

**School of Public Health**

**Improving nutrition and physical activity behaviours  
of mothers with young children**

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

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## DECLARATION

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

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

Name: Sarojini Maria Dos Remedios Monteiro

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Date: 30/10/2014

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# ABSTRACT

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## INTRODUCTION

Globally, reproductive aged women have low levels of fruit and vegetable consumption and physical activity. These are among the top 10 modifiable risk factors of non-communicable disease associated mortality and morbidity. Women of childbearing-age are vulnerable to obesity and its medical consequences during antepartum, intrapartum and postpartum period. The World Health Organisation recommends improving dietary consumption and levels of physical activity however, there is a paucity of randomised controlled trials tailored to mothers with young children.

This thesis describes the development, implementation and evaluation of a health promotion intervention to increase the fruit, vegetable and fibre intake, and decrease fat and sugar consumption, and increase vigorous and moderate intensity physical activity for mothers with young children.

## METHODS

The National Health and Medical Research Council (NHMRC) funded a randomised controlled trial that promoted diet and physical activity intervention in mothers with young children (0 to 5 years) titled 'REminder on Food, Relaxation, Exercise and Support for Health (REFRESH)'. The trial was based on in-depth exploration of the evidence on promotion of diet and physical activity and systematic literature reviews and informed by a previous trial conducted by the supervisors that was funded by Healthway (The Health Promotion Foundation of Western Australia). The intervention strategies, content and resources were developed and tested with mothers with young children (n=20). Impact evaluation questionnaires were developed and test-retest was conducted with mothers (n=92).

The participants were recruited (n=716) via playgroups from 60 neighbourhoods in Perth, Western Australia. Mothers were randomly assigned to the intervention (n=394) and control group (n=322) arms based on the socio-economic index for areas (SEIFA) for their neighbourhood. The 6-month intervention was primarily home-based. It included a REFRESH book, six face-to-face sessions delivered by a trained facilitators (optional), newsletters, Short-Message-Service (SMS) on the

main messages of the program. Participants were blinded to allocation. Response rates at 6-months post-intervention was 63% in the intervention group (n=249) and 84% in the control group (n=272).

A mixed methods design was used to evaluate the study. Process data was gathered from the mothers using paper based self-reported questionnaires (n=194 and 174, respectively) and semi-structured interviews (10 intervention completers and 10 non-completers) on perception of staff facilitation and presentation skills at the workshops usefulness, relevance and suitability of the intervention strategies and resources, perception on the program and potential intervention improvements. Process data was gathered from the staff (n= 25) included barriers and facilitators to using the playgroup setting; requests for health information; reported misconceptions around health; suitability of the playgroup setting for the delivery of the intervention for the mothers with children between 0 and 5 years; and the suitability of the program content and resources. Results were analysed using thematic analysis and frequencies.

Outcome measures included physical activity, fat and fibre intake, self-efficacy, social support, and demographics (age, level of education, employment status, body mass index (BMI), marital status, and number of children). Outcome data were collected from mothers using self-reported questionnaires at baseline (prior to the intervention) and post-intervention (after the 6-month intervention). Results were analysed using SPSS. Univariate statistics were applied to compare the intervention and control groups, followed by Analysis of Variance (ANOVA).

## **RESULTS**

The REFRESH intervention had a significant effect on the weekly mean duration for vigorous (p=0.008), moderate (p=0.023) and total physical activity (p=0.001) when compared to the control group.

The intervention group had significant improvements when compared to the control group in the overall consumption of low fat and high fibre diets assessed via the fat and fibre barometer scores (p<0.0005); fibre barometer scores (p<0.0005) which included fruit and vegetables scores (p<0.0005), wholegrain scores (p=0.002), and fat barometer scores (p=0.005) which included low fat dairy product (p=0.006) and lean meat and chicken (p=0.041). There were no significant differences between the intervention and control group in the consumption of fruit juices, soft drinks and

flavoured drinks. The intervention group when compared to the control group increased daily serves of fruit consumption by 7.5% and vegetables by 11.3% .

The process evaluation demonstrated of the REFRESH intervention demonstrated that the mothers found the intervention useful (98%), relevant (92%), and helped them make changes to their physical activity (66%) and dietary (79%) behaviours. The mothers reported that the most useful intervention strategies were the 'REFRESH: REminder on Food, Relaxation, Exercise, Support for Health' book (85%), face-to-face workshops (86%), and newsletters (73%).

## **CONCLUSION**

The results suggest that the REFRESH intervention was successful in improving mothers with young children's diet and physical activity behaviours. This study is one of first randomised controlled trial to demonstrate a significant improvement in the fruit, vegetable serves, fat and fibre intake behaviours, and increase in the duration of vigorous and moderate minutes of physical activity, and walking in mothers for young children with the assistance of a primarily home-based (6-month) flexible delivery intervention. Playgroups provide a suitable avenue for engaging and equipping mothers with young children with skills and information for diet and physical activity lifestyle behaviour change.

Based on the findings from the research, future health promotion lifestyle interventions should consider: using playgroups to engage mothers with young children, providing a home-based and flexible delivery programs, include support and optional face-to-face sessions.

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## LIST OF PUBLICATIONS

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The publications below are listed according to the order in which they appear in the thesis.

1. Monteiro, S. M. D. R., Tobin, R., Jancey, J., Howat, P. (2013) Behaviour change theories in diet and physical activity randomised controlled trials for mothers of young children: Systematic Review. *[Refer to Chapter Three]*
2. Monteiro, S. M. D. R., Jancey, J., Howat, P., Burns, S., Jones, C., Dhaliwal, S. S., McManus, A., Hills, A.P., Anderson, A. S. (2010) The protocol of a randomised controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program. *BMC Public Health*, 11; 648-562. DOI: 10.1186/1471-2458-11-648 [Impact Factor 2.08] *[Refer to Chapter Four & Appendix 8: Paper 1]*
3. Monteiro, S. M. D. R., Jancey, J., Howat, P. Physical activity and nutrition intervention for mothers of young children: Process evaluation. *Health*, 6 (3); 223-230. DOI: 10.4236/health.2014.63033 [Impact Factor 1.28] *[Refer to Chapter Five & Appendix 8: Paper 2]*
4. Jancey, J., Monteiro, S. M. D. R., Howat, P. Dhaliwal, S. S., P. Hills, A.P., Anderson, A. S., Burns, S. (2014) Dietary outcomes of a community based intervention for mothers of young children: A randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 11; 120-129. DOI: 10.1186/s12966-014-0121-1 [Impact Factor 3.68] *[Refer to Chapter Six & Paper 3]*
5. Monteiro, S. M. D. R., Jancey, J., Dhaliwal, S. S., Howat, P. Burns, S., Hills, A.P., Anderson, A. S. (2014) Results of a randomised controlled trial to promote physical activity behaviours in mothers of young children. *Preventive Medicine*, 59; 12-18. DOI: 10.1016/j.ypmed.2013.10.022 [Impact Factor 3.496] *[Refer to Chapter Seven & Appendix 8: Paper 4]*
6. Monteiro, S. M. D. R., Jancey, J., Howat, P., McManus, A., Burns, S., Jones, C.

REFRESH: Healthy Lifestyle Program for Mothers With Young Children. Curtin University, Perth, Western Australia ISBN 978-0-9807998-0-4 [Book] [*Refer to Appendix 9*]

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# LIST OF CONFERENCE PRESENTATIONS

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The following presentations have been made on this thesis:

1. Jones, C., Monteiro, S. M. D. R., Howat, P., Jancey, J., Burns, S., McManus, A., Dhaliwal, S., Hills, A., Anderson, A. A tailored lifestyle intervention for mothers with young children. Public Health Association of Australia Conference; Canberra, Australia; September 2009. (Oral Presentation)
2. Monteiro, S. M. D. R., Howat, P., Jancey, J., Jones, C., Burns, S., McManus, A., Dhaliwal, S., Hills, A., Anderson, A. Development of the REFRESH program for mothers with young children. Australian Health Promotion Association National Conference, Melbourne, Australia; May 2010. (Poster Presentation)
3. Monteiro, S. M. D. R., Howat, P., Jancey, J., Jones, C., Burns, S., McManus, A., Hills, A., Anderson, A., Dhaliwal, S. Healthy lifestyle program for mothers with young children. International Union for Health Promotion and Education Conference; Geneva, Switzerland; July 2010. (Oral Presentation)
4. Monteiro, S. M. D. R., Howat, P., Jancey, J., Burns, S., McManus, A., Dhaliwal, S., Jones, C., Hills, A., Anderson, A. Dietary Behaviours of Perth's Mothers with children between 0-5 years Western Australian Branch of Public Health Association of Australia, Perth, Australia; October 2010. (Oral Presentation)
5. Monteiro, S. M. D. R., Jancey, J., Howat, P., Burns, S., McManus, A., Dhaliwal, S., Jones, C., Hills, A., Anderson, A. Physical activity behaviours of mothers with children between 0-5 years. Asia Pacific Academic Consortium for Public Health; Bali, Indonesia; November 2010. (Oral Presentation)  
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7. Monteiro, S. M. D. R., Jancey, J., Howat, P. Use of multiple physical activity behaviour change skills and strategies in mothers with young children attending playgroups. 139th American Public Health Association Annual Meeting; Washington, DC, USA; November 2011. (Oral Presentation)
8. Monteiro, S. M. D. R., Jancey, J., Howat, P., Dhaliwal, S. Impact of the REFRESH randomised controlled trial on the physical activity behaviours of mothers with young children. International Physical Activity Public Health Conference, Sydney Australia; October 2012. (Oral Presentation)

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## ABBREVIATIONS

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AHA	American Heart Association
ACSM	American College of Sports Medicine
AWAS	Australian Women's Activity Survey
ANOVA	Analysis of Variance
BMI	Body Mass Index
BRFSS	Brief Risk Factor Surveillance System
FFQ	Food Frequency Questionnaire
HBM	Health Belief Model
IPAQ	International Physical Activity Questionnaire
NHMRC	National Health and Medical Research Council
MI	Motivational Interviewing
PMM	Protection Motivation Model
PPOE	Proximal Physical Outcome Expectancy
RCT	Randomised Controlled Trial
SCT	Social Cognitive Theory
SDT	Self-Determination Theory
SD	Standard Deviation
SEIFA	Socio-Economic Indexes For Area
SEM	Social Ecological Model
SLT	Social Learning Theory
SMS	Short-Message-Service
SOC	Stages of Change
SPSS	Statistical package for social sciences
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTM	Trans-Theoretical Model
UK	United Kingdom
USA	United States of America
WIC	Women's Infants and Children's
WHO	World Health Organisation
YPAS	Yale Physical Activity Survey

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# CHAPTER ONE

## INTRODUCTION

---

### PRELUDE

The thesis describes the development, implementation and evaluation of a community based health promotion intervention to increase the fruit, vegetable and fibre intake as well as the intensity of physical activity and to decrease fat consumption in mothers of young children.

This chapter presents an overview of the contents of the thesis. The background to the study briefly explains the overarching reasons for selecting the objectives, target population, and study design. It is followed by the research aim, objectives and hypothesis, an overview of the methodology, role of the researcher and professional context, significance of the results and organisation of the thesis.

## 1.1 STATEMENT OF THE PROBLEM

Maternal obesity is one of the biggest global challenges due to the magnitude of the problem and the lifelong health consequences to the mother and the infant (Davis et al., 2012, Gunderson et al., 2008). Promoting fruit and vegetable consumption, decreasing fat and sugar intake, and increasing physical activity levels are public health initiatives that are proven to reduce the burden of non-communicable diseases (World Health Organisation, 2011). Specifically, they are also proven strategies to maintain energy balance and to prevent overweight and obesity (World Health Organisation, 2003). Obesity is a complex health issue that is linked to cardiovascular diseases, metabolic diseases and some cancers (World Health Organisation, 2003, World Health Organisation, 2005).

Worldwide, women have low levels of fruit and vegetable consumption (Hall et al., 2009, World Health Organisation, 2013, Australian Institute of Health and Welfare, 2010) and low prevalence of moderate to high intensity physical activity (Bauman et al., 2009). Furthermore, women of childbearing-age are vulnerable to obesity (Ryan, 2007, Davis et al., 2012) and their risk of obesity increases after their first and subsequent pregnancies (Rooney et al., 2005, Bastian et al., 2005). One of the factors implicated in maternal overweight and obesity is excessive postpartum weight retention which is linked to high body mass index prior to pregnancy (Gunderson et al., 2004, Soltani and Fraser, 2000), weight gain above the recommended guidelines for pregnancy (Linne and Rossner, 2003, Siega-Riz et al., 2009), weight retention during the postpartum period (Gore et al., 2003, Linne and Rossner, 2003, Schmitt et al., 2007, Krummel, 2007) and inter-pregnancy weight gain (Villamor and Cnattingius, 2006). Maternal obesity has multiple health and medical consequences during the antepartum (Tsoi et al., 2010, Davis and Olson, 2009), intrapartum (Chu et al., 2007b, Ramachenderan et al., 2008), and postpartum period. Maternal obesity negatively affects the offspring in the short- and long-term (Ruager-Martin et al., 2010).

Mothers with young children identify numerous barriers to regular physical activity and healthy eating habits. Among them are: reduced time for self-care with parenting duties; inadequate childcare facilities at gyms and parks; lack of motivation/self-esteem/negative body image associated with physiological changes in pregnancy; lack of social support, and prioritising the family's needs (Nash, 2010, McIntyre and Rhodes, 2009, Jones et al., 2010, Lewis, 2005, Ransdell et al., 2004).

Furthermore, the transition from pregnancy to motherhood has previously been identified as a 'challenging period' for maintaining a healthy weight (Welch et al., 2009, Olson, 2005). However, motherhood is an event that has been identified as a 'teachable moment' as it "increases perceptions of personal risk and outcome expectancies, prompts strong affective or emotional responses, and redefines self-concept or social role" (McBride et al., 2003, pp 156). Evidence suggests that pregnant women and mothers with young children are motivated to make changes to their diet and physical activity habits (Welch et al., 2009, Bastian et al., 2010).

Health promotion interventions can assist in altering the course of chronic disease patterns by changing health behaviours (World Health Organisation, 2005). Behaviour change theories (Glanz et al., 2008) and techniques (Abraham and Michie, 2008) play a critical role in the intervention-mapping research cycle (Painter et al., 2008, Glanz et al., 2008, Glanz and Bishop, 2010, Brug et al., 2005, Michie et al., 2008, Kok et al., 2004, Macdowall et al., 2006). Evidence demonstrates that theoretically informed interventions are more effective (Michie et al., 2009, Noar et al., 2008). The literature suggests that nutrition intervention studies used one or a combination of the cognitive behaviour therapy, Trans-Theoretical Model and Social Cognitive Theory (Spahn et al., 2010) and physical activity intervention studies used Social Cognitive Theory, Trans-Theoretical Model, Theory of Planned Behaviour (Ajzen, 1991b), the Social Learning/Determination Theory (Bandura, 1969), and the Protection Motivation Theory (Rogers, 1975).

Several reviews report on nutrition and physical activity interventions targeting weight management and reduction during and after childbirth (Amorim et al., 2007, Gardner et al., 2011, Hartman et al., 2010, Streuling et al., 2010, Thangaratinam and Jolly, 2010). However, these reviews had several limitations. Some of these are: most studies included were quasi-experimental studies, lack of randomised controlled trials, small sample sizes, sample restricted to overweight and obese women only, lack of reporting on physical activity and dietary outcomes, clinically focused intervention design, lack of community-based interventions, lack of a behaviour change theoretical framework, and behaviour change theories were not evaluated (Amorim et al., 2007, Gardner et al., 2011, Hartman et al., 2010, Streuling et al., 2010, Thangaratinam and Jolly, 2010).

## **1.2 RESEARCH STUDY**

### **1.2.1 Research aims**

To design, implement, and evaluate a low cost, accessible, sustainable and replicable, randomised controlled trial to improve diet and physical activity behaviours of mothers with young children.

### **1.2.2 Research objectives**

1. To conduct a systematic literature review on diet and physical activity randomised controlled trials for mothers of young children.
2. To design and implement a randomised controlled trial to increase the fruit, vegetable and fibre intake, and decrease high fat food consumption, and increase the duration of physical activity of mothers with young children.
3. To assess the appropriateness and acceptability of the nutrition and physical activity intervention strategies and resources.
4. To compare fruit, vegetable, fat and fibre, and sweet drink consumption at 6-months post-intervention of mothers with young children.
5. To compare the duration of vigorous intensity physical activity, moderate intensity physical activity, and combined high intensity walking and moderate intensity walking, at 6-months post-intervention of mothers with young children.

### **1.2.3 Research hypotheses**

It was hypothesised that by the end of the 6-month REFRESH randomised controlled trial there would be significant differences between the intervention group participants compared with the control group participants in the following:

#### Dietary behaviours

The consumption of

- Foods low in fat
- Foods high in fibre
- Daily fruit serves
- Daily vegetable serves

- Daily cups of sweetened drinks (fruit juice, soft drinks and flavoured drinks)

#### Physical activity behaviours

- Minutes of vigorous intensity physical activity per week
- Minutes of moderate intensity physical activity per week
- Minutes of walking per week
- Days of muscle strength exercises per week

#### **1.2.4 Research methodology**

The randomised controlled trial was a three year study titled 'REFRESH: REminder on Food, Relaxation, Exercise, Support for Health'. Initially, the study included a literature review, systematic literature review on diet and physical activity behaviours in mothers with young children, and the development and testing of the measuring instrument and intervention content.

The randomised controlled trial participants, mothers of young children (0-5 years) (n=716), were recruited via playgroups from 60 neighbourhoods in Perth, Western Australia and randomised to the intervention (n=394) and control group (n=322) arms. The randomised controlled trial project staff, (n=25) were recruited and trained to recruit participants and deliver the face-to-face intervention workshops. The 6-month intervention included four main strategies: 1) 'REFRESH: REminder on Food, Relaxation, Exercise, Support for Health' book, mailed or emailed newsletters; 2) Supportive resources: pedometer; physical activity diary; home-based flexibility and strength exercises; recipe booklet; menu planner; shopping list holder with information on 'how to read food labels' when buying packaged foods; shopping list with information on choosing healthy foods; and tape measure; 3) six face-to-face workshop information and skill development sessions; and 4) SMS reminders on the main messages of the REFRESH program.

Data were collected at baseline and at the end of the 6-month intervention post-test via a self-completed paper based questionnaire. Process evaluation data were collected from the project staff and the mothers with young children during the intervention implementation. Analysis of the data was undertaken using quantitative and qualitative research methods. Qualitative analysis was conducted using thematic research methods. Quantitative analysis included analysis of variance. The

physical activity data were analysed including and excluding mothers who were pregnant, breastfeeding and postpartum (up to 12 months).

### **1.3 PROFESSIONAL CONTEXT AND ROLE OF THE RESEARCHER**

#### **Professional context of the candidate:**

The basis of my interest public health and prevention of diseases stemmed from witnessing a decline in health with increasing access to high sugar, high fat and low fibre packaged foods in India. I lived in a village in Goa, India where I completed my undergraduate degree, a Bachelor of Nutrition. In 2003, I moved to Australia and I completed my post-graduate certificate in Social Science (Health Practice). During this term, I volunteered with community health organisations in Brisbane working with drug addiction which exposed me for the need for public health and behaviour change interventions. In 2005, I moved to Western Australia and worked in rural and remote health services within the Department of Health, Western Australia as a Health Promotion Coordinator focusing on diet and physical activity projects. Having had the opportunity to see the impact of carefully developed and evaluated health promotion projects, my passion to work in the area of chronic diseases research and policy flourished. I later moved to Perth as a Policy Officer within the Population Health Policy Branch and the Child Adolescent and Maternal Health Policy Unit, Department of Health, Western Australia, where I had the opportunity to learn and contribute towards chronic disease prevention policy development, implementation, and evaluation. To conclude, my professional experience and my life's purpose have been driven by a strong passion to alleviate the suffering and improve the health of disadvantaged people across the world.

#### **Role of the researcher:**

The diet and physical activity randomised controlled trial for mothers with young children project, was funded by the National Health and Medical Research Council for three years. The PhD researcher was appointed as the project coordinator.

The project coordinator's responsibilities (under the guidance of the Management committee and the supervisors) encompassed administration, management of human and financial resources, and the coordination, development, implementation and evaluation of the randomised controlled trial. Weekly meetings were held with the management committee. This provided a weekly forum for the research

candidate to report on the project and be provided with advice and guidance on all aspects of the project. The project coordinator's roles are outlined below:

- Maintain knowledge of and compliance with University sponsored research procedures, protocol requirements and regulations of funding and collaborating institutions (Playgroup WA Inc.);
- Plan and direct the execution of the project, bearing in mind the objectives of the project, its duration and the approved budget;
- Provide organisational management of all aspects of the study and maintain accurate and complete regulatory documentation including signed consent forms, clinical trial approvals, participant logs, and study-related communication;
- Manage recruitment, screening, enrolment, and follow-up of participants according to the study protocol;
- Manage data collection, data entry, data cleaning, and preliminary data analysis under the supervision of the statistician;
- Communicate, provide regular updates to the management committee and, collaborating institutions;
- Perform cost negotiation for intervention resources and coordinate for restricted expenditures, invoices and staff pays with approval from the chief investigator and principal investigators;
- Recruit, select, provide training, and supervise project staff, research assistants, and student researchers supporting the study;
- Identify and resolve staff and research issues promptly in conjunction with the management committee with approval from the chief investigator and principal investigators; and
- Identify key challenges, areas of improvements and develop appropriate solutions and methodologies to meet milestones.

The responsibilities of PhD student included:

- Design, implement and evaluate the research
- Identify complex research problems and review related information to develop and evaluate options and implement solutions
- Critically analyse the research to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems
- Communicate effectively orally and in writing as appropriate for the needs of the audience
- Attend and present papers at national and international conferences, seminars and meetings

- Organise multiple research activities simultaneously
- Meet deadlines for various phases of the research
- Work collaboratively with a multidisciplinary team
- Maintain confidentiality
- Acquire any new skills required to fulfil the research
- Maximise the efficient utilisation of human, physical and monetary resources
- Work as a team player and a leader as necessary in the research

The project details and results are included in Chapter Three, Chapter Four, Chapter Five, Chapter Six and Chapter 7.

Additional projects participated in during the PhD tenure:

During the PhD tenure the researcher participated in two additional projects:

1. Project 1: Western Australian women's diet and physical activity health behaviours before and during pregnancy project; and
2. Project 2: Internship at the Centre for Disease Control and Prevention, Atlanta, on a project titled 'Systematic literature review of physical activity, nutrition and behaviour change in Latin America '.

Project 1: Western Australian women's diet and physical activity health behaviours before and during pregnancy:

In 2009-10, during the formative research stage of the randomised controlled trial for mothers with young children (PhD project), the researcher identified the lack of data on Western Australian women's diet and physical activity health behaviours before and during pregnancy.

The role of the researcher included:

- Conceptualisation of project in consultation with the supervisors to assess the Western Australian women's diet and physical activity health behaviours before and during pregnancy with the support and approval of the chief investigator (Professor Peter Howat) and principal investigator (Dr Jonine Jancey);
- Develop a Honours project proposal that was feasible (human and financial resources) with the approval of the chief investigator and principal investigator;
- Organise the recruitment and administration to enroll the Honours student in conjunction with the approval of the chief investigator and principal investigator;
- Assisted with the supervision of the Honours student for three months with the approval from the main supervisor/principal investigator;

- Provide support to the project design and preliminary data analysis; and
- Review the project report and peer-reviewed journal article.

The results of the project support the findings of the diet and physical activity randomised controlled trial for mothers with young children project. The Honours student published peer reviewed journal article.

Smedley J., Jancey, J., Dhaliwal, S., Zhao, Y., **Monteiro, S. M. D. R.**, Howat, P. (2014) Womens reported health behaviours before and during pregnancy: a retrospective study. Health Education, 73(1), 28-40. DOI: 10.1177/0017896912469570

### Project 2: Literature review of physical activity, nutrition and behaviour change in Latin America.

In 2011, the researcher was awarded a three month internship at the Centre for Disease Control and Prevention (CDC), Global Health Promotion Directorate, Atlanta, USA under the supervision of the Director and Adjunct Professor Michael Pratt (Emory University, Atlanta) and University of Los Andes, Bogota, Colombia under the supervision of Prof Olga Sarmiento. The project aimed to provide recommendations on improving physical activity and nutrition behaviour change interventions in Latin America.

The role of the researcher included:

- Assist in the conceptualisation of the project in conjunction with co-authors;
- Assist in training and ongoing supervision of students at the University of Los Andes, Bogota, Colombia on conducting a systematic review (1 month);
- Draft the peer-reviewed journal article on improving physical activity and nutrition behaviour change interventions in Latin America: systematic review; and
- Review the final peer-reviewed journal article.

The results of the project contributed to the researchers knowledge of the diet and physical activity interventions in Latin America and application of behaviour change theories in the context of a different social environments and cultures. The results are included as a published peer reviewed journal article.

Barboza, C., **Monteiro, S. M. D. R.**, Barradas S.C., Sarmiento O.L., Rios P., Ramirez, A., Mahecha M.P., & Pratt, M. (2013) Physical Activity, Nutrition and Behaviour Change in Latin America: Systematic Review. Global Health Promotion. 20(4), 65-81. DOI: 10.1177/1757975913502240

## 1.4 SIGNIFICANCE

The REminder on Food, Relaxation, Exercise and Support for Health (REFRESH) study aimed to design, implement, and evaluate a randomised controlled trial to improve diet and physical activity behaviours of mothers with young children. The REFRESH study has a number of levels of significance and is unique compared with previously conducted physical activity and diet research for mothers of young children.

To the author's knowledge, the REFRESH study conducted in 2010, is one of the first diet and physical activity randomised controlled trials to demonstrate a statistically significant improvement in the diet and physical activity behaviours of mothers with young children:

- Decrease in the consumption of foods high in fat;
- Increase in the consumption of foods high in fibre;
- Increase in the consumption of daily serves of fruit;
- Increase in the consumption of daily serves of vegetable;
- Increase in the minutes of vigorous intensity physical activity per week;
- Increase in the minutes of moderate intensity physical activity per week; and
- Increase in the minutes of vigorous and moderate intensity physical activity and walking per week.

This study is unique compared to other diet and physical activity research previously carried out with mothers with young children for a number of reasons described below.

- The study used playgroups to recruit, engage and provide a diet and physical activity lifestyle intervention to mothers of young children.
- The study used playgroups where there were established relationships between participants, which is known to act as a motivator.
- Participants were not discriminated against based on BMI, level of physical activity and stage of change, thereby not just recruiting those who were motivated to adopt health enhancing behaviour.
- A comprehensive literature review failed to show any other research with mothers of this magnitude. The REFRESH study may be the largest randomised controlled trial (baseline sample size of 716) specifically targeting mothers with young children (0-5 years).

- The diet, physical activity and resistance exercise data were collected from the participants in their own communities and not in a research centre, using survey instruments with a high level of sensitivity and specificity, thereby making the results relevant to the general population and not just a clinical group.
- Process evaluation provided information on the development, implementation, intervention settings, and evaluation of a home-based, flexible delivery, multi-strategy and multi-resource tailored intervention aimed at improving diet and physical activity behavioural outcomes.

It is acknowledged that there are social determinants including environmental risk factors that contribute to maternal overweight and obesity and REFRESH intervention alone will not reduce or eliminate non-communicable disease. However, an important component of the public health response is to ensure that there are adequate accessible and affordable prevention programs in the community that mothers with young children can avail of. The REFRESH study intervention components and booklet are available to the public as it was funded by the National Health and Medical Research Council. This has positive implications for wide-scale implementation of a prevention package for mothers with young children attending playgroups.

## **1.5 ORGANISATION OF THESIS**

The main thesis contains the four publications. Three scientific articles have been published, and one is currently under review in a peer reviewed public health journal. The articles are included as chapters. These articles are limited by publishing house requirements in terms of word count, figures and tables. Relevant information that was not included in the article has been added at the end of the chapter.

The thesis appendix contains two additional publications that are relevant to the thesis content and completed by the researcher during the tenure of the PhD. These two scientific articles have been published.

All publications have co-authors whose respective contributions are presented in Appendix 8.

## **Chapter Two: Literature Review (Part A)**

The literature review is described in two chapters. Chapter Two initially provides an overview of overweight and obesity. It is followed by an in depth description of the role of maternal overweight and obesity, its risk factors, the consequences on the mother and the infant's health, and the cost of overweight and obesity to the general population and specifically for maternal obesity. The next section of this chapter focuses on physical activity and diet to prevent overweight and obesity. The diet segment specifically describes the prevalence of fruit and vegetable consumption, women's dietary behaviours before and after pregnancy, dietary guidelines, health benefits of selected foods, and barriers to eating a healthy diet. The dietary background information is expanded upon in Chapter Six. The physical activity segment specifically describes the prevalence of physical activity levels, women's physical activity behaviours before and after pregnancy, physical activity guidelines, and the health benefits of, and barriers to doing regular physical activity.

## **Chapter Three: Literature Review (Part B)**

Chapter Three is a continuation of the literature review and describes the prevalence of diet and physical activity in women, maternal overweight and obesity, health promotion behaviour change theories, and the application of behaviour change theory research in diet and physical activity research, and diet and physical activity interventions in pregnancy, postpartum and mothers. The systematic literature review specifically reviews the components (recruitment, intervention duration, strategies and resources, behaviour change theoretical framework, measurement tools and diet and physical activity outcomes of randomised controlled trials for mothers of young children.

## **Chapter Four: Methodology**

Chapter Four is based upon the scientific journal article published in *BMC Public Health*.

Monteiro, S. M. D. R., Jancey, J., Howat, P., Burns, S., Jones, C., Dhaliwal, S. S., McManus, A., Hills, A.P., Anderson, A. S. (2010) The protocol of a

randomised controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program. *BMC Public Health*, 11; 648-562. DOI: 10.1186/1471-2458-11-648 [Impact Factor 2.08] (*Paper 1*)

Chapter Four describes the study design, setting, target group, recruitment of participants and program staff, ethics, randomisation, blinding, data collection, statistical analysis, measures (process and outcome) and intervention. This chapter expands on the published article and includes information on the intervention development and testing, and questionnaire development and test-retest results.

### **Chapter Five: Process evaluation results**

Chapter Five is a scientific journal article that was published in *Health*.

Monteiro, S. M. D. R., Jancey, J., Howat, P. (2014) Physical activity and nutrition intervention for mothers of young children: Process evaluation. *Health*, 6 (3); 223-230. DOI: 10.4236/health.2014.63033 [Impact Factor 1.28] (*Paper 2*)

Chapter Five reports on the description of the recruitment of project staff, feedback from the facilitators on the face-to-face workshops and intervention resources, participants' feedback on the relevance and acceptability of the intervention strategies and recommendations for future interventions for mothers with young children.

### **Chapter Six: Diet behavioural outcomes**

Chapter Six is a scientific journal article that was published in *International Journal of Behavioral Nutrition and Physical Activity*.

Jancey, J., Monteiro, S. M. D. R., Howat, P. Dhaliwal, S. S., P. Hills, A.P., Anderson, A. S., Burns, S. (2014) Dietary outcomes of a community based intervention for mothers of young children: A randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 11; 120-129. DOI: 10.1186/s12966-014-0121-1 [Impact Factor 3.68] (*Paper 3*)

Chapter Six reports the findings of daily serves of fruit and vegetable intake, Fat and Fibre eating behaviours barometer, and soft drinks consumed between the intervention and control groups at baseline and at 6-months post intervention. The discussion section reports on the REFRESH findings compared to other similar studies and provides recommendations for the future.

### **Chapter Seven: Physical activity behavioural outcomes**

Chapter Seven is a scientific journal article that was published in *Preventive Medicine*.

Monteiro, S. M. D. R., Jancey, J., Dhaliwal, S. S., Howat, P. Burns, S., Hills, A.P., Anderson, A. S. (2014) Results of a randomised controlled trial to promote physical activity behaviours in mothers of young children. *Preventive Medicine*, 59; 12-18. DOI: 10.1016/j.ypmed.2013.10.022 [Impact Factor 3.496] (*Paper 4*)

Chapter Seven reports the findings of minutes of levels of physical activity, minutes of high intensity physical activity and minutes of walking between the intervention and control groups at baseline and at six-months post intervention.

### **Chapter 8: Summary, discussion and recommendations**

This chapter discusses the results for each of the objectives, describes the limitations and significance of the study and provides recommendations.

---

## **CHAPTER TWO**

### **LITERATURE REVIEW (Part A)**

---

#### **PRELUDE**

Chapter Two (Part A) is the first section of a two-part literature review. Chapter Two initially provides an overview of overweight and obesity. It is followed by an in depth description of the role of maternal overweight and obesity, its risk factors, the consequences for the mother and infant's health, and the cost of overweight and obesity and specifically maternal obesity. The next section of this chapter focuses on physical activity and diet to prevent and manage overweight and obesity. The diet segment specifically describes the current food consumption patterns among women, food consumption behaviours before and during pregnancy, Australian Dietary guidelines, health benefits of selected foods, and barriers to eating a healthy diet. The diet section is expanded upon in Chapter Six. The physical activity segment specifically describes the guidelines, health benefits, and barriers to doing regular physical activity. The physical activity section is expanded upon in Chapter Seven.

The next chapter describes the systematic review of diet and physical activity randomised controlled trials for mothers with young children. This chapter focuses specifically on research that includes health promotion behaviour change theories.

## 2.1 OVERWEIGHT AND OBESITY

Obesity is medical condition that is an accumulation of excess body fat, to an extent that may impair health (World Health Organisation, 1998). Obesity is classified by a body mass index (BMI) of greater than  $30\text{kg/m}^2$  (World Health Organisation, 1998) or waist circumference of greater than 88 centimeters in women and 108 centimeters in men (Arderm et al., 2004, Huxley et al., 2010, World Health Organisation, 2011). Worldwide rates of overweight and obesity in women are higher than men (World Health Organisation, 2011b). In 2008, globally among women aged 20 years and older, 35% were overweight ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) and 14% were obese ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) versus 34% of men who were overweight and 10% who were obese (World Health Organisation, 2011).

Overweight and obesity contribute to 5% of global mortality (World Health Organisation, 2009) and are associated with chronic medical conditions and diminished quality of life (World Health Organisation, 1998). Overweight and obesity are risk factors for cardiovascular diseases (Bennett and Magnus, 1994, Romero-Corral et al., 2006), cancers such as endometrial, breast, and colon (Harvie et al., 2003, Calle et al., 2003), Type 2 diabetes mellitus (Jafar-Mohammadi and McCarthy, 2008), high total cholesterol or high levels of triglycerides, liver (De Ridder et al., 2007) and gallbladder disease (Naumnik and Mysliwiec, 2010), sleep apnoea and respiratory problems, degeneration of cartilage and underlying bone within a joint (osteoarthritis) (Berenson and Bogalusa Heart Study, 2012), reproductive health complications such as infertility (Naukkarinen et al., 2012) and mental health conditions (World Health Organisation, 2011).

Overweight and obesity are quite a complex health consequence impacted upon by the social determinants of health. An individuals age, sex, lifestyle, social and community networks, living and working conditions such as housing, health service, unemployment, education, and general social, and cultural and environmental conditions all contribute to overweight and obesity globally (World Health Organisation, 2003). The non-modifiable risk factors of overweight and obesity include genetic susceptibility, family history, and certain health conditions such as hypothyroidism, polycystic ovarian syndrome, and Cushing's syndrome. Furthermore, individuals may be prone to hyperplasia of adipose tissue (increase in number of fat cells) at certain life stages, namely, during invitro, in the first year of life, puberty (Van Harmelen et al., 2003), pregnancy (O'Sullivan, 2001) and post-

menopause (O'Sullivan, 2001). However, hypertrophy (enlargement of the fat cells) of the adipose tissue only occurs after the present adipose cells have enlarged to the point of critical size which depends on the body's energy balance (Hirsch and Bachelor, 1976; Tremblay and Doucet, 2000).

The energy balance is the balance of the kilojoules consumed through eating and drinking and the kilojoules burned through physical activity. Thus, the physical activity and diet are potentially modifiable risk factors that can assist in maintaining the energy balance of the body and are critical in addressing overweight and obesity (Durand et al., 2011; Stamatakis and Brownson, 2008; Chen et al., 2008; World Health Organisation, 2009; World Health Organisation, 2011).

### **2.1.1 Prevalence of overweight and obesity in childbearing-aged women**

The prevalence of overweight or obesity in women of childbearing-age has significantly increased over the past decade. In 2011-12, 42.4% of Australian women aged 25-34 years were overweight or obese while in 1995 only 26% were overweight or obese (Australian Bureau of Statistics, 2012). In the UK (2007) 24% of women aged 16 years and over were obese, this increased from 16% in 1993 (Helsehurst et al., 2007, Office of National Statistics, 2008). In 2011-12, 56.2% of Australian females aged 18 years and over were classified as overweight or obese (28% overweight and 28.2% obese) (Australian Bureau of Statistics, 2012). In the USA (2002) among women aged 22-44 years, 24.5% were overweight and 23% were obese (Vahratian, 2009).

The prevalence of overweight and obesity in pregnant women is increasing globally. A review of hospitalisations between 1998 and 2009 demonstrated that 34% of the Australian obstetric population were overweight, obese or morbidly obese (Callaway et al., 2006). Of all Australian women who gave birth in 2011, 20.5% were reported obese and 26.2% were reported to be overweight at the first antenatal visit (Li et al., 2013). Additionally, a study conducted with 75,432 births in Australia, demonstrated that mothers with a BMI  $\geq 35$  kg/m<sup>2</sup> increased from 3.7% in 1998 to 5.2% in 2009 (McIntyre et al., 2012). Similar figures have been reported in the USA and UK. In the USA, 45% of women were reported to be overweight or obese prior to pregnancy (U.S. Department of Health and Human Services, 2009). In the UK, the prevalence of women with a known BMI  $\geq 35$  kg/m<sup>2</sup> (Class II and Class III obesity) was 5% in 2009 (Centre for Maternal and Child Enquiries, 2010).

### **2.1.2 Correlation between women's age and body mass index**

There is a positive correlation between an increase in women's age and BMI (Stuckler, 2008). In women, this upward trend in BMI and maternal age increases the risk of maternal overweight or obesity (Australian Institute of Health and Welfare, 2010). The Australian Longitudinal Study on Women's Health reported that between 1996 and 2003, the younger women's cohort (18-23 years) had the highest weight gain (649 grams per year) when compared with the mid-aged cohort of 45-50 years (492 grams per year) and older women aged 70-75 years (162 grams per year) (Australian Longitudinal Study on Women's Health, 2005). In 2011-12, 42% of Australian women aged 25-34 years were overweight or obese and this figure increased to 55% among women aged 35-44 years (Australian Bureau of Statistics, 2012). This positive association between BMI and age is further validated by results from the National Health Surveys conducted in 1995 and 2004-05 (the surveys do not include the same people but are used as cohorts to observe changes). In Australia, the greatest increase in obesity rates for women occurred for the cohort aged 35-44 years in 1995 and 45-54 years in 2011-12 (individuals classified as obese increased from 12% in 1995 to 28% in 2011-12) (Australian Bureau of Statistics, 2012). In USA, among women aged 20-34 years, 51% were classified as overweight or obese and it increased to 61% in women aged 35-44 (World Health Organisation, 2013). In the UK, 45% of women aged 25-34 were overweight or obese and this figure increased to 51% in those aged 35-44 years (Heslehurst et al., 2010).

Women having children at a later age are reported to be at increased risk of maternal overweight or obesity and its consequences (Kerrigan and Kingdon, 2010; Callaway et al., 2006; Nassar and Usta, 2009). Despite the medical consequences there is a growing trend in trend towards delayed childbearing in Western Europe, New Zealand, Canada, the United States and Australia (Royal College of Obstetricians and Gynaecologists, 2009). Of all first time mothers, 14.2% were aged 35 years or older in 2011 compared with 11.2% in 2002 and 9% in 1998 (Laws and Sullivan, 2009; Li et al, 2013).

### **2.1.3 Correlation between parity and body mass index**

Longitudinal studies demonstrate that there is a positive correlation between parity and weight/BMI in women. The USA Coronary Artery Risk Development in Young

Adults Study (CARDIA) (1985-86 to 1995-96) reported that childbearing was associated with a threefold greater increase in visceral fat deposition when compared with women not bearing children (Gunderson et al., 2008). The CARDIA study also reported that women who had a baby gained 4.7 kg more than nulliparous women over the 10 year period (Gunderson et al., 2004). The Australian Longitudinal Study on Women's Health (1996 to 2006) reported that women on average gained 605 grams per year, however, women with a child gained four kilograms more than childless women over the 10 year duration (Brown et al., 2010). Finally, a 25 year American retrospective study conducted with 2415 women followed between 1981 and 2006 (560 nulliparous and 1855 primiparous or multiparous) demonstrated that primiparas and multiparas have greater increases in BMI than nulliparas (Abrams et al., 2013) (Table 1).

Table 1 Body mass index increase attributable to parity (25 Year Follow-up)

	BMI <25		BMI ≥25	
	BMI Increase	95% CI	BMI Increase	95% CI
10 year follow-up				
Nulliparous(reference group)				
Primiparous	0.72	0.52, 0.93	1.30	0.58, 2.02
Multiparous	0.56	0.35, 0.78	1.52	0.44, 2.60
25 year follow-up				
Nulliparous(reference group)				
Primiparous	0.28	-0.28, 0.83	0.85	-0.03, 1.73
Multiparous	0.12	0.36, 0.60	1.07	-0.10, 2.25

*2 tailed Wald test comprising weight gain between primiparous and multiparous (results only for White ethnic populations); BMI=Body Mass Index (weight (kg)/height (m<sup>2</sup>); BMI increase was modelled for time-dependent follow-up live birth categories as the difference in BMI increase as compared to zero live births since baseline; Baseline groups consist of baseline BMI categories (Normal, <25, overweight, ≥25)*  
 Sourced from (Abrams et al., 2013)

#### 2.1.4 Maternal overweight and obesity risk factors

Childbearing is identified as a predictor of long term overweight and obesity (Abrams et al., 2013; Davis et al., 2009). Postpartum Weight Retention (PPWR) it is defined as weight retained as a result of physiological changes in pregnancy. It is associated with weight increase after childbirth. However, 12-18 months post childbirth, claims that postpartum weight retention is a natural part of pregnancy have been refuted. According to Schmitt et al. (2007) any excessive weight retained cannot be attributed to these physiological changes in pregnancy 12-18 months postnatal. It is suggested that excessive postpartum weight retention is more likely

to be linked to high body mass index (BMI) prior to pregnancy (Gunderson et al., 2004; Soltani and Fraser, 2000; Kerrigan and Kingdon, 2010), weight gain above the recommended guidelines for pregnancy (Linne and Rossner, 2003; Siega-Riz et al., 2009), weight retention during the postpartum period (Gore et al., 2003; Linne and Rossner, 2003; Schmitt et al., 2007; Krummel, 2007) and inter-pregnancy weight gain (Villamor and Cnattingius, 2006). Interpregnancy weight gain and weight gain 12-18 months postpartum are attributed to lifestyle factors relating to unhealthy diets and lack of physical activity, and gestational weight gain (Devine et al., 2000).

One of the mechanisms associated with long term adiposity is stress (Wardle. J. et al., 2011). Figure 1 depicts the mechanisms for childbearing women's heightened vulnerability to obesity may be attributable to chronic stress exposure during the childbearing years (Davis et al., 2012). The stress related physiological activation (stress response) (Figure 1, B) are purported to be caused by a combination of genetics, environmental factors (social, cultural and physical), socio-economic status and stressful experiences (Figure 1, A) and the social determinants of health (Figure 1, social determinants of health) (World Health Organisation, 2003b). The physiological activation to stress may include higher cortisol levels and dysfunction of the hypothalamic-pituitary axis system, a system involved in eating and weight control, and greater central obesity (Davis et al., 2012). The stress response is influenced by health behaviours (Figure 1, B) such as diet, physical activity and smoking. If unhealthy behaviours (Figure 1, B) are enacted during the stress response (such as unhealthy diet, insufficient physical activity and smoking), homeostasis is disrupted (Figure 1, C) and in turn results in impaired biological adaptive systems such as excessive gestational weight gain (Figure 1, D), increased postpartum weight retention (Figure 1, D) and long-term overweight and obesity (Figure 1, E) (Davis et al., 2012) (Figure 1).

#### 2.1.4.1 Weight management behaviours before and during pregnancy in Western Australia

The Institute of Medicine published gestational weight gain guidelines to assist in the prevention of overweight and obesity (Institute of Medicine, 2009; Rasmussen et al., 2010). In a retrospective study exploring women's weight management behaviours before and during pregnancy in Western Australia, more than half the participants reported that they gained weight beyond those recommended for pregnancy (Smedley et al., 2014; Institute of Medicine, 2009).

Assessment of weight is promoted as a routine antenatal care procedure in Western Australia (Department of Health Western Australia, 2003), yet the majority of women had little or no idea of the importance of gestational weight gain on health, with a typical comment being: 'I was weighed every time, but I had no idea what I should have weighed' (Tovar et al., 2010). The lack of concern for weight gain reported by the women may reflect their lack of knowledge about the health implications of excessive weight gain. The finding indicates a need for weight management education during the antenatal period so that women understand the healthy weight gain parameters and the implications of excessive weight gain for themselves and their unborn child. Research indicates that education around weight management does affect pregnant women's weight gain (Rasmussen et al., 2010; Thangaratinam and Jolly, 2010). The optimal impact of weight management advice is achieved when medical professionals commence education at the time of pregnancy confirmation and continue it throughout the pregnancy (Centre for Maternal and Child Enquiries and Royal College of Obstetricians and Gynaecologists, 2010; Rasmussen et al., 2010).



### **2.1.5 Consequences of obesity on women of childbearing age**

Maternal obesity has multiple health and medical consequences during the antepartum, intrapartum and postpartum period and is also associated with impaired fecundity. The mechanisms of reduced fertility in obese women include hormonal imbalance such as an increase in leptin (Brewer and Balen 2010), and increased risk of polycystic ovarian syndrome (Teede et al., 2013). In the antepartum period obese women may experience gestational diabetes, hypertensive disorders, thromboembolism, antepartum infections, preterm delivery and multiple pregnancies (Tsoi et al., 2010; Davis and Olson; 2009, Ramachenderan et al., 2008). During the intrapartum period medical consequences for the woman include a long labour, need for induced labour, caesarean delivery (Chu et al., 2007b), stillbirth (Chu et al., 2007a), and foetal distress (Ramachenderan et al., 2008). The postpartum complications include maternal mortality, postpartum haemorrhage, and a reduced likelihood of initiating and maintaining breastfeeding. Furthermore, gestational weight gain and weight retention during the postpartum period are independent risk factors of long-term obesity (Arendas et al., 2008; Linne et al., 2002; Linne et al., 2004; Rooney and Schauburger, 2002).

Maternal obesity has deleterious effects on neonatal outcomes such as macrosomia which occurs due to a change in maternal metabolic hormones that regulate placental nutrient transport (Ramachenderan et al., 2008; Jansson et al., 2008), increased risk of a range of structural anomalies (Stothard et al., 2009), increased risk of still birth (Chu et al., 2007a), low birthweight infants (McDonald et al., 2010), congenital anomalies (Stothard et al., 2009), childhood obesity (Danielzik et al., 2002) which tracks strongly into adolescence and adulthood (Eriksson et al., 2001), and metabolic diseases (Cottrell and Ozanne, 2008).

Evidence suggests obese mothers are 10 times more likely to raise obese children (O'Reilly and Reynolds, 2013). Overweight and obese children are more likely to suffer from a range of related medical complications, than children who are in a healthy weight range (Reilly, 2005; Cottrell and Ozanne, 2008). Furthermore, studies indicate that children who are overweight or obese have a 50% more chance of being overweight during their adult life, a significant long-term consequence (Reilly and Kelly, 2010). If overweight children continue to be overweight during their adult life they are more likely to suffer from weight-related illnesses and have a higher risk of early death than those adults who only become

overweight or obese once they become an adult (Booth et al., 2001; Galliano and Bellver, 2013).

### 2.1.6 Cost of overweight and obesity

A systematic review of the economic burden of obesity worldwide found that obese patients were accrued medical costs that were six to 45% higher than normal weight patients (Withrow and Alter, 2011). Furthermore, obesity was estimated to account for between 0.7 and 2.8% of the total healthcare expenditure of countries included in the study (Withrow and Alter, 2011). In 2008 the total direct and indirect cost of obesity in Australia was \$8.3 billion (Access Economics, 2008) a dramatic increase from \$3.8 billion in 2005 (Access Economics, 2005).

Economic modelling provides conservative annual estimates for a variety of medical conditions associated with obesity. The annual cost of some of these medical conditions per individual reported in 1999 were: antihypertensive therapy (\$543), services and treatment of Type 2 diabetes mellitus associated diseases for women aged 35 to 64 years (\$2,374), hypercholesterolemia treatment and medication (\$860), total treatment and management of coronary heart disease and stroke (\$3,171, \$5,356, and \$9,421 annually for persons aged 35-74, 75-84 and older than 84 years, respectively (Thompson et al., 1999) (Table 2). The expected lifetime costs of selected obesity-related diseases for women with a BMI of 22.5 and 37.5 demonstrated almost doubled the figures for all age groups; among women aged 35-44 years, for example, the cost was \$15,200 and \$29,700 (Thompson et al., 1999). The economic cost of overweight and obesity demonstrates that there is financial incentive at both the individual and societal levels to prevent or decrease weight among overweight and obese individuals (Colagiuri et al., 2010).

Table 2 Expected lifetime medical care costs of selected obesity-related diseases

Sex and Age (years)	Expected lifetime costs (\$) by BMI (Kg/m <sup>2</sup> )			
	22.5	27.5	32.5	37.5
Men				
35-44	16,2000	20,200	25,300	31,700
45-54	19,600	24,000	29,600	36,500
55-64	22,000	26,100	31,200	37,400
Women				
35-44	15,2000	20,200	23,800	29,700
45-54	18,800	23,200	28,700	35,300
55-64	21,900	26,500	31,200	39,000

*Discounted 3% by sex, age group and BMI. BMI indicates body mass index. In persons assumed initially free of coronary heart disease and stroke. The obesity-related diseases are coronary heart disease, stroke, Type 2 diabetes mellitus, hypertension and hypercholesterolemia. Source (Thompson et al., 1999)*

Overweight and obesity is a major risk factor for maternal deaths. Patients often do not understand the risks associated with maternal obesity (Kominiarek et al., 2010). In the UK, between 2006 and 2008, 47% of the mothers who died from direct causes were overweight and obese (e.g., thromboembolism, pre-eclampsia, haemorrhage, and anaesthetic complications) and 50% of the mothers who died from indirect causes were overweight and obese (such as cardiac disease, psychiatric cause) (Centre for Maternal and Child Enquiries, 2011). In Australia between 2006 and 2010, there were 15 indirect maternal deaths from cardiac diseases. Obesity is identified as one of the risk factors for pregnancy and postpartum mortality, however there was inadequate reporting on lifestyle factors and BMI in this population (Australian Institute of Health and Welfare, 2014).

The economic costs associated with obesity, chronic diseases and the financial burden for health systems makes 'prevention' imperative (Egger, 2011). There is compelling evidence that the promotion of physical activity and healthy eating is beneficial for short and long-term quality of life and financial savings versus management and treatment of associated non-communicable diseases (Pratt et al., 2004; Avenell et al., 2004).

## **2.2 PREVENTION OF OBESITY**

The WHO identifies physical activity and a healthy diet (increase in fruit, vegetable and fibre consumption, reduction in fat and salt) as behavioural factors that can prevent obesity and chronic diseases (World Health Organisation, 2011a, World Health Organisation, 2011c, World Health Organisation, 2009, World Health Organisation, 2008, World Health Organisation, 2005, World Health Organisation, 2004, World Health Organisation, 2003a, World Health Organisation, 1998).

## **2.3 PHYSICAL ACTIVITY**

It is widely accepted that physical activity is vital for the prevention of chronic diseases while sedentary behaviours proliferate the same (World Health Organisation, 2009a; World Health Organisation 2009b). Physical activity is defined "as any bodily movement produced by skeletal muscles that expends energy" (Pg. IV: Brown et al., 2012). The Australian physical activity guidelines recommended doing 30 minutes of moderate intensity activity on most—preferably all—days of the week (150 minutes week) and 30 minutes of vigorous intensity activity three to four

days of the week (90 minutes per week) (Table 3) (Egger et al., 1999). Muscle strengthening activity recommendations include doing 8-10 exercises on two or more non-consecutive days per week using the major muscle groups (Table 4) (Haskell et al., 2007; Egger et al., 1999; US Department of Health and Human Services, 2008; Tremblay et al., 2011; World Health Organisation, 2010b). The updated Australian physical activity guidelines released in 2013 recommend 150 to 300 minutes of moderate physical activity and 75 minutes to 150 minutes of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous intensity activities, each week (Brown et al., 2012; Commonwealth of Australia, 2014). They also recommend doing muscle strengthening activities on at least 2 days each week and minimising the amount of time spend in prolonged sitting and breaking up long periods of sitting as often as possible (Brown et al., 2012; Commonwealth of Australia, 2014). [The 2013 Australian physical activity guidelines were not used in the REFRESH study]. Sedentary behaviours include activities that do not require a lot of energy and are done sitting or lying down. Examples of sedentary activity include watching television, working at a desk or computer. Vigorous intensity physical activity is defined as any activity that makes an individual breath harder or puff and pant. Examples include running, jogging and some competitive sports. Moderate intensity activity requires some effort, but allow a conversation to be held. Examples include brisk walking and swimming (Egger et al., 1999; Brown et al., 2012).

Table 3 Australian physical activity guidelines

	<b>Moderate Intensity Physical Activity</b>	<b>Vigorous Intensity Physical Activity</b>
Frequency	5 days per week	3 days per week
Intensity	Moderate	Vigorous
Duration	Minimum 30 minutes per day or 150 minutes per week	Minimum 20 minutes per day or 60 minutes per week

Source: Australian Physical Activity Guidelines (Egger et al., 1999)

Table 4 Strength exercise guidelines

<b>Number of exercises</b>	<b>Frequency</b>	<b>Sets</b>	<b>Repetitions</b>
8-10	2 non-consecutive days per week	3	8-12

Source: American Physical Activity Guidelines, Canadian Physical Activity Guidelines, WHO Physical Activity Guidelines (Haskell et al., 2007, Egger et al., 1999, US Department of Health and Human Services, 2008, Tremblay et al., 2011, World Health Organisation, 2010b)

### **2.3.1 Prevalence of physical activity**

In Australia, the prevalence of vigorous intensity physical activity (20 minutes per day for at least 3 days per week or 60 minutes per week) among women 18 years and over remained unchanged at 11% in 1989, 2000 (Merom et al., 2006) and 2008 (Australian Bureau of Statistics, 2009c; Australian Bureau of Statistics, 2009b). In 2006, Australian women aged 28-33 (n=8869) did an average of 53 minutes of vigorous leisure activity once per week and 104 minutes of vigorous household or garden chores 1.7 times per week (Australian Longitudinal Study on Women's Health, 2007). Twenty per cent of these women reported going to a gym, doing aerobics or other vigorous exercise classes more than once a week, 8% once a week, 5% one to three times per month, 9% less than once a month and 56% never engaging in this activity (Australian Longitudinal Study on Women's Health, 2007).

The prevalence of moderate intensity physical activity among women has increased. In 1989, 28% of women reported achieving the recommended levels of moderate intensity physical activity (30 minutes per day for at least 5 days per week or 150 minutes per week), increasing to 32.5% in 2000 (Merom et al., 2006) and in 2008 it increased further to 33% (Australian Bureau of Statistics, 2009b). In 2006, Australian women aged 28-33 (n=8869) reported doing on average 37 minutes of moderate intensity leisure activity less than once per week (Australian Longitudinal Study on Women's Health, 2007). Of these, 41% reported walking, swimming or cycling for exercise or fitness more than once a week, 17% once a week, 14% one to three times per month, 12% less than once a month and 16% never engaging in this activity (Australian Longitudinal Study on Women's Health, 2007).

Recent evidence suggests that Australian adults spend between 7 and 10 hours per day sitting, of which 2 to 3 hours is spent watching television (Healy et al. 2008). In 2006, Australian women aged 28-33 reported engaging in sedentary behaviour for an average of 8 hours on a weekday and 5 hours on a weekend (Australian Longitudinal Study on Women's Health, 2007).

Age has an inverse impact on the levels of physical activity among women. In 2007-08, among Australian women aged 25-34 years, 74% had low levels of activity, 20.2% had moderate level of activity and 5.5% high level of activity (Australian Bureau of Statistics, 2009a; Australian Bureau of Statistics, 2009b). These figures increased among Australian women aged 35-44, with 78.2% doing low activity,

18.2% did moderate activity and 4% had high levels of physical activity (Australian Bureau of Statistics, 2009a). The physical activity categories were divided according to the scores calculated based on frequency, intensity and duration of exercise: sedentary activity had less than 1600, moderate activity had scores from 1600 to 3200, or score of more than 3200 but with less than 2 hours of vigorous exercise, and high activity included scores more than 3200 plus 2 hours or more of vigorous exercise (Australian Bureau of Statistics, 2009b).

### **2.3.2 Physical activity behaviours before and during pregnancy**

Pregnancy is a life event that seems to support sedentary behaviours (Petersen et al., 2005; Melzer et al., 2010). Although physical activity can be a protective factor for many pregnancy-related disorders such as preeclampsia and gestational diabetes, research indicates that too few pregnant women are sufficiently active (Gilligan et al., 2009). This is a public health concern as physical inactivity may increase a pregnant woman's risk of gaining weight above the recommended guidelines and developing gestational diabetes (Tobias et al., 2011).

In 2011, a retrospective study on physical activity behaviours before and during pregnancy in Western Australia established that women who reported being physically active before pregnancy were more likely to remain physically active during pregnancy, compared with those who reported being physically inactive before pregnancy (Smedley et al., 2014). However, a large proportion (40%) of healthy, otherwise-active women decreased their physical activity during pregnancy. Comments by the women gave some insight into why this was so.

*'I've got an exercise bike at home but I haven't really been on that since I got pregnant 'cause I lost my energy'*

and

*'I was doing a lot of walking, pilates and yoga. I didn't do any of that at all while I was pregnant, I completely stopped' (Smedley et al., 2014, pp7).*

Remaining physically active during pregnancy is extremely important as it predicts a greater likelihood of postpartum physical activity (McIntyre and Rhodes, 2009). Rarely does physical activity return to the same levels after childbirth, with an increase in physical activity post pregnancy unlikely for most women (Pereira et al., 2007; Brown et al., 2009). However, women in the retrospective study indicated that the excess weight inhibited physical activity, with statements such as:

*'I tried to keep walking but by the end it lessened because after about 10 minutes I was sore, I could feel the pressure and I couldn't be bothered ... it took a long time to get back into it afterwards' (Smedley et al., 2014, pp7).*

This supports the need for alternative forms of physical activity, such as water-based activities, that are available and promoted by health practitioners to women in the early stages of pregnancy (Hegaard et al., 2011; Pereira et al., 2007).

### **2.3.3 Physical activity benefits**

Physical inactivity is identified as a modifiable risk factor linked to a vast majority of chronic disease deaths in all ages in all parts of the world (World Health Organisation, 2005). Sedentary behaviours such as sitting for prolonged periods are associated with higher mortality rates and developing diabetes and chronic diseases. For example, television viewing time is correlated to increase in long term weight gain (Ding, et al., 2012; Parsons, et al., 2008). Booth et al. argue that since humans are not genetically suited to sedentary lifestyles, inactivity is abnormal leading to conditions such as obesity, insulin resistance, Type 2 diabetes mellitus, cardiovascular diseases and cancers (Booth et al., 2008). The role of physical activity in health, and the prevention and management of metabolic diseases, including overweight and obesity is indisputable (Hawley and Holloszy, 2009).

The Surgeon General's Report on Physical Activity and Health promotes the lifelong participation in moderate intensity physical activity (U.S. Department of Health and Human Services, 1996). Evidence of physical activity and health in women suggests that as little as 15-30 minutes of physical activity per day can produce a reduction in the risk of several health problems (Brown et al., 2007). Furthermore, an hour of moderate intensity physical activity per week (240 metabolic equivalents (METs) per week) significantly reduces the risk of cardiovascular outcomes and diabetes (Brown et al., 2007). The American physical activity guidelines report a dose-response relationship exists between physical activity and health benefits within a range of 500 -1,000 MET-minutes of activity per week (U.S. Department of Health and Human Services, 2008).

### **2.3.4 Barriers to physical activity**

The association between both pregnancy and motherhood, and a decline in levels of physical activity has been well documented (McIntyre and Rhodes, 2009; Brown et al., 2009a; Symons Downs and Hausenblas, 2004; Rousham, 2006). This significant life transition affects all aspects of women's physical, social, family and work patterns, and has a negative impact on physical activity (Lewis, 2005; Symons Downs and Hausenblas, 2004).

Barriers to physical activity during pregnancy include lack of information on safe levels of physical activity at the different stages of pregnancy and physical limitations such as nausea, vomiting, tiredness, fatigue and weight gain, which may cause discomfort or pain (Symons Downs and Hausenblas, 2004; Evenson, 2009). Some of the barriers to physical activity during motherhood include: lack of time (Symons Downs and Hausenblas, 2004; Brown et al., 2001; Hoebeke, 2008, Lewis, 2005, Sechrist, 1987; McIntyre and Rhodes, 2009; Brown et al., 2001); caring for other children, tiredness (Symons Downs and Hausenblas, 2004; Brown et al., 2001, Hoebeke, 2008, Lewis, 2005, McIntyre and Rhodes, 2009; Jones et al., 2010); lack of motivation (Symons Downs and Hausenblas, 2004; Brown et al., 2001, Hoebeke, 2008); lack of finances (Brown et al., 2001; Lewis, 2005; Sechrist, 1987, Rowley et al., 2007, Ramirez, 2007; Jones et al., 2010); lack of child care (Brown et al., 2001; Hoebeke, 2008; Lewis, 2005; McIntyre and Rhodes, 2009; Jones et al., 2010; Thornton et al., 2006), lack of facilities or transport (Hoebeke, 2008; Sechrist, 1987; Ramirez, 2007); safety concerns (Hoebeke, 2008; Rowley et al., 2007; Ramirez, 2007); lack of support (Hoebeke, 2008; Sechrist, 1987; Thornton et al., 2006); and, body image concerns and low self-esteem (Hoebeke, 2008; Lewis, 2005; Nash, 2010; Ransdell et al., 2004; Walker and Freeland-Graves, 1998).

A key theme reported by several studies exploring the barriers to physical activity is the conflict mothers experience between the social expectations of being a 'good mother' (identified as addressing the needs of children and family ahead of her own needs) and leading a healthy lifestyle that includes regular physical activity (Lewis, 2005; Ransdell et al., 2004; Jones et al., 2010; Brown et al., 2009). Attitudes and behaviours towards body weight and physical activity is an important determinant of physical activity and weight retention during motherhood (Friedman et al., 2008;

Devine et al., 2000) and should be considered when developing behaviour change interventions.

## **2.4 DIET**

Healthy eating is reported as the foundation for health and prevention of diseases. The Australian Guide to Healthy Eating provides information on the types and amounts of foods, food groups and dietary patterns for health and wellbeing, and protection against chronic diseases. The Australian Guide to Healthy Eating recommends the following:

- eating plenty of vegetables, including different types and colours, and legumes/beans, fruit, grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties, lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans, milk, yoghurt, cheese and/or their alternatives, mostly reduced fat, and drinking plenty of water;
- limiting the intake of foods containing saturated fat and to replace high fat foods, which contain predominantly saturated fats with foods which contain predominantly polyunsaturated and mono-unsaturated fats such as oils, spreads, nut butters/pastes and avocado;
- limiting intake of foods and drinks containing added salt, reading labels to choose lower sodium options among similar foods and not adding salt to foods in cooking or at the table;
- limiting the intake of foods and drinks containing added sugars; and
- limiting the intake of alcohol (Department of Health and Ageing, 2005; National Health and Medical Research Council., 2003).

The Australian Dietary Guidelines also provide information on the recommended number of serves of each of the food groups in accordance with the different age, life stage and gender (Table 5) (Department of Health and Ageing, 2005; National Health and Medical Research Council., 2003).

Table 5 The Australian Dietary Guidelines recommended serves of each of the food groups

Women (age group in years)	Breads, Cereals, Rice, Pasta, Noodles	Vegetables and Legumes	Fruit	Milk, Cheese, Yogurt	Meat, Fish, Poultry, Legumes, Eggs, Nuts,	Extra Foods
19-60 years (1998)*	4-9 4-6	5 4-7	2 2-3	2 2-3	1 1-1½	0-2½ 0-2½
19-50 years (2013)#	6	5	2	2½	2½	Use in small amounts
Pregnant (1998)*	4-6	5-6	4	2	1½	0-2½
Pregnant (19-50 years) (2013)#	8½	5	2	2½	3½	Use in small amounts
Breastfeeding (1998)*	5-7	7	5	2	2	0-2½
Breastfeeding (19-50 years) (2013)#	9	7½	2	2½	2½	Use in small amounts
60+ years (1998)*	4-7 3-5	5 4-6	2 2-3	2 2-3	2 1-1½	0-2 0-2
51-70 years (2013)#	4	5	2	4	2½	Use in small amounts
70+ years (2013)#	3	5	2	4	2	Use in small amounts

\*Source: Australian Dietary Guidelines (Australian Government Department of Health and Aging, 1998)

# Source: Australian Dietary Guidelines (National Health and Medical Research Council, 2013)

In 2013, the Australian Dietary Guidelines were updated and include the following recommendations:

- To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs;
- Enjoy a wide variety of nutritious foods from the five food groups;
- Limit intake of foods containing saturated fat, added salt, added sugars and alcohol;
- Encourage, support and promote breastfeeding;
- Care for your food; prepare and store it safely (National Health and Medical Research Council 2013).

### **2.4.1 The role of specific foods and consumption behaviours in obesity**

Globally, the excessive consumption of salt, sugar and fat, energy-dense, nutrient-poor foods and limited intake of fruit and vegetables and whole-grains contribute to a range of chronic, non-communicable diseases (World Health Organisation, 2009). Furthermore, evidence suggests that adherence to the dietary guidelines is vital during pregnancy and postpartum period for fruit and vegetables, fast food, milk and sugars in order to prevent long term consequences for the mother and the infant such as overweight and obesity (Reifsnider and Gill, 2000).

#### **Fruits and vegetables**

Inadequate fruit and vegetable consumption is a major risk factor contributing to the worldwide burden of disease (Lock et al., 2005). Alternatively, adequate intake of fruits and vegetables play an important role in disease prevention (Department of Health and Ageing, 2005), and are associated with a reduced incidence of many chronic diseases such as cardiovascular disease (Dauchet et al., 2006), stroke (He et al., 2006), diabetes and obesity, and cancers (World Health Organisation, 2003a, Hartley et al., 2013). Experimental studies suggest that protection against heart disease via consumption of fruit and vegetables may occur in several ways including the following: 1) the presence of antioxidant phytochemicals (for example, bioflavonoids and carotenoids) and antioxidant vitamins (for example, vitamins E and C) may reduce the risk of cholesterol becoming oxidised in coronary blood vessels and deposited to form atheromatous plaques; 2) the presence of vitamin folate may reduce blood levels of homocysteine, which is a possible risk factor for coronary heart disease; and 3) potassium and magnesium, both of which have been proposed to be associated with a lower blood pressure and may help prevent or control hypertension (Martinez et al., 2011; Hartley et al., 2013). There is an association between increased consumption of plant foods and lower incidence of obesity and Type 2 diabetes mellitus, although it is not clear whether the apparent protection arises principally from a lower body weight (Martinez et al., 2011; Hartley et al., 2013). In the dietary control of Type 2 diabetes mellitus, vegetables are likely to be of particular value because of their content of fibre and low-energy density carbohydrates and their possible hypoglycaemic activity (Hartley et al., 2013).

Globally, rates of fruit and vegetable consumption have been low (Hall et al., 2009). In 2003, approximately 74% women of childbearing-age (25-44 years) in the US and between 73% and 77% in the UK consumed less than five serves of fruits and

vegetables (World Health Organisation, 2013a). Between 2003 and 2009, pregnant Australian women aged 25-30 year reported a mean intake of 2.08 serves of fruit per day and 2.26 serves of vegetables per day; and 10.5% met the recommendation of 4 serves of fruit per day and 2.4% met the recommendation of 4 serves of vegetables per day (Dobson et al., 2012). Of the non-pregnant Australian women aged 25-30 year (2003-2009) the mean intake was 1.92 serves of fruit per day and 2.22 serves of vegetables per day; and 20.8% met the recommendation of 2 serves of fruit per day and 0.3% met the recommendation of 5 serves of vegetables per day (Dobson et al., 2012). In 2003, the Australian Longitudinal Study on Women's Health reported on childbearing women ability to meet the recommendations for fruit and vegetables: of the women trying to conceive (n=454) 41.4% consumed 2 serves of fruits and 13% consumed 5 serves of vegetables per day, among pregnant women (n=606) 55.4% consumed 4 serves of fruits, and 10.9% consumed 6 serves of vegetables per day and among mothers who had children 12 months prior to the survey (n=829) 45.4% consumed 2 serves of fruits and 13.5% consumed 5 serves of vegetables per day (Blumfield et al., 2011).

### **Wholegrain foods**

Wholegrain food consumption is strongly associated with lower body mass index, smaller waist circumference, reduced risk of becoming overweight or obese, insulin sensitivity and diabetes (Venn and Mann, 2004) all of which are important risk factors for heart disease (Flight and Clifton, 2006). Wholegrain foods are high in insoluble fibre and can also help to reduce weight gain, and increase significant weight-loss (Williams et al., 2008). Wholegrains may have beneficial effects on weight control through promoting satiety (Clarke & Salvin, 2013). The intake of whole grains may also slow starch digestion or absorption, which leads to relatively lower insulin and glucose responses that favour the oxidation and lipolysis of fat rather than its storage (Liu et al., 2003).

Cereal consumption is low among Australian women. Between 2003 and 2009, the mean intake of cereals among Australian women aged 25-30 years, and who reported to be pregnant was 2.46 serves per day and 11.9% met the Australian cereal dietary guidelines (4-6 serves per day); and the non-pregnant women's mean intake of cereals was 2.28 serves per day and 2.1% met the dietary guidelines (4-9 serves per day) (Dobson et al., 2012).

## **Fast foods**

The Australian Dietary Guidelines recommends limiting the intake of foods high in saturated fat such as many biscuits, cakes, pastries, pies, processed meats, commercial burgers, pizza, fried foods, potato chips, crisps and other savoury snacks; replacing high fat foods which contain predominately saturated fats such as butter, cream, cooking margarine, coconut and palm oil with foods which contain predominately polyunsaturated and monounsaturated fats such as oils, spreads, nut butters/pastes and avocado; and low fat diets are not suitable for children under the age of 2 years (National Health and Medical Research Council, 2013). Compared with other macronutrients, fat is the most energy dense and has a higher likelihood of being stored into adipose tissue (Pirozzo et al., 2003; Hooper et al, 2012). Overconsumption of high fat foods is possible due to its high palatability, or perceived improvement in taste and its lower satiety value than high carbohydrate and high protein foods (Pirozzo et al., 2003; Hooper et al, 2012). Furthermore, the body does not have auto-regulation abilities to increase fat utilisation in response to increased fat intake (Pirozzo et al., 2003; Hooper et al, 2012). Common Australian foods such as pies, sausages, crumbed and fried meats, and cold meats may contain significant amounts of saturated fat, either from the ingredients themselves (including non-meat components such as pastry or fillers) or from added cooking fats. Selection of lean mince and removal of visible fat from meat and poultry cuts before cooking can also help to limit fat intake (Commonwealth of Australia, 2003; National Health and Medical Research Council, 2013). Consumption of meals from fast food outlets among Australian women aged 16-44 years varied from 30% not eating from any fast food, 31% eating fast food less than once a week, 35% ate fast food one to two times a week, 3% ate fast three to four times a week and 1% ate fast food more than five times per week (Joyce and Daly, 2010).

## **Sugar intake**

The Australian Dietary Guidelines recommends limiting intake of foods and drinks containing added sugars such as confectionary, sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters, energy and sports drinks (National Health and Medical Research Council, 2013). Excess consumption of sugar contributes to an energy-dense diet that may lead to energy imbalance and obesity (Commonwealth of Australia, 2003; National Health and Medical Research Council, 2013; Morenga et al, 2013). Excessive sugar consumption may also displace other nutrients from the diet (Commonwealth of Australia, 2003; Morenga et al. 2013), increase glucose and insulin levels (Johnson et al., 2009; Morenga et al. 2013), and increase the total

energy intake, which ultimately results in weight gain and obesity (Commonwealth of Australia, 2003; Morenga et al, 2013). Although the mechanisms are uncertain, intake of foods and beverages high in sugar appears to be linked with increased triglyceride levels, inflammation and oxidative stress which are risk factors for coronary heart disease (Johnson et al., 2009). Intake of sugar has been increasing due to the increased intake of high sugar-containing foods such as soft drinks, fruit drinks, desserts, jellies and ready to eat cereals (Johnson et al., 2009). The American Heart Association recommends no more than 100 to 150 calories per day from added sugars (Johnson et al., 2009).

Based on the 1995 Australian dietary survey food analysis, 9% of soft drinks/flavoured mineral waters/ or electrolyte drinks contributed to sugar intake and 10% was contributed by fruit and vegetables juices in females aged 19 years and over (McLennan and Podger, 1998).

#### **2.4.2 Dietary behaviours before and during pregnancy**

A systematic review on pregnant women's dietary behaviours in Europe, Australia, Japan, USA, UK and Canada demonstrates that the energy intake was  $8969 \pm 1034$  kilojoules per day, fibre intake was  $18.7 \pm 4.4$  grams per day, carbohydrate intake was  $269.1 \pm 37$  grams per day, saturated fat intake was  $32.2 \pm 9.1$  grams per day, polyunsaturated intake was  $12.9 \pm 4.41$  grams per day, saturated fat intake was  $32.2 \pm 9.1$  grams per day, sugar intake was  $100.9 \pm 40.1$  grams per day, total fat intake was  $84.7 \pm 17.1$  grams per day, protein intake was  $82.1 \pm 12.5$  grams per day, (Blumfield et al., 2012). A Western Australian pregnant women (before and during pregnancy) dietary behaviours study reported that two-thirds of the participants meet the Australian recommendations for fruit and vegetable consumption (4 serves of fruit and 5/6 serves of vegetables per day) (Smedley et al., 2014). This finding is in contrast to studies conducted in New South Wales (NSW) (Wen et al., 2010) and Queensland (QLD) (Crozier et al., 2010), Australia. In those studies few pregnant women reported eating the recommended daily intake of fruit (9.2% [NSW]; 13% [QLD]) and vegetables (2.7% [NSW]; 7% [QLD]), and about one-third reported that they consumed half the recommended serves of fruit and one-third of the recommended serves of vegetables. The lower reported levels of fruit and vegetable consumption in these two studies may reflect the education levels of the participants. More than 60% of participants in the retrospective study were university educated (Smedley et al., 2014), while more than 60% of

participants in the QLD study and 77% in the NSW study did not finish high school (Wen et al., 2010). The reported level of income was also lower in these studies, highlighting the impact of socio-economic factors on health behaviours (Laraia et al., 2006; Mishra et al., 2010; Crozier et al., 2010).

