天不能进行正常活动？

_________ 天。若回答“不知道”，则在这个方框里打勾 ☐

113. 当您的孩子不舒服或受伤时，您会怎么做？

1. 自己给他/她治疗
2. 向生活在澳洲的**华人亲友**寻求帮助
3. 向澳洲的**非华人亲友**寻求帮助
4. 向**生活在中国的亲友**寻求帮助
5. 求助于医生 (诊所，医院)
6. 求助于其他专业人员

114. 在过去四周中，您有否给孩子任何用药？

1. 中药/中成药 2. 中国产的西药 3. 本地购买的药 4. 没有用药 5. 其他________________

115. 在过去四周中，您是否带您的孩子去正规的医疗机构看病？

2. 是 2. 否 (跳到问题 120)

116. 您带您的孩子去哪个医院看的病？

6. 私人诊所
7. 其他诊所
8. 公立医院
9. 其他 (注明:________________)
10. 不知道

117. 是看门诊还是住院治疗？

2. 门诊 (跳到问题 120) 2. 住院

118. 在过去四周中，在医院中住了几天或已经住了几天？

________ 天。若回答“不知道”，则记录在方框里打勾 ☐

119. 关于您孩子的病或伤，医生的诊断是什么？

____

能再告诉我一些关于您个人的情况吗？

120. 您的年龄:______

121. 您的受教育程度：

1. 高中或以下　　2. 中专或职业技术资格认证　　3. 大学及以上

122. 婚姻状况：

2. 已婚或事实婚姻　　2.分居或离婚　　3.单身或丧偶

123. 工作状况

2. 全职工作　　2.兼职工作　　3.随意时间安排的工作　　4.未工作

124. 家庭年收入（包括退休金，津贴，来自父母或他人的资助等）

1. 少于 $20,000
2. $20,001 到 $40,000
3. $40,001 到 $70,000
4. $70,001 到 $100,000
5. 超过 $100,000

24 小时食物记录

请记录下您的小孩 24 小时内的所有食物和饮料。请试着不要忽略每餐之间的食物和饮料。请记录下所有饮料，包括水，果汁和软饮料。

请尽可能记录下详细的信息，记录下您知道的食物的品牌。食物的量非常重要，请给我尽可能多的细节。请您想象 250ml 的量杯来记录食物的量，如南瓜泥和番茄酱，半杯。

早餐前

时间	食物/饮料	描述，准备过程	量

BREAKFAST **早餐**

时间	食物/饮料	描述，准备过程	量

早餐和午餐之间

时间	食物/饮料	描述，准备过程	量

午餐

时间	食物/饮料	描述，准备过程	量

下午茶（午餐和晚餐之间）

时间	食物/饮料	描述，准备过程	量

晚餐

时间	食物/饮料	描述，准备过程	量

晚餐过后

时间	食物/饮料	描述，准备过程	量

请记录下食用的药物、维他命、矿物质和其他食物补充剂		
品牌	名字	数量：片，颗，茶匙

Appendix 6 Follow-up questionnaire in Perth (English version)

INCIDENCE OF ILLNESS

No.: ________________________

Completed date: ________________________

----

1. **<u>During the past 3 months</u>, have your child been sick? Have your child suffered from a chronic or acute disease?**

   1. yes 2. no (skip to Q4) 3. don't know (skip to Q4)

2. **<u>During the past 3 months</u>, how many times did your child suffer from any illnesses?**

   _________ time(s).

3. **Please fill the following table with the details of the illnesses of your child <u>in the past 3 months.</u>**

	Name of the illness	**How severe?**	**Person(s) you talk to (get help from) for this illness?**	**Where did you see a doctor?**	**Medication used for this Illness?**
illness 1		1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other __________ 5. don't know	1. Chinese traditional (patent) medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other ___________
illness 2		1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other __________ 5. don't know	1. Chinese traditional (patent) medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other ___________
illness 3		1.not severe 2. somewhat	1. No-one else (just yourself)	1. did not see 2. private clinic	1. Chinese traditional (patent) medicine

		severe 3. quite severe	2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	(GP) 3. local hospital 4 .other __________ 5. don't know	2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other ___________
illness 4		1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other __________ 5. don't know	1. Chinese traditional （patent） medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other ___________

4. Have you noticed any of these symptoms of your child during the past 4 weeks?

1) fever, sore throat, cough 1. yes 2. no 3. don't know

2) diarrhea, stomachache 1. yes 2. no 3. don't know

3) headache, dizziness 1. yes 2. no 3. don't know

4) joint pain, muscle pain 1. yes 2. no 3. don't know

5) rash, dermatitis 1. yes 2. no 3. don't know

6) eye/ear disease 1. yes 2. no 3. don't know

7) heart disease/chest pain 1. yes 2. no 3. don't know

8) other infectious disease 1. yes 2. no 3. don't know
(specify:_____________)

9) other noncommunicable disease 1. yes 2. no 3. don't know
(specify:_____________)

5. Did your child have any injuries (no matter how small) in last 3 months?

1. yes 2. no (skip to Q8) 3. don't know (skip to Q8)

6. During the past 3 months, how many times was your child injured?

_________ time(s).

7. **Please fill the following table with details of injuries that happened to your child in last 3 months.**

	Where was the injury happened?	**How sever**	**Person(s) you talk to (get help from) for this illness?**	**Where to see doctor?**	**medication used for this illness**
injury 1	1. at home 2. at child care 3.outdoor playground 4. indoor playground 5. other ____________	1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other _________ 5. don't know	1. Chinese traditional （patent） medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other __________
injury 2	1. at home 2. at child care 3.outdoor playground 4. indoor playground 5. other ____________	1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other _________ 5. don't know	1. Chinese traditional （patent） medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other __________
injury 3	1. at home 2. at child care 3.outdoor playground 4. indoor playground 5. other ____________	1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other _________ 5. don't know	1. Chinese traditional （patent） medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other

					___________
injury 4	1. at home 2. at child care 3.outdoor playground 4. indoor playground 5. other _____________	1.not severe 2. somewhat severe 3. quite severe	1. No-one else (just yourself) 2. Chinese relatives or friends in Au 3. non-Chinese relatives or friends 4. people in China 5. doctor(s) 6. other health professionals	1. did not see 2. private clinic (GP) 3. local hospital 4 .other __________ 5. don't know	1. Chinese traditional （patent） medicine 2.Western medicine brought from China 3. Western medicine brought in Au 4. none 5. other ___________

8. For how many days was your child unable to carry out normal activities <u>in the past 3 months</u> due to illness or injury?