The women in the retrospective study did report making significant changes to their diets during pregnancy (Smedley et al., 2014). They decreased consumption of fast foods (Smedley et al., 2014), which may be related to regular public education campaigns aimed at pregnant women to inform them of foods not to eat in order to avoid listeria (Anderson, 2001). This indicates that pregnancy is a life event that provides an opportunity to intervene and encourage the adoption of health enhancing behaviours (Thangaratinam and Jolly, 2010).

## **2.5 CONCLUSION**

This literature review demonstrates that maternal obesity is a global problem and the consequences of obesity in reproductive-aged women are significant to the mother and infant's long-term health. Physical activity and healthy eating are vital in the prevention of overweight and obesity despite the barriers encountered by mothers. Pregnancy provides an opportunity for women to reassess their current health behaviours and an opportunity for health professionals to support positive behaviour change. Structuring health systems so that they support women to adopt and maintain positive health behaviours should be a public health priority.

The following chapter three and four is an extension of the literature review. Chapter three includes a review of behaviour change theories and models and their application in intervention research. It also reports on a systematic literature review of the randomised controlled trials on diet and physical activity for mothers with young children.

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## **CHAPTER THREE**

### **LITERATURE REVIEW (PART B)**

**Behaviour change theories in diet and physical activity randomised controlled trials for mothers of young children: Systematic review**

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## **PRELUDE**

Chapter three is a continuation of the literature review. It summarises current evidence and assesses the application of behaviour change theories in randomised controlled trials on diet and physical activity for mothers with young children. The background provides an overview of maternal obesity, diet and physical activity consumption of women and evidence on the application of behaviour change theories in intervention research. The methodology describes the search strategy. The results report on the randomised controlled trials selected on diet and physical activity. The conclusion shows that there is a paucity of research on physical activity and diet randomised controlled trials targeting mothers with young children. The review recommends further research on mothers with young children, elaborating on operational research and consistency in measurement and reporting on food consumption and physical activity outcomes.

The following chapter addresses Objective 1: To conduct a systematic literature review of diet and physical activity interventions for mothers with young children.

### 3.1 INTRODUCTION

Women of childbearing-age consume inadequate fruit and vegetables (Hall et al., 2009) and have low levels of physical activity (Bauman et al., 2009). Furthermore, physical activity declines during pregnancy and the post-partum period (Liu et al., 2011, Evenson, 2011, Borodulin et al., 2009). Among women aged 25 to 44 years, 74% consumed less than five serves of fruit and vegetables in the United States of America (USA) and 77% in the United Kingdom (UK) (World Health Organisation, 2013a). Among women aged 24 to 44 in Australia, 46% consumed less than one serve of fruit and 86% consumed less than five serves of vegetables (Australian Institute of Health and Welfare, 2011). Among females aged 18 to 39, 18% had low levels of physical activity in USA and 19% in Australia (Bauman et al., 2009). A low level of physical activity is classified as not achieving 30 minutes of moderate-intensity physical activity at least 5 days a week, or not achieving 20 minutes of vigorous-intensity physical activity at least 3 days a week, or an equivalent combination achieving 600 metabolic equivalent minutes per week (U.S. Department of Health and Human Services, 2008).

The prevalence of overweight and obesity in women of childbearing-age is high and increases with age and parity (World Health Organisation, 2013b; Gunderson et al., 2008). In Australia, there was a 10% increase in the prevalence of overweight and obesity in women from the age of 25 to 34 (45%) to those aged 35 to 44 (55%) (World Health Organisation, 2013b). The Australian Longitudinal Study on Women's Health (1996 to 2006) reported that on average women gained 605 grams per year. However women with a child gained 4 kilograms more than childless women over the 10 year period (Brown et al., 2010).

The factors linked to ongoing maternal overweight and obesity include being overweight or obese prior to pregnancy (Gunderson, 2009), gestational weight gain above the recommended guidelines (Siega-Riz et al., 2009), failure to lose gestational weight in an appreciable timeframe or excessive postpartum weight retention (Krummel, 2007), and inter-pregnancy weight gain (Villamor and Cnattingius, 2006).

Maternal obesity is associated with gestational diabetes, hypertensive disorders, thromboembolism, antepartum infections, preterm delivery, caesarean delivery, stillbirth, foetal distress, macrosomia and congenital anomalies, maternal mortality,

postpartum hemorrhage, and a reduced likelihood of effective breastfeeding (Gunderson, 2009). Thus, maternal obesity can be of significant cost to the healthcare system due to the increased use of maternal services (Rowlands et al., 2010).

### **3.1.1 Health Promotion and Behaviour Change Theories**

Health promotion interventions can assist in altering the course of chronic disease patterns by changing health behaviours (World Health Organisation, 2005; Glanz and Bishop, 2010). Behaviour change theories (Glanz et al., 2008) and techniques (Abraham and Michie, 2008) play a critical role in the intervention mapping research cycle (Painter et al., 2008). During formative evaluation, theories ensure that the social, environmental and personal factors that mediate change are accounted for, and in intervention development phase they direct the techniques that promote and support behaviour change (Michie et al., 2008). In the impact evaluation phase, theories identify the specific components of the intervention that contributed to its successes or failures, thereby improving its generalisability and replication (Noar and Mehrotra, 2011).

Evidence demonstrates that theoretically-informed interventions are more effective (Michie et al., 2009a). Widely used behaviour change theories and models include the Health Belief Model (HBM), the Protection Motivation Theory (PMT), the Theory of Planned Behaviour (TPB), the Trans-Theoretical Model (TTM)/Stages of Change (SOC) and the Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Social Ecological Model (SEM), Self-Determination Theory (SDT), Social Learning Theory (SLT), and Motivational Interviewing (MI).

The HBM focuses on an individual's perceived susceptibility to diseases and the anticipated consequences. It also includes individual's perception of the benefits of recommended health behaviours, and the barriers to achieving the behaviour (Abegunde et al., 2007). The PMT and the TRA central premise is that an individual's appraisal of the consequences of the disease and their belief that the health behaviour is effective in reducing the consequences will either encourage or deter them from acting on the health behaviour (Rogers, 1975; Conner and Norman, 2005). The TPB and SDT are based on the notion that an individual must have an intention to prevent disease and the motivation to make conscious decisions to perform the health behaviour (Ajzen, 1991; Conner and Norman, 2005). The TTM of

behaviour change is based on the idea that individuals move through different stages of change as they adopt a health behaviour (i.e., pre-contemplation, contemplation, preparation, action and maintenance), (Marcus and Lewis, 2003). The SCT suggests that health behaviour is the outcome of the interaction between the individual's beliefs and attitudes towards health, and the environment. The individual is more likely to engage in behaviours that promote health if the social environment promotes it and reduces the barriers to engaging in it. This theory also includes the provision of skills to increase self-efficacy and ensure social-support for long-term health behaviour maintenance (Marshall and Biddle, 2001; Bandura, 2001; Bandura, 1986; Bandura, 1997). The SLT focuses on learning health behaviours through observation of health behaviours and their positive outcomes. It also states that there is a need for positive intrinsic reinforcement so that behaviour is continued (Bandura, 1969).

Motivational Interviewing is a person-centered counselling approach which focuses on the individual's readiness to change behaviour, perceived importance (perceived threat and positive outcomes) to change behaviour, and confidence (skills and positive attitude) to change the behaviours (Resnicow et al., 2002a; Resnicow et al., 2002b; Rollnick et al., 2010; Rollnick and Miller, 1995). Socio-ecological models emphasize that individuals behaviours are an outcome of their interaction with their physical and socio-cultural surroundings. Additionally, ecological models of health behaviour change are based on the premise that social determinants of health and support or deter an individual from performing healthy behaviours. It includes biological and psychological characteristics, organisational regulations, social/cultural factors, environmental structures, and policy variables (Sallis et al., 1997).

Behaviour change techniques are linked to the theories and provide practical ways to change behaviours. For example, the provision of information is linked to the TRA (Fishbein and Ajzen, 1975); the provision of information on consequences is linked to the TRA, TPB and SCT (Ajzen, 1991b); prompt intention formation is linked to the TRA, TPB, and SOC; prompting barrier identification is linked to SOC; and providing general encouragement is linked to SOC (Abraham and Michie, 2008).

### **3.1.2 Application of behaviour change theories in physical activity and diet interventions**

Health behaviour change theories may be applied at different stages of the research cycle, from formative research and project planning to those of intervention design, implementation, and evaluation (Glanz and Bishop, 2010; Glanz et al., 2008; Kok et al., 2004; Green and Kreuter, 2005; Brug et al., 2005). Evidence suggests that the appropriate selection of a behaviour change theory can increase the effectiveness of an intervention (Glanz and Bishop, 2010; Painter et al., 2008). The application of a behaviour change theory and its constructs has demonstrated varying degrees of effectiveness on physical activity and dietary interventions (Ashford et al., 2010; Hardeman et al., 2002; Horwath, 1999; Michie et al., 2009; Nothwehr et al., 2008). Social cognitive constructs are frequently applied in health promotion interventions, where they result in a positive correlation between physical activity (Keller et al., 1999) and nutrition related behaviours (AbuSabha and Achterberg, 1997).

Similarly, meta-analysis on PMT (Floyd et al., 2000) and the TTM (Marshall and Biddle, 2001) reveal that behaviour change theories are positively associated with increasing physical activity and improving dietary consumption (Michie et al., 2009; Khan et al., 2002). However, there is also evidence contrary to these findings, particularly in terms of the longer-term effect of the TTM based interventions on physical activity adherence (Horwath, 1999). Despite these aspects, there is a need for better understanding of the ways behaviour change theories are actually used in intervention research (Painter et al., 2008; Bhattacharyya et al., 2006), and to clearly identify mediator variables such as social support, in order to establish the efficacy of behaviour change theories (Glanz and Bishop, 2010).

### **3.1.3 Weight management interventions during pregnancy and/or postpartum period**

Reviews on weight management during pregnancy and/or the postpartum period have been conducted (Amorim, Linne, & Lourenco, 2007; Birdsall, Vyas, Khazaezadeh, & Oteng-Ntim, 2009; Dodd, Grivell, Crowther, & Robinson, 2010; Gardner, Wardle, Poston, & Croker, 2011; Hartman, Hosper, & Stronks, 2010; Keller, Records, Ainsworth, Permana, & Coonrod, 2008; Kuhlmann, Dietz, Galavotti, & England, 2008; Ronnberg, 2010; Skouteris et al., 2010; Streuling, Beyerlein, & von Kries, 2010; Thangaratinam & Jolly, 2010; Campbell et al., 2011; Elliott-Sale et

al., 2014). These reviews have a number of limitations: the studies included were not all community-based interventions; diet or physical activity were not the primary outcomes; the target group were mothers with and without children; and one review identified the target group as mothers with young children but included a study wherein 2% of participants were men (Hartman et al., 2010).

#### **3.1.4 Aim**

This paper aims to identify and examine peer-reviewed published community-based diet and physical activity randomized controlled trials that use behaviour change theories and target mothers with young children.

### **3.2 METHODS**

The methods for this systematic review are adapted from the 'Cochrane handbook for systematic reviews of interventions' guidelines (Higgins & Green, 2011).

#### **3.2.1 Search strategy**

A systematic search was conducted in May 2012 to identify relevant publications from the following databases: Cochrane Library, CINAHL, EMBASE, Medline, PsycINFO, Scopus and Web of Science. Searched fields were keyword, title and abstract. All searches were narrowed to retrieve records published from January 1991 to December 2011. Where possible searches were narrowed to include only human studies (CINAHL, PsycINFO, EMBASE) and additionally the CINAHL search strategy was restricted to those aged 18 years or over.

The systematic electronic database search was conducted in four stages.

Stage 1 (Search Terms): Initially, the search terms were categorised into topic areas and entered into the databases. The search topics and terms included:

- a) Study design: intervention research/study, randomised controlled trial, control trial, quasi-experiment;
- b) Target group: pre-pregnancy, pregnant, maternal, postpartum, interpregnancy, antenatal, postnatal, mother;
- c) Behaviour change theories: Health Belief Model (HBM), Protection Motivation Theory (PMT), Theory of Planned Behaviour (TPB), Transtheoretical Model (TTM), Stages of Change (SoC), Social Cognitive

Theory (SCT), Theory of Reasoned Action (TRA), Social Ecological Model (SEM), Self-Determination Theory (SDT), Social Learning Theory (SLT), Motivational Interviewing (MI);

- d) Physical activity outcomes: exercise, physical activity, walking, physical fitness, moderate intensity physical activity, vigorous intensity physical activity;
- e) Nutrition outcomes: diet, energy intake, calorie, fat, lipid, sugar, fibre, soft drink, saturated fat, glycemic index, healthy eating, food intake, fruit, vegetable).

Stage 2: References from the databases were downloaded into Endnote and duplicates were excluded.

Stage 3 (Eligibility Criteria 1): The reference abstracts were downloaded and reviewed by two researchers against the following eligibility criteria:

- i) Date: January 1991 to December 2011;
- ii) Language: published in English;
- iii) Population: mothers (pregnant and/or non-pregnant) with young children;
- iv) Study design: experimental;
- v) Physical activity and/or eating/nutrition behaviour outcomes: physical activity, walking, MPA, VPA, low intensity, fat, sugar, fibre, soft drink, saturated fat, food intake, fruit, vegetable;
- vi) Behaviour change theory or techniques: HBM, PMT, TPB, TTM, SOC, SCT, TRA, SEM, SDT, SLT, MI, self-efficacy, social support, prompting of barrier identification, providing general encouragement, providing feedback on performance, prompting intention formation and monitoring of behaviour, planning social support/social change and use of follow up prompts;
- vii) Type of study: Quantitative studies;
- viii) Conference abstracts without full-text articles were excluded.

Stage 4 (Eligibility Criteria 2): Finally, the full-text of the remaining reference abstracts were obtained and filtered to meet the following additional eligibility criteria:

- i) Population: all women (pregnant and/or non-pregnant) in the study had at least one child aged 0 and 5 years and had no metabolic diseases;

- ii) Study design: randomised controlled trial;
- iii) Study criteria: women without gestational diabetes mellitus;
- iv) Outcome analysis related to physical activity and/or eating/nutrition behaviours.

Additionally, a hand search of the selected articles reference lists were assessed against the eligibility criteria 1 and 2 (described in stage 3 and 4).

### **3.2.2 Data extraction**

Two researchers independently extracted data from the full-text of the studies using standardised extraction forms in order to ensure consistency, whilst reducing bias and improving validity and reliability of the data. Disagreements between investigators were resolved through discussion. The variables included:

- i) participant characteristics (sample size, age, country, setting, pregnancy status, children aged 0 to 5 years);
- ii) intervention characteristics (target health behaviour, delivery mechanism and intervention content);
- iii) study methods (study design; duration and control characteristics);
- iv) outcomes (units of measurement, instruments and time points);
- v) results (number of participants allocated to each intervention group, summary data and key conclusions of study authors).

### **3.2.3 Data quality assessment**

Studies were evaluated for data quality using an adaptation of the Cochrane Collaboration's tool for assessing and reporting randomised controlled trials (Higgins & Green, (2011); Armstrong et al., 2008). The criteria included: method of participant randomisation reported, blinding of participants, analysis conducted by treatment received, intention to treat analysis conducted, participants had standardised assessments and number of withdrawals reported.

## **3.3 RESULTS**

Figure 2 outlines the number of references in the database and hand search. The database search retrieved a total of 1,636 hits and 776 duplicates deleted. Of the 860 abstracts screened, 815 references were excluded as they did not meet eligibility criteria 1 (Figure 2). Of the 45 full-text references screened, 33 references

were excluded as they did not meet eligibility criteria 2 (Figure 2 & 3). The hand search retrieved 11 references that were assessed using eligibility criteria 1 and 2 and 7 references were excluded. The systematic review assessed nine randomised controlled trials studies that were reported in 16 references (12 references from the database search (Craigie, Macleod, Barton, Treweek, & Anderson, 2011; Cramp & Brawley, 2009; Fahrenwald, Atwood, & Johnson, 2005; Fahrenwald, Atwood, Walker, Johnson, & Berg, 2004; Fahrenwald & Sharma, 2002; Fjeldsoe, Miller, & Marshall, 2010; N. Liu et al., 2009; Lombard, Deeks, Ball, Jolley, & Teede, 2009; Lombard, Jolley, Deeks, & Teede, 2010; Miller, Trost, & Brown, 2002; O'Toole, Sawicki, & Artal, 2003; Ostbye et al., 2008) and four references from the hand search (Cramp & Brawley, 2006; Fjeldsoe, Miller, & Marshall, 2012; Lombard, Deeks, Jolley, & Teede, 2009; Ostbye et al., 2009).

Figure 2 Flow diagram of study selection

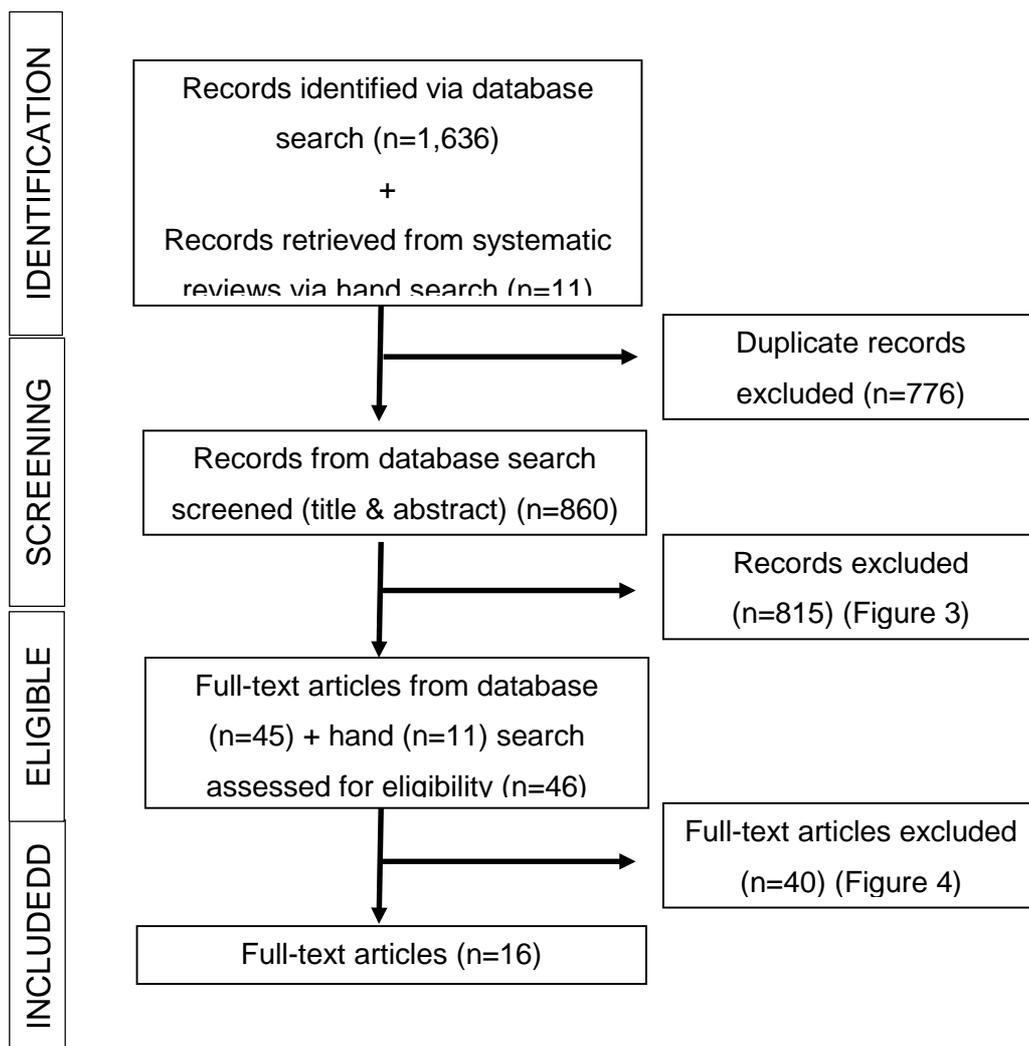


Figure 3 Reasons for abstract reference exclusion

<p>Total abstract references excluded (n=815)</p> <ul style="list-style-type: none"><li>• Conference abstract only (n=3)</li><li>• Abstract and full-text unable to be retrieved (n=3)</li><li>• Animal studies (n=35)</li><li>• Literature reviews (n=20)</li><li>• Primary target group adolescent mothers, children, family, father, mother and adolescent children (n=171)</li><li>• Did not include nutrition or physical activity behavioral outcome (nutrition outcome was not related to fruit, veg, fat, fibre or sugar and physical activity outcome was not related to aerobic activity or strength training) (n=521)</li><li>• Cross sectional studies (n=50)</li><li>• Descriptive or qualitative (not related to RCTs)(n=12)</li></ul>
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Figure 4 Reasons for full-text reference exclusion

<p>Total full-text references excluded (n=40)</p> <ul style="list-style-type: none"><li>• Quasi-experimental studies without a control group: protocol studies (n=3) (Smith et al., 2010, Ebbeling et al., 2007, Downs et al., 2009); outcome studies (n=9) (Cody and Lee, 1999, Peterson et al., 2002, Mauriello et al., 2011, Lewis et al., 2011, Leermakers et al., 1998, Klohe-Lehman et al., 2006, Urizar et al., 2006, Taveras et al., 2010, Albright et al., 2009)</li><li>• Quasi-experimental outcome studies with a control group (n=9) (Chang et al., 2010, Chang et al., 2009, Gray-Donald, 2000, Jordan et al., 2008, Kinnunen et al., 2008, Kinnunen et al., 2007a, Kinnunen et al., 2007b, Watson et al., 2005, Wilkinson et al., 2010)</li><li>• Randomised controlled trial with no physical activity or nutrition behaviour outcome variables (n=4) (Haakstad and Bø, 2011, Belizan, 1995, Bastani, 2010, Hillemeier et al., 2008)</li><li>• Randomised controlled trial - all participants did not have at least one child aged between 0 and 5 years, first time pregnant women included or participants not described adequately (n=10) (Cena et al., 2008, Gaston and Prapavessis, 2009, Hausenblas et al., 2008, Havas et al., 2003, Huang et</li></ul>
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al., 2011, Jackson et al., 2011, Krummel et al., 2004, Krummel et al., 2010, Polley et al., 2002, Thompson et al., 2008)

- Randomised controlled trial titled women's study with 2% men (n=1) (Campbell et al., 2004)
- Randomised controlled trial with only protocol information (n=4) (Chasan-Taber et al., 2011, Keller et al., 2011, Luoto et al., 2010, Monteiro et al., 2011)

### **3.3.1 Study characteristics**

The 16 selected references represented nine randomised controlled trial studies published in English. Three studies were published before 2006 (Fahrenwald et al., 2005; Fahrenwald et al., 2004; Fahrenwald & Sharma, 2002; Miller et al., 2002; O'Toole et al., 2003) and six between 2006 and 2011 (Craigie et al., 2011; Cramp & Brawley, 2006, 2009; Fjeldsoe et al., 2010, 2012; N. Liu et al., 2009; Lombard, Deeks, Ball, et al., 2009; Lombard, Deeks, Jolley, et al., 2009; Lombard et al., 2010; Ostbye et al., 2008; Ostbye et al., 2009). Eight studies were conducted in high-income countries, four in the US (Cramp & Brawley, 2006, 2009; Fahrenwald et al., 2005; Fahrenwald et al., 2004; Fahrenwald & Sharma, 2002), three in Australia (Fjeldsoe et al., 2010, 2012; Lombard, Deeks, Ball, et al., 2009; Lombard, Deeks, Jolley, et al., 2009; Lombard et al., 2010; Miller et al., 2002) and one in the UK (Craigie et al., 2011). One study was conducted in a low-to-middle income country, China (N. Liu et al., 2009). Five studies reported physical activity behaviour outcomes (Craigie et al., 2011; Cramp & Brawley, 2006, 2009; Fahrenwald et al., 2005; Fahrenwald et al., 2004; Fahrenwald & Sharma, 2002; Fjeldsoe et al., 2010, 2012; Miller et al., 2002), one dietary behaviour outcomes (N. Liu et al., 2009) and three both dietary and physical activity behaviour outcomes (Lombard, Deeks, Ball, et al., 2009; Lombard, Deeks, Jolley, et al., 2009; Lombard et al., 2010; O'Toole et al., 2003; Ostbye et al., 2008; Ostbye et al., 2009) (Table 6).

### **3.3.2 Quality Assessment**

All nine studies reported randomization and two studies described the method of randomization (Fjeldsoe et al., 2010; Ostbye et al., 2009). Two studies reported blinding of both participants and researcher (Fjeldsoe et al., 2010; Lombard et al., 2010). Seven studies reported data analysis by treatment received (Craigie et al., 2011; Cramp & Brawley, 2009; Fahrenwald et al., 2004; N. Liu et al., 2009; Miller et

al., 2002; O'Toole et al., 2003; Ostbye et al., 2009) and two by intention to treat analysis (Fjeldsoe et al., 2010; Lombard et al., 2010). One study reported on the participants that withdrew (Lombard et al., 2010) (Table 6).

### **3.3.3 Recruitment**

Five studies had less than 100 participants (Fjeldsoe et al., 2010, Fahrenwald et al., 2004, Cramp and Brawley, 2006, O'Toole et al., 2003a, Craigie et al., 2011) and four studies had between 250 and 554 participants (Ostbye et al., 2009, Lombard et al., 2009b, Miller et al., 2002, Liu et al., 2009).

Three studies recruited participants via clinical settings using mail and telephone calls (Liu et al., 2009, Fjeldsoe et al., 2010, Ostbye et al., 2009). Six studies recruited participants via community settings. These included a school (Lombard et al., 2009a), Women's Infants and Children's (WIC) centres (Fahrenwald et al., 2004), a childcare and preschool (Miller et al., 2002), and the general community (Craigie et al., 2011, Cramp and Brawley, 2006, O'Toole et al., 2003a). The strategies used for recruitment included face-to-face meetings, letters to general practitioners, support workers providing patients with a free phone number to contact, as well as newspaper advertising and displayed posters (Craigie et al., 2011; Cramp & Brawley, 2006; Fahrenwald et al., 2004; Lombard, Deeks, Ball, et al., 2009; Miller et al., 2002; O'Toole et al., 2003) (Table 6).

### **3.3.4 Participant characteristics**

In six studies the mother's mean age ranged between 30 and 33 years (Craigie et al., 2011; Cramp & Brawley, 2006; Fjeldsoe et al., 2010; Miller et al., 2002; O'Toole et al., 2003; Ostbye et al., 2009). Two studies included mothers whose mean age was 26 years (Liu et al., 2009; Fahrenwald et al., 2004) and one with a mean age of 40 years (Lombard et al., 2010). Six studies excluded pregnant women (Craigie et al., 2011; Cramp & Brawley, 2006; Fahrenwald et al., 2004; Lombard, Deeks, Ball, et al., 2009; O'Toole et al., 2003; Ostbye et al., 2009), two included pregnant women (Liu et al., 2009; Fjeldsoe et al., 2010) and one did not report on pregnancy status (Miller et al., 2002).

All nine studies reported that the mothers had at least one child and the mean reported parity ranged from 1 to 3 children. Five studies included postpartum

mothers (with children less than 1 year) (Cramp and Brawley, 2009; Liu et al., 2009; Craigie et al., 2011; Ostbye et al., 2009), two included children aged 3 to 13 (Miller et al., 2002; Lombard et al., 2010), and two did not state the age of the children (Fjeldsoe et al., 2010; Fahrenwald et al., 2004). Of the eight physical activity studies, three included mothers described as inactive (Fahrenwald et al., 2004, Cramp and Brawley, 2006, Fjeldsoe et al., 2010) and three included mothers with a BMI  $\geq$  25 (Craigie et al., 2011; O'Toole et al., 2003; Ostbye et al., 2009). Of the five diet studies, one included mothers who did not want to gain weight (Lombard et al., 2009), three included mothers with a BMI  $\geq$  25 (O'Toole et al., 2003; Ostbye et al., 2008; Craigie et al., 2011), and one did not include weight related criteria (Liu et al., 2009) (Table 6).

Table 6 Randomised controlled study characteristics

Study	Target health behaviour (Country)	Sample (n); Int (n); Cont (n)	Mother's Age (years); Children's age (years)	Participants: Parity (mean); Preg; PP; After PP	Inclusion Criteria	Recruitment setting (strategies)	Quality Assessment
Liu, N. et al. (2009)	Diet; Food hygiene (China)	Sample: 302; Int: 220; Cont: 190	Mother's age: 26.33 (urban) & 26.28 (rural) Children's age: >1 year <sup>#</sup>	Parity: 86% primiparous & 14% multiparous; Preg: Yes; PP: Yes; After PP: No	Healthy preg women; at their third trimester; had at least three routine examinations at antenatal clinics	Clinical (Not stated)	*Randomized (method not described) ^Analysis by treatment received Blinding not reported
Lombard, C. et al. (2009, 2009, 2010)	Diet; PA; weight (Australia)	Sample: 250; Int: 127; Cont: 123	Mother's age: 40.39 Children's age: 5-13	Parity: Int: 2.3 & Cont: 2.4; Preg; PP: Not stated; After PP: Yes	Not bf; infants <6 months; no prescribed weight control medications; did not wish to gain weight; no physical or psychological illness	School (letter)	*Randomized (method not described) ITT (withdrawals reported) Blinding of researcher
Fjeldsoe, B. et al. (2010, 2012)	PA (Australia)	Sample: 88; Int: 45; Cont: 43	Mother's age: 30 Children's age: not stated but postnatal women recruited	Parity;PP: Not stated; Preg: Yes; After PP: Yes	English;<12 months PP; not second or third trimesters of preg; a mobile telephone; engaged in less than 5 days/week of 30 mins of MVPA and nominated a social support person with a mobile telephone	Clinical (telephone)	*Randomized and method described ITT Blinding of participants and researcher
Miller, Y. D. et al. (2002)	PA (Australia)	Sample: 554 Int Arm 1: 164; Arm 2: 199; Cont: 191	Mother's age: Group 1: 32.8; Group 2 33.1 and Group 3 33.5 Children's age: 4.7	Parity: Not stated; Preg; PP: No; After PP: Yes	Mothers enrolled in selected preschool and childcare centres	Preschool; childcare centres (No stated)	*Randomized (method not described) ^Analysis by treatment received Blinding not reported
Fahrenwald, N. L. et al. (2002, 2004, 2005)	PA (USA)	Sample: 52; Int: 26; Cont: 26	Mother's age: 26.48 Children's age: Not stated but infants and children	Parity: 2.02; Preg: No; PP: Yes; After PP: Yes	Women with a child enrolled in Women's Infant Childrens' Program; telephone; respond to question over the phone; contemplation or preparation stages of PA behaviour change; not preg or >6 weeks PP; spoke English	Women's Infants and Children's centres (face-to-face)	*Randomized (method not described) ^Analysis by treatment received Blinding not reported

Cramp, A. G. et al. (2006, 2009)	PA (USA)	Sample: 67; Int: 32; Cont: 35	Mother's age: 31.5 Children's age: >1 year <sup>#</sup>	Parity: 1.62; Preg; After PP: No; PP: Yes	Between 6 and 52 weeks postnatal; primarily sedentary for the past six months; physicians consent to be physically active; spoke English; not preg; no medical conditions	Community (advertising in newspaper)	*Randomized (method not described) ^Analysis by treatment received Blinding not reported
O'Toole; M. et al. (2003)	Diet; PA (USA)	Sample: 40; Int: 21; Cont: 19	Mother's age: 32.2 (mean); Children's age: >1 year <sup>#</sup>	Parity: 2.3 (mean); PP: Yes; Preg; After PP: No	Between 6 weeks and 6 months PP; self reported pre-pregnancy BMI $\geq$ 25; had gained more than 15kg during pregnancy and more than 5kg heavier than pre-pregnancy weight	Community (advertisements on newspaper and TV)	*Randomized (method not described) ^Analysis by treatment received Blinding of participants
Ostbye T, et al. (2008, 2009)	Diet; PA (USA)	Sample: 450; Int: 225; Cont: 225	Mother's age: 30.9 Children's age: >1 <sup>#</sup>	Parity: 1.9 (mean); Preg; After PP: No; PP: Yes	Age >18 ; BMI $\geq$ 25; spoke English; could walk a mile; no health conditions	Clinical (letter and telephone call)	*Randomized and method described ^Analysis by treatment received Blinding not reported
Craigie, A. M. et al. (2011)	Diet; PA (UK)	Sample: 52; Int: 29; Cont: 23	Mother's age: 30 (mean) Children's age: >1 year <sup>#</sup>	Parity: not stated; Preg: No; PP: Yes; After PP: Yes	BMI $\geq$ 25; and living in areas of moderate to high deprivation	Community (newspaper; posters; letters)	*Randomized (method not described) ^Analysis by treatment received Blinding of participant and researcher

*BF (breastfeeding), BMI (Body Mass Index), Cont (Control), Int (Intervention), ITT (Intention to Treat), PA (Physical activity), Preg (Pregnant), PP (Postpartum); # (inferred and not reported), \*All participants had standardized assessment, ^ withdrawals not reported*

### **3.3.5 Intervention characteristics**

The duration of the interventions ranged from six weeks to 12 months. One study was conducted for six weeks (N. Liu et al., 2009), three for eight weeks (Cramp & Brawley, 2006; Fahrenwald et al., 2004; Miller et al., 2002), two for 12 weeks (Craigie et al., 2011; Fjeldsoe et al., 2010), one for 16 weeks (Lombard et al., 2010), one for 36 weeks (Ostbye et al., 2008) and one for 52 weeks (O'Toole et al., 2003). Two studies delivered the intervention via hospital (N. Liu et al., 2009; Ostbye et al., 2009), one via a local primary school (Lombard et al., 2010), four via community centres (Fahrenwald et al., 2004; Fjeldsoe et al., 2010; Miller et al., 2002; O'Toole et al., 2003), and three were home-based (via print or counselling) (Craigie et al., 2011; Cramp & Brawley, 2006; Miller et al., 2002) (Table 7).

### **3.3.6 Attrition rate**

The attrition rate for interventions of six to eight weeks duration ranged from 15% to 34% for the intervention group and 11% to 30% in the control group (Cramp & Brawley, 2006). For interventions of 12 to 16 weeks duration the attrition rate ranged between 14% and 25% for the intervention group, and 14% and 39% for the control group (O'Toole et al., 2003). And finally, for long-term interventions (9 to 12 months) the attrition rate was 37% in the intervention group and 47% for the control group (O'Toole et al., 2003) (Table 7).

### **3.3.7 Intervention strategies**

Eight studies included group workshops/face-to-face education/skills sessions (Craigie et al., 2011; Fahrenwald et al., 2004; Fjeldsoe et al., 2010; N. Liu et al., 2009; Lombard, Deeks, Jolley, et al., 2009; Miller et al., 2002; O'Toole et al., 2003; Ostbye et al., 2008), seven provided a booklet (Craigie et al., 2011; Cramp & Brawley, 2009; Fahrenwald et al., 2004; Fjeldsoe et al., 2010; N. Liu et al., 2009; Miller et al., 2002; Ostbye et al., 2008), six utilised telephone counselling (Craigie et al., 2011; Cramp & Brawley, 2006; Fahrenwald et al., 2004; Fjeldsoe et al., 2010; Miller et al., 2002; Ostbye et al., 2008), three employed behavioural/lifestyle one-on-one counselling (Craigie et al., 2011; Cramp & Brawley, 2006; Fjeldsoe et al., 2010), four incorporated written instructions (Craigie et al., 2011; Lombard, Deeks, Ball, et al., 2009; O'Toole et al., 2003; Ostbye et al., 2008), and three used group exercise sessions (Cramp & Brawley, 2006; Miller et al., 2002; Ostbye et al., 2008). Two studies communicated with participants via short-message-service (SMS) (Fjeldsoe

et al., 2010; Lombard, Deeks, Jolley, et al., 2009) and one used notice boards (Miller et al., 2002). One study conducted home visits (N. Liu et al., 2009) (Table 7).

Table 7 Intervention characteristics

Study	Objectives	Setting; Delivery; Duration; Attrition; Attendance at face-to-face sessions; Childcare	Intervention content & dose	Behaviour Change Theory & Technique
Liu, N. et al. (2009)	Diet: fruit and vegetable consumption PA: No	Setting: hospital Delivery: WK, BK, HV Duration: 42 days Attrition: Int: 34%; Cont: 30% (6 weeks) Attendance: 19 did not participate in all lectures Childcare: Not reported	<b><u>Intervention Group</u></b> Diet Content: food pyramid guidelines; nutrient food association; dairy; fruit; vegetables; examples of healthy menus; discussion about nutrition concerns in postpartum period Diet intensity: WK 2/month (2 hour/session), 4 HV <b><u>Control Group:</u></b> No intervention	Individual beliefs; provided information on consequences, instructions on diet and monitoring of behaviour
Lombard, C. et al. (2009, 2009, 2010)	Diet: fat consumption behaviours PA: increase in MVPA	Setting: local primary school Delivery: WK, NB Duration: 4 months initial intervention and additional 1 year SMS Attrition: Int: 11%; Cont: 31% (4 months); Int: 14%; Cont: 14% (12 months) Attendance: 98% attended session 1, 80% attended session 2, 70% attended session 3 Childcare: Children accommodated	<b><u>Intervention Group</u></b> Diet Content: food pyramid guidelines; fruit; vegetables PA Content: pedometer; self-monitoring; guidelines Intensity: WK- 3 sessions in 1 <sup>st</sup> month and 4 <sup>th</sup> session in 4 <sup>th</sup> month. 1 hour/session (sessions were held at various times) and accommodated young children; 1 SMS/month for 1 year <b><u>Control Group:</u></b> No intervention	SCT; goal setting; social support; educational and skills sessions; SMS; self-monitoring weight; individual feedback on goals; goal setting; identifying barriers to goals; problem solving; relapse prevention
Fjeldsoe, B. et al. (2010, 2012)	Diet: No; PA: increase in MVPA	Setting: Community Delivery: SMS; FC Duration: 12 weeks Attrition: Int: 25%; Cont: 25% (12 weeks) Attendance: Not reported Childcare: Not reported	<b><u>Intervention Group</u></b> Content: goal setting, behavioural and cognitive strategies for behaviour change, benefits of PA, Free trials for local PA opportunities including maps; self monitoring Intensity: Print based information pack at a face-to-face consultation, 1 FC goal-setting; 1 TP, a goal-setting magnet; 3 to 5 personally tailored SMS/week, 11 goal check SMS, and a nominated support person received 2 SMS/week. <b><u>Control Group:</u></b> Print based information pack at a face-to-face	SCT; self-efficacy; social support; educational and skills sessions; counselling; SMS; telephone counselling; booklet; goal setting; identify achievements identify barriers to goals; Identify rewards for achievements; problem solving; individualised feedback

consultation				
Miller, Y. D. et al. (2002)	Diet: No PA: increase in adherence to guidelines for adequate PA	Setting: Print based and community Delivery: BK; Discussion Group, TP Duration: 8 weeks Attrition: Int Arm 1: 19%; Arm 2: 25%; Cont: 17% (8 weeks) Attendance: Not reported Childcare: Not reported	<b><u>Intervention Group</u></b> Arm 1 Content: print intervention (1 BK) Arm 2 Content: Group exercise sessions; Information about local PA opportunities; importance of PA; identify barriers to PA; develop solutions. Strategies included lobbying local leisure service providers to increase mum friendly activities; increase partner support for PA and creation of walking groups. Intensity: 1 BK; 1 Group mediated cognitive behavioural discussion group; 1 TP <b><u>Control Group:</u></b> No intervention	No theory stated, discussion group; notice boards; telephone call; booklet; identify barriers to goals
Fahrenwald, N. L. et al. (2002, 2004, 2010)	Diet: No PA: increase in MET's and MPA	Setting: WIC centre Delivery: FC; NB, TC Duration: 8 weeks Attrition: Int: 15%; Cont: 15% (8 weeks) Attendance: Not reported Childcare: Not reported	<b><u>Intervention Group</u></b> PA content: social support; solutions to sedentary habits; benefits of PA PA intensity: 1 FC; 1 NB; 4 bi-weekly TC <b><u>Control Group:</u></b> Counseling on self breast examination	TTM; decisional balance; self-efficacy for exercise; self liberation; counter-conditioning and environmental re-evaluation; social support for exercise; educational and skills sessions; telephone counselling; booklet; goal setting; identify barriers to goals; problem solving; individualised feedback
Cramp, A. G. et al. (2006, 2009)	Diet: No PA: increase in frequency; minutes and volume of PA	Setting: Home-based; community centre Delivery: WK; home-based exercise; TC Duration: 8 weeks Attrition: Int: 19%; Cont: 11% (8 weeks) Attendance: 75% completed 6 to 8 WK postnatal exercises Childcare: Yes	<b><u>Intervention Group</u></b> PA Content: Group exercise sessions; self-monitoring of PA; self management of PA; PA intensity: 8 WK exercise; home-based exercise, 6 Group mediated cognitive behavioural counselling sessions, 1 TP <b><u>Control Group:</u></b> 8 WK exercise; home-based exercise	Group mediated cognitive behavioural approach; self-efficacy telephone counselling; goal setting; identify barriers to goals; problem solving

O'Toole; M. et al. (2003) (O'Toole et al., 2003a)	Diet: caloric deficit of at least 350 kcal/day PA: energy expenditure from physical activity by 350 kcal/day	Setting: Not stated Delivery: WK, NB, FC dietician and exercise physiologist Duration: 1 year Attrition: Int: 19%; Cont: 38% (12 weeks); Int: 37%; Cont: 47% (1 year) Attendance: Not reported Childcare: Not reported	<b><u>Intervention Group</u></b> Diet content: self monitoring diet; healthy diet practices; caloric requirements PA content: heart rate monitor; self monitoring PA; healthy PA practices Intensity: 23 group educational sessions Diet intensity: 1 individualised diet plan; 1 consultation with a dietician PA intensity: 1 individualised activity plan; 1 FC with dietitian and exercise physiologist, Wk- 1 time/ week from 1 <sup>st</sup> to 3 <sup>rd</sup> month, 2 times/week in 4 <sup>th</sup> and 5 <sup>th</sup> month, 1 time/month from 6 <sup>th</sup> to 12 <sup>th</sup> month <b><u>Control Group:</u></b> One face-to-face session with a dietitian and exercise physiologist for one hour on healthy eating and exercise practices with a goal of creating a 500 calorie deficit	No theory stated; goal setting; individualised feedback; peer support and active problem solving education and skills sessions; written instruction; goal setting; identify achievements; identify barriers to goals; problem solving; individualised feedback per day.
Ostbye T, et al. (2008, 2009)	Diet: reduction of calorie intake; reduction of calories from fat; increased fruit and vegetable consumption PA: MPA- 30 min/day at least 5 days/week	Setting: Hospital Delivery: WK, NB, TC Duration: 9 months Attrition: 30% (9 months) Attendance: 97% did not attended, 68% attended between 1 and 5 classes, 60% attended 6 or more classes Childcare: Not stated	<b><u>Intervention Group</u></b> Diet Content: Healthy diet practices; examples of healthy menus; frequency of consumption; portion size; Methods to: decrease fat; decrease sugar; make appropriate choices in fast food restaurants; shop for low cost nutritious foods; avoid overeating in stressful situations; identify cures to fullness; eat at a slow pace; develop meal plans PA Content: Group exercise sessions; fitness band; sports stroller; water bottle; pedometer; Instruction on appropriate exercises in the postpartum period Intensity: 6 TC (20 minutes/session) Diet intensity: 8 healthy eating classes/month at convenient times; two sessions are in the form of field trips to the food court and to the grocery store	SCT; TTM; MI; educational and skills sessions; telephone counselling; booklet; written instruction; individual feedback on goals; goal setting; identify barriers to goals; problem solving; individualised feedback

			PA intensity: 10 PA classes (offered for 2 to 6 times/week) (multiple sessions provided to accommodate various schedules of both working and stay-at-home mothers) <b>Control Group:</b> No intervention	
Craigie, A. M. et al. (2011)	Diet: results not presented PA: MVPA minutes/day	Setting: Convenience /home based Delivery: BK, TC, FC (home) Duration: 12 weeks Attrition: Int: 24%; Cont: 39% (12 weeks) Attendance: 76% were provided face-to- face counselling at home Childcare: Not stated	<b>Intervention Group</b> Diet Content: food pyramid guidelines; frequency of consumption; portion size PA Content: pedometer; self monitoring of PA Intensity: 1 BK (weight loss); 3 FC (lifestyle) and 3 TC (diet and PA messages) <b>Control Group:</b> No intervention	No theory stated; telephone or face-to-face counselling; booklet; written instruction; goal setting; identify achievements; identify barriers to goals; individualised feedback

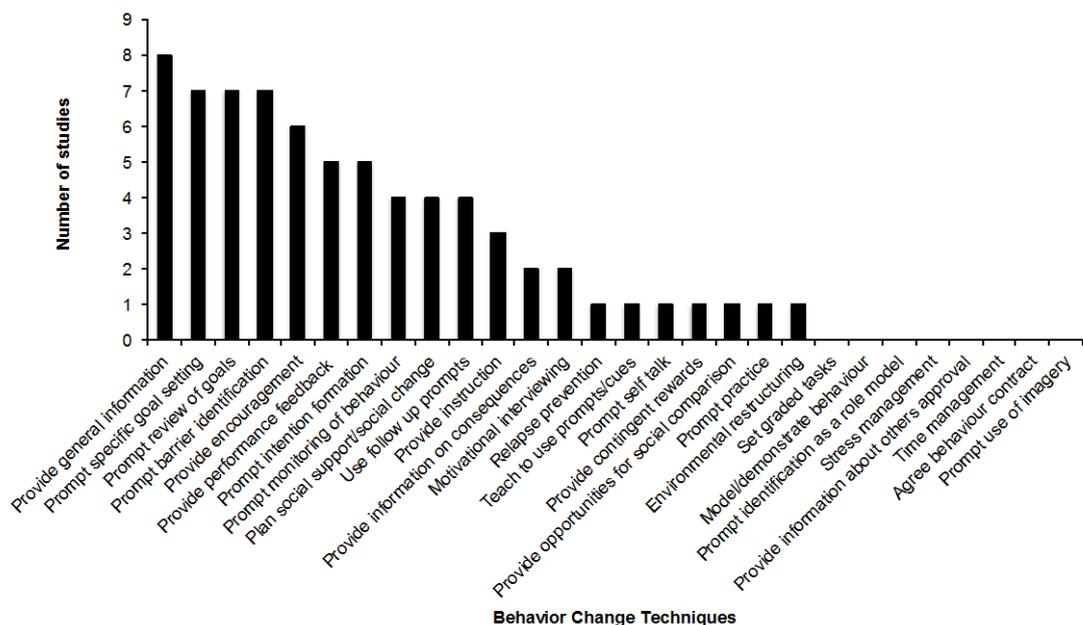
*BK (booklet); Cont (Control), FC (face-to-face counselling), HV (home visits/counselling), Intv (Intervention), Kcal (kilo calories), MVPA (moderate vigorous physical activity), MPA (moderate physical activity), MET (metabolic equivalent), NB (newsletters/brochures), PA (physical activity), SCT (Social Cognitive Theory), SMS (short message service/text messages), TP (telephone), TC (telephone counselling), TTM (transtheoretical model), WK (workshops/face-to-face educational and skills session)*

### 3.3.8 Behaviour change theories and techniques

The studies reported using seven different behaviour change components to inform the intervention. Four studies reported social support (Fahrenwald et al., 2004; Fjeldsoe et al., 2010; Lombard, Deeks, Ball, et al., 2009; O'Toole et al., 2003), three SCT (Fjeldsoe et al., 2010; Lombard, Deeks, Ball, et al., 2009; Ostbye et al., 2009), two self-efficacy (Fahrenwald et al., 2004; Fjeldsoe et al., 2010), two the TTM (Fahrenwald et al., 2004; Ostbye et al., 2008), one a group mediated cognitive behavioural approach (Cramp & Brawley, 2009), one focused on altering beliefs (N. Liu et al., 2009) and one included barriers to goals achievement (Miller et al., 2002) (Figure 5).

The nine studies reported using 20 different behaviour change techniques. Figure 5 shows the number of interventions incorporating each technique (multiple behaviours were targeted by each study). The most frequently used techniques (in at least 4 of the 9 studies) were: provision of general information; prompting of specific goal setting, barrier identification, monitoring of behaviours, intention formation and behavioural goals; provision of encouragement and feedback on performance; use of follow-up prompts; and plan social support for social change.

Figure 5 Number of behaviour change techniques used



### **3.3.9 Diet measurement tools**

On reviewing the dietary measurement tools, two studies used two-day and three-day food records (Liu et al., 2009), one used a 24 hour recall (Ostbye et al., 2009) and one used a food frequency questionnaire (FFQ) (Hodge et al., 2000; Lombard et al., 2009) (Table 3). One study reported a dietary behaviour change objective but did not include information on the assessment tool (Craigie et al., 2011) (Table 8).

### **3.3.10 Diet behaviour outcomes**

Of the five studies that targeted behaviour change outcomes, only four reported dietary behavioural results (Ostbye et al., 2009; Liu et al., 2009; Lombard et al., 2009). The four studies reported on a variety of diet behavioural outcome variables: fruit and vegetable intake (grams/day) (Liu et al., 2009); fat behaviours (scores) (Lombard et al., 2009a); calorie intake (Kcal) (O'Toole et al., 2003a); and selected foods associated with sugar and fat (Ostbye et al., 2009). Only one of the five dietary studies reported a significant intervention effect for fruit ( $p < 0.05$ ) and vegetable intake ( $p < 0.05$ ) (Liu et al., 2009) (Table 8).

### **3.3.11 Physical activity measurement tools**

On reviewing the physical activity measurement tools, four studies used the self-reported 7-day physical activity recall questions (Cramp & Brawley, 2006; Fahrenwald et al., 2004; Miller et al., 2002; Ostbye et al., 2009), one study used the International Physical Activity Questionnaire short version (IPAQ) (Lee, Macfarlane, Lam, & Stewart, 2011; Lombard et al., 2009), one study used the Australian Women's Activity Survey (AWAS) (Fjeldsoe, Marshall, & Miller, 2009; Fjeldsoe et al., 2010), one study used the Yale Physical Activity Survey (YPAS) (Schuler, et al., 2001; O'Toole et al., 2003), and one study used the Brief Risk Factor Surveillance System (BRFSS) that also included dietary questions (National Centre for Chronic Disease Prevention and Health Promotion; Ostbye et al., 2009). Two studies used objective physical activity measures: ActiGraph (Fjeldsoe et al., 2010); and SenseWear (Craigie et al., 2011) (Table 9).

### **4.3.12 Physical activity behaviour outcomes**

Of the eight studies that targeted physical activity behaviour change outcomes, three reported no significant intervention effects (Lombard et al., 2010; Craigie et al.,

2011; Ostbye et al., 2009) and five reported significant intervention effects (Cramp and Brawley, 2006; Fjeldsoe et al., 2010; Fahrenwald et al., 2004; O'Toole et al., 2003; Miller et al., 2002). The physical activity variables varied across the studies. The three effective physical activity interventions demonstrated the following effect sizes: Fjeldsoe et al. reported a significant intervention effect on moderate and vigorous intensity physical activity frequency (days/week) ( $p=0.003$ ) and walking frequency (days/week) ( $p=0.004$ ) and duration (minutes/week) ( $p=0.005$ ) (Fjeldsoe et al., 2010); Fahrenwald et al. reported on moderate intensity physical activity (minutes/week) ( $p=0.001$ ) (Fahrenwald et al., 2004); and Cramp et al. reported on moderate intensity physical activity (days/week) ( $p<0.011$ ) (Cramp and Brawley, 2006). One study reported that women in the intervention (group 3: print and community development) were 1.7 times significantly more likely to meet the adequate physical activity guidelines at 8 weeks post-intervention (Miller et al., 2002) (Table 9).

Table 8 Diet randomised controlled trials: measurement tools and outcomes

Study	Scales/ Instruments (Self-reported)	Diet behavioural outcome measures	Effect Size (p value)	Analysis type	Follow-up period
Liu, N. et al. (2009)	3 day food record; 2 day food record (SR)	Fruit; vegetables; grain/cereal; egg; diary; meat/poultry/fish; soyabean/soyabean product (grams/day/person)	No significant difference between the Int and Cont group for grain/cereal. Significant difference between the Int and Cont group at post-test: Fruit (Int: 53.4; Cont: 30.0; p<0.01); vegetables (Int: 278.0; Cont: 263.6; p<0.05); egg p<0.05; diary p<0.05; meat/poultry/fish p<0.05; soyabean/soyabean product p<0.01	T-test	42 days
Lombard, C. et al. (2009, 2009,2010)	Food Frequency Questionnaire (Victoria) (SR)	Fat behaviours: modifying meat; avoid frying; avoid high fat foods; substitute with low fat foods; replace high fat foods (scores)	No significant difference between the Int and Cont group: modifying meat (Int: 1.45; Cont: 1.41; p=0.68); avoid frying (Int: 1.9; Cont: 1.79; p=0.76); avoid high fat foods (Int: 2.09; Cont: 2.98; p=0.93); substitute with low fat foods (Int: 1.91; Cont: 1.90; p=0.80); replace high fat foods (Int: 1.89; Cont: 1.76; p=0.28) (scores)	Linear regression	4 months
O'Toole; M. et al. (2003)	3-day food records (SR)	Calorie intake (kcal/day)	No significant between Int and Cont group difference of calorie intake; however; calorie intake had decreased from baseline in both groups: Caloric intake (Int: 1541; Cont: 1592; p <0.001) (kcal/day)	One way ANOVA	1 year
Ostbye T, et al. (2008, 2009)	24 hour dietary recall (SR)	Calorie intake (kcal/day); Soda; Sweetened beverages; Fries or chips; Fast food/week; Fruits/vegetables (servings/day)	No significant differences between the Int and Cont group from baseline to post-test: Soda (Int: 0.54; Cont: 0.70; p=0.93); Sweetened beverages (Int: 0.55; Cont: 0.67; p=0.16); Fast food (Int: 2.14; Cont: 2.09; p=0.48); Fries or chips (Int: 0.56; Cont: 0.58; p=0.68); Fruits/vegetables (Int: 3.38; Cont: 3.37; p=0.47)	Sensitivity analysis	9 months

ANOVA (Analysis of Variance), Cont (Control), Int (Intervention), Kcal (Kilocalories), SR (self-reported)

Table 9 Physical activity randomised controlled trials: measurement tools and outcomes

Study	PA Scales/ Instruments (self-reported/measured)	PA behavioural outcome measures	Effect Size	Analysis type	Post-intervention & Follow-up
Lombard, C. et al. (2009, 2009, 2010)	International PA Questionnaire (SR) Self-efficacy for exercise and eating scale (Marcus et al., 1992a); SOC for eating, PA and weight gain (Kristal et al., 1999)	MVPA (MET min)	No significant differences for walking (Int: 952; Cont: 826; p=0.84); MVPA (Int: 543; Cont: 391; p=0.75); VPA (Int: 600; Cont: 530; p=0.82) No outcomes were reported for SOC. No significant difference was observed for weight, diet and physical activity self-efficacy (p>0.05)	Linear regression	4 months (PI)
Fjeldsoe, B. et al. (2010, 2012)	Australian Women's Activity Survey (AWAS) and ActiGraph (SR & OM); Barrier self-efficacy for exercise (Marcus et al., 1992a); Exercise Goal-setting Scale (EGS) (Rovniak et al., 2002); social support for exercise scale (Sallis et al., 1987); outcome expectancy (Rodgers and Brawley, 1991); perceived environmental opportunity for physical activity (Hoehner et al., 2005)	MVPA frequency (days/week) & duration (min/week); walking frequency (days/week) & duration (min/week)	Significant difference for MVPA frequency (Int: 1.82; Cont: 0.24; p=0.001); walking frequency (Int: 1.08; Cont: 0.73; p=0.004); walking duration (Int: 16.67; Cont: 0.34; p=0.005) No significant difference for MVPA duration (Int: 18.26; Cont: 16.36; p=0.255) No significant improvement on barriers to exercise self-efficacy, goal setting skills, outcome expectancy, social support and perceived environmental opportunity for physical activity.	ANOVA  Sobel Test	13 weeks (PI)  13 weeks (PI)
Miller, Y. D. et al. (2002)	7 day PA recall question modified from Active Australia: whether participant was meeting guidelines for adequate PA (SR); Social support for exercise scale (Sallis et al., 1987); self-efficacy for exercise (Marcus et al., 1992a);	Close ended questions with responses Yes/No	Int group 3 (print & community development) women were 1.71 times (60%) significantly more likely to meet PA guidelines. No significant differences between control and intervention arm 2	Logistic regression	8 weeks (PI)  5 months (FU)
Fahrenwald, N. L. et al. (2002, 2004, 2010)	7-day PA recall (SR); SOC for PA (Marcus et al., 1992a); Exercise benefits and barriers scale (Sechrist, 1987); self-efficacy for exercise (Marcus et al., 1992a); process	MPA (min/week)	Significant difference for MPA (Int: 88.18; Cont: 1.14; p<0.001) Significant difference between int and cont group for SOC, decisional balance (pros and cons), self-	ANOVA Chi-square	8 weeks (PI)

	of exercise adoption tool (Marcus et al., 1992b); social support for exercise scale (Sallis et al., 1987)		efficacy, social support (p<0.001)		
Cramp, A. G. et al. (2006, 2009)	7 day PA recall (SR); PPOE (Rodgers and Brawley, 1991); Barriers to efficacy scale (Garcia and King, 1991)	MVPA duration (min/session); frequency (times/week) and volume (mean frequency multiplied by mean duration)	Significant difference for MVPA frequency (Int: 6.7; Cont: 3.65; p<0.01); MVPA volume (Int: 400.38; Cont: 222.24; p<0.01) No significant differences for MVPA duration (Int: 51.82; Cont: 46.38; p>0.05) Significant treatment effect on PPOE (p<0.01) and barriers to efficacy (p<0.05)	ANCOVA   ANCOVA	8 weeks (PI)  8 weeks (PI)
O'Toole; M. et al. (2003)	Yale Physical Activity survey (SR & OM); No behaviour change constructs and questionnaires reported	Exercise expenditure (kcal/week) and vigorous activity score	Significant differences for exercise expenditure (Int: 1987; Cont: 1236; p<0.001); VPA scores (Int: 28.5; Cont: 15.0; p<0.001) No results reported on behaviour change constructs.	Independent t-test	1 year
Ostbye T, et al. (2008, 2009)	7 day PA recall; Brief PA questions from Brief Risk Factor Surveillance System (SR); Self-efficacy; motivation; SOC for weight (no questionnaires reported)	MVPA duration (min/week); frequency (times/week)	No significant differences VPA duration (Int: 73.6; Cont: 70.3; p=0.95); VPA frequency (Int: 1.71; Cont: 1.25; p=0.14) No results reported on behaviour change constructs	t-test	9 months
Craigie, A. M. et al. (2011)	PA survey and SenseWear (SR & OM) TPB: self-efficacy (no questionnaire reported)	MVPA (min/day)	No significant differences between the int and cont group: At post-test MVPA (min/day) (Int: 103; Cont: 0.79; p=0.86) No results reported on behaviour change constructs	One-way ANOVA	12 weeks

ANOVA (Analysis of Variance), ANCOVA (Analysis of Covariance), cont (control), FU (follow-up), kcal (kilocalories), Int (intervention), MVPA (moderate and vigorous intensity physical activity), MPA (moderate intensity physical activity), min (minutes), OM (objectively measured), PA (physical activity), PI (post-intervention), PPOE (Proximal physical outcome expectancies, SR (self-reported), SOC (Stage of Change), TPB (Theory of planned behaviour)

### **3.3.13 Behaviour change construct measurement tools**

Five studies reported on behaviour change construct measurement tools/behavioural mediators (Cramp & Brawley, 2009; Fahrenwald et al., 2005; Fjeldsoe et al., 2012; Lombard, Deeks, Ball, et al., 2009; Miller et al., 2002). Studies measured exercise self-efficacy (Marcus et al., 1992), self-efficacy for exercise and diet (Sallis et al., 1988), social support for exercise (Sallis et al., 1987), and SOC (Kristal et al., 1999; Marcus et al., 1992). Other measurement tools to evaluate constructs included Exercise Goal-setting Scale (EGS) (Rovniak et al., 2002), proximal physical outcome expectancy (PPOE) (Rodgers and Brawley, 1991); barrier efficacy (Garcia and King, 1991), perceived environmental opportunity for physical activity (Hoehner et al., 2005), exercise benefits and barriers scale (Sechrist, 1987), and process of exercise adoption tool (Marcus et al., 1992).

### **3.3.14 Behaviour change outcomes**

One study reported that the PPOE and the barrier efficacy scale demonstrated a significant treatment effect (PPOE  $p < 0.01$  and barrier efficacy  $p < 0.05$ ) (Cramp and Brawley, 2009). One study reported no significant intervention effect on the residual changes in self-efficacy and partner support (Miller et al., 2002). One study reported that a significant difference between intervention and control group for SOC, decisional balance (pros and cons), self-efficacy, social support ( $p < 0.001$ ) (Fahrenwald et al., 2004). One study reported no significant intervention effect on self-efficacy for weight ( $p = 0.82$ ); diet ( $p = 0.61$ ) and physical activity ( $p = 0.44$ ) (Lombard et al., 2009a). One reported no significant improvement on barriers to exercise self-efficacy, goal setting skills, outcome expectancy, social support and perceived environmental opportunity for physical activity at post-intervention (Fjeldsoe et al., 2012).

Three studies assessed mediators for physical activity (Fahrenwald et al., 2005; Fjeldsoe et al., 2012; Miller et al., 2002). Fjeldsoe et al. (2012) reported that barriers to self-efficacy ( $p > 0.001$ ); goal setting skills ( $p = 0.011$ ); and social support ( $p = 0.031$ ) were significant predictors of changes in moderate and vigorous intensity physical activity at six-weeks (mid-intervention) but did not remain as significant predictors at 13-weeks (post-intervention). Fjeldsoe et al. (2012) also reported that goal setting skills ( $p = 0.017$ ) and outcome expectancies ( $p = 0.050$ ) significantly predicated changes in walking at six-weeks (mid-intervention) however, these changes were not

observed post-intervention. Finally, Fjeldsoe et al. (2012) reported that no behaviour change outcomes significantly mediated the relationship between group allocation and overall change in frequency of moderate and vigorous intensity physical activity or walking for exercise. Fahrenwald et al. (2005) reported that self-efficacy, decisional balance, and social support were correlated with weekly MPA ( $p \leq 0.01$ ). Miller et al. (2002) reported that self-efficacy (OR 1.86) and partner support (OR 2.29) significantly predicted meeting the physical activity guidelines.

### **3.4 DISCUSSION**

This systematic review summarised the published literature on diet and physical activity randomised controlled trials for mothers with young children. The study is unique as it is a systematic review of randomised controlled trials that (a) specifically target mothers with at least one young child, (b) the primary outcomes were diet and/or physical activity behaviour change, and (c) the studies reported on a behaviour change component.

Research on mothers with young children is important, as it is a 'challenging period' for maintaining a healthy weight, a healthy diet and undertaking sufficient levels of physical activity (Welch et al., 2009; Olson, 2005). Some of the barriers to engaging in healthy eating and physical activity behaviours include:

- a lack of time for self-care due to busy schedules looking after young children's needs;
- decreased motivation/self-esteem;
- lack of social support;
- poor access to physical activity facilities and childcare;
- lack of transport;
- inadequate knowledge of the benefits of physical activity and healthy eating,
- limited funds to access gymnasiums and pay for childcare,
- physical discomfort/injury,
- a negative body image and
- society's expectation of a mother's role (Brown et al., 2009; Nash, 2010).

However, evidence also demonstrates that motherhood is a momentous life event and is a teachable moment as it meets the 'teachable moment models' comprising three domains: increases perceptions of personal risk and outcome expectancies, prompts strong affective or emotional responses, and redefines self-concept or

social role (McBride et al., 2003). For example, it has been suggested that mothers may be motivated to make changes to their diet and physical activity habits in order to support their own health and wellbeing and that of their child (Welch et al., 2009; Bastian et al., 2010).

The review documents that there is a lack of reporting on several key issues: description of the strategies; description of the content and intensity of each strategy; “use” of behaviour change theories (informed by theory; applied a theory; tested a theory; created a theory); evaluation of theoretical techniques (Michie et al., 2011; Michie et al., 2009); evaluation of behaviours changed (e.g. fruit intake) rather than the consequence (e.g. body mass index) (Dombrowski et al., 2012), and evaluation of behaviour change aspects that significantly mediate the outcome effectiveness of diet and physical activity interventions (Hardeman et al., 2000; Michie et al., 2009; Kahn et al., 2002).

The studies also reported challenges in recruiting and engaging mothers and labelled mothers with young children as a ‘hard to reach and engage’ target group (Hartman et al., 2010). However, the present review indicates that active recruitment of mothers via telephone calls and personalised invitations increased the likelihood of mothers participating in the interventions.

The quality assessment of the randomised controlled trials revealed a lack of reporting on the method of randomization, significant differences between participants who completed the study and those that withdrew, intention to treat analysis, and blinding of the participants and the analyst (Armstrong et al., 2008). In addition, most studies reported a sample size of less than 100 participants (Fjeldsoe et al., 2010, Fahrenwald et al., 2004, Cramp and Brawley, 2006, O’Toole et al., 2003a, Craigie et al., 2011) and those with larger samples varied in outcome measures and variables, statistical analysis, follow-up periods, intervention periods and reported information on withdrawn participants, which made overall comparisons and conclusions challenging (Ostbye et al., 2009, Lombard et al., 2009b, Miller et al., 2002, Liu et al., 2009).

This review was unable to demonstrate a significant relationship between the strategies and the effectiveness of the interventions due to the small number of studies that met the inclusion criteria. However, the review indicated that multiple delivery strategies provided to mothers was more likely to improve mothers’

engagement and effectiveness of the program (Noar et al., 2007). Face-to-face workshops and counseling sessions were commonly used but few studies provided multiple sessions to accommodate for the busy schedules of mothers caring for a young family. Attendance rates for six or more classes ranged between 60% and 75%. Lombard et al. recommended a maximum of three face-to-face contact sessions but did not report on the method used to accommodate children in these sessions (Lombard et al., 2009a). Despite childcare being a crucial element when developing an intervention for mothers with young children only two studies reported on providing childcare.

Even though overweight and obesity are significant public health issue in women of childbearing-age with young children, this systematic review retrieved only nine randomised controlled trials from the last 21 years that met the selection criteria. The large number of studies that did not meet the inclusion criteria demonstrates the gap between the guidelines for reporting on systematic reviews of health promotion and public health interventions (Jackson et al., 2005) and the information reported by the randomised controlled trial studies in this and previous reviews (Amorim et al., 2007; Keller et al., 2008; Kuhlmann et al., 2008; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Ronnberg, 2010; Skouteris et al., 2010; Streuling et al., 2010; Thangaratinam and Jolly, 2010; Gardner et al., 2011).

Forty full-text references were excluded although related to improving diet and physical activity in childbearing-aged women due to the following reasons: 21 studies had a quasi-experimental study design; 10 randomised controlled trials did not report that mothers had at least one child aged 0-5 years or women were first-time pregnant or participants were not described adequately; four randomised controlled trials did not include physical activity or nutrition behaviour outcome variables; four randomised controlled trials provided protocol information only; and one randomised controlled trial claimed to be a women's study but included 2% men in the data analysis. Of the nine studies included in this review, one study reported statistically significant diet behaviour outcomes (Liu et al., 2009), and five studies reported physical activity outcomes (Cramp and Brawley, 2006; Fjeldsoe et al., 2010; Fahrenwald et al., 2004; O'Toole et al., 2003; Miller et al., 2002). However, it should be noted that the context of the study is vital to understand the difference in outcomes due to variations in duration of the intervention, number of objectives, intervention content, theoretical frameworks, theoretical techniques and sample size.

Evidence suggests that mothers with young children experience unique barriers to being active and eating a healthy diet (responsibility of caring for a young family and organising childcare when doing physical activity) (Brown et al., 2009; Nash, 2010). Thus, it is vital that future randomised controlled trials targeting this group account for these factors when selecting intervention strategies. Future interventions could review alternative settings for the recruitment of mothers with young children such as playgroups (Jones et al., 2010; Monteiro et al., 2010).

Eight of the reviewed randomised controlled trials were conducted in high-income countries which is consistent with a previous systematic review that assessed diet and exercise interventions for weight reduction after childbirth (Amorim et al., 2007). This may indicate a need for a greater maternal health promotion in low-to-middle income countries due to the increase in non-communicable chronic disease attributable to low fruit and vegetable consumption, and physical activity levels (De Maio, 2011).

The results from the reviewed studies also suggest that behaviour change theories should be included in intervention studies as they not only increase the effectiveness of studies (Michie et al., 2009) but also improve replicability and generalisability (Dombrowski et al., 2012; Michie et al., 2011). However there was no observed pattern between the effective and ineffective interventions with regards to behaviour change theories and constructs, which may be due to the small number of studies addressing this topic and target group.

The SCT was used to inform the development of two nutrition studies and TTM was used in one study. These results were similar to a review of nutrition intervention studies using behaviour change theories which reported using one or a combination of the cognitive behaviour therapy, TTM and SCT to inform project development (Spahn et al., 2010). The common nutrition behaviour change techniques used by the studies in the present review were also similar to those identified in a previous review, i.e. motivational interviewing, self-monitoring, problem solving, social support, goal setting (Spahn et al., 2010).

The review demonstrates a need for diet and physical activity randomised controlled trials targeting mothers with at least one young child and including a reported behaviour change component. These findings are consistent with previous reviews targeting weight management in pregnant, postpartum and mothers with young

children (Amorim et al., 2007; Keller et al., 2008; Kuhlmann et al., 2008; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Ronnberg, 2010; Skouteris et al., 2010; Streuling et al., 2010; Thangaratinam and Jolly, 2010; Gardner et al., 2011).

### **3.5 CONCLUSIONS**

The systematic review demonstrates that there is a paucity of research on physical activity and diet randomised controlled trials targeting mothers with young children (0-5 years). The use of behaviour change theory to inform the development or evaluation of these randomised controlled trial was also minimal or absent. There are attempts to incorporate theory into some aspects of most studies, however, the degree of theory used is variable with some studies having a minimal, cursory application. There is substantial scope for such intervention studies to use a much more systematic approach to theory use to inform planning, intervention development, evaluation and implementation. It is likely the quality and hence the outcomes of such projects could be improved substantially.

The review recommends further research on mothers with young children, and much more rigorous use of behavioural theory and techniques, improved quality in randomization and blinding, consistency in reporting diet and physical activity behaviour measurements, and evaluation of behaviour change theories and constructs. Operational research is also needed to identify the optimal strategies for recruitment, retention, childcare options, dosage (frequency and amount of contact with the intervention), intervention components, training of facilitators, skills and educational approaches, and delivery settings. There is a need for better use and reporting of the application of behaviour change theories during the development, implementation and evaluation stages of the study, mediator analysis of behaviour change constructs, and diet and physical activity behaviour change outcomes.

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## **CHAPTER FOUR**

### **METHODOLOGY**

#### **ARTICLE 1**

**The protocol of a randomised controlled trial for playgroup mothers: REminder of Food, Relaxation, Exercise and Support for Health (REFRESH) program**

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## PRELUDE

Chapter Four describes the methodology of the REFRESH randomised controlled trial. This chapter was published in a peer-reviewed journal in the future tense but is presented as the past tense. Please see Appendix 7: Paper 1 for authorship contribution and consent, and Appendix 8: Paper 1 for full-text.

Reference:

Monteiro, S. M. D. R., Jancey, J., Howat, P., Burns, S., Jones, C., Dhaliwal, S. S., McManus, A., Hills, A.P., Anderson, A. S. (2010) The protocol of a randomised controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program. *BMC Public Health*, 11; 648-562. DOI: 10.1186/1471-2458-11-648 [Impact Factor 2.08] [Refer to Chapter Four & Appendix 8: Paper 1)

This chapter addresses part of Objective 2: To design, develop, implement and evaluate a community based health promotion intervention to increase the fruit, vegetable and fibre intake, and decrease fat and sugar consumption, and increase the intensity of physical activity for mothers with young children.

This chapter describes the setting, study design, participant and staff recruitment and randomisation, sample size determination, inclusion criteria, intervention strategies, resources, evaluation instruments, statistical analysis, and ethics. Information that was not included in the journal article published is included after the contents of the journal article the section titled 'Additional Information on Methodology'. This additional information expands upon the settings, participant and staff recruitment and randomisation, informed consent, confidentiality, data storage, results from test-retest conducted on the questions included in the paper-based survey and finally, results from the intervention content testing.

## 4.1 BACKGROUND

Overweight and obesity are important public health concerns. The percentage of Australian women of childbearing-age that are overweight or obese has significantly increased over the past decade. In 2007, 44% of Australian women aged between 25 and 34 years were overweight or obese compared to only 26% in 1995 (Australian Bureau of Statistics, 2009).

Childbearing-aged women are an important target group for dietary and physical activity interventions as they are at an increased risk of long-term overweight and obesity (Rooney et al., 2005). Women's increased risk of overweight and obesity after their first and subsequent pregnancies is associated with overweight or obesity prior to pregnancy (Gunderson et al., 2004; Soltani and Fraser, 2000), gestational weight gain above the recommended guidelines (Linne and Rossner, 2003; Siega-Riz et al., 2009), failure to lose gestational weight in an appreciable timeframe or excessive postpartum weight retention (Gore et al., 2003) and interpregnancy weight gain (Villamor and Cnattingius, 2006).

Overweight and obese childbearing-aged women appear to have a disproportionate risk of maternal, intrapartum, peripartum, neonatal, and postpartum complications (Ramachenderan et al., 2008; Ryan, 2007). If this weight gain continues after childbearing, women will be at increased risk of obesity related chronic conditions such as type II diabetes, high blood pressure, dyslipidaemia, cardiovascular disease and the risk of several major cancers (Ryan, 2007). In addition, maternal obesity may have deleterious effects on the neonate such as macrosomia, increased risk of a range of structural anomalies and of still birth (Ruager-Martin et al., 2010).