_________ days.

9. For how many days were or have your child been hospitalized <u>in the past 3 months</u>?

________ days.

10. Has your child had any other days of reduced activities <u>in past 3 months</u> due to illness or injury (except the days in hospital)?

1. yes　　2. no　　3. don't know

If yes, ________day(s) of absence from child care or preschool.

Appendix 7 Follow-up questionnaire in Perth (Chinese version)

5 岁以下儿童患病率

No.: ____________________________

完成日期: ____________________________

----

1. **在过去 3 个月里, 您的孩子是否生过病？是否患有慢性病或急性病？**

   2. 是 2. 否 （跳至问题 4） 3. 不知道（跳至问题 4）

3. **在过去 3 个月里, 您的孩子生活几次病?**

   __________ 次

4. **请在下表中填写过去 3 个月里，您孩子的疾病情况。**

	疾病名称	严重程度	您向谁寻求过帮助?	在哪里看医生?	用药情况
疾病 1		1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生 6. 其他专业人员	1. 未看医生 2. 私人诊所 （GP） 3. 本地的医院 4. 其他____________ 5. 不知道	1. 中药/中成药 2. 中国购买的药 3. 本地购买的西药 3. 未用药 4. 其他（请指明）__________
疾病 2		1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生 6. 其他专业人员	1. 未看医生 2. 私人诊所 （GP） 3. 本地的医院 4. 其他____________ 5. 不知道	1. 中药/中成药 2. 中国购买的药 3. 本地购买的西药 3. 未用药 4. 其他（请指明）__________
疾病 3		1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生	1. 未看医生 2. 私人诊所 （GP） 3. 本地的医院 4. 其他____________ 5. 不知道	1. 中药/中成药 2. 中国购买的药 3. 本地购买的西药 3. 未用药 4. 其他（请指

			6. 其他专业人员		明） __________
疾病 4		1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生 6. 其他专业人员	1. 未看医生 2. 私人诊所 （GP） 3. 本地的医院 4. 其他____________ 5. 不知道	1. 中药/中成药 2. 中国购买的药 3. 本地购买的西药 3. 未用药 4. 其他（请指明） __________

5. 过去四周中，您的孩子是否有以下症状（包括今天）？

1) 发烧，咽喉痛，咳嗽 1. 有 2. 无 3. 不知道

2) 腹泻，胃痛 1. 有 2. 无 3. 不知道

3) 头痛，眩晕 1. 有 2. 无 3. 不知道

4) 关节痛，肌肉酸痛 1. 有 2. 无 3. 不知道

5) 皮疹，皮炎 1. 有 2. 无 3. 不知道

6) 眼/耳疾病 1. 有 2. 无 3. 不知道

7) 心脏病/心口痛 1. 有 2. 无 3. 不知道

8) 其他感染或疾病 1. 有 2. 无 3. 不知道

(注明：____________)

9) 其他慢性病 1. 有 2. 无 3. 不知道

(注明：____________)

6. <u>在过去 3 个月里，</u>您有没有留意到您的孩子受什么伤（无论多小的伤）？

1. 有 2. 没有(跳至问题 8) 3. 不知道 (跳至问题 8)

7. <u>在过去 3 个月里，</u>您的小孩受过多少次伤？

_________ 次

8. 请在下表中填写过去 3 个月里，您孩子的疾病情况。

	受伤的地点?	**严重程度?**	**因为此向谁求助?**	**在哪里看医生?**	**用药?**
injury 1	1. 家里 2. 学校 3. 室外的游乐场所 4.室内的游乐场所	1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲	1. 未看医生 2. 私人诊所（GP） 3. 本地的医院 4. 其他 ____________	1. 中药/中成药 2. 中国购买的药 3. 本地购买的西药 3. 未用药

	5. 其他______		友 5. 医生 6. 其他专业人员	5. 不知道	4. 其他（请指明） __________
injury 2	1. 家里 2. 学校 3. 室外的游乐场所 4.室内的游乐场所 5. 其他______	1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生 6. 其他专业人员	1. 未看医生 2. 私人诊所（GP） 3. 本地的医院 4. 其他 ____________ 5. 不知道	1. 中国的药 2. 西药 3. 未用药 4. 其他（请指明） __________
injury 3	1. 家里 2. 学校 3. 室外的游乐场所 4.室内的游乐场所 5. 其他______	1.不严重 2. 一般 3. 相当重	1.自己解决 2.在澳洲的华人亲友 3. 在澳洲的非华人亲友 4.在中国的亲友 5. 医生 6. 其他专业人员	1. 未看医生 2. 私人诊所（GP） 3. 本地的医院 4. 其他 ____________ 5. 不知道	1. 中国的药 2. 西药 3. 未用药 4. 其他（请指明） __________

9. 在过去 3 个月里，您的孩子有多少天因为生病或受伤不能开展日常的活动？

_________ 天

10. 在过去 3 个月里，您的孩子有多少天住院？

________ 天

11. 在过去 3 个月里，您的孩子是否有过因为生病或受伤减少日常的活动（除了住院的日子）？

1. 是　　2. 否　　3. 不知道

如果是, ________天因病或者受伤没有去幼儿园或者学前班。

Appendix 8 Questionnaire in Chengdu and Wuhan (English version)

A cohort study of health beliefs, behaviours and information sources of Chinese mothers and their children living in Perth

Dear Mother
We know this questionnaire will take a little time, but it will help us understand important health issues about your child. Your individual information will be kept confidential. We will only use information from the group answers to compare with Australian children and Chinese children in Perth, Australia. This will help improve services in our kindergarten.
Thank you so much for your cooperation!
If you have any question or want further information, please contact the researcher,

Shu Chen (Chengdu):
shu.chen2@postgrad.curtin.edu.au or crosssilence@gmail.com, 13880930785.

Yuexiao Zhang (Wuhan)：sunshine122@sina.com 电话：15671571831

Yours sincerely,
Shu Chen

Curtin University of Technology

curtin
University of Technology
Western Australia

-- *Office use only* --

ID: ________________________

Recruitment date: ________________________

Mother's weight without shoes and only light clothing ______ *(kg), height without shoes*______ *(cm)*

Child's weight without shoes and only light clothing ______ *(kg), height without shoes* _______ *(cm*

Your name: ____________ Mobile: ______________ Home phone: ______________

Email address: ____

Mother's physical activity

1. In a normal week do you do **vigorous activities** (take hard physical effort and make you breathe much harder than normal. e.g. jogging and running, fast cycling or cycling on hills, fast swimming, aerobics, moving heavy furniture)?

   2. yes 2. no (skip to Q7)

2. How many times do you do **vigorous activities** in a normal week?

   ___________ times/week

3. On average, how many hours do you do **vigorous activities** in each time?

   ___________minutess

4. In a normal week do you do **moderate intensity activities** (make you breathe somewhat harder than normal and increase your heart rate, e.g. paced cycling, swimming, slow jogging, playing table tennis)?

   1. yes 2. no (skip to Q9)

5. How many times do you do **moderate intensity activities** in a normal week?

   ___________ times/week

6. On average, how many hours do you do **moderate intensity activities** each time?

   ___________ hours

7. On average, how many hours in a day do you spend in **walking in different places** (including walking at work, to and from work, running errands and leisure, etc.)?

   __________ hours/day

8. On average, how many hours in a day do you spend in sitting activities (including sitting in a car or bus, sitting at work, watching TV, sitting at meals, etc.)?

   __________ hours/day

Child feeding experience

9. Your weight gain during the most recent pregnancy:

   ____________kg

10. Did you smoke while pregnant?

1. yes 2. no

11. Did you smoke while breastfeeding?

1. yes 2. no

12. Did you drink alcohol while pregnant?

1. yes 2. no

13. Did you drink alcohol while breastfeeding?

1. yes 2. No

14. Whether this child ever breastfed?

1. yes 2. no

15. Whether the child currently being breastfed?

1. yes 2. no

16. How long for exclusive breastfeeding? (Nothing but breastmilk)

________________months

17. How long for any breastfeeding (till now if you are still breastfeeding your child)?

________________months

18. What is the main reason you stopped breastfeeding?

1. child grow old enough to eat adult food
2. did not have enough breastmilk (How did you know this?____________________________)
3. nipple problems (What is the problem? ____________________________)
4. breast problems (What is the problem? ______________________________)
5. return to work
6. baby sick (Name of the disease ______________________________)
7. mother tired
8. mother sick (Name of the disease ______________________________)
9. other reasons (please specify) ____

19. Whether the child ever given infant breastmilk substitutes regularly?

1. yes 2. no (skip to Q 23)

20. Which breastmilk substitutes do you give to your child regularly? (you can choose more than one options)

1. infant formula   2. cow's milk   3. other _______(please indicated)

21. Age of the child first given infant breastmilk substitutes regularly?

________months old

22. Age of this child when first given solid food?

________months old

23. Compared to other people of your age, would you say your health is?

1. poor   2   3   4   5.excellent

Iowa Infant Feeding Attitude Scale

For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion (1=strong disagreement [SD], 2=disagreement [D], 3=neutral [N], 4=agreement [A], 5=strong agreement [SA].) You may choose any number from 1 to 5.

Table 3. Iowa Infant Feeding Attitude Scale

statements	SD	D	N	A	SA
24. The benefits of breastfeeding last only as long as the baby is breast fed.	1	2	3	4	5
25. Formula feeding is more convenient than breastfeeding.	1	2	3	4	5
26. Breastfeeding increase mother infant bonding.	1	2	3	4	5
27. Breastmilk is lacking in iron.	1	2	3	4	5
28. Formula fed babies are more likely to be overfed than breastfed babies.	1	2	3	4	5
29. Formula feeding is the better choice if the mother plans to go back to work.	1	2	3	4	5
30. Mothers who formula feed miss one of the great joys of motherhood.	1	2	3	4	5
31. Women should not breastfeed in public places such as restaurants	1	2	3	4	5
32. Breastfed babies are healthier than formula fed babies.	1	2	3	4	5
33. Breastfed babies are more likely to be overfed than formula fed babies.	1	2	3	4	5
34. Fathers feel left out if a mother breastfeeds.	1	2	3	4	5
35. Breastmilk is the ideal food for babies	1	2	3	4	5
36. Breastmilk is more easily digested than formula.	1	2	3	4	5
37. Formula is as healthy for an infant as breastmilk	1	2	3	4	5
38. Breastfeeding is more convenient than formula.	1	2	3	4	5
39. Breastmilk is cheaper than formula.	1	2	3	4	5
40. A mother who occasionally drinks alcohol should not breastfeed her baby.	1	2	3	4	5

Child Feeding Questionnaire

41. When your child is at home, how often are you responsible for feeding her/him?

    1. never 2. seldom 3. half of the time 4. most of the time 5. always

42. How often are you responsible for deciding what your child's portion sizes are?

    1. never 2. seldom 3. half of the time 4. most of the time 5. always

43. How often are you responsible for deciding if your child has eaten the right kind of foods?

    1. never 2. seldom 3. half of the time 4. most of the time 5. always

What do you think about your weight and your child's weight?

Please indicate what do you think you and your child's weight by circling the number that most closely corresponds to your opinion (1= Markedly underweight [MU], 2= Underweight [U], 3= Normal [N], 4=Overweight [O], 5=Obesity [OB].) You may choose any number from 1 to 5.

Table 4. mother's evaluation of her and her child's weight

	MU	U	N	O	OB
44. Your weight in your childhood (0-12 years)	1	2	3	4	5
45. Your weight as a teenager (13-19 years)	1	2	3	4	5
46. Your weight in your 20s	1	2	3	4	5
47. Your current weight	1	2	3	4	5
48. Your child's current weight	1	2	3	4	5

49. How concerned are you about your child eating too much when you are not around him or her?

    1.unconcerned 2 3 4 5. very concerned

50. How concerned are you about your child having to diet to maintain a desirable weight?

    1.unconcerned 2 3 4 5. very concerned

51. How concerned are you about your child becoming overweight?

    1.unconcerned 2 3 4 5. very concerned

Do you have any restrictions or put any pressure to the child on his/her eating behaviours?