Research indicates that the mechanisms for interpregnancy and 12 months postpartum weight gain can be due to a range of factors such as lack of nutrition knowledge (Nuss et al., 2007), poor dietary habits and physical inactivity (Oken et al., 2007, Devine et al., 2000). For example, research shows that 96% of females aged 25- 34 and 94% of females aged 35-44 consume inadequate fruit or vegetables when compared to the Australian Dietary Guidelines (Australian Bureau of Statistics, 2009b, Australian Bureau of Statistics, 2009a). Furthermore, despite the known health benefits of physical activity, 30% of women aged between 24 and 34 do not do any physical activity, while 44% participate in low intensity activity (Australian Bureau of Statistics, 2009).

The barriers to mothers adopting the recommended physical activity behaviours include lack of social support, lack of time, lack of energy and motivation, procrastination, lack of self-efficacy and childcare and financial constraints (Nash, 2010, Lewis, 2005). The influences on eating habits include convenience, cost, lifestyle preferences, confusion around food messages, nutrition knowledge and environmental factors (Nitzke and Freeland-Graves, 2007). Furthermore, common postpartum physical symptoms such as fatigue, headaches, nausea, backache and urinary or bowel problems can inhibit mothers following a healthy diet and physical activity plan (Webb et al., 2008).

Mothers are an important group within the family unit as they are generally the primary caregiver and help to shape the attitudes and behaviour of their children with respect to food and physical activity. Overweight and obese children are twice as likely to become overweight and obese adults when compared to normal weight children (Singh et al., 2008). Mothers can prevent children from becoming overweight and obese as they play a major role in determining the family mealtime environment, and managing the amount and type of food available (Williams et al., 2011). Thus, efforts to interrupt this cycle of obesity by targeting interventions at mothers are vital from both a public health perspective. Dietary and physical activity interventions could provide benefits to the mother, her future pregnancies and subsequent generations from becoming overweight and obese (Oken, 2009).

Currently, there are few studies that have reported the effectiveness of behavioural interventions designed to improve physical activity and dietary behaviours (Hartman et al., 2010; Keller et al., 2008; Kuhlmann et al., 2008; Amorim et al., 2007; National Institute for Health and Clinical Excellence, 2010) in mothers with young children. These studies have included small samples and have incorporated limited evaluation measures (Amorim et al., 2007; Keller et al., 2008; Kuhlmann et al., 2008), even though the evidence suggests that after childbirth mothers are ready to change behaviours associated with overweight and obesity (Keller et al., 2006; Krummel et al., 2004).

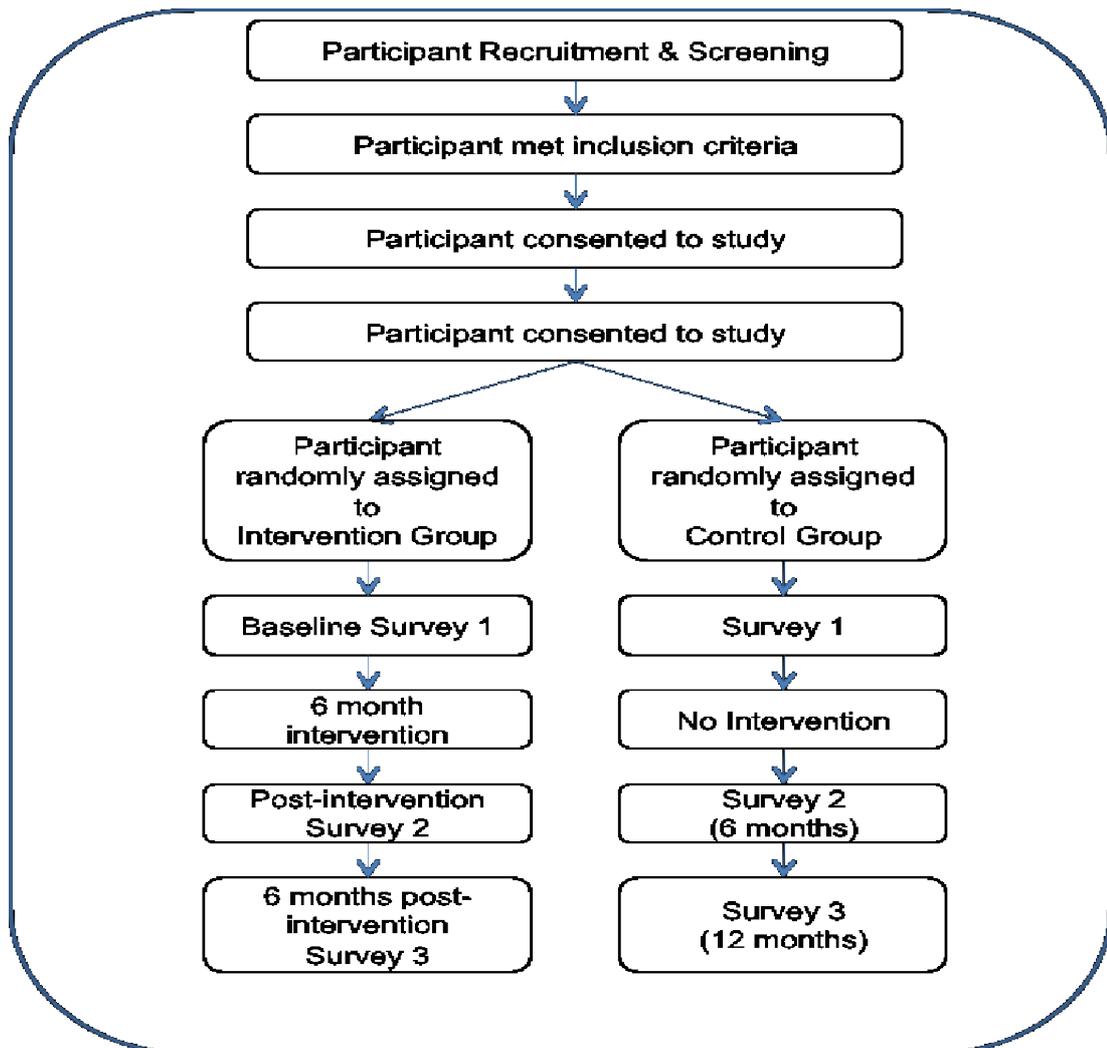
This paper describes the protocol of a randomised controlled trial to improve the physical activity and nutrition behaviours of mothers with young children (between 0 and 5 years of age) attending playgroups.

## 4.2 METHODS

### 4.2.1 Study design

The study was a community based 12 month randomised controlled trial (Figure 6). The study was designed according to the recommendations of the CONSORT statement for randomised trials of non-pharmacologic treatment (Boutron et al., 2008). The REFRESH study was conducted as part of a three-year project. The first year included formative research (literature review), development of the evaluation framework and the intervention, and test-retest of the questionnaire. In the second year, participants were recruited, the intervention was implemented and data was collected from participants. The final year included data collection, data analysis and review of the intervention.

Figure 6 Study design



#### **4.2.2 Study aim**

The REFRESH study aimed to evaluate the effect of a 6-month physical activity and nutrition randomised controlled trial for mothers with young children attending playgroups in Perth, Western Australia (WA). The REFRESH program focused on behaviour change to meet the Australian physical activity guidelines, by encouraging increased levels of vigorous, and moderate physical activity, the number of steps taken each day and muscle strength exercises (Pollock et al., 2000, Egger et al., 1999). The REFRESH program also aimed to encourage behaviour change to meet the Australian Dietary Guidelines (improve nutritional intake by increasing fruit, vegetable and fibre intake and decreasing fat and added sugar intake) (Department of Health and Ageing, 2005).

#### **4.2.3 Settings**

Playgroups in Australia are informal regular community groups that are set up for babies, toddlers and pre-school children (0 to 5 years). The purpose of a playgroup is to encourage play among children to enhance their social, emotional, physical and intellectual development. Parents and carers also find it a valuable resource as they help establish support networks. Playgroups are run by volunteer parents and carers who get together once a week for a couple of hours. They are held at a variety of venues such as libraries, child and maternal health centres, church halls, kindergartens and schools. Playgroups are supported by National and State organisations (Playgroup Australia, 2010). The REFRESH project was conducted in collaboration with Playgroup WA Inc. (Playgroup Western Australia Inc., 2010), as the playgroup was used as the setting to recruit mothers and implement the project.

Additional pertinent information on the settings of the study that was not included in the journal article is provided in section 4.7.1.

#### **4.2.4 Participant recruitment and randomisation**

A stratified random sampling procedure was adopted to recruit participants from 560 playgroups embedded in 106 suburbs (neighbourhoods). Stratification was conducted by suburb (neighbourhoods) geographical location and Socio-Economic Indexes For Area scores. The SEIFA scores are values derived from income, education level, employment status and skill level (Australian Bureau of Statistics,

2008a). The suburbs were randomly assigned to either the intervention group or the control group using a table of random numbers. Control and intervention group suburbs were arbitrarily matched for low and medium levels of socio-economic status based on SEIFA scores. The senior Playgroup WA Inc. staff made phone calls to all registered playgroup leaders, explained the REFRESH project and obtained permission for project staff to contact the playgroup. Project staff then visited the playgroup to further explain the project, obtain consent and allocate participants to the intervention or control group. Intervention group participants also completed the Physical Activity Readiness Questionnaire and provided a medical certificate if deemed necessary before commencing the program.

Additional pertinent information on participant and project staff recruitment that was not included in the journal article is provided in section 4.7.2.

#### **4.2.4 Inclusion criteria**

Study participants needed to be:

- a) women aged 18 or over registered with Playgroup WA Inc.;
- b) have a child between 0 to 5 years;
- c) healthy to the extent that participation in a low-stress physical activity program would not place them at risk;
- d) not taken part in any research that involves physical activity or nutrition within the last five years; and
- e) not on a special diet.

#### **4.2.5 Sample size determination**

In order to detect a 20% difference in physical activity at 80% power and 5% level of significance, sample size of 310 mothers of young children are required at the 6-months post-intervention survey in each of the intervention and control groups. A small effect size (0.2) (Cohen, 1987) is assumed for studies on behavioural effects due to the influence of extraneous variables and the subtleties of human performance. Allowing for an attrition rate of 30%, 900 mothers of young children were going to be recruited into the study. Sample size calculations were determined using Power Analysis and Sample Size software (2011).

## **4.2.6 Data collection**

### **4.2.6.1 Process data collection**

Process data was collected during the implementation of the intervention. The playgroup is a novel setting for the recruitment and delivery of health promotion interventions for mothers with young children. Therefore, the process evaluation was a key component of the program's evaluation. This was conducted with both the participants and the project staff, providing two perspectives on the program delivery and content.

### **4.2.6.2 Outcome data collection**

Outcome data was collected at baseline and 6-months. At baseline control group participants were hand delivered a self-completion questionnaire at the playgroup along with a self-addressed envelope and measuring tape to record waist and hip measurements. The intervention groups were provided with all of the above and a pedometer to record the number of steps taken each day. At 6-months the control group participants were hand delivered a self-completion questionnaire at the playgroup along with a self-addressed envelope. The intervention group was provided all of the above and a pedometer to record the number of steps taken each day.

## **4.2.7 Blinding**

It is not possible to blind study project staff to the randomisation process, however, the participants were blinded as to whether they are in the study or control group. The assessor was blinded until the comparative data analysis was conducted. Participants were given codes when recruited and these codes were used throughout the implementation of the study. The participant codes were revealed only at the 6-month comparative data analysis.

## **4.2.8 Statistical and qualitative analysis**

Data collected was coded and analysed using the Statistical Package for the Social Sciences computer statistical software (Coakes et al., 2010). P-values < 0.05 were considered statistically significant. Descriptive statistics was first used to summarise participants' demographic and health characteristics. For hierarchical data (repeated measurements of individuals) collected over the 6-month observational period Analysis of Variance was conducted.

Additional information on the statistical conducted on demographics, physical activity and diet variables that was not included in the journal article is provided in 4.7.3.

## **4.3 INTERVENTION DEVELOPMENT PROCEDURE**

### **4.3.1 Intervention group**

To facilitate the development of the intervention and to ensure adherence to its timeline, the implementation of the intervention was organised into four stages.

#### **Stage 1**

##### **Intervention development:**

A literature review of nutrition and physical activity community based interventions for mothers with young children, pregnant and postpartum women was conducted and was continuously updated. Relevant behaviour change theories reviewed including the Social Cognitive Theory (Glanz et al., 2008), Trans-Theoretical Model (Prochaska and Diclemente, 1983) and Motivational interviewing (Resnicow et al., 2002a) supported the development of a multi-strategy intervention (Walker, 2007). Previous qualitative data obtained from Perth playgroup mothers were used to ascertain the barriers and facilitators to healthy eating and being physically active, as well as their preferred intervention strategies (Jones et al., 2010). The Precede-Proceed model was used to organise the behaviour change theories and formative research data into an appropriate nutrition and physical activity behaviour change program (Howat et al., 2008; Green and Kreuter, 2005).

#### **Stage 2**

##### **Recruitment of staff:**

The program was staffed by Health Science graduates, who delivered the face-to-face workshop styled information and skill building sessions. Recruitment of the health promotion, nutrition and sport science graduates was conducted via local universities and relevant professional associations.

#### **Stage 3**

##### **Staff training:**

Staff received intensive training on the application of the Australian dietary and

physical activity guidelines (Department of Health and Ageing, 2005; Egger et al., 1999), and behaviour change theories including motivational interviewing. They received a comprehensive training manual on the delivery of the face-to-face workshop sessions. The staff also received ongoing support via email and phone by an accredited dietician, human movement specialist, health promotion specialist and the project coordinator.

#### **Stage 4**

##### **Delivery of intervention in playgroup settings:**

The intervention was delivered over 6-months. Interventions that aim to address multiple risk factors such as nutrition and physical activity show more positive outcomes when multiple intervention strategies are used to reach the target audience (Walker, 2007; Walker et al., 2010). Hence the intervention group participants received four strategies: face-to-face workshop information and skill development session; mailed or emailed newsletters; SMS reminders on the main messages of the REFRESH program; and a home-based component (Table 10) (Appendix 7).

##### **Delivery of face-to-face workshops:**

The intervention group participants received six workshop sessions over 6-months (one session a month). Each session was conducted for 30 minutes by project staff during the playgroup session at the playgroup venue. Workshops focused on enhancing knowledge, attitudes and skills to enable informed decision making about nutrition and physical activity behaviours.

##### **Delivery of newsletters:**

The intervention group participants received six newsletters via post or email over 6-months (one newsletter a month, one week after each face-to-face workshop session). The newsletters were in an informal format and contained myth dispelling information on nutrition and physical activity.

##### **Delivery of SMS reminders:**

The intervention group participants received 18 SMS reminders via mobile phones over six-months (reminders to attend the face-to-face workshop sessions and nutrition and physical activity motivating messages).

##### **Delivery of home-based component:**

The intervention group participants received home-based resources at each of the face-to-face workshop sessions to support the content of the REFRESH program. The home-based components included a specially tailored program booklet, pedometer, menu planner fridge magnet, a shopping list with food label reading tips, a muscle strength and flexibility exercise chart fridge magnet, a physical activity diary and an 'extra' food record sheet. The workshops offered an opportunity for these resources to be explained and for questions to be answered.

Table 10 REFRESH intervention content

Session (Week)	Session Details	Participant resources
1 (Week 1)	<ul style="list-style-type: none"> <li>• Introduction to REFRESH Program</li> <li>• Overview of healthy eating and being physically active</li> <li>• Focus nutrition: fruits, vegetables and water               <ul style="list-style-type: none"> <li>○ Guidelines</li> <li>○ Benefits/ barriers/ overcoming barriers</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>• Program booklet</li> <li>• Healthy recipe booklet</li> <li>• Session one summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>• determine participant program needs</li> </ul>
2 (Week 5)	<ul style="list-style-type: none"> <li>• Focus behaviour change:               <ul style="list-style-type: none"> <li>○ Stages of change</li> <li>○ Goal setting: long and short-term goals</li> </ul> </li> <li>• Focus physical activity: aerobic               <ul style="list-style-type: none"> <li>○ Guidelines</li> <li>○ Benefits/ barriers/ overcoming barriers</li> </ul> </li> <li>• Focus nutrition: five food groups and 'extra' foods               <ul style="list-style-type: none"> <li>○ Guidelines</li> <li>○ Benefits/ barriers/ overcoming barriers</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>• Pedometer</li> <li>• Family dinner and physical activity planner (fridge magnet)</li> <li>• 'Extra' food record sheet</li> <li>• Session two summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>• Playgroup 10,000 steps per day challenge</li> </ul>
3 (Week 9)	<ul style="list-style-type: none"> <li>• Focus behaviour change:               <ul style="list-style-type: none"> <li>○ Review established short-term goals</li> <li>○ Set new short-term goals</li> </ul> </li> <li>• Focus physical activity: Muscle strength and flexibility exercises               <ul style="list-style-type: none"> <li>○ Guidelines</li> <li>○ Benefits/ barriers/ overcoming barriers</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>• Muscle strength and flexibility exercise card (fridge magnet)</li> <li>• Physical activity diary</li> <li>• Session three summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>• Muscle strength and flexibility exercises</li> <li>• Integrated exercises</li> </ul>
4 (Week 13)	<ul style="list-style-type: none"> <li>• Focus behaviour change:               <ul style="list-style-type: none"> <li>○ Review established short-term goals</li> <li>○ Set new short-term goals</li> </ul> </li> <li>• Focus nutrition:               <ul style="list-style-type: none"> <li>○ Healthy eating messages</li> <li>○ Menu planning</li> <li>○ Food package label reading</li> <li>○ Making sense of nutritional claims on packaging materials</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>• Shopping list with healthy shopping tips</li> <li>• Comparing packaged food per 100g (fridge magnet)</li> <li>• Session four summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>• Reading food labels</li> </ul>

		<ul style="list-style-type: none"> <li>Developing a menu</li> </ul>
5 (Week 17)	<ul style="list-style-type: none"> <li>Focus behaviour change: <ul style="list-style-type: none"> <li>Review established short-term goals</li> <li>Set new short-term goals</li> <li>Overcoming relapses</li> </ul> </li> <li>Focus nutrition: fats and sugars <ul style="list-style-type: none"> <li>Recommended intake</li> <li>Benefits/ barriers/ overcoming barriers</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>Session five summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>Modifying recipes</li> <li>Healthy cooking methods</li> </ul>
6 (Week 21)	<ul style="list-style-type: none"> <li>Focus behaviour change: <ul style="list-style-type: none"> <li>Review established short-term goals</li> <li>Social support</li> </ul> </li> <li>Focus nutrition: Fibre and Glycemic Index <ul style="list-style-type: none"> <li>Recommended intake</li> <li>Benefits/ barriers/ overcoming barriers</li> </ul> </li> </ul>	Resources: <ul style="list-style-type: none"> <li>Session six summary pamphlet</li> </ul> Interactive activity: <ul style="list-style-type: none"> <li>Modifying recipes</li> <li>Healthy cooking methods</li> </ul>

### 4.3.2 Control group

The control group participants did not receive any intervention materials. Their only contact with the project included completing the questionnaires at the three data collection periods.

## 4.4 EVALUATION MEASURES

### 4.4.1 Process measures

#### 4.4.1.1 Participant process evaluation

The REFRESH booklet was assessed by the participants in terms of attractiveness, comprehension, personal relevance, believability, and legibility (Burke, 2008). Workshop and staff feedback sheets were provided to participants to assess the content and workshop delivery methods in the playgroup setting. Participants were invited to comment on the REFRESH program's impact on their physical activity and nutrition behaviours and to provide suggestions for improvements to the intervention (United States Department of Health and Human Services, 1992) (see Chapter Six for further information and Appendix 6 for staff survey and interview schedule).

#### 4.4.1.2 Staff process evaluation

The staff provided feedback on the playgroup as a setting for health promotion programs. This evaluation focused specifically on the playgroup characteristics, and

the skills deemed necessary to deliver workshops in this setting. Staff also provided feedback on working with mothers as a target group within the playgroup setting, what the mothers want to learn about nutrition and physical activity and common myths mothers report. Staff also maintained a diary of their perceptions related to the delivery of the face-to-face workshop sessions, and responses by participants to the session content and activities (see Chapter Six for further information and Appendix 6 for staff survey and interview schedule).

#### **4.4.2 Outcome measures**

The self-administered questionnaire comprised of instruments which were previously validated and tested for reliability with the adult population (Forsen et al., 2010, Sallis et al., 1987, Sallis et al., 1988b), and had undergone further reliability testing with mothers with young children prior to its use at baseline (information included at the end of the chapter) (see Section 4.7.7).

##### **4.4.2.1 Physical activity**

Physical activity was measured by The International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003). This instrument has been accepted as the physical activity measurement tool in many settings and is specifically designed for population-based prevalence studies. Muscle strength exercise assessment was based on recommendations from the American Heart Association and Australian physical activity guidelines (Haskell et al., 2007). Physical activity knowledge was assessed by a modified version of the American Adult's Knowledge of Exercise Questionnaire (Morrow et al., 2004).

##### **4.4.2.2 Dietary intake**

Dietary intake was measured using a modified version of the Fat and Fibre Barometer (Wright and Scott, 2000). The New South Wales Government questionnaire was used to measure snack consumption (Flood et al., 2005). Added sugar consumption was assessed using the 2005 National Health Interview Survey (U.S. Department of Health and Human Services, 2006). Nutrition knowledge was assessed by a modified version of the General Nutrition Knowledge Questionnaire (Hendrie et al., 2008). Frequency of serves of fruit and vegetable intake per day (Marks et al., 2001) and cups of soft drink, flavoured drink and 100% fruit juice consumed per day (National Cancer Institute, 2003) were assessed. Fruit and

vegetable serves were defined in the survey, one serve of vegetables being equivalent to '1cup (75g) cooked vegetables or legumes, 1 cup salad vegetables, 1 small potato' and one serve of fruit is equivalent to '1 medium piece (150g) of fruit, 1 cup diced pieces or canned fruit, cup fruit juice' (National Health and Medical Research Council., 2003).

#### **4.4.2.5 Behavioural Mediators**

Self-efficacy for nutrition and physical activity behaviours was assessed. Nutrition and physical activity self-efficacy was assessed using items from previously validated instruments (Sallis et al. 1988). Validated questions confirmed participants' stages of change regarding fruit and vegetable consumption (Jalleh et al. 2009). Social support for physical activity will be assessed based on items from the Sallis et al. instrument (Sallis et al. 1987).

#### **4.4.2.6 General Health**

General physical and mental health measured by The Medical Outcomes Study Short-Form Health Survey (SF-8) (Saris-Balgama et al. 2007). SF-8 is a standard international generic instrument of health status. It comprises two summary scales - the physical component summary (PCS) score and the mental component summary (MCS) score.

#### **4.4.2.7 Demographics**

Demographic characteristics included gender, age, educational level, country of birth, marital status, socioeconomic status, financial status and co-morbidities. Anthropometric measures included self-reported height and weight, waist and hip girth. A recent study has confirmed that self-report measures are suitable for such studies when a correction factor is applied (Dhaliwal et al., 2010).

Height, weight, waist and hip girth measurements were obtained by research staff on a random subsample of 100 participants from the intervention group. Calculations of differences between self reported and research staff measured data was undertaken to identify a correction factor based on the previously researched methodology (Dhaliwal et al., 2010).

## **4.5 ETHICS**

Ethics approval was obtained from Curtin University (protocol approval number 183/2008). Extension was obtained for 2009, 2010 and 2011. The trial was also registered with the Australian and New Zealand Clinical Trial Registry (ANZCTR) with approval number ACTRN 12609000718246 (Appendix 1).

## **4.6 DISCUSSION**

The REFRESH project is unique in using playgroups for a lifestyle intervention. The playgroup environment is an innovative setting for health promotion for mothers with young children, as it offered an exciting avenue to reach this target group and support behaviour change. The recruitment of participants through playgroups was beneficial as it encouraged all playgroup members to register for the program, thereby not just recruiting those who are motivated to adopt health enhancing behaviour (Treweek et al., 2010).

The program provided an opportunity for a variety of strategies to be implemented and evaluated. This evaluation data was collected from participants in their own communities and not in a research centre, making the program relevant to the community based population and not just a clinical group. The project provided guidelines for the development, implementation and evaluation of a minimal intervention home-based tailored physical activity and nutrition program. The information gathered was valuable in helping to identify and address the barriers to participating in physical activity and nutrition programs for this target group. The project demonstrated the potential, to reduce chronic disease and enhance mental health for mothers of young children in the playgroup setting.

## **4.7 ADDITIONAL INFORMATION ON METHODOLOGY**

This segment of the chapter was not included in the published journal article.

### **4.7.1 Settings**

This segment is continuation from section 4.2.3 and was not included in the published journal article. It expands upon the recruitment and randomisation process.

The playgroup was chosen as the setting for recruitment, delivery of the intervention and data collection for a number of reasons:

- The playgroup is embedded within the community setting (conducted at the local church hall, community hall, after hours at the primary school or kindergarten, or library hall) thus mothers enroll in their local neighbourhood playgroup and do not have to drive long hours;
- The playgroup venues are set up with the infrastructure to ensure that children are safe and have a kitchen thus not requiring additional resources;
- The playgroup is designed for young children to socialise and mostly mothers attend these sessions for their children, thus mothers do not feel guilty for leaving the children at a young age by themselves for long periods of time or for taking time out of their busy schedule to attend a program to improve diet and physical activity; and
- Mothers have established a bond with other mothers attending the playgroup and can support each other with diet and physical activity behaviour changes (Figure 7).

Figure 7 Playgroup setting



Source: Photo consent obtained from participants at Subiaco playgroup

## **4.7.2 Recruitment and randomisation**

### **4.7.2.1 Participant recruitment and randomisation**

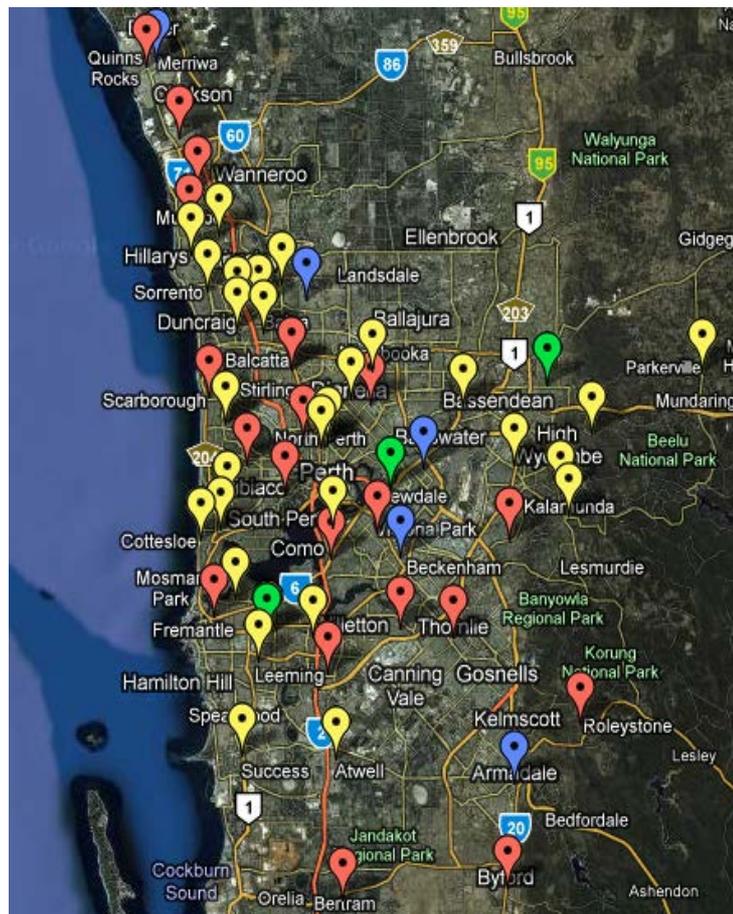
This segment is continuation from section 4.2.1 and was not included in the published journal article. It expands upon the recruitment and randomisation process.

The stages in the recruitment and randomisation process are outlined below:

- Stage 1: Playgroup Western Australia Incorporated (Playgroup WA Inc.) (Playgroup Western Australia Inc., 2010) provided the REFRESH project with a list of suburbs in Perth, Western Australia with a registered playgroup.
- Stage 2: The REFRESH project identified the playgroups located in suburbs within a 60 km radius of the Perth city and classified them according to their SEIFA.
- Stage 3: The suburbs were then randomly assigned to either the intervention or control group to using a table of random numbers.
- Stage 4: Control and intervention group suburbs were arbitrarily matched for low and medium levels of socio-economic status based on the SEIFA scores of economic advantage and disadvantage. In the intervention group, 306 playgroups with a total of 3,536 members were registered in the 53 suburbs of Perth selected for the study. In the control group, 335 playgroups with a total of 3,478 members were registered in the 53 suburbs of Perth selected for the study. The median SEIFA score for the intervention group was 1049 and the control group was 1051 (Table 11, 12, Figure 8).
- Stage 5: The senior Playgroup WA Inc. staff made phone calls to all registered playgroup leaders, explained the REFRESH project and obtained permission for REFRESH project staff to contact the playgroup. Interested playgroups were also requested to provide contact details or to contact the research centre. This procedure was followed in order to maintain confidentiality of the playgroup leaders. In the intervention group, 105 playgroups with a total of 576 members initially expressed an interest in the REFRESH study. In the control group, 115 playgroups with a total of 564 members initially expressed an interest in the REFRESH study. The median SEIFA score for the intervention group was 1036 and the control group was 1075 (Table 12).

Stage 6: REFRESH project staff visited the playgroup to further explain the project, obtain consent and allocate participants to the intervention or control group. Intervention group participants also completed the Physical Activity Readiness Questionnaire (Thomas et al., 1992) and provided a medical certificate if deemed necessary before commencing the program. In the intervention group, 60 playgroups with a total of 394 members registered and completed the baseline survey of the REFRESH study. In the control group, 60 playgroups with a total of 322 members registered and completed the baseline survey of the REFRESH study. The median SEIFA score for the intervention group was 1036 and the control group was 1075 (Table 12). (Appendix 4 includes staff recruitment instructions, participant information letter, consent forms, pedometer instructions, anthropometric data collection instructions) (Table 12).

Figure 8 Neighbourhoods in the intervention and control group, Perth, Western Australia.



Blue: Intervention group SEIFA decile ranking between 1-5; Red: Intervention group SEIFA decile ranking between 6-10; Green: Control group SEIFA decile ranking between 1-5; Yellow: Control group SEIFA decile ranking between 6-10

Table 11 Socio-Economic Index of Areas of suburbs in the intervention and control group, Perth, Western Australia.

SEIFA*	Intervention Group		Control Group	
	Suburbs (n)	Members (n) <sup>+</sup>	Suburbs (n)	Members (n) <sup>+</sup>
1	0	0	0	0
2	1	11	1	17
3	3	50	3	48
4	4	106	3	88
5	2	51	2	215
6	5	321	6	322
7	4	303	4	316
8	6	427	6	506
9	13	1039	13	922
10	15	1228	15	1044
Total	53	3536	53	3478

\*SEIFA (Socio-Economic Indexes For Area) is reported as decile rankings based on scores of economic advantage and disadvantage; + Number of members registered with Playgroup WA

Table 12 Intervention and control group details according to the stages of recruitment

	Intervention Group	Control Group
<b>Stage 4</b>		
Playgroups (n)	306	335
Suburbs (n)	53	53
Playgroup members (n)	3536	3478
SEIFA score-economic advantage and disadvantage (median (range))	1049 (886-1172)	1051 (893-1204)
<b>Stage 5</b>		
Playgroups (n)	105	115
Suburbs (n)	30	30
Playgroup members (n)	576	564
SEIFA score-economic advantage and disadvantage (median (range))	1036 (886-1172)	1075 (948-1183)
<b>Stage 6</b>		
Suburbs (n)	30	30
Playgroup members (n)	394	322
SEIFA score-economic advantage and disadvantage (median (range))	1048 (886-1172)	1065 (948-1183)

#### 4.7.2.2 Project staff recruitment

The project staff (n=25) were an integral component of the 6-month intervention. They were recruited via universities and health associations. They were required to have good interpersonal communication skills, an ability to work with minimal supervision in a team environment and with experience conducting group education sessions or workshops. Training was provided to the project staff on how to recruit participants and they were also provided information sheets with instructions and the paper-based surveys for the participants.

### **4.7.3 Statistical analysis**

#### **4.7.3.1 Demographics statistical analysis**

Descriptive statistics was first used to summarise participants' demographic and health characteristics. Descriptive statistics are reported as the mean ( $\pm$ SD) for continuous data, and counts and percentages for categorical data.

#### **4.7.3.2 Physical activity statistical analysis**

The effects of the intervention on continuous physical activity outcome measures were assessed using analysis of variance (ANOVA). The baseline data for the 716 participants, were used to determine the median (or 50th percentile) for vigorous, moderate and total physical activity, all expressed as minutes per week. These medians were subsequently used to categorise each of the physical activity variables into two groups, above and below the median. A McNemar test was used to assess the change in the status of the correlated data from above or below the median at baseline to above or below the median post-intervention for each of the physical activity variables comparing the intervention and control group.

#### **4.7.3.3 Diet statistical analysis**

The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA), after adjusting for mother's age and the corresponding variable at baseline. Percentage difference in the intervention group compared to that of the control for Fat and Fibre Barometer and consumption of food types per day were also calculated.

#### **4.7.3.4 Process evaluation qualitative analysis**

Qualitative data was entered in NVivo- a qualitative data analysis package (Bazeley, 2007). The qualitative data was reviewed by two staff members. Content analysis and inductive reasoning was conducted and salient themes were reported on.

### **4.7.4 Informed consent**

An invitation letter with study information was created for the test-retest (Appendix 2), intervention and control group (Appendix 4). The invitation letter highlighted the objectives of the study, the requirements of participation, that participation was voluntary, that no remuneration was offered for participation, the contact details for

the researcher and Curtin University Human Research Ethics Committee, the contact details of the study coordinator, that responses were confidential and de-identified that consent to participate could be withdrawn at any time. Intervention participants completed the Physical Activity Readiness Questionnaire and were provided instructions on recording pedometer readings (Appendix 4).

Signatures indicating willingness to proceed were required on a separate registration and consent form (Appendix 4). Participants retained information sheets and consent forms were returned to the project staff.

#### **4.7.5 Confidentiality**

To ensure confidentiality consent forms with recorded participants' names and signatures were stored in locked cabinets and the data was entered on the computer and protected with a password accessible only by the Project Coordinator. Each participant enrolled was assigned a code number, in order of completion. Names were not recorded on surveys and there was no identifying link between the paper-based survey and the paper-based consent form. Participants were not identified by name in any publication or report.

#### **4.7.6 Data storage**

Paper-based surveys and consent forms were collected and stored in cabinets under lock, except during periods of data entry or checking. The raw data of interviews were downloaded on the computer and password protected. All data entered onto the computer from the surveys for data analysis purposes was password protected.

#### **4.7.7 Questionnaire reliability testing**

The reliability testing methodology and results of the diet and physical activity questionnaire was not included in the published paper.

##### **4.7.7.1 Methodology**

The questionnaire was tested with 94 mothers of young children recruited from playgroups not involved in the research in March 2010. Participants were requested to complete the questionnaire twice within two weeks and as an incentive they were

informed that they went into a draw to win a voucher. Test-retest reliability was examined using the intraclass correlation coefficient (ICC), weighted Kappa coefficients, and Pearson or Spearman correlation coefficients between first and second applications (Carmines and Zellar, 1988). All analyses were done using the Statistical Package of Social Sciences (SPSS) version 17 for Windows. All statistical tests were two-tailed and conducted with a significant level of 0.05. The ICC and weighted Kappa coefficients were calculated for each individual question. An ICC <0.40 was rated as poor agreement, 0.40–0.75 as fair to good agreement and >0.75 as excellent agreement. Pearson correlation coefficients or Spearman's correlation coefficient were calculated to assess the degree of association between responses provided to questionnaire one and two. Spearman's correlation coefficient was used only when the data was not normally distributed. The guidelines proposed by Cohen were used for interpreting correlation coefficients, a coefficient of 0.1 being small agreement, 0.3 moderate agreement, and 0.5 large agreement (Cohen, 1960) (Appendix 2).

#### **4.7.7.2 Results**

Descriptive statistics demonstrate that 7% of mothers were aged between 21 and 20, 74% were between 31 and 40 and 19% were above 41 years. Eighty percent of the mothers were born in Australia, 72% had a university degree or higher, 72% were in paid employment, and 61% had a household income of greater than \$100,000. Results on the ICC for the IPAQ physical activity questions (short-form self-reported) ranged between 0.553 and 0.976 (Table 15). The international reliability study conducted for the IPAQ short-form self-reported questionnaire reported a spearman correlation coefficient of 0.88 based on all the physical activity components (Craig et al. 2003). The questions on serves of vegetables, fruits, dairy foods, breads and cereals, noodles and rice, meat, fish, and legumes consumed had ICC between 0.53 and 0.98 (Table 16). The fat and fibre barometer questions generally had ICC above 0.40. However, there were five questions with a ICC of below 0.40 (Table 17). The individual questions included in the stage of change and social support scale had ICC above 0.40 (Table 17, 19). The physical activity self-efficacy questions had ICC scores between 0.53 to 0.69 (Table 18). The physical activity self-efficacy ICC scores reported by Sallis et al. were higher than reported by the REFRESH test-retest (ICC=0.68) (Sallis et al. 1988). The diet self-efficacy ICC scores were classified into reducing calories questions (range 0.47 to 0.76), reducing fat questions (range 0.67 to 0.81) and behavioural skills questions (range

0.48 to 0.78) (Table 19). The diet self-efficacy test-retest scores reported by Sallis et al. for reducing calorie questions was 0.57, reducing fat was 0.43 and behavioural skills was 0.64 (Sallis et al. 1988). Thus, the REFRESH program questionnaire had fair to good agreement between the first and second responses provided by the mothers when compared to the test-retest results of other studies.

Table 13 Reliability testing of physical activity questions

Sr. No.	Physical Activity Questions	Correct cases (%)	ICC	Pearson's correlation
1	During a usual week, on how many days did you do vigorous activities for 10 minutes or more continuously?	79.8	0.948	***0.948
2	How much time in total did you usually spend doing vigorous activities?	45.2	0.912	0.927
3	During a usual week, on how many days did you do moderate activities for 10 minutes or more continuously?	67.8	0.701	0.701
4	How much time in total did you usually spend doing moderate activities?	48.9	0.553	0.577
5	In a usual week, on how many days did you walk for 10 minutes or more continuously?	83.3	0.741	0.741
6	How much time in total did you usually spend walking at vigorous intensity (speed walking) for 10 minutes or more continuously?	78.3	0.575	0.616
7	How much time in total did you usually spend walking at a moderate intensity (brisk walking) for 10 minutes or more continuously?	74.3	0.662	0.662
8	How much time in total did you usually spend walking at a light pace (strolling) for 10 minutes or more continuously?	83.3	0.635	0.635
9	During a usual week, did you do muscle strength activities (such as Pilates, calisthenics, weight training)?	97.7	0.947	^0.947
10	During a usual week, on how many days did you do strength activities?	89.7	0.946	0.946
11	How much time in total did you spend doing strength activities?	69	0.976	0.983
12	Do you do one strength exercise for each of the major muscle groups (legs, hip, back, abdomen, chest, shoulders, arms) at least twice a week?	93.1	0.847	^0.847
13	During a usual week, how much time in total did you spend sitting on a <u>week day</u> ?	63.6	0.814	0.817
14	During a usual week, how much time in total did you spend sitting on a <u>weekend</u> ?	73.6	0.828	0.828
15	During a usual week, how much time in total did you spend breastfeeding	90	0.617	0.728

ICC (Intraclass correlation coefficient), \*\*\* ( $p < 0.05$ ), ^ Spearman's correlation coefficient

Table 14 Reliability testing of diet questions

	Diet Questions	Correct cases (%)	ICC	Pearson's correlation
<b>FOOD GROUP</b>				
1	How many serves of vegetables did you eat in a usual day?	91.4	0.876	0.876
2	How many serves of fish did you eat in a usual week?	86.3	0.839	0.84
3	How many serves of bread did you eat in a usual day?	88.6	0.802	0.806
4	How many serves of dairy foods did you eat in a usual day?	84	0.767	0.77
5	How many serves of cereals did you eat in a usual day?	92.3	0.739	0.744
6	How many serves of legumes, seeds or nuts did you eat in a usual week?	82	0.733	0.733
7	How many serves of meat, poultry or eggs did you eat in a usual day?	94.9	0.714	0.752
8	How many serves of fruit did you eat in a usual day?	81.5	0.707	0.714
9	How many serves of rice, noodles, or pasta did you eat in a usual day?	81	0.539	0.594
<b>FRUIT JUICE AND SOFT DRINKS</b>				
10	How many cups of 100% fruit juice did you usually drink?	92	0.981	0.981
11	How many standard drinks of alcohol do you drink in a usual week?	71.4	0.942	0.946
12	How many standard drinks of alcohol do you drink in a usual week?	96.3	0.941	0.949
13	How many cups of flavoured (or fruit flavoured) drinks did you usually drink?	94.7	0.93	0.949
14	How many cups of flavoured (or fruit flavoured) drinks did you usually drink?	82.9	0.836	0.842
15	How many cups of soft drink did you usually drink?	75.8	0.823	0.84
16	How many cups of 100% fruit juice did you usually drink?	83	0.807	0.808

ICC (*Intraclass correlation coefficient*)

Table 15 Reliability testing of fat and fibre barometer questions

Sr. No.	Diet Questions	Correct cases (%)	ICC	Spearman's correlation
<b>FAT AND FIBRE BAROMETER</b>				
1	How often did you choose low-fat milk (HiLo or skim) in preference to whole milk?	96.7	0.976	0.964
2	In a usual week, how often did you eat smoothies, milkshakes?	92.9	0.885	0.7334
3	How often did you choose reduced-fat or low-fat cheese/yogurt in preference to regular fat cheese/yogurt?	83	0.871	0.872
4	How many different types of vegetables did you usually eat each day?	81.7	0.862	0.811
5	How often did you eat wholemeal, wholegrain, rye or seeded bread in preference to white bread?	90.2	0.849	0.831
6	How many teaspoons in total of sugar/honey did you usually add to your tea, coffee, cappuccino, cereal, etc. each day?	83.9	0.848	0.849
7	How often did you trim all visible fat off the meat you eat?	91	0.81	0.7
8	How often did you eat wholemeal spaghetti, pasta / brown rice in preference to regular spaghetti, pasta/ rice?	81.5	0.803	0.766
9	In a usual week, how many days did you eat legumes?	87.9	0.796	0.652
10	How many teaspoons in total of margarine or butter did you usually apply on your bread/toast/sandwich each day?	78	0.785	0.848
11	How often did you remove the skin from chicken before it is cooked?	84.9	0.748	0.789
12	In a usual week, how many days did you eat processed meats?	78.5	0.745	0.747
13	In a usual week, how many days did you eat 2 or more serves of fruit?	71.1	0.714	0.713
14	In a usual week, how often did you eat snacks?	92.9	0.708	0.708
15	In a usual week, how often did you eat fried foods?	89.7	0.707	0.401
16	In a usual week, how many days did you eat cheese?	67.2	0.7	0.704
17	In a usual week, how often did you eat hot/iced chocolate, mocha, coffee?	72.2	0.694	0.692
18	How often did you use fat (oil, lard, butter, margarine) when cooking?	75	0.678	0.678
19	In a usual week, how many days did you eat snacks?	85.2	0.658	0.677
20	How often did you spread butter or margarine when eating bread/crisp bread/crackers?	68.5	0.601	0.599
21	In a usual week, how often did you eat cakes muffins pastries, scones, sweet, bakery, products?	69.8	0.563	0.614
22	In a usual week, how many days did you eat high fibre breakfast cereal?	69.7	0.56	0.552
23	In a usual week, how often did you eat plain, biscuits, short bread, cream/chocolate biscuits?	67.9	0.511	0.493
24	In a usual week, how often did you eat regular ice cream, mouse, custard, caramel, chocolate?	64	0.491	0.539
25	In a usual week, how many days did you eat 5 or more serves of vegetables?	51.1	0.361	0.37
26	In a usual week, how many days did you eat fried food with batter or bread crumb coating?	92.9	0	-
27	In a usual week, how many days did you eat fastfood?	95.7	0	-
28	In a usual week, how often did you eat pies, pastries?	93.8	0	-
29	In a usual week, how many days did you eat fried foods?	93.1	0.036	-0.036

ICC (Intraclass correlation coefficient)

Table 16 Reliability testing of stage of change questions

Diet and Physical Activity Stage of Change Questions	Correct cases (%)	ICC	Spearman's correlation	Kappa
Increase fruit	75.3	0.785	0.798	0.619
Increase vegetables	68.8	0.524	0.535	0.483
Decrease sugar	73.1	0.655	0.712	0.627
Decrease fat	67.7	0.708	0.73	0.565
Increase physical activity	73.1	0.848	0.791	0.647

ICC (Intraclass correlation coefficient)

Table 17 Reliability testing of social support for physical activity questions

Sr. No.	Physical Activity Self-efficacy Questions	Correct cases (%)	ICC	Spearman's correlation	Kappa
1	During the past 6 weeks either my family, friends or a partner encouraged me to engage in physically activity.	75.3	0.796	0.797	0.628
2	During the past 6 weeks either my family, friends or a partner was physically active with me.	75.3	0.719	0.692	0.588
3	During the past 6 weeks either my family, friends or a partner took over chores so that I had more time to be physically active.	87.1	0.812	0.787	0.735
4	During the past 6 weeks either my family, friends or a partner offered to look after the children so that I could be physically active.	81.7	0.797	0.761	0.68
5	During the past 6 weeks either my family, friends or a partner helped plan activities around my exercise.	76.3	0.75	0.707	0.574

ICC (Intraclass correlation coefficient)

Table 18 Reliability testing of self-efficacy for physical activity questions

Sr. No.	Physical Activity Self-efficacy Questions	Correct cases (%)	ICC	Spearman's correlation	Kappa
1	I am sure that I can do moderate intensity activity for at least 30 minutes a day, five days a week OR do vigorous intensity activity for at least 20 minutes a day, three days a week.	65.9	0.571	0.574	0.459
2	I am sure that I can do one strength exercise for each of the major muscle groups at least twice /week.	73	0.697	0.705	0.59
3	I am sure that I can be physically active even when I don't have a partner/relatives or friends to support me.	73.3	0.657	0.646	0.572
4	I am sure that I can find time during the day to do physical activity with or without the children.	70.3	0.695	0.729	0.523
5	I am sure that I can be physically active even when I felt self-conscious about my body shape/appearance.	81.3	0.539	0.519	0.446

ICC (Intraclass correlation coefficient)

Table 19 Reliability testing of self-efficacy for diet questions

	Diet Self-efficacy Questions	Correct cases (%)	ICC	Spearman's correlation	Kappa
1	I am sure that I can replace two high-fat high-sugar snacks/desserts such as biscuits, cakes, pastries, muffins, doughnuts with fruit, low-fat yogurt or nuts everyday.	77.9	0.633	0.624	0.539
2	I am sure that I can eat 5 or more types of vegetables each day.	74.2	0.476	0.484	0.463
3	I am sure that I can replace two high-fat high-sugar snacks such as of sausage rolls, spinach rolls, pies and crisps with vegetables everyday.	77.3	0.478	0.407	0.355
4	I am sure that I can eat 2 serves of legumes/lentils/peas at least 3 times a week.	69.6	0.697	0.674	0.529
5	I am sure that I can eat wholemeal/grain breads with more than 3 grams of fibre per 100 grams.	88.1	0.49	0.403	0.292
6	I am sure that I can use low fat cheese, avocado or slice of tomato instead of butter or margarine on bread/sandwiches.	85.7	0.761	0.775	0.624
7	I am sure that I can use lemon juice and citrus fruits as a dressing instead of oil/mayonnaise in salads.	75.6	0.683	0.639	0.569
8	I am sure that I can eat low-fat or skim milk, cheese, yogurt instead of regular dairy products.	80.7	0.672	0.61	0.546
9	I am sure that I can add less sugar to your tea/coffee everyday.	78.2	0.744	0.705	0.61
10	I am sure that I can eat a high-fibre breakfast such as wholemeal/grain bread, rolled oats, wheat flakes or Wheetbix everyday.	93.8	0.769	0.781	0.723
11	I am sure that I can understand food labels and check the fat, sugar and fibre content every time you buy a new food product.	80.9	0.485	0.583	0.546
12	I am sure that I can remove the skin of the chicken before cooking it.	92.8	0.817	0.796	0.747
13	I am sure that I can trim the fat of meat.	96.2	0.807	0.863	0.797
14	I am sure that I can plan dinner and snack meals in advance.	73.6	0.526	0.529	0.443
15	I am sure that I can eat smaller portions in general.	85.9	0.784	0.749	0.723

ICC (Intraclass correlation coefficient)

#### 4.7.8 REFRESH intervention testing

The methodology and results of intervention content testing was not included in the published paper.

##### 4.7.8.1 Methodology for intervention testing

In 2008, a pilot program was conducted in Perth that aimed to improve the diet and physical activity of mothers with young children. The pilot intervention was conducted for three months and included a A5 paper sized program booklet, A4 paper sized menu planner, A5 paper sized exercise card, and pedometers (Jones et al. 2009).

The REFRESH project intervention was developed and tested with 20 mothers of young children recruited from playgroups who had attended the pilot program. Qualitative data on intervention resources was collected via two focus groups (n=20). Quantitative data on the intervention duration and face-to-face sessions was collected via a paper-based surveyed (n=16) hand delivered to the participants (Appendix 3).

#### **4.7.8.2 Results of the intervention testing**

The results of the intervention testing are reported below.

- 20 mothers with young children were included in the sample.
- Duration of the intervention: 56% of mothers preferred the intervention to be for three months, 31% for 6-months and 13% for two months.
- Most mothers reported preferring to receive emailed physical activity and diet information during the school holidays to keep motivated (75%).
- Duration of the face-to-face workshop sessions: 63% of mothers preferred one face-to-face session per month, and 19% two sessions per month and 18% one session per three months.
- Length of the face-to-face workshop sessions: 69% of the mothers preferred each session to 20 minutes and 31% preferred it to be for 30 minutes. Most mothers preferred the sessions to be conducted at the playgroup (94%).
- Intervention resources: Mothers reported that the A5 sized program booklet included good information but was too small and could provide more tips on eating healthy foods. Mothers reported that the menu planner was a good idea but could be made more functional by including a organiser section. The exercise card was also reported to be too small and could be improved by making it a fridge magnet with a exercise monitoring section.
- Intervention diet and physical activity information: Mothers reported to want information on the following topics:
  - a) physical activity: Integrated physical activity: what is it and how can you get fit without going to the gym?; Are you getting enough exercise to help your heart?; Physical activity guidelines for Australians;
  - b) diet: Recipe modification (including fruit and vegetables in your meals); Heart: How it works with the food you feed it?; Serving sizes and portion sizes; Developing a shopping list that gives your family the best nutrition?; Food label reading; Fast facts on fat; Fast facts

- about sugar; Dietary Guidelines for Australians: What do they mean for you and your family?; Breakfast: Why is it so important?; Fast facts on fibre; Fast facts on protein & carbohydrates; and
- c) behaviour change: Stages of Change: how can you help yourself move to the Action Stage?; and Implementation of goals: how to get started?.

## **4.8 CONCLUSION**

This chapter described the REFRESH project setting, study design, participant and staff recruitment and randomisation, sample size determination, inclusion criteria, intervention strategies, resources, evaluation instruments, statistical analysis, and ethics. This additional information was provided on selected topics included in the published journal article in order to give a clear understanding of the settings, participant and staff recruitment and randomisation, informed consent procedures, confidentiality processes, data storage structures, results from test-retest conducted on the questions included in the paper-based survey, and finally, results from the intervention content testing.

The next chapter includes the process evaluation and outcome evaluation results. The results are reported as peer-reviewed journal articles.

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**CHAPTER FIVE**

**FINDINGS FROM RESEARCH**

**ARTICLE 2**

**Physical activity and nutrition intervention for mothers of young children: Process evaluation**

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## PRELUDE

Chapter Five was published as a journal article in *Health*. Please see Appendix 8: Paper 2 for authorship contribution and consent and Appendix 8: Paper 2 for full-text.

### *Reference:*

Monteiro, S. M. D. R., Jancey, J., Howat, P. Physical activity and nutrition intervention for mothers of young children: Process evaluation. *Health*, 6 (3); 223-230. DOI: 10.4236/health.2014.63033 [Impact Factor 0.56]

The article addresses Objective 2: To assess the usefulness, relevance and suitability of the diet and physical activity intervention strategies and resources.

Chapter Five describes the process evaluation of the REFRESH randomised controlled trial. Specifically, it assesses the intervention strategies and resources used in a playgroup setting aimed at mothers of young children. The methodology describes the data collection from participants (n=249) and staff (n=25) involved in the intervention. Data collected included staff perspectives on use of the playgroup as a setting, participants' views on the feasibility and acceptability of the program strategies and resources, and program reach. Results demonstrate that the process evaluation provides valuable information on participants' perspectives of the program strategies, content and overall implementation. It provides insights into the feasibility and acceptability of the intervention and identifies areas for improvement when conducting programs in playgroup settings. The process evaluation indicated that playgroups are a suitable setting for health promotion targeting mothers with young children.

## 5.1 INTRODUCTION

Physical inactivity, overweight and obesity, high blood pressure and high blood sugar are among the five leading global risks for mortality in the world (World Health Organisation, 2009). According to the World Health Organisation decreased physical activity, fruit and vegetable consumption and increased sugar and fat consumption are identified as major risk factors for cardiovascular diseases, metabolic syndrome, and cancers (World Health Organisation, 2005).

Women are at increased risk of weight gain during their childbearing years and across the life span (Davis et al., 2012). Obesity during pregnancy, and the perinatal and postpartum period has several negative consequences for the obese woman. Some of these include gestational diabetes mellitus, pre-eclampsia, thromboembolic disease, postpartum haemorrhage, spontaneous onset of labour and increased risk of anaesthetic complications (Thangaratinam and Jolly, 2010). Maternal obesity is associated with several major risks to the fetus, such as congenital abnormalities, macrosomia, and increased risk of intrauterine death (Tsoi et al., 2010).

The Australian Dietary Guidelines recommend that women (19 to 60 years) eat at least four to seven serves of vegetables and legumes and three serves of fruit daily. However, 96% of females aged between 25-34 years and 94% aged 35-44 years fail to meet these guidelines (Australian Bureau of Statistics, 2009). Women's physical activity levels decrease significantly after childbirth due to life transitions that affect their priorities and lifestyles, resulting in insufficient daily physical activity (Brown et al., 2009).

Research interventions have had varying degrees of success in increasing fruit and vegetable consumption and levels of physical activity among mothers with young children (Amorim et al., 2007; Birdsall et al., 2009; Dodd et al., 2010; Gardner et al., 2011; Hartman et al., 2010, Keller et al., 2008; Kuhlmann et al., 2008; Ronnberg, 2011; Skouteris et al., 2010; Streuling et al., 2010; Thangaratinam and Jolly, 2010). However, the recruitment and retention of participants into research studies is challenging due to the increased demands on these women, which include limited time and competing priorities (Hartman et al., 2010).

Process evaluation is identified as an important reporting aspect by the CONSORT statement for public health research interventions (Boutron et al., 2008; Armstrong

et al., 2008) and is regarded as an essential component of health promotion program evaluation (O'Connor-Fleming et al., 2006). Process evaluation measures variation in program activities, reach, participant satisfaction and perception, quality and delivery of the program strategies and takes into account or limits the influence of Type III errors in health promotion practice (Nutbeam and Bauman, 2006; Hubley, 2004).

Program evaluation in health promotion is a complex process as it aims to gather evidence to assess the effectiveness of strategies and programs, maintain a level of accountability and improve health promotion practice (Hawe et al., 1990). Despite impact and outcome evaluation being the most commonly reported forms of evaluation for randomised controlled trials, process evaluation, which is under reported is vital as it accounts for factors that contribute to the success or failure of programs (Rootman et al., 2001; Hawe et al., 1990).

The Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) intervention (program) aimed to encourage participants to increase their levels of physical activity and strength exercises and to improve their diet by increasing fruit, vegetable and fibre intake and decreasing their fat and added sugar intake. Information about the program protocol has been previously published (Monteiro et al., 2011). In this paper we present the main process evaluation conducted with program staff and the mothers of young children participating in the playgroup based program.

## **5.2 METHOD**

### **5.2.1 Theoretical framework**

The REFRESH program's strategies were based on a robust process (Glanz et al., 2008) using the PRECEDE - PROCEED Model (Green and Kreuter, 2005) as the overall conceptual framework and the Social Cognitive Theory constructs such as (Bandura, 2001), self-efficacy (Bandura, 1997) and goal setting (Michie et al., 2009a), along with motivational interviewing (Resnicow et al., 2002). Materials and strategies designed for the intervention had a strong emphasis on improving participants' self-efficacy relating to both dietary intake and physical activity behaviour. Information presented at workshops and written resources highlighted barriers and motivators (intrinsic and extrinsic) for achieving adequate levels of

physical activity and a healthy diet. The workshops sessions helped equip participants with skills and knowledge to better manage their physical activity and dietary behaviours. For example, information on how to read food labels and tips on healthy dietary choices were provided, while text messaging reinforced healthy food choices. The program also supported goal setting, related to dietary and physical activity behaviour change and assessment of these goals as the intervention progressed.

### **5.2.2 Intervention content**

The 6-month intervention used four primary approaches to reach the target audience (mothers of young children based in playgroups).

(1) A comprehensive *program booklet* was produced based on the Australian Dietary Guidelines (Department of Health and Ageing, 2005) and physical activity guidelines (U.S. Department of Health and Human Services, 2008; Egger et al., 1999). This contained information on sample menus, understanding food labels, healthy eating tips and how to increase physical activity, along with behaviour change and goal setting information.

(2) Six 30 minute *workshops* were delivered by trained program staff (one per month) in the playgroup setting. Detailed information on staff training and workshop content has been previously published (Monteiro et al., 2011).

(3) Six *Newsletters* containing chatty health information were posted or emailed over the 6-month intervention period (Appendix 10.6). A total of 18 *Short Message Service* were sent to participants, six messages on nutrition and physical activity and 12 messages were reminders to attend the face-to-face workshops (Appendix 10.4).

(4) Additional *home-based resources* were provided to all participants to support behaviour change at home and to assist participants when they were unable to attend the workshops. These resources included: a *pedometer* to record their number of steps; a *menu planner chart* (fridge magnet) with information on the Australian dietary and physical activity guidelines (Department of Health and Ageing, 2005; Egger et al., 1999; U.S. Department of Health and Human Services, 2008) for the entire family; a *shopping list* with tips to understand food labels, a shopping list holder (fridge magnet) containing information on sugar, fat and fibre in packaged foods; a strength and flexibility *exercise chart* (fridge magnet); a *physical activity diary*, and a *recipe booklet*.

### **5.2.3 Intervention program staff recruitment**

The trained program staff (n=25) were an integral component of the 6-month intervention. They were recruited via universities and health associations. They were required to have good interpersonal communication skills, an ability to work with minimal supervision in a team environment and with experience conducting group education sessions or workshops. They were provided with intensive training on the application of the physical activity guidelines (U.S. Department of Health and Human Services, 2008, Egger et al., 1999), nutrition guidelines (Department of Health and Ageing, 2005), motivational interviewing (Resnicow et al., 2002a), and Social Cognitive Theory (Bandura, 2001). The program staffs were responsible for implementing the program in the playgroups, and providing the link between the researchers and the playgroup participants. They kept detailed records, provided participant feedback and helped coordinate the process evaluation data collection.

### **5.2.4 Program participants recruitment**

The intervention group consisted of 249 mothers aged 18 year and over; with at least one child between 0 to 5 years; healthy to the extent that participation in a low-stress physical activity program would not place them at risk; not taken part in any research that involved physical activity or nutrition within the previous five years; not on a special diet; and registered with Playgroup WA Inc. Participants were recruited from playgroups based in the Perth metropolitan area with the assistance of Playgroups WA Inc. (peak playgroup body in WA).

### **5.2.5 Process evaluation methods**

The process evaluation gathered qualitative and quantitative data from two perspectives, those of program staff and those of the participants (mothers of young children). Both qualitative and quantitative data was obtained via semi-structured interviews, paper based and online surveys. Data were collected on the staff; program activities, resources and overall feedback on the program.

#### **5.2.5.1 Intervention program staff on-line survey**

Fourteen program staff completed a 10 minute online survey. The staff were contacted by email and invited to complete the survey via Survey Monkey. Informed consent was obtained. The survey aimed to determine barriers and facilitators to

using the playgroup setting; requests for health information; reported misconceptions around health; and demographic data of the program staff.

#### **5.2.5.2 Intervention program staff Interviews**

Twelve program staff completed a semi-structured interview which expanded on the information gathered via the online survey. It aimed to assess the factors related to the suitability of the playgroup setting for the delivery of the intervention for the mothers with children between 0 and 5 years; and the suitability of the program content and resources. The interview schedule explored the responses to the online survey. A trained external interviewer conducted the interviews to reduce bias. The interviews were conducted via telephone and were of 30 minutes in duration. Prior to commencement of the interview, the aim of the research was explained and informed consent was obtained. Participants received a \$20 gift voucher as an incentive.

#### **5.2.5.3 Participants self-complete surveys**

Surveys were completed by the participants at two time points during the 6-month intervention. Survey one (n=194: third month) aimed to determine participant perception of staff facilitation and presentation skills at workshops. Survey two (n=174: sixth month) assessed the usefulness, relevance and suitability of all the intervention strategies and resources for supporting management and changes in physical activity and nutrition behaviours; overall perception of the program; and potential intervention improvements.

The purpose of the surveys was explained to the participants and informed consent was obtained. The surveys were distributed at the playgroups and collected on completion. The questions contained in the surveys used a 5-point likert scale (ranging from '*strongly agree*' to '*strongly disagree*'; '*very useful*' to '*not at all useful*'; '*very relevant*' to '*not relevant*') along with several open-ended questions.

#### **5.2.5.4 Participants semi-structured exit interviews**

Twenty semi-structured exit interviews (10 completers and 10 non-completers) were conducted with randomly selected program participants, who were invited by telephone to participate in the exit interviews. A trained external researcher conducted the interviews to reduce bias. The interviews were conducted in the

participants' homes or at a convenient location and were up to 60 minutes in duration. Permission was sought for recording the interviews and a \$20 gift voucher was provided as an incentive. Questions included how effective the program was, usefulness of resources and how the program could be improved. It incorporated both qualitative and quantitative questions.

#### **5.2.5.5 Data analysis**

Quantitative data was coded and analysed using the Statistical Package for the Social Sciences computer statistical software (Coakes et al., 2010). Descriptive statistics were used to summarise participants' demographic and health characteristics. Qualitative data was entered in NVivo- a qualitative data analysis package (Bazeley, 2007). The qualitative data was reviewed by two staff members. Content analysis and inductive reasoning was conducted and salient themes were reported on.

### **5.3 RESULTS**

#### **5.3.1 Program staff**

The majority of staff were aged 20 to 24 years (71%), had a Health Science degree (80%) and between three to 24 months experience working in the area of health promotion (76%).

#### **5.3.2 Interview and online survey**

The program staff reported that the participants were receptive to information and motivated to understand the information provided. Staff reported that the participants requested dietary-related information on *carbohydrates, proteins, fats and how they function in the body, how to creatively include vegetables in family meals, tips on healthy eating for the whole family and healthy recipe menu planning*. Participants requested information on strategies to resist eating high calorie foods. The physical activity topics participants wanted information on included *how to fit physical activity around family activities, types of exercises that could be completed at home, activities they could complete with children and realistic exercise expectations of weight loss after pregnancy*. Participants also requested information on *strategies to maintain weight while attending to the family needs*. Interestingly the staff reported that participants expressed a range of misconceptions around nutrition

and physical activity. The most commonly reported misconceptions is included in Table 20 (eight or more participants reported the misconception).

### 5.3.3 Participants

The majority of participants were aged 31 to 40 years of age (75%), most were in paid employment (60%), born in Australia (66%) and had two or more children (67%). Approximately half (51%) of the participants had a university degree (Table 21).

Table 20 Nutrition and physical activity misconceptions

<u>Nutrition misconceptions</u>	
•	Canned fruits and vegetables contain minimal nutrients in comparison to fresh fruits and vegetables
•	Bananas are 'a super food' – you can live on them only
•	Fruits are high in sugar and they should not be consumed
•	Fruits contain high levels of pesticides and are bad for children
•	Peas and corn do not contain carbohydrates
•	Corn is undigested in the body
•	Certain vegetables should not be consumed at night
•	Consuming the skin of root vegetables increases the risk of diabetes
•	Certain fruits (watermelon, grapes) contain a high sugar content and have a high glycaemic index and should be avoided
•	Butter has more saturated fat but is better than margarine that is highly processed and contains additives
•	Vegetable and palm oil are high in saturated fat
•	Sugar is natural and hence is a better option than artificial sweeteners
•	Caffeinated drinks before exercise are good for muscles
<u>Physical activity misconceptions</u>	
•	If you don't sweat you haven't exercised enough
•	You need to eat protein before doing muscle strength exercises
•	Running fast is bad for you
•	Brisk walking is better than fast walking
•	Not sure if it's okay to exercise before breastfeeding
•	Not sure if it's okay to eat before and after exercise

Table 21 Participant demographics (n=249)

	N	(%)
Mothers age (years)		
21 to 30	23	(9.2%)
31 to 40	187	(75.1%)
41 and above	39	(15.7%)
Pregnant/breastfeeding/postpartum	103	(41.4%)
Parity (%)		
1	82	(32.9%)
2	167	(67.1%)
Education		
Year 12/TAFE	115	(46.2%)
University	127	(51.0%)
Married/Partner	245	(98.8%)
Born in Australia	165	(66.3%)
Employment		
Casual	33	(13.3%)

Full/Part-time Income	117	(47.0%)
> \$50,999	32	(13.4%)
\$51 000 to \$100,999	95	(39.9%)
< \$101,000	111	(46.0%)

### 5.3.4 Home-based components

Most participants reported that the home-based component (comprised of a pedometer, menu planner, shopping list, exercise chart, menu planner and program booklet) were *useful, comprehensive, helpful, and valuable if they could not attend the workshops.*

Participants reported that these resources were as good as attending a workshop:

*'Very helpful as I missed a couple of sessions and handouts and resources were excellent and extremely informative'*

Participants found the healthy eating resources provided interesting food information and was generally a good reminder when planning meals, shopping and modifying recipes to be healthier:

*'There were ... facts and things that I didn't know... it made me rethink... just a little bit more awareness of what you're eating and what things contain'*

Participants reported that the booklet *encouraged them to think about physical activity and nutrition behaviours (93%)*. Other supporting resources such as the *pedometer (70%), menu planner (81%) and shopping list (88%)* were all reported to be useful and were well received. See Table 22 for a summary of the responses.

Table 22 Participants response to program

	Agree/Strongly agree with statement	
<b>Booklet</b> (n = 149) (RR: 59.8%)		
Useful advice in booklet	97%	(n=144)
Easy to understand	95%	(n=142)
Suitability for mothers	97%	(n=145)
Interesting information in booklet	98%	(n=146)
Attractive format	90%	(n=134)
Messages were relevant	91%	(n=136)
Encouraged me to think about physical activity	93%	(n=139)
Encouraged me to think about nutrition	93%	(n=139)

<b>Workshop sessions</b> (n=170) (RR: 68.3%)		
Sessions were useful	86%	(n=146)
Attendance at sessions	66%	(range 51-82%)
<b>MYC resources</b> (n=170) (RR: 68.3%)		
Newsletters were useful	73%	(n=122)
The pedometer was useful	70%	(n=120)
The exercise chart was useful	57%	(n=96)
Shopping List and the Food Label magnet	88%	(n=149)
Recipe booklet was useful	81%	(n=136)
<b>MYC Activities</b> (n=170) (RR: 68.3%)		
The goal setting was useful	52%	(n=106)
Useful SMS reminder messages	57%	(n=90)
The 16 week physical activity diary was useful	34%	(n=56)
The Walk to the Gold Coast activity was useful	29%	(n=48)
Flexibility and muscle strength exercise	39%	(n=48)
<b>Program overall</b> (n=170) (RR: 68.3%)		
The Program was useful	98%	(n=148)
The program was relevant to me	92%	(n=138)
Encouraged me to think about dietary changes	98%	(n=149)
Encouraged me to think about physical activity changes	95%	(n=150)
Helped me make changes to my nutrition behaviours	79%	(n=132)
Helped me make changes physical activity behaviours	66%	(n=110)
I would recommend the program to others	84%	(n=144)

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### 5.3.5 Newsletter

Participants reported that the newsletters were a useful method of providing nutrition and physical activity information:

*'They (newsletters) made you understand the correct information about lots of topics (nutrition and physical activity)'*

*'They (newsletters) helped to change my behaviour as I now had information from the dietician rather than a magazine'*

### 5.3.6 Short Message Service

Approximately half the participants reported that the SMS reminders (57% agreed) were *useful*. Participants reported that SMS were an effective method to remind them to attend the workshops and bring program resources:

*'Very good reminders – particularly as we're all busy mums'*  
*'It helped me to remember and focus on the REFRESH program'*  
*'It was a good non-intrusive way of communication with the participants'*

However, some participants did not take notice of the SMS received from the program and some preferred not to receive them:

*'I use SMS for urgent messages, would have preferred emails'*  
*'I never really read them (SMS).'*

### **5.3.7 Workshops**

Of those who responded to the survey, the majority of participants stated that the *purpose of the workshop sessions were clear* (99% agreed: n=187); *workshops were well organised* (98% agreed: n=189), and there were *sufficient discussion opportunities* (97% agreed: n=188). Participants described the sessions as *inspiring*, providing *helpful reminders for eating healthily and physical activity*, and *useful information and resources*. Most participants reported that the *staff were well informed* (97% agreed: n=192), *easy to understand* (99% agreed: n=192) and *kept the focus of the session on the objectives* (n=189: 97% agreed).

The monthly workshops were not attended by all participants (n=249), with attendance decreasing over the 6-month intervention. Attendance at workshop one was 82% (n=202); workshop two was 71% (n=175); workshop three was 65% (n=161); workshop four was 66% (n=164); workshop five was 59% (n=147) and workshop six was 51% (n=127).

### **5.3.8 Overall program response**

Participants reported that the program had helped them to change their nutrition (79%: n=132) and their physical activity behaviours (66%: n=110).

Participants reported that the program made them think about what they are eating more often, plan meals ahead and understand the difference between diet versus healthy eating:

*'I think that I've gained an appreciation of what kind of information is out there about healthy eating... I did go through and picked out what I thought*

*was the most helpful... from the information we got from REFRESH I definitely found that it was valuable and worth keeping'*

Suggested improvements to the program included provision of childcare for workshop sessions and/or shorter sessions, program information suited to weight loss, and coordinated walking groups. In regard to resources it was suggested that: 'there be provision of more recipes, sample shopping lists, information via email and online and a workbook, and an interactive website with a discussion board. The main reasons reported for dropping out were: '*returning to work*' and '*changes in children's sleep patterns*'.

## **5.4 DISCUSSION**

### **5.4.1 Overall triangulation of data**

The process evaluation results are very positive from both the staff and program participant perspective and compare favourably to other projects conducted with mothers (Olvera et al., 2008). The close contact that program staff maintained with the participants, may have assisted in increasing the accuracy and hence the validity of the staff's perceptions of the program. In turn the data collected from the participants should substantiate that reported by the program staff. This triangulation of data from both the program staff and program participants strengthens the reported results (Olvera et al., 2008).

### **5.4.1 Home-based component**

A pilot project (Jones et al., 2010b) along with formative research (Hartman et al., 2010) indicated that the home-based component should comprise the main focus of the intervention, as all the resources that were provided could be used by the women independently at home at a suitable time. The home-based program especially the 'flagship' *booklet* were all reported to be useful and were well received by the women. The other supporting resources such as the *pedometer menu planner* and *shopping list* were also rated positively.

### **5.4.2 Workshops**

The workshops aimed to complement and reinforce the home-based resources while providing a means of interacting with and engaging with the target group.

Workshops can be problematic, especially with this target group, as attendance can reduce over time due to competing priorities (Hartman et al., 2010). Attendance of mothers at the workshops did drop off throughout the program with 82% of mothers attending in the first month, while in the sixth month only 51% attended. The relatively short timeframe during playgroup meetings, the need to attend to children are recognised as barriers to regular workshop attendance (Hartman et al., 2010; Marcus and Forsyth, 1998; Jones et al., 2010).

### **5.4.3 Misconceptions**

An interesting and useful component of the study was the women's reported misconceptions. The education level of this study population was a reasonably high (51% university educated) compared to the Australian population (Gary et al., 2002), yet there were some curious misconceptions or beliefs. These included, *Peas and corn do not contain carbohydrates*, *'certain vegetables should not be consumed at night* and *caffeinated drinks before exercise is good for muscles*. This information supported interaction between participants and staff, as staff could respond to these statements and further engage women in the program. The staff were trained in motivational interviewing which assisted the mothers to explore these misconceptions and often resolve them. Staff were empathetic, non-judgemental and used open ended questions which fostered an opportunity for discussion in a safe and supportive environment (Resnicow et al., 2002).

Overall the program participants were positive in regard to the program resources and strategies and reported that the program helped them to *change their nutrition* (79%) and *physical activity* (66%) behaviours, which is an extremely positive reflection. The women also made a number of recommendations for future programs. These included providing sample shopping lists; information via email, and a workbook; and an interactive website with a discussion board. All these suggested strategies are suitable for women in paid employment or those working at home caring for their children.

### **5.4.4 Limitations**

Between 60 and 69 % of participants responded to the process evaluation and this may have biased some of the results. However, the response rates compare favourably with similar process evaluations reported in the literature for this target

group (Walker et al., 2005). Also due to the close relationship between staff and participants it is possible there was some social desirability when reporting outcomes. However, all reported data were anonymous and non-identifiable which was likely to minimise potential biases.

## **5.5 CONCLUSIONS**

The reported outcomes of physical activity and nutrition interventions for mothers with young children has increased gradually over the last two decades but few studies have reported detailed process evaluations of such programs. The process evaluation data indicated that the intervention's unique features such as using multiple strategies and targeting mothers via playgroups ensured that the program reached and engaged a significant proportion of the target group throughout the 6-month intervention. The mothers were positive about the various strategies and resources used in the intervention, indicating that the program had been implemented and delivered as intended. The combination of the home-based components supported by the interactive workshops was a suitable approach. The suggestions for improvements and refinements of the participants will be useful to make future community based health promotion interventions even more relevant to the priority population. It is recommended that more interventions include detailed process evaluation as part of their research methodology.