For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion (1=Strong disagreement [SD], 2=Disagreement [D], 3=Neutral [N], 4=Agreement [A], 5=Strong agreement [SA].) You may choose any number from 1 to 5.

Table 5. restrictions and pressure on the eating behaviours of the child

	SD	D	N	A	SA
52. I have to be sure that my child does not eat too many sweets (candy, ice cream, cakes or pastries).	1	2	3	4	5
53. I have to be sure that my child does not eat too much high-fat foods.	1	2	3	4	5
54. I have to be sure that my child does not eat too much of her/his favourite foods.	1	2	3	4	5
55. I intentionally keep some foods out of my child's reach.	1	2	3	4	5
56. I offer sweets (candy, ice cream, cakes or pastries) to my child as a reward for good behaviour.	1	2	3	4	5
57. I offer my child her favourite foods in exchange for good behaviour.	1	2	3	4	5
58. If I did not guide or regulate my child's eating, she/he would eat too much of her favourite foods.	1	2	3	4	5
59. My child should always eat all of the food on her plate.	1	2	3	4	5
60. I have to be especially careful to make sure my child eats enough.	1	2	3	4	5
61. If my child says "I'm not hungry", I try to get him/her to eat anyway.	1	2	3	4	5
62. If I did not guide or regulate my child's eating, she/he would eat much less than she/he should.	2	2	3	4	5

63. How much do you keep track of the sweets (candy, ice cream, cakes, pies and pastries) that your child eats?

1. never 2. rarely 3. sometimes 4. mostly 5. Always

64. How much do you keep track of the snack food (e.g. potato chips, Doritos, cheese puffs) that your child eats?

    1. never 2. rarely 3. sometimes 4. mostly 5. Always

65. How much do you keep track of the high-fat foods that your child eats?

    1. never 2. rarely 3. sometimes 4. mostly 5. always

Encouragement of Physical Activity (PA), Participation in PA, Instrumental Support for PA

66. How often during a typical week do you encourage your child to participate in physical activities?

    _________ days/ week

67. How often during a typical week do you participate in physical activities with your child?

    _________ days/ week

68. How often during a typical week do you provide transportation to where the child can be physically active?

    _________ days/week

Health beliefs

69. How concerned are you about your child's health? (circle the number you think fit your concern degree)

    1. not at all 2 3 4 5. completely

70. How concerned are you about the possibility of your child getting sick? (circle the number you think fit your concern degree)

    1. not at all 2 3 4 5. completely

71. Do you ever buy special foods to improve or protect your family's health?

    2. yes 2. no

72. Besides things involving food, do you do any special things to help keep your child well?

    2. yes 2. no

73. Some people are quite concerned about health, while others are not as concerned. How concerned are you about your own health? (circle the number you think fit your concern degree)

    1. not at all 2 3 4 5. completely

74. Some people are quite concerned about the chance of getting sick, while others are not as concerned. How concerned are you about the chance of getting sick? (circle the number you think fit your concern degree)

1. not at all 2. 3 4 5 .completely

75. Balancing my child's intake of "hot" and "cold" (yin and yang) foods can benefit the health of her/him.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

76. Moderate exercise can protect my child from getting sick.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

77. If your child is kept closely on the special diet, it will help the problem of obesity.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

78. How difficult would you say it will be for you to do something to keep your child healthy?

1. impossible 2. 3 4 5. not a problem at all

79. Foods without rich sauces are extremely tasteless.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

80. Sometimes I worry that going on a diet can cause health problems.

81. How confident are you that you can influence your child's dietary behaviour?

1. extremely 2. 3 4 5. not at all

82. How confident are you that you can influence your child's physical activity?

1. extremely 2. 3 4 5. not at all

83. There isn't much anyone can do about how much he/ she weights.

1. disagree 2. slightly disagree 3. neutral 4. slightly agree 5. agree

84. How easily would you say your child getting sick?

1. not at all 2. 3 4 5. very easily

85. When your child grows up, how much chance do you feel there is that he/she will be overweight?

1. not at all 2. 3 4 5. completely

86. Suppose your child was to become overweight, how much do you think you would be worry about it?

1.not at all 2. 3 4 5. completely

87. How much would you say your child's weight problem interferes with his/ her normal activities?

1. not at all — 2. — 3 — 4 — 5. completely

88. When I read about any disease, I start worrying about the chances of my child getting it.

    1. disagree   2. slightly disagree   3. neutral   4. slightly agree   5. Agree

89. When I read about people who have obesity related disease (e.g. heart disease, diabetes), I start worrying about the chances of my child getting it.

    1. disagree   2. slightly disagree   3. neutral   4. slightly agree   5. agree

Could you please tell me more about your Child?

90. The gender of the child: 1. male   2. female

91. Where born : ____________

92. Ethnicity : ___________

93. Date your baby was born (DD/MM/YY) : ___ ___ / ___ ___ / ___ ___

94. Birth weight of the child ___________(kg), length _________(cm)

95. Delivery method :

    1. vaginal delivery   2. caesarean section

Children Physical Activity

96. How much time each day does your child usually spend in bed either sleeping or lying there, including nighttimes?

    __________ hours. If "don't know", tick the box here ☐

97. Does your child do any regular physical exercises (e.g., running, using playground equipment, playing soccer, swimming or other sports) in preschool facilities, athletic schools, or at home?

    3. yes   2. no (skip to Table 6)   3. don't know (skip to Table 6)

98. How many hours does your child spend doing physical exercises each week?

    __________ hours. If "don't know", tick the box here ☐

cPlease answer questions about each activity in Table.

Table 6. sedentary activities for children under age 6

Activity type	Does your child participate in this activity?	How much time does your child spend during a typical day? (hours: minutes) If "don't know", record 00:00.	
		Monday-Friday	Saturday-Sunday
99. TV	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
100. Watch videos, VCD, DVD	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
101. Video games	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
102. Surfing the internet	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
103. Participating in chat rooms	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
104. Playing computer games, etc.	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
105. Reading (books, newspapers and magazines), writing, drawing	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐
106. Toy cars, puppets, board games	yes ☐ no ☐ don't know ☐	☐☐:☐☐	☐☐:☐☐

Use of health care and medical services

107. During the past 4 weeks, has your child been sick or injured? Does your child suffer from any disease?

1. yes 2. no 3. don't know

108. Have you noticed any of these symptoms of your child during the past 4 weeks?

1) fever, sore throat, cough	1. yes	2. no	3. don't know
2) diarrhea, stomachache	1. yes	2. no	3. don't know
3) headache, dizziness	1. yes	2. no	3. don't know
4) joint pain, muscle pain	1. yes	2. no	3. don't know
5) rash, dermatitis	1. yes	2. no	3. don't know
6) eye/ear disease	1. yes	2. no	3. don't know
7) heart disease/chest pain	1. yes	2. no	3. don't know
8) other infectious disease (specify:____________)	1. yes	2. no	3. don't know
9) other noncommunicable disease (specify:____________)	1. yes	2. no	3. don't know
10) bruising	1. yes	2. no	3. don't know
11) bleeding, injury (by what reason: ____)	1. yes	2. no	3. don't know

If no symptoms or injury, skip to Question 118. Otherwise, ask Question 109-117 about the most recent illness or injury. Then answer Question 120.

109. How severe was the illness or injury?

1. not severe 2. somewhat severe 3. quite severe

110. For how many days during the past 4 weeks was your child unable to carry out normal activities due to this illness or injury?

_________ days. If "don't know", tick the box here ☐

111. What did you do when your child was not well or injured?

1. care for him/her by yourself
2. ask for help or advices from Chinese relatives or friends living in China
3. ask for help or advices from Chinese relatives or friends living in Australia
4. ask for help or advices from non-Chinese relatives
5. saw a doctor (clinic, hospital)
6. saw other health professionals

112. Did you give any kind of medication to your child for this illness?

1. Chinese traditional （patent） medicine
2. Western medicine brought from China
3. Western medicine brought in Australia
4. none
5. other__________

113. Did you seek care from a formal medical provider for your child's illness or injury during the past 4 weeks?

1. yes 2. no (skip to Q120)

114. Where did your child see a doctor when your child was sick or injured?

1. at home
2. private clinic (GP)
3. local hospital
4. other (specify:_______)
5. don't know

115. Was it an outpatient or inpatient visit?

1. outpatient (skip to Question 120) 2. inpatient

116. For how many days during the past 4 weeks were your child or have your child been hospitalized?

________ days.

117. What was the doctor's diagnosis of your child's illness or injury?

____

Could you tell me more about yourself?

118. Your current age: ______

119. Educational attainment：

1. high school diploma or less
2. TAFE certificate/diploma
3. university degree or higher

120. marital status：

1. married 2. separated / devoiced 3. single / widow

121. working status:

1. full-time work 2. part-time work 3. casual 4. not employed

122. What is your yearly household income (before tax) from all sources (including pension, allowances, financial support from parents/others)?

1. Less than ¥30,000
2. ¥30,001 to ¥60,000
3. ¥60,001 to ¥90,000
4. ¥90,001 to ¥120,000
5. More than ¥120,000

24 Hour Food Record

Please record all of the food and drink eaten by this child within the 24 hour period. Please try not to forget any drinks or foods eaten between meals. Please include all of the drinks consumed, including water, juice, milk and soft drinks.

Please remember to list as much detail as possible; record brand names where you know them. Serve sizes (portion sizes) are important - please give us as much detail as you can. We would like you to think about a 250 ml measuring cup to give us an indication of size e.g. mashed pumpkin and potato – half cup.

Time	Food / Drink	Description, Preparation	Amount
BEFORE BREAKFAST			
BREAKFAST			
MID-MORNING- between breakfast			
LUNCH			
AFTERNOON TEA- between lunch and dinner			
EVENING MEAL			
LATER EVENING- and through the night			

Please list any medication, vitamins, minerals or food supplements and when they were taken		
Brand	Name (in full)	Number : pills, capsules, teaspoons

Appendix 9 Questionnaire in Chengdu and Wuhan (Chinese version)

中国/澳大利亚华人母亲健康信念、行为及信息来源对学龄前儿童健康的影响

亲爱的妈妈们，

我相信您一定会同意您的孩子的健康对您来说非常重要。澳大利亚科廷大学公共卫 生学院正在做一个关于华人妈妈 的健康模式以及孩子的生长发育情况的调研，并研究妈妈的健康行为和信息对孩子的营养和健康行为的影响。希望能获得您的帮助，完成这个调研。这个研究将帮助我们更好的理解文化因素对孩子健康的影响。本研究通过了澳大利亚和中国科研伦理的审核，我们会对您提供的所有信息绝对保密。我们会将收集到的数据仅用于从整体上分析和比较。这也将有助于提高我们幼儿园的服务。

非常感谢您的配合！

如果您想知道更多关于本研究的信息，请和我们的研究人员联系。

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章月潇（武汉）：sunshine122@sina.com 电话：15671571831

为了孩子的健康和快乐，我们一直在努力！

您真诚的，

陈舒

-- *调查人员填写*--

编号: ______________________________

招募时间: ______________________________

妈妈不穿鞋仅穿轻薄衣物时的体重 _______ *(公斤), 不穿鞋的身高*_________ *(厘米)*

孩子不穿鞋仅穿轻薄衣物时的体重 _______ *(公斤), 不穿鞋的身高*_________ *(厘米)*

您的基本信息

请圈出与您的情况相符合的选项或在横线上填写您的情况

母亲姓名：___________ 手机：______________________ 电话：_____________________

电子邮箱：____

您的运动量

1. 您平常是否参加一些剧烈运动（让你很费劲并且会呼吸急促的运动，如跑步，快速骑自行车或骑自行车上坡，快速游泳，健身操，篮球，排球，搬运重物）？

   1. 是 2. 否（跳至 6 题）

2. 平均来说，您一周有几次做**剧烈运动**？

   ________次/周

3. 平均来说，您每次会花多长时间做**剧烈运动**？

   ________分钟/次

4. 您是否参加一些**中等强度的运动**（让你呼吸和心跳比平常加快的运动，如骑自行车，慢跑，游泳等）？

   1. 是 2. 否（跳至 9 题）

5. 平均来说，您一周有几次做**中等强度运动**？

   ________次/周

6. 平均来说，您每次会花多长时间做**中等强度运动**？

   ________分钟/次

7. 平均来说，您每天要花多少时间**走路**（包括在工作中，上下班，跑腿，散步等）？

   __________小时/天

8. 平均来说，您一天要花多少时间**坐着**（请包括坐在车里，坐着工作，看电视，坐着吃饭）？

   __________小时/天

母乳喂养和您的健康自我评述

9. 您怀这个孩子时的体重增加是多少？

   ____________斤

10. 您在怀孕期间吸烟吗？

    1. 是 2. 否

11. 您在哺乳期间吸烟吗?