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## **CHAPTER SIX**

### **FINDINGS FROM RESEARCH**

#### **ARTICLE 3**

**Diet behavioural outcomes of a community-based intervention program for mothers with young children: A randomised controlled trial**

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## PRELUDE

Chapter Six was submitted as as a journal article in International Journal of Behavioural Nutrition and Physical Activity (2014). Please see Appendix 7: Paper 3 for authorship contribution and consent.

### *Reference:*

Jancey, J., Monteiro, S. M. D. R., Howat, P. Dhaliwal, S. S., P. Hills, A.P., Anderson, A. S., Burns, S. (2014) Dietary outcomes of a community based intervention for mothers of young children: A randomised controlled trial. *International Journal of Behavioural Nutrition and Physical Activity*, 11; 120-129. DOI: 10.1186/s12966-014-0121-1 [Impact Factor 3.68] [*Refer to Chapter Six & Paper 3*]

The chapter addresses Objective 3: To compare fruit, vegetable, fat and fibre, and sugar consumption at 6-months post-intervention

Chapter Six describes the background on benefits of fruit and vegetable consumption, statistics on fruit and vegetable consumption among mothers, and a review of diet studies for mothers of young children. This is followed by the methodology, which describes the measurement instruments and analysis of fruit and vegetables serves, fat and fibre barometer and number of cups of soft drink. The results demonstrate that the intervention group had significantly increased odds of consuming high fibre foods (fibre scores), low fat foods (fat scores), and fruit and vegetable serves.

## 6.1 BACKGROUND

Unhealthy dietary behaviours are one of the key risk factors for many lifestyle related diseases worldwide (World Health Organization, 2009; He et al., 2007; Riboli and Norat, 2003). Globally, 1.8% of the disease burden is attributed to inadequate fruit and vegetable consumption (Lock et al., 2005), while in Australia this figure is 2.1% (Begg et al., 2007). The economic costs associated with unhealthy dietary behaviours are substantial (Rayner and Scarborough, 2005) and as the prevalence of lifestyle related diseases such as obesity and type II diabetes increase, the associated economic costs are predicted to rise significantly (National Health and Medical Research Council., 2013). Increasing healthy dietary behaviours is being recognised as the single most important aspect of reducing an individual's risk of lifestyle related disease (Rayner and Scarborough, 2005).

According to the Australian Dietary Guidelines, it is recommended that individuals enjoy a wide variety of nutritious foods, including fruit and vegetables and limit their intake of foods containing saturated fat, added salt and sugars (National Health and Medical Research Council., 2013). Guidelines suggest that adult woman should consume two serves of fruit, five serves of vegetables, six serves of grains, two and a half serves of dairy foods or alternatives and two and a half serves of lean meat and poultry, fish, eggs or alternatives. During pregnancy and the postpartum period these recommendations change to reflect an increased need for nutrients, vitamins and minerals (National Health and Medical Research Council., 2013).

However, global rates of fruit and vegetable consumption are low (8). For example, in the United States approximately 74% women of childbearing age (25 to 44 years) reporting consuming less than five serves of fruits and vegetables, while in the United Kingdom this figure may be between 73% and 77% (World Health Organisation, 2013). In the 2011-12 Australian Health Survey (Australian Bureau of Statistics, 2012), 55% Australian women aged 24 to 44 did not meet the recommended intake of two serves of fruit and 92% consumed less than the recommended five serves of vegetables. The most recent Australian national data on dietary fibre is obtained from the 1995 National Nutrition Survey indicates that the fibre intake of an adult women was 20 g/day, which was less than the recommended 25 g/day (McLennan and Podger, 1998).

Furthermore, many Australians are over consuming foods that are high in sugar and/or fat (Australian Institute of Health and Welfare, 2012), with energy dense, nutrient poor (EDNP) foods, often referred to as 'extra' foods (e.g. sugary drinks; pies/pastries; wine) contributing to 33.8% of Australian women's mean daily energy intake (Rangan et al, 2009). This overconsumption of 'extra foods' has contributed to the significant increase in the prevalence of overweight and obesity in Australian women of childbearing aged, with 35% of women aged 18 to 24 years being classified as overweight or obese, increasing to 55% of women aged 35 to 44 years (Australian Bureau of Statistics, 2013).

Factors influencing the food choices of mothers with young children are varied. Barriers to consuming a healthy diet include inadequate food related knowledge and preparation skills (Nuss et al., 2007), affordability and access to healthy produce (Reyes et al., 2013), food choices based on convenience due to reduced time for meal preparation (Eikenberry and Smith, 2004), and a greater focus on the family (Chang et al., 2008). Conversely, it has been acknowledged that during this period mothers of young children may experience increased motivation to adopt healthier behaviours (Bastian et al., 2010), thereby providing a window of opportunity when women may be more receptive to nutrition messages stemming from health concerns (Peterson et al, 2001).

There are limited dietary interventions aimed at mothers with young children. Interventions that have been implemented have predominantly focused on weight loss outcomes as opposed to dietary behaviours and have targeted women with high body mass indexes (De Jerse et al., 2011; Ostbye et al., 2008; Baker, 2011; Keller et al., 2008; O'Toole et al., 2003) The overall aim of this randomised control trial was to improve dietary intake and increase physical activity levels of mothers with young children via a flexible home-based multi-strategy intervention. This research paper will specifically report on the outcomes related to increasing fruit, vegetables and fibre intake and decrease the fat and sugar-sweetened beverage consumption.

## 6.2 METHODS

### 6.2.1 Design and intervention

The 6-month randomised controlled trial was informed by a pilot project with regards to recruitment, retention and behaviour change intervention strategies via playgroups (Jones et al., 2010a). Playgroups provide a community-based venue for mothers' of children aged less than five years to meet and socialise in a relaxed and informal environment. The playgroup sessions are run by parents and are usually held once a week for a 2 hour period. All playgroups in Western Australia (WA) are registered with Playgroups WA, an incorporated body and are not for profit.

The nutrition content was based on the Australian Dietary Guidelines (Department of Health and Ageing, 2005) and behaviour change strategies were informed by the Social Cognitive Theory (Glanz et al., 2008b), Trans-theoretical Model (Prochaska and Diclemente, 1983), and Motivational Interviewing (Rollnick and Miller, 1995). Behaviour change theory techniques included increasing self-efficacy, provision of nutrition information and discussion of solutions to barriers to healthy eating; increasing understanding of strategies to obtain support from family and friends; increased support for behaviour change through encouragement; skill building, rewards, positive self-talk, goal setting and relapse prevention strategies (Table 23). The intervention was primarily home-based and supported by five face-to-face workshops (30-minute sessions every month) at playgroups that provided an opportunity for the resources to be further explained and topics clarified. The face to face sessions were conducted by final year Health Science students recruited through local universities and professional associations. The program resources included a comprehensive specifically tailored information booklet, menu planner, nutritional information panel guide, guidelines for the formulation of a shopping list, recipe booklets and bi-monthly 'chatty' newsletter providing health information and health related activities. The control group completed a baseline and post-intervention questionnaire and had no other contact. Further information about the study has been published elsewhere (Monteiro et al. 2014), with this paper focussing on the dietary outcomes of the intervention.

Table 23 Description of intervention linked to behaviour change theory

THEME	INTERVENTION	THEORY
Orientation to the diet intervention (Week 1)	Distribution of resources (booklet, menu planner, recipe booklet) containing information on healthy eating (increasing fruit, vegetables and fibre and reducing fat and sugar-sweetened beverages) Barriers and benefits to a healthy diet and overcoming barriers	Expectation and expectancies ; Self-efficacy (SCT)
Behaviour change (Week 5)	Goal setting - diet Family dinner planner & food record sheet Activity with healthy dinner planner Newsletter	Behavioural capabilities; self-efficacy; observational (SCT and TTM)
Monitoring progress (Week 9)	Review established goals Set new short term goals Support networks Review resources Newsletter	Behavioural capabilities; self-control; social support; reciprocal determinism; reinforcement (SCT); MI
Monitoring progress (Week 13)	Review established goals Set new short term goals Menu planning Shopping list with healthy tips Reading food labels Newsletter	Self-control; social support; reciprocal determinism (SCT); (MI)
Reinforcing messages/information (Week 17)	Overcoming relapses Support networks Modify recipes to make healthier Healthy cooking methods Newsletter	Social support; observational, reinforcement (SCT)
Review and feedback (Week 21)	Review of goals; review of program; Fibre and glycaemic index Modified recipes/healthy cooking methods Newsletter	Social support; observational, behavioural capabilities (SCT)

*SCT (Social Cognitive Theory), TTM (Trans Theoretical Model), MI (Motivational Interviewing)*

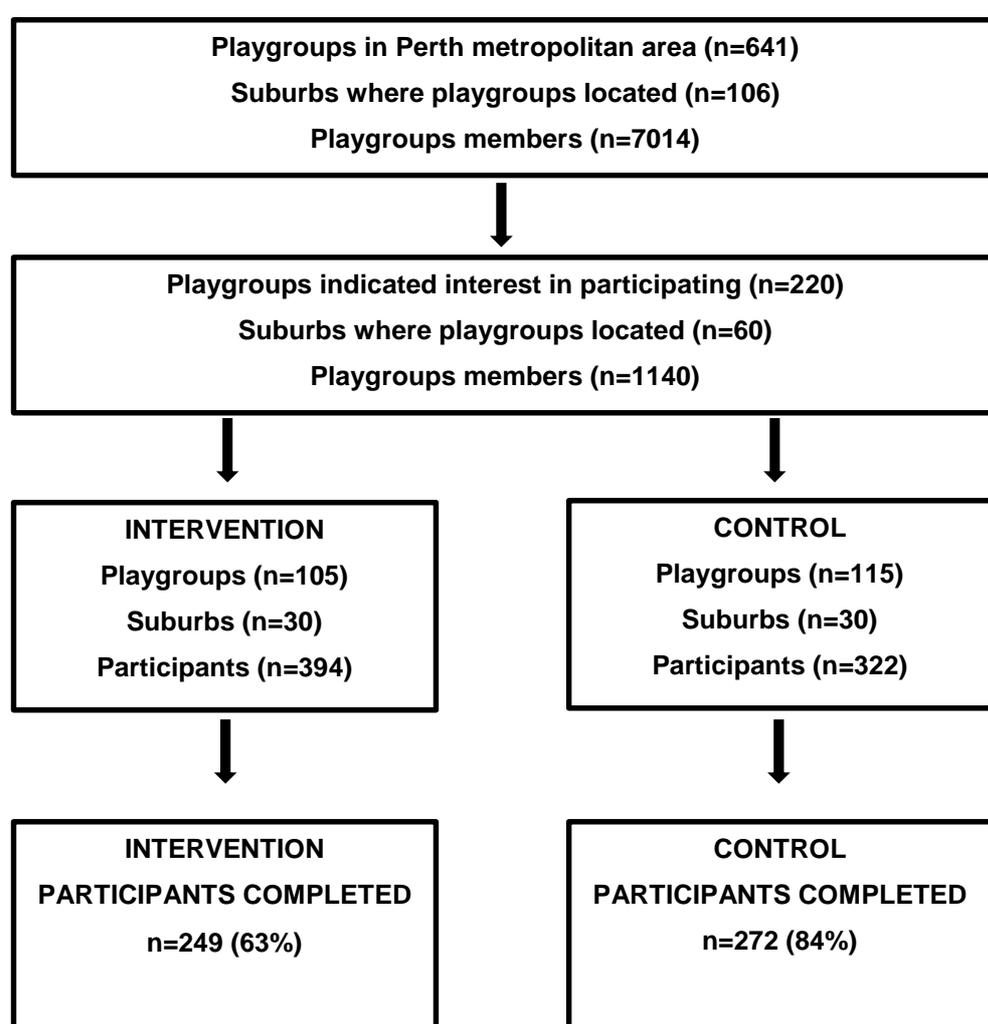
### 6.2.2 Recruitment and randomisation

Playgroups located in 60 suburbs (neighborhoods) in the Perth Metropolitan area registered with Playgroups WA were randomly assigned to the intervention (n=30) or control (n=30) group and arbitrarily matched on their Socio-Economic Indexes For Area (SEIFA) scores (Australian Bureau of Statistics, 1998), a value derived from income, education level, employment status, and skill level. Playgroup WA staff contacted the playgroups to obtain consent for the project staff to make contact. To

be eligible for participation in the study, participants were required to be: women aged 18 years and above; have at least one child aged 0-5 years; and on no special diet. Of the 1140 participants who were recruited, 716 participants consented to be part of the study (Figure 9).

Ethics approval was obtained from the Curtin University Human Research Ethics Committee (approval number HR 183/2008). Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12609000718246.

Figure 9 Flow chart of recruitment process



### 6.2.3 Nutrition measurements

Dietary intake of participants was collected by the validated Fat and Fibre Barometer (FFB) (Wright and Scott, 2000). The FFB is a brief food behaviour questionnaire that is self-administered and contains 20 food related behaviour items. It has good internal consistency ( $\alpha = 0.86$ ) and test retest reliability ( $r = 0.92$ ).

The relative validity of the FFB was assessed by comparing it to the food frequency questionnaire with weighted Kappa indicating fair to moderate agreement. The FFB assesses individual's fat-related food intake (fried foods, dairy foods, meat and chicken and butter) and fibre-related food intake (wholegrain foods, fruit and vegetables). Response values for each item range from 1 to 5, with '1' representing food behaviour associated with the high fat intake or low fibre intake, to '5' representing the low fat or high fibre intake. Fat and fibre scores are calculated by summing the scores from the corresponding fat and fibre foods assessed. Individual items (fruit and vegetables; wholegrain foods; dairy products; lean meat and chicken) were also analysed.

Additional questions assessed the frequency of serves of fruit and vegetable intake per day (Marks et al., 2001); and cups of soft drink, flavoured drink and fruit juice consumed per day (National Cancer Institute, 2003). Fruit and vegetable serves were defined in the questionnaire. One serve of vegetables is equivalent to '1 cup (75g) cooked vegetables or legumes, 1 cup salad vegetables, 1 small potato' and one serve of fruit is equivalent to '1 medium piece (150g) of fruit, 1 cup diced pieces or canned fruit, cup fruit juice' (National Health and Medical Research Council., 2003). Demographic data was also collected.

#### **6.2.4 Statistical analysis**

Descriptive statistics are reported as the mean ( $\pm$ SD) for continuous data and, count and percentages for categorical data (Table 24). The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA), after adjusting for mother's age and the corresponding variable at baseline (Table 25). Also, playgroups effects were treated as "block" random effects within the analysis of variance and the variability between these blocks were removed before valid comparisons between the two treatment groups were made to remove the effect of clustering by playgroups (Campbell et al., 2004). Figure 9 shows the percentage differences between the intervention and the control group for Fat and Fibre Barometer and consumption of food types per day. Statistical Analysis were performed using Statistical Package for Social Sciences (SPSS Version 20).

## 6.3 RESULTS

### 6.3.1 Demographics

In total, 521 participants completed both the baseline and post-program questionnaire (72.8% retained). The intervention group compared to the control group had slightly higher BMI, lower fruit consumption ('less than 2 servings of fruit/day'), and had a lower percentage of participants who were 'least disadvantaged' (SEIFA score). These differences, if of any effect, bias the results against the Intervention group and hence do not compromise the validity of the research. No significant differences at baseline were present for all other variables ( $p > 0.1$ ) (Table 24).

Table 24 Baseline demographics of study participants

Variables	Intervention	Control	P-value
Count	249	272	
AGE	35.9 ± 4.3	35.6 ± 4.3	n.s
BMI (kg/m <sup>2</sup> )			0.081
<25	73 (54.5%)	116 (67.1%)	
≥25 and <30	47 (35.1%)	44 (25.4%)	
≥30	14 (10.4%)	13 (7.5%)	
Vegetable consumption			n.s.
< 5 serves/day	212 (85.1%)	215 (79.0%)	
5 serves/day	35 (14.1%)	55 (20.2%)	
> 5 serves/day	2 (0.8%)	2 (0.7%)	
Fruit consumption			0.036
< 2 serves/day	157 (63.3%)	143 (52.6%)	
2 serves/day	75 (30.2%)	101 (7.1%)	
< 2 serves/day	16 (6.5%)	28 (10.3%)	
Pregnant, breastfeeding or postpartum	103 (41.4%)	95 (34.9%)	n.s.
Parity			n.s.
1 child	82 (32.9%)	94 (34.6%)	
≥2 child	167 (67.1%)	178 (65.4%)	
Married or De facto	245 (98.8%)	265 (98.1%)	n.s.
University degree or higher	127 (51.0%)	170 (62.5%)	0.008
Not employed	99 (39.8%)	94 (34.7%)	n.s.
Annual household income (AUD)			n.s.
<\$51,000	32 (13.4%)	27 (10.1%)	
≥\$51,000 to <\$101,000	95 (39.9%)	107 (39.9%)	
≥\$101,000	111 (46.6%)	134 (50.0%)	
SEIFA score			<0.0005
Least disadvantage	95 (38.6%)	147 (54.9%)	
Less disadvantage	83 (33.7%)	21 (7.8%)	
Average disadvantage	34 (13.8%)	55 (20.5%)	
Disadvantage	20 (8.1%)	36 (13.4%)	
Most disadvantaged	14 (5.7%)	9 (3.4%)	

BMI (Body Mass Index), SEIFA (Socio-Economic Index for Areas, N.S ( $p$ -value  $> 0$ ))

### 6.3.2 Effects of intervention on diet outcomes

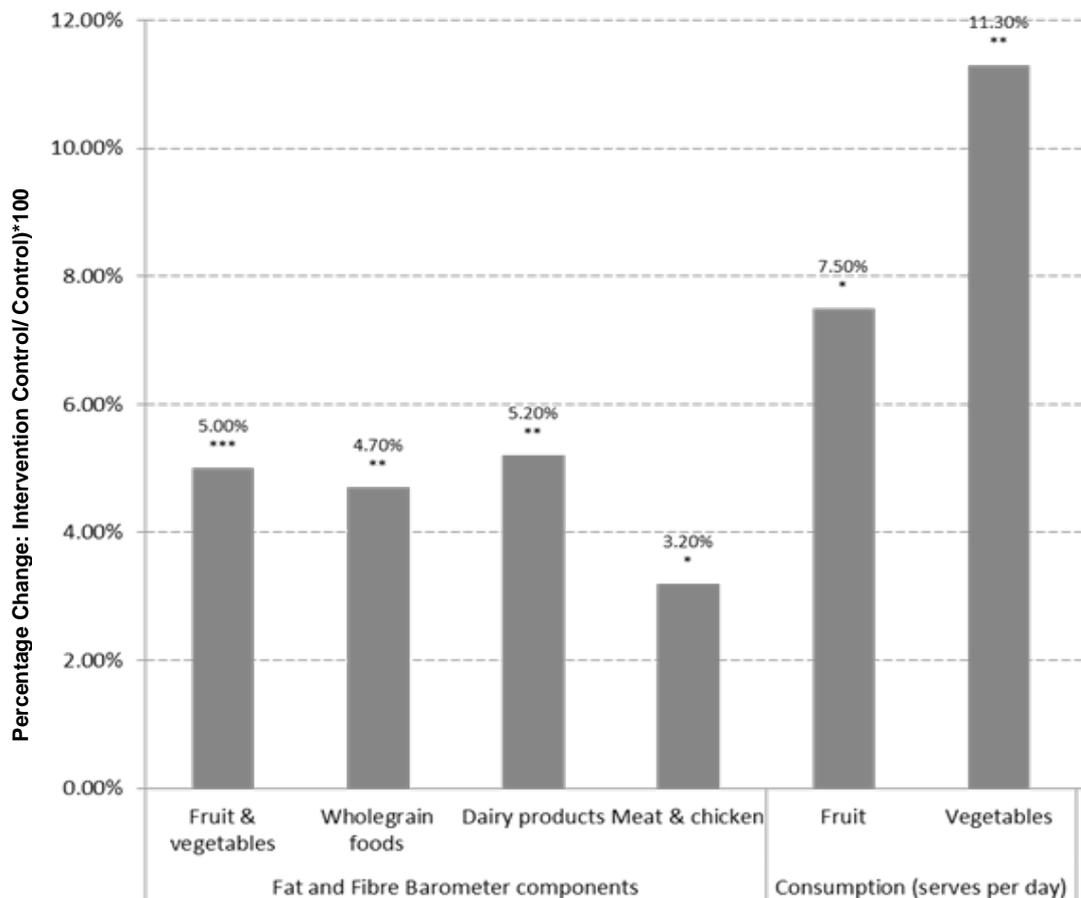
The continuous diet outcome variables and FFB variables were compared between the intervention and control group post intervention (Table 25). The intervention group was significantly higher than the control group on the FFB, fibre barometer (fruit and vegetables consumption, whole grain foods consumption), fat barometer (low fat dairy products consumption, and cooking methods to reduce fat from meat & chicken) (all  $p < 0.05$ ). These mean differences between the intervention and control group ranged from 0.12 to 0.17. Intervention group participants also consumed higher serves of fruit and vegetables compared to the control group. No significant differences were reported between the two groups in the consumption of fruit juice, soft drinks and flavoured drinks.

Table 25 Comparison of diet post-intervention outcomes between the intervention and control groups

Scores	Intervention	Control	Mean difference	95% CI of mean difference	Change	P-value
<b>Fat and fibre barometer</b>						
Fat and fibre barometer	3.63 ± 0.02	3.52 ± 0.02	0.12	0.07 , 0.16	3.3%	<0.0005
Fibre barometer	3.47 ± 0.03	3.29 ± 0.02	0.17	0.10 , 0.24	5.3%	<0.0005
Fruits and vegetables	3.39 ± 0.03	3.23 ± 0.03	0.16	0.08 , 0.24	5.0%	<0.0005
Wholegrain foods	3.55 ± 0.04	3.39 ± 0.04	0.16	0.06 , 0.26	4.7%	0.002
Fat barometer	3.73 ± 0.02	3.65 ± 0.02	0.08	0.03 , 0.14	2.3%	0.005
Reduced fat dairy products	3.37 ± 0.04	3.21 ± 0.04	0.17	0.05 , 0.29	5.2%	0.006
Lean meat and chicken	3.93 ± 0.04	3.81 ± 0.04	0.12	0 , 0.24	3.2%	0.041
<b>Consumption per day</b>						
Fruits (serves)	2.26 ± 0.05	2.10 ± 0.05	0.16	0.01 , 0.31	7.5%	0.038
Vegetables (serves)	3.39 ± 0.08	3.05 ± 0.08	0.35	0.13 , 0.56	11.3%	0.002
100% fruit juice (serves)	0.18 ± 0.04	0.13 ± 0.03	0.06	-0.04 , 0.16	46.6%	n.s.
Soft drinks (cups)	0.18 ± 0.05	0.25 ± 0.05	-0.07	-0.20 , 0.06	-28.2%	n.s.
Flavoured drinks (cups)	0.18 ± 0.03	0.21 ± 0.02	-0.02	-0.09 , 0.05	-11.0%	n.s.

The effect of the intervention as compared to the control group in changing consumption is summarised in Figure 10, illustrating that the intervention increased positive behaviours in consumption by between 3.2% and 11.3%; increased consumption of lean meat and chicken (by 3.2%) and wholegrain foods (by 4.7%), fruit and vegetables (by 5.0%), and reduced fat dairy products by (5.2%). Daily serves of fruit (by 7.5%) and vegetables (by 11.3%) also increased.

Figure 10 Effect of intervention in changing consumption (intervention and control group)



\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

## 6.4 DISCUSSION

This study was conducted via a playgroup setting, in order to reach mothers of young children to provide them with a flexible home-based multi-strategy intervention. The intervention aimed to encourage an increase in the levels of fruit,

vegetable and fibre intake and a decrease in fat and sugar-sweetened beverage consumption. The outcomes of the intervention were positive suggesting the program to be both acceptable and suitable for mothers of young children.

#### **6.4.1 Comparison to other studies**

Overall, the Intervention group improved their consumption of Fat and Fibre ( $p < 0.0005$ ) and the intervention group participants' Fibre ( $p < 0.0005$ ) and Fat ( $p = 0.005$ ) consumption. The reported increase in the Intervention groups' consumption of fruit and vegetables ( $p < 0.0005$ ) and wholegrain ( $p = 0.002$ ) were encouraging considering the low levels of fruit and vegetable consumption worldwide (e.g. Australia, USA, UK) (Hall et al., 2009; World Health Organisation, 2013, Australian Institute of Health and Welfare, 2012), as well as fibre (McLennan and Podger, 1998). However, it should be acknowledged that the actual changes in daily consumption were small and although the participants did achieve the recommended daily serves of fruit at the conclusion of the intervention, they did not achieve the recommended intake for vegetables, with the reported mean intake being 3.39 serves per day. This dietary area requires more focus and additional investigation to determine ways of increasing daily vegetable intake.

The statistical significant decrease in Fat ( $p = 0.005$ ) that included dairy products ( $p = 0.006$ ) and lean meat and chicken ( $p = 0.041$ ) was encouraging as it is well recognized that the intake of fat is high and above recommended levels (Australian Institute of Health and Welfare, 2012). However, in regards to sugary drinks (soft drinks, fruit juices and flavoured drinks) there were no significant changes found between groups. This result is not unexpected as the intervention placed little emphasis on this aspect of diet compared to fruit and vegetable intake, and fat reduction. Nevertheless this area that warrants further investigation as sugar-sweetened drinks such as soft drinks and juices are a common source of excess sugar, contributing to weight gain and tooth caries (DeBoer et al., 2013).

However, the moderate positive outcomes in regard to fat and fibre intake indicate that playgroups may provide a viable setting to recruit, engage and retain mothers of young children in programs that support the adoption of health-enhancing behaviours (Jones et al., 2010). More aggressive recruitment strategies, such as more personalized contact may serve to improve these outcomes. It also indicates the suitability of an intervention program that is flexible and primarily home-based,

but also incorporates supportive face-to-face information and skill building sessions in a relaxed, family friendly group environment. This intervention was conducted in a 'real world context' using a combination of strategies, which strengthened the program's appeal and ability to influence. The outcomes are particularly encouraging when the many barriers to maintaining a healthy diet that confront women of young children are considered. These include the changing priorities and competing family demands (Chang et al., 2008) reduced time for meal preparation (Bastian et al., 2010) affordability and access to healthy foods (Reyes et al., 2013), and at times a lack of food related knowledge and preparation skills (Nuss et al., 2007). This study comprised a range of supportive strategies able to help women make positive changes to their diet over a 6-month period. These findings further support the notion that this period of early motherhood provides a 'window of opportunity' for encouraging the adoption of healthier behaviours (Bastian et al., 2010), with the potential for this to have a beneficial impact on offspring.

These research outcomes are not dissimilar to the Women's Diabetes Reduction Study (Thompson et al., 2008) and the Women Infants and Children Study (Havas et al., 2003). Both studies also showed statistically significant results at six and eight months post baseline, respectively. However, as with the findings of this research, the changes in daily consumption by the intervention group of vegetables, fruit and fibre were small. Thompson et al. (2008) reported an increased vegetable consumption of only 0.31, while Havas and colleagues (2003) combined fruit and vegetables serving daily intakes increased by 0.10. These interventions both targeted women, adopting similar behavioural models and strategies as used in this intervention. The theories included the Social Cognitive Theory and the Transtheoretical Model and they developed strategies that encouraged support, reduced barriers, providing knowledge and skills, incorporating goal setting and monitoring. The strategies supporting these theories also included face-to-face interventions, along with supportive information resources e.g. newsletter and written resources. Both studies acknowledged the importance of flexibility of the multi-strategy approach as a key component of these programs.

To the best of our knowledge, this nutrition behaviour change intervention may be the largest randomised controlled trial to have specifically targeted mothers with young children aged 0 to 5 years (Ostbye et al., 2009; O'Toole et al., 2003; Lombard et al., 2009). A very limited number of intervention studies have been reported where all the participants were mothers with at least one young child (Lombard et

al., 2009; Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Miller et al., 2002; O'Toole et al., 2003; Ostbye et al., 2008), compared to those interventions that included only a small proportion of mothers with young children (Huang et al., 2011; Thompson et al., 2008; Polley et al., 2002; Krummel et al., 2010; Jackson et al., 2011; Havas et al., 2003; Hausenblas et al., 2008; Gaston and Prapavessis, 2009; Cramp and Brawley, 2006; Cena et al., 2008). This makes this study very timely, relevant and a welcome contribution to the dietary intervention literature, providing a practical workable model to inform others.

#### **6.4.2 Limitations**

Self-reported surveys were used to obtain data on the consumption of fruit, vegetable, fat and fibre, and sugar (via consumption of sugar-sweetened beverages), which may have led to some over-reporting. However, this potential bias was minimised by the use of a control group that would have responded in a similar way. The combining of both the physical activity and nutrition components into this intervention may have diluted the outcomes and it may have been better to focus on one behaviour (nutrition outcomes are only reported here). There was no endpoint to the study in the form of measurement of changes in weight, however, we chose not to focus on this, instead focussing on the positive aspects of eating a healthy diet. Also, this study's measurement of change in behaviour is limited to a 6-month timeframe.

### **6.5 CONCLUSIONS**

This intervention was successful in recruiting women into a 6-month flexible and predominantly home-based nutrition intervention. It was effective in achieving its aim of increasing fibre and decreasing fat in the intervention group participants, however, it did not influence sugary drink consumption and the recommended daily serves of vegetables was not achieved. However, in this instance it was found that playgroups provide a sound avenue for reaching and recruiting women into health programs and in turn equipping them with skills and information. This intervention adds to the research in terms of the paucity of effective interventions for mothers with young children and indicates the usefulness of playgroups as a vehicle for future programs. Further research is required in this area.

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**CHAPTER SEVEN**  
**FINDINGS FROM THE RESEARCH**

**Article 4**  
***Results of a randomised controlled trial to  
promote physical activity behaviours in  
mothers with young children***

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## PRELUDE

Chapter Seven was published as a journal article in *Preventive Medicine* (2014). Please see Appendix 8: Paper 3 for authorship contribution and consent.

### *Reference:*

Monteiro, S. M. D. R., Jancey, J., Dhaliwal, S. S., Howat, P. Burns, S., Hills, A.P., Anderson, A. S. (2014) Results of a randomised controlled trial to promote physical activity behaviours in mothers of young children. *Preventive Medicine*, 59; 12-18. DOI: 10.1016/j.yjpm.2013.10.022 [Impact Factor 3.496]

The chapter addresses Objective 4: To compare the duration of high intensity physical activity, moderate intensity physical activity, and combined high and moderate intensity walking at 6-months post-intervention

Chapter Seven describes the background on benefits of physical activity, statistics on physical activity levels among mothers, and a review of physical activity studies for mothers of young children. This is followed by the methodology and results which demonstrate that the REFRESH intervention had a significant effect on the mean duration for vigorous, moderate and total physical activity on the intervention group when compared with the control group.

## 7.1 INTRODUCTION

Physical inactivity is identified as a modifiable risk factor that is linked to chronic disease in all ages across the globe (World Health Organisation, 2010; World Health Organisation, 2008). It is estimated to cause 6-10% of the major non-communicable diseases of coronary heart disease, Type 2 diabetes mellitus and breast and colon cancer (Lee et al., 2012).

Worldwide, women have lower rates of physical activity compared to men; Australia 51.4% women vs. 65.8% men; Canada 54.8% vs. 64.4%; USA 57.6% vs. 67.2%; New Zealand 52.2% vs. 74% (Bauman et al., 2009). Furthermore, physical activity declines during pregnancy and post-partum period (Liu et al., 2011; Evenson, 2011; Borodulin et al., 2009) and is linked to the demands of multiple role expectations (Ransdell et al., 2004) (e.g. caring for children) and changes in life events leading to lack of time, fatigue, lack of motivation and financial constraints (Bell and Lee, 2005; Borodulin et al., 2008; Symons Downs and Hausenblas, 2004; Brown et al., 2001). Lack of physical activity among pregnant and post-partum women is associated with negative impact on the health of the mother and the child, including gestational diabetes, mental health, musculoskeletal issues and weight gain (Tobias et al., 2011; Pivarnik et al., 2006).

In 2007-08, 45% of Australian women of childbearing-age (25 and 34 years) were overweight or obese and 75% were classified as sedentary or had a low activity level (Australian Bureau of Statistics, 2009). Women's propensity to become overweight and obese during the childbearing years is linked to high body mass index (BMI) prior to pregnancy, excessive gestational weight gain, failure to lose excessive weight in the postpartum period within a 12 month timeframe and inter-pregnancy weight gain (Keitt et al., 2008; Ryan, 2007; Davis et al., 2010; Callaway et al., 2006). Obese women of childbearing-age are at greater risk of short-term adverse health consequences during pregnancy and postpartum period (Ramachenderan et al., 2008; Ruager-Martin et al., 2010) and long-term weight retention (Linne et al., 2004; Rooney et al., 2005). Evidence also demonstrates that individuals who are overweight or obese and inactive face the highest risk of morbidity or mortality (Lee et al., 2009; Siega-Riz et al., 2009; Gore et al., 2003). Hence, improving the physical activity levels of mothers with young children is important from a public health perspective.

Systematic literature reviews report on a number of interventions for pregnant women and mothers with children (Amorim et al., 2007; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Keller et al., 2008; Kuhlmann et al., 2008; Lombard et al., 2009; Ronnberg, 2010; Skouteris et al., 2010). However, a review of the literature demonstrates that there are limited community based randomised controlled trials addressing diet and physical activity specifically designed for mothers with young children (O'Toole et al., 2003; Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Liu et al., 2009; Lombard et al., 2009; Miller et al., 2002). Further, some of these interventions only include women with Body Mass Index <25 (O'Toole et al., 2003) or those who are ready to be more physically active (Fjeldsoe et al., 2010). Hence, there is a urgent need for further research on tailored dietary and physical activity interventions for mothers with young children (Amorim et al., 2007; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Keller et al., 2008b; Kuhlmann et al., 2008; Ronnberg, 2010; Skouteris et al., 2010; Streuling et al., 2010; Thangaratinam and Jolly, 2010).

Becoming a mother is a redefining time for health, as health behaviours are often altered to accommodate the needs of motherhood. It has been reported that after having babies women are motivated to participate in programs to reduce their weight (Walker and Wilging, 2000; Bastian et al., 2010). It therefore may be an opportunistic time to commence health promotion activities to improve women's immediate and long-term health, which in turn will impact on the health of the children.

Recent evidence also reports that as little as one hour of moderate intensity physical activity per week can significantly reduce women's risk of cardiovascular diseases, diabetes, breast cancer and endometrial cancer (U.S. Department of Health and Human Services, 1996; Brown et al., 2007). Accordingly, this study aimed to increase the levels of physical activity of mothers via a home-based intervention conducted in playgroups (Reminder on Food, Relaxation, Exercise and Support for Health: REFRESH). This paper presents changes in physical activity and muscle strength exercise from baseline to post-intervention.

## **7.2 METHODS**

### **7.2.1 Trial design and intervention components**

The study was a two-arm (intervention and control group) randomised controlled trial. The intervention design was based on a pilot project that produced encouraging results with respect to adherence and behaviour change (Jones et al., 2010). The intervention group received a 6-month physical activity intervention. The physical activity component was based on the 2007 American College of Sports Medicine (ACSM) (Haskell et al., 2007) and American Heart Association (AHA) physical activity guidelines (Pollock et al., 2000).

The behaviour change theories and techniques used to assist in the development of the intervention included the social cognitive theory (Glanz et al., 2008), transtheoretical model (Prochaska and Diclemente, 1983) and motivational interviewing (Rollnick and Miller, 1995). The 6-month home-based intervention provided information and advice on the recommended levels of physical activity (30 minutes of moderate physical activity on five or all days of the week) and appropriate muscle strength and flexibility exercises. The resources comprised a comprehensive booklet, muscle strength and flexibility exercise chart, physical activity diary and pedometer. There were four electronic (email) or hard copy (mail) newsletters containing health information and advice and 18 key SMS on suitable health behaviours. The home-based program was reinforced by five 30 minute monthly face to face workshops and skill development sessions delivered by 12 trained staff in the playgroup setting.

The resources/activities provided information on the health benefits of physical activity; encouraged skill development to support the integration of physical activity into daily living and goal setting; promoted discussion on the barriers and potential solutions to being active; supported increased self-efficacy and social support for physical activity; and provided skills to prevent relapse. Full details of the intervention are provided elsewhere (Monteiro et al., 2011). The control group did not receive the intervention, and the only contact with the project occurred when they completed the questionnaires.

### **7.2.2 Recruitment and randomisation**

Playgroup Western Australia (Playgroup WA Inc.) is the governing body for playgroups in the State. Playgroups provide an informal local setting for women and children to come together to socialise. Women attend the playgroup with their pre-school child (usually 0-4years) on a set day every week. The playgroups are run by volunteer parents and are held in a variety of venues such as church halls, community centres and child health centres. Women submit applications to join the local playgroup. Each playgroup may have up to 10 sessions per week. The number of attendees at each session is usually restricted to about 10-12 families.

Playgroup staff contacted playgroups registered in the Perth metropolitan area and obtained consent for the project staff to visit the playgroups. The suburbs (neighbourhoods) (n=60) were randomly assigned to the intervention (n=30) or control (n=30) group and arbitrarily matched on their Socio-Economic Indexes For Area (SEIFA) scores (Australian Bureau of Statistics, 1998), (SEIFA values ranged from 866-1151).

To be eligible for participation in the study, participants were required to be: women aged 18 years and above; registered with Playgroup WA. Inc.; have at least one child aged 0-5 years; considered "healthy" to the extent that participation in a low-stress physical activity program would not place them at risk; and no special diet. The intervention group participants completed the Physical Activity Readiness Questionnaire (PARQ) (Thomas et al., 1992) and provided a medical certificate if deemed necessary before commencing the program. Of the 1140 participants who were recruited, 716 participants consented to the study and were randomised to either the intervention (n=394) or control (n=322) group (Figure 11).

Ethics approval was obtained from the Curtin University Human Research Ethics Committee (approval number HR 183/2008). Further detailed information is published in the protocol article (Monteiro et al., 2011).

### **7.2.3 Physical activity measurements**

Physical activity was assessed using the International Physical Activity Questionnaire-Short Version (IPAQ-SV) (Craig et al., 2003). This instrument has been accepted as an appropriate physical activity measurement tool in many

settings and measures physical activity in 'min/day' and 'days/week' (Craig et al., 2003b). Walking, moderate physical activity and vigorous physical activity were measured independently. Moderate intensity activities were defined as those that made one breathe somewhat harder than normal and increased the heart rate. Vigorous intensity activities were defined as activities that required hard physical effort and made one breathe much harder than normal ('huff and puff'). Muscle strength exercise questions were based on the AHA guidelines (Pollock et al., 2000) and measured in 'days' (Morrow et al., 2011).

#### **7.2.4 Statistical analysis**

Descriptive statistics are reported as the mean ( $\pm$ SD) for continuous data and percentages for categorical data. The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA). All data was analysed including and excluding mothers who were pregnant, breastfeeding and postpartum (up to 12 months). The statistical analyses were performed using Statistical Package for Social Sciences (SPSS, Version 18) and p-values  $< 0.05$  were considered statistically significant.

The baseline data for the 716 participants, were used to determine the median (or 50th percentile) for vigorous, moderate and total physical activity, all expressed as minutes per week. These medians were subsequently used to categorise each of the physical activity variables into two groups, above and below the median. A McNemar test was used to assess the change in the status of the correlated data from above or below the median at baseline to above or below the median post-intervention for each of the physical activity variables comparing the two groups. A change in the positive direction was due to a change in the number of participants who improved in physical activity as a result of a change from below the median at baseline to a change above the median post-intervention. A change in the negative direction indicating reduction in physical activity and was the result of a change from above the median at baseline to a change below the median post-intervention. Net change for each of the physical activity variables and for each of the groups was calculated as a change in the positive direction subtracting the change in the negative direction, expressed as percentage of subjects of the total sample.

### 7.3 RESULTS

A total of 521 participants (73%) completed the study (Figure 11). At 6-months, the overall attrition was 27.3% with 16% (n=50) being in the control group and 37% (n=145) in the intervention group.

Figure 11 Recruitment procedure and number of participants who completed the study at 6 months.

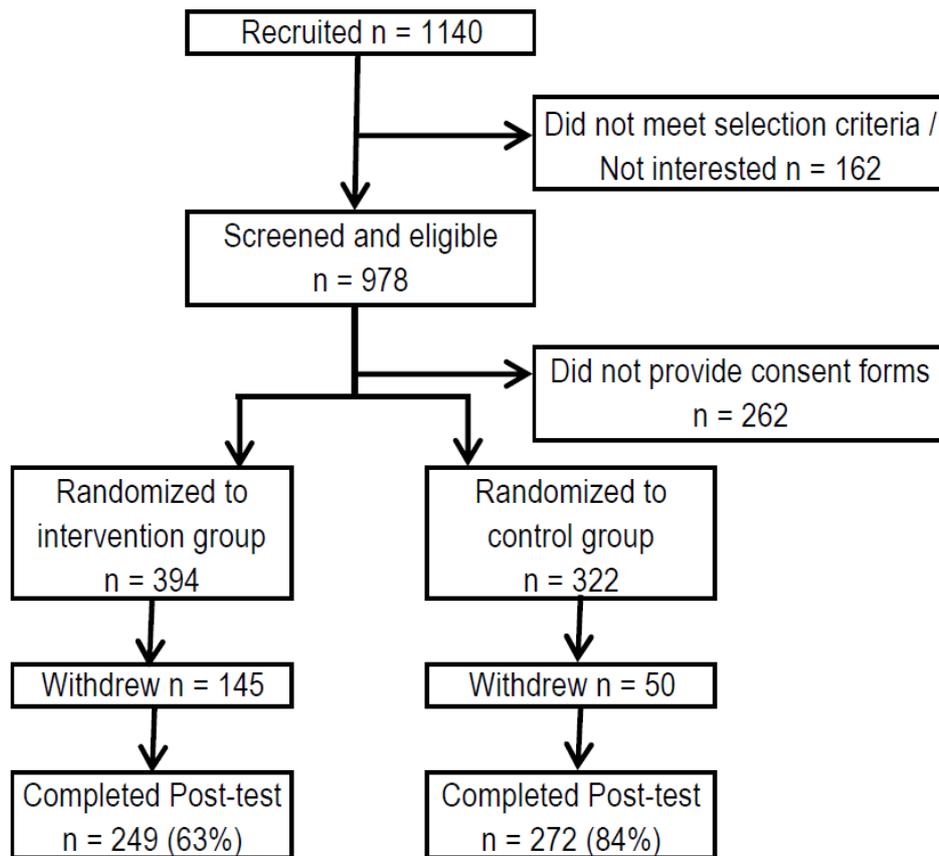


Table 26 Demographics of study group at baseline.

	Completed		Withdrawn	
	Intervention	Control	Intervention	Control
N	249	272	145	50
Age (years)	35.9 ± 4.3 (249)	35.6 ± 4.3 (272)	34.6 ± 5 (139)	36 ± 4.3 (49)
Pregnant, Breastfeeding or Postpartum				
No	146 (58.6%)	177 (65.1%)	97 (66.9%)	38 (76%)
Yes	103 (41.4%)	95 (34.9%)	45 (31%)	12 (24%)
Parity				
1	82 (32.9%)	94 (34.6%)	60 (42.9%)	15 (30%)
2 or more	167 (67.1%)	178 (65.4%)	80 (57.1%)	35 (70%)
Body Mass Index (kg/m <sup>2</sup> )	24.9 ± 4.6 (134)	24.2 ± 4.6 (173)	24.4 ± 6.5 (92)	23.1 ± 3.2 (37)
Waist circumference (cm)	86 ± 12 (134)	84.8 ± 10.7 (173)	82.7 ± 13.6 (87)	82 ± 10.4 (34)
Waist-hip ratio (cm)	0.9 ± 0.3 (134)	0.9 ± 0.1 (173)	0.8 ± 0.1 (87)	0.9 ± 0.1 (34)
Strength Exercises Major Muscle Group				
No	197 (83.8%)	204 (78.5%)	111 (84.1%)	37 (78.7%)
Yes	38 (16.2%)	56 (21.5%)	21 (15.9%)	10 (21.3%)

*Continuous variables are presented as Mean ± Standard Deviation (Count) and categorical variables are presented as Count (Percentage).*

The mothers were generally above 25 years of age, with the distribution relatively similar between 25-35 and 35 years and over. The majority of women were classified as a healthy weight (60.8%), 30.2% were classified as overweight and 9% as obese. The majority of women (61.5%) were university educated (Table 26). Of those participants who did not complete the 6-month intervention, 29.7% were pregnant, postpartum or breastfeeding compared to 38% of mothers who completed the intervention ( $p=0.040$ ). Participants who withdrew from the study were slightly younger (about 9 months) ( $p=0.044$ ) and had a lower waist circumference (2.8cm) ( $p=0.025$ ) compared to women who completed the study. Apart from these minor differences, those withdrawing before the completion of the study were comparable to those who completed the study. Mothers who withdrew were not significantly different in parity, participation in strength muscle group exercises, BMI and waist to hip ratio ( $p>0.05$ ) (Table 26).

Table 27 Comparison of physical activity variables (minutes per week) between intervention and control groups.

		Intervention	Control	P-value	Group difference Mean (95% CI)
<b>All mothers</b>					
Vigorous	Pre	59.5 ± 5.5 (237)	81.6 ± 7.1 (265)		
	Post	76.2 ± 6.5 (237)	74.7 ± 6.7 (265)		
	Difference (Post-Pre)	16.8 ± 6.3	-7.3 ± 6.5	.008	24.1 (6.2,42.0)
Moderate	Pre	76.5 ± 5.1 (237)	94.7 ± 6.8 (263)		
	Post	100.8 ± 6.4 (237)	94.2 ± 7.2 (263)		
	Difference (Post-Pre)	25.2 ± 6.9	1.9 ± 7.5	.023	23.3 (3.3, 43.4)
Vigorous, Mod, Walking	Pre	195.1 ± 13.5 (238)	257.5 ± 17.6 (265)		
	Post	252.8 ± 16.4 (238)	243.2 ± 17.6 (265)		
	Difference (Post-Pre)	58.5 ± 15.2	-13.7 ± 14.8	.001	72.2 (30.4, 114)
Muscle strength exercises	Pre	22 ± 2.8 (222)	24.6 ± 2.6 (250)		
	Post	19.3 ± 2.3 (222)	20.4 ± 2.4 (250)		
	Difference (Post-Pre)	-4.0 ± 2.7	-4.7 ± 2.4	.852	0.7 (-6.3, 7.6)
<b>Excluding mothers who are pregnant, breastfeeding or postpartum</b>					
Vigorous	Pre	65.9 ± 7.3 (135)	80.9 ± 7.8 (172)		
	Post	88.1 ± 8.9 (135)	75.5 ± 8.1 (172)		
	Difference (Post-Pre)	21.8 ± 7.7	-5.4 ± 7.7	.014	27.3 (5.5, 49.0)
Moderate	Pre	82.1 ± 7.2 (134)	104 ± 8.2 (170)		
	Post	99 ± 8.3 (134)	92.5 ± 8.5 (170)		
	Difference (Post-Pre)	18.1 ± 9.3	-8.2 ± 8.3	.036	26.3 (1.7, 50.8)
Vigorous, Mod, Walking	Pre	213.9 ± 18.3 (135)	265.3 ± 20.1 (172)		
	Post	274.5 ± 22.6 (135)	242.9 ± 21.7 (172)		
	Difference (Post-Pre)	61.6 ± 19.4	-20.3 ± 17.7	.002	82 (30.2, 133.8)
Muscle strength exercises	Pre	21.8 ± 3.9 (121)	26 ± 3.4 (162)		
	Post	22.5 ± 3.3 (121)	23.4 ± 3.2 (162)		
	Difference (Post-Pre)	-1.5 ± 3.9	-3.7 ± 2.9	.641	2.2 (-7.2, 11.7)

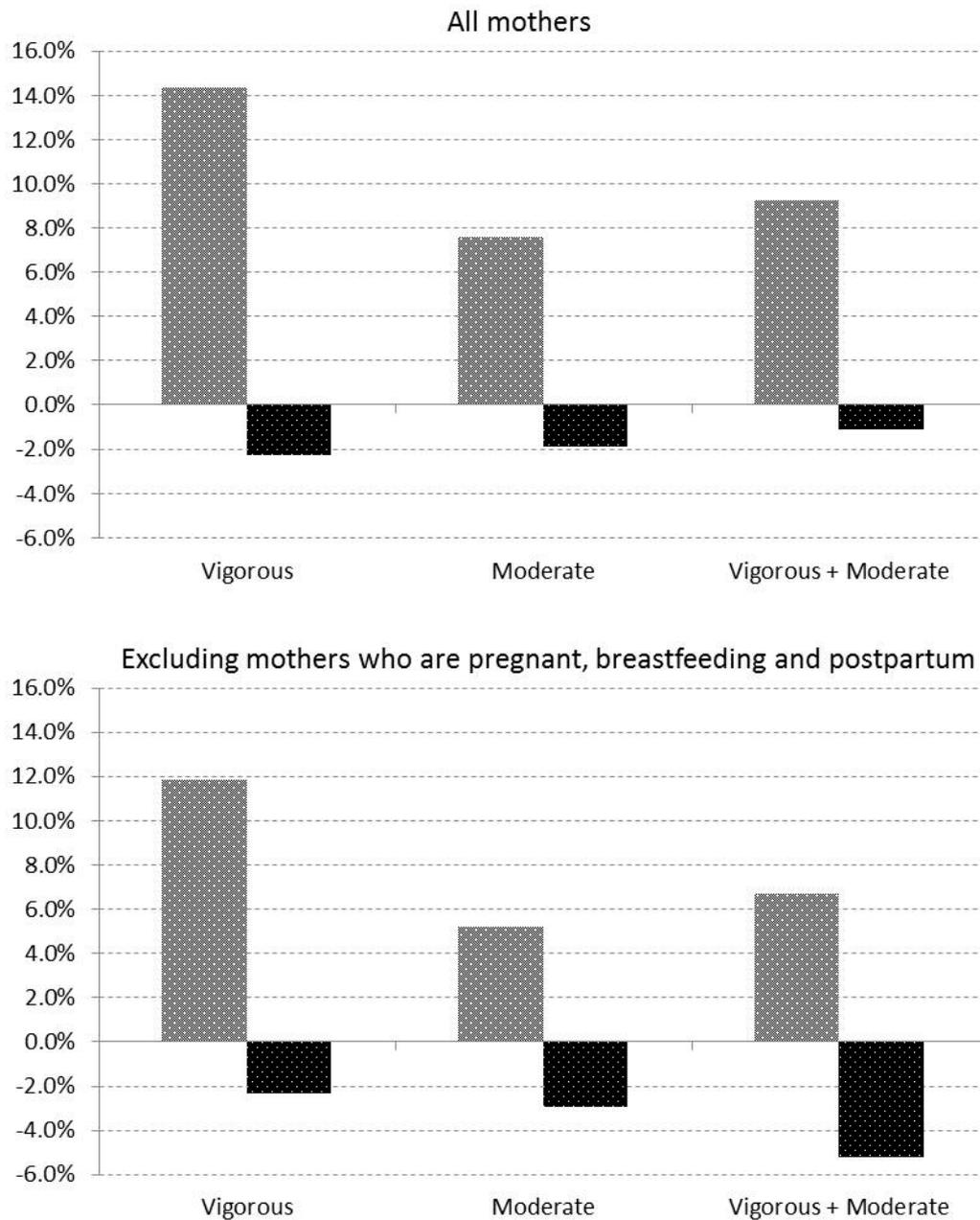
Pre, Post and Difference are expressed as Mean ± Standard Error (Count), Pre (Pre-intervention), Post (Post-intervention), Mod (Moderate)

The intervention had a significant effect on the weekly mean time for vigorous ( $p=0.008$ ), moderate ( $p=0.023$ ) and total physical activity ( $p=0.001$ ) but did not have an effect on muscle strength exercises ( $p>0.05$ ) when compared to the control group (Table 26). The intervention group increased their weekly mean time for vigorous physical activity by 24 minutes, moderate activity by 23 minutes and total physical activity by 72 minutes. Excluding mothers who were pregnant, postpartum and breastfeeding, slightly larger differences were observed between groups. The intervention and control groups were not significant in the time spent on muscle strength exercises, both for all mothers ( $p>0.85$ ) and excluding mothers who were pregnant, postpartum and breastfeeding ( $p>0.64$ ) (Table 26).

The net change for each of the physical activity variables (moderate and vigorous) and for each of the groups is presented in Figure 12. It is calculated as a change in the positive direction subtracting the change in the negative direction, expressed as percentage of subjects of the total sample. Net change is calculated as the difference between the percentage of participants who improved, by moving to a higher category, and the percentage of subjects who were classified in a lower category of the outcome variable. The intervention group consistently showed a net positive change in the physical activity variables (moderate, vigorous, moderate + vigorous), whereas the control group consistently showed a net negative change (Figure 12).

The percentage of participants who improved in each of the physical activity variables under the intervention was significantly greater than the participants who declined ( $p<0.05$ ). In the control group, however, the percentage of participants who improved in each of the physical activity variables was not significantly different from the participants who declined ( $p>0.05$ ). Similar results were observed when the data for all mothers were analysed and when data for mothers who were pregnant, postpartum and breastfeeding were excluded from the analysis.

Figure 12 Difference between intervention and control group participants who improved and who did not improve.



Net change expressed as difference between percentage of participants who improve and participants who did not improve for each type of physical activity; Intervention Group is denoted by grey bars and control groups is denoted by black bars.

## 7.4 DISCUSSION

### 7.4.1 Sample characteristics

A review of the literature demonstrates that the REFRESH physical activity study may be the largest randomised controlled trial (baseline sample size of 716) specifically targeting mothers with young children (aged between 0 to 5 years)

(Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Lombard et al., 2009; Miller et al., 2002; O'Toole et al., 2003; Cramp and Brawley, 2006; Gaston and Prapavessis, 2009; Hausenblas et al., 2008; Huang et al., 2011; Jackson et al., 2011; Krummel et al., 2010; Polley et al., 2002; Thompson et al., 2008), except for the WIC studies which does not indicate if all women included had at least one child (Fahrenwald and Sharma, 2002; Krummel et al., 2010).

There has been limited community based intervention physical activity research programs aimed at reaching and retaining mothers of young children (Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Lombard et al., 2009; Miller et al., 2002; O'Toole et al., 2003). Such interventions may be particularly challenging due to the multiple role expectations placed on women during the childbearing years (Ransdell et al., 2004), the competing priorities and lifestyle challenges that often lead to fatigue, restrictions on time and decreased motivation (Bell and Lee, 2005; Borodulin et al., 2008; Symons Downs and Hausenblas, 2004; Brown et al., 2001).

This program used the playgroup setting to reach the mothers' of young children to provide them with resources to support an increase in their levels of physical activity. The home-based support materials comprised an information booklet, exercise chart, pedometer, SMS messaging and newsletter, enabling the women to work around their family demands. However, the program was supplemented by five short face-to-face sessions that reinforced the home-based program, providing an opportunity to clarify information and to interact in a supportive environment.

Considering the many competing demands of parenting, the number of mothers completing this 6-month intervention was very encouraging, with an overall retention rate of 73% (intervention 63%; control 84%). The attrition rate in the control group (16%) was lower when compared to studies with similar populations including Fjeldsoe et al. (25%) (Fjeldsoe et al., 2010), Miller et al. (2002) (17%) and Craigie et al. (2011) (39%).

It is also encouraging that the characteristics of those women who dropped out of the program were similar to completers (parity, participation in strength muscle group exercises, BMI and waist to hip ratio ( $p>0.05$ )), thereby increasing the relevance of the findings overall to this target group.

### **7.4.2 Physical activity**

The main objective of this intervention was to increase the physical activity levels of these mothers. Once again the results were encouraging with the intervention participants showing significant improvements in mean minutes per week of moderate ( $p=0.023$ ), vigorous ( $p=0.008$ ) and total physical activity ( $p=0.001$ ) when compared to the control group. These REFRESH study results are difficult to compare to previous research due to the differences in reporting techniques (example, mins per day (Craigie et al., 2011), MET min per week (Lombard et al., 2009), hard bouts mins per week (Ostbye et al., 2009)). However, this study reported more encouraging results than those reported by the Active Mothers Postpartum (AMP) study (Ostbye et al., 2008; Ostbye et al., 2009), and HeLP study (Lombard et al., 2009). The AMP and HeLP studies were predominantly face-to-face structured physical activity class interventions, which perhaps could have been better tailored to the target groups needs. The REFRESH results were similar to the Moms on the Move (MOM) study ( $p<0.05$ ) which was a predominantly telephone based intervention providing women the flexibility of being active at times convenient to them (Fahrenwald et al., 2004). The results in this study are also very positive, due to the program being primarily a home-based intervention supported by a face-to-face component, making replication realisable (Noar et al., 2007).

In addition, when mothers who were pregnant, postpartum and breastfeeding were excluded from the analysis slightly larger differences in mean physical activity times were observed between the control and intervention groups. This is to be expected and highlights the need for consideration of the physiological demands of these conditions on women when designing interventions (Hartman et al., 2010; Dewey and Lovelady, 1993; Morrow et al., 2011). Specific programs may be required for these particular target groups.

### **7.4.3 Muscle strength**

The number of days that participants completed muscle strength exercises did not increase during the 6-month intervention. This is not unexpected, as it was a lesser component of the intervention, with the focus being on aerobic activity. Interestingly, a review of the literature, indicated that this may be the first program that attempted to incorporate strength exercises into an intervention for this target group (Amorim et al., 2007; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al.,

2010; Keller et al., 2008; Kuhlmann et al., 2008; Ronnberg, 2010; Skouteris et al., 2010; Streuling et al., 2010; Thangaratinam and Jolly, 2010). The Australian national physical activity guidelines do not include muscle strength exercise guidelines (Egger et al., 1999) and for this reason, this type of activity may not be perceived as important for health benefits. This warrants further investigation and potentially more of a focus when designing interventions with the target group.

#### **7.4.4 Setting**

This study is one of a few interventions aimed at improving the physical activity of mothers with young children, which has been previously identified as a hard to reach group (Hartman et al., 2010). The intervention indicates that playgroups provide a valuable and viable setting to recruit, engage and retain mothers of young children in programs that support the adoption of health enhancing behaviours (Jones et al., 2010).

#### **7.4.5 Limitations**

Firstly, this program was restricted to 6-month duration, although this kind of timeframe should be adequate to reflect behaviour change (Keller et al., 2008b, Kuhlmann et al., 2008). Similar to other interventions, self-selection bias can be an issue, as shown by the high number of university educated participants. However, this was minimised through the randomising of participants to the control and intervention groups. Finally, data were collected via self-complete questionnaires, which may lead to some over reporting of physical activity. The literature, however, suggests that self-report data has been found to be adequate for monitoring changes over time in such interventions, especially when a control group is also used (Eakin et al., 2009; Dhaliwal et al., 2010; Morey et al., 2009).

### **7.5 CONCLUSIONS**

This relatively minimal intervention program was able to demonstrate modest but statistically significant improvements in physical activity behaviour (moderate, vigorous and total physical activity) in a hard to reach target group via the playgroup setting. These changes in behaviour, if maintained over a longer period are likely to reduce the impact of several chronic conditions such as Type 2 diabetes mellitus, cardiovascular disease and some cancers. In addition, the improved health behaviours of mothers are likely to also have a positive impact on their partners and

children. It appears that this is one of the few effective physical activity interventions for mothers of young children reported to date and possibly the first randomised controlled trial to also assess changes in muscle strength exercise activities. Further investigation of viable physical activity interventions with this target group is recommended.

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## **CHAPTER EIGHT**

# **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

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### **PRELUDE**

The aim of the present research thesis was to develop, implement and evaluate a community-based health promotion intervention to increase the fruit, vegetable and fibre intake, and decrease fat and sugar consumption, and increase the intensity of physical activity in mothers with young children.

This chapter summarises the key results of each of the objectives of this research thesis. It is followed by a review of the conclusions, limitations and significance of the study. Finally, this chapter provides recommendations for public health practice and health promotion research.

## 8.1 INTRODUCTION

Prevention of weight gain and maintaining a healthy weight is a public health priority, with the long term aim of preventing chronic disease. The high prevalence of maternal overweight and obesity in Australia makes women in their childbearing years an important target group. Improving the levels of physical activity and increasing fibre intake and lowering fat intake of women of childbearing age has become increasingly relevant as the management of overweight and obesity is challenging, costly and often ineffective in the long-term. Research on diet and physical activity intervention programs for women has provided insight into how physical activity and dietary behaviours can be improved; however, only a few interventions have been implemented to date and further, fewer randomised controlled trials have attempted to improve the combined diet and physical activity outcomes for mothers with young children.

This research developed, implemented and evaluated a randomised controlled trial titled 'REFRESH: REminder on Food, Relaxation, Exercise, Support for Health' aimed at increasing levels of physical activity and improving the diet of mothers of young children. The participants (n=716), were recruited via playgroups in Perth, Western Australia. At baseline participants were randomised to the intervention (n=394) and control group (n=322) arms. The six-month intervention provided mothers with information and skills on how to incorporate regular physical activity and a healthy diet into their everyday activities. The intervention included five main strategies based on behaviour change theoretical framework: REFRESH program booklet (refer to Appendix 10.1); six face-to-face workshop information and skill development sessions delivered by a trained facilitator (refer to Appendix 10.2 & 10.3); SMS reminders on main messages of the REFRESH program (refer to Appendix 10.4); home-based component including a booklet (refer to Appendix 10.5); newsletters with information on common myths on diet and physical activity (refer to Appendix 10.6).

The research incorporated both qualitative and quantitative research methods. Factors explored included changes in diet and physical activity behavioural outcomes. The REFRESH program contributed significantly to the current understanding of developing, implementing and evaluating diet and physical activity interventions for mothers of young children. Importantly, based on the researchers literature review, this study was one of the first randomised controlled trial

interventions to target both physical activity and diet through a sole intervention and demonstrate statistically significant improvements in both the diet and physical activity behaviours of mothers with young children. The comprehensive review of the literature showed that REFRESH study has a number of significant attributes:

- **Randomised Controlled Trial:** The study design helped ensure that known and unknown human or environmental characteristics which could affect the outcome of interest were evenly distributed across both the control and intervention group. Thus, the applicability of the results are based on the confidence that the differences between the outcome of the control and intervention group, are likely to be due to the intervention;
- **Multi-strategy intervention:** The six-month intervention provided mothers with information and skills on how to incorporate regular physical activity and a healthy diet into everyday activities. The intervention included five main strategies based on a behaviour change theoretical framework: REFRESH program book; six face-to-face workshop information and skill development sessions delivered by a trained facilitator; SMS reminders on main messages of the REFRESH program; newsletters with information on common myths on diet and physical activity; and a home-based component;
- **Flexible delivery intervention:** The REFRESH intervention was conducted over six-months and included one face-to-face session per month, one newsletter per month, and one SMS reminder per month. The information and skills were provided in varied formats in order to ensure that mothers had the flexibility of interacting with the information. They were able to complete the program at home, whenever they had the time available or by attending the face-to-face sessions that were 30 minutes in duration.
- **Large sample size:** The intervention group had 394 participants and the control group had 322 participants at baseline.

## **8.2 REFLECTIONS ON THE OBJECTIVES**

### **8.2.1 Objective 1**

**To conduct a literature review on maternal obesity, diet and physical activity behaviour change interventions.**

The systematic literature review on diet and physical activity randomised controlled trial for mothers of young children was undertaken in order to ensure that the

intervention components and methodologies used in the research s were supported by 'evidence-based practice' (Chapter Three). The systematic literature review of community-based diet and physical activity randomised controlled trial for mothers of young children found that of the 860 abstracts downloaded between January 1991 to December 2011, only nine studies met the strict eligibility criteria (refer to Figure 3 & 4). Five studies reported physical activity behavioural outcomes, one reported dietary behaviour outcomes only and three reported both dietary and physical activity behaviour outcomes. All the studies were randomised controlled trials however, only two studies described the method of randomisation. Seven studies reported conducting analysis by treatment assignment and did not report withdrawals. Two studies conducted intention to treat analysis, however, one only reported on the withdrawn participants

Of the five studies reporting dietary behavioural outcomes, one reported an improvement in the dietary intake of the intervention group. Of the eight studies reporting physical activity behavioural outcomes, five reported improvements in the physical activity behaviours. The commonly used behaviour change techniques included identification of barriers to eating a healthy diet and participating in physical activity, goal setting, problem solving, individualised feedback and self-monitoring. The commonly used behaviour change theories or constructs included Social Cognitive Theory, Trans-theoretical Model, Social Support and Self-efficacy. There was a lack of research on assessing the behaviour change theories and techniques as mediators of physical activity and diet.

### **8.2.2 Objective 2**

**To design, implement and evaluate a community based randomised controlled trial to increase the fruit, vegetable and fibre intake, and decrease fat and sugar consumption, and increase the level of physical activity for mothers with young children.**

The community based randomised controlled trial to increase the fruit, vegetable and fibre intake, and decrease fat and sugar consumption, and increase the level of physical activity for mothers with young children was designed, implemented and evaluated (Chapter Four).

### **Settings**

Mothers of young children are a hard to reach target group due to reported barriers such as lack of time and prioritising the family demands over their own health. The trial was designed for the 'playgroup' setting, as many mothers in Australia attend playgroups with their young children. The playgroup setting was used for the recruitment of mothers, delivery of the intervention and data collection. Detailed information on the playgroup is provided in sections 4.2.3 and 4.7.1. The REFRESH program successfully implemented in the playgroup setting, an important setting for health promotion programs targeting mothers.

### **Recruitment**

The recruitment of mothers with young children is a challenge as it involves a substantial number of resources as mothers may return to work or stay at home to undertake family duties. The recruitment of mothers was conducted via phone-calls made by senior staff at Playgroup WA Inc. and face-to-face visits by REFRESH project staff to each of the playgroups within a 60 kilometer radius of Perth city. The project staff were provided training on recruitment of participants by the Project Coordinator. Detailed information on the recruitment and randomisation of participants is provided in section 4.7.2 (Figure 13). The REFRESH program successfully recruited mothers of young children attending playgroups in the Perth metropolitan area. The successful recruitment features included collaboration with Playgroup WA Inc. and adherence to its policies, and face-to-face visits by the project staff to each playgroup to explain the REFRESH program.

### **Intervention**

The theoretical frameworks that underpinned the program design included the Social Cognitive Theory, Trans-Theoretical Model and Motivational Interviewing. The Social Cognitive Theory is built on the assumption that behaviour is the outcome of intrinsic and extrinsic personal, social and environmental expectations. The Social Cognitive Theory's central themes, social support, self-efficacy and reciprocal determinism, were applied to the REFRESH intervention by providing mothers behaviour change techniques that accounted for these via the knowledge and skills provided to mothers. The behaviour change techniques included: provision of a list of barriers relevant to mothers on eating a healthy diet and doing physical activities; provision of a list of solutions relevant to mothers on eating a healthy diet and doing physical activities; skills on how to increase self-confidence and self-efficacy using self-instruction (self-talk), self-encouragement (self-talk) and

self-monitoring (Table 27). The Trans-Theoretical Model suggests that individuals go through various stages when changing behaviour. However, the individual's behaviour change is dependent on personal, social and environmental circumstances, thus, the flow of behaviour change may not happen sequentially from pre-contemplation to contemplation to preparation to action and maintenance. The REFRESH intervention provided mothers with the REFRESH program book that supported mothers with information and skills to assist them to move to the next stage of behaviour change. The REFRESH program book included information such as the link between eating a healthy diet and meeting the recommended levels of physical activity and its impact on health (overweight, obesity, chronic diseases such as, Type 2 diabetes mellitus) (Appendix 9). Motivational Interviewing is a method of counseling individuals to change their behaviour by encouraging them to reflect on their readiness to make the behaviour change, the importance of the behaviour change, and the confidence to achieve the behaviour change. The REFRESH intervention provided mothers with practical skills on goal setting and assessing their motivation to achieve these goals via long-term and short-term goal setting templates (Appendix 10.3). Table 28 provides an in-depth view of how each of the themes of the six-month intervention (such as, focusing on the benefits of fruit and vegetables, goal setting), the resources (such as, fridge magnets with a menu planner, physical activity diary) provided to mothers to support the behaviour change, and the link to the behaviour change techniques and theories.

Table 28 REFRESH program intervention components and behaviour change techniques linked to Social Cognitive Theory, Transtheoretical Model and Motivational Interviewing.

Session	Session Details	Behaviour change techniques linked to SCT, TTM and MI
Themes: Information provision, behaviour change  Session 1	<ul style="list-style-type: none"> <li>Focus on fruits, vegetables: Recommendations, benefits and barriers to healthy eating</li> </ul> Resources: <ul style="list-style-type: none"> <li>REFRESH Program booklet</li> <li>Healthy recipe booklet</li> <li>Newsletter</li> </ul>	<ul style="list-style-type: none"> <li>Provision of behaviour health link (SCT)</li> <li>Provision of information on consequences (SCT)</li> <li>Prompt intention formation (goal setting) (SCT, TTM, MI)</li> <li>Prompt barrier identification (SCT)</li> <li>Prompt solution identification (SCT)</li> </ul>
Themes: Information provision, behaviour change & monitoring progress  Session 2	<ul style="list-style-type: none"> <li>Focus on understanding stages of behaviour change and goal setting: long and short-term goals</li> <li>Focus on physical activity (aerobic): Recommendations, benefits and barriers to being active</li> </ul> Resources: <ul style="list-style-type: none"> <li>Pedometer</li> <li>Family dinner menu planner (fridge</li> </ul>	<ul style="list-style-type: none"> <li>Prompt specific goal setting (TTM &amp; MI)</li> <li>Prompt set graded tasks (TTM &amp; MI)</li> <li>Prompt practice to increase self-confidence &amp; self-efficacy (SCT)</li> <li>Prompt self-talk (use of self-instruction and self-encouragement) (MI)</li> <li>Prompt use of rewards (praise, or material rewards) (SCT, TTM MI)</li> </ul>

	magnet)	
	<ul style="list-style-type: none"> <li>• 'Extra' food record sheet</li> <li>• Newsletter</li> </ul>	
Themes: Information provision, behaviour change & monitoring progress	<ul style="list-style-type: none"> <li>• Focus on reviewing behaviour change goals</li> <li>• Focus on physical activity (muscle strength): Recommendations, benefits and barriers to being active</li> <li>• Focus on relapse prevention</li> </ul>	<ul style="list-style-type: none"> <li>• Prompt review of behavioural goals (MI &amp; TTM)</li> <li>• Prompt self monitoring (MI &amp; TTM)</li> <li>• Prompt relapse prevention by reviewing barriers and possible solutions to achieving goals (SCT, MI, TTM)</li> </ul>
Session 3	Resources: <ul style="list-style-type: none"> <li>• Muscle strength and flexibility exercise card (fridge magnet)</li> <li>• Physical activity diary</li> <li>• Newsletter</li> </ul>	
Themes: Information provision, behaviour change & monitoring progress	<ul style="list-style-type: none"> <li>• Focus on reviewing behaviour change goals</li> <li>• Focus on healthy eating messages, menu planning, food package label reading, making sense of nutritional claims on packaging materials</li> </ul>	<ul style="list-style-type: none"> <li>○ Prompt the use of environmental cues that can be used to be reminded to perform the behaviour (TTM&amp; MI)</li> <li>○ Prompt consideration on how others could change their behaviour to offer the person help ("buddy" systems) (SCT)</li> </ul>
Session 4	Resources: <ul style="list-style-type: none"> <li>• Shopping list with healthy shopping tips</li> <li>• Comparing packaged food per 100g (fridge magnet)</li> <li>• Reading packaged food labels</li> <li>• Developing a menu</li> <li>• Newsletter</li> </ul>	
Themes: Information provision, behaviour change & monitoring progress	<ul style="list-style-type: none"> <li>• Focus on reviewing behaviour change goals</li> <li>• Focus on fats and sugars: recommendations, benefits and barriers to healthy eating</li> <li>• Focus on social support</li> </ul>	<ul style="list-style-type: none"> <li>• Prompt opportunities for social comparison (SCT)</li> <li>• Prompt identification as a role model (SCT)</li> </ul>
Session 5	Resources: <ul style="list-style-type: none"> <li>• Modifying recipes</li> <li>• Healthy cooking methods</li> <li>• Newsletter</li> </ul>	
Themes: Information provision, behaviour change, review and feedback	<ul style="list-style-type: none"> <li>• Focus on reviewing behaviour change goals</li> <li>• Focus on fibre and Glycemic Index: recommendations, benefits and barriers to healthy eating</li> </ul>	<ul style="list-style-type: none"> <li>• Prompt review of behavioural goals (MI &amp; TTM)</li> <li>• Prompt time management</li> <li>• Prompt stress management</li> </ul>
Session 6		

Social Cognitive Theory (SCT), Tran-Theoretical Model (TTM), Motivational Interviewing (MI)

(Modified from Abraham & Michie, 2008)

The REFRESH intervention included five strategies based on the behaviour change theoretical framework.

The REFRESH program book was developed based on the literature review and significant formative research and included evidence-based information. The book was the key resource of the program and the four additional strategies were

developed to support the skills development and knowledge increase of the mothers with young children.

Six face-to-face information and skill development sessions (one session per month) on diet and physical activity were conducted at the 30 playgroups. The sessions were facilitated by 25 facilitators who were recruited and trained by the Project Coordinator. The facilitators held 60 sessions a month as the intervention group had 394 mothers with young children.

Six Short Messaging Service (SMS) reminders supporting the main messages of the REFRESH program were delivered to mothers once per month during the weeks they did not have any face-to-face contact with the program facilitators. Six messages were sent as reminders to attend the face-to-face sessions.

Six newsletters were sent with information on common myths surrounding diet and physical activity reported by mothers during the face-to-face sessions.

The REFRESH program home-based component provided mothers with the flexibility of attending the face-to-face sessions. The activities and resources aimed to achieve the following:

- Provide knowledge and skills to achieve a healthy diet and increase physical activity:

The REFRESH program activities that provided knowledge and skills included: techniques to increase fibre, and decrease fat and sugar in recipes; process to understand the nutrition content labels on packaged foods to assess their fat, fibre and sugar content; techniques on how to use the Australian Dietary Guidelines to develop a healthy menu for the family; and cooking methods to decrease fat; procedures on how to do muscle strength exercises and flexibility exercises.

- Provide resources to support the implementation of the knowledge and skills gained on achieving a healthy diet and increasing physical activity:

The REFRESH program resources that supported the implementation of the diet and physical activity knowledge and skills included: a high fibre, low sugar and fat recipe booklet; a fridge magnet with an erasable family menu planner; a fridge magnet with pictures of muscle strength and flexibility exercises; a fridge magnet with information on the cut-off levels for sugar, salt, fat and fibre in packaged foods; and a shopping list booklet with information on buying health food products.