1. 是 2. 否

12. 您在怀孕期间喝酒吗?

1. 喝 2. 不喝

13. 您在哺乳期间喝酒吗?

1. 喝 2. 不喝

14. 您的小孩是否母乳喂养过?

1. 是 2. 否 （跳至 21 题）

15. 目前您的小孩还在喂母乳吗?

1. 是 2. 否

16. 喂养母乳的总时间

________________月

17. 完全母乳喂养（除了母乳什么也不喂）的时间？

_________月

18. 停止/未能母乳喂养的原因？

10. 孩子大了
11. 奶不够 （如何做出判断的？____）
12. 乳头问题 （具体问题是？____）
13. 乳房问题 （具体问题是？____）
14. 回去工作
15. 小孩生病 （疾病名称？ ____）
16. 母亲太累
17. 母亲生病 （疾病名称？ ____）
18. 其他原因 （请指明）: ____

19. 现在您的小孩是否有规律地喂母乳替代品(如牛奶，豆浆)？

1. 是 2. 否（跳至 25 题）

20. 您规律地喂养小孩哪种母乳替代品（可多选）？

1. 配方奶粉 2. 牛奶 3. 豆浆___________ 3. 其他____________(请指出)

21. 从何时开始规律地喂母乳替代品?

_________月龄

22. 给小孩喂固体食物（辅食）的年龄？

_________月龄，若还未添加固体食物请填写“0”

23. 比起您的同龄人，您如何评价您的健康状况？

1. 差	2	3	4	5. 非常好

您对婴儿母乳喂养的态度

对于以下陈述，您是否同意？请勾出最符合您看法的数字。 (1=强烈反对, 2=反对, 3=中立, 4=同意, 5=强烈同意) 你可以选择从 1 到 5 的数字。

表 3. Iowa 婴儿喂养态度问卷

	强烈反对	反对	中立	同意	强烈同意
24. 母乳喂养的好处仅持续到小孩母乳喂养结束。	1	2	3	4	5
25. 配方奶喂养比母乳喂养方便很多。	1	2	3	4	5
26. 母乳喂养增强母婴的感情联系。	1	2	3	4	5
27. 母乳缺铁。	1	2	3	4	5
28. 喂配方奶比母乳喂养更容易让婴儿喂得过多。	1	2	3	4	5
29. 如果妈妈决定回到工作岗位，配方奶喂养是一个更好的选择。	1	2	3	4	5
30. 给婴儿喂配方奶的母亲将失去作为母亲的一大快乐。	1	2	3	4	5
31. 女性不应该在公共场所比如餐馆里母乳喂养婴儿。	1	2	3	4	5
32. 母乳喂养的婴儿比喂配方奶的婴儿更健康。	1	2	3	4	5
33. 母乳喂养比喂配方奶更容易让婴儿喂得过多。	1	2	3	4	5
34. 如果母亲母乳喂养婴儿，父亲会觉得被冷落。	1	2	3	4	5
35. 母乳是婴儿的理想食品。	1	2	3	4	5
36. 母乳比配方奶更容易消化。	1	2	3	4	5
37. 配方奶对婴儿来说和母乳一样健康。	1	2	3	4	5
38. 母乳喂养比喂配方奶方便。	1	2	3	4	5
39. 母乳比配方奶便宜。	1	2	3	4	5
40. 偶尔喝酒的母亲不应该母乳喂养她的小孩。	1	2	3	4	5

您喂养孩子的方式

41.当您的小孩在家时，有多少时候您负责准备孩子的食物?

1. 从不　2. 很少　3. 一半的时间　4. 大多数时候　5. 总是

42.有多少时候您决定您小孩的食物分量？

1. 从不　2. 很少　3. 一半的时间　4. 大多数时候　5. 总是

43. 有多少时候您决定您的小孩吃什么好？

1. 从不　2. 很少　3. 一半的时间　4. 大多数时候　5. 总是

您认为您和您的小孩的体重的情况

请指出您认为您和您孩子的体重情况，对表格里最符合您的看法的数字打勾。(1=显著低体重, 2= 低体重, 3= 正常, 4= 超重, 5=肥胖) 您可选择从 1 到 5 的任何数字。

表 4. 母亲对自己和孩子体重的评估

	显著低体重	低体重	正常	超重	肥胖
44. 您在童年时期的体重情况 (0-12 岁)	1	2	3	4	5
45. 您在青少年时期的体重情况 (13-19 岁)	1	2	3	4	5
46. 您二十几岁时的体重情况	1	2	3	4	5
47. 您现在的体重情况	1	2	3	4	5
58. 您的孩子的体重情况	1	2	3	4	5

49.当您不在小孩身边的时候，您有多关心您的小孩吃了多少?

1.不关心　2　3　4　5.非常关心

50. 您有多关心您的小孩的饮食以保持他/她的理想体重？

1.不关心　2　3　4　5.非常关心

51. 您有多关心您的小孩变肥胖？

1.不关心　2　3　4　5.非常关心

您是否对孩子吃东西有任何限制或在这方面给他/她任何压力？

对于以下陈述，您是否同意？请勾出您认为最符合你看法的数字。(1=强烈反对 [SD], 2=反对 [D], 3=中立 [N], 4=同意 [A], 5=强烈同意 [SA].) 您可以选择从 1 到 5 的任何数字。

表 5. 对孩子吃东西行为的限制和施加的压力

	强烈反对	反对	中立	同意	强烈同意
52. 我必须保证我的小孩没有吃太多的甜食（糖、冰欺凌、蛋糕等）。	1	2	3	4	5
53. 我必须保证我的小孩没有吃太多高脂的食物。	1	2	3	4	5
54. 我必须保证我的小孩没有吃太多他/她最喜欢吃的食物。	1	2	3	4	5
55. 我故意把某些食物放在我小孩拿不到的地方。	1	2	3	4	5
56. 我给小孩甜食（糖，冰欺凌，蛋糕，甜点）作为他/她某些好的行 7 的奖励。	1	2	3	4	5
57. 我给小孩他/她喜欢吃的东西作为好的行为的交换。	1	2	3	4	5
58. 如果我不指导或规范小孩吃东西，他/她就会吃太多他/她喜欢的东西。	1	2	3	4	5
59. 我的小孩必须总是吃完他/她碗里的食物。	1	2	3	4	5
60. 我必须非常小心确保我的孩子吃够了。	1	2	3	4	5
61. 如果小孩说“我不饿”，我还是会试着让他/她吃些。	1	2	3	4	5
62. 如果我不指导或规范孩子吃饭，他/她会吃得比需要吃的少。	1	2	3	4	5

63.您有多少时候会追踪您的孩子吃了多少甜食（糖，冰激凌，蛋糕，甜点）？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

64. 您有多少时候会追踪您的孩子吃了多少零食（如薯条，玉米片，奶酪泡芙）？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

65. 您有多少时候会追踪孩子吃了多少高脂食物？

1. 从不　2. 很少　3. 有时候　4. 大多数时候　5. 总是

您对孩子运动鼓励、参与以及支持

66. 一周里有多少天您会鼓励您的小孩参与体力活动或做运动？

_________ 天/周

67. 一周里有多少天您会同您的小孩一起参与运动？

_________天/周

68. 一周里有多少天您会带您的小孩去他/她能进行运动的地方？

_________天/周

您的健康信念

69. 您有多关心您小孩的健康？

1. 不关心　2　3　4　5. 非常关心

70. 您有多关心您小孩的生病的概率？

1. 不关心　2　3　4　5. 非常关心

71. 您是否买过专门的食物来提高或保护您家人的健康？

1. 是　2. 否

72. 除了食物，您有没有做任何特别的事来保持小孩的健康？

1. 是　2. 否

73. 某些人非常关注健康，而某些人不那么关注。您有多关注自身的健康呢？

1. 完全不　2.　3　4　5. 非常关心

74. 某些人非常关注得病的几率，而某些人不那么关注。您有多关注您得病的几率呢？

1. 完全不　2.　3　4　5. 非常关心

75. 平衡食物的“热”和“凉”（阴和阳）对孩子的健康有好处。

1. 强烈反对　2. 反对　3. 中立　4. 赞同　5. 强烈赞同

76. 中等强度的锻炼可以避免孩子生病。

1. 强烈反对　2. 反对　3. 中立　4. 赞同　5. 强烈赞同

77. 如果您的孩子保持专门的饮食能在很大程度上避免肥胖。

1. 强烈反对　2. 反对　3. 中立　4. 赞同　5. 强烈赞同

78.您认为要保持小孩的健康对您来说有多困难？

1. 不可能　　2.　　3　　4　　5 . 完全没问题

79. 没有很多酱料（汤汁）的食物就不好吃。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

80.有时候我会担心节食会导致健康问题。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

81.您有多大把握能影响您的小孩的饮食习惯？

1. 绝对能　　2.　　3　　4　　5. 完全不能

82. 您有多大把握能影响您小孩的运动量？（请圈出您的把握度）

1. 绝对能　　2.　　3　　4　　5. 完全不能

83. 没有谁能做什么影响他/她的体重(请圈出您认为的赞同程度）

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

84. 您认为您的小孩有多容易生病？

1. 完全不会　　2.　　3　　4　　5. 非常容易

85. 当您的小孩长大时，您感觉他/她有多大可能变肥胖？

1. 完全不会　　2.　　3　　4　　5. 绝对会

86. 假设您的小孩变肥胖了，您认为您会有多担心？

1. 完全不会　　2.　　3　　4　　5. 非常担心

87. 您认为您的小孩的体重问题会在多大程度上影响他/她的正常活动？

1. 完全不会　　2.　　3　　4　　5. 绝对会

88.当我读到或看到别人得某些疾病，我便开始担心我的小孩得这些病。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

89. 当我读到肥胖相关疾病的时候（如心脏病，糖尿病），我便开始担心我的小孩会因肥胖而得这些病。

1. 强烈反对　　2. 反对　　3. 中立　　4. 赞同　　5. 强烈赞同

请再告诉我一些关于您的孩子的情况

90. 孩子的性别：　　1. 男　　2. 女

91. 出生地：___________

92. 民族：__________

93. 出生日期：___ ___ / ___ ___ / ___ ___（年/月/日）

94. 出生时的体重 __________(斤)，　身长 ________(厘米)

95. 分娩方式：

1. 自然产　　2. 剖宫产

您的孩子的运动情况

96. 包括晚上睡觉，您的孩子每天躺在床上的时间有多少？

_________ 小时。如果不知道，请在这个框里打勾☐

97. 您的孩子平时是否在学前机构、体校或家中进行体育活动（如跑步、使用操场器械、踢足球或其他运动）？

1.是　　2. 否 (跳到表6)　　3. 不知道（跳到表6）

98. 您的孩子平均每周进行多长时间的体育活动？

_________小时。如果不知道，请在这个框里打勾☐

请就您孩子的下列各活动回答提问，并将答案记入表 6.