- Resources to support self-monitoring, and to encourage social support.

The REFRESH program resources that supported self-monitoring of diet and physical activity levels included a pedometer, a physical activity diary and 'extra' foods calorie calculation sheet. The REFRESH program activities that encouraged social support included an inter-playgroup walking challenge.

### **Data collection**

Data collection was conducted at baseline and after the 6-month intervention from mothers within the community setting via a paper based survey. The survey included both diet and physical activity validated questions. Reliability testing was conducted with mothers with young children as previously published data was not available. Results show that the interclass correlation for most questions were greater than 0.5, demonstrating good agreement (Refer to section 4.7.7).

Process evaluation information was collected during the intervention from both the face-to-face workshop facilitator staff and mothers with young children in order to ensure that the outcome results could be better understood. The results of the usefulness, relevance and suitability of the REFRESH intervention strategies are discussed in Objective 3.

### **8.2.3 Objective 3**

**To assess the usefulness, relevance and suitability of the nutrition and physical activity intervention strategies and resources.**

Process evaluation is an essential practice when designing and implementing interventions programs as it ensures that the implementation plan of the program is adhered to and reaches the target group. The information contained in Chapter 5 confirmed that process evaluation was pertinent as it provided an opportunity to obtain in-depth feedback and data from participants about the resources, the groups leaders and the workshops.

The process evaluation lead to an understanding that mothers have a number of misconceptions about diet and physical activity such as '*Bananas are a superfood, and hence you can live on them*', '*Peas and corn do not contain carbohydrates*', '*certain vegetables should not be consumed at night and caffeinated drinks before exercise is good for muscles*'. The intervention provided information to the

participants on these misconceptions via newsletters containing myth busting information.

The process evaluation data revealed that the mothers' found the intervention 'useful' (98%), 'relevant' (92%); encouraged to think about making changes to physical activity (n=150, 95%) and dietary (98%) behaviours. Overall the program participants were positive with regard to the program resources and strategies and reported that the program helped them to 'change their nutrition' (79%) and physical activity (66%) behaviours, which is a very positive reflection. The mothers reported that the most useful intervention strategies were the program booklet (n=144, 85%), workshops (n=146, 86%), and newsletters (n=122, 73%). The attendance of mothers at the workshops did reduce over time, with 82% of mothers attending in the first session and by the sixth month this was 51%.

#### **8.2.4 Objective 4**

**To compare fruit, vegetable, fat and fibre, and sugar consumption at 6-months post-intervention of mothers with young children.**

This study demonstrated that mothers in the intervention group, when compared to the control group, improved their fibre barometer scores ( $p < 0.0005$ ) and fat barometer scores ( $p < 0.0005$ ) and overall their Fat and Fibre barometer scores ( $p < 0.0005$ ). The reported increase in the Intervention groups' consumption of fruit and vegetable barometer scores ( $p < 0.0005$ ) and wholegrain ( $p = 0.002$ ) were particularly encouraging considering the low levels of fruit and vegetable consumption worldwide (e.g. Australia, US, UK). Furthermore the significant decrease in Fat barometer scores ( $p = 0.005$ ) that included reducing high fat dairy products ( $p = 0.006$ ) and increasing lean meat and chicken ( $p = 0.041$ ) was also significant.

The study also demonstrated that mothers in the intervention group compared to the control group improved the serves of fruit consumption by 7.5%, serves of vegetable consumption by 11%, and 100% fruit juice intake (cups) by 46%. However, in regards to sugary drinks (soft drinks and flavoured drinks) there were no significant changes found between groups. This result is not unexpected as the intervention placed little emphasis on this aspect of diet compared to fruit and vegetable intake, and fat reduction.

### 8.2.5 Objective 5

**To compare the duration of high intensity physical activity, moderate intensity physical activity, and combined high intensity walking and moderate intensity walking at 6-months post-intervention of mothers with young children.**

The intervention had a significant effect on the mean time for vigorous ( $p=0.008$ ), moderate ( $p=0.023$ ) and total physical activity ( $p=0.001$ ) when compared with the control group. The intervention group increased their vigorous activity by a mean of 24 minutes per week, moderate activity by 23 minutes per week and total physical activity by 72 minutes per week. Excluding mothers who were pregnant, postpartum and breastfeeding, slightly larger differences were observed between groups. The intervention had a significant effect on the mean time for vigorous ( $p=0.014$ ), moderate ( $p=0.036$ ) and total physical activity ( $p=0.002$ ) when compared with the control group. The intervention group increased their vigorous activity by a mean of 27 minutes per week, moderate activity by 26 minutes per week and total physical activity by 82 minutes per week. The intervention and control groups were not significant in the time spent on muscle strength exercises, both for all mothers ( $p>0.85$ ) and ( $p>0.64$ ) after excluding mothers who were pregnant, postpartum and breastfeeding. This result is not unexpected as little emphasis was placed on this in the intervention compared to the other physical activity.

The percentage of participants who improved their vigorous intensity activity, moderate intensity activity and walking minutes from baseline to post program was significantly greater than the participants who declined ( $p<0.05$ ). In the control group, however, the percentage of participants who improved in each of the physical activity variables was not significantly different from the participants who declined ( $p>0.05$ ).

### 8.3 LIMITATIONS

The REFRESH study is unique, having many strengths, however, as with community intervention there are limitations in regards to its design, implementation and evaluation.

#### *Systematic review limitations:*

The primary limitation for the systematic review on diet and physical activity randomised controlled trials for mothers of young children was the small number of studies retrieved (n=9 studies; 16 articles). Hence the level of evidence of the effects of such interventions is limited. However, this systematic review indicated overall favourable effects of the interventions on behavioural outcomes. The review also indicated that there is a need for further research on diet and physical activity behavioural outcomes of mothers with young children that include behaviour change theoretical frameworks.

#### *Randomised controlled trial study limitations:*

Physical activity data is likely to be more rigorous if it is objectively measured using relatively non-intrusive equipment such as accelerometers. These can be costly, requiring specialised staff and interpret the data. They also have measurement limitations including lack of sensitivity to static activity such as resistance training. Furthermore, mothers with young children have additional constraints when using such equipment including children playing with the equipment, distribution of and orientation to monitors, non-wearing, incorrect placement and loss of equipment (Sharpe et al., 2011). However, the International Physical Activity Questionnaire (short form), used in this research, demonstrates good properties having a high correlation for moderate and vigorous intensity physical activity and total energy expenditure (Lee et al. 2011).

A potential limitation of the study is that anthropometric measures (height, weight and waist-circumference) were self-reported. Despite this, any inherent inaccuracies were expected to be similar between the intervention and control group due to the large sample size and similar demographics. To standardise measures clear written instructions were provided to participants on how to take the required anthropometric measurements (height, weight and waist circumference).

Furthermore, in large scale community trials self-reported data are deemed to be adequately reliable for monitoring changes over time and have been considered proxies to reduce cost and attrition rates by minimising subject burden (Dhaliwal et al., 2010).

Data collected via the paper-based questionnaire at baseline and post-intervention was limited in order to ensure the subject burden was not high. However, including further questions may have captured the changes in diet that have gone unnoticed due to the exclusion of extra questions. The physical activity data was collected using the International Physical Activity Questionnaire – short version instead of the long version. This may have reduced the amount of participant recall as the questions do not do a systematic review of the activities. However, the target group also considered this a less intrusive option than face-to-face interviews and enabled completion of questionnaire at the participant's own convenience. These features may have consequently reduced attrition and incomplete questionnaires returned and therefore improved data collection.

Limitations pertaining to the randomised controlled trial study include self-selection bias. The impact of selection bias was minimized through the randomised controlled trial design and the recruitment procedure. Suboptimal reach of mothers with young children from the lower socio-economic for areas (SEIFA) status was a limitation. However, this drawback is prevalent in most studies aiming to target individuals from all SEIFA deciles as mothers who are more educated are known to have higher participation rates (Van der Waerden et al., 2010; Daniels et al., 2012).

The REFRESH data analysis did not include intention to treat analysis. Finally, the REFRESH intervention duration of follow-up was limited to six months, therefore the maintenance of behaviour changes cannot be determined beyond this time period.

## **8.4 SIGNIFICANCE**

This research demonstrates that successful design, development, implementation and evaluation of a randomised controlled trial, significantly increased fruit, vegetable and fibre intake, level of physical activity, and decreased fat and sugar consumption in mothers with young children.

### **Study Setting:**

Playgroups are popular and widely used in Australia to encourage social development of children and to ensure that mothers have an opportunity to meet and feel connected with other mothers undergoing the same life stage issues. On review of the literature it seems the REFRESH study is one of the first few studies to use 'playgroups' as a setting to target mothers with a health promotion lifestyle intervention. Mothers are reported to be at a life stage where they are open to learning and thus the playgroup environment is an innovative setting to reach this target group and support behaviour change.

#### **Participant Recruitment:**

Mothers of young children are difficult to access to include in diet and physical activity behaviour change health promotion programs as it reported that the focus of the mother is on the child and time constraints and changes in the infants sleep and eating patterns can become barriers to engagement.

This study is also one of the first studies conducted in the community for mothers of young children that did not limit the selection of participants to high BMI, individuals in the contemplation or preparation stage of change for eating or physical activity. This form of recruitment of participants is beneficial as it encouraged all playgroup members to register for the study, thereby not just recruiting those who are motivated to adopt health-enhancing behaviours.

Bias in participant selection is a common threat to the applicability of the study findings. REFRESH is one of the few studies that undertook two measures to reduce the bias. Firstly, the recruitment of participants was conducted through playgroups and encouraged all playgroup members to register, thereby not restricting the recruitment of participants individuals motivated to adopt health-enhancing behaviour, individuals identified as overweight or obese or individuals with a history of metabolic diseases. Secondly, the evaluation data was collected from participants in their own communities and not in a research centre, making the program relevant to the community based general population and not just a clinical group.

#### **Study methodology:**

This is also one of a few studies that included a large sample size in both the intervention and control groups. This study was a high quality study as it was a randomised controlled trial where the following information was reported on: method

of participant randomisation, withdrawn participants characteristics, and analysis by treatment group. REFRESH is one of the few studies that had a relatively low attrition rate in both the intervention group and control group. Furthermore, this study demonstrates that there was no significant difference between participants that completed the program and those that withdrew.

A unique feature of the study is that it conducted reliability testing of the Fat and Fibre Barometer diet validated questions and International Physical Activity Questionnaire physical activity validated questions with mothers with young children which demonstrated interclass correlation coefficient of above 0.4 (fair to good agreement).

**Study outcomes:**

The study was effective in changing dietary behavioural outcomes in mothers with young children. On reviewing of the literature, this is one of the first studies to demonstrate a statistically significant improvement in the serves of fruit and vegetable and fat and fibre intake of mothers with young children. Specifically, the study demonstrate a statistically significant improvement in wholegrain foods consumption, fruit and vegetable consumption, reduced high fat foods intake, and changed cooking methods to reduce fat consumption from chicken and meat.

On reviewing the literature this is one of the first studies to demonstrate a significant improvement minutes (per week) of moderate and vigorous physical activity as well as minutes (per week) of walking in mothers with young children, thus it was effective in changing physical activity behavioural outcome.

This study is unique as it analysed the physical activity data of mothers including and excluding pregnant, breastfeeding or in the postpartum period. The results of both the analysis demonstrated significant increase in the vigorous and moderate minutes of physical activity and walking. It is also possibly the first randomised controlled trial to develop and include questions on muscle strength exercise assessment in mothers with young children, which demonstrated good reliability and positive outcomes.

The REFRESH study may contribute to the reduction of overweight and obesity in women of childbearing age and the prevention of long-term chronic diseases as it targeted mothers who are reported to be vulnerable to obesity especially during their

reproductive years. Furthermore, the study has potentially a flow on effect to other members of the family via mothers in terms of positive diet and physical activity behaviours.

## **8.5 RECOMMENDATIONS FROM THE STUDY**

The REFRESH study demonstrated that a low intensity, low cost, flexible delivery and multi-strategy intervention was successful in improving the diet and physical activity behaviours of mothers with young children. Several recommendations drawn from the research finding are proposed for future public health and health promotion policy, practice and research.

- 1) Given the positive results of the REFRESH intervention, public health community programs can benefit from investing in further rigorously evaluated interventions in playgroup settings to refine and build on the potential in improving health behaviours.
- 2) Health professionals have a role in influencing lifestyle behaviour change. The results of the study indicate that is important to identify the gaps in the provision of health information and provide health resources wherever possible. The strategies for health promotion need government agencies to work in partnership with communities to ensure that the social environment promotes health (Talbot & Verrinder, 2005).
- 3) One of the strengths of the intervention was its adaptability to the varying needs and concerns of the target group (Chapter 5). Mothers with young children are 'busy' people (Ratner, 2007). However, since new mothers access mothers groups and playgroups for the socialisation of the child, the REFRESH intervention indicates it is an opportune time to target mothers. Health services providing health information and skills to mothers of young children would benefit from either attending playgroup that are embedded in the community settings to conduct prevention initiatives.
- 4) Another strength of the REFRESH study was consideration of the health determinants such as, education, employment and cultural factors in conjunction with the behaviour change theories. The combination assisted in identifying the barriers and facilitators to healthy eating and improving physical activity in

mothers with young children. Health promotion interventions should continue to make a commitment to considering the broader social determinants of health and improving the access of health programs to disadvantaged groups such as mothers (Chapter 3) (Glanz and Bishop, 2010).

5) The systematic literature review identified multiple areas that can be improved when designing randomised controlled trials for diet and physical activity for mothers with young children. These areas include:

- measuring the diet and physical activity behavioural outcomes instead of only assessing the consequence of these health behaviours (such as, weight, body mass index);
- recruit larger sample sizes and improved quality in randomisation; conduct process evaluation in order to identify the optimal strategies for recruitment, retention, childcare options, dosage (frequency and amount of contact with the intervention), intervention components, training of facilitators, educational approaches, and delivery settings;
- report on the application of behaviour change theories during the development, implementation and evaluation stages of the study, and mediator analysis of behaviour change constructs with the diet and physical activity outcomes.

6) The study's qualitative (Chapter 5) and quantitative research (Chapter 6 & Chapter 7) highlights areas that would benefit from additional examination. Future research should consider some of the design factors that led to the positive outcomes of the REFRESH program. These include:

- tailoring the recruitment strategy to fit the target group;
- tailoring the intervention components to address the barriers to eating a healthy diet and physical activity with the target group;
- allowing for flexibility in the strategies (provision of multiple strategies, for example, primarily home-based and complemented by face to face components);
- encouraging self-tailoring of the physical activity program provided to suit individual needs and time constraints; providing supplementary materials which acted as cues to encourage positive behaviour change; and

- using health sciences students especially nutrition and dietetics students to support the information sessions and provide one-on-one nutritional advice.
- 7) It is recommended that future research studies be conducted on the adaptability of the REFRESH program for mothers from minority risk groups such as, Aboriginal and Torres Strait Islander mothers, culturally and linguistically diverse mothers and those from low socio-economic areas and that the programme be extended and replicated in alternative settings such as mother's groups.
  - 8) The duration of the intervention programs should support sustainable dietary and physical activity behaviour change and long-term evaluation to demonstrate these changes.
  - 9) Mothers have access to the external world while caring for a new infant through social networking websites. Future research would be desirable to explore the adaptation of the REFRESH program for mothers in rural areas using the internet and social networking. Further research is needed to explore barriers to including the REFRESH program as part of clinical practice at antenatal clinics and General Practitioner visits during pregnancy and after childbirth.

## **8.6 CONCLUSION**

To successfully address chronic disease prevention in the community, population approaches are required. Integrated health promotion programs that are comprehensive, embedded in the Ottawa Charter for Health Promotion and built on sound behaviour change theories are vital to successful outcome of these interventions. Unfortunately, as has been emphasised throughout this thesis and the current systematic reviews on diet and physical activity behaviour change interventions for mothers with young children, there are few examples of community-based interventions that have reported rigorous methodologies and successful outcomes

The 'REFRESH' program which comprised a relatively low intensity home based intervention was successful in improving dietary intake and physical activity levels of the mothers with young children in the intervention group when compared to the control group participants. This research provides valuable information on

participants' perspectives of the program strategies, content and overall implementation. It provides insights into the feasibility and acceptability of the intervention and identifies areas for improvement when conducting programs in playgroup settings.

The process and impact evaluation indicated that playgroups are a potential setting for health promotion targeting mothers with young children. In this instance it was also found that playgroups provide an useful avenue for reaching and recruiting women into health programs and in turn equipping them with skills and information. These changes if maintained over a longer period are likely to improve the health of mothers and also have a positive impact on that of their partners and children.

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## APPENDICES

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# APPENDIX 1: ETHICS & TRIAL REGISTRATION

## ETHICS APPROVAL 2009



Office of Research and Development

### Human Research Ethics Committee

TELEPHONE 9266 2784  
FACSIMILE 9266 3793  
EMAIL hrec@curtin.edu.au

### memorandum

To	Peter Howat, Public Health/ CBRCC
From	A/Professor Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval HR 183/2008
Date	9 December 2008
Copy	

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "An intervention to improve the nutrition and physical activity behaviours of mothers with young children". Your application has been reviewed by the HREC and is **approved**.

- You are authorised to commence your research as stated in your proposal.
- The approval number for your project is **HR 183/2008**. Please quote this number in any future correspondence.
- Approval of this project is for a period of twelve months **09-12-2008 to 09-12-2009**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **09-12-2009**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Divisional 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 183/2008). 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

PP

## ETHICS APPROVAL 2010

memorandum



<b>To</b>	Peter Howat, Public Health/ CBRCC
<b>From</b>	Miss Linda Teasdale, Manager, Research Ethics
<b>Subject</b>	<b>PROTOCOL APPROVAL – EXTENSION 183/2008</b>
<b>Date</b>	20 November 2009
<b>Copy</b>	

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 for the project *"An intervention to improve the nutrition and physical activity behaviours of mothers with young children."*

Approval for this project is extended for the year to **09/12/2010**.

Your approval number remains **183/2008**. 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.

A handwritten signature in blue ink that reads "Linda Teasdale".

Linda Teasdale  
Manager, Research Ethics  
Office of Research and Development

## ETHICS APPROVAL 2011



### Memorandum

To	Peter Howat, Public Health/CBRCC
From	Miss Linda Teasdale, Manager, Research Ethics
Subject	PROTOCOL APPROVAL – EXTENSION HR183/2008
Date	15 November 2010
Copy	

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 for the project *"An intervention to improve the nutrition and physical activity behaviours of mothers with young children."*

Approval for this project is extended for the year to **09/12/2011**.

Your approval number remains **HR183/2008**. 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.

A handwritten signature in black ink, appearing to read "Linda Teasdale".

Linda Teasdale  
Manager, Research Ethics  
Office of Research and Development

## CLINICAL TRIAL REGISTRATION 2009

**From:** ACTR - Info [mailto:actr@ctc.usyd.edu.au] **Sent:** Friday, 21 August 2009 8:09 AM  
**To:** Ginny Monteiro **Subject:** Your ACTRN (registration number): ACTRN12609000718246

Dear SAROJINI,

Re: Randomised Control Trial in playgroup mothers with young children-Lifestyle program to improve nutrition and physical activity behaviours, and perceived social support, physical health and mental health.

Thank you for submitting the above trial for inclusion in the Australian New Zealand Clinical Trials Registry (ANZCTR).

Your trial has now been successfully registered and allocated the ACTRN:  
ACTRN12609000718246

Web address of your trial: <http://www.ANZCTR.org.au/ACTRN12609000718246.aspx>  
Date submitted: 13/08/2009 1:29:35 PM  
Date registered: 21/08/2009 10:06:44 AM  
Registered by: SAROJINI MONTEIRO

If you have already obtained Ethics approval for your trial, could you please send the ANZCTR a copy of at least one Ethics Committee approval letter? A copy of the letter can be sent to [info@actr.org.au](mailto:info@actr.org.au) (by email) OR (61 2) 9565 1863, attention to ANZCTR (by fax).

Please be reminded that the quality and accuracy of the trial information submitted for registration is the responsibility of the trial's Primary Sponsor or their representative (the Registrant). The ANZCTR allows you to update trial data, but please note that the original data lodged at the time of trial registration and the tracked history of any changes made will remain publicly available.

The ANZCTR is recognised as an ICMJE acceptable registry (<http://www.icmje.org/faq.pdf>) and a WHO Primary Registry (<http://www.who.int/ictrp/network/primary/en/index.html>).

If you have any enquiries please send a message to [info@actr.org.au](mailto:info@actr.org.au) or telephone +61 2 9562 5333.

Kind regards,  
ANZCTR Staff  
T: +61 2 9562 5333  
F: +61 2 9565 1863  
E: [info@actr.org.au](mailto:info@actr.org.au)  
W: [www.ANZCTR.org.au](http://www.ANZCTR.org.au)

This e-mail message has been scanned for Viruses and Content and cleared by **MailMarshal**

**IMPORTANT NOTICE:** This e-mail and any attachment to it are intended only to be read or used by the named addressee. It is confidential and may contain legally privileged information. No confidentiality or privilege is waived or lost by any mistaken transmission to you. The CTC is not responsible for any unauthorised alterations to this e-mail or attachment to it. Views expressed in this message are those of the individual sender, and are not necessarily the views of the CTC. If you receive this e-mail in error, please immediately delete it and notify the sender. You must not disclose, copy or use any part of this e-mail if you are not the intended recipient.

**Request Number:** 308086  
**ACTR Number:** ACTRN12609000718246  
**Trial Status:** Registered  
**Date Submitted:** 13/08/2009  
**Date Registered:** 21/08/2009

## Page 1

**Public title:** Reminder on Eating, Relaxation and Exercise Support for Health  
**ANZCTR registration title:** Randomised Control Trial in playgroup mothers with young children-Lifestyle program to improve nutrition and physical activity behaviours, and perceived social support, physical health and mental health.  
**Secondary ID:**  
**Trial acronym:** REFRESH

## Page 2

**Health condition(s) or problem(s) studied:**  
 Prevention of overweight and obesity,  
 Preventino of chronic diseases including cardiovascular diseases, Type 2 diabetes and some cancers.  
**Condition category:** Public Health  
**Condition code:** Health promotion/education

## Page 3

**Description of intervention(s) / exposure:**  
 Intervention will include:  
 1. Trained Nutrition Educators will conduct six group based face to face education sessions of 20 minutes each on nutrition, physical activity, goal setting, self-monitoring and relapse prevention  
 2. Fortnightly emails  
 3. Mobile phone messages  
 4. Booklet will focus on healthy eating, physical activity (walking and integrated exercises at home), relaxataion, goal setting, self-monitoring and relapse prevention techniques.  
**Intervention code 1:** Prevention  
**Intervention code 2:** Lifestyle  
**Intervention code 3:** Behaviour  
**Comparator / control treatment:** Control group will be recruited at the same time as the interervention group. The control group will not be provided any interervention and will only

participate in providing information via questionnaires at baseline, 6 months and 12 months

**Control group:** Active

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**Page 4**

<b>Primary outcome 1:</b>	-To reduce the fat and sugar intake in the intervention group participants compared to the control group participants by 10% -Data will be collected using self-reported questionnaires - Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Primary outcome 2:</b>	-To increase the fibre, fruit and vegetable intake in the intervention group participants compared to the control group participants by 20% -Data will be collected using self-reported questionnaires -Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Primary outcome 3:</b>	To improve the dietary self-efficacy in the intervention group participants compared to the control group participants by 20% -Data will be collected using self-reported questionnaires - Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Primary outcome 4:</b>	-To increase the minutes of moderate intensity physical activity in the intervention group participants compared to the control group participants by 20% -Data will be collected using self-reported questionnaires -Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Primary outcome 5:</b>	-To improve the physical activity self-efficacy in the intervention group participants compared to the control group participants by 20% -Data will be collected using self-reported questionnaires - Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline 6 months 12 months
<b>Primary outcome 6:</b>	-To improve the perception of social support in the intervention group participants compared to the control group participants by 20% -Data will be collected using self-reported questionnaires - Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Primary outcome 7:</b>	-To improve the overall perception of physical health and mental health in the intervention group participants compared to the control group participants by 10% -Data will be collected using self-reported questionnaires -Data will be analysed using SPSS
<i>Timepoint:</i>	Baseline, 6 months, 12 months
<b>Secondary outcome:</b>	Nil
<i>Timepoint:</i>	Nil

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**Page 5**

<b>Key inclusion criteria:</b>	Mothers with a child registered with Playgroup WA.
<b>Minimum Age:</b>	18 Years
<b>Maximum Age:</b>	No limit
<b>Gender:</b>	Females

<b>Healthy volunteers?</b>	Yes
<b>Key exclusion criteria:</b>	Mothers below the age of 18. Mothers with a medical condition that may contraindicate their participation in the study.

#### Page 6

<b>Study type:</b>	Interventional
<b>Purpose of the study:</b>	Prevention
<b>Allocation to intervention:</b>	Randomised controlled trial
Describe the procedure for enrolling a subject and allocating the treatment (allocation concealment procedures):	A list of playgroups registered with Playgroup WA in the Perth Metropolitan area will be obtained. Playgroups will then be categorised into low, medium and high socioeconomic status, according to their location and based on the socio-economic index for areas scores. Playgroups will be randomly selected to participate in the study using a random sampling method. Playgroups will then be randomly allocated to either the control or intervention group using central randomisation by computer. In total, 450 mothers from playgroups will be selected to the intervention group and 450 mothers from playgroups will comprise the control group.
Describe the methods used to generate the sequence in which subjects will be randomised (sequence generation):	Random numbers were generated in Excel software and listed against the playgroups.
<b>Masking / blinding:</b>	Open (masking not used)
<b>Assignment:</b>	Parallel
<b>Other design features (specify):</b>	
<b>Type of endpoint(s):</b>	Efficacy

#### Page 7

<b>Phase</b>	Not Applicable
<b>Anticipated or actual start date:</b>	1/02/2010
<b>Target sample size:</b>	620
<b>Recruitment status:</b>	Not yet recruiting

#### Page 8

<b>Funding source:</b>	Government funding body e.g. NHMRC, ARC
<b>Name:</b>	NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL
<b>Address:</b>	GPO BOX 1421 CANBERRA ACT 2601
<b>Country:</b>	Australia
<b>Primary sponsor:</b>	Government funding body e.g. Department of Health
<b>Name:</b>	NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL
<b>Address:</b>	GPO BOX 1421 CANBERRA ACT 2601
<b>Country:</b>	Australia
<b>Secondary sponsor:</b>	University

**Name:** Curtin University  
**Address:** Rm 470, Bldg 400 Kent Street Bentley WA 6102  
**Country:** Australia  
Other collaborator: Other Collaborative groups  
**Name:** Playgroup WA  
**Address:** PO Box 61 North Perth WA 6906  
**Country:** Australia

#### Page 9

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**Has the study received approval from at least one ethics committee?** Yes  
**Ethics Committee name:** Curtin University Human Research Ethics Committee  
**Address:** Office of Research and Development Curtin University of Technology GPO BOX U1987 Perth WA  
**Country:** Australia  
**Date of approval:** 9/12/2008  
**HREC Number:** HR 183/2008  
**Countries of recruitment:** Australia  
**Brief summary:** This study aims to improve the nutrition and physical activity behaviours of mothers with young children.  
**Trial website:**  
**Presentations / publication list:**

#### Page 10

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##### Contact person for public queries

**Name:** Professor Peter Howat  
**Address:** Centre for Behavioural Research in Cancer Control, Curtin University of Technology, GPO BOX U1987, Perth, WA 6845  
**Country:** Australia  
**Tel:** +618 9266 1719  
**Fax:**  
**Email:** p.howat@curtin.edu.au

##### Contact person for scientific queries

**Name:** Professor Peter Howat  
**Address:** Centre for Behavioural Research in Cancer Control, Curtin University of Technology, GPO BOX U1987, Perth, WA 6845  
**Country:** Australia  
**Tel:** +618 9266 1719  
**Fax:**  
**Email:** p.howat@curtin.edu.au

##### Contact person responsible for updating information

**Name:** Ginny Monteiro  
**Address:** Curtin University of Technology, GPO BOX U1987, Perth, WA 6845  
**Country:** Australia  
**Tel:** +618 9266 7382  
**Fax:**  
**Email:** g.monteiro@curtin.edu.au

## APPENDIX 2: TEST-RETEST

### INVITATION LETTER

*Mothers with Young Children Study*  
*REFRESH*

Dear Participant,

Thank you for participating in the REFRESH program. This is a collaborative project between Playgroup WA Inc. and Curtin University and is funded by the National Health and Medical Research Council of Australia.

The goal of the REFRESH program is to encourage mothers to keep eating healthy food and do physical activity. The program will refresh mother's knowledge and skills by providing basic and advanced information and strategies on eating healthy food and doing physical activity.

The REFRESH program will give you a number of FREE resources to get you started or to keep you motivated on your healthy lifestyle journey.

- Booklets and newsletters
- Family menu and activity planner
- Shopping list with tips
- Home strength exercise card
- A pedometer will also be loaned to you for the duration of the REFRESH program.

As part of the REFRESH program, I request you to complete the two Mothers with young children study surveys.

1. The first Mothers with Young Children Study survey has **T1** in the **red box** on the front cover. The T1 survey should to be completed first and posted back along with the 'registration and consent form' in the reply paid envelope within 1 week.
2. The second Mothers with Young Children Study survey has a **T2** in the **red box** on the front cover. The T2 survey should be completed after a minimum of 2 days but no later than 1 week after completing the first survey (T1). Please post this survey back in the reply paid envelope.

Please note that both the surveys' are identical. Each survey will take about 20 minutes to complete.

This envelope contains the following:

1. Mothers with Young Children Study T1 Survey
2. Mothers with Young Children Study T2 Survey
3. Free measuring tape
4. Two reply paid envelopes

Thank you for your support.

Kind regards,  
Ginny Monteiro  
Project Coordinator  
School of Public health, Curtin University of Technology  
Postal Address: GPO Box U1987 Perth WA 6845  
Address: Rm 470, Bldg 400, Kent Street, Bentley WA 6102  
Phone: 08 9266 7382 Email: [g.monteiro@curtin.edu.au](mailto:g.monteiro@curtin.edu.au)

## CONSENT FORM

# *Mothers With Young Children Study*

### Registration & Consent Form

The information that you provide us will remain confidential and only used for this study.

I have been *given clear information* and been given time to consider whether I want to take part in the study. I have been able to ask *questions* and they have been answered to my satisfaction. I understand I may *withdraw* from the study at any stage. I agree that information gathered during the program may be published, provided I will not be identified.

(Please complete in CAPITAL letters)

Signature:	Date:
First name:	Surname:
Postal Address:	
Suburb you live in:	Post Code:
Mobile Ph:	Home Ph:
Email:	Questionnaire ID:



This is a joint Curtin University and Playgroup  
WA Inc. project funded by National Health and  
Medical Research Council

## STAFF INSTRUCTIONS

### Mothers with young children study Recruitment Staff Information Sheet

(Green information- to be provided to participants at playgroup)

1. Introduce yourself
  - a. My name is...
  - b. I am a project officer at Curtin University working on the Mothers with young children study.
2. We really appreciate support and help towards this very important study on mothers with a child below 5 years.
3. The study acknowledges that mothers with child below 5 years often miss out on nutrition and physical activity programs. Hence this study aims to gather information on mothers eating, physical activity habits and general health to help us develop nutrition and physical activity resources and programs for mothers like yourselves.
4. All information collected in this study will be kept confidential.
5. This part of the study aims to make sure that the questions in the questionnaire are valid by requesting you to complete the same questionnaire twice in two months.
  - a. The first questionnaire will need to be completed by the week of the 29 March or you can complete it today if you wish.
  - b. I will visit your playgroup a second time in the week of the 29<sup>th</sup> March and collect the 1<sup>st</sup> set of questionnaires and give you the second set of questionnaires which will need to be returned in a month i.e. by the 29<sup>th</sup> April.
6. The questionnaire will take about 20 minutes to fill in.
7. Registration and Consent Form: In order to sign up for this study, you will need to sign and enter your contact details on this Registration and Consent Form (show Registration and Consent Form) I am going to give you in a minute.
  - a. The form first includes a few sentences saying that you agree to participate in the study.
  - b. The final section requests for your signature and contact details so that we can post the next questionnaire out to you.
  - c. Please sign these forms and return them to me. (Give the registration and consent form out)
8. PG Participant List: While you are filling the registration form, I will come around and write your names on this list and give you your questionnaire. Project officer to fill in the PG Participant List- note the number of the questionnaire next to the participant and give the questionnaire to the participant. Check that the participant writes the correct questionnaire number on the Registration and Consent Form.
9. Collect all registration forms and check to make sure they are completed.
10. If participants are not at the session- request the playgroup leader to give you the names of the participants that may wish to participate in the study. Ask her to give the participant the questionnaires, registration and consent form and reply paid envelope. Note the questionnaire number on the 'PG Participant List' as well as on the participants 'Registration and consent form'.
11. Thank you once again for your time and support towards the mothers with young children study. Please do not forget to bring the questionnaire on the week of the 22<sup>nd</sup> as I will be visiting your playgroup again to collect the 1<sup>st</sup> set of questionnaires and give you the second set.

## QUESTIONNAIRE



### *Mothers with Young Children Study Survey*

Dear Participant,

Thank you for participating in the 'Mothers with Young Children' study survey. This survey includes questions about the foods you eat and physical activities you do as part of your everyday life.

The 'Mothers with Young Children' study is a collaborative project between Curtin University and Playgroup WA Inc. funded by the National Health and Medical Research Council of Australia.

Your participation in completing this survey is very much appreciated.

Ginny Monteiro  
Project Coordinator

---

**Instructions:**

It is important that you answer every question as best you can. There are no right or wrong answers, we just ask you to be completely honest.

---

Please answer Q1 to Q4 even if you do not consider yourself to be an active person.

---

**Q1. During the last month, think about the time you spent doing VIGOROUS ACTIVITY for 10 minutes or more continuously.** Vigorous activities include aerobics, netball, basketball, football, fast swimming, fast cycling, jogging and running. Vigorous activities refer to activities that take hard physical effort and make you breathe much harder than normal ('huff and puff').

- a. During a usual week, on how many days did you do vigorous activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q2.]

- b. How much time in total did you usually spend doing vigorous activities?

\_\_\_\_\_ minutes per week

---

**Q2. During the last month, think about the time you spent doing MODERATE ACTIVITY for 10 minutes or more continuously.** Moderate activities include medium regular paced cycling, swimming, slow jogging, playing doubles tennis and aerobics. Moderate activities refer to activities that make you breathe somewhat harder than normal and increase your heart rate.

- c. During a usual week, on how many days did you do moderate activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q3.]

- d. How much time in total did you usually spend doing moderate activities?

\_\_\_\_\_ minutes per week

---

**Q3. During the last month, think about the time you spent WALKING for 10 minutes or more continuously.** Walking includes walking at work, at home, to go from place to place, as part of your job, to and from work, to run errands, leisure, recreation.

- a. In a usual week, on how many days did you walk for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening, yard work and routine activities such as cooking and shopping.*)

\_\_\_\_\_ days per week [If 0 days per week, go to Q4.]

- b. How much time in total did you usually spend walking at vigorous intensity (speed walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- c. How much time in total did you usually spend walking at a moderate intensity (brisk walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- d. How much time in total did you usually spend walking at a light pace (strolling) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

**Q4. During the last month, think about the MUSCLE STRENGTH ACTIVITIES you did.**

a. During a usual week, did you do muscle strength activities (such as Pilates, calisthenics, weight training)?

No .....1 → If No, go to Q5.  
Yes .....2

b. During a usual week, on how many days did you do strength activities?

\_\_\_\_\_ days per week

c. How much time in total did you spend doing strength activities?

\_\_\_\_\_ minutes per week

d. Do you do one strength exercise for each of the major muscle groups (legs, hip, back, abdomen, chest, shoulders, arms) at least twice a week?

No .....1  
Yes .....2

**Q5. During the last month, think about the time you spent SITTING DOWN.**

Include time spent sitting while at work, studying, home, socially (e.g. visiting friends), in the car, reading, lying down, working at a desk or a computer, watching TV, DVDs etc. **If you were breastfeeding during the last month, do not include the time spent breastfeeding in the total time spent sitting down.**

a. During a usual week, how much time in total did you spend sitting on a week day?

\_\_\_\_\_ hours per week OR \_\_\_\_\_ minutes per week

b. During a usual week, how much time in total did you spend sitting on a weekend?

\_\_\_\_\_ hours per weekend OR \_\_\_\_\_ minutes per week

c. During a usual week, how much time in total did you spend breastfeeding?

\_\_\_\_\_ hours per day OR \_\_\_\_\_ minutes per week

**Q6. Physical Activity- Think about the support you receive from family, friends or a partner. Please circle one answer for each statement below.**

During the past 6 weeks either my family, friends or a partner.....	Never	Rarely	Some-times	Often	Very often
a. encouraged me to engage in physically activity.	1.....	2.....	3.....	4.....	5
b. was physically active with me.	1.....	2.....	3.....	4.....	5
c. took over chores so that I had more time to be physically active.	1.....	2.....	3.....	4.....	5
d. offered to look after the children so that I could be physically active.	1.....	2.....	3.....	4.....	5
f. helped plan activities around my exercise.	1.....	2.....	3.....	4.....	5



**Q8. Think about the number of SERVES of the different foods you ate during the last month.**

**How many serves of...**

a. **vegetables** did you eat in a usual day? [one serve = ½ cup cooked vegetables; 1 cup salad (exclude chips or fries)]  
\_\_\_\_\_ serves per day

b. **fruit** did you eat in a usual day? [one serve= 1 medium piece or 2 small pieces; 1 cup diced fruit; 1 tablespoon dried fruit]  
\_\_\_\_\_ serves per day

c. **dairy foods (exclude cream)** did you eat in a usual day or a usual week?  
[one serve = 1 cup milk; ½ cup yogurt; 2 thin slices cheese; 2 cheese squares (size of a dice)]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

d. **breads** did you eat in a usual day or in a usual week? [one serve = 2 thin slices bread; 1 medium roll]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

e. **cereals/oats** did you eat in a usual day or in a usual week?  
[one serve = 1 cup porridge/cereal; ½ cup muesli]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

f. **noodles, rice or pasta** did you eat in a usual day or in a usual week?  
[one serve = 1 cup cooked rice, pasta, noodles]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

g. **meat, poultry and eggs (exclude ham, sausages and other cold/processed meats)** did you eat in a usual day or in a usual week?  
[one serve = ½ cup cooked lean meat (beef, lamb, chicken, liver) (the size of your palm); 2 eggs]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **fish** did you eat in a usual day or in a usual week? [one serve = 120g; ½ cup cooked/canned fish]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **legumes, seeds and nuts** did you eat in a usual day or in a usual week?  
[one serve = ½ cup of cooked lentils/ legumes/ beans/ chickpeas/ soya beans; ½ cup peanuts/ walnuts/ almonds; ¼ cup sunflower/sesame seeds]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

---

**Q9. During the last month, think about your usual food consumption.**

**How many . . .**

a. teaspoons in total of margarine or butter did you usually apply on your bread/toast/sandwich each day?  
\_\_\_\_\_ teaspoons per day

b. teaspoons in total of sugar/honey did you usually add to your tea, coffee, cappuccino, cereal, etc. each day?  
(Exclude artificial sweeteners)  
\_\_\_\_\_ teaspoons per day

c. different types of vegetables did you usually eat each day?  
\_\_\_\_\_ types of vegetables per day

---

**Q10. Think about the NUMBER OF DAYS PER WEEK you ate the foods below during the last month.**  
Please circle one answer for each statement below.

In a usual week, how many days did you eat...	DAYS per WEEK
a. fried food with batter or bread crumb coating?	0.....1.....2.....3.....4.....5.....6.....7
b. fried foods (hot chips, French fries, etc.)?	0.....1.....2.....3.....4.....5.....6.....7
c. fast food (eg: KFC, McDonalds, pizza, fish & chips, fried chicken)?	0.....1.....2.....3.....4.....5.....6.....7
d. legumes (baked beans, three beans, lentils, split peas, etc.)?	0.....1.....2.....3.....4.....5.....6.....7
e. high fibre breakfast cereal (eg wheetbix, Allbran, untoasted muesli, oats, porridge)?	0.....1.....2.....3.....4.....5.....6.....7
f. (regular fat) cheese (eg cheddar)?	0.....1.....2.....3.....4.....5.....6.....7
g. processed meats (eg bacon, polony, salami, ham, processed chicken, sausage, mini-sausages)?	0.....1.....2.....3.....4.....5.....6.....7
h. 2 or more serves of fruit?	0.....1.....2.....3.....4.....5.....6.....7
i. 5 or more serves of vegetables?	0.....1.....2.....3.....4.....5.....6.....7
j. snacks (Twisties, Cheezels, Chips)?	0.....1.....2.....3.....4.....5.....6.....7

**Q11. Think about the NUMBER OF TIMES PER WEEK you ate the foods below during the last month.**  
Please circle one answer for each statement below.

In a usual week, how often did you eat...	TIMES per WEEK
a. cakes, muffins, pastries, scones, sweet bakery products?	0.....1.....2.....3.....4.....5.....6.....7 or more
b. plain biscuits, short bread and cream/chocolate biscuits?	0.....1.....2.....3.....4.....5.....6.....7 or more
c. regular ice cream, mousse, custard, caramel, chocolate? (exclude no added sugar foods)	0.....1.....2.....3.....4.....5.....6.....7 or more
d. hot/iced chocolate, mocha, coffee?	0.....1.....2.....3.....4.....5.....6.....7 or more
e. smoothies, milk shakes etc.?	0.....1.....2.....3.....4.....5.....6.....7 or more
f. fried foods (hot chips, etc.)?	0.....1.....2.....3.....4.....5.....6.....7 or more
g. pies, pasties, sausage rolls?	0.....1.....2.....3.....4.....5.....6.....7 or more
h. snacks (Twisties, Cheezels, Chips)?	0.....1.....2.....3.....4.....5.....6.....7 or more

**Q12. Think about your food choices during the last month.**

*Please circle one answer for each statement below.*

How often did you . . . .	Never	Rarely	Some- times	Usually	Always	Not Applicable
a. choose reduced-fat or low-fat cheese/yogurt in preference to regular fat cheese/yogurt?	1.....	2.....	3.....	4.....	5.....	9
b. choose low-fat milk (HiLo or skim) in preference to whole milk?	1.....	2.....	3.....	4.....	5.....	9
c. eat wholemeal spaghetti, pasta / brown rice in preference to regular spaghetti, pasta/ rice?	1.....	2.....	3.....	4.....	5.....	9
d. eat wholemeal, wholegrain, rye or seeded bread in preference to white bread?	1.....	2.....	3.....	4.....	5.....	9
e. trim all visible fat off the meat you eat?	1.....	2.....	3.....	4.....	5.....	9
f. remove the skin from chicken before it is cooked?	1.....	2.....	3.....	4.....	5.....	9
g. use fat (oil, lard, butter, margarine) when cooking?	1.....	2.....	3.....	4.....	5.....	9
h. spread butter or margarine when eating bread/crisp bread/crackers?	1.....	2.....	3.....	4.....	5.....	9

**Q13. Think about the number of cups of drinks you had during the last month.**

a. How many cups of soft drink did you usually drink? *Exclude DIET soft drinks.*

*[One cup = 250 ml bottle soft drink; 1.5 cups = 1 can soft drink; 2.4 cups = 600 ml bottle of soft drink]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

b. How many cups of 100% fruit juice did you usually drink?

*[One cup = 250 ml carton of 100% fruit juice]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

c. How many cups of flavoured (or fruit flavoured) drinks did you usually drink?

*[One cup = 250 ml of 25% fruit juice/ cordial/ flavoured water/ sports drinks (Gatorade)/ energy drinks (Red Bull)]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

**Q14. How many standard drinks of alcohol do you drink in a usual week?**

*[1 drink = 375ml can/bottle mid strength beer, middy/¼ can full strength beer, 100ml glass wine, full nip of spirits, or 60ml glass of port or sherry]*

\_\_\_\_\_ standard drinks per day                      OR                      \_\_\_\_\_ standard drinks per week

**Q15. Food– How sure are you that you can do these things consistently, for at least six months?**

*Please circle one answer for each statement below.*

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable
a. replace two high-fat high-sugar snacks/desserts such as biscuits, cakes, pastries, muffins, doughnuts with fruit, low-fat yogurt or nuts everyday.	1.....2.....3.....4.....5			9
b. eat 5 or more types of vegetables each day.	1.....2.....3.....4.....5			9
c. replace two high-fat high-sugar snacks such as of sausage rolls, spinach rolls, pies and crisps with vegetables everyday.	1.....2.....3.....4.....5			9
d. eat 2 serves of legumes/lentils/peas at least 3 times a week.	1.....2.....3.....4.....5			9
e. eat wholemeal/grain breads with more than 3 grams of fibre per 100 grams.	1.....2.....3.....4.....5			9
f. use low fat cheese, avocado or slice of tomato instead of butter or margarine on bread/sandwiches.	1.....2.....3.....4.....5			9
g. use lemon juice and citrus fruits as a dressing instead of oil/mayonnaise in salads.	1.....2.....3.....4.....5			9
h. eat low-fat or skim milk, cheese, yogurt instead of regular dairy products.	1.....2.....3.....4.....5			9
i. add less sugar to your tea/ coffee everyday.	1.....2.....3.....4.....5			9
j. eat a high-fibre breakfast such as wholemeal/grain bread, rolled oats, wheat flakes or Wheetbix everyday.	1.....2.....3.....4.....5			9
k. understand food labels and check the fat, sugar and fibre content every time you buy a new food product.	1.....2.....3.....4.....5			9
l. remove the skin of the chicken before cooking it.	1.....2.....3.....4.....5			9
m. trim the fat of meat.	1.....2.....3.....4.....5			9
n. plan dinner and snack meals in advance.	1.....2.....3.....4.....5			9
o. eat smaller portions in general.	1.....2.....3.....4.....5			9

**Q16. PHYSICAL ACTIVITY – How sure are you that you can do these things consistently, for at least six months? Please circle one answer for each statement below.**

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

Physical activity means doing at least 30 minutes of moderate intensity physical activity, five days a week OR doing at least 20 minutes of vigorous intensity physical activity, two days a week.

Moderate intensity physical activity is when you experience a slight, but noticeable, increase in your breathing and heart rate. Vigorous intensity physical activity is when you 'huff and puff' and cannot say a sentence in one breath.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable	
a. do moderate intensity activity for at least 30 minutes a day, five days a week OR do vigorous intensity activity for at least 20 minutes a day, three days a week. (10 minute bouts of physical activity can be done to accumulate 20-30 minutes each day)	1.....	2.....	3.....	4.....5	9
b. do one strength exercise for each of the major muscle groups at least twice a week.	1.....	2.....	3.....	4.....5	9
c. be physically active even when I don't have a partner/relatives or friends to support me.	1.....	2.....	3.....	4.....5	9
d. find time during the day to do physical activity with or without the children.	1.....	2.....	3.....	4.....5	9
e. be physically active even when I felt self-conscious about my body shape/appearance.	1.....	2.....	3.....	4.....5	9

**Q17. Are you currently using or doing anything to control your weight?**

*If you are pregnant, write your response for the month prior to pregnancy.  
Please circle the number that applies to you.*

- No ..... 1 → **If No, go to Q18.**  
 Yes ..... 2 → **If yes, go to Q17. a & b**

- 17.a) Are you trying to ...**
- Gain weight..... 1
  - Lose weight..... 2
  - Maintain your weight..... 3

**17.b) What are you using or doing to control your weight?**

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**Q18. The following questions ask for your views about your health.**  
*Please circle one answer for each statement below.*

---

**a. Overall, how would you rate your health during the past 4 weeks?**

Excellent	Very Good	Good	Fair	Poor	Very Poor
1	2	3	4	5	6

---

**b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking or climbing stairs)?**

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
1	2	3	4	5

---

**c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?**

Not at all	A little bit	Some	Quite a lot	Could not do daily work
1	2	3	4	5

---

**d. How much bodily pain have you had over the past 4 weeks?**

None	Very mild	Mild	Moderate	Severe	Very Severe
1	2	3	4	5	6

---

**e. Over the past 4 weeks, how much energy did you have?**

Very Much	Quite a bit	Some	A little	None
1	2	3	4	5

---

**f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?**

Not at all	Very little	Somewhat	Quite a lot	Could not do social activities
1	2	3	4	5

---

**g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?**

Not at all	Slightly	Moderately	Quite a lot	Extremely
1	2	3	4	5

---

**h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?**

Not at all	Very little	Somewhat	Quite a lot	Could not do daily activities
1	2	3	4	5

**Q19. What is your year of birth and country of birth?**

\_\_\_\_\_ Year \_\_\_\_\_ Country

---

**Q20. What is the highest level of educational qualification you completed?**  
*(Please circle the number that applies)*

- Year 12..... 1
  - TAFE Certificate/Diploma..... 2
  - University degree or higher ..... 3
  - None of the above..... 4
- 

**Q21. What is your usual employment status? If you are on maternity leave now, tick your usual employment status. (Please circle the number that applies)**

- Full-time ..... 1
  - Part-time ..... 2
  - Casual ..... 3
  - Not employed ..... 4
- 

**Q22. What is your yearly household income (before tax) (from all sources (including pension, allowances, financial support from parents/others)? (Please circle the number that applies)**

- Less than \$31,000..... 1
  - \$31,000 to \$50,999..... 2
  - \$51,000 to \$80,999..... 3
  - \$81,000 to \$100,999..... 4
  - \$101,000 to \$150,999..... 5
  - \$150,000 and above..... 6
- 

**Q23. What is your marital status? (Please circle the number that applies)**

- Married/De facto ..... 1
  - Separated/Divorced..... 2
  - Single/Widowed ..... 3
- 

**Q24. Are you currently pregnant? (Please circle the number that applies)**

- No ..... 1
  - Yes ..... 2 → If yes, how many weeks pregnant are you? \_\_\_\_\_ weeks
- 

**Q25. How many people usually live in your home including yourself?**

a. Number of people aged of 18 years and over: \_\_\_\_\_

Number of child

Q26. In what year were your children born? (Include foster/adopted and your partners children if under your care)

Child	Year	Child	Year	Child	Year
1		3		5	
2		4		6	

Q27. Which of the following best describes your use of cigarettes?

Never smoked ..... 1

Ex-smoker ..... 2

Current smoker ..... 3 → How many cigarettes do you smoke in a usual week?

\_\_\_\_\_ cigarettes

Q28. How tall are you without shoes? Write the measurement to the nearest 0.5 centimeters.

\_\_\_\_\_ centimeters

Q29. How much do you weigh without shoes and only light clothing?

Write the measurement to the nearest 0.1 kilogram.

If you are pregnant now, write in the weight you were in the month prior to pregnancy

\_\_\_\_\_ kilograms

Q30. What is your waist measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the waist measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Breathe out normally. Make sure the tape is snug, without compressing the skin. Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

\_\_\_\_\_ centimeters

Q31. What is your hip measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the hip measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Measure at the level where your buttocks protrude the most when viewed from the side. Make sure the tape is snug, without compressing the skin.

\_\_\_\_\_ centimeters

It's really important that all questions are answered so that we can use your survey in the 'Mothers with Young Children' study.

Postal Address:

Ginny Monteiro, School of Public Health, Bldg 400, GPO Box U1987 Perth WA 6845



## **APPENDIX 3: INTERVENTION DEVELOPMENT QUESTIONNAIRE**

## Physical Activity and Nutrition Program QUESTIONNAIRE

This questionnaire aims to improve the Physical Activity and Nutrition (PA&N) Program for new mothers like yourselves. Please answer each question as accurately as possible by either ticking the most appropriate box or writing your answer in the designated space. All information will be kept confidential.

### Length of the program:

The program you attended was conducted for three months.

**Q1. What would the ideal length of the program be?**

(Please tick one)

<b>2 months</b>	<input type="checkbox"/>
<b>3 months</b>	<input type="checkbox"/>
<b>4 months</b>	<input type="checkbox"/>
<b>5 months</b>	<input type="checkbox"/>
<b>6 months</b>	<input type="checkbox"/>

### Program Timing:

During last year's physical activity and nutrition program, if school holidays occurred during the program we did not conduct the face to face sessions.

**Q2. Would you like to receive emailed physical activity and nutrition information to keep you motivated as well as a reminder during the school holidays?**

(Please tick one)

<b>Yes</b>	<input type="checkbox"/>
<b>No</b>	<input type="checkbox"/>

### Number of the face to face sessions:

The program you attended at the playgroup included three face to face sessions over three months i.e. approximately one session per month.

**Q3. How many face to face sessions would you have liked per month to help you change your lifestyle (increase physical activity and healthy eating)?**

(Please tick one)

<b>1 face to face session every 3 weeks</b>	<input type="checkbox"/>
<b>1 face to face session every month</b>	<input type="checkbox"/>
<b>2 face to face sessions every month</b>	<input type="checkbox"/>

### Length of the face to face sessions:

The session you attended at the playgroup was held for approximately 20 minutes.

**Q4. How long would you have liked the face to face session to be?**

**Venue of sessions:**

The session you attended was held at the playgroup session.

**Q1. Where would you like the face to face session to be conducted?**

(Please tick one)

At the playgroup venue in the evening	<input type="checkbox"/>
At the playgroup session	<input type="checkbox"/>

**Evaluation of program:**

Before and after the physical activity and nutrition sessions, a booklet questionnaire was provided to you complete.

**Q2. How would you have preferred to complete this questionnaire?**

(Please tick one)

Internet questionnaire emailed to you	<input type="checkbox"/>
Booklet questionnaire posted to you	<input type="checkbox"/>

**Home Session Packs:**

If you did not attend the nutrition or physical activity session at the playgroup, a pack of information and materials was posted to you.

**Q3. Along with the pack of information sent to your home address, would you like to receive an email with the PowerPoint presentation with a voice over that explains the information in the PowerPoint presentation?**

(Please tick one)

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

**Content of the Program:**

Below is a list of topics that we can include in the in the program related to nutrition, physical activity, goal setting and goal implementation.

**PHYSICAL ACTIVITY**

Please number the topics you would like to see included in the program according to their importance to you.

1 = Most Important

2 = Important

3 = Least Important

1	Physical Activity Guidelines for Australians (What do they mean for you and your family?)	
2	Levels of Intensity in Physical Activity (Understanding the importance of the level of intensity)	
3	Integrated physical activity: What is it and how can you get fit without going to the gym?	
4	Start right: starting an exercise regimen?	
5	What is the best time to exercise?	
6	Are you getting enough exercise to help your heart?	
7	Monitoring activity goals: Why are they important?	
8	Lungs: Importance of exercise	

**UTRITION**

Please number the topics you would like to see included in the program according to their importance to you.

1 = Most Important

2 = Important

3 = Least Important

1	Dietary Guidelines for Australians: What do they mean for you and your family?	
2	Serving sizes and Portion sizes (What are they and how many servings should you be getting every day?)	
3	Cues for hunger and thirst (emotional or physical)- interventions to control emotional eating	
4	Menu planning	
5	Recipe Modification (including fruit and vegetables in your meals)	
6	Developing a shopping list: How to develop a shopping list that helps you give your family the best nutrition?	
7	Food label reading	
8	Breakfast: Why is it so important? Conversion of food for energy: how the calories you eat work in your body?	
9	Fast facts on fibre: Banish Hunger	
10	Fast facts on protein & carbohydrates	
11	Fast facts on fat: Can you tell if a food is high in fat?	
12	Fast facts about sugar	
13	How strong are your bones? (Calcium) & Iron	
14	Water	
15	Heart: How it works with the food you feed it?	

**GENERAL**

Please number the topics you would like to see included in the program according to their importance to you.

1 = Most Important

2 = Important

3 = Least Important

1	Reasons to eat healthy and do physical activity	
2	Stages of Change: How can you help yourself move to the Action Stage?	
3	Goal: How to develop goals you can achieve and stay motivated?	
4	Implementation of Goals: How to get started?	
5	Monitoring of Goals- Sustaining Motivation Techniques	
6	Body image & Self-esteem & Eating: Comparing ourselves to celebrities and the media	
7	Building self-confidence and enthusiasm: Developing the it can be done attitude	
8	Television viewing and its impact on eating habits	

Do you have any other comments or topics that you would have liked to be included in the program?

## APPENDIX 4: PARTICIPANT RECRUITMENT

### INTERVENTION GROUP STAFF INSTRUCTIONS

#### REFRESH- INTERVENTION GROUP- UPDATED

(Green information- to be provided to participants at playgroup)

1. Introduce yourself to the Playgroup Leader.
  - a. My name is...
  - b. I am a project officer at Curtin University working on the REFRESH Healthy Lifestyle program.
  - c. I am here to talk to the mothers about the REFRESH program.
2. Introduce yourself to the Playgroup
  - a. My name is...
  - b. I am a project officer at Curtin University working on the REFRESH Healthy Lifestyle program.
3. Introduction to project
  - a. This is a collaborative project between Playgroup WA Inc. and Curtin University.
  - b. It is funded by the National Health and Medical Research Council of Australia.
  - c. Before I start, I would like to let you know that the team of health professionals that developed the REFRESH program acknowledge that mothers may already know about healthy lifestyles but may be struggling to keep to a healthy lifestyle due to the demands of being a mother and caring for a family.
4. Introduction to REFRESH program
  - a. The goal of the REFRESH program is to act a reminder or a refresher as well as to provide advanced information on nutrition, healthy eating, healthy snacks, modifying recipes, being physically active with children and the family etc.
  - b. The REFRESH program will give you a number of FREE resources to get you started or to keep you motivated on your healthy lifestyle journey
    - i. booklets
    - ii. newsletters
    - iii. tape measure
    - iv. family menu and activity planner
    - v. shopping list with tips
    - vi. home strength exercise card
    - vii. integrated strength exercise card
    - viii. pedometers will be loaned to you- so that you can count the number of steps you do each day.

**PROJECT OFFICER-(MAKE SURE YOU DO NOT TELL THE MOTHERS THE NUMBER OF STEPS THEY SHOULD BE AIMING FOR. – if a mother asks for the number of steps- inform the mother/s that it will be discussed when the program starts in April and we want to know their normal activity levels)**
  - c. The REFRESH program also acknowledges that playgroup time is for the children, hence it is designed so that it does not take up a lot of your playgroup time.
    - i. There will be only one session per month for the next 6 months- starting at the end of April.
    - ii. The sessions will be no more than 20 minutes but it can go longer if mothers are keen and want to ask questions and discuss any topics.
    - iii. Even though there are 6 sessions, mothers do not have to attend all 6 sessions. That is, if a mother does not attend any of the sessions we will post out the session information to them.
5. As part of the REFRESH program, we will give you three survey forms along in a reply paid envelope.
  - a. The first survey needs to be completed by the 9<sup>th</sup> of April.
  - b. The second survey will be posted out to you in October at the end of the year.
  - c. The final survey will also be posted out to you in April next year or 2011.
  - d. Each survey will take about 20 minutes to complete and if you send the questionnaire by the due date you will go into a draw to win one of several \$50 vouchers.
6. We will give you a FREE measuring tape so that you can take your measurement. And write it in the survey form.
7. We will also loan pedometers so that you can check the number of steps you take each day.
8. Is your playgroup willing to participate in the REFRESH program?

1. If yes, we need a minimum of 6 participants to sign up for the program.
2. **Registration and Consent Form:** I am going to give you this registration and consent form.
  - a. The form first includes a few sentences saying that you agree to participate in the study.
  - b. Then it includes a special question asking you if you agree for project staff to take your physical measurement when we visit your playgroup next. Please tick yes or no.
  - c. There are also a few questions asking you if you there are any reasons you cannot participate in physical activity. Please tick yes only if the question applies to you.
  - d. I would also like to inform you that a mobile phone message will be sent as a reminder to each participant registered with the REFRESH program a day prior to the session.
  - e. The final section requests for your signature and contact details so that we can post the next questionnaire out to you.
  - f. Please sign these forms and return them to me. (Give the registration and consent form out)
3. **Participant list:** While you are filling the registration form, I will come around and write your names on this list and give you your survey form and pedometer.
  - a. Go to playgroup leader
    - i. Request playgroup leader to fill in her details on the participant list.
    - ii. If she is also going to be a participant in the program, include her details in the participant list and note the survey number.
    - iii. Request the playgroup leader to give you the names of the participants that may wish to participate in the study. Request her or if any other playgroup member who lives close to the person who is interested but not present at the session to give the participants the following: questionnaire, registration and consent form, reply paid envelope, pedometer and the measuring tapes. (Project officer: Note the questionnaire and pedometer number on the 'PG Participant List' as well as on the participants 'Registration and consent form'.)
  - b. Project officer to fill in the PG Participant List-
    - i. the number of the questionnaire
    - ii. the number on the pedometer
    - iii. tick the box once the registration and consent form is returned to you.
4. Give out measuring tapes
5. Give our pedometer instructions sheet. I will now teach you how to wear your pedometer so that you can get an accurate reading. (Use pedometer instructions and ask participants to follow.)
6. With regards to child care during the session, as the number of playgroups requested for the session increased significantly, we do not have staff to take care of the children. However, if you playgroup would really like to have one, we will try and see if we have any staff available for some sessions.
  - a. Would you like us to provide someone to look after the children?
7. **Refresh Program Delivery (Sessions 1 to 6)-** We have two options for when you can get started with the intervention. Group A or Group B. You can choose one or you can be flexible. If you are flexible we will call the playgroup leader and let them know which group your playgroup has been assigned to and we will send out the dates for all 6 sessions. (If the group is flexible it is good for me (Ginny) as otherwise I may have issues with staffing)
8. Thank you once again for your time and support towards the REFRESH program. Please do not forget to return the questionnaires by 9<sup>th</sup> April in the REPLY PAID envelopes so that you can go into the draw to win one of several \$50 vouchers.

Extra information: If any mother asks you what will happen if 5 mothers do not return the questionnaire before the 9<sup>th</sup> April-inform them that- If 6 people do not return the questionnaire, we will contact the playgroup leader and request you to return the pedometers as we have borrowed them from the government.

Checklist of things to be given to participants:

1. Registration and consent forms- check if all fields are completed
2. Survey forms
3. Measuring tapes
4. Pedometers
5. Reply paid envelope
6. Program Delivery (Group A or B)

## CONTROL GROUP STAFF INSTRUCTIONS

### MOTHERS WITH YOUNG CHILDREN STUDY - CONTROL GROUP-

(Green information- to be provided to participants at playgroup)

1. Introduce yourself to the Playgroup Leader.
  - a. My name is...
  - b. I am a project officer at Curtin University working on the Mothers with young children study.
  - c. I am here to talk to the mothers about the Mothers with young children study.
2. Introduce yourself to the Playgroup
  - a. My name is...
  - b. I am a project officer at Curtin University working on the Mothers with young children study .
3. Introduction to project
  - a. This is a collaborative project between Playgroup WA Inc. and Curtin University.
  - b. It is funded by the National Health and Medical Research Council of Australia.
  - c. All information collected in this study will be kept confidential.
4. Introduction to Mothers with young children study
  - a. The study acknowledges that mothers with child below 5 years often miss out on nutrition and physical activity programs.
  - b. Hence this study aims to gather information on mothers eating, physical activity habits and general health to help us develop nutrition and physical activity resources and programs for mothers like yourselves.
5. As part of the Mothers with young children study, we will give you three survey forms along in a reply paid envelope.
  - a. The first survey needs to be completed by the 9<sup>th</sup> of April.
  - b. The second survey will be posted out to you in October at the end of the year.
  - c. The final survey will also be posted out to you in April next year or 2011.
  - d. Each survey will take about 20 minutes to complete and if you send the questionnaire by the due date you will go into a draw to win one of several \$50 vouchers.
6. We will give you a FREE measuring tape so that you can take your measurement. And write it in the survey form.
7. We are hoping you will support this study. If any of you are interested in participating in this study, we will give you a registration form.
8. Registration and Consent Form: I am going to give you this registration and consent form.
  - a. The form first includes a few sentences saying that you agree to participate in the study.
  - b. Then it includes a special question asking you if you agree for project staff to take your physical measurement when we visit your playgroup next. Please tick yes or no.
  - c. The final section requests for your signature and contact details so that we can post the next questionnaire out to you.
  - d. Please sign these forms and return them to me. (Give the registration and consent form out)
9. Participant list: While you are filling the registration form, I will come around and write your names on this list and give you your survey form.
  - a. Go to playgroup leader
    - i. Request playgroup leader to fill in her details on the participant list.
    - ii. If she is also going to be a participant in the program, include her details in the participant list and note the survey number.
    - iii. Request the playgroup leader to give you the names of the participants that may wish to participate in the study. Request her or if any other playgroup member who lives close to the person who is interested but not present at the session to give the participants the following: questionnaire, registration and consent form, reply paid envelope, and the

- i. measuring tapes. (Project officer: Note the questionnaire number on the 'PG Participant List' as well as on the participants 'Registration and consent form' .)
  - b. Project officer to fill in the PG Participant List-
    - i. the number of the questionnaire
    - ii. tick the box once the registration and consent form is returned to you.
2. Give out measuring tapes
3. Thank you once again for your time and support towards the mothers with young children study. Please do not forget to return the questionnaires by 9<sup>th</sup> April in the reply paid envelopes so that you can go into the draw to win one of several \$50 vouchers.

Checklist of things to be given to participants:

1. Registration and consent forms- check if all fields are completed
2. Survey forms
3. Measuring tapes
4. Reply paid envelope
5. letters

## INTERVENTION GROUP INFORMATION LETTER

### *REFRESH PROGRAM*

Dear Playgroup Participant,

Thank you for your interest in the REFRESH program. This is a collaborative project between Playgroup WA Inc. and Curtin University and is funded by the National Health and Medical Research Council of Australia.

The team of health professionals that developed the REFRESH program acknowledge that mothers may already know about healthy lifestyles but may be struggling to keep to it due to the demands of being a mother and caring for a family. The goal of the REFRESH program is to encourage mothers to keep eating healthy food and do physical activity. The program will refresh mother's knowledge and skills by providing basic and advanced information and strategies on eating healthy food and doing physical activity.

The REFRESH program will give you a number of FREE resources to get you started or to keep you motivated on your healthy lifestyle journey.

Booklets and newsletters

Tape measure

Family menu and activity planner

Shopping list with tips

Home strength exercise card

A pedometer will also be loaned to you for the duration of the REFRESH program.

As part of the REFRESH program, we will give you three survey forms along in a reply paid envelope. The first survey needs to be completed by the 9<sup>th</sup> of April. The second survey will be posted out to you in October 2010 and the final survey will be posted out to you in April next year or 2011. All information collected in this program will be kept confidential.

Each survey will take about 20 minutes to complete and if you send the questionnaire by the due date you will go into a draw to win one of several \$50 vouchers.

This envelope contains the following:

Registration and consent form: Please fill this in and post it along with your survey form in the reply paid envelope.

Survey form: Please fill in and post it in the reply paid envelope by the 9<sup>th</sup> April 2010 to go into a draw to win one of several \$50 vouchers.

Measuring tape

Pedometer (On loan)

Reply paid envelope

If you have any questions about this study please contact Ginny Monteiro on 9266 7382 or email [g.monteiro@curtin.edu.au](mailto:g.monteiro@curtin.edu.au)

Thank you for your time.

Ginny Monteiro,

Project Coordinator

## CONTROL GROUP INFORMATION LETTER

### *Mothers With Young Children Study*

Dear Playgroup Participant,

Thank you for your interest in the Mothers with Young Children study. This is a collaborative project between Playgroup WA Inc. and Curtin University and is funded by the National Health and Medical Research Council of Australia. The Mothers with young children study acknowledges that mothers with child below 5 years often miss out on nutrition and physical activity programs due to their busy schedules. Hence, this study aims to understand mothers eating habits, physical activity habits and general health to develop resources and programs that motivate mothers to keep eating healthy food and doing physical activities.

As part of the Mothers with young children study, we will give you three survey forms along in a reply paid envelope. The first survey needs to be completed by the 9<sup>th</sup> of April. The second survey will be posted out to you in October 2010 and the final survey will be posted out to you in April next year or 2011. All information collected in this study will be kept confidential. Each survey will take about 20 minutes to complete and if you send the questionnaire by the due date you will go into a draw to win one of several \$50 vouchers.

This envelope contains the following:

- Registration and consent form: Please fill this in and post it along with your survey form in the reply paid envelope.
- Survey form: Please fill in and post it in the reply paid envelope by the 9<sup>th</sup> April 2010 to go into a draw to win one of several \$50 vouchers.
- Measuring tape: Free
- Reply paid envelope.

If you have any questions about this study please contact Ginny Monteiro on 9266 7382 or email [g.monteiro@curtin.edu.au](mailto:g.monteiro@curtin.edu.au)

Thank you for your time.  
Ginny Monteiro  
Project Coordinator

## INTERVENTION GROUP CONSENT FORM

### *REFRESH PROGRAM*

#### Registration & Consent Form

The information that you provide will remain confidential and used only for this program.

I have been given clear information and time to consider whether I want to take part in the program. I have been able to ask questions and they have been answered to my satisfaction. I understand I may withdraw from the program at any stage. I agree that information gathered during the program may be published, provided I will not be identified. I agree to return the pedometers at the completion of the REFRESH program.

• Do you agree to participate in physical <i>measurements</i> conducted by program staff at the playgroup (height, weight, hip and waist)?	
Yes	No
Please note that you need to fill in your waist and hip measurements in the questionnaire even if you do not agree to participate in this process.	

#### Are You ready for Physical Activity?

For most people physical activity should not pose any problem or hazard.

The questions below have been designed to identify people for whom it would be wise to have medical advice before starting our program, especially if you are increasing your level of physical activity.

Please tick the 'YES' box if it applies to you.		Yes
a.	Has your doctor ever said that you have a heart condition and recommended only medically approved physical activity?	
b.	Do you have chest pain brought on by physical activity?	
c.	Have you had chest pain when resting in the past month?	
d.	Do you lose consciousness or lose your balance as a result of dizziness?	
e.	Do you have a joint or bone problem that could be made worse by a change in your physical activity?	
f.	Is your doctor currently prescribing medication for your blood pressure or heart condition?	
g.	Do you know of any reason why you should not do or increase your physical activity?	

I understand that if I answered YES to one or more of the above questions, I should seek medical advice, at my own expense, before participating in this program.

*If I answered NO honestly to all questions and I am planning to increase my levels of physical activity, I understand that I need to begin slowly and build up gradually.*



## CONTROL GROUP CONSENT FORM

### *Mothers With Young Children Study*

#### Registration & Consent Form

The information that you provide us will remain confidential and only used for this study.

I have been given clear information and time to consider whether I want to take part in the study. I have been able to ask questions and they have been answered to my satisfaction. I understand I may withdraw from the study at any stage. I agree that information gathered during the program may be published, provided I will not be identified.

• Do you agree to participate in physical <i>measurements</i> conducted by program staff at the playgroup (height, weight, hip and waist)?	
Yes	No
Please note that you need to fill in your waist and hip measurements in the questionnaire even if you do not agree to participate in this process.	

(Please complete in CAPITAL letters)

Signature:	Date:
First name:	Surname:
Postal Address:	
Suburb you live in:	Post Code:
Mobile Ph:	Home Ph:
Email:	Questionnaire ID:  (In red square on front of booklet)

## PARTICIPANT PEDOMETER INSTRUCTIONS

### PEDOMETER INSTRUCTIONS

#### **What is a pedometer?**

The pedometer counts the steps you take each time you walk or run. It is important to wear the pedometer in the correct position everyday in order that the pedometer records the correct number of steps.

#### **How do I wear the pedometer?**

Attach the pedometer to your belt or a waist band on your hipbone or as close to it as possible, and secure with a safety pin.

Make sure the pedometer is in line with your foot when you are standing.

#### **How do I set the pedometer to measure my steps?**

Press the 'MODE' button until the cursor is under 'STEP'

Then press the 'RESET' (yellow) button. This will reset the number to 0.

Do not press the 'RESET' button during the day or you will lose your step count.

#### **When do I wear the pedometer?**

The pedometer should be worn at all times during the waking hours except while you are swimming, during showers or when you are sleeping.

#### **Instructions:**

Press the 'RESET' button every morning.

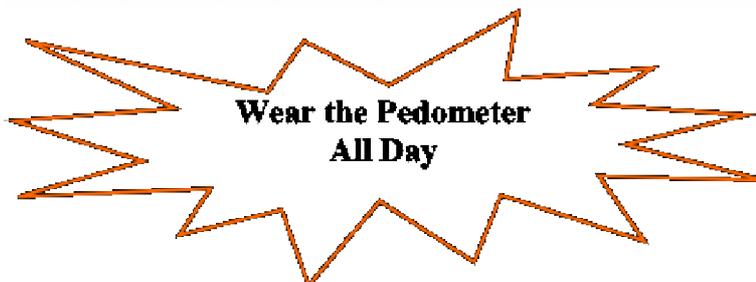
Place the pedometer on you your hip when you wake up in the morning and wear it all day.

Before you go to bed, record the number of steps on your survey.

**Please record the number of steps every day for 7 days on your survey.**



The pedometer is attached to the waist band at the hip and over the right foot



## STAFF ANTROPOMETRIC MEASUREMENT PROCEDURES

IMPORTANT: Please note if the playgroup is an intervention or a control group and accordingly provide extra information on the study. Please note we are still not able to inform the control group that there is an intervention group and vice versa-so that the participants don't feel bad!

Step 1: Look for a quiet spot –preferably a separate room where you can set up the scales

Step 2: Invite one participant to come and take their measures.

Step 3: Handout a measurement form to the participant requesting them to write down their measurements if they do remember them. (they are not allowed to use your scales to measure themselves). If they do not remember them, we will have to call them the following day and request it.

Step 4: Take the measurements twice on each person. (If the participant requests to know the measurements you have taken, you are allowed to give it to them only if the participant has provided their measurements in the form. Alternatively, we will have to give them the measurements you took, when we phone the participant and request for their measurements.)

1. You have three files
  - a. A plain white file: contains
    1. List of playgroups you will conducting measurements with
    2. participant lists

I have included two sheets for each playgroup as you need to take the measurements twice for each person.

In the row 'TEST'- please include 1 and 2.

You need to complete all measurements once-record it on sheet 1 (test 1)- and then take it a second time and record it on sheet 2 (Test 2).

- b. A REFRESH file: to be used for intervention groups. Give this file to the participant from the intervention group and request them to fill in the form. After they fill in the form, you will have to take their form out of the file and put in the your box provided. (Please place forms for one playgroup in one plastic sleeve). (Please ensure that the participants form is not in the file

when you give it to the next participant as we need to maintain confidentiality of measurements.)

- c. A mothers with young children file: to be used for control groups. Give this file to the participant from the control group and request them to fill in the form. After they fill in the form, you will have to take their form out of the file and put in the plastic sleeve provided. (please place forms for one playgroup in one plastic sleeve). (Please ensure that the participants form is not in the file when you give it to the next participant as we need to maintain confidentiality of measurements.
2. Record all measurements exactly as measured (this is required for scientific measurement purposes). (Sally I checked up on this and you have to record the measurement as taken- not to the nearest 0.5cm as I mentioned earlier.)

Recording weight: Please request mothers to take off their shoes and socks when recording weight.

Recording height: Please request mothers to take off any hair clips that may come in your way and shoes and socks.

Recording waist and hip: Please request mothers to take off belts or jackets if they come in the way of measuring.

Please be sensitive when recording measurements. If individuals refuse to adhere to instructions , please take measurements and make a note of any issues so that I can take this into consideration.

#### STAFF FORMS

Name: \_\_\_\_\_

PG Name: \_\_\_\_\_

Please fill in your measurements (even if filled in the Mothers with young children survey form).

Height: \_\_\_\_\_ centimeters

Weight: \_\_\_\_\_ kilograms

Waist: \_\_\_\_\_ centimeters

Hip: \_\_\_\_\_ centimeters

## APPENDIX 5: IMPACT EVALUATION

### INTERVENTION GROUP QUESTIONNAIRE



## *REFRESH PROGRAM Survey*

Dear Participant,

Thank you for participating in the REFRESH survey for mothers with young children. As part of this program we request that you please complete this survey in order to help evaluate if this program has improved mothers eating and physical activity behaviours.

Your participation in completing this survey is very much appreciated.

Ginny Monteiro  
Project Coordinator

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#### **Instructions:**

It is important that you answer every question as best you can. There are no right or wrong answers, we just ask you to be completely honest.

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#### **Q1. How many steps do you do in a week?**

Use the pedometer provided to record the number of steps you do each day for the next seven days in the table below.

DAY	DATE	TOTAL NUMBER OF STEPS	Did anything prevent you from doing your usual physical activities? (Tick the responses that apply to you)			
			Unwell	Busy/ Lack of time	Personal Crisis	Other
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						
Sunday						



Please answer Q2 to Q5 even if you do not consider yourself to be an active person.

---

**Q2. During the last month, think about the time you spent doing VIGOROUS ACTIVITY for 10 minutes or more continuously.** Vigorous activities include aerobics, netball, basketball, football, fast swimming, fast cycling, jogging and running. Vigorous activities refer to activities that take hard physical effort and make you breathe much harder than normal ('huff and puff').

- a. During a usual week, on how many days did you do vigorous activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q3.]

- b. How much time in total did you usually spend doing vigorous activities?

\_\_\_\_\_ minutes per week

---

**Q3. During the last month, think about the time you spent doing MODERATE ACTIVITY for 10 minutes or more continuously.** Moderate activities include medium regular paced cycling, swimming, slow jogging, playing doubles tennis and aerobics. Moderate activities refer to activities that make you breathe somewhat harder than normal and increase your heart rate.

- c. During a usual week, on how many days did you do moderate activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q4.]

- d. How much time in total did you usually spend doing moderate activities?

\_\_\_\_\_ minutes per week

---

**Q4. During the last month, think about the time you spent WALKING for 10 minutes or more continuously.** Walking includes walking at work, at home, to go from place to place, as part of your job, to and from work, to run errands, leisure, recreation.

- a. In a usual week, on how many days did you walk for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening, yard work and routine activities such as cooking and shopping.*)

\_\_\_\_\_ days per week [If 0 days per week, go to Q5.]

- b. How much time in total did you usually spend walking at vigorous intensity (speed walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- c. How much time in total did you usually spend walking at a moderate intensity (brisk walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- d. How much time in total did you usually spend walking at a light pace (strolling) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

---

**Q5. During the last month, think about the MUSCLE STRENGTH ACTIVITIES you did.**

- a. During a usual week, did you do muscle strength activities (such as Pilates, calisthenics, weight training)?

No .....1 → If No, go to Q6.  
Yes .....2

- b. During a usual week, on how many days did you do strength activities?

\_\_\_\_\_ days per week

- c. How much time in total did you spend doing strength activities?

\_\_\_\_\_ minutes per week

- d. Do you do one strength exercise for each of the major muscle groups (legs, hip, back, abdomen, chest, shoulders, arms) at least twice a week?

No .....1  
Yes .....2

**Q6. During the last month, think about the time you spent SITTING DOWN.**

Include time spent sitting while at work, studying, home, socially (e.g. visiting friends), in the car, reading, lying down, working at a desk or a computer, watching TV, DVDs etc. **If you were breastfeeding during the last month, do not include the time spent breastfeeding in the total time spent sitting down.**

- a. During a usual week, how much time in total did you spend sitting on a week day?

\_\_\_\_\_ hours per week OR \_\_\_\_\_ minutes per week

- b. During a usual week, how much time in total did you spend sitting on a weekend?

\_\_\_\_\_ hours per weekend OR \_\_\_\_\_ minutes per week

- c. During a usual week, how much time in total did you spend breastfeeding?

\_\_\_\_\_ hours per day OR \_\_\_\_\_ minutes per week

**Q7. Physical Activity-Think about the support you receive from family, friends or a partner.**

*Please circle one answer for each statement below.*

During the past 6 weeks either my family, friends or a partner.....	Never	Rarely	Some-times	Often	Very often
a. encouraged me to engage in physically activity.	1.....	2.....	3.....	4.....	5
b. was physically active with me.	1.....	2.....	3.....	4.....	5
c. took over chores so that I had more time to be physically active.	1.....	2.....	3.....	4.....	5
d. offered to look after the children so that I could be physically active.	1.....	2.....	3.....	4.....	5
f. helped plan activities around my exercise.	1.....	2.....	3.....	4.....	5



**Q9. Think about the number of SERVES of the different foods you ate during the last month.**

**How many serves of...**

a. **vegetables** did you eat in a usual day? [one serve = ½ cup cooked vegetables; 1 cup salad (exclude chips or fries)]

\_\_\_\_\_ serves per day

b. **fruit** did you eat in a usual day? [one serve= 1 medium piece or 2 small pieces; 1 cup diced fruit; 1 tablespoon dried fruit]

\_\_\_\_\_ serves per day

c. **dairy foods (exclude cream)** did you eat in a usual day or a usual week?  
[one serve = 1 cup milk; ½ cup yogurt; 2 thin slices cheese; 2 cheese squares (size of a dice)]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

d. **bread**s did you eat in a usual day or in a usual week? [one serve = 2 thin slices bread; 1 medium roll]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

e. **cereals/oats** did you eat in a usual day or in a usual week?  
[one serve = 1 cup porridge/cereal; ½ cup muesli]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

f. **noodles, rice or pasta** did you eat in a usual day or in a usual week?  
[one serve = 1 cup cooked rice, pasta, noodles]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

g. **meat, poultry and eggs (exclude ham, sausages and other cold/processed meats)** did you eat in a usual day or in a usual week?  
[one serve = ½ cup cooked lean meat (beef, lamb, chicken, liver) (the size of your palm); 2 eggs]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **fish** did you eat in a usual day or in a usual week? [one serve = 120g; ½ cup cooked/canned fish]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **legumes, seeds and nuts** did you eat in a usual day or in a usual week?  
[one serve = ½ cup of cooked lentils/ legumes/ beans/ chickpeas/ soya beans; ½ cup peanuts/ walnuts/ almonds; ¼ cup sunflower/sesame seeds]

\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

---

**Q10. During the last month, think about your usual food consumption.**

**How many . . .**

a. teaspoons in total of margarine or butter did you usually apply on your bread/toast/sandwich each day?

\_\_\_\_\_ teaspoons per day

b. teaspoons in total of sugar/honey did you usually add to your tea, coffee, cappuccino, cereal, etc. each day?  
(Exclude artificial sweeteners)

\_\_\_\_\_ teaspoons per day

c. different types of vegetables did you usually eat each day?

\_\_\_\_\_ types of vegetables per day

---

**Q11. Think about the NUMBER OF DAYS PER WEEK you ate the foods below during the last month.**  
*Please circle one answer for each statement below.*

In a usual week, how many days did you eat...	DAYS per WEEK
a. fried food with batter or bread crumb coating?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
b. fried foods (hot chips, French fries, etc.)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
c. fast food (eg: KFC, McDonalds, pizza, fish & chips, fried chicken)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
d. legumes (baked beans, three beans, lentils, split peas, etc.)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
e. high fibre breakfast cereal (eg wheetbix, Allbran, untoasted muesli, oats, porridge)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
f. (regular fat) cheese (eg cheddar)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
g. processed meats (eg bacon, polony, salami, ham, processed chicken, sausage, mini-sausages)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
h. 2 or more serves of fruit?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
i. 5 or more serves of vegetables?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7
j. snacks (Twisties, Cheezels, Chips)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7

**Q12. Think about the NUMBER OF TIMES PER WEEK you ate the foods below during the last month.**  
*Please circle one answer for each statement below.*

In a usual week, how often did you eat...	TIMES per WEEK
a. cakes, muffins, pastries, scones, sweet bakery products?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
b. plain biscuits, short bread and cream/chocolate biscuits?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
c. regular ice cream, mousse, custard, caramel, chocolate? (exclude no added sugar foods)	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
d. hot/iced chocolate, mocha, coffee?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
e. smoothies, milk shakes etc.?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
f. fried foods (hot chips, etc.)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
g. pies, pasties, sausage rolls?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more
h. snacks (Twisties, Cheezels, Chips)?	Rarely .....0.....1.....2.....3.....4.....5.....6.....7 or more

**Q13. Think about your food choices during the last month.**

Please circle one answer for each statement below.

How often did you . . . .	Never	Rarely	Some-times	Usually	Always	Not Applicable
a. choose reduced-fat or low-fat cheese/yogurt in preference to regular fat cheese/yogurt?	1.....	2.....	3.....	4.....	5.....	9
b. choose low-fat milk (HiLo or skim) in preference to whole milk?	1.....	2.....	3.....	4.....	5.....	9
c. eat wholemeal spaghetti, pasta / brown rice in preference to regular spaghetti, pasta/ rice?	1.....	2.....	3.....	4.....	5.....	9
d. eat wholemeal, wholegrain, rye or seeded bread in preference to white bread?	1.....	2.....	3.....	4.....	5.....	9
e. trim all visible fat off the meat you eat?	1.....	2.....	3.....	4.....	5.....	9
f. remove the skin from chicken before it is cooked?	1.....	2.....	3.....	4.....	5.....	9
g. use fat (oil, lard, butter, margarine) when cooking?	1.....	2.....	3.....	4.....	5.....	9
h. spread butter or margarine when eating bread/crisp bread/crackers?	1.....	2.....	3.....	4.....	5.....	9

**Q14. Think about the number of cups of drinks you had during the last month.**

a. How many cups of soft drink did you usually drink? Exclude DIET soft drinks.  
 [One cup = 250 ml bottle soft drink; 1.5 cups = 1 can soft drink; 2.4 cups = 600 ml bottle of soft drink]

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

b. How many cups of 100% fruit juice did you usually drink?  
 [One cup = 250 ml carton of 100% fruit juice]

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

c. How many cups of flavoured (or fruit flavoured) drinks did you usually drink?  
 [One cup = 250 ml of 25% fruit juice/ cordial/ flavoured water/ sports drinks (Gatorade)/ energy drinks (Red Bull)]

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

**Q15. How many standard drinks of alcohol do you drink in a usual week?**

[1 drink = 375ml/can/bottle mid strength beer, middy/¼ can full strength beer, 100ml glass wine, full nip of spirits, or 60ml glass of port or sherry]

\_\_\_\_\_ standard drinks per day                      OR                      \_\_\_\_\_ standard drinks per week

**Q16. Food– How sure are you that you can do these things consistently, for at least six months?**

*Please circle one answer for each statement below.*

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable
a. replace two high-fat high-sugar snacks/desserts such as biscuits, cakes, pastries, muffins, doughnuts with fruit, low-fat yogurt or nuts everyday.	1.....2.....3.....4.....5			9
b. eat 5 or more types of vegetables each day.	1.....2.....3.....4.....5			9
c. replace two high-fat high-sugar snacks such as of sausage rolls, spinach rolls, pies and crisps with vegetables everyday.	1.....2.....3.....4.....5			9
d. eat 2 serves of legumes/lentils/peas at least 3 times a week.	1.....2.....3.....4.....5			9
e. eat wholemeal/grain breads with more than 3 grams of fibre per 100 grams.	1.....2.....3.....4.....5			9
f. use low fat cheese, avocado or slice of tomato instead of butter or margarine on bread/sandwiches.	1.....2.....3.....4.....5			9
g. use lemon juice and citrus fruits as a dressing instead of oil/mayonnaise in salads.	1.....2.....3.....4.....5			9
h. eat low-fat or skim milk, cheese, yogurt instead of regular dairy products.	1.....2.....3.....4.....5			9
i. add less sugar to your tea/ coffee everyday.	1.....2.....3.....4.....5			9
j. eat a high-fibre breakfast such as wholemeal/grain bread, rolled oats, wheat flakes or Wheatbix everyday.	1.....2.....3.....4.....5			9
k. understand food labels and check the fat, sugar and fibre content every time you buy a new food product.	1.....2.....3.....4.....5			9
l. remove the skin of the chicken before cooking it.	1.....2.....3.....4.....5			9
m. trim the fat of meat.	1.....2.....3.....4.....5			9
n. plan dinner and snack meals in advance.	1.....2.....3.....4.....5			9
o. eat smaller portions in general.	1.....2.....3.....4.....5			9

**Q17. PHYSICAL ACTIVITY – How sure are you that you can do these things consistently, for at least six months? Please circle one answer for each statement below.**

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

Physical activity means doing at least 30 minutes of moderate intensity physical activity, five days a week OR doing at least 20 minutes of vigorous intensity physical activity, two days a week.

Moderate intensity physical activity is when you experience a slight, but noticeable, increase in your breathing and heart rate. Vigorous intensity physical activity is when you 'huff and puff' and cannot say a sentence in one breath.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable	
a. do moderate intensity activity for at least 30 minutes a day, five days a week OR do vigorous intensity activity for at least 20 minutes a day, three days a week. (10 minute bouts of physical activity can be done to accumulate 20-30 minutes each day)	1.....	2.....	3.....	4.....5	9
b. do one strength exercise for each of the major muscle groups at least twice a week.	1.....	2.....	3.....	4.....5	9
c. be physically active even when I don't have a partner/relatives or friends to support me.	1.....	2.....	3.....	4.....5	9
d. find time during the day to do physical activity with or without the children.	1.....	2.....	3.....	4.....5	9
e. be physically active even when I felt self-conscious about my body shape/appearance.	1.....	2.....	3.....	4.....5	9

**Q18. Are you currently using or doing anything to control your weight?**

*If you are pregnant, write your response for the month prior to pregnancy.  
Please circle the number that applies to you.*

- No ..... 1 → If No, go to Q19.  
Yes ..... 2 → If yes, go to Q18. a & b

- 18.a) Are you trying to ...
- Gain weight..... 1
  - Lose weight..... 2
  - Maintain your weight..... 3

18.b) What are you using or doing to control your weight?

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**Q19.** The following questions ask for your views about your health.  
Please circle one answer for each statement below.

**a. Overall, how would you rate your health during the past 4 weeks?**

Excellent	Very Good	Good	Fair	Poor	Very Poor
1	2	3	4	5	6

**b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking or climbing stairs)?**

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
1	2	3	4	5

**c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?**

Not at all	A little bit	Some	Quite a lot	Could not do daily work
1	2	3	4	5

**d. How much bodily pain have you had over the past 4 weeks?**

None	Very mild	Mild	Moderate	Severe	Very Severe
1	2	3	4	5	6

**e. Over the past 4 weeks, how much energy did you have?**

Very Much	Quite a bit	Some	A little	None
1	2	3	4	5

**f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?**

Not at all	Very little	Somewhat	Quite a lot	Could not do social activities
1	2	3	4	5

**g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?**

Not at all	Slightly	Moderately	Quite a lot	Extremely
1	2	3	4	5

**h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?**

Not at all	Very little	Somewhat	Quite a lot	Could not do daily activities
1	2	3	4	5

**Q20. What is your year of birth and country of birth?**

\_\_\_\_\_ Year \_\_\_\_\_ Country

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**Q21. What is the highest level of educational qualification you completed?**

*(Please circle the number that applies)*

- Year 12..... 1
  - TAFE Certificate/Diploma..... 2
  - University degree or higher ..... 3
  - None of the above..... 4
- 

**Q22. What is your usual employment status? If you are on maternity leave now, tick your usual employment status. (Please circle the number that applies)**

- Full-time ..... 1
  - Part-time ..... 2
  - Casual ..... 3
  - Not employed ..... 4
- 

**Q23. What is your yearly household income (before tax) (from all sources (including pension, allowances, financial support from parents/others)? (Please circle the number that applies)**

- Less than \$31,000..... 1
  - \$31,000 to \$50,999..... 2
  - \$51,000 to \$80,999..... 3
  - \$81,000 to \$100,999..... 4
  - \$101,000 to \$150,999..... 5
  - \$150,000 and above..... 6
- 

**Q24. What is your marital status? (Please circle the number that applies)**

- Married/De facto ..... 1
  - Separated/Divorced..... 2
  - Single/Widowed ..... 3
- 

**Q25. Are you currently pregnant? (Please circle the number that applies)**

- No ..... 1
  - Yes ..... 2 → If yes, how many weeks pregnant are you? \_\_\_\_\_ weeks
- 

**Q26. How many people usually live in your home including yourself?**

- a. Number of people aged of 18 years and over: \_\_\_\_\_
  - b. Number of children under 18 years: \_\_\_\_\_
-

Q27. In what year were your children born? (Include foster/adopted and your partners children if under your care)

Child	Year	Child	Year	Child	Year
1		3		5	
2		4		6	

---

Q28. Which of the following best describes your use of cigarettes?

Never smoked ..... 1

Ex-smoker ..... 2

Current smoker ..... 3 → How many cigarettes do you smoke in a usual week?

\_\_\_\_\_ cigarettes

---

Q29. How tall are you without shoes? Write the measurement to the nearest 0.5 centimeters.

\_\_\_\_\_ centimeters

---

Q30. How much do you weigh without shoes and only light clothing?

Write the measurement to the nearest 0.1 kilogram.

If you are pregnant now, write in the weight you were in the month prior to pregnancy

\_\_\_\_\_ kilograms

---

Q31. What is your waist measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the waist measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Breathe out normally. Make sure the tape is snug, without compressing the skin. Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

\_\_\_\_\_ centimeters

---

Q32. What is your hip measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the hip measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Measure at the level where your buttocks protrude the most when viewed from the side. Make sure the tape is snug, without compressing the skin.

\_\_\_\_\_ centimeters

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It's really important that all questions are answered so that we can use your survey in the REFRESH project.

Postal Address:

Ginny Monteiro, School of Public Health, Bldg 400, GPO Box U1987 Perth WA 6845



## CONTROL GROUP QUESTIONNAIRE



### *Mothers with Young Children Study Survey*

Dear Participant,

Thank you for participating in the 'Mothers with Young Children' study survey. This survey includes questions about the foods you eat and physical activities you do as part of your everyday life.

The 'Mothers with Young Children' study is a collaborative project between Curtin University and Playgroup WA Inc. funded by the National Health and Medical Research Council of Australia.

Your participation in completing this survey is very much appreciated.

Ginny Monteiro  
Project Coordinator

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**Instructions:**

It is important that you answer every question as best you can. There are no right or wrong answers, we just ask you to be completely honest.

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Please answer Q1 to Q4 even if you do not consider yourself to be an active person.

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**Q1. During the last month, think about the time you spent doing VIGOROUS ACTIVITY for 10 minutes or more continuously.** Vigorous activities include aerobics, netball, basketball, football, fast swimming, fast cycling, jogging and running. Vigorous activities refer to activities that take hard physical effort and make you breathe much harder than normal ('huff and puff').

- a. During a usual week, on how many days did you do vigorous activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q2.]

- b. How much time in total did you usually spend doing vigorous activities?

\_\_\_\_\_ minutes per week

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**Q2. During the last month, think about the time you spent doing MODERATE ACTIVITY for 10 minutes or more continuously.** Moderate activities include medium regular paced cycling, swimming, slow jogging, playing doubles tennis and aerobics. Moderate activities refer to activities that make you breathe somewhat harder than normal and increase your heart rate.

- c. During a usual week, on how many days did you do moderate activities for 10 minutes or more continuously? (*Exclude walking, home chores, gardening and yard work*).

\_\_\_\_\_ days per week [If 0 days per week, go to Q3.]

- d. How much time in total did you usually spend doing moderate activities?

\_\_\_\_\_ minutes per week

---

**Q3. During the last month, think about the time you spent WALKING for 10 minutes or more continuously.** Walking includes walking at work, at home, to go from place to place, as part of your job, to and from work, to run errands, leisure, recreation.

- a. In a usual week, on how many days did you walk for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening, yard work and routine activities such as cooking and shopping.*)

\_\_\_\_\_ days per week [If 0 days per week, go to Q4.]

- b. How much time in total did you usually spend walking at vigorous intensity (speed walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- c. How much time in total did you usually spend walking at a moderate intensity (brisk walking) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

- d. How much time in total did you usually spend walking at a light pace (strolling) for 10 minutes or more continuously? (*Exclude walking as part of home chores, gardening and shopping.*)

\_\_\_\_\_ minutes per week

**Q4. During the last month, think about the MUSCLE STRENGTH ACTIVITIES you did.**

a. During a usual week, did you do muscle strength activities (such as Pilates, calisthenics, weight training)?

No .....1 → If No, go to Q5.  
Yes .....2

b. During a usual week, on how many days did you do strength activities?

\_\_\_\_\_ days per week

c. How much time in total did you spend doing strength activities?

\_\_\_\_\_ minutes per week

d. Do you do one strength exercise for each of the major muscle groups (legs, hip, back, abdomen, chest, shoulders, arms) at least twice a week?

No .....1  
Yes .....2

---

**Q5. During the last month, think about the time you spent SITTING DOWN.**

Include time spent sitting while at work, studying, home, socially (e.g. visiting friends), in the car, reading, lying down, working at a desk or a computer, watching TV, DVDs etc. **If you were breastfeeding during the last month, do not include the time spent breastfeeding in the total time spent sitting down.**

a. During a usual week, how much time in total did you spend sitting on a week day?

\_\_\_\_\_ hours per week OR \_\_\_\_\_ minutes per week

b. During a usual week, how much time in total did you spend sitting on a weekend?

\_\_\_\_\_ hours per weekend OR \_\_\_\_\_ minutes per week

c. During a usual week, how much time in total did you spend breastfeeding?

\_\_\_\_\_ hours per day OR \_\_\_\_\_ minutes per week

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**Q6. Physical Activity- Think about the support you receive from family, friends or a partner. Please circle one answer for each statement below.**

During the past 6 weeks either my family, friends or a partner.....	Never	Rarely	Some- times	Often	Very often
a. encouraged me to engage in physically activity.	1.....	2.....	3.....	4.....	5
b. was physically active with me.	1.....	2.....	3.....	4.....	5
c. took over chores so that I had more time to be physically active.	1.....	2.....	3.....	4.....	5
d. offered to look after the children so that I could be physically active.	1.....	2.....	3.....	4.....	5
f. helped plan activities around my exercise.	1.....	2.....	3.....	4.....	5



**Q8. Think about the number of SERVES of the different foods you ate during the last month.**

**How many serves of...**

a. **vegetables** did you eat in a usual day? [one serve = ½ cup cooked vegetables; 1 cup salad (exclude chips or fries)]  
\_\_\_\_\_ serves per day

b. **fruit** did you eat in a usual day? [one serve= 1 medium piece or 2 small pieces; 1 cup diced fruit; 1 tablespoon dried fruit]  
\_\_\_\_\_ serves per day

c. **dairy foods (exclude cream)** did you eat in a usual day or a usual week?  
[one serve = 1 cup milk; ½ cup yogurt; 2 thin slices cheese; 2 cheese squares (size of a dice)]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

d. **breads** did you eat in a usual day or in a usual week? [one serve = 2 thin slices bread; 1 medium roll]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

e. **cereals/oats** did you eat in a usual day or in a usual week?  
[one serve = 1 cup porridge/cereal; ½ cup muesli]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

f. **noodles, rice or pasta** did you eat in a usual day or in a usual week?  
[one serve = 1 cup cooked rice, pasta, noodles]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

g. **meat, poultry and eggs (exclude ham, sausages and other cold/processed meats)** did you eat in a usual day or in a usual week?  
[one serve = ½ cup cooked lean meat (beef, lamb, chicken, liver) (the size of your palm); 2 eggs]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **fish** did you eat in a usual day or in a usual week? [one serve = 120g; ½ cup cooked/canned fish]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

h. **legumes, seeds and nuts** did you eat in a usual day or in a usual week?  
[one serve = ½ cup of cooked lentils/ legumes/ beans/ chickpeas/ soya beans; ½ cup peanuts/ walnuts/ almonds; ¼ cup sunflower/sesame seeds]  
\_\_\_\_\_ serves per day OR \_\_\_\_\_ serves per week

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**Q9. During the last month, think about your usual food consumption.**

**How many . . .**

a. teaspoons in total of margarine or butter did you usually apply on your bread/toast/sandwich each day?  
\_\_\_\_\_ teaspoons per day

b. teaspoons in total of sugar/honey did you usually add to your tea, coffee, cappuccino, cereal, etc. each day?  
(Exclude artificial sweeteners)  
\_\_\_\_\_ teaspoons per day

c. different types of vegetables did you usually eat each day?  
\_\_\_\_\_ types of vegetables per day

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**Q10. Think about the NUMBER OF DAYS PER WEEK you ate the foods below during the last month.**  
Please circle one answer for each statement below.

In a usual week, how many days did you eat...	DAYS per WEEK
a. fried food with batter or bread crumb coating?	0.....1.....2.....3.....4.....5.....6.....7
b. fried foods (hot chips, French fries, etc.)?	0.....1.....2.....3.....4.....5.....6.....7
c. fast food (eg: KFC, McDonalds, pizza, fish & chips, fried chicken)?	0.....1.....2.....3.....4.....5.....6.....7
d. legumes (baked beans, three beans, lentils, split peas, etc.)?	0.....1.....2.....3.....4.....5.....6.....7
e. high fibre breakfast cereal (eg wheetbix, Allbran, untoasted muesli, oats, porridge)?	0.....1.....2.....3.....4.....5.....6.....7
f. (regular fat) cheese (eg cheddar)?	0.....1.....2.....3.....4.....5.....6.....7
g. processed meats (eg bacon, polony, salami, ham, processed chicken, sausage, mini-sausages)?	0.....1.....2.....3.....4.....5.....6.....7
h. 2 or more serves of fruit?	0.....1.....2.....3.....4.....5.....6.....7
i. 5 or more serves of vegetables?	0.....1.....2.....3.....4.....5.....6.....7
j. snacks (Twisties, Cheezels, Chips)?	0.....1.....2.....3.....4.....5.....6.....7

**Q11. Think about the NUMBER OF TIMES PER WEEK you ate the foods below during the last month.**  
Please circle one answer for each statement below.

In a usual week, how often did you eat..	TIMES per WEEK
a. cakes, muffins, pastries, scones, sweet bakery products?	0.....1.....2.....3.....4.....5.....6.....7 or more
b. plain biscuits, short bread and cream/chocolate biscuits?	0.....1.....2.....3.....4.....5.....6.....7 or more
c. regular ice cream, mousse, custard, caramel, chocolate? (exclude no added sugar foods)	0.....1.....2.....3.....4.....5.....6.....7 or more
d. hot/iced chocolate, mocha, coffee?	0.....1.....2.....3.....4.....5.....6.....7 or more
e. smoothies, milk shakes etc.?	0.....1.....2.....3.....4.....5.....6.....7 or more
f. fried foods (hot chips, etc.)?	0.....1.....2.....3.....4.....5.....6.....7 or more
g. pies, pasties, sausage rolls?	0.....1.....2.....3.....4.....5.....6.....7 or more
h. snacks (Twisties, Cheezels, Chips)?	0.....1.....2.....3.....4.....5.....6.....7 or more

**Q12. Think about your food choices during the last month.**

*Please circle one answer for each statement below.*

How often did you . . . .	Never	Rarely	Some- times	Usually	Always	Not Applicable
a. choose reduced-fat or low-fat cheese/yogurt in preference to regular fat cheese/yogurt?	1.....	2.....	3.....	4.....	5.....	9
b. choose low-fat milk (HiLo or skim) in preference to whole milk?	1.....	2.....	3.....	4.....	5.....	9
c. eat wholemeal spaghetti, pasta / brown rice in preference to regular spaghetti, pasta/ rice?	1.....	2.....	3.....	4.....	5.....	9
d. eat wholemeal, wholegrain, rye or seeded bread in preference to white bread?	1.....	2.....	3.....	4.....	5.....	9
e. trim all visible fat off the meat you eat?	1.....	2.....	3.....	4.....	5.....	9
f. remove the skin from chicken before it is cooked?	1.....	2.....	3.....	4.....	5.....	9
g. use fat (oil, lard, butter, margarine) when cooking?	1.....	2.....	3.....	4.....	5.....	9
h. spread butter or margarine when eating bread/crisp bread/crackers?	1.....	2.....	3.....	4.....	5.....	9

**Q13. Think about the number of cups of drinks you had during the last month.**

a. How many cups of soft drink did you usually drink? *Exclude DIET soft drinks.*

*[One cup = 250 ml bottle soft drink; 1.5 cups = 1 can soft drink; 2.4 cups = 600 ml bottle of soft drink]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

b. How many cups of 100% fruit juice did you usually drink?

*[One cup = 250 ml carton of 100% fruit juice]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

c. How many cups of flavoured (or fruit flavoured) drinks did you usually drink?

*[One cup = 250 ml of 25% fruit juice/ cordial/ flavoured water/ sports drinks (Gatorade)/ energy drinks (Red Bull)]*

\_\_\_\_\_ cups per day                      OR                      \_\_\_\_\_ cups per week

**Q14. How many standard drinks of alcohol do you drink in a usual week?**

*[1 drink = 375ml can/bottle mid strength beer, middy/¼ can full strength beer, 100ml glass wine, full nip of spirits, or 60ml glass of port or sherry]*

\_\_\_\_\_ standard drinks per day                      OR                      \_\_\_\_\_ standard drinks per week

**Q15. Food– How sure are you that you can do these things consistently, for at least six months?**

*Please circle one answer for each statement below.*

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable
a. replace two high-fat high-sugar snacks/desserts such as biscuits, cakes, pastries, muffins, doughnuts with fruit, low-fat yogurt or nuts everyday.	1.....2.....3.....4.....5			9
b. eat 5 or more types of vegetables each day.	1.....2.....3.....4.....5			9
c. replace two high-fat high-sugar snacks such as of sausage rolls, spinach rolls, pies and crisps with vegetables everyday.	1.....2.....3.....4.....5			9
d. eat 2 serves of legumes/lentils/peas at least 3 times a week.	1.....2.....3.....4.....5			9
e. eat wholemeal/grain breads with more than 3 grams of fibre per 100 grams.	1.....2.....3.....4.....5			9
f. use low fat cheese, avocado or slice of tomato instead of butter or margarine on bread/sandwiches.	1.....2.....3.....4.....5			9
g. use lemon juice and citrus fruits as a dressing instead of oil/mayonnaise in salads.	1.....2.....3.....4.....5			9
h. eat low-fat or skim milk, cheese, yogurt instead of regular dairy products.	1.....2.....3.....4.....5			9
i. add less sugar to your tea/ coffee everyday.	1.....2.....3.....4.....5			9
j. eat a high-fibre breakfast such as wholemeal/grain bread, rolled oats, wheat flakes or Wheetbix everyday.	1.....2.....3.....4.....5			9
k. understand food labels and check the fat, sugar and fibre content every time you buy a new food product.	1.....2.....3.....4.....5			9
l. remove the skin of the chicken before cooking it.	1.....2.....3.....4.....5			9
m. trim the fat of meat.	1.....2.....3.....4.....5			9
n. plan dinner and snack meals in advance.	1.....2.....3.....4.....5			9
o. eat smaller portions in general.	1.....2.....3.....4.....5			9

**Q16. PHYSICAL ACTIVITY – How sure are you that you can do these things consistently, for at least six months? Please circle one answer for each statement below.**

Below is a list of things people might do when trying to change their habits. Whether you are trying to change your habits or not, please rate how confident you are that you can really motivate yourself to do things like these consistently, for at least six months.

Physical activity means doing at least 30 minutes of moderate intensity physical activity, five days a week OR doing at least 20 minutes of vigorous intensity physical activity, two days a week.

Moderate intensity physical activity is when you experience a slight, but noticeable, increase in your breathing and heart rate. Vigorous intensity physical activity is when you 'huff and puff' and cannot say a sentence in one breath.

I am sure that I can...	I know I cannot	Maybe I can	I know I can	Not applicable	
a. do moderate intensity activity for at least 30 minutes a day, five days a week OR do vigorous intensity activity for at least 20 minutes a day, three days a week. (10 minute bouts of physical activity can be done to accumulate 20-30 minutes each day)	1.....	2.....	3.....	4.....5	9
b. do one strength exercise for each of the major muscle groups at least twice a week.	1.....	2.....	3.....	4.....5	9
c. be physically active even when I don't have a partner/relatives or friends to support me.	1.....	2.....	3.....	4.....5	9
d. find time during the day to do physical activity with or without the children.	1.....	2.....	3.....	4.....5	9
e. be physically active even when I felt self-conscious about my body shape/appearance.	1.....	2.....	3.....	4.....5	9

**Q17. Are you currently using or doing anything to control your weight?**

*If you are pregnant, write your response for the month prior to pregnancy.  
Please circle the number that applies to you.*

- No ..... 1 → **If No, go to Q18.**  
 Yes ..... 2 → **If yes, go to Q17. a & b**

- 17.a) Are you trying to ...**
- Gain weight..... 1
  - Lose weight..... 2
  - Maintain your weight..... 3

**17.b) What are you using or doing to control your weight?**

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**Q18. The following questions ask for your views about your health.**  
*Please circle one answer for each statement below.*

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**a. Overall, how would you rate your health during the past 4 weeks?**

Excellent	Very Good	Good	Fair	Poor	Very Poor
1	2	3	4	5	6

---

**b. Over the past 4 weeks, how much did physical health problems limit your usual physical activities (walking or climbing stairs)?**

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
1	2	3	4	5

---

**c. Over the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?**

Not at all	A little bit	Some	Quite a lot	Could not do daily work
1	2	3	4	5

---

**d. How much bodily pain have you had over the past 4 weeks?**

None	Very mild	Mild	Moderate	Severe	Very Severe
1	2	3	4	5	6

---

**e. Over the past 4 weeks, how much energy did you have?**

Very Much	Quite a bit	Some	A little	None
1	2	3	4	5

---

**f. Over the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?**

Not at all	Very little	Somewhat	Quite a lot	Could not do social activities
1	2	3	4	5

---

**g. Over the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?**

Not at all	Slightly	Moderately	Quite a lot	Extremely
1	2	3	4	5

---

**h. Over the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, studies or other daily activities?**

Not at all	Very little	Somewhat	Quite a lot	Could not do daily activities
1	2	3	4	5

**Q19. What is your year of birth and country of birth?**

\_\_\_\_\_ Year \_\_\_\_\_ Country

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**Q20. What is the highest level of educational qualification you completed?**  
*(Please circle the number that applies)*

- Year 12..... 1
  - TAFE Certificate/Diploma..... 2
  - University degree or higher ..... 3
  - None of the above..... 4
- 

**Q21. What is your usual employment status? If you are on maternity leave now, tick your usual employment status. (Please circle the number that applies)**

- Full-time ..... 1
  - Part-time ..... 2
  - Casual ..... 3
  - Not employed ..... 4
- 

**Q22. What is your yearly household income (before tax) (from all sources (including pension, allowances, financial support from parents/others)? (Please circle the number that applies)**

- Less than \$31,000..... 1
  - \$31,000 to \$50,999..... 2
  - \$51,000 to \$80,999..... 3
  - \$81,000 to \$100,999..... 4
  - \$101,000 to \$150,999..... 5
  - \$150,000 and above..... 6
- 

**Q23. What is your marital status? (Please circle the number that applies)**

- Married/De facto ..... 1
  - Separated/Divorced..... 2
  - Single/Widowed ..... 3
- 

**Q24. Are you currently pregnant? (Please circle the number that applies)**

- No ..... 1
  - Yes ..... 2 → If yes, how many weeks pregnant are you? \_\_\_\_\_ weeks
- 

**Q25. How many people usually live in your home including yourself?**

a. Number of people aged of 18 years and over: \_\_\_\_\_

Number of child

Q26. In what year were your children born? (Include foster/adopted and your partners children if under your care)

Child	Year	Child	Year	Child	Year
1		3		5	
2		4		6	

Q27. Which of the following best describes your use of cigarettes?

Never smoked ..... 1

Ex-smoker ..... 2

Current smoker ..... 3 → How many cigarettes do you smoke in a usual week?

\_\_\_\_\_ cigarettes

Q28. How tall are you without shoes? Write the measurement to the nearest 0.5 centimeters.

\_\_\_\_\_ centimeters

Q29. How much do you weigh without shoes and only light clothing?

Write the measurement to the nearest 0.1 kilogram.

If you are pregnant now, write in the weight you were in the month prior to pregnancy

\_\_\_\_\_ kilograms

Q30. What is your waist measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the waist measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Breathe out normally. Make sure the tape is snug, without compressing the skin. Measure halfway between your lowest rib and the top of your hipbone, roughly in line with your belly button.

\_\_\_\_\_ centimeters

Q31. What is your hip measurement? Write the measurement to the nearest 0.5 centimeters.

If you are pregnant now, write in the hip measurement for the month prior to pregnancy.

Instructions: Use a tape measure and measure directly against your skin. Measure at the level where your buttocks protrude the most when viewed from the side. Make sure the tape is snug, without compressing the skin.

\_\_\_\_\_ centimeters

It's really important that all questions are answered so that we can use your survey in the 'Mothers with Young Children' study.

Postal Address:

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## APPENDIX 6: PROCESS EVALUATION

### STAFF QUESTIONNAIRE (ONLINE SURVEY)

#### STAFF DEMOGRAPHICS

- Qualifications
- Age
- Years and months of experience in health promotion (paid-full-time only), including the Refresh Program.
- Years and months of experience in nutrition/dietetics (paid-full-time only), including the Refresh Program.
- Years and months of experience in physical activity (paid-full-time only), including the Refresh Program.
- Years and months of experience in health promotion (paid-part-time only), including the Refresh Program
- Years and months of experience in nutrition/dietetics (paid-part-time only), including the Refresh Program.
- Years and months of experience in physical activity (paid-part-time only), including the Refresh Program.
- Reasons for joining the project
- Why playgroups exist
- What are the unique characteristics of conducting a health promotion nutrition and physical activity program's in playgroup setting?
- What are some of the things to consider when delivering health promotion programs in playgroup settings?
- What are your experiences and challenges working with mothers in the playgroup setting?
- What are the strategies necessary to facilitate a health promotion session with mothers in the playgroup setting?
- What are the skills necessary to facilitate an education session with mothers in a playgroup?

## STAFF INTERVIEW SCHEDULE

Dear .....,

Thank you for working with the REFRESH project over 2010. The project is being evaluated to improve the project delivery in the future. The management committee are interested in finding out about your opinion on processes and your experiences working with the program. We would highly appreciate it if you would kindly take the time to fill in this short exit interview survey.

Objectives:

- Identify the reasons for staff applying for the REFRESH project officer position
- Identify the skills and knowledge/qualifications used to deliver the REFRESH program
- Identify the training needs of the participants
- Identify the enablers and barriers when facilitating nutrition and physical activity sessions with mothers in playgroups
- Identifying the experiences of the staff working with the REFRESH project

Please tell us a bit about yourselves:

1. Year of birth
2. Highest qualifications at the time of job application
3. Number of years & months since completing undergraduate degree
4. Number of years & months worked in health promotion or dietetics
5. Why did you decide to join the REFRESH program?
6. Did you deliver the REFRESH surveys? Yes/no
  - Go to 10
7. Did you deliver any of the REFRESH sessions? Yes/No
  - Go to 8
8. I would like you to think about the sessions that you delivered to the mothers at the playgroups
  - The first question is on skills and knowledge necessary to deliver the sessions to mothers in a playgroup setting.
  - You chose (score value) on group facilitation skills. Can you please explain why you chose this particular score and not a score higher or lower?
  - You chose (score value) on analytical skills. Can you please explain why you chose this particular score and not a score higher or lower?

- You chose (score value) on interpersonal skills. Can you please explain why you chose this particular score and not a score higher or lower?
- You chose (score value) on organisational skills. Can you please explain why you chose this particular score and not a score higher or lower?
- You chose (score value) on teaching skills- adult learning principles. Can you please explain why you chose this particular score and not a score higher or lower?
- You chose (score value) on motivational interviewing. Can you please explain why you chose this particular score and not a score higher or lower?

9. Thinking about specifically working with the mothers -

- What were your best experiences working with the mothers in playgroups?
- What were your most challenging experiences working with the mothers in playgroups?
- If you were going to develop a program such as REFRESH how do you think the program could be improved or changed in order to help mothers with young children change their nutrition and physical activity habits (content and delivery)?

10. REFRESH training-

- Finally, do you think you received enough support and training to adequately do your job?
- How could the project improve the support and training the REFRESH project offers?

11. Thinking back in general -

- What were your best experiences working for the REFRESH Program?
- What do you think were your most challenging experiences working for the REFRESH Program?
- Do you have any other comments?



## PARTICIPANT WORKSHOP AND FACILITATOR FEEDBACK



## Feedback

Playgroup (PG) Name: \_\_\_\_\_ PG Suburb: \_\_\_\_\_ PG Day & Time: \_\_\_\_\_

Please circle one number for each statement.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
a. The purpose of each session was clear, before during and at the end of the session.	1.....	2.....	3.....	4.....	5
b. The presenter was well informed about the topic.	1.....	2.....	3.....	4.....	5
c. The session was well organized	1.....	2.....	3.....	4.....	5
d. The presenter was easy to understand	1.....	2.....	3.....	4.....	5
f. There were enough discussion opportunities.	1.....	2.....	3.....	4.....	5
g. The presenter could keep the focus on the objectives of the session.	1.....	2.....	3.....	4.....	5

Do you have any comments or suggestions for the presenter?

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---

---

Do you have any comments or suggestions on how the sessions could be improved?

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*Thank you very much for your feedback.*

## PARTICIPANT REFRESH PROGRAM FEEDBACK

Full Name: \_\_\_\_\_



### REFRESH Program Feedback

We are interested in your opinion of the Refresh program and would be grateful if you would take the time to provide us with your feedback.

Below are a series of questions and statements about the program. Please circle one number on each line that best describes how you feel about the REFRESH program overall, its resources and activities.

1) The REFRESH program...		Strongly Agree	Neither agree nor disagree		Strongly Disagree
a	...provided useful information	1	2	3	4 5
b	...was relevant to me	1	2	3	4 5
c	...encouraged me to think about my nutrition/eating habits	1	2	3	4 5
d	...encouraged me to think about my physical activity habits	1	2	3	4 5
e	...has helped me make positive changes to my nutrition/eating habits	1	2	3	4 5
f	...has helped me make positive changes to my physical activity habits	1	2	3	4 5
g	I would recommend the REFRESH program to other playgroup mums	1	2	3	4 5
2) Did you find the REFRESH program resources below useful?		Strongly Agree	Neither agree nor disagree		Strongly Disagree
a	... REFRESH magazine	1	2	3	4 5
b	... dietitian/nutritionist face-to-face sessions	1	2	3	4 5
c	... nutrition and physical activity newsletters	1	2	3	4 5
d	... nutrition and physical activity SMS reminders	1	2	3	4 5
e	... REFRESH folder with Go for 2&5 recipes, seasonal foods, children's eating behaviours, grower's markets list	1	2	3	4 5
f	... Shopping List and the Food Label magnet	1	2	3	4 5
g	... 'Family Meal and Physical Activity Planner' magnet	1	2	3	4 5
h	... 'REFRESH Recipe Booklet'	1	2	3	4 5
i	... pedometers	1	2	3	4 5
j	... 'Flexibility and Muscle Strength Exercise' card	1	2	3	4 5
3) Did you find the REFRESH program activities below useful?		Strongly Agree	Neither agree nor disagree		Strongly Disagree
a	...setting goals activity and trying to achieve them	1	2	3	4 5
b	...16 week physical activity diary	1	2	3	4 5
c	... recipe modification activity	1	2	3	4 5
d	... food label reading activity	1	2	3	4 5
e	... flexibility and strength exercise demonstrations	1	2	3	4 5
f	...'Walk to Gold Coast Pedometer Challenge'	1	2	3	4 5
g	...'Limit Extra Foods' record sheet	1	2	3	4 5

4) What do you think of the **SMS's reminders** sent prior to the face-to-face sessions as reminders?

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5) If you were unable to attend the face-to-face sessions at the playgroup a home package (**session handout and resources**) was provided to you. **What do you think of the home package (session handout and resources)?**

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6) Was there anything you **particularly liked** about the REFRESH program?

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7) How do you think we can **improve** the REFRESH program?

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8) Do you think the **REFRESH program had an impact on your family's eating and physical activity behaviours?**

No       Yes -If yes, how did they impact on your family's eating and physical activity behaviours?

---

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9) Recent research indicates that weak bladders affect many women and can be a barrier to being physically active. We are interested in finding out how many women attending playgroups also share this experience and would appreciate an answer to the following question.

**Does bladder leakage or weak bladders affect your ability to be physically active?**

Yes       No

THANK YOU

## PARTICIPANT GOAL REVIEW

Full Name: \_\_\_\_\_



### REFRESH Program Goals

Listed below are topics on which you may have set short term goals for during the REFRESH program.

Tick all the statements that apply to you and let us know if you were able to make a change.

With the help of the REFRESH program I was trying to....	Tick all the statements that apply to you (√)	Did you achieve the goal? Yes/No	If No, what were the <b>barriers</b> to achieving this goal?
...increase my fruit intake			
...increase my vegetable intake			
...increase my fibre (oats, wholemeal bread) intake			
...eat healthy snacks			
...reduce fatty snacks			
...reduce sugary snacks			
...reduce saturated fats			
...eat smaller food portions			
...eat breakfast regularly			
...drink more water			
...eat fresh food			
...not skip meals			
...modify recipes to make them healthier			
...use healthier cooking methods			
...read food labels when buying new products			
...do 10,000 steps each day			

## PARTICIPANT REFRESH PROGRAM REVIEW INTERVIEW SCHEDULE

- Interviewees
- Participants that completed the program (n=10)
- Objectives
  1. To assess the REFRESH program format on physical activity behaviour change
  2. To assess the REFRESH program resources on physical activity behaviour change
  3. To understand the impact of the REFRESH program on the meaning of physical activity
  4. To understand how to improve the physical activity component of the REFFRESH program
  5. To assess the REFRESH program format on eating behaviour change
  6. To assess the REFRESH program resources on eating behaviour change
  7. To understand the impact of the REFRESH program on the meaning of healthy eating
  8. To understand how to improve the eating component of the REFFRESH program

### Introduction

*This discussion aims to assess the REFRESH program and its impact on the mothers physical activity and eating behaviours. You do not have to answer any questions that make you feel uncomfortable and you are free to stop the discussion at any time. Please ask me to explain anything that you do not understand. There are no right and wrong answers -- only your opinion is what is important. I would like to tape your answers. Is that O.K.? (Tape machine turned on with permission).*

### Physical Activity

*I would like to start out by asking you some questions on the REFRESH program*

Objective1: To assess the REFRESH program format on physical activity behaviour change

- *Firstly, what I would like you to do is cast your mind back to the REFRESH program. The REFRESH program was comprised of session handouts, newsletters and SMS to you- as we could not arrange for workshops. (These mothers were not invited to workshops as there were less than 5 mothers at their playgroup that wished to*

participate and it was not economical and time efficient for us to organise a nutrition officer to go out to this playgroup). You also received some resources such as the pedometer, meal planner, flexibility and strength exercise fridge magnet during the program.

- How effective is a mailed out program in helping you improve your physical activity behaviours on a scale of 1 (not effective) to 10 (very effective)? Why did you give this number?

Objective 2: Impact of the physical activity resources of the REFRESH program on physical activity behaviour change

(Show the interviewee the physical activity resources list and a copy of each of them (strength and exercise card, pedometer, REFRESH booklet))

- I would like to now ask you a few questions on the physical activity resources we used in the program.

Physical Activity Resources	
...16 week physical activity diary	..... <b>'Flexibility and Muscle Strength Exercise'</b> card
... <b>pedometers</b>	...'Walk to Gold Coast Pedometer Challenge'

- How effective do you think the physical activity resources were on helping you improve your physical activity behaviours on a scale of 1 (not effective) to 10 (very effective)? Why did you give this scorer?
- Did you use these resources? Yes/No
- Yes- How did you use these resources to help you?
- No- why did you not use these resources?
- Do you think any of these resources could be improved?

Objective 3: Impact of the REFRESH program on the meaning of Physical Activity

- How has the meaning of physical activity changed since you have had contact with the REFRESH program?

Objective 4: Obtain additional information for the future programs

- Is there anything else the program could include that could have helped you further improve your physical activity habits?

**Eating healthy food and following healthy eating habits**

- *I would like to now ask you some questions on eating behaviours and the REFRESH program*

Objective 5: Impact of the mailed out program delivery method on healthy eating/food behaviour change

- **The REFRESH program was delivered via session handouts, newsletters and SMS.**
- *How effective is a mailed out program in helping you improve your healthy eating/food behaviours on a scale of 1 (not effective) to 10 (very effective)? Why did you give this number?*

Objective 6: Impact of the physical activity resources of the REFRESH program on healthy eating/food behaviour change

- Show the interviewee the healthy eating/food resources list and a copy of each of them (menu planner fridge magnet, shopping list, recipe booklet, REFRESH booklet)
- *I would like to now ask you a few questions on the healthy eating resources we used in the program.*

Healthy Eating Resources	
	... <b>REFRESH folder</b> with Go for 2&5 recipes, seasonal foods, children’s eating behaviours, grower’s markets list
	... <b>Shopping List and the Food Label magnet</b>
	... ‘ <b>Family Meal and Physical Activity Planner</b> ’ magnet
	... ‘ <b>REFRESH Recipe Booklet</b> ’
	recipe modification activity
	food label reading activity
	Limit Extra Foods’ record sheet

- *How effective do you think the healthy eating/food resources were on helping you improve your physical activity behaviours on a scale of 1 (not effective) to 10 (very effective)? Why did you give this number?*
- *Did you use these resources? Yes/No*
- *Yes- How did you use these resources to help you?*

- *No- why did you not use these resources?*
- *Do you think any of these resources could be improved?*

Objective 7: Impact of the REFRESH program on the meaning of Physical Activity

- *How has the meaning of eating or diet changed since you have had contact with the REFRESH program?*

Objective 8: Additional information for the future programs

- *Is there anything else the program could include that could have helped you further improve your eating habits?*

## APPENDIX 7 CO-AUTHORSHIP CONSENT FORMS

### PAPER 1

Monteiro, S. M. D. R., Jancey, J., Howat, P., Burns, S., Jones, C., Dhaliwal, S. S., McManus, A., Hills, A.P., Anderson, A. S. (2010) The protocol of a randomised controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program. *BMC Public Health*, 11; 648-562. DOI: 10.1186/1471-2458-11-648 [Impact Factor 2.08]

To Whom It May Concern

I, Sarojini Maria Dos Remedios Monteiro, contributed to the design, conducted the data collection and analysis, and drafted the publication entitled '*The protocol of a randomised controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program*'.



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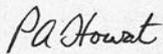
(Signature of Candidate)

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.



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Dr. Jonine Jancey



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Prof. Peter Howat

Sharyn Burns

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Dr. Sharyn Burns

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Dr. Satvinder Dhaliwal

Alexandra McManus

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Prof. Alexandra McManus

Andrew Hills

---

Prof. Andrew Hills

Annie S. Anderson

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Prof. Annie Anderson

## PAPER 2

Monteiro, S. M. D. R., Jancey, J., Howat, P. Physical activity and nutrition intervention for mothers of young children: Process evaluation. *Health*, 6 (3); 223-230. DOI: 10.4236/health.2014.63033 [Impact Factor 1.28]

To Whom It May Concern

I, Sarojini Maria Dos Remedios Monteiro, contributed to the design, conducted the data collection and analysis, and drafted the publication entitled '*Physical activity and nutrition intervention for mothers of young children: Process evaluation*'.



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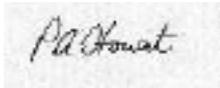
(Signature of Candidate)

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.



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Dr. Jonine Jancey



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Prof. Peter Howat

### PAPER 3

Jancey, J., Monteiro, S. M. D. R., Howat, P. Dhaliwal, S. S., P. Hills, A.P., Anderson, A. S., Burns, S. (2014) Dietary outcomes of a community based intervention for mothers of young children: A randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 11; 120-129. DOI: 10.1186/s12966-014-0121-1 [Impact Factor 3.68]

To Whom It May Concern

I, Sarojini Maria Dos Remedios Monteiro, contributed to the design, conducted the data collection, managed the database under the guidance of the statistician and conducted the preliminary data analysis, and drafted the publication entitled 'Dietary outcomes of a community based intervention for mothers of young children: A randomised controlled trial.'



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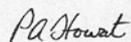
(Signature of Candidate)

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.



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Dr. Jonine Jancey

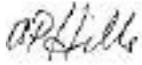


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Prof. Peter Howat

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Dr. Satvinder Dhaliwal



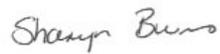
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Prof. Andrew Hills



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Prof. Annie Anderson



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Dr. Sharyn Burns

**PAPER 4**

Monteiro, S. M. D. R., Jancey, J., Dhaliwal, S. S., Howat, P. Burns, S., Hills, A.P., Anderson, A. S. (2014) Results of a randomised controlled trial to promote physical activity behaviours in mothers of young children. *Preventive Medicine*, 59; 12-18. DOI: 10.1016/j.ypmed.2013.10.022 [Impact Factor 3.496]

To Whom It May Concern

I, Sarojini Maria Dos Remedios Monteiro, contributed to the design, conducted the data collection, managed the database under the guidance of the statistician and conducted the preliminary data analysis, and drafted the publication entitled '*Results of a randomised controlled trial to promote physical activity behaviours in mothers of young children.*'



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(Signature of Candidate)

I, as a Co-Author, endorse that this level of contribution by the candidate indicated above is appropriate.

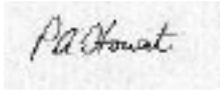


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Dr. Jonine Jancey

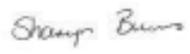
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Dr. Satvinder Dhaliwal



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Prof. Peter Howat



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Dr. Sharyn Burns



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Prof. Andrew Hills



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Prof. Annie Anderson

## **APPENDIX 8 PUBLISHED JOURNAL ARTICLES**

### **PAPER 1: The protocol of a randomized controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program**

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# The protocol of a randomized controlled trial for playgroup mothers: Reminder on Food, Relaxation, Exercise, and Support for Health (REFRESH) Program

Sarojini MDR Monteiro<sup>1,2\*</sup>, Jonine Jancey<sup>1,2</sup>, Peter Howat<sup>1,2</sup>, Sharyn Burns<sup>1</sup>, Carlie Jones<sup>1,2</sup>, Satvinder S Dhaliwal<sup>1,2</sup>, Alexandra McManus<sup>3</sup>, Andrew P Hills<sup>4</sup> and Annie S Anderson<sup>5</sup>

## Abstract

**Background:** Mother's physical activity levels are relatively low, while their energy consumption is generally high resulting in 58% of Australian women over the age of 18 years being overweight or obese. This study aims to confirm if a low-cost, accessible playgroup based intervention program can improve the dietary and physical activity behaviours of mothers with young children.

**Methods/Design:** The current study is a randomized controlled trial lifestyle (nutrition and physical activity) intervention for mothers with children aged between 0 to 5 years attending playgroups in Perth, Western Australia. Nine-hundred participants will be recruited and randomly assigned to the intervention (n = 450) and control (n = 450) groups. The study is based on the Social Cognitive Theory (SCT) and the Transtheoretical Model (TTM), and the Precede-Proceed Framework incorporating goal setting, motivational interviewing, social support and self-efficacy. The six month intervention will include multiple strategies and resources to ensure the engagement and retention of participants. The main strategy is home based and will include a specially designed booklet with dietary and physical activity information, a muscle strength and flexibility exercise chart, a nutrition label reading shopping list and menu planner. The home based strategy will be supported by face-to-face dietary and physical activity workshops in the playgroup setting, posted and emailed bi-monthly newsletters, and monthly Short Message Service (SMS) reminders via mobile phones. Participants in the control group receive no intervention materials. Outcome measures will be assessed using data that will be collected at baseline, six months and 12 months from participants in the control and intervention groups.

**Discussion:** This trial will add to the evidence base on the recruitment, retention and the impact of community based dietary and physical activity interventions for mothers with young children.

**Trial Registration:** Australian and New Zealand Clinical Trials Registry ACTRN12609000735257

## Background

Overweight and obesity are important public health concerns. The percentage of Australian women of child-bearing age that are overweight or obese has significantly increased over the past decade. In 2007, 44% of Australian women aged between 25 and 34 years were overweight or obese compared to only 26% in 1995 [1].

Childbearing aged women are an important target group for dietary and physical activity interventions as they are at an increased risk of long-term overweight and obesity [2]. Women's increased risk of overweight and obesity after their first and subsequent pregnancies is associated with overweight or obesity prior to pregnancy [3,4], gestational weight gain above the recommended guidelines [5,6], failure to lose gestational weight in an appreciable timeframe or excessive postpartum weight retention [7] and interpregnancy weight gain [8].

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Overweight and obese childbearing aged women appear to have a disproportionate risk of maternal, intrapartum, peripartum, neonatal, and postpartum complications [9,10]. If this weight gain continues after childbearing, women will be at increased risk of obesity related chronic conditions such as type II diabetes, high blood pressure, dyslipidaemia, cardiovascular disease and the risk of several major cancers [10]. In addition, maternal obesity may have deleterious effects on the neonate such as macrosomia, increased risk of a range of structural anomalies and of still birth [11].

Research indicates that the mechanisms for interpregnancy and 12 months postpartum weight gain can be due to a range of factors such as lack of nutrition knowledge [12], poor dietary habits and physical inactivity [13,14]. For example, research shows that 96% of females aged 25-34 and 94% of females aged 35-44 consume inadequate fruit or vegetables when compared to the Australian dietary guidelines [1]. Furthermore, despite the known health benefits of physical activity, 30% of women aged between 24 and 34 do not do any exercise, while 44% participate in low intensity activity [1].

The barriers to mothers adopting the recommended physical activity behaviours include lack of social support, lack of time, lack of energy and motivation, procrastination, lack of self-efficacy and childcare and financial constraints [15,16]. The influences on eating habits include convenience, cost, lifestyle preferences, confusion around food messages, nutrition knowledge and environmental factors [17]. Furthermore, common postpartum physical symptoms such as fatigue, headaches, nausea, backache and urinary or bowel problems can inhibit mothers following a healthy diet and physical activity plan [18].

Mothers are an important group within the family unit as they are generally the primary caregiver and help to shape the attitudes and behaviour of their children with respect to food and physical activity. Overweight and obese children are twice as likely to become overweight and obese adults when compared to normal weight children [19]. Mothers can prevent children from becoming overweight and obese as they play a major role in determining the family mealtime environment, and managing the amount and type of food available [20]. Thus, efforts to interrupt this cycle of obesity by targeting interventions at mothers are vital from both a public health perspective. Dietary and physical activity interventions could provide benefits to the mother, her future pregnancies and subsequent generations from becoming overweight and obese [21].

Currently, there are few studies that have reported the effectiveness of behavioural interventions designed to improve physical activity and dietary behaviours [22-26] in mothers with young children. These studies have included small samples and have incorporated limited

evaluation measures [23-25], even though the evidence suggests that after childbirth mothers are ready to change behaviours associated with overweight and obesity [27,28].

This paper describes the protocol of a randomized controlled trial to improve the physical activity and nutrition behaviours of mothers with young children (between 0 and 5 years of age) attending playgroups.

## Methods/Design

### Study design

The study is a community based 12 month randomized controlled trial. The study is designed according to the recommendations of the CONSORT statement for randomized trials of nonpharmacologic treatment [29].

The REFRESH study will be conducted over three years (Figure 1). The first year will include formative research, development of the evaluation framework and the intervention. In the second year, participants will be recruited, the intervention will be implemented and data will be collected from participants. The final year will include data collection, data analysis and review of the intervention.

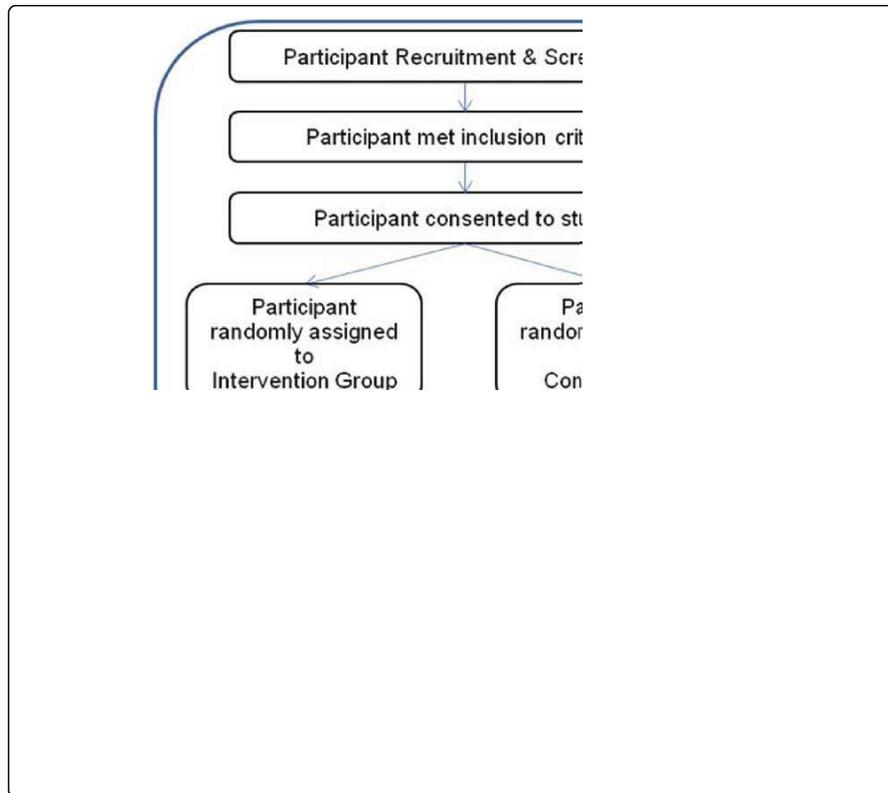
### Study aim

The REFRESH study aims to evaluate the effect of a six month physical activity and nutrition randomized controlled trial for mothers with young children attending playgroups in Perth, Western Australia (WA).

The REFRESH program will focus on behaviour change to meet the Australian physical activity guidelines, by encouraging increased in levels of vigorous, and moderate physical activity, the number of steps taken each day and muscle strength exercises [30,31]. The REFRESH program will also aim to encourage behaviour change to meet the Australian dietary guidelines (improve nutritional intake by increasing fruit, vegetable and fibre intake and decreasing fat and added sugar intake) [32].

### Settings

Playgroups in Australia are informal regular community groups that are set up for babies, toddlers and pre-school children (0 to 5 years). The purpose of a playgroup is to encourage play among children to enhance their social, emotional, physical and intellectual development. Parents and carers also find it a valuable resource as they help establish support networks. Playgroups are run by volunteer parents and carers who get together once a week for a couple of hours. They are held at a variety of venues such as libraries, child and maternal health centres, church halls, kindergartens and schools. Playgroups are supported by National and State organisations [33]. The REFRESH project will be conducted in collaboration with Playgroup WA Inc. [34], as the playgroup will be used as the setting to recruit mothers and implement the project.



#### Recruitment and randomisation process

A stratified random sampling procedure will be adopted to recruit participants from 560 playgroups embedded in 106 suburbs (neighbourhoods) within the Perth metropolitan area. Stratification will be conducted by suburb geographical location and Socio-Economic Indexes For Area (SEIFA) scores. SEIFA scores are values derived from income, education level, employment status and skill level [35]. The suburbs will then be randomly assigned to either the intervention group or the control group using a table of random numbers. Control and intervention group suburbs will be arbitrarily matched for low and medium levels of socio-economic status based on the SEIFA scores. The senior Playgroup WA Inc. staff will make phone calls to all registered playgroup leaders, explain the REFRESH project and obtain permission for

project staff to contact the playgroup. Project staff will visit the playgroup to further explain the project, obtain consent and allocate participants to the intervention or control group. Intervention group participants will also complete the Physical Activity Readiness Questionnaire [36] and provide a medical certificate if deemed necessary before commencing the program.

#### Inclusion criteria

Study participants will need to be: (a) women aged 18 or over registered with Playgroup WA Inc.; (b) have a child between 0 to 5 years; (c) healthy to the extent that participation in a low-stress physical activity program would not place them at risk; (d) not taken part in any research that involves physical activity or nutrition within the last five years; and (e) not on a special diet.

#### Sample size determination

In order to detect a 20% difference in physical activity at 80% power and 5% level of significance, sample size of 310 mothers of young children are required at the 6-months post-intervention survey in each of the intervention and control groups. A small effect size (0.2) [37] is assumed for studies on behavioural effects due to the influence of extraneous variables and the subtleties of human performance. Allowing for an attrition rate of 30%, 900 mothers of young children will be recruited into the study. Sample size calculations were determined using Power Analysis and Sample Size software [38].

#### Data collection

Process data will be collected during the implementation of the intervention. The playgroup is a novel setting for the recruitment and delivery of health promotion interventions for mothers with young children. Therefore, the process evaluation will be a key component of the program's evaluation. This will be conducted with both the participants and the project staff, providing two perspectives on the program delivery and content.

Outcome data will be collected at baseline, six months and 12 months. At baseline control group participants will be hand delivered a self-completion questionnaire at the playgroup along with a self-addressed envelope and measuring tape to record waist and hip measurements. The intervention group will be provided all of the above and a pedometer to record the number of steps taken each day. At six months the control group participants will be hand delivered a self-completion questionnaire at the playgroup along with a self-addressed envelope. The intervention group will be provided all of the above and a pedometer to record the number of steps taken each day. At 12 months the control and intervention group participants will be posted a self-completion questionnaire with a self-addressed envelope.

#### Blinding

It is not possible to blind study project staff to the randomisation process, however, the participants will be blinded as to whether they are in the study or control group. The assessor will be blinded until the comparative data analysis is conducted. Participants will be given codes when recruited and these codes will be used throughout the implementation of the study. The participant codes will be revealed only at the six and 12 month comparative data analysis.

#### Statistical analysis

Data collected will be coded and analysed using the Statistical Package for the Social Sciences computer statistical software [39]. Descriptive statistics will first be used to summarise participants' demographic and health

characteristics. For the hierarchical data (repeated measurements of individuals) collected over the one-year observational period, multi-level repeated measures analyses and multivariate logistic regression analyses will be used extensively in the statistical analyses.

#### Intervention group

To facilitate the development of the intervention and to ensure adherence to its timeline, the implementation of the intervention will be organised into four stages.

##### Stage 1

**Intervention development** A literature review of nutrition and physical activity community based interventions for mothers with young children, pregnant and postpartum women has been conducted and will be continuously updated. Relevant behaviour change theories reviewed including the Social Cognitive Theory (SCT) [40], Trans-theoretical Model (TTM) [41] and motivational interviewing [42] will support the development of a multi-strategy intervention [43]. Previous qualitative data obtained from Perth playgroup mothers will be used to ascertain the barriers and facilitators to healthy eating and being physically active, as well as their preferred intervention strategies [44]. The Precede-Proceed model will be used to organise the behaviour change theories and formative research data into an appropriate nutrition and physical activity behaviour change program [45,46].

##### Stage 2

**Recruitment of staff** The program will be staffed by Health Science graduates, who will deliver the face-to-face workshop styled information and skill building sessions. Recruitment of the health promotion, nutrition and sport science graduates will be conducted via local universities and relevant professional associations.

##### Stage 3

**Staff training** Staff will receive intensive training on the application of the Australian dietary and physical activity guidelines [31,32], and behaviour change theories including motivational interviewing. They will receive a comprehensive training manual on the delivery of the face-to-face workshop sessions. The staff will also receive ongoing support via email and phone by an accredited dietician, human movement specialist, health promotion specialist and the project coordinator.

##### Stage 4

**Delivery of intervention in playgroup settings** The intervention will be delivered over six months. Interventions that aim to address multiple risk factors such as nutrition and physical activity show more positive outcomes when multiple intervention strategies are used to reach the target audience [43,47]. Hence the intervention group participants will receive four strategies: face-to-face workshop information and skill development session; mailed or emailed newsletters; SMS reminders on the

main messages of the REFRESH program; and a home-based component.

**Delivery of face-to-face workshops** The intervention group participants will receive six workshop sessions over six months (one session a month). Each session will be conducted for 30 minutes by project staff during the playgroup session at the playgroup venue. Workshops will focus on enhancing knowledge, attitudes and skills to enable informed decision making about nutrition and physical activity behaviours (Table 1).

**Delivery of newsletters** The intervention group participants will receive six newsletters via post or email over six months (one newsletter a month, one week after each face-to-face workshop session). The newsletters will be in an informal format and will contain myth dispelling information on nutrition and physical activity.

**Delivery of SMS reminders** The intervention group participants will receive 18 SMS reminders via mobile phones over six months (reminders to attend the face-to-face workshop sessions and nutrition and physical activity motivating messages).

**Delivery of home based component** The intervention group participants will receive home based resources at each of the face-to-face workshop sessions to support the content of the REFRESH program. The home based components will include a specially tailored program booklet, pedometer, menu planner fridge magnet, a shopping list with food label reading tips, a muscle strength and flexibility exercise chart fridge magnet, a physical activity diary and an 'extra' food record sheet. The workshops will offer an opportunity for these resources to be explained and for questions to be answered.

**Table 1 REFRESH Intervention**

Session (Week)	Session Details	Participant resources/interactive activities
1 (Week 1)	<ol style="list-style-type: none"> <li>Introduction to Refresh Program</li> <li>Overview of healthy eating and being physically active</li> <li>Focus nutrition: fruits, vegetables and water                             <ul style="list-style-type: none"> <li>Guidelines</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Program booklet</li> <li>Healthy recipe booklet</li> <li>Session one information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Determine participant program needs</li> </ul> </li> </ol>
2 (Week 5)	<ol style="list-style-type: none"> <li>Focus behaviour change:                             <ul style="list-style-type: none"> <li>Stages of change</li> <li>Goal setting: long and short term goals</li> </ul> </li> <li>Focus physical activity: aerobic                             <ul style="list-style-type: none"> <li>Guidelines</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> <li>Focus nutrition: five food groups and 'extra' foods                             <ul style="list-style-type: none"> <li>Guidelines</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Pedometer</li> <li>Family dinner and physical activity planner (fridge magnet)</li> <li>'Extra' food record sheet</li> <li>Session two information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Playgroup 10,000 steps per day challenge</li> </ul> </li> </ol>
3 (Week 9)	<ol style="list-style-type: none"> <li>Focus behaviour change:                             <ul style="list-style-type: none"> <li>Review established short term goals</li> <li>Set new short term goals</li> </ul> </li> <li>Focus physical activity: Muscle strength and flexibility exercises                             <ul style="list-style-type: none"> <li>Guidelines</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Muscle strength and flexibility exercise card (fridge magnet)</li> <li>Physical activity diary</li> <li>Session three information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Muscle strength and flexibility exercises</li> <li>Integrated exercises "</li> </ul> </li> </ol>
4 (Week 13)	<ol style="list-style-type: none"> <li>Focus behaviour change:                             <ul style="list-style-type: none"> <li>Review established short term goals</li> <li>Set new short term goals</li> </ul> </li> <li>Focus nutrition:                             <ul style="list-style-type: none"> <li>Healthy eating messages</li> <li>Menu planning</li> <li>Food label reading</li> <li>Making sense of nutritional claims</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Shopping list with healthy shopping tips</li> <li>Comparing packaged food per 100 g (fridge magnet)</li> <li>Session four information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Reading packaged food labels</li> <li>Developing a daily menu</li> </ul> </li> </ol>
5 (Week 17)	<ol style="list-style-type: none"> <li>Focus behaviour change:                             <ul style="list-style-type: none"> <li>Review established short term goals</li> <li>Set new short term goals</li> <li>Overcoming relapses</li> </ul> </li> <li>Focus nutrition: fats and sugars                             <ul style="list-style-type: none"> <li>Recommended intake</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Session five information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Modifying recipes</li> <li>Healthy cooking methods</li> </ul> </li> </ol>
6 (Week 21)	<ol style="list-style-type: none"> <li>Focus behaviour change:                             <ul style="list-style-type: none"> <li>Review established short term goals</li> <li>Social support</li> </ul> </li> <li>Focus nutrition: Fibre and Glycemic Index                             <ul style="list-style-type: none"> <li>Recommended intake</li> <li>Benefits/barriers/overcoming barriers</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>Resources:                             <ul style="list-style-type: none"> <li>Session six information summary pamphlet</li> </ul> </li> <li>Interactive activity:                             <ul style="list-style-type: none"> <li>Modifying recipes</li> <li>Healthy cooking methods</li> </ul> </li> </ol>

### **Control group**

The control group participants will not receive any intervention materials. Their only contact with the project will include completing the questionnaires at the three data collection periods.

### **Process measures**

#### **Participant process evaluation**

The REFRESH booklet will be assessed by the participants in terms of attractiveness, comprehension, personal relevance, believability, and legibility [48]. Workshop and staff feedback sheets will be provided to participants to assess the content and workshop delivery methods in the playgroup setting. Participants will be invited to comment on the REFRESH program's impact on their physical activity and nutrition behaviours and to provide suggestions for improvements to the intervention [49].

#### **Staff process evaluation**

The staff will provide feedback on the playgroup as a setting for health promotion programs. This evaluation will focus specifically on the playgroup characteristics, and the skills deemed necessary to deliver workshops in this setting. Staff will also provide feedback on working with mothers as a target group within the playgroup setting, what the mothers want to learn about nutrition and physical activity and common myths mothers report. Staff will also maintain a diary of their perceptions related to the delivery of the face-to-face workshop sessions, and responses by participants to the session content and activities.

### **Outcome measures**

The self-administered questionnaire will be comprised of instruments which have been previously validated and tested for reliability [50-52], and will undergo further reliability testing prior to its use at baseline.

Physical activity will be measured by The International Physical Activity Questionnaire (IPAQ) [53]. This instrument has been accepted as the physical activity measurement tool in many settings and is specifically designed for population-based prevalence studies. Muscle strength exercise assessment will be based on recommendations from the American Heart Association and Australian physical activity guidelines [54]. Physical activity knowledge will be assessed by a modified version of the American Adult's Knowledge of Exercise Questionnaire [55]. Dietary intake will be measured using a modified version of the Fat and Fibre Barometer [56]. The New South Wales Government questionnaire will be used to measure soft drinks, fruit juice and snack consumption [57]. Added sugar consumption will be assessed using the 2005 National Health Interview Survey [58]. Nutrition knowledge will be assessed by a modified version of the General Nutrition Knowledge Questionnaire [59].

Self-efficacy for nutrition and physical activity behaviours will be assessed. Nutrition and physical activity self-efficacy will be assessed using items from previously validated instruments [52]. Validated questions will also confirm participants' stages of change regarding fruit and vegetable consumption [60]. Social support for physical activity will be assessed based on items from the Sallis et al. instrument [51].

General physical and mental health will be measured by The Medical Outcomes Study Short-Form Health Survey (SF-8) [61]. SF-8 is a standard international generic instrument of health status. It comprises two summary scales - the physical component summary (PCS) score and the mental component summary (MCS) score.

Demographic characteristics will include gender, age, educational level, country of birth, marital status, socioeconomic status, financial status and co-morbidities. Anthropometric measures will include self-reported height and weight, waist and hip girth. A recent study has confirmed that self report measures are suitable for such studies when a correction factor is applied [62].

Height, weight, waist and hip girth measurements will be conducted by research staff on a random subsample of 100 participants from the intervention group. Calculations of differences between self reported and research staff measured data will be undertaken to identify a correction factor based on the methodology of Dhaliwal et al. [62].

### **Ethics**

The project protocol has been approved by the Curtin University Human Research Ethics Committee (approval number HR 186/2008).

### **Discussion**

The REFRESH project is unique in using playgroups for a lifestyle intervention. The playgroup environment is an innovative setting for health promotion for mothers with young children, as it offers an exciting avenue to reach this target group and support behaviour change. The recruitment of participants through playgroups is beneficial as it will encourage all playgroup members to register for the program, thereby not just recruiting those who are motivated to adopt health enhancing behaviour [63].

The program will provide an opportunity for a variety of strategies to be implemented and evaluated. This evaluation data will be collected from participants in their own communities and not in a research centre, making the program relevant to the community based population and not just a clinical group. The project will provide guidelines for the development, implementation and evaluation of a minimal intervention home-based tailored physical activity and nutrition program. The information gathered will be valuable in helping to identify and address the barriers to participating in physical activity

and nutrition programs for this target group. The project has the potential, to reduce chronic disease and enhance mental health for mothers of young children in the playgroup setting.

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#### Authors' contributions

SM coordinated the project, led the design of the REFRESH program and drafted the manuscript. JJ, PH, SB, CJ, SD, AM, AH and AA designed the study and revised the manuscript. All authors read and approved the final manuscript.

#### Competing interests

The authors declare that they have no competing interests.

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**PAPER 2: Physical activity and nutrition intervention for mothers of young children: Process evaluation**

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## Physical activity and nutrition intervention for mothers of young children: Process evaluation

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### ABSTRACT

**Introduction:** Process evaluation of community based projects is integral to understanding the success or failure of health promotion interventions. Process evaluation was used to assess the intervention strategies and resources in a playgroup setting aimed at mothers of young children. **Methods:** Process evaluation data were collected from participants ( $n = 249$ ) and staff ( $n = 25$ ) involved in the intervention. Data included staff perspectives on use of the playgroup as a setting, participants' views on the feasibility and acceptability of the program strategies and resources, and program reach. **Results:** Responding participants reported that the intervention was useful (98%) and relevant for their age group (92%), encouraged them to think about making changes to their physical activity (95%) and dietary (98%) behaviors, and helped them to make changes to their physical activity (66%) and dietary (79%) behaviors. Participants reported that the most useful intervention strategies included the program booklet (85%), workshops (86%), newsletters (73%) and SMS (57%). **Conclusion:** This research provides valuable information on participants' perspectives of the program strategies, content and overall implementation. It provides insight into the feasibility and acceptability of the intervention and identifies areas for improvement when conducting programs in playgroup settings. The process evaluation indicated that playgroups are a suitable setting for health promotion targeting mothers of young children.

### KEYWORDS

Diet; Physical Activity; Process Evaluation

### 1. INTRODUCTION

Physical inactivity, overweight and obesity, high blood pressure and high blood sugar are among the five leading global risks for mortality in the world [1]. According to the World Health Organisation (WHO), decreased physical activity, fruit and vegetable consumption and increased sugar and fat consumption are identified as major risk factors for cardiovascular diseases, cancer, metabolic syndrome and obesity [2].

Women are at increased risk of weight gain during their childbearing years and across the life span [3]. Obesity during pregnancy, the perinatal and the postpartum period has several negative consequences for the obese woman. Some of these include gestational diabetes mellitus, pre-eclampsia, thromboembolic disease, postpartum haemorrhage, spontaneous onset of labour and increased risk of anaesthetic complications [4]. Maternal obesity is associated with several major risks to the fetus, such as congenital abnormalities, macrosomia and increased risk of intrauterine death [5].

The Australian Dietary Guidelines recommend that women (19 to 60 years) eat at least four to seven serves of vegetables and legumes and three serves of fruit daily. However, 96% of females aged 25 - 34 years and 94% aged 35 - 44 years fail to meet these guidelines [6]. While women's physical activity levels decrease significantly after childbirth, due to life transitions that affect their priorities and lifestyle, it often results in insufficient daily levels of physical activity [7].

Research interventions have had varying degrees of

success in increasing fruit and vegetable consumption and levels of physical activity among mothers with young children [8,9]. However, the recruitment and retention of participants into community based interventions are challenging due to the increased demands on these women, which include limited time and competing priorities [10].

Process evaluation is identified as an important reporting aspect of the CONSORT statement for public health research interventions [11,12] and is regarded as an essential component of health promotion program evaluation [13]. Process evaluation measures variation in program activities, reach, participant satisfaction and perception, and quality and delivery of the program strategies and takes into account or limits the influence of Type III errors in health promotion practice [14,15].

Program evaluation in health promotion is a complex process as it aims to gather evidence to assess the effectiveness of strategies and programs, maintain a level of accountability [16] and improve health promotion practice [17]. Despite impact and outcome evaluation being the most commonly reported forms of evaluation for randomised controlled trials, process evaluation, which is under reported, is vital as it accounts for factors that contribute to the success or failure of programs [18,19].

The intervention (program) aimed to encourage participants to increase their levels of physical activity and strength exercises and to improve their diet by increasing fruit, vegetable and fibre intake and decreasing their fat and added sugar intake. Information about the program protocol has been previously published [20]. This paper reports the main process evaluation conducted with program staff and the mothers of young children participating in the playgroup based program.

## 2. METHOD

### 2.1. Theoretical Framework

The program's strategies were based on a robust process [21] using the PRECEDE-PROCEED Model [22] as the overall conceptual framework and the Social Cognitive Theory constructs such as [23], self-efficacy and goal setting, along with motivational interviewing [24]. These constructs helped to inform the intervention strategies and design. Materials and strategies designed for the intervention had a strong emphasis on improving participants' self-efficacy relating to both dietary intake and physical activity behaviour. Information presented at workshops and written resources highlighted barriers and motivators (intrinsic and extrinsic) for achieving adequate levels of physical activity and a healthy diet. The workshop sessions helped equip participants with skills and knowledge to better manage their physical activity

and dietary behaviours. For example, information on how to read food labels and tips on healthy dietary choices were provided, while text messaging reinforced healthy food choices. The program also supported goal setting, related to dietary and physical activity behaviour change and assessment of these goals as the intervention progressed.

### 2.2. Intervention

The six month intervention used four primary approaches to reach the population of interest (mothers of young children based in playgroups-playgroups are non-profit organisations, that are locally based, providing a place for children aged 0 - 4 years and their mothers' to meet, play and socialise): 1) A comprehensive *program booklet* was produced based on the Australian Dietary Guidelines [25] and Physical Activity Guidelines [26]. This contained information about sample menus, understanding food labels, healthy eating tips and how to increase physical activity, along with behaviour change and goal setting information. 2) Six 30 minute *workshops* were delivered by trained program staff (one per month) in the playgroup setting. Detailed information about staff training and workshop content has been previously published [20]. 3) Six *Newsletters* containing chatty health information were posted or emailed over the six month intervention period. Eighteen *Short Message Service (SMS)* about nutrition and physical activity were sent to participants along with 12 messages reminding them to attend the face-to-face workshops. 4) Additional *Home-Based Resources* were provided to all participants to support behaviour change at home and to assist participants when they were unable to attend the workshops. These resources included: a *pedometer* to record their number of steps on a daily basis; a *menu planner chart* containing information about the Australian dietary and physical activity guidelines [25-27] for the entire family; a *shopping list* with tips designed to help participants to understand food labels, containing information about sugar, fat and fibre in packaged foods; a strength and flexibility *exercise chart*; a *physical activity diary*; and a *recipe booklet*.

### 2.3. Intervention Program Staff

The trained program staff (n = 25) were an integral component of the six month intervention. They were recruited via universities and health associations. They were required to have good interpersonal communication skills, an ability to work with minimal supervision in a team environment and previous experience conducting group education sessions or workshops. They were provided with intensive training about the application of the

physical activity guidelines [26,27], nutrition guidelines [25], motivational interviewing [24], and Social Cognitive Theory [23]. The program staff members were responsible for implementing the program in the playgroups, and providing the link between the researchers and the playgroup participants. They kept detailed records, provided participant feedback and helped coordinate the process evaluation data collection.

## 2.4. Program Participants

The intervention group consisted of 249 mothers aged 18 and over; with at least one child between 0 to 5 years. The participants needed to be healthy to the extent that participation in a low-stress physical activity program would not place them at risk; not taken part in any research that involved physical activity or nutrition within the previous five years; not on a special diet; and registered with Playgroup WA. Participants were recruited from 30 playgroups based in the Perth metropolitan area with the assistance of Playgroups WA (peak playgroup body in WA).

## 2.5. Process Evaluation Methods

The process evaluation gathered data from two perspectives, those of program staff and those of the participants (mothers of young children). Both qualitative and quantitative data were obtained via semi-structured interviews, paper based and online surveys. Data were collected about the staff, program activities, resources and overall feedback on the program.

## 2.6. Program Staff

### 2.6.1. On-Line Survey

Fourteen program staff completed a 10 minute online survey. The staff were contacted by email and invited to complete the survey via Survey Monkey. Informed consent was obtained via email prior to completion of the survey. The survey aimed to determine barriers and facilitators to using the playgroup setting; requests for health information; reported misconceptions around health; and demographic data of the program staff.

### 2.6.2. Interviews

Twelve program staff completed a semi-structured interview which expanded on the information gathered via the online survey. The interview was designed to assess the factors related to the suitability of the playgroup setting for the delivery of the intervention for the mothers with children between 0 and 5 years; and the suitability of the program content and resources. The interview schedule explored the responses to the online survey. The interviews were conducted by a trained researcher

via telephone and were generally of 30 minutes in duration. Prior to commencement of the interview, the aim of the research was explained and informed consent was obtained. Participants received a \$20 gift voucher as an incentive.

## 2.7. Participants

### 2.7.1. Self-Complete Surveys

Surveys were completed by the participants at two time points during the six-month intervention. Survey one (n = 194: third month) was designed to determine participant perception of staff facilitation and presentation skills at workshops. Survey two (n = 174: sixth month) assessed the usefulness, relevance and suitability of all the intervention strategies and resources for supporting management and changes in physical activity and nutrition behaviours; overall perception of the program; and potential intervention improvements.

The purpose of the surveys was explained to the participants and informed consent was obtained. The surveys were distributed at the playgroups and collected on completion. The questions contained in the surveys used a 5-point Likert scale (ranging from "strongly agree" to "strongly disagree"; "very useful" to "not at all useful"; "very relevant" to "not relevant") along with several open-ended questions.

### 2.7.2. Semi Structured Exit Interviews

Twenty semi-structured exit interviews (10 completers and 10 non-completers) were conducted with randomly selected program participants, who were invited by telephone to participate in the exit interviews. A trained external researcher conducted the interviews to reduce bias. The interviews were conducted in the participants' homes or at a convenient location and were up to 60 minutes in duration. Permission was sought for recording the interviews and a \$20 gift voucher was provided as an incentive. Questions included how effective the program was, usefulness of resources and how the program could be improved. It incorporated both qualitative and quantitative questions.

## 2.8. Data Analysis

Quantitative data was coded and analysed using the Statistical Package for the Social Sciences (SPSS 18.0) computer statistical software. Descriptive statistics were used to summarise participants' demographic and health characteristics. Qualitative data were entered in NVivo, a qualitative data analysis package. The qualitative data were reviewed by two staff members. Content analysis and inductive reasoning were conducted and salient themes were identified. Ethics approval was obtained

from the Curtin University Human Research Ethics Committee (approval number HR 183/2008).

### 3. RESULTS

#### 3.1. Program Staff

The majority of staff were aged 20 to 24 years (71%), had a Health Science degree (80%) and between three to 24 months experience working in the area of health promotion (76%).

#### 3.2. Interview and Online Survey

The program staff reported that the participants were receptive to information and motivated to understand the information provided. Staff reported that the participants requested dietary related information about *carbohydrates, proteins, and fats and how they function in the body, how to creatively include vegetables in family meals, tips on healthy eating for the whole family and healthy recipe menu planning*. Participants requested information about strategies to resist eating high calorie foods. The physical activity topics about which participants wanted information included *how to fit physical activity around family activities, types of exercises that could be completed at home, activities they could complete with their children and realistic expectations of weight loss after pregnancy*. Participants also requested

information about *strategies to maintain weight while attending to the family needs*. Interestingly the staff reported a range of misconceptions around nutrition and physical activity (see Table 1).

#### 3.3. Participants

The majority of participants were aged 31 to 40 years (75%), most were in paid employment (60%), born in Australia (66%) and had two or more children (67%). Approximately half (51%) of the participants had a university degree (see Table 2).

#### 3.4. Participant's Feedback about Intervention

##### 3.4.1. Home-Based Components

Most participants indicated that the home-based component (comprised of a pedometer, menu planner, shopping list, exercise chart, menu planner and program booklet) were *useful, comprehensive, helpful, and valuable if they could not attend the workshops*. Participants reported that these resources were as good as attending a workshop, *"very helpful as I missed a couple of sessions and handouts and resources were excellent and extremely informative"*. Participants indicated the healthy eating resources provided interesting food information and were generally a good reminder when planning meals, doing

Table 1. Nutrition and physical activity misconceptions.

<i>Nutrition</i>	
	<ul style="list-style-type: none"> <li>• Canned fruits and vegetables contain minimal nutrients in comparison to fresh fruits and vegetables</li> <li>• Bananas are "a super food"—you can live on them only</li> <li>• Fruits are high in sugar and they should not be consumed</li> <li>• Fruits contain high levels of pesticides and are bad for children</li> <li>• Peas and corn do not contain carbohydrates</li> <li>• Corn is undigested in the body</li> <li>• Certain vegetables should not be consumed at night</li> <li>• Consuming the skin of root vegetables increases the risk of diabetes</li> <li>• Certain fruits (watermelon, grapes) contain a high sugar content and have a high glycemic index and should be avoided</li> <li>• Butter has more saturated fat but is better than margarine that is highly processed and contains additives</li> <li>• Vegetable and palm oil are high in saturated fat</li> <li>• Sugar is natural and hence is a better option than artificial sweeteners</li> <li>• Caffeinated drinks before exercise are good for muscles</li> </ul>
<i>Physical activity</i>	
	<ul style="list-style-type: none"> <li>• If you don't sweat you haven't exercised enough</li> <li>• You need to eat protein before doing muscle strength exercises</li> <li>• Running fast is bad for you</li> <li>• Brisk walking is better than fast walking</li> <li>• Not sure if it's okay to exercise before breastfeeding</li> <li>• Not sure if it's okay to eat before and after exercise</li> </ul>

**Table 2.** Demographics of participants (n = 249).

	N (%)
Mothers age (years)	
21 to 30	23 (9.2%)
31 to 40	187 (75.1%)
41 and above	39 (15.7%)
Pregnant/breastfeeding/postpartum	103 (41.4%)
Parity (%)	
1	82 (32.9%)
2	167 (67.1%)
Education	
Year 12/TAFE	115 (46.2%)
University	127 (51.0%)
Born in Australia	165 (66.3%)
Married/Partner	245 (98.8%)
Employment	
Casual	33 (13.3%)
Full/Part-time	117 (47.0%)
Income	
> \$50,999	32 (13.4%)
\$51,000 to \$100,999	95 (39.9%)
< \$101,000	111 (46.0%)

shopping and modifying recipes to be healthier. "There were... facts and things that I didn't know... it made me rethink... just a little bit more awareness of what you're eating and what things contain."

Participants indicated that the booklet encouraged them to think about physical activity and nutrition behaviours (93%). Other supporting resources such as the pedometer (70%), menu planner (81%) and shopping list (88%) were all reported to be useful and were well received. See Table 3 for a summary of the responses.

### 3.4.2. Newsletter

Participants reported that the newsletters were a useful method of providing nutrition and physical activity information. "They (newsletters) made you understand the correct information about lots of topics (nutrition and physical activity)", "they (newsletters) helped to change my behaviour as I now had information from the dietitian rather than a magazine."

### 3.5. Short Message Services (SMS)

Approximately half the participants reported that the

**Table 3.** Participant responses to statements relating to program resources.

Agree/Strongly agree with statement	
<b>Booklet (n = 149)</b>	
Useful advice in booklet	97% (n = 144)
Easy to understand	95% (n = 142)
Suitability for mothers	97% (n = 145)
Interesting information in booklet	98% (n = 146)
Attractive format	90% (n = 134)
Messages were relevant	91% (n = 136)
Encouraged me physical activity	93% (n = 139)
Encouraged me to think about nutrition	93% (n = 139)
<b>Workshop sessions (n = 170)</b>	
Sessions were useful	86% (n = 146)
Attendance at sessions	66% (51% - 82%)
<b>MYC resources</b>	
Newsletters were useful	73% (n = 122)
The pedometer was useful	70% (n = 120)
The exercise chart was useful	57% (n = 96)
Shopping List and the Food Label magnet	88% (n = 149)
Recipe booklet was useful	81% (n = 136)
<b>MYC Activities</b>	
The goal setting was useful	52% (n = 106)
Useful SMS reminder messages	57% (n = 90)
The 16 week physical activity diary was useful	34% (n = 56)
The Walk to the Gold Coast activity was useful	29% (n = 48)
Flexibility and muscle strength exercise	39% (n = 48)
<b>Program overall</b>	
The program was useful	98% (n = 148)
The program was relevant to me	92% (n = 138)
Encouraged me to think about dietary changes	98% (n = 149)
Encouraged physical activity changes	95% (n = 150)
Helped me change my nutrition behaviours	79% (n = 132)
Helped me change physical activity behaviours	66% (n = 110)
I would recommend the program to others	84% (n = 144)

SMS reminders (57% agreed) were useful. Participants reported that SMS were an effective method to remind them to attend the workshops and bring program resources. "Very good reminders—particularly as we're all

*busy moms*": "It helped me to remember and focus on the program" and "It was a good non-intrusive way of communication with the participants". However, some participants did not take notice of the SMS received from the program and some preferred not to receive them. "I use SMS for urgent messages, would have preferred emails" and "I never really read them (SMS)".

### 3.6. Workshops

Of those who responded to the survey one, the majority of participants stated that the *purpose of the workshop sessions were clear* (99% agreed: n = 187); *were well organised* (98% agreed: n = 189), and there were *sufficient discussion opportunities* (97% agreed: n = 188). Participants described the sessions as *inspiring*, providing *helpful reminders for eating healthily and physical activity*, and *useful information and resources*. Most participants reported that the *staff were well informed* (97% agreed: n = 192), *easy to understand* (99% agreed: n = 192) and *kept the focus of the session on the objectives* (97% agreed: n = 189).

The monthly workshops were not attended by all participants (n = 249), with attendance decreasing over the six-month intervention. Attendance at workshop one was 82% (n = 202); workshop two was 71% (n = 175); workshop three was 65% (n = 161); workshop four was 66% (n = 164); workshop five was 59% (n = 147) and workshop six was 51% (n = 127).

### 3.7. Overall Program Response

Participants responding to survey two reported that the program had helped them to change their nutrition (79%: n = 132) and their physical activity behaviours (66%: n = 110). Participants reported that the program made them think more often about what they are eating, plan meals ahead and understand the difference between diet versus healthy eating: "I think that I've gained an appreciation of what kind of information is out there about healthy eating... I did go through and picked out what I thought was the most helpful... from the information we got from I definitely found that it was valuable and worth keeping."

Suggested improvements to the program included provision of child care for workshop walking groups. In regard to resources it was suggested that there be provision of more recipes; sample shopping lists; information via email and online; a workbook; and an interactive website with a discussion board. The main reasons reported for dropping out were *returning to work* and *changes in children's sleep patterns*.

## 4. DISCUSSION

### 4.1. Overall Triangulation of Data

The process evaluation results are very positive from

both the staff and program participant perspective and compare favourably when compared to other process evaluations conducted by other projects [28,29]. The close contact that program staff maintained with the participants, may have assisted in increasing the accuracy and hence the validity of the staffs' perceptions of the program. In turn the data collected from the participants should substantiate that reported by the program staff. This triangulation of data from both the program staff and program participants strengthens the reported results [28].

### 4.2. Home-Based Component

A pilot research project in playgroups conducted by the researchers [30], along with formative data [10] informed the development of the program, indicating that the home based component should be the main focus of the intervention, as all the resources that were provided could be used by the women independently at home at a suitable time. The home-based program especially the flagship *booklet* were all reported to be useful and were well received by the women. The other supporting resources such as the *pedometer*, *menu planner* and *shopping list* were also rated positively.

### 4.3. Workshops

The workshops were designed to complement and reinforce the home-based resources while providing a means of interacting with and engaging with the participant population. Workshops can be problematic, especially with this target group, as attendance can decline over time due to competing priorities [10]. Attendance of mothers at the workshops did drop off throughout the program with 82% of mothers attending in the first month, while in the sixth month only 51% attended. The relatively short timeframe during playgroup meetings, and the need to attend to children are recognised as barriers to regular workshop attendance [10,31,32].

### 4.4. Misconceptions

An interesting and useful component of the study was the women's reported misconceptions. The education level of this study population was a reasonably high (51% university educated), yet there were some curious misconceptions or beliefs. These included, "Peas and corn do not contain carbohydrates", "certain vegetables should not be consumed at night and caffeinated drinks before exercise are good for muscles". This "misconceptions" discussion supported interaction between participants and staff, as staff could respond to these statements and further engage women in the program. The staff were trained in motivational interviewing, a technique that enabled the staff to assist the mothers to ex-

plore these misconceptions and often assist in resolving them.

Overall the program participants were positive in regard to the program resources and strategies and reported that the program helped them to *change their nutrition* (79%) and *physical activity* (66%) behaviours, which is an extremely positive reflection. The women also made a number of recommendations for future programs. These included providing *sample shopping lists*; *information via email*, *a workbook*; and an *interactive website* with a *discussion board*. All these suggested strategies are suitable for women in paid employment or those working at home caring for their children.

## 5. LIMITATIONS

Between 60% and 69% of participants responded to the process evaluation and this may have biased some of the results. However, the response rates compare favourably with similar process evaluations reported in the literature for this population of interest [33]. Also due to the close relationship between staff and participants it is possible there was some social desirability when reporting outcomes. However, all reported data were anonymous and non-identifiable which was likely to minimise potential biases.

## 6. CONCLUSION

The reported outcomes of physical activity and nutrition interventions for mothers with young children have increased gradually over the last two decades but few studies have reported detailed process evaluations of such programs. The process evaluation data indicated that the intervention's unique features such as using multiple strategies and targeting mothers via playgroups ensured that the program reached and engaged a significant proportion of the target group throughout the six month intervention. The mothers were positive about the various strategies and resources used in the intervention, indicating that the program had been implemented and delivered as intended. The combination of the home-based components supported by the interactive workshops was a suitable approach. The suggestions for improvements and refinements of the participants will be useful to make future community based health promotion interventions even more relevant to the priority population. It is recommended that more interventions include detailed process evaluation as part of their research methodology.

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**PAPER 3: Dietary outcomes of a community based intervention for mothers of young children: randomised controlled trial.**

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RESEARCH

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## Dietary outcomes of a community based intervention for mothers of young children: a randomised controlled trial

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### Abstract

**Background:** Unhealthy dietary behaviours are one of the key risk factors for many lifestyle-related diseases worldwide. This randomised controlled trial aimed to increase the level of fruit, vegetable and fibre intake and decrease the fat and sugar consumption of mothers with young children (0–5 years) via the playgroup setting.

**Methods:** Playgroups located in 60 neighbourhoods in Perth, Western Australia were randomly assigned to an intervention (n = 249) or control group (n = 272). Those in the intervention group received a 6-month multi-strategy primarily home-based physical activity and nutrition program (data is only presented on dietary behaviours). Data on dietary consumption was collected via the Fat and Fibre Barometer and frequency of serves of fruit and vegetable and cups of soft drink, flavoured drink and fruit juice. The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA), after adjusting for mother's age and the corresponding variables.

**Results:** The outcomes of the intervention were positive with the intervention group showing statistically significant improvements, when compared to the control group in the overall consumption of fat and fibre (p < 0.0005); of fibre (p < 0.0005) – fruit and vegetables (p < 0.0005), wholegrain (p = 0.002); and fat (p = 0.005) – dairy products (p = 0.006) and lean meat and chicken (p = 0.041). There were no significant changes in the consumption of sweet drinks.

**Conclusions:** This intervention was successful in improving dietary intake in the intervention group participants. The moderate positive outcomes indicate that playgroups potentially provide quite a viable setting to recruit, engage and retain this hard to reach group of mothers of young children in programs that support the adoption of health-enhancing behaviours. This adds valuable information to this under researched area.

**Trial registration:** Australian and New Zealand Clinical Trials Registry ACTRN12609000718246

**Keywords:** Community interventions, Behaviours, Mothers, Nutrition

### Background

Unhealthy dietary behaviours are one of the key risk factors for many lifestyle-related diseases worldwide [1–3]. Globally, 1.8% of the disease burden is attributed to inadequate fruit and vegetable consumption [4], while in Australia this figure is estimated to be 2.1% [5]. The economic costs associated with unhealthy dietary behaviours are substantial [6] and as the prevalence of lifestyle-related diseases such as obesity and type II diabetes increase the

associated economic costs are predicted to rise significantly [7]. Increasing healthy dietary behaviours is recognised as the single most important aspect of reducing an individual's risk of lifestyle-related disease [6].

According to the Australian Dietary Guidelines, it is recommended that individuals enjoy a wide variety of nutritious foods, including fruit and vegetables and limit their intake of foods containing saturated fat, added salt, added sugars and alcohol [7]. Guidelines suggest that adult women should consume two serves of fruit, five

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servings of vegetables, six servings of grains, two and a half servings of dairy foods or alternatives and two and a half servings of lean meat and poultry, fish, eggs or alternatives. During pregnancy and the postpartum period, these recommendations change to reflect an increased need for nutrients, vitamins and minerals.

However, global rates of fruit and vegetable consumption are low [8]. For example, in the United States approximately 74% women of childbearing age (25 to 44 years) reported consuming less than five servings of fruits and vegetables, while in the United Kingdom this figure may be between 73% and 77% [9]. In the 2011–12 Australian Health Survey [10], 55% of Australian women aged 24 to 44 did not meet the recommended intake of two servings of fruit and 92% consumed less than the recommended five servings of vegetables. The most recent Australian national data on dietary fibre obtained from the 1995 National Nutrition Survey indicates that the fibre intake of adult women of 20 g/day is less than the recommended 25 g/day [11].

Furthermore, many Australians are over consuming foods that are high in sugar and/or fat [12], with energy dense, nutrient poor (EDNP) foods, often referred to as 'extra' foods (e.g. sugary soft drinks; pies/pastries; wine) contributing to 33.8% of Australian women's mean daily energy intake [13]. This over consumption of 'extra foods' has contributed to the significant increase in the prevalence of overweight and obesity in Australian women of childbearing age, with 35% of women aged 18 to 24 years being classified as overweight or obese, increasing to 55% of women aged 35 to 44 years [14].

Factors influencing the food choices of mothers with young children are varied. Barriers to consuming a healthy diet include inadequate food related knowledge and preparation skills, [15] affordability and access to healthy produce [16], food choices based on convenience due to reduced time for meal preparation [17] and a greater focus on the family [18]. Conversely, it has been acknowledged that during this period mothers of young children may experience increased motivation to adopt healthier behaviours [19] thereby providing a window of opportunity when women may be more receptive to nutrition messages stemming from health concerns [20].

There are limited dietary interventions aimed at mothers with young children. Interventions that have been implemented have predominantly focused on weight loss outcomes as opposed to dietary behaviours and have targeted women with high body mass index scores [21–24]. The overall aim of this RCT was to improve dietary intake and increase the physical activity levels of mothers' with young children via a flexible home based multi-strategy intervention. This research paper will specifically report on the outcomes related to increasing fruit, vegetables and fibre intake and decreasing the fat and sugar-sweetened beverage consumption.

## Methods

### Design and intervention

The 6-month RCT was informed by a pilot project with regards to recruitment, retention and behaviour change intervention strategies via playgroups [25]. Playgroups provide a community-based venue for mothers' of children aged less than five years to meet and socialise in a relaxed and informal environment. The playgroup sessions are run by parents and are usually held once a week for a two-hour period. All playgroups in Western Australia (WA) are registered with Playgroups WA, an incorporated body and are not for profit.

The nutrition content of the intervention was based on the Australian Dietary Guidelines [26] and behaviour change strategies were informed by the Social Cognitive Theory [27], Trans-theoretical model [28] and motivational interviewing [29]. Behaviour change theory techniques included increasing self-efficacy, provision of nutrition information and discussion of solutions to barriers to healthy eating; increasing understanding of strategies to obtain support from family and friends; increased support for behaviour change through encouragement; skill building, rewards, positive self-talk, goal setting, monitoring and relapse prevention strategies (see Table 1). The intervention was primarily home-based and supported by five face-to-face workshops (30-minute sessions every month) at playgroups that provided an opportunity for the resources to be further explained and topics clarified. The face-to-face sessions were conducted by final year Health Science students recruited through local universities and professional associations. The program resources included a comprehensive specifically tailored information booklet, menu planner, nutritional information panel guide, guidelines for the formulation of a shopping list, recipe booklets and bi-monthly 'chatty' newsletter providing health information and health related activities. The control group completed a baseline and post-intervention questionnaire and had no other contact. Further information about the physical activity outcomes of this study has been published elsewhere [30], with this paper focussing on the dietary outcomes of the intervention.

### Recruitment and randomization

Playgroups located in 60 suburbs (neighbourhoods) in the Perth Metropolitan area in Western Australia (WA) registered with Playgroups WA were randomly assigned to the intervention ( $n = 30$ ) or control ( $n = 30$ ) group and arbitrarily matched on their Socio-Economic Indexes For Area (SEIFA) scores [14], a value derived from income, education level, employment status, and skill level. Playgroup WA staff contacted the playgroups to obtain consent for the project staff to make contact. To

**Table 1 Description of intervention linked to behaviour change theory**

Theme	Intervention	Theory
Orientation to the diet intervention (Week 1)	Distribution of resources (booklet, menu planner, recipe booklet) containing information on healthy eating (increasing fruit, vegetables and fibre and reducing fat and sugar-sweetened beverages)	expectation and expectancies; Self-efficacy (SCT)
	Barriers and benefits to a healthy diet and overcoming barriers	
Behaviour change (week 5)	Goal setting - diet	behavioural capabilities; self-efficacy
	Family dinner planner & food record sheet	Observational (SCT and TTM)
	Activity with healthy dinner planner	
	Newsletter	
Monitoring progress (week 9)	Review established goals	behavioural capabilities; self-control;
	Set new short term goals	social support; reciprocal determinism;
	Support networks	reinforcement (SCT); M
	Review resources	
	Newsletter	
Monitoring progress (week 13)	Review established goals	self-control; social support; reciprocal
	Set new short term goals	determinism(SCT); M
	Menu planning	
	Shopping list with healthy tips	
	Reading food labels	
	Newsletter	
Reinforcing messages/information (week 17)	Overcoming relapses	Social support; observational,
	Support networks	reinforcement (SCT)
	Modify recipes to make healthier	
	Healthy cooking methods	
	Newsletter	
Review and feedback (week 21)	Review of goals; review of program;	Social support; observational,
	Fibre and glycaemic index	behavioural capabilities (SCT)
	Modified recipes/healthy cooking methods	
	Newsletter	

be eligible for participation in the study, participants were required to be: women aged 18 years and above; have at least one child aged 0–5 years; and on no special diet. Of the 1140 participants who were recruited, 716 participants consented to be part of the study (see Figure 1).

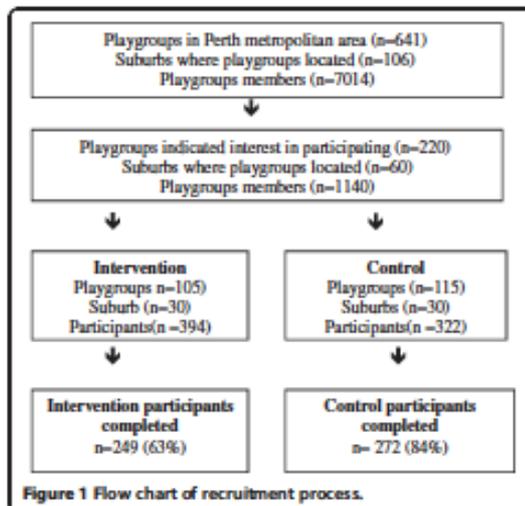
Ethics approval was obtained from the Curtin University Human Research Ethics Committee (approval number HR 183/2008). Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12609000718246.

#### Nutrition measurements

Dietary intake of participants was collected by the validated Fat and Fibre Barometer (FFB) [31]. The FFB is a brief food behaviour questionnaire that is self-administered and contains 20 food related behaviour items. It has good internal

consistency ( $\alpha = 0.86$ ) and test retest reliability ( $r = 0.92$ ). The relative validity of the FFB was assessed by comparing it to the food frequency questionnaire with weighted Kappa indicating fair to moderate agreement. The FFB assesses individual's fat-related food intake (fried foods, dairy foods, meat and chicken and butter) and fibre-related food intake (wholegrain foods, fruit and vegetables). Response values for each item range from 1 to 5, with '1' representing food behaviour associated with the high fat intake or low fibre intake, to '5' representing the low fat or high fibre intake. Fat and fibre scores are calculated by summing the scores from the corresponding fat and fibre foods assessed. Individual items (fruit and vegetables; wholegrain foods; dairy products; lean meat and chicken) were also analysed.

Additional self-administered questions assessed the frequency of serves of fruit and vegetable intake per day and cups of soft drink, flavoured drink and [32], fruit juice



consumed per day [33]. Fruit and vegetable serves were defined in the questionnaire. One serve of vegetables is equivalent to '1 cup (75 g) of cooked vegetables or legumes, 1 cup of salad vegetables, 1 small potato' and one serve of fruit is equivalent to '1 medium piece (150 g) of fruit, 1 cup of diced pieces or canned fruit, cup of fruit juice [26]. Demographic data was also collected.

#### Statistical analysis

Descriptive statistics are reported as the mean ( $\pm$ SD) for continuous data and count and percentages for categorical data (Table 1). The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA), after adjusting for mother's age and the corresponding variable at baseline (Table 2). Also, playgroups effects were treated as "block" random effects within the analysis of variance and the variability between these blocks were removed before valid comparisons between the two treatment groups were made to remove the effect of clustering by playgroups [34]. Figure 1 shows the percentage difference between the intervention and control group for Fat and Fibre Barometer and consumption of food types. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS Version 20).

#### Results

In total, 521 participants completed both the baseline and post-program questionnaire (72.8% retained). The intervention group compared to the control group had slightly higher BMI, lower fruit consumption 'above recommendation', and had a lower percentage of participants who were 'least disadvantaged' (SEIFA score). These differences, if of any effect, bias the results

against the Intervention group and hence do not compromise the validity of the research. No significant differences at baseline were present for all other variables ( $p > 0.1$ ) (see Table 2).

The continuous diet outcome variables and Fat and Fibre Barometer variables were compared between the intervention and control group post intervention (see Table 3). The intervention group was significantly higher than the control group on the Fat and Fibre Barometer, Fibre Barometer, fruit and vegetables, whole grain foods, Fat Barometer, dairy products, and meat and chicken (all  $p < 0.05$ ). These mean difference between the intervention and control ranged from 0.12 to 0.17. Intervention group participants also consumed a higher number of serves of fruit and vegetables compared to the control group. The mean differences between the intervention and control ranged from 0.16 to 0.35. No significant differences were reported between the two groups in the consumption of fruit juice drinks, soft drinks and flavoured drinks.

The effect of the intervention as compared to the control group in changing consumption is summarised in Figure 2, illustrating that the intervention increased positive behaviours in consumption by between 3.2% and 11.3% (increased consumption of lean meat and chicken (by 3.2%); wholegrain foods (by 4.7%); fruit and vegetables (by 5.0%) and decreased consumption in dairy product (by 5.2%). Daily serve of fruit (by 7.5%) and vegetables (by 11.3%) also increased.

#### Discussion

This study was conducted via a playgroup setting, in order to reach mothers of young children to provide them with a flexible home-based multi-strategy intervention. The intervention aimed to encourage an increase in their levels of fruit, vegetable and fibre intake and a decrease in their fat and sugar-sweetened beverage consumption. The outcomes of the intervention were moderately positive suggesting the program to be both acceptable and suitable for the mothers of young children.

Overall, the Intervention group improved their consumption of Fat and Fibre ( $p < 0.0005$ ) along with their Fibre ( $p < 0.0005$ ) and Fat ( $p = 0.005$ ) consumption. The reported increase in the Intervention groups' consumption of fruit and vegetables ( $p < 0.0005$ ) and wholegrain ( $p = 0.002$ ) were encouraging considering the low levels of fruit and vegetable consumption worldwide (e.g. Australia, US, UK) [10,11,15], as well as fibre [11]. However, it should be acknowledged that the actual changes in daily consumption were small and although the participants did achieve the recommended daily serves of fruit at the conclusion of the intervention, they did not achieve the recommended intake for vegetables, with the reported mean

**Table 2 Baseline characteristics of intervention and control groups**

Variables	Intervention N = 249	Control N = 272	P-value
AGE	35.9 ± 4.3	35.6 ± 4.3	ns.
BMI (kg/m <sup>2</sup> )			0.081
<25	73 (54.5%)	116 (67.1%)	
≥25 and <30	47 (35.1%)	44 (25.4%)	
≥30	14 (10.4%)	13 (7.5%)	
Vegetable consumption			ns.
Below recommendation	212 (85.1%)	215 (79.0%)	
Met Recommendation	35 (14.1%)	55 (20.2%)	
Above Recommendation	2 (0.8%)	2 (0.7%)	
Fruit consumption			0.036
Below recommendation	157 (63.3%)	143 (52.6%)	
Met Recommendation	75 (30.2%)	101 (37.1%)	
Above Recommendation	16 (6.5%)	28 (10.3%)	
Pregnant, breastfeeding or postpartum	103 (41.4%)	95 (34.9%)	ns.
Parity			ns.
1 child	82 (32.9%)	94 (34.6%)	
≥2 child	167 (67.1%)	178 (65.4%)	
Married or De facto	245 (98.8%)	265 (98.1%)	ns.
University degree or higher	127 (51.0%)	170 (62.5%)	0.008
Not employed	99 (39.8%)	94 (34.7%)	ns.
Annual household income (AUD)			ns.
<\$51,000	32 (13.4%)	27 (10.1%)	
≥\$51,000 to < \$101,000	95 (39.9%)	107 (39.9%)	
≥\$101,000	111 (46.6%)	134 (50.0%)	
SEIFA score			<0.0005
Least disadvantaged	95 (38.6%)	147 (54.9%)	
Less disadvantage	83 (33.7%)	21 (7.8%)	
Average disadvantage	34 (13.8%)	55 (20.5%)	
Disadvantaged	20 (8.1%)	36 (13.4%)	
Most disadvantaged	14 (5.7%)	9 (3.4%)	

Abbreviations: BMI/body mass index, SEIFA socio-economic index for area. ns: p-value > 0.05. Adjusted for baseline value of the corresponding variable and mothers age.

intake being 3.39 serves for day. This dietary area requires more focus and additional investigation to determine ways of increasing daily vegetable intake.

The statistical significant decrease in Fat ( $p = 0.005$ ) that included dairy products ( $p = 0.006$ ) and lean meat and chicken ( $p = 0.041$ ) was encouraging as it is well recognised that the intake of fat is high and above recommended levels [12]. However, in regards to sugar-sweetened drinks (soft drinks, fruit juices and flavoured drinks) there were no significant changes found between groups. This result is not unexpected as the intervention placed little emphasis on this aspect of diet

compared to fruit and vegetable intake, and fat reduction. Nevertheless, this area warrants further investigation as sugar-sweetened drinks such as soft drinks and juices are a common source of excess sugar, contributing to weight gain and tooth caries [35].

However, the moderate positive outcomes in regard to fat and fibre intake indicate that playgroups potentially provide quite a viable setting to recruit, engage and retain this hard to reach groups of mothers of young children in programs that support the adoption of health-enhancing behaviours [25]. More aggressive recruitment strategies, such as more personalised contact may serve to improve

**Table 3 Comparison diet outcomes between intervention and control groups**

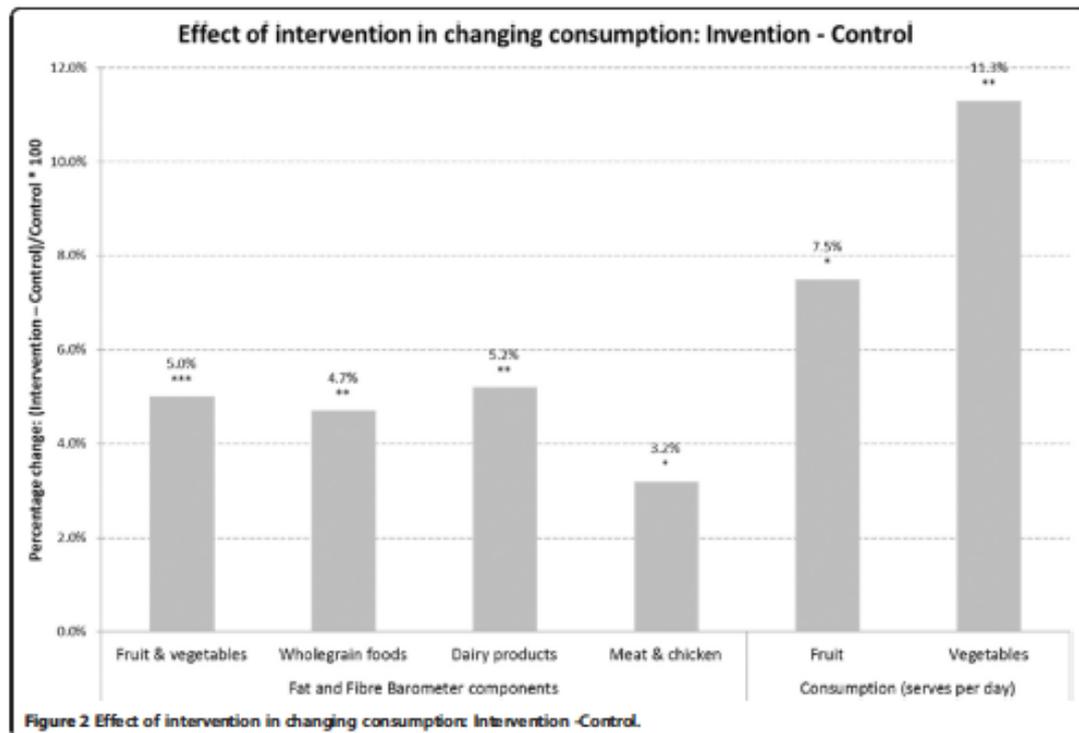
Scores	Intervention	Control	Mean difference	95% CI of mean difference	P-value
<b>Fat and fibre barometer</b>					
Fat and fibre barometer	3.63 ± 0.02	3.52 ± 0.02	0.12	0.07, 0.16	<0.0005
Fibre barometer	3.47 ± 0.03	3.29 ± 0.02	0.17	0.10, 0.24	<0.0005
Fruits and vegetables	3.39 ± 0.03	3.23 ± 0.03	0.16	0.08, 0.24	<0.0005
Wholegrain foods	3.55 ± 0.04	3.39 ± 0.04	0.16	0.06, 0.26	0.002
Fat barometer	3.73 ± 0.02	3.65 ± 0.02	0.08	0.03, 0.14	0.005
Dairy products	3.37 ± 0.04	3.21 ± 0.04	0.17	0.05, 0.29	0.006
Lean meat and chicken	3.93 ± 0.04	3.81 ± 0.04	0.12	0, 0.24	0.041
<b>Consumption per day</b>					
Fruits (serves)	2.26 ± 0.05	2.10 ± 0.05	0.16	0.01, 0.31	0.038
Vegetables (serves)	3.39 ± 0.08	3.05 ± 0.08	0.35	0.13, 0.56	0.002
100% fruit juice (serves)	0.18 ± 0.04	0.13 ± 0.03	0.06	-0.04, 0.16	0.239
Soft drinks (cups)	0.18 ± 0.05	0.25 ± 0.05	-0.07	-0.20, 0.06	0.309
Flavoured drinks (cups)	0.18 ± 0.03	0.21 ± 0.02	-0.02	-0.09, 0.05	0.517

Comparison between groups after adjustment for baseline value of the corresponding variable and mother's age.

these outcomes. It also indicates the suitability of an intervention program that is flexible and primarily home-based, but also incorporates supportive face-to-face information and skill building sessions in a relaxed, family friendly group environment. This intervention was conducted in a

'real world context' using a combination of strategies, which strengthened the program's appeal and ability to influence.

The outcomes are encouraging when the many barriers to maintaining a healthy diet that confront women of young children are considered. These include the



**Figure 2 Effect of intervention in changing consumption: Intervention - Control.**

changing priorities and competing family demands [18] reduced time for meal preparation [22] affordability and access to healthy foods [16], and at times a lack of food related knowledge and preparation skills [16]. This study comprised a range of supportive strategies able to help women make positive changes to their diet over a 6-month period. These findings provide further support for the notion that this period of early motherhood provides a 'window of opportunity' for encouraging the adoption of healthier behaviours [19], with the potential for this to have a beneficial impact on offspring.

These research outcomes are not dissimilar to the Women's Diabetes Reduction Study [36] and the Women Infants and Children Study [37]. Both studies also showed statistically significant results at six and eight months post baseline, respectively. However, as with the findings of this research, the changes in daily consumption by the intervention group of vegetables, fruit and fibre were small. Thompson et al. [36] reported an increased vegetable consumption of only 0.31, while Havas and colleagues [37] combined fruit and vegetables serving daily intakes increased by 0.10. These interventions [36,37] both targeted women, adopting similar behavioural models and strategies as used in this intervention. The theories included the Social Cognitive Theory and the Transtheoretical Model and they developed strategies that encouraged support, reduced barriers, providing knowledge and skills, incorporating goal setting and monitoring. The strategies supporting these theories also included face-to-face interventions, along with supportive information resources e.g. newsletter and written resources. Both studies acknowledged the importance of flexibility and a multi-strategy approach as a key component of these programs.

To the best of our knowledge, this nutrition behaviour change intervention may be the largest RCT to have specifically targeted mothers with young children aged 0 to 5 years [23,38,39]. A very limited number of intervention studies have been reported where all the participants were mothers with at least one young child [24,37-43], compared to those interventions that included only a small proportion of mothers with young children [36,37,44-50]. This makes this study very timely, relevant and a welcome contribution to the dietary intervention literature, providing a practical workable model to inform others.

#### Limitations

Self-report surveys were used to obtain data on the consumption of fruit, vegetable, fat and fibre and sugar (via consumption of sugar-sweetened beverages), which may have led to some over-reporting. However, this potential bias was minimised by the use of a control group that

would have responded in a similar way. The combining of both the physical activity and nutrition components into this intervention may have diluted the outcomes and it may have been better to focus on one behaviour (nutrition outcomes are only reported here). There was no endpoint to the study in the form of measurement of changes in weight, however, we chose not to focus on this, instead focussing on the positive aspects of a eating a healthy diet. Also this study's measurement of change in behaviour is limited to a 6-month timeframe.

#### Conclusions

This intervention was successful in recruiting women into a 6-month flexible and predominantly home-based nutrition intervention. It was effective in achieving its aim of increasing fibre and decreasing fat in the intervention group participants, however, it did not influence sugary drink consumption and the recommended daily serves of vegetables was not achieved. However, in this instance it was found that playgroups provide a sound avenue for reaching and recruiting women into health programs and in turn equipping them with skills and information. This intervention adds to the research in terms of the paucity of effective interventions for mothers with young children and indicates the usefulness of playgroups as a vehicle for future programs. Further research is required in this area.

#### Abbreviations

BM: Body mass index; SEIFA: Socio-economic index for areas; NS: Non-significant.

#### Competing interests

The authors declare that they have no competing interests.

#### Authors' contributions

SM coordinated the trial and reviewed the manuscript. JJ drafted the manuscript. JJ, PH, AH, SD, SB and AA designed the study and the contributed to the manuscript. SD performed statistical analysis and interpreted the data. All of the authors contributed to the submitted version of the paper. All authors read and approved the final manuscript.

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**PAPER 4: Results of a randomized controlled trial to promote physical activity among mothers with young children.**

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## Results of a randomized controlled trial to promote physical activity behaviours in mothers with young children

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### ABSTRACT

**Objective.** Increasing levels of physical activity in mothers have long-term health benefits for the mother and family. The study aimed to evaluate the effect of a six-month, physical activity RCT for mothers of young children.

**Methods.** Women were recruited via playgroups and randomly assigned to intervention ( $n = 394$ ) or control group ( $n = 322$ ). The intervention group received a six-month multi-strategy programme delivered via playgroups in Perth, Australia, measures were mean minutes per week of moderate (M) and vigorous (V) intensity physical activity (PA), and number of days/week of muscle strength exercises.

**Results.** The intervention had a significant effect on mean time for vigorous ( $p = 0.008$ ), moderate ( $p = 0.023$ ) and total physical activity ( $p = 0.001$ ) when compared to the control group. The intervention group increased their vigorous activity by a mean of 24 min/week, moderate activity by 23 min/week and total physical activity by 72 min/week.

**Conclusions.** A relatively minimum home based intervention was able to demonstrate modest but statistically significant improvements in physical activity in a hard to reach group. These changes if maintained over a longer period are likely to improve the health of mothers and have a positive impact on their partners and children.

Australian and New Zealand Clinical Trials Registry ACTRN12609000735257.

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### Introduction

Physical inactivity is identified as a modifiable risk factor that is linked to chronic disease in all ages across the globe (World Health Organisation, 2008, 2010). It is estimated to cause 6–10% of the major non-communicable diseases of coronary heart disease, type 2 diabetes and breast and colon cancer (Lee et al., 2012).

Worldwide women have lower rates of physical activity compared to men; Australia 51.4% women vs. 65.8% men; Canada 54.8% vs. 64.4%; USA 57.6% vs. 67.2%; and New Zealand 52.2% vs. 74% (Bauman

et al., 2009). Furthermore, physical activity declines during pregnancy and post-partum period (Borodulin et al., 2009; Everson, 2011; Liu et al., 2011) and is linked to the demands of multiple role expectations (Ransdell et al., 2004) (eg. caring for children) and changes in life events leading to lack of time, fatigue, lack of motivation and financial constraints (Bell and Lee, 2005; Borodulin et al., 2008; Brown et al., 2001; Symons Downs and Hausenblas, 2004). Lack of physical activity among pregnant and post-partum women is associated with negative impact on the health of the mother and the child, including gestational diabetes, mental health, musculoskeletal issues and weight gain (Pivarnik et al., 2006; Tobias et al., 2011).

In 2007–08, 45% of Australian women of childbearing age (25 and 34 years) were overweight or obese and 75% were classified as sedentary or had a low activity level (Australian Bureau of Statistics, 2009). Women's propensity to become overweight and obese during the childbearing years is linked to high body mass index (BMI) prior to pregnancy, excessive gestational weight gain, failure to lose excessive weight in the

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postpartum period within a 12 month timeframe and inter-pregnancy weight gain (Callaway et al., 2006; Davis et al., 2010; Keitt et al., 2008; Ryan, 2007). Obese women of childbearing age are at greater risk of short-term adverse health consequences during pregnancy and postpartum period (Ramachenderan et al., 2008; Ruager-Martin et al., 2010) and long-term weight retention (Linne et al., 2004; Rooney et al., 2005). Evidence also demonstrates that individuals who are overweight or obese and inactive face the highest risk of morbidity or mortality (Gore et al., 2003; Lee et al., 2009; Siega-Riz et al., 2009). Hence, improving the physical activity levels of mothers with young children is important from a public health perspective.

Systematic literature reviews report on a number of interventions for pregnant women and mothers with children (Amorim Adegboye and Linne, 2013; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Keller et al., 2008; Kuhlmann et al., 2008; Lombard et al., 2009b; Ronnberg, 2010; Skouteris et al., 2010). However, a review of the literature demonstrates that there are limited community based randomized controlled trials addressing diet and physical activity specifically designed for mothers with young children (Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Liu et al., 2009; Lombard et al., 2009a; Miller et al., 2002; O'Toole et al., 2003). Further, some of these interventions only include women with body mass index <25 (O'Toole et al., 2003) or those who are ready to be more physically active (Fjeldsoe et al., 2010). Hence, there is an urgent need for further research on tailored dietary and physical activity interventions for mothers with young children (Amorim Adegboye and Linne, 2013; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Keller et al., 2008; Kuhlmann et al., 2008; Ronnberg, 2010; Skouteris et al., 2010; Stredling et al., 2010; Thangaratinam and Jolly, 2010).

Becoming a mother is a redefining time for health, as health behaviours are often altered to accommodate the needs of motherhood (Walker and Wilging, 2000). It has been reported that after having babies women are motivated to participate in programmes to reduce their weight (Bastian et al., 2010). It therefore may be an opportunistic time to commence health promotion activities to improve women's immediate and long-term health (Walker and Wilging, 2000), which in turn will impact on the health of the children.

Recent evidence also reports that as little as 1 h of moderate intensity physical activity per week can significantly reduce women's risk of cardiovascular diseases, diabetes, breast cancer and endometrial cancer (Brown et al., 2007; United States Department of Health and Human Services, 1996). Accordingly, this study aimed to increase the levels of physical activity of mothers via a home-based intervention conducted in playgroups (Reminder on Food, Relaxation, Exercise and Support for Health: REFRESH). This paper presents changes in physical activity and muscle strength exercise from baseline to post-intervention.

## Methods

### Trial design and intervention components

The study was a two-arm (intervention and control group) randomized controlled trial (RCT). The intervention design was based on a pilot project that produced encouraging results with respect to adherence and behaviour change (Jones et al., 2010). The intervention group received a six-month physical activity intervention. The physical activity component was based on the 2007 American College of Sports Medicine (ACSM) (Haskell et al., 2007) and American Heart Association (AHA) physical activity guidelines (Pollock et al., 2000). Dietary information was also provided and outcome data collected but due to the complexity of the analysis this will be presented separately.

The behaviour change theories and techniques used to assist in the development of the intervention included the Social Cognitive Theory (Glanz et al., 2008), Transtheoretical Model (Prochaska and DiClemente, 1983) and motivational interviewing (Rollnick and Miller, 1995). The 6-month home-based intervention provided information and advice on the recommended levels of physical activity (30 min of moderate physical activity on five or all days of the week) and appropriate muscle strength and flexibility exercises. The resources comprised a comprehensive booklet, muscle strength and flexibility exercise

chart, physical activity diary and pedometer. There were four electronic (email) or hard copy (mail) newsletters containing health information and advice and 18 key short message service (SMS) on suitable health behaviours. The home based programme was reinforced by five 30 min monthly face to face workshops and skill development sessions delivered by 12 trained staff in the playgroup setting.

The resources/activities provided information on the health benefits of physical activity; encouraged skill development to support the integration of physical activity into daily living and goal setting; promoted discussion on the barriers and potential solutions to being active; supported increased self-efficacy and social support for physical activity; and provided skills to prevent relapse. Full details of the intervention are provided elsewhere (Monteiro et al., 2011). The control group did not receive the intervention, and the only contact with the project occurred when they completed the questionnaires.

### Recruitment and randomization

Playgroup Western Australia (Playgroup WA Inc.) is the governing body for playgroups in the State. Playgroups provide an informal local setting for women and children to come together to socialise. Women attend the playgroup with their pre-school child (usually 0–4 years) on a set day every week. The playgroups are run by volunteer parents and are held in a variety of venues such as church halls, community centres and child health centres. Women submit applications to join the local playgroup. Each playgroup may have up to 10 sessions per week. The number of attendees at each session is usually restricted to about 10–12 families.

Playgroup WA staff contacted playgroups registered in the Perth metropolitan area and obtained consent for the project staff to visit the playgroups. The suburbs (neighbourhoods) ( $n = 60$ ) were matched for low and medium Socio-Economic Indexes for Area (SEIFA) values and then randomly assigned to the intervention ( $n = 30$ ) or control ( $n = 30$ ) group (Australian Bureau of Statistics, 1998). (SEIFA values ranged from 866 to 1151).

To be eligible for participation in the study, participants were required to be: women aged 18 years and above; registered with Playgroup WA Inc.; have at least one child aged 0–5 years; considered "healthy" to the extent that participation in a low-stress physical activity programme would not place them at risk; and no special diet. The intervention group participants completed the Physical Activity Readiness Questionnaire (PARQ) (Thomas et al., 1992) and provided a medical certificate if deemed necessary before commencing the programme. Of the 1140 participants who were recruited, 716 participants consented to the study and were randomized to either the intervention ( $n = 394$ ) or control ( $n = 322$ ) group (Fig. 1).

Ethics approval was obtained from the Curtin University Human Research Ethics Committee (approval number HR 183/2008). Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12609000735257. Further detailed information is published in the protocol article (Monteiro et al., 2011).

### Physical activity measurements

Physical activity was assessed using the International Physical Activity Questionnaire-Short Version (IPAQ-SV) (Craig et al., 2003a). This instrument has been accepted as an appropriate physical activity measurement tool in many settings and measures physical activity in 'minutes/day' and 'days/week' (Craig et al., 2003b).

Walking, moderate physical activity and vigorous physical activity were measured independently. Moderate intensity activities were defined as those that made one breathe somewhat harder than normal and increased the heart rate. Vigorous intensity activities were defined as activities that required hard physical effort and made one breathe much harder than normal ('huff and puff').

Muscle strength exercise questions were based on the American Heart Association (AHA) guidelines (Pollock et al., 2000) and measured in 'days' (Morrow et al., 2011).

### Statistical analysis

Descriptive statistics are reported as the mean ( $\pm$  SD) for continuous data and percentages for categorical data. The effects of the intervention on continuous outcome measures were assessed using analysis of variance (ANOVA). All data was analysed including and excluding mothers

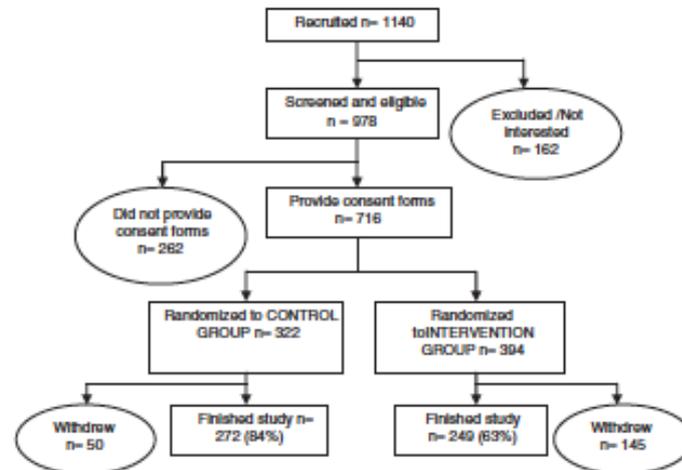


Fig. 1. Flow chart of intervention and control participants.

who were pregnant, breastfeeding and postpartum (up to 12 months). The statistical analyses were performed using Statistical Package for Social Sciences (SPSS, Version 18) and  $p$ -values  $< 0.05$  were considered statistically significant.

The baseline data for the 716 participants, were used to determine the median (or 50th percentile) for vigorous, moderate and total physical activity, all expressed as minutes per week. These medians were subsequently used to categorise each of the physical activity variables into two groups, above and below the median. A McNemar test was used to assess the change in the status of the correlated data from above or below the median at baseline to above or below the median post-intervention for each of the physical activity variables comparing the two groups.

A change in the positive direction was due to a change in the number of participants who improved in physical activity as a result of a change from below the median at baseline to a change above the median post-intervention. A change in the negative direction indicating reduction in physical activity and was the result of a change from above the median at baseline to a change below the median post-intervention. Net change for each of the physical activity variables and for each of the groups was calculated as a change in the positive direction subtracting the change in the negative direction, expressed as percentage of subjects of the total sample.

## Results

A total of 521 participants (73%) completed the study. At six months, the overall attrition was 27.3% with 16% ( $n = 50$ ) being in the control group and 37% ( $n = 145$ ) in the intervention group.

The mothers were generally above 25 years of age, with the distribution relatively similar between 25–35 and 35 years and over. The majority of women were classified as a healthy weight (60.8%), 30.2% were classified as overweight and 9% as obese. The majority of women (61.5%) were university educated (see Table 1). Of those participants who did not complete the 6-month intervention, 29.7% were pregnant, postpartum or breastfeeding compared to 38% of mothers who completed the intervention ( $p = 0.040$ ). Participants who withdrew from the study were slightly younger (about 9 months) ( $p = 0.044$ ) and had a lower waist circumference (2.8 cm) ( $p = 0.025$ ) compared to women who completed the study. Apart from these minor differences, those withdrawing before the completion of the study were comparable to those who completed the study. Mothers who withdrew were not significantly different in parity, participation in strength muscle group exercises, BMI and waist to hip ratio ( $p > 0.05$ ).

The intervention had a significant effect on the weekly mean time for vigorous ( $p = 0.008$ ), moderate ( $p = 0.023$ ) and total physical

Table 1  
Demographics of study group at baseline. Continuous variables are presented as mean  $\pm$  standard deviation (count) and categorical variables are presented as count (percentage).

	Completed		Withdraw	
	Intervention	Control	Intervention	Control
N	240	272	145	50
Age (years)	35.9 $\pm$ 4.3 (240)	35.6 $\pm$ 4.3 (272)	34.6 $\pm$ 5 (130)	36 $\pm$ 4.3 (40)
Pregnant, breastfeeding or postpartum				
No	146 (58.6%)	177 (65.1%)	97 (66.9%)	38 (76%)
Yes	103 (41.4%)	95 (34.9%)	45 (31%)	12 (24%)
Parity				
1	82 (32.9%)	94 (34.6%)	60 (42.9%)	15 (30%)
2 or more	167 (67.1%)	178 (65.4%)	80 (57.1%)	35 (70%)
Body mass index (kg/m <sup>2</sup> )	24.9 $\pm$ 4.6 (134)	24.2 $\pm$ 4.6 (173)	24.4 $\pm$ 6.5 (92)	23.1 $\pm$ 3.2 (37)
Waist circumference (cm)	86 $\pm$ 12 (134)	84.8 $\pm$ 10.7 (173)	82.7 $\pm$ 13.6 (87)	82 $\pm$ 10.4 (34)
Waist-hip ratio (cm)	0.9 $\pm$ 0.3 (134)	0.9 $\pm$ 0.1 (173)	0.8 $\pm$ 0.1 (87)	0.9 $\pm$ 0.1 (34)
Strength exercises major muscle group				
No	197 (83.8%)	204 (78.5%)	111 (84.1%)	37 (78.7%)
Yes	38 (16.2%)	56 (21.5%)	21 (15.9%)	10 (21.3%)

Table 2

Comparison of physical activity variables (mean minutes per week) between intervention and control groups. Pre, post and difference are expressed as mean  $\pm$  standard error (count).

		Intervention	Control	p-Value	Group difference mean (95% CI)
<b>All mothers</b>					
Vigorous	Pre	595 $\pm$ 5.5 (237)	81.6 $\pm$ 7.1 (265)		
	Post	762 $\pm$ 6.5 (237)	74.7 $\pm$ 6.7 (265)		
	Difference (post-pre)	168 $\pm$ 6.3	-7.3 $\pm$ 6.5	.008	24.1 (6.2, 42.0)
Moderate	Pre	765 $\pm$ 5.1 (237)	94.7 $\pm$ 6.8 (263)		
	Post	1008 $\pm$ 6.4 (237)	94.2 $\pm$ 7.2 (263)		
	Difference (post-pre)	252 $\pm$ 6.9	1.9 $\pm$ 7.5	0.023	23.3 (3.3, 43.4)
Vigorous, Moderate, Walking	Pre	195.1 $\pm$ 13.5 (238)	257.5 $\pm$ 17.6 (265)		
	Post	252.8 $\pm$ 16.4 (238)	243.2 $\pm$ 17.6 (265)		
	Difference (post-pre)	58.5 $\pm$ 15.2	-13.7 $\pm$ 14.8	.001	72.2 (30.4, 114)
Muscle strength exercises	Pre	22 $\pm$ 2.8 (222)	24.6 $\pm$ 2.6 (250)		
	Post	193 $\pm$ 2.3 (222)	20.4 $\pm$ 2.4 (250)		
	Difference (post-pre)	-40 $\pm$ 2.7	-4.7 $\pm$ 2.4	.852	0.7 (-6.3, 7.6)
<b>Excluding mothers who are pregnant, breastfeeding or postpartum</b>					
Vigorous	Pre	659 $\pm$ 7.3 (135)	80.9 $\pm$ 7.8 (172)		
	Post	881 $\pm$ 8.9 (135)	75.5 $\pm$ 8.1 (172)		
	Difference (post-pre)	218 $\pm$ 7.7	-5.4 $\pm$ 7.7	.014	27.3 (5.5, 49.0)
Moderate	Pre	821 $\pm$ 7.2 (134)	104 $\pm$ 8.2 (170)		
	Post	90 $\pm$ 8.3 (134)	92.5 $\pm$ 8.5 (170)		
	Difference (post-pre)	181 $\pm$ 9.3	-8.2 $\pm$ 8.3	.096	26.3 (1.7, 50.8)
Vigorous, Moderate, Walking	Pre	21.39 $\pm$ 18.3 (135)	265.3 $\pm$ 20.1 (172)		
	Post	27.45 $\pm$ 22.6 (135)	242.9 $\pm$ 21.7 (172)		
	Difference (post-pre)	6.16 $\pm$ 19.4	-20.3 $\pm$ 17.7	.002	82 (30.2, 133.8)
Muscle strength exercises	Pre	21.8 $\pm$ 3.9 (121)	2.6 $\pm$ 3.4 (162)		
	Post	2.25 $\pm$ 3.3 (121)	23.4 $\pm$ 3.2 (162)		
	Difference (post-pre)	-1.5 $\pm$ 3.9	-3.7 $\pm$ 2.9	.641	2.2 (-7.2, 11.7)

Physical activity variables: vigorous intensity, moderate (mod) intensity, walking and muscle strength exercises were calculated in minutes per week.

activity ( $p = 0.001$ ) but did not have an effect on muscle strength exercises ( $p > 0.05$ ) when compared to the control group (Table 2).

The intervention group increased their weekly meantime for vigorous physical activity by 24 min, moderate physical activity by 23 min and total physical activity by 72 min. Excluding mothers who were pregnant, postpartum and breastfeeding, slightly larger differences were observed between groups. The intervention and control groups were not significant in the time spent on muscle strength exercises, both for all mothers ( $p > 0.85$ ) and excluding mothers who were pregnant, postpartum and breastfeeding ( $p > 0.64$ ).

The net change for each of the physical activity variables (moderate and vigorous) and for each of the groups is presented in Fig. 2. It is calculated as a change in the positive direction subtracting the change in the negative direction, expressed as percentage of subjects of the total sample. Net change is calculated as the difference between the percentage of participants who improved, by moving to a higher category, and the percentage of subjects who were classified in a lower category of the outcome variable. The intervention group consistently showed a net positive change in the physical activity variables (moderate, vigorous, moderate + vigorous), whereas the control group consistently showed a net negative change.

The percentage of participants who improved in each of the physical activity variables under the intervention were significantly greater than the participants who declined ( $p < 0.05$ ). In the control group, however, the percentage of participants who improved in each of the physical activity variables were not significantly different from the participants who declined ( $p > 0.05$ ). Similar results were observed when the data for all mothers were analysed and when data for mothers who were pregnant, postpartum and breastfeeding were excluded from the analysis.

## Discussion

### Sample characteristics

A review of the literature demonstrates that the REFRESH physical activity study may be the largest RCT (baseline sample size of 716) specifically targeting mothers with young children (aged between 0 and

5 years) (Craigie et al., 2011; Cramp and Brawley, 2006; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Gaston and Prapavessis, 2009; Hausenblas et al., 2008; Huang et al., 2011; Jackson et al., 2011; Krummel et al., 2010; Lombard et al., 2009a; Miller et al., 2002; O'Toole et al., 2003; Polley et al., 2002; Thompson et al., 2008), except for the WIC studies which does not indicate if all women included had at least one child (Fahrenwald and Sharma, 2002; Krummel et al., 2010).

There has been limited community based intervention physical activity research programmes aimed at reaching and retaining mothers of young children (Craigie et al., 2011; Fahrenwald and Sharma, 2002; Fjeldsoe et al., 2010; Lombard et al., 2009a; Miller et al., 2002; O'Toole et al., 2003). Such interventions may be particularly challenging due to the multiple role expectations placed on women during the child-bearing years (Ransdell et al., 2004), the competing priorities and lifestyle challenges that often lead to fatigue, restrictions on time and decreased motivation (Bell and Lee, 2005; Borodulin et al., 2008; Brown et al., 2001; Symons Downs and Hausenblas, 2004). In addition, the financial costs of raising children can reduce available funds, thereby prohibiting mothers from joining physical activity programmes that charge.

This programme used the playgroup setting to reach the mothers' of young children to provide them with resources to support an increase in their levels of physical activity. The home-based support materials comprised an information booklet, exercise chart, pedometer, SMS messaging and newsletter, enabling the women to work around their family demands. However, the programme was supplemented by five short face-to-face sessions that reinforced the home-based programme, providing an opportunity to clarify information and to interact in a supportive environment.

Considering the many competing demands of parenting, the number of mothers completing this six-month intervention was very encouraging, with an overall retention rate of 73% (intervention 63%; control 84%). The attrition rate in the control group (16%) was lower when compared to studies with similar populations including Fjeldsoe et al. (25%) (Fjeldsoe et al., 2010), Miller et al. (17%) (Miller et al., 2002) and Craigie et al. (39%) (Craigie et al., 2011).

It is also encouraging that the characteristics of those women who dropped out of the programme were similar to completers (parity,

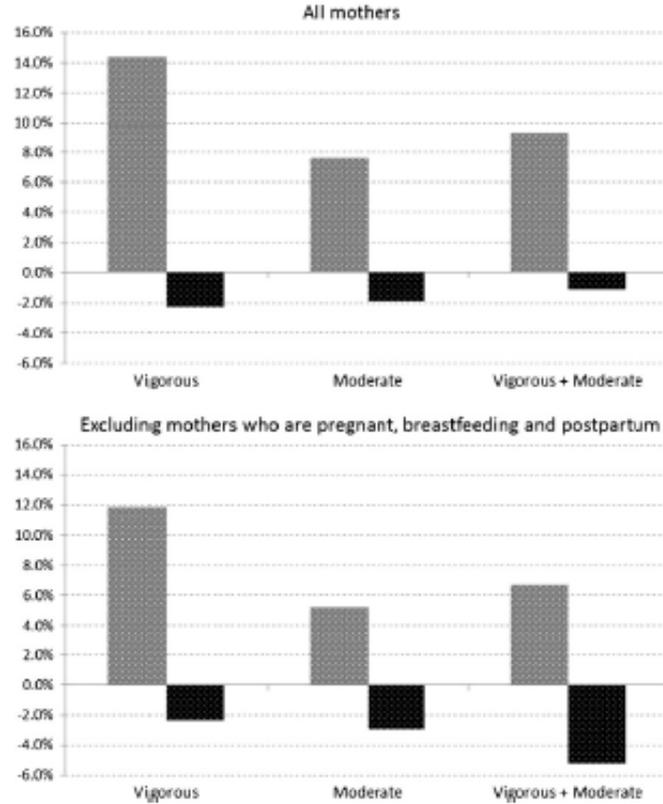


Fig. 2. Net change expressed as difference between percentage of participants who improve and participants who did not improve for each type of physical activity, in both intervention (light grey colour) and control (black colour) groups.

participation in strength muscle group exercises, BMI and waist to hip ratio ( $p > 0.05$ ), thereby increasing the relevance of the findings overall to this target group.

#### Physical activity

The main objective of this intervention was to increase the physical activity levels of these mothers. Once again the results were encouraging with the intervention participants showing significant improvements in mean minutes per week of moderate ( $p = 0.023$ ), vigorous ( $p = 0.008$ ) and total physical activity ( $p = 0.001$ ) when compared to the control group. These REFRESH study results are difficult to compare to previous research due to the differences in reporting techniques (example, minutes per day (Craigie et al., 2011), MET minutes per week (Lombard et al., 2009a), hard bouts minutes per week (Ostbye et al., 2009)). However, this study reported more encouraging results than those reported by the Active Mothers Postpartum (AMP) study (Ostbye et al., 2008, 2009), and HeLP study (Lombard et al., 2009a). The AMP and HeLP studies were predominantly face-to-face structured physical activity class interventions, which perhaps could have been better tailored to the target groups needs. The REFRESH results were similar to the Moms on the Move (MOM) study ( $p < 0.05$ ) which was a predominantly telephone based intervention providing women the flexibility of being active at times convenient to them (Fahrenwald et al., 2004). The results in this study are also very positive, due to the

programme being primarily a home-based intervention supported by a face-to-face component, making replication realisable (Noar et al., 2007).

In addition, when mothers who were pregnant, postpartum and breastfeeding were excluded from the analysis slightly larger differences in mean physical activity times were observed between the control and intervention groups. This is to be expected and highlights the need for consideration of the physiological demands of these conditions on women when designing interventions (Dewey and Lovelady, 1993; Hartman et al., 2010; Morrow et al., 2011). Specific programmes may be required for these particular target groups.

#### Muscle strength

The number of days that participants completed muscle strength exercises did not increase during the 6-month intervention. This is not unexpected, as it was a lesser component of the intervention, with the focus being on aerobic activity. Interestingly, a review of the literature, indicated that this may be the first programme that attempted to incorporate strength exercises into an intervention for this target group (Amorim Adegboye and Linne, 2013; Birdsall et al., 2009; Dodd et al., 2010; Hartman et al., 2010; Keller et al., 2008; Kuhlmann et al., 2008; Romberg, 2010; Skouteris et al., 2010; Streuling et al., 2010; Thangaratnam and Jolly, 2010). The Australian national physical activity guidelines do not include muscle strength exercise guidelines (Egger

et al., 1999) and for this reason, this type of activity may not be perceived as important for health benefits. This warrants further investigation and potentially more of a focus when designing interventions with the target group.

#### Setting

This study is one of a few interventions aimed at improving the physical activity of mothers with young children, which has been previously identified as a hard to reach group (Hartman et al., 2010). The intervention indicates that playgroups provide a valuable and viable setting to recruit, engage and retain mothers of young children in programmes that support the adoption of health enhancing behaviours (Jones et al., 2010).

#### Limitations

This programme was restricted to six-month duration, although this kind of timeframe should be adequate to reflect behaviour change (Keller et al., 2008; Kuhlmann et al., 2008). Similar to other interventions, self-selection bias can be an issue, as shown by the high number of university educated participants. However, this was minimised through the randomising of participants to the control and intervention groups. The collection of data on the age of children, length of time since birth and duration of breastfeeding would have provided greater insight into the target group but on consideration of subject burden these variables were collected. Finally, data were collected via self-complete questionnaires, which may lead to some over reporting of physical activity. The literature, however, suggests that self-report data has been found to be adequate for monitoring changes over time in such interventions, especially when a control group is also used (Dhaliwal et al., 2010; Eakin et al., 2009; Mbrey et al., 2009).

#### Conclusions

This relatively minimal intervention programme was able to demonstrate modest but statistically significant improvements in physical activity behaviour (moderate, vigorous and total physical activity) in a hard to reach target group via the playgroup setting. These changes in behaviour, if maintained over a longer period are likely to reduce the impact of several chronic conditions such as type 2 diabetes, cardiovascular disease and some cancers. In addition, the improved health behaviours of mothers are likely to also have a positive impact on their partners and children. It appears that this is one of the few effective physical activity interventions for mothers of young children reported to date (Amorim Adegboye and Linne, 2013; Hartman et al., 2010; National Institute for Health and Clinical Excellence, 2011; National Institute for Health and Excellence, 2010) and possibly the first RCT to also assess changes in muscle strength exercise activities. Further investigation of viable physical activity interventions with this target group is recommended.

#### Conflict of interest

The authors declare that there are no conflicts of interests.

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#### Author contributions

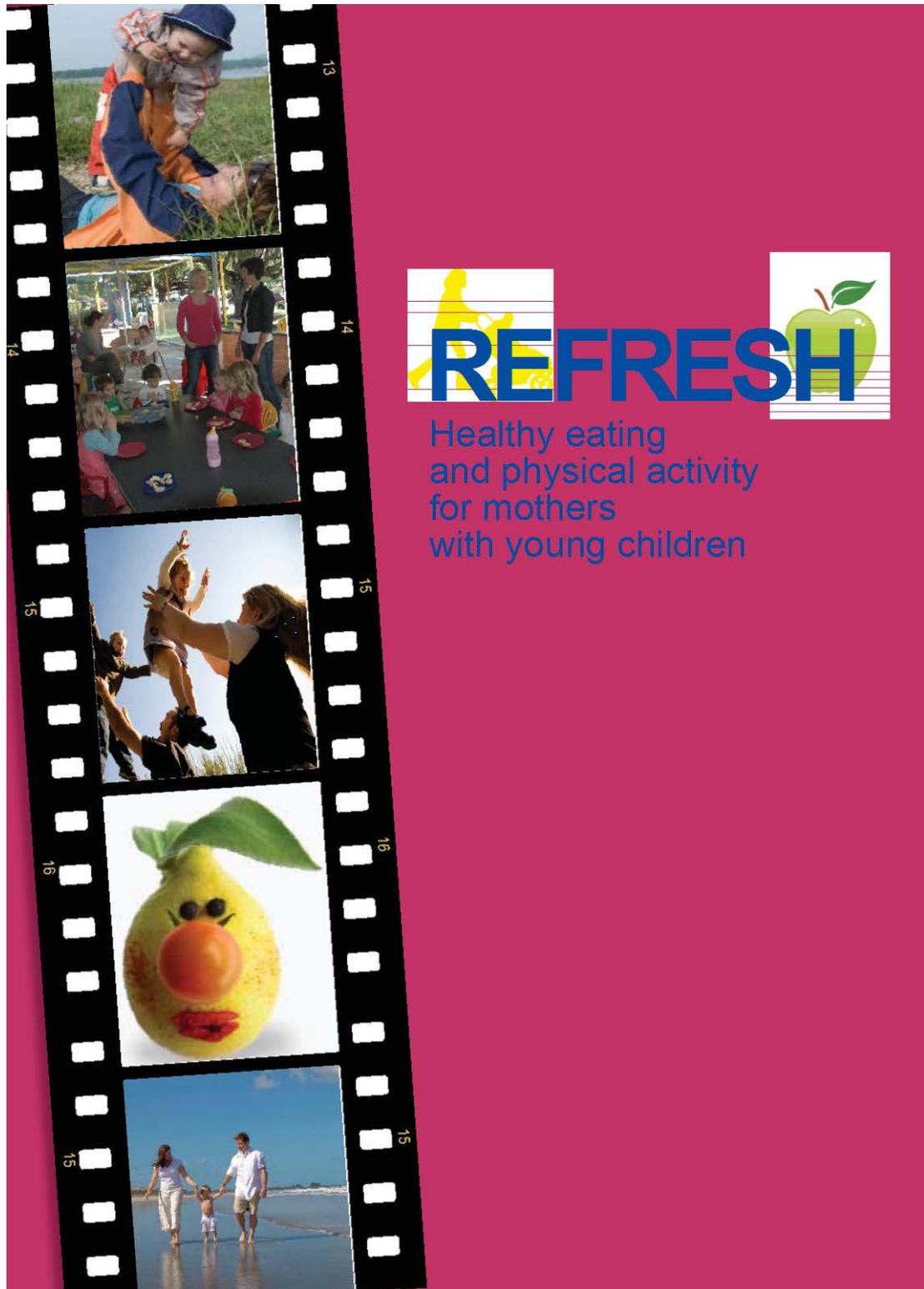
SM coordinated the trial and drafted the manuscript. JJ, PH, AH, SD, SB and AA designed the study and contributed to the manuscript. SD and SM performed statistical analysis and interpreted the data. All of the authors contributed to the submitted version of the paper.

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## APPENDIX 9 PUBLISHED BOOK



The REFRESH program is a collaboration between Curtin University (Western Australian Centre for Health Promotion Research and Centre for Behavioural Research in Cancer Control) and Playgroup WA (Inc).

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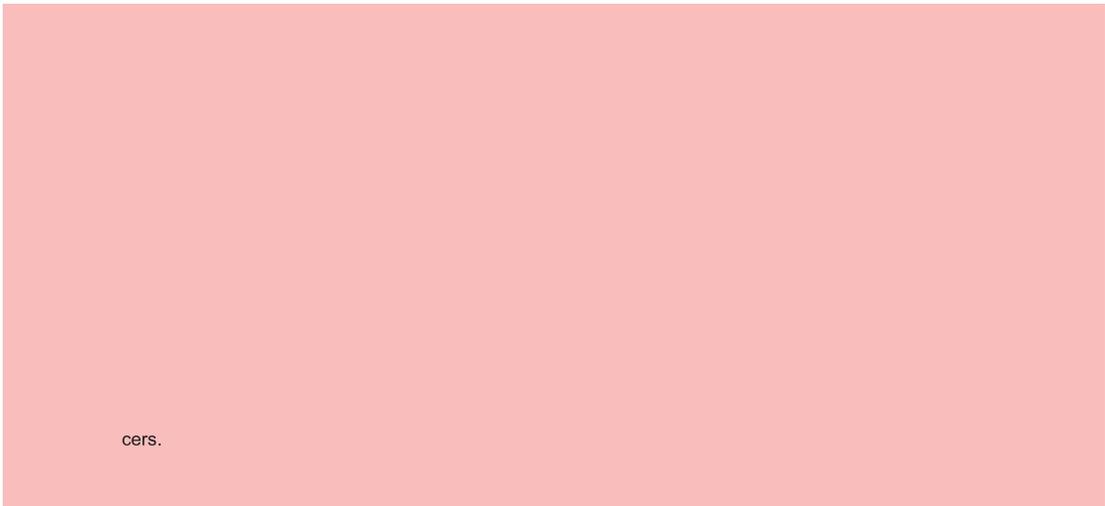


**Attention:**

This document is published for use in the REFRESH program and provides general information only. You should always consult a health care professional for specific health care information and diagnosis and treatment of health conditions.



ur  
health while taking care of your family, then REFRESH is  
the program for you.



cers.

# How ready are you

## to improve your physical activity and eating habits?

*In order to achieve a healthy lifestyle and make positive changes to your health the REFRESH program requires you to:*

- *regularly use the tips, skills and resources provided*
- *accept that making a change in physical activity and eating habits is a process, it takes time and effort*
- *start taking small steps such as swapping biscuits with a piece of fruit each day.*

*You may already have started to think about ways you can be more active or eat healthy food. However, putting your thoughts into action when you have so many other commitments may be challenging. The REFRESH program is designed to help you put your healthy eating and physical activity thoughts into actions and achieve your goals. REFRESH shows you how small changes practised over time can make a big difference to your health.*



### Changing behaviour is a **process**, not an event

Changing behaviours successfully requires you to take a number of steps and go through different stages of change similar to the process used by a child learning to walk. There are mistakes, trials, successes, setbacks and celebrations. It takes time: a child does not learn to walk overnight; there are a number of stages such as sitting, crawling and standing before the first step. It takes effort and setbacks are normal: a child may fall and get hurt when attempting to first stand but continues to try. It takes concentration: a child must think about the process of taking her first steps in order to achieve them. It takes practice: a child repeatedly practices taking the first few steps before walking effortlessly.

o reality.



## Step 2: check the *importance* of this goal to you.

1.....2.....3.....4.....5.....6.....7.....8.....9.....10  
Not at all important Very important

Ask yourself, why did you give yourself this score and what can you do to increase your importance score by one point? What are the benefits of achieving this goal?

## Step 3: check your *confidence* to achieve your goal.

1.....2.....3.....4.....5.....6.....7.....8.....9.....10  
Not at all confident Very confident

What are the barriers to achieving this goal? Can you overcome these barriers? Ask yourself, why did you give yourself this score and what can you do to increase your confidence score by one point?

## Step 4: check your *readiness* to achieve your goal.

1.....2.....3.....4.....5.....6.....7.....8.....9.....10  
Not at all ready Ready

Ask yourself, why did you give yourself this score and what can you do to increase your readiness score by one point?

## Stages of change

### *tips to move to the action stage of change*

There are six identifiable stages of change, however, these are fluid and you can skip or jump stages of change depending on the importance of your goal and confidence to achieve it.

#### **1. Precontemplation: not thinking about making a change in the next six months.**

- Think about how you physically feel when you don't do regular physical activity. Ask your friends how they feel after doing physical activity.

#### **2. Contemplation: thinking about making a change in the next six months.**

- List the pros and cons of eating healthy foods. For example, less mood swings and stable energy levels versus time it takes to cut up the vegetables.

#### **3. Preparation: looking for information and skills to make a change in the next few weeks.**

- For example, buy a new recipe book with low fat recipes or check your local paper for information about fitness activities in your area.

#### **4. Action: currently making a change.**

- Keep reading the booklet for tips on how to achieve your healthy eating and physical activity goals.

#### **5. Maintenance: made a change in the last six months.**

#### **6. Relapse: setbacks may occur and are a normal part of the change process.**

Prochaska & DiClemente, 1983

# Getting the balance right



habits.

Eat low fat, low sugar and high fibre foods.

# Healthy Eating

life.

or



# Five food groups: main nutrients in each food group

## Carbohydrates

Essential source of energy for day to day activities.

Found in food groups:

- bread, cereals, pasta, rice, noodles
- meat, fish, poultry, eggs, legumes, nuts
- vegetables
- fruits
- low fat/skim milk, cheese and yoghurt.

## Protein

Needed for building and repairing muscles, bones and other body parts.

Found in food groups:

- meat, fish, poultry, eggs, legumes, nuts
- low fat/skim milk, cheese and yoghurt.

## Fat

Provides energy, keeps you warm and protects organs.

Food groups found in:

- meat, fish, poultry, eggs, legumes, nuts
- low fat/skim milk, cheese and yoghurt.

## 13 Vitamins (A, B group, C, D, E, K)

Important for growing new cells and repairing damaged cells and muscles.

Found in food groups:

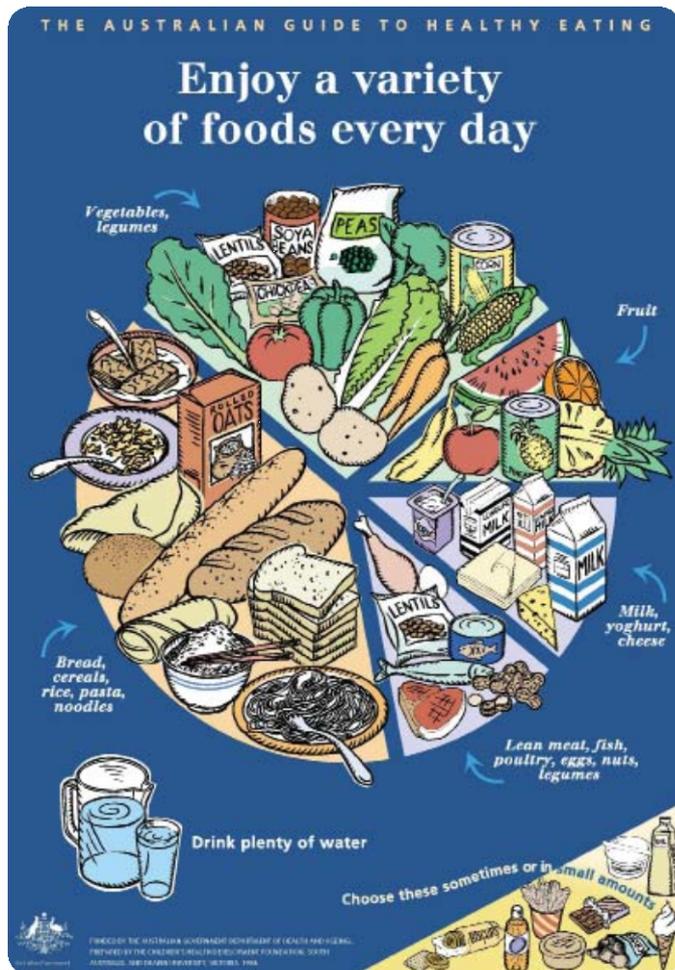
- bread, cereals, pasta, rice, noodles
- vegetables
- fruits.

## 21 Minerals

Required to activate thousands of reactions within the body such as keeping the heart beating, helping nerves and muscles to work and keeping body fluid balanced.

Found in food groups:

- bread, cereals, pasta, rice, noodles
- meat, fish, poultry, eggs, legumes, nuts
- vegetables
- fruits
- low fat/skim milk, cheese and yoghurt.



# Healthy Eating





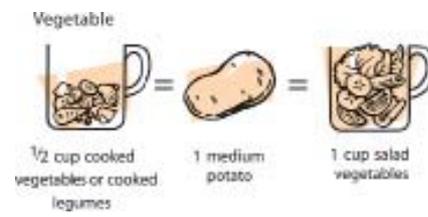
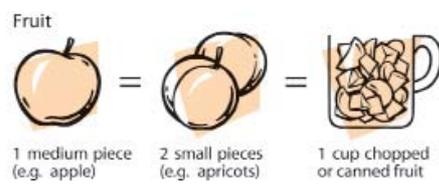
me seeds

- $\frac{1}{2} - 1$
- $1 - 1\frac{1}{2}$
- $1 - 2$
- $1 - 1\frac{1}{2}$
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- $2$
- $1\frac{1}{2} - 2$

# Healthy Eating

and has 7.5g of  
fibre!





# Healthy Eating

man, 1.66m and 68 kg. All activity should be done at moderate intensity for at least 10 minutes continuously.





take 6-8 weeks  
to get used to it!

# Healthy Eating



art disease.

### **Omega-6**

Found in: nuts, seeds and plant oils.

Function in the body: lowers blood pressure.

# Fat

*n some common foods*

# Healthy Eating

## Eat Low GI Food



after eating them. Foods with a low GI value (less than 55) contain carbohydrates that are slowly digested

d wheat	67
High GI	
Sultana bran	73
Branflakes	74
Coco Pops	77
Oats in honey bake	77
Puffed wheat	80
Cornflakes	80

## Eat low GI foods



# Healthy Eating



## Healthy Spreads

*Guacomole (avocado based dip)*

*Reduce fat cottage cheese*

*Hommus (chickpea based dip)*

*Peanut butter*

*Toffuti (tofu based dip)*

... kinds of drinks try to include some non-alcoholic drinks.

Source: Department of Health and Ageing 2010

# Healthy Cooking

- reduced fat yoghurt.
- Use pastry made with oil such as canola, sunflower or olive oil.

# Healthy Eating

an if you do not want to use oil and do not want your vegetables to stick to the pan.





drinks. Better still, drink water from the tap at home. <sup>oft</sup>

# Healthy Shopping



# Steps to understand food labels

Eating mostly fresh and minimally processed/packaged foods is the key to maintaining a healthy lifestyle. However, due to your busy lifestyle you may rely on packaged/processed foods.

Use the nutrition information panel (NIP) and tips on packaged food label to help you choose healthier products.

THINLY CUT CHIPS			
Nutrition Information Panel			
Servings per package: 7.4			
Serving size: 27g (About 18 chips)			
	Average Quantity per serve	% Daily Intake per serve	Average Quantity per 100g
ENERGY	564kJ	6%	2090kJ
PROTEIN	2.2g	4%	8.2g
FAT TOTAL	8.3g	12%	30.6g
SATURATED	2.9g	12%	10.8g
CARBOHYDRATE TOTAL	12.6g	4%	46.8g
SUGARS	1.0g	1%	3.6g
DIETARY FIBRE	0.8g	3%	3g
SODIUM	181mg	8%	669mg

## Step 1

Check the servings per package. Serving size per package provides the number of serves in a packet for an adult. Note: Serving size is not the same as the serves recommended by the Australian Guide to Healthy Eating.

## Step 2

Check the average quantity of nutrients per serve. This column shows that the amount of nutrients in one serve of food. Do not use this column to compare products as serving sizes may differ by product.

## Step 3

Use the Average Quantity per 100g column to compare energy, total fat, saturated fat and sodium.

## Tips to buying healthy packaged foods

### Step 1: Use the 100g column to compare packaged foods.

When using the 100g column to compare foods, check if the foods are low or high in energy, total fat, saturated fat, sugar and salt using the tables below.

### Step 2: Choose foods from the LOW column for energy, total fat, saturated fat, sugar and salt.

Compare SOLID foods per 100g		
	LOW	HIGH
Energy	Less than 170kJ	More than 600kJ
Total Fat	Less than 3g	More than 20g
Saturated Fat	Less than 1.5g	More than 5g
Sugar	Less than 5g	More than 15g
Salt	Less than 120mg	More than 400mg

Compare LIQUID foods per 100ml		
	LOW	HIGH
Energy	Less than 80kJ	More than 295kJ
Total Fat	Less than 1.5g	More than 10g
Saturated fat	Less than 0.75g	More than 2.5g
Sugar	Less than 2.5g	More than 7.5g

# Healthy Shopping



e information.

# Common barriers to healthy eating *and possible solutions*

Mothers commonly report the barriers below. Do any apply to you?

I feel like I don't have time or I am too busy.  
*Try one pot recipes.*

I just don't think about what I'm eating.  
*Keep a food diary for a day.*

I feel like healthy foods are monotonous and unsatisfying.  
*Include a few spices or add nuts and seeds*

I'm unable to give up my favourite foods.  
*Modify your favourite food with low fat and low sugar alternatives.  
Eat an entree size serve.*

Consuming more fruit and vegetables is very difficult.  
*Cut up fruit and vegetables and store them in the fridge for when you want to snack on a food.  
Eat fruit with yoghurt or vegies with dips.*

Fresh foods are too expensive.  
*Try the local growers markets for fresh cheap produce.*

Not sure about the importance of healthy eating or not sure how to read the food labels - all very confusing.  
*Update your knowledge by reading this REFRESH book.*

Don't feel I have the skills to prepare and cook healthy foods/meals.  
*Try the internet or your local library for some low fat recipe books.*

I tend to eat to keep others company or to be accepted.  
*Choose low fat or low sugar alternatives.*

I tend to eat when I am bored, stressed or tired.  
*Go for a walk while catching up with a friend.*

I tend to eat sugary or savoury high fat foods when watching TV.  
*Replace the ice cream with a fresh fruit salad and a tub of low fat yoghurt.*

I tend to eat when I don't feel good about myself.  
*Write down your thoughts or talk to a friend about your feelings.*

I tend to eat due to increased availability of food.  
*Carry a yoghurt tub or a piece of fruit to eat when you feel hungry while you are out and about.*



## Tips to Overcome Setbacks

Setbacks may occur and are a normal part of your journey to change. It does not mean an end to making a change in your behaviour. **Treat setbacks as temporary and get back on track as soon as you can.**

Stop, look and listen. Identify the reasons for lapses and take them as learning experiences for the future.

Stay calm and do not blame yourself.

Review your goals and take one action at a time.

Ask for help: partners, friends and family can be a real source of support if you tell them what you want.

# Healthy Eating



thy eating goals.

ast 3 times a week).

**Goal into action?**

Not at all ready

9.....10  
Ready

**Why did you give yourself this score and what can you do to increase your score on readiness by one point?**

---

# Physical Activity

Be physically active every day in as many ways as you can.

Do both aerobic & muscle-strength activities for good health.

# Physical Activity for Health

.ive —

Tip  
Think of movement  
as an opportunity  
not an  
inconvenience



# Aerobic activities

Aerobic activities or cardio gets you breathing harder and your heart beating faster. With aerobic activities, the intensity (or how hard your body is working aerobically) and the duration (length of time) of the activities is important for overall health benefits.

How do you know if you're doing light, moderate or vigorous intensity aerobic activities?

For most people, light activities are shopping, cooking, cleaning, doing the laundry or strolling in the park but these don't count towards the guidelines. Why? Your body isn't working hard enough to increase your heart rate and provide SIGNIFICANT health benefits.



## Recommendations for Aerobic Activities

It is recommended that you do either moderate or vigorous physical activity for health benefits or a combination of both.

### Moderate intensity activity

5-7 days per week  
Minimum of 30 minutes a day or  
150 minutes a week

### Vigorous intensity activity

3 days per week  
Minimum of 20 minutes a day or  
60 minutes a week

### Moderate intensity activity isn't hard!

Moderate intensity activity is when you experience a slight, but noticeable, increase in your breathing and heart rate. A good example of moderate intensity activity is when you can walk and are able to comfortably talk but not sing.

- Ballroom and line dancing
- Biking on level ground or with few hills
- Canoeing and cycling
- General gardening (raking)
- Sports where you catch and throw (volleyball)
- Tennis
- Walking briskly
- Swimming moderately
- Water aerobics
- Low impact aerobic workouts
- Strength exercises

### Vigorous intensity activity makes you "huff and puff"!

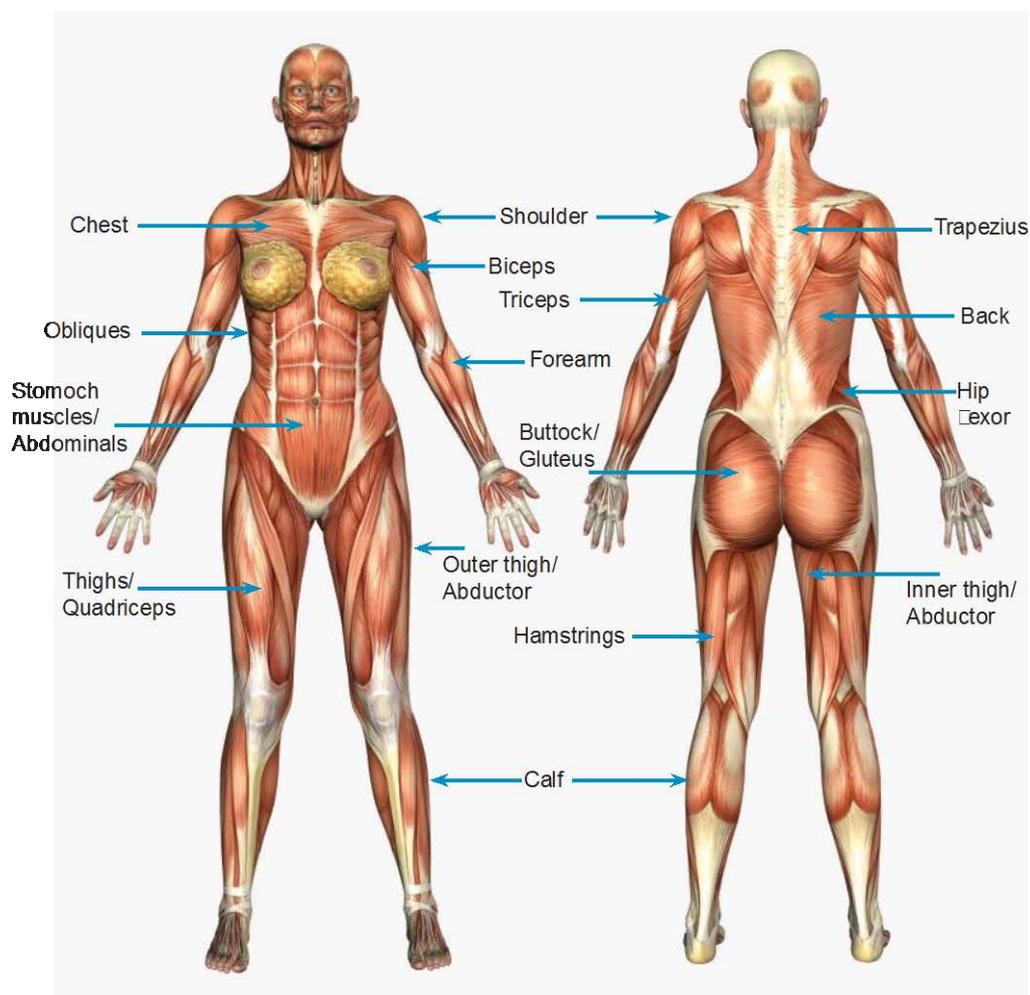
Vigorous intensity activity is when taking full sentences between breaths is difficult.

- Aerobic dancing
- Biking faster than 1km per hour
- Fast dancing
- Heavy gardening (digging, hoeing)
- Hiking uphill
- Jumping rope
- Martial arts (such as karate)
- Race walking, jogging or running
- Sports with a lot of running (netball, basketball, hockey, soccer)

# Physical Activity for Health

## Get to know your muscle groups

Regular muscle-strength and muscle flexibility activities will provide a range of benefits. These activities will prevent muscle loss, reduce the risk of injury, improve balance, range of motion, coordination, strengthen muscles as well as making your body feel toned.



# Muscle-strength

## Recommendations for Muscle-strength Activities

Frequency:	2 days per week non-consecutive
Number of exercises:	8 to 10 exercises (at least one set of exercises for major muscle groups)
Repetitions:	8 to 12 (or to the point where it's hard for you to do another repetition without help)
Sets:	3 sets
Examples:	Lifting weights, using body weight as resistance, pilates

### INSTRUCTIONS

A repetition is one complete movement of an activity, like lifting a weight or doing a sit-up.

Try to do 8-12 repetitions per exercise, this counts as 1 set.

Try to do at least 1 set of muscle-strength exercises, but to gain even more benefits, do 2 or 3 sets.

For health benefits, muscle-strength exercises need to be done to the point where it's hard for you to do another repetition without help.

#### 1. Squat or assisted squat (legs and gluteus)

If you are inexperienced with this exercise use a chair, a rail or a post for support.

Stand with your feet shoulder width apart.

Keep your back straight.

Bend your knees and lower your bottom towards the floor as if sitting down on a chair.

Make sure your front knee does not cover your toes (you should be able to see your shoes).

Push through the heel to return to the starting position and repeat exercise.



#### 2. Wall push ups (arms, chest and upper body)

Stand away from a wall and place your palms flat against the wall at shoulder-height and slightly wider than shoulder-width.

Keep your back straight and your stomach muscles tight.

Bend at the elbows and lower your body towards the wall/rail until your elbows are at least at 90 degree angles.

Return to starting position and repeat exercise.



# Physical Activity for Health

## 2. Lunge or assisted lunge (legs and gluteus)

If you are inexperienced with this exercise use a chair, a rail or a post for support.

Stand with one foot in front of the other about 90cm apart.

Keep your back straight.

Bend your knees and lower towards the floor until your front leg is at 90 degrees (you should be able to see your shoes).

Push through the heel of the front foot to return to the starting position.

Follow the same instructions with the opposite leg.



## 3. Side hip raises and front leg lifts (abductors and hip flexors)

Use a chair/rail/post for support.

Stand with your feet shoulder-width apart.

Keep your back straight and the standing leg slightly flexed.

Slowly lift one leg out to the side (try to keep lifted leg straight), pause and slowly return to starting the position.

Lift your knee towards your chest and slowly return to the starting position.

Make sure to keep the standing leg flexed at all times.

Follow the same instructions with the opposite leg.



## 5. Pelvic tilt and bottom raise (pelvic floor, hamstrings and bottom)

Lie on your back with your knees bent and your feet shoulder-width apart.

Contract your pelvic floor muscles so you can feel your lower back pushing into the floor.

Hold for 5 seconds and release.

Then, in a controlled movement lift your bottom as high as you can in line with your knees.

You will feel your head, neck and shoulder press into the floor.

Hold for 2-3 seconds before slowly returning to the starting position.

Repeat the exercise.



## 6. Side push ups (abdominals and obliques)

Lie on one side with your elbow underneath your shoulder.

Let the upper leg cross over in front of your lower leg.

Let your upper arm hang in front of you and use it to help you push your side up or give you stability.

Lift your hip up as far as possible and hold the position for 2-3 seconds before returning slowly to the starting position.

Repeat exercise on opposite side.



## 7. Bird dog (back, shoulder, gluteus and legs)

Kneel on both hands and knees with your back straight.

Your hands should be underneath your shoulder and your knees underneath your hips.

Lift the opposite arm and leg up to the same level as your back, your palms facing inside.

Slowly return to the starting position.

Repeat exercise by lifting opposite arm and leg.



## 8. Plank (abdominals and whole body stability)

If you have never done this exercise before, start with your bottom in the air and once you feel stronger lower your bottom at shoulder height. You can also start on your knees and once you are confident, you can do it on your toes instead.

Lie on your stomach, put your elbows underneath your shoulder.

Push your body up on your elbows and knees/toes

Keep your back straight and your face down.

Remember to keep your tummy muscles tense at all times while performing the exercise.

Hold this position for 1-5 seconds, provided it is pain free and you are maintaining good posture.



# Physical Activity for Health

## Flexibility activities

### Recommendations for Flexibility Activities

Frequency:	Whenever doing aerobic or muscle-strength activities
Number of exercises:	At least one stretch for each major muscle group
Duration:	15 to 20 seconds or until the furthest comfortable position
Examples:	Stretches, yoga

#### INSTRUCTIONS

Do each stretch evenly and hold each stretch for at least 15–20 seconds.

If you feel pain or discomfort, ease the stretch and do it again slowly.

Only stretch to a comfortable point.

#### 1. Calf stretch

Place one foot in front of the other approximately 90cms apart with both feet pointing forward.

Place your hands against a wall approximately shoulder-width apart.

Bend the front knee while extending the back leg.

Press your heels down on both feet and gently move your front knee forward until you feel a stretch in the calf of the back leg.

Your front knee should not extend past the toes of your front foot.

Repeat on opposite leg.



#### 2. Hamstring stretch

Extend your left leg in front of you and keep your knee and back straight.

Lean forward at your hips until you feel a stretch in the back of your upper left leg.

Repeat on opposite leg.



# Flexibility activities

## 3. Quadricep stretch

Stand and use a chair for balance.

Bend your right leg back and grab your ankle or foot with your right hand so that your foot comes towards your bottom.

Keep your knees together and your back straight.

Draw the hip and knee back towards your bottom until you feel a stretch in the front of your upper leg.

Repeat on opposite leg.



## 4. Glute stretch

Sit down with one leg crossed over the other.

Place the opposite arm (to the leg) over the leg that is on top and press your elbow into your knee.

Repeat on opposite side.



## 5. Hip flexor

Kneel down on one knee with the front knee at 90 degrees.

Keep your back in a neutral position.

Gently step forwards until you feel a stretch in the front of your hip.

Hold this position for 15 – 20 seconds.

Repeat on opposite leg.



## 6. Chest stretch

Stand in a neutral position, with knees slightly bent and shoulder-width apart.

Clasp your hands together behind your back with your palms facing towards your body.

Extend your arms behind your body and hold this position for 15 – 20 seconds.

Repeat.



# Physical Activity for Health

## 7. Shoulder

Stand in a comfortable position, with knees slightly bent and shoulder-width.

Bring right arm across your chest, place left hand onto right elbow for support and hold for 15–20 seconds.

Slowly return to starting position.

Repeat with opposite arm.



## 8. Triceps

Stand in a comfortable position, with knees slightly bent and shoulder width apart.

Raise left arm above head and bend at elbow.

Grasp left elbow with right hand and bring left palm towards back.

Gently push elbow down until a slight stretch is felt and hold this position for 15–20 seconds.

Repeat on opposite arm.



## 9. Upper back stretch

Stand in a neutral position, with knees slightly bent and shoulder width apart.

Clasp your hands together in front of you with your palms facing towards your body.

Extend your arms in front of your body and hold this position for 15–20 seconds.

Repeat.



## 10. Groin stretch

Begin by sitting down with the insides of your feet together and back straight.

Using your elbows, gently push your knees down towards the floor until you feel a stretch in the groin and hold for 15–20 seconds.

Repeat.





*ach day.*

**41**

|

# Physical Activity for Health

## Integrated exercises

Here is a range of integrated exercises for you to do with your child and to incorporate into your everyday activities. They provide an ideal way to be active while enjoying time with loved ones.

### 1. Baby lifting

Lie on your back, holding your baby above you.

Gently extend your arms lifting your baby into the air.

Bring your arms down and elbows close to your body.

The muscles will work harder when the movements are slower and more controlled.



### 2. Buggy squat

Hold on to the buggy and stand with your feet shoulder-width apart, your toes should be pointing slightly outwards.

Keep your back straight.

Bend your knees and lower your bottom towards the floor as if sitting down on a chair.

Make sure your front knee does not cover your toes (you should be able to see your shoes).

Push through the heel to return to starting position.

Repeat.



### 3. Sofa dips

Sit on the sofa arm with your hands resting next to your thighs.

While keeping your hands on the sofa arm, push hips forward and off the sofa.

Bend your elbows and lower your body (stay close to the sofa arm) until your elbows are at right angles.

Your knees should be hip-width apart and your thighs at a right angle to the floor.

Push your body up and repeat.



# Integrated exercises

## 4. Chest press

Sit tall and pull your navel back to your spine.

Tighten your abdominal muscles and bring your hands together in front of your chest with your elbows at the same height.

Push your hands together firmly and hold the tension for 5 seconds.

Repeat as many times as you can.



## 5. Shopping-bag raise

Stand with two shopping bags of equal weight by your sides.

Bend your knees to pick up the bags and slowly stand up, but don't straighten your legs completely.

Keep your back straight while lifting the bags.

Raise your arms to your sides until almost parallel to the floor.

Slowly return your arms to the side of your body and repeat.



## 6. Toe stands

Stand with feet shoulder width apart.

Keep your back straight and slowly lift your heels as far up as possible without losing balance.

Hold for 5 seconds before slowly coming down with your heels to the floor.

Repeat.



# Physical Activity for Health

## Tips from other mothers on getting physically active

- **Try adding activity to your daily routine in small ways.** Remember, it's not all or nothing. Even if your plan for the day doesn't work out, try to fit in a 10 minute walk. Accumulating three 10 minute bouts of moderate intensity is easier than you think.
- **Wake up 15 minutes earlier** in the morning to do some activity.
- **Get your heart rate up** during the day by pushing your children on the swing.
- **Moderate-intensity aerobic exercise can be as simple as taking your children to the park** and doing a brisk walk or skip or just dancing to music or an exercise video - remember 10 minute bouts.
- **Don't give up.** Don't be discouraged by the effort needed at first. Progress can be slow and it is very common for mothers to find it difficult to feel or see the results initially.
- **Make it a habit.** Mark down the days and times on your calendar, so you don't double book and miss out. *Enjoy it!*
- **There are always things that need doing, but most can wait for a while.** You will feel much better after participating in some physical activity (alone or in a group).
- **Regular 'time out' helps you to be happier,** more relaxed and fun to be around - it has benefits for the whole family.
- **Try leaving your child/children with your partner, friend, family member or neighbour while you do one lap of the block.** Drop in and see how things are going. Increase the number of laps as you get more confident.
- **Make it a family affair.** Take your partner, your children, or a friend with you during exercise to add some fun to your routine. This is also a good way to encourage your kids to be physically active and get them committed early to a lifetime of health.





**tep 5: Cool down and stretch**

# Physical Activity for Health

## Physical activity plan

Below is a table to use as a guide for gradually increasing levels of physical activity over time. Remember it is only a guide and it is up to you to establish a plan and set physical activity goals.

WEEK	Number of DAYS per week	Minutes of AEROBIC activity per day	Number of STRENGTH exercises per day	Number of FLEXIBILITY stretches per day
1	2 to 3	10	5	10
2	2 to 3	10	5	10
3	3 to 4	15	6	10
4	3 to 4	15	6	10
5	3 to 5	20	6	10
6	3 to 5	20	6	10
7	3 to 5	20	7	10
8	3 to 5	25	7	10
9	3 to 5	25	8	10
10	3 to 5	30	8	10
11	3 to 5	30	8	10
12	4+	30	8	10
13	4+	30	8	10
14	4+	30	8	10
15	4+	30	8	10
16	4+	30	8	10

## Physical Activity: Keep it up or Step it up

If you are already doing 2 hours and 30 minutes of moderate intensity physical activity and you want to add more health benefits...

- **Slowly add more time to your weekly routine.**
- **Add more effort:** move from light to moderate intensity aerobic activity and walk briskly. If already doing moderate intensity activity, replace some of it with vigorous activity. Adding vigorous activity provides the same health benefits in less amount of time. 15 minutes of vigorous physical activity provides the same health benefits as moderate intensity activity.



*by one point?*

*readiness*



***Making sense  
of your health***

# Your health and body fat

Your health is linked to the amount, type and places your body fat is stored. Hence, it is important to understand how your body fat functions and its relationship to your eating and physical activity habits.

## A certain amount of body fat is essential for normal bodily functions.

It regulates body temperature, cushions the internal organs and regulates how much we eat, how much energy we burn, how our immune system works and how we reproduce. Most importantly, body fat is the body's energy storage system.

## There are two types of body fat: subcutaneous and visceral body fat.

Subcutaneous fat is noticeable as it is found just underneath the skin, which may cause dimpling and cellulite.

Visceral fat, on the other hand, is bad for health as it is located in the abdominal cavity. Visceral fat may surround vital organs such as the heart and liver or get inside the blood stream and affect organs such as the heart. The more visceral fat a person has, the greater the chance of organs clogging up and normal functioning prevented. Visceral fat is associated with diabetes, hypertension, heart disease and stroke. Visceral fat does not interfere with the fit of your jeans, but is bad for your health.



healthy foods.

## The total amount of body fat is affected by your genetics and your everyday food, physical activity and relaxation patterns.

Genetic factors mean that you may inherit a large body size or slow metabolism (the rate at which the energy from food and drink is used in your body). However, the factors recognised as causing an increase in body fat are unhealthy food and lack of physical activity.

## An increase in body fat may result in WEIGHT GAIN.

Body fat increases to unhealthy levels when the amount of kilojoules consumed from food and drink is more than the amount of kilojoules you use being physically active. These excess kilojoules from food and drink are changed to fat in the body and stored in fat cells. These fat cells increase in size with the extra fat and may increase in number to store this extra fat, resulting in an increase in overall body fat and body weight.

### Fact

*Eating healthy foods and being physically active can reduce the size of the fat cells but that's up to you!*



w	0.80cms or below	Low
0.96cms to 1.0cms	0.81cms to 0.85cms	Moderate
1.0+cms	0.85+cms	High

## Weight gain during pregnancy and after childbirth



# Relaxation techniques you can try

## Tips from other mothers to help you relax

- **Make Time For You:** Make it a priority to take some time to just relax and recharge.
- **Take a few deep breaths** when doing the dishes or putting out the washing. Read a good book, take a bath, have a nap, phone a close friend or lie on the couch and listen to relaxing music.
- **Sleeping at approximately the same time each night can help you feel more refreshed.** If you have very young children, work around their sleeping and eating schedules and get as much rest as possible.
- **Try using relaxation techniques as a daily routine.** It may be easier to practise  rest thing in the morning before you need to take care of other things.
- **Choose a relaxation technique that interests you,** and that fits your lifestyle and your fitness level. The techniques can be combined and performed together.

## Examples of relaxation techniques

- **Being physically active every day.**
- **Stretching and breathing** helps loosen tense muscles.
- **Deep breathing:** breathe in through your nose right down to your stomach, then breathe out slowly, concentrating on letting the muscles of your body relax. Try this while hanging out the washing or doing the dishes.
- **Mindful meditation** helps deal with stressful situations by accepting them as they come and being aware of them.
- **Massage** can be great for relaxing and relieving stress and tension. It is not necessary to follow any set type of massage to get a good result. Ask your partner/husband to give you a shoulder massage for ve minutes.
- **Aromatherapy** is the use of oils and herbs that help reduce stress. Try a scented oil bath or hand cream to help calm you down.
- **Keep your sense of humour.** Laughing is well known to help release the feel good hormones in the body. Join a laughing club or just laugh every day!

## Things to avoid when stressed

**Avoid caffeine:** Caffeine is found in stimulant found in food and drinks such as coffee, chocolate and tea. Caffeine causes the release of stress hormones which increases the heart rate and blood pressure. Excessive caffeine can cause restlessness, insomnia, agitation, diuresis, decrease in appetite and a decrease in calcium absorption.

**Avoid eating excessive amounts of high sugar foods** such as chocolate, muffins and cakes to deal with stress. Sugars in the diet increase the levels of sugar in blood causing mood swings and affect your ability to think and cope with the stressful situation.

# Food and physical activity

## How much physical activity should you do to burn off the kilojoules in food?

52

Type of Food	Quantity	Fat (teaspoons)	Sugar (teaspoons)	Kilojoules	Physical activities in minutes							
					Brisk Walking	Dancing	Bicycling moderate pace	Gardening	Housework	Swimming	Skipping	
Meat Pie	174g	4	0.3	1608	2 hrs	1 hr 20 mins	1 hr	1 hr 30 mins	2 hrs	45 mins	30 mins	
Fried break-fast	2 bacon rashers, 2	9.5	1	3032	3 hrs	2 hrs 30 mins	2 hrs	2 hrs 45 mins	3 hrs 40 mins	1 hr 25 mins	1 hr	
Takeaway burger	217g	4	3	2094	2 hrs 20 mins	1 hr 45 mins	1 hr 20 mins	2 hrs	2 hrs 30 mins	1 hr	45 mins	
Carbonara pasta	300g	3.5	1.5	1644	2 hrs	1 hr 20 mins	1 hr	1 hr 30 mins	2 hrs	45 mins	40 mins	
Iced dough-nut	129g	6	7	2316	2 hrs 30 min	2 hrs	1 hr 25 mins	2 hrs	3 hrs	1 hr 4 mins	51	
Large fries	140g (36 chips)	5	0.5	1838	2 hrs	1 hr 30 mins	1 hr	1 hr 40 mins	2 hrs 15mins	1 hr	40	
Takeaway pizza	2-3 slices (235g)	6	0.5	2801	3 hrs	2 hrs 20 mins	1 hr 40 mins	2 hrs 30 mins	3 hrs 25 mins	1 hr 20 mins	1 hr	
Fish and chips	100g fish & 180g chips (36 chips)	6.5	0.5	2859	3 hrs 10 mins	2 hrs 20 mins	1 hrs 45 mins	2 hrs 40 mins	3 hrs 30 mins	1 hr 20 mins	1 hr	
Ice cream	77g	2.5	4.5	868	1 hr	40	30	1 hr	1 hr	25	20	
Crisps	50g	3.2	0.06	1097	1 hr 15 mins	1 hr	40	1 hr	1 hr 20 mins	30	20	
Large milk-shake	410ml	2.4	11.5	1665	2 hrs	1 hr 20 mins	1 hr	1 hr 30 mins	2 hr	45	40	
Chocolate bar	50g	3	5.5	1100	1 hr	1 hr	40	1 hr	1 hr 20 mins	30	30	

Source: Calorie King 2010 Note: Approximate length of physical activity is based on female, 35 years, 166cm and 65kg.

Type of food	Quantity	Kilojoules	Physical activities in minutes							
			Brisk Walking	Dancing	Bicycling moderate pace	Gardening	Housework	Swimming	Skipping	
Pork chop	100g	605	40	30	20	30	45	20	15	
Barbecue chicken breast (with skin)	Small piece	1300	1 hr 30mins	1 hr	45	1 hr	1 hr 30 mins	40	30	
2 fried eggs	2 eggs	835	1 hr	41	30	45	1 hr	25	20	
Boiled/poached eggs	1 egg	290	19	14	10	15	20	10	10	
Almonds	1.5 tbsp (30g)	730	50	35	30	40	1 hr	20	15	
2 slices cheese	2 slices (42g)	700	1 hr	35	26	40	1 hr	20	15	
Milk	1 punnet (200ml)	680	45	33	25	35	1 hr	20	15	
Sausage	80g (1 thick sausage)	750	50	40	30	40	1 hr	20	20	
Soft drink	375ml can	695	45	30	30	40	1 hr	20	15	
Diet soft drink	375ml can	10	1	1	0	1	1	0	0	
100% Juice	1 cup (250ml)	397	2 hrs	1 hr	1 hr	1 hr 30 mins	2 hrs	45	40	
Beer (mid strength)	1 can/bottle (375ml)	545	40	30	20	30	40	15	10	
Wine	Small glass (120ml)	375	25	20	15	20	30	10	10	

# Food and physical activity

Type of food	Quantity	Kilojoules	Physical activities in minutes							
			Brisk Walking	Dancing	Bicycling moderate pace	Gardening	Housework	Swimming	Skipping	
2 slices white bread	2 slices- 60g	585	45	30	20	30	45	15	10	
Rice	1 cup cooked	870	1 hr	43	32	48	1 hr	30	20	
Pasta	1 cup cooked	545	30	30	20	30	40	15	10	
Corn Flakes	1 cup (30g)	475	30	30	20	30	30	15	10	
Natural muesli	½ cup (45g)	765	1 hr	40	30	45	1 hr	20	20	
Wholegrain biscuits	2 biscuits (30g)	450	30	20	20	30	30	10	10	
Porridge	30g	600	40	30	20	30	45	20	10	
Salad	1 cup (250g)	85	5	5	5	5	5	5	5	
Baked beans	½ cup (125g)	520	35	30	20	30	40	15	10	
Banana	Small (100g)	375	25	20	15	20	30	10	10	
Skim milk	1 punnet (200g)	425	30	20	15	30	30	10	10	
Fruit yoghurt	1 punnet (200g)	835	1 hr	40	30	45	1 hr	30	20	
Diet fruit yoghurt	1 punnet (200g)	380	30	18	15	20	30	10	10	
Low fat sausage	70g	400	26	19	15	20	30	10	10	
Baked fish	100g	460	30	20	15	25	30	15	10	
Steak	Small (80g)	730	1 hr	30	30	40	1 hr	20	15	
Mince	100g	710	47	35	25	40	1 hr	20	15	

Source: Calorie King 2010 Note: Approximate length of physical activity is based on female, 35 years, 166cm and 65kg.

## For more information

For more information:

*Cancer Council WA*  
[www.cancerwa.asn.au](http://www.cancerwa.asn.au)

*National Heart Foundation WA*  
[www.heartfoundation.org.au](http://www.heartfoundation.org.au)

*Diabetes WA*  
[www.diabeteswa.com.au](http://www.diabeteswa.com.au)

*Go for 2 & 5*  
[www.gofor2and5.com.au](http://www.gofor2and5.com.au)

*Local Child Health Centre Health Department of WA*  
[www.health.wa.gov.au](http://www.health.wa.gov.au)  
1300 135 030

*Ngala for Parenting Information*  
[www.ngala.com.au](http://www.ngala.com.au)  
(08) 9368 9368

*Raising children network*  
[www.raisingchildren.net.au](http://www.raisingchildren.net.au)

*Australian Department of Health and Ageing*  
[www.alcohol.gov.au](http://www.alcohol.gov.au)

*Health Insite*  
Glycemic Index  
[www.healthinsite.gov.au](http://www.healthinsite.gov.au)

*King Edward Memorial Hospital*  
Breastfeeding centre of WA  
[www.kemh.health.wa.gov.au](http://www.kemh.health.wa.gov.au)  
(08) 9340 1844

*King Edward Memorial Hospital*  
Perinatal Mental Health Unit  
[www.kemh.health.wa.gov.au/health/emotional\\_health/index.htm](http://www.kemh.health.wa.gov.au/health/emotional_health/index.htm)

*Postnatal and Antenatal Depression Services*  
[www.panda.org.au](http://www.panda.org.au)

*Emotional Health During Pregnancy and Early Parenthood*  
[www.beyondblue.org.au](http://www.beyondblue.org.au)

*Parenting WA Line*  
(08) 6279 1200 or Country callers 1800 654 432

*Ishar Multicultural Women's Health Services*  
(08) 9345 5335

*WA Transcultural Mental Health Centre*  
(08) 9224 1760

*Womens Health Services*  
[www.whs.org.au](http://www.whs.org.au)  
(08) 9227 8122 or Country Callers 1800 998 399

# 10,000 Steps A Day Pedometer Challenge

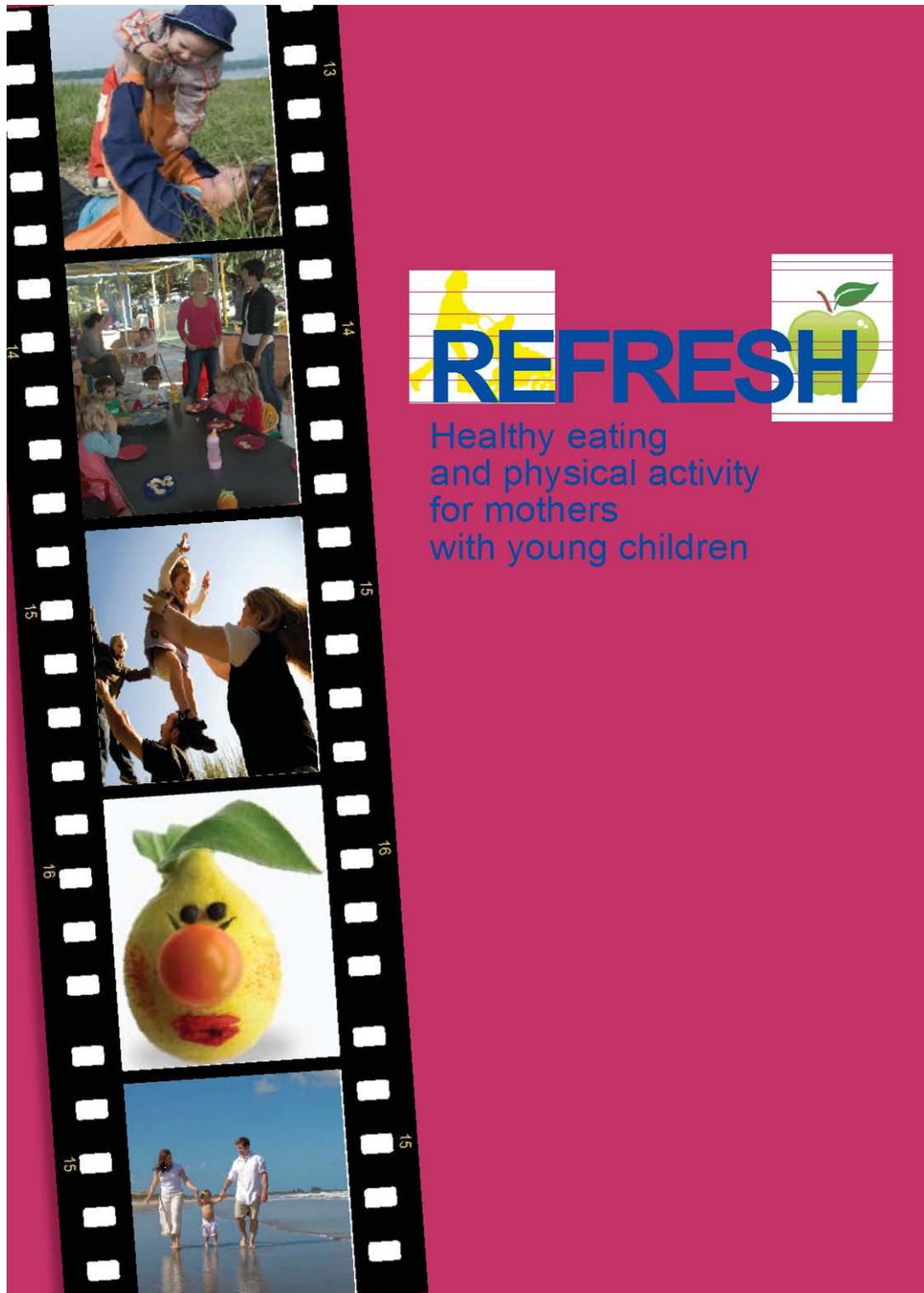
Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total Weekly Step Count
1								
2								
3								
4								
5								
6								
7								



## APPENDIX 10 REFRESH INTERVENTION CONTENTS

### APPENDIX 10.1: REFRESH PROGRAM BOOK

See Appendix 9 for full text.



## APPENDIX 10.2: WORKSHOP POWERPOINTS

REFRESH program intervention face-to-face workshops sessions were conducted.

Session	Session Details
<p>Themes: Information provision, behaviour change</p> <p>Session 1</p>	<ul style="list-style-type: none"> <li>Focus on fruits, vegetables: Recommendations, benefits and barriers to healthy eating</li> </ul> <p>Resources:</p> <ul style="list-style-type: none"> <li>REFRESH Program booklet</li> <li>Healthy recipe booklet</li> <li>Newsletter</li> </ul>
<p>Themes: Information provision, behaviour change &amp; monitoring progress</p> <p>Session 2</p>	<ul style="list-style-type: none"> <li>Focus on understanding stages of behaviour change and goal setting: long and short-term goals</li> <li>Focus on physical activity (aerobic): Recommendations, benefits and barriers to being active</li> </ul> <p>Resources:</p> <ul style="list-style-type: none"> <li>Pedometer</li> <li>Family dinner menu planner (fridge magnet)</li> <li>'Extra' food record sheet</li> <li>Newsletter</li> </ul>
<p>Themes: Information provision, behaviour change &amp; monitoring progress</p> <p>Session 3</p>	<ul style="list-style-type: none"> <li>Focus on reviewing behaviour change goals</li> <li>Focus on physical activity (muscle strength): Recommendations, benefits and barriers to being active</li> <li>Focus on relapse prevention</li> </ul> <p>Resources:</p> <ul style="list-style-type: none"> <li>Muscle strength and flexibility exercise card (fridge magnet)</li> <li>Physical activity diary</li> <li>Newsletter</li> </ul>
<p>Themes: Information provision, behaviour change &amp; monitoring progress</p> <p>Session 4</p>	<ul style="list-style-type: none"> <li>Focus on reviewing behaviour change goals</li> <li>Focus on healthy eating messages, menu planning, food package label reading, making sense of nutritional claims on packaging materials</li> </ul> <p>Resources:</p> <ul style="list-style-type: none"> <li>Shopping list with healthy shopping tips</li> <li>Comparing packaged food per 100g (fridge magnet)</li> <li>Reading packaged food labels</li> <li>Developing a menu</li> <li>Newsletter</li> </ul>
<p>Themes: Information provision, behaviour change &amp; monitoring progress</p> <p>Session 5</p>	<ul style="list-style-type: none"> <li>Focus on reviewing behaviour change goals</li> <li>Focus on fats and sugars: recommendations, benefits and barriers to healthy eating</li> <li>Focus on social support</li> </ul> <p>Resources:</p> <ul style="list-style-type: none"> <li>Modifying recipes</li> <li>Healthy cooking methods</li> <li>Newsletter</li> </ul>
<p>Themes: Information provision, behaviour change, review and feedback</p> <p>Session 6</p>	<ul style="list-style-type: none"> <li>Focus on reviewing behaviour change goals</li> <li>Focus on fibre and Glycemic Index: recommendations, benefits and barriers to healthy eating</li> </ul>

Social Cognitive Theory (SCT), Tran-Theoretical Model (TTM), Motivational Interviewing (MI)

(Modified from Abraham & Michie, 2008)

## APPENDIX 10.3: WORKSHOP ACTIVITIES

### FOOD KNOWLEDGE ACTIVITY

Name: \_\_\_\_\_

#### Getting To Know Your Food

1. What does eating healthy mean to you?

---



---



---

2. Do you know about the *Dietary Guidelines for Australians*?  Yes  No

a. According to the *Dietary Guidelines for Australians* what is one serve of vegetables equal to?  
- Note: exclude potato chips or fries. (Tick all that apply)

- (a) ½ cup cooked vegetables or 1 cup salad
- (b) 2 cups cooked vegetables or 2 cups salad
- (c) 1 cup cooked vegetables of 1 ½ cups salad

b. According to the *Dietary Guidelines for Australians* what is one serve of fruit equal to?  
(Tick all that apply)

- (a) 1 medium piece or 2 small pieces or 1 cup chopped
- (b) 1 cup diced fruit or 1 tablespoon dried fruit
- (c) 1 ½ cups diced fruit or 2 medium pieces
- (d) 3 small pieces or 1 ½ tablespoons dried fruit

c. According to the *Dietary Guidelines for Australians* what is one serve of extras (sometimes foods) equal to?  
(Tick all that apply)

- (a) 40 g cakes/muffins/doughnuts or ½ small bar/25g chocolate or 1 can of soft drink
- (b) 2 tablespoons mayonnaise/cream or 1 tablespoon margarine/butter
- (c) All of the above

3. Do you think these are high or low in added sugar? (tick one box per food)

	High	Low	Not sure
(a) Biscuits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Bananas/apple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Plain/Unflavoured yoghurt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Ice-cream / chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Orange 35% Juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Tomato Sauce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Tinned fruit in natural fruit juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Cakes/pastries/muffins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) Mocha/coffee chill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(j) Apple pie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Do you think these are high or low in fat? (tick one box per food)

	High	Low	Not sure
(a) Whole milk of yogurt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Pasta (without sauce)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Mayonnaise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Baked beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Processed/Sandwich meats (salami, ham)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Sausage rolls/pies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Chocolate /regular ice-cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Cakes/biscuits/muffins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) Potato chips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(j) Regular Cottage or Cheddar cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(k) Polyunsaturated margarine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(l) Butter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## LONG TERM GOAL SETTING ACTIVITY



Name: \_\_\_\_\_

Date: \_\_\_\_\_

### *Set Your Long Term Goal (Home Activity 1)*

*You must have long term goals to keep you from being frustrated by short term failures.*  
*Charles C. Noble*

<p><i>What is your long term goal/s?</i></p>	<p>Example: Eat be healthy and active.</p>	
<p><i>When do you aim to achieve this long term goal by?</i></p>	<p>Example: 2010 December</p>	
<p><i>Why do you want to achieve this goal?</i></p>		
<p><i>What past, present or future events have made you decide on this goal?</i></p>		
<p><i>What are the pros and cons of achieving this goal?</i></p>	<p><u>PROS</u></p>	<p><u>CONS</u></p>
<p><i>Have you had the same or a similar goal in the past? If yes, what was it?</i></p>		
<p><i>Why did you decide on this goal in the past?</i></p>		
<p><i>Did you achieve this goal in the past?</i></p>		
<p><i>What actions did you use to try to achieve your goal?</i></p>	<p><u>What worked?</u></p>	<p><u>What didn't work?</u></p>

## SHORT TERM GOAL SETTING ACTIVITY

Name: \_\_\_\_\_



Date: \_\_\_\_\_

### *Set Your Short Term*

*Write your goal, make a plan and pull the trigger.  
Written goals have a way of turning the invisible into visible; wishes into wants;  
Can'ts into cans; dreams into plans and plans into reality.  
Don't just think it- ink it!*

1. **My goal is to...** (Example: Eat 2 pieces of fruit every day and eat oats for breakfast 3 times a week)

\_\_\_\_\_

2. **I am going to achieve this goal by...**(Example: replacing the biscuits with a tub of low-fat yogurt & a slice of apple)

\_\_\_\_\_

3. **How important is your eating/physical activity goal on a scale of 1 to 10?**

1.....2.....3.....4.....5.....6.....7.....8.....9.....10

Not at all important

Very important

4. **Why did you give yourself this score and what can you do to increase your *importance* score by one point?**

\_\_\_\_\_

\_\_\_\_\_

5. **How confident are you of achieving your eating/physical activity goal on a scale of 1 to 10?**

1.....2.....3.....4.....5.....6.....7.....8.....9.....10

Not at all confident

Very confident

6. **Why did you give yourself this score and what can you do to increase your *confidence* score by one point?**

\_\_\_\_\_

\_\_\_\_\_

7. **How ready are you to achieve your eating/physical activity goal on a scale of 1 to 10?**

1.....2.....3.....4.....5.....6.....7.....8.....9.....10

Not at all ready

Ready

8. **Why did you give yourself this score and what can you do to increase your *readiness* score by one point?**

\_\_\_\_\_

## FOOD LABEL READING ACTIVITY

### Food Label Reading Activity

Wheat Biscuit Type Cereal			Toasted Muesli Cereal		
Nutrition Information Panel			Nutrition Information Panel		
Nutrient	Per Serve ¼ cup (30g)	Amount per 100g	Nutrient	Per Serve ¼ cup (30g)	Amount per 100g
Kilojoules	446kJ	1486kJ	Kilojoules	497kJ	1657kJ
Protein	3.1g	10.4g	Protein	2.7g	8.9g
Total Fat	2.3g	7.6g	Total Fat	3.9g	13.1g
Sat Fat	1.6g	5.4g	Sat Fat	1.2g	4.0g
Cholesterol	0.0mg	0.0mg	Cholesterol	0.0mg	0.0mg
Total Carbohydrate	15.8g	52.5g	Total Carbohydrate	17.0g	56.6g
Sugar	2.9g	9.5g	Sugar	6.5g	21.7g
Sodium	120.0mg	400.0mg	Sodium	25.2mg	84.0mg
Fibre	5.4g	18.0g	Fibre	3.0g	10.1g

Compare the fat content of product 1 and 2 which one is higher in fat?

- 1  
 2

Compare the sugar content of product 1 and 2, which one is higher in sugar?

- 1  
 2

Compare the fibre content of product 1 and 2, which one is higher in fibre?

- 1  
 2

Looking at the products 1 and 2, which products do you think would be the best option for a healthy diet

- 1  
 2

## MODIFYING RECIPES ACTIVITY

### Activity instructions:

**Modify the 2 recipes with an aim to decrease fat, sugar and salt content, and increase fibre and nutritional content of recipe. Change cooking method to a healthier cooking method if necessary.**

### Easy Quiche

#### Ingredients

4-5 eggs

½ cup flour

1 ½ cups milk

Short cut bacon, (small packet) cut 1-2cm pieces

1 cup grated cheese

1 pack frozen spinach (defrosted and drained)

Salt &/or pepper

#### Method

Mix eggs, flour and milk together in mixing bowl (I usually use a hand blender) then add bacon, cheese and spinach. Add salt &/or pepper to taste.

Grease a quiche dish or pie dish with butter.

Pour into dish and cook for 30 mins or longer if needed (middle needs to set)

Easy – no pastry needed!! Enjoy!!!

## **APPENDIX 10.4: SHORT MESSAGE SERVICE REMINDERS**

### **SMS 1**

Hi [[Name\_of\_Participant]], set and achieve your physical activity goals. Try 10min of moderate physical activity everyday.

### **SMS 2**

Hi , try to aim for 8 muscle strength exercises on 2 non-consecutive days this week. Try 1 set for each exercise to get yourself started.

### **SMS 3**

Have you swapped your sugary snack with a piece of fruit today?

### **SMS 4**

Try to reduce fats by using healthy cooking methods like roasting, steaming and pan frying!

### **SMS 5**

Have you found 30 minutes of physical activity today? Try 3 lots of 10 minutes to boost your energy levels today.

### **SMS 6**

Try to increase your serves of veg by adding salad to your meal or swapping your sugary snack with sliced up veg.

## APPENDIX 10.5: HOME-BASED RESOURCES

### INDIVIDUAL WALKING DIARY

 **WALK TO GOLD COAST CHALLENGE**  
How many steps did you do today?

Name: \_\_\_\_\_ Start date: \_\_\_\_\_

WEEK	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Step Count
1								
2								
3								
4								
5								
6								
7								

Step up the intensity of your walking for greater health benefits.  
Go from light (eg. strolling) to moderate (eg. brisk walking) to vigorous (eg. jogging) intensity.

# GROUP WALKING DIARY




## REFRESH WALK TO GOLD COAST CHALLENGE

Record each participants weekly total step count

Playgroup Name & Suburb: \_\_\_\_\_ Playgroup Session (Day & Time): \_\_\_\_\_

Participant Name	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Total
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								



**START PERTH**

**ESPERANCE**  
The whitest beach in Australia - 481km = 721,500 steps

**STREAKY BAY**  
Murphy's Haystacks: One of nature's little gems - 602km = 903,000 steps

**SYDNEY**  
Australia's biggest city is one of the world's great destinations - 1,078km

**SURFER'S PARADISE**  
The jewel of Queensland's Gold Coast - 859km = 1,288,500 steps

**FINAL DESTINATION GOLD COAST**  
5,478km = 8,217,000 steps



## TIPS TO READ FOOD LABELS



**Healthy eating begins in the supermarket.**

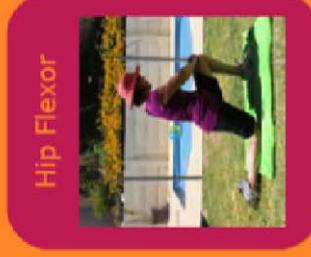
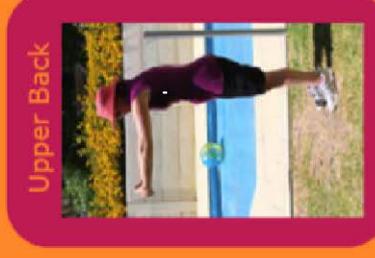
Compare packaged foods per 100g - choose foods from the 'low' category.

	HIGH	LOW
Energy	More than 600kJ	Less than 170kJ
Total Fat	More than 20g	Less than 3g
Saturated Fat	More than 5g	Less than 1.5g
Sugar	More than 15g	Less than 5g
Salt	More than 400mg	Less than 120mg



EXERCISE CARD

  **REFRESH STRETCHING EXERCISE CARD** 

 <p>Calves</p>	 <p>Hamstring</p>	 <p>Quadriceps</p>	 <p>Inner Thighs</p>	 <p>Hip Flexor</p>	 <p>Gluts</p>
 <p>Upper Back</p>	 <p>Chest</p>	 <p>Shoulder</p>	 <p>Triceps</p>		

# REFRESH STRENGTH EXERCISE CARD

Assisted Squat



Assisted Lunge



Side and Front Leg Lifts



Push Ups



Pelvic Tilt and Bottom Raise



Side Push



Bird Dog



Plank





# HEALTHY FOOD MENU PLANNER



**REFRESH** FAMILY MEAL & PHYSICAL ACTIVITY PLANNER



Group  
**Curtin**  
UNIVERSITY

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
FAMILY DINNER MENU							
FAMILY PHYSICAL ACTIVITY							
TO DO LIST							



### Daily Sample Serves For Healthy Eating

FOOD GROUP	Breads, Cereals, Rice, Pasta, Noodles	Vegetables	Fruit	Low-Fat Milk, Yogurt, Cheese	Meat, Fish, Poultry, Nuts, Eggs, Legumes, Beans, Lentils	Extra
AGE (Years)	1 serve is = 2 slices bread = 1 cup cooked rice, pasta = 1 cup porridge, cereal = 1/2 cup muesli	1 serve is = 1/2 cup cooked vegetables = 1 cup salad = 1 small potato = 1/2 cup potatoes	1 serve is = 1 medium piece = 2 small pieces = 1 cup dried fruit (40g) = 2 dried apricots	1 serve is = 1 cup milk = 2 slices cheese (40g) = 1 cup yogurt	1 serve is = 100g cooked lean meat or chicken = 120g cooked fish = 2 eggs (soft-boiled/boiled/scrambled) = 1/2 cup peanuts, almonds = 1/2 cup sunflower/soybean seeds	1 serve is = 2 tablespoons mayonnaise = 1 tablespoon oil = 1/2 cup butter
4-7	3-4	4	2	3	1/2-1	1
8-11	4-6	4-5	1-2	3	1-1.5	1
12-18	4-7	5-9	3-4	3-5	1-2	1
Women 18-60	4-6	4-7	2-3	2-3	1-1.5	1
Pregnancy	4-6	5-6	4	2	1.5	1.5
Breastfeeding	5-7	7	5	2	2	2
Men 19-60	5-7	6-8	3-4	2-4	1.5-2	1

### Physical Activity For a Healthy Lifestyle

Age	Duration	Frequency
Below 5 years	Minimum of 3 hours every day	Minimum of 3 times a week
5 years and above	Minimum of 60 minutes moderate to vigorous physical activity every day	Minimum of 3 times a week

**CHILDREN**

- 30 minutes a day of moderate aerobic physical activity (e.g. brisk walking) at least 5 times per week and
- 2 or more nonconsecutive days a week of muscle strength activities

**OR**

- 20 minutes a day of vigorous aerobic physical activity (e.g. jogging) at least 3 times a week and
- 2 or more nonconsecutive days a week of muscle strength activities

**OR**

- Equivalent mix of moderate to vigorous aerobic physical activity a week and
- 2 or more nonconsecutive days a week of muscle strength activities

## APPENDIX 10.6: NEWSLETTERS



### For mothers with young children

VOLUME 1, ISSUE 1

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#### Fruits

##### Are fruits high in sugar?

The sugar content of fruit ranges from between two grams to 20 grams per 100 grams of fruit. For example, two small peaches has around seven grams of sugar, and one apple has around 15 grams. But what does this mean in comparison to other foods? Well, a 100 gram chocolate bar has around 55 grams of sugar, and two Tim Tams (or chocolate coated biscuits) has around 17 grams of sugar.

*Fruits are a great source of energy and are packed with vitamins, minerals and antioxidants that are great for your health, and have a lower kilojoule (energy) content which is beneficial for balancing body weight.* People tend to eat more sugar in the form of foods such as cakes and biscuits in comparison to fruit. So next time you choose an apple over a biscuit, think of all the health benefits and make the healthy choice!

##### Is fruit juice as beneficial as whole fruit?

*It is best to consume the whole fruit as it contains more fibre (which keeps you feeling full longer) and less sugar than fruit juices.* In order to produce one cup of fruit juice you require two to three whole fruits. The Australian Guide to Healthy Eating considers juice as part of the fruit food group. It recommends only half a cup (125ml) of fruit juice as a replacement for 1 serve of fruit. Fruit juice can provide you with valuable nutrients, however the Australian Guide to Healthy Eating does point out that fruit juice has relatively small amount of fibre when compared to fresh fruit. One cup of fruit juice also contains more sugar and kilojoules than one piece of fruit.

#### Send us your family's favorite recipes or cooking ideas

Please send in the recipe that was a hit with your family last week or the tricks you use to increase fruit, vegetables, legumes and fish in your everyday meals.

Email: [g.monteiro@curtin.edu.au](mailto:g.monteiro@curtin.edu.au)

# Food Additives

Anything that is added to food, during processing is considered a **food additive**. For example sugar and salt have been used for centuries to increase the shelf life of foods and are examples of additives. Other examples of food additives are preservatives and antioxidants. Preservatives are used to preserve the texture, flavour or increase the shelf life of foods. Antioxidants are added to reduce or prevent foods from going rancid or bad, prevent oxidation or browning/black spots on foods and decrease vitamin loss.

The use of food additives in Australia is regulated by Food Standards Australia and New Zealand (FSANZ). According to FSANZ, additives serve three purposes:

1. improve the taste or appearance of a processed food
2. improve the keeping quality or stability of a food
3. preserve food when this is the most practical way of extending its storage life.

**Additives and numbers:** Lots of additives are given numbers so they can easily be identified on food labels, and save space from printing long chemical names. These 'numbers' often sound scarier than they are.

FSANZ does not approve an additive unless extensive testing has been undertaken and it has been shown that no harmful effects are expected from consumption. FSANZ also sets the Acceptable Daily Intake (ADI) for each additive - the amount that can be eaten every day over a lifetime without risk of harm.

## The bottom line:

*The foods containing lots of additives are usually the foods that we should not be eating a lot of anyway.*

Foods with additives are usually highly processed such as cakes, biscuits, chips, ice cream, sausages, and other common snacks that contain a lot of fat, sugar and salt. Fat, sugar and salt contribute to overweight and obesity are major causes of cancer and heart diseases.

*So the healthiest foods to choose are whole fresh foods. These foods have less additives than processed foods and are also lower in fat, sugar and salt.*

For more information check

FSANZ [www.foodstandards.gov.au/consumerinformation/additives.cfm](http://www.foodstandards.gov.au/consumerinformation/additives.cfm)



## For mothers with young children

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### Physical Activity Myth: If you're not sweating when you exercise, it's not worth it!

Sweating helps control the body's temperature. Sweating is not an indicator of how hard you exercise. Sweating depends on a number of factors including your unique sweating pattern as well as the weather (in the cold climate you may sweat less and in the hot climate you may sweat more).

Health benefits