表 6. 5 岁以下儿童的静坐活动

活动的类型	**是否参加?**	**平均每天花多少时间？（小时：分钟）若不知道，则记录-9:99**	
		周一-周五	**周六-周日**
99.看电视	是 ☐　否 ☐　不知道 ☐	☐☐:☐☐	☐☐:☐☐
100. 看录像，VCD, DVD	是 ☐　否 ☐　不知道 ☐	☐☐:☐☐	☐☐:☐☐
101. 玩游戏机	是 ☐　否 ☐　不知道 ☐	☐☐:☐☐	☐☐:☐☐
102. 网上浏览	是 ☐　否 ☐　不知道 ☐	☐☐:☐☐	☐☐:☐☐
103. 网上聊天	是 ☐　否 ☐　不知道 ☐	☐☐:☐☐	☐☐:☐☐

104. 电脑游戏	是 □ 否 □ 不知道 □	□□:□□	□□:□□
105. 读书（报纸，杂志）、写字或画画	是 □ 否 □ 不知道 □	□□:□□	□□:□□
106. 玩玩具车、木偶、棋类等	是 □ 否 □ 不知道 □	□□:□□	□□:□□

卫生保健和医疗服务的利用

107. 在过去四周中， 您的孩子是否生过病或受过伤？是否患有慢性病或急性病？

2. 是 2. 否 3. 不知道

108. 过去四周种，您的孩子是否有以下症状（包括今天）？

1) 发烧，咽喉痛，咳嗽 1. 有 2. 无 3. 不知道

2) 腹泻，胃痛 1. 有 2. 无 3. 不知道

3) 头痛，眩晕 1. 有 2. 无 3. 不知道

4) 关节痛，肌肉酸痛 1. 有 2. 无 3. 不知道

5) 皮疹，皮炎 1. 有 2. 无 3. 不知道

6) 眼/耳疾病 1. 有 2. 无 3. 不知道

7) 心脏病/心口痛 1. 有 2. 无 3. 不知道

8) 其他感染或疾病 1. 有 2. 无 3. 不知道

(注明：____________)

9) 其他慢性病 1. 有 2. 无 3. 不知道

(注明：____________)

10) 淤青或红肿 1. 有 2. 无 3. 不知道

（注明原因：____）

11) 受伤，流血 1. 有 2. 无 3. 不知道

(注明原因：____)

如果无症状，跳到问题 120， 否则，就最近疾病回答问题 111-119。

109. 疾病的严重程度?

1. 不严重 2. 一般 3. 相当重

110. <u>在过去四周</u>，您的孩子由于这种病有多少天不能进行正常活动？

_________ 天。若回答“不知道”，则在这个方框里打勾 □

111. 当您的孩子不舒服或受伤时，您会怎么做？

1. 自己给他/她治疗
2. 向亲友寻求帮助

3. 求助于医生 (诊所，医院)
4. 求助于其他专业人员

112. 在过去四周中，您有否给孩子任何用药？

1. 中药/中成药 2.西药 3. 没有用药 4. 其他________________

113. 在过去四周中，您是否带您的孩子去正规的医疗机构看病？

1. 是 2. 否 (跳到问题 120)

114. 您带您的孩子去哪个医院看的病？

1. 私人诊所
2. 公立医院
3. 其他 (注明:_________________)

115. 是看门诊还是住院治疗？

1. 门诊 (跳到问题 120) 2. 住院

116. 在过去四周中，在医院中住了几天或已经住了几天？

________ 天。若回答“不知道”，则记录在方框里打勾 ☐

117. 关于您孩子的病或伤，医生的诊断是什么？ ____

能再告诉我一些关于您个人的情况吗？

118. 您的年龄:______

119. 您的受教育程度：

1. 高中或以下 2. 中专或职业技术资格认证 3. 大学及以上

120. 婚姻状况：

1. 已婚 2. 分居或离婚 3. 单身或丧偶

121. 工作状况

1. 全职工作 2. 兼职工作 3. 随意时间安排的工作 4. 未工作

122. 家庭年收入（包括退休金，津贴，来自父母或他人的资助等）

1. 少于¥30,000
2. ¥30,001 到¥60,000
3. ¥60,001 到 $90,000
4. ¥90,001 到¥120,000
5. 超过¥120,000

24 小时食物记录

请记录下您的小孩 24 小时内的所有食物和饮料。请试着不要忽略每餐之间的食物和饮料。请记录下所有饮料，包括水，果汁和软饮料。

请尽可能记录下详细的信息，记录下您知道的食物的品牌。食物的量非常重要，请给我尽可能多的细节。请您想象 250ml 的量杯来记录食物的量，如南瓜泥和番茄酱，半杯。

时间	**食物/饮料**	**描述，准备过程**	**量**
早餐前			
早餐			
早餐和午餐之间			
午餐			
下午茶（午餐和晚餐之间）			
晚餐			
晚餐过后到睡前			

请记录下食用的药物、维他命、矿物质和其他食物补充剂		
品牌	名字	数量：片，颗，茶匙

Appendix 10 Publications

CHEN, S., BINNS, C. W. & ZHANG, Y. 2012. The importance of definition in diagnosing obesity: a review of studies of children in China. Asia Pac J Public Health, 24, 248-62.

CHEN, S., BINNS, C. W., LIU, Y., MAYCOCK, B., ZHAO, Y. & TANG, L. 2013. Attitudes towards breastfeeding - the Iowa Infant Feeding Attitude Scale in Chinese mothers living in China and Australia. Asia Pac J Clin Nutr, 22, 266-9.

CHEN, S., BINNS, C. W., ZHAO, Y., MAYCOCK, B. & LIU, Y. 2013. Breastfeeding by chinese mothers in australia and china: the healthy migrant effect. *J Hum Lact*, 29, 246-52.

Shu Chen, Colin Binns, Bruce Maycock. 2013. Calcium Supplementation in Young Children in Asia: Prevalence, Benefits and Risks. in Child Nutrition and Health, Gregor Cvercko and Luka Predovnik. Nova Science Publishers Inc, ISBN: 978-1-62257-982-2, New York.

Tang, L., Binns, C.W., Lee, A.H., Pan, X., Chen, S. and Yu, C. (2012) 'Low prevalence of breastfeeding initiation within the first hour of life in a rural area of Sichuan Province, China', *Birth*, 40(2):134-142.

CHEN, S., BINNS, C. W., MAYCOCK, B., ZHAO, Y. 2014. Chinese mothers' perceptions of their child's weight and obesity status. *Asia Pac J Clin Nutr*, 23 (3):452-8.

Chen, S., C.W. Binns, B. Maycock, Y. Liu, Y.X. Zhang. 2014. Prevalence of Dietary Supplement Use in Healthy Pre-School Chinese Children in Australia and China. *Nutrients*. 6 (2):815-828.

CHEN, S., MAYCOCK, B., BINNS, C. W., ZHAO, Y. 2013. The more she cares the more overweight her child: a population-based survey on the Health Belief Model in Chinese children. *Pediatrics*. Under review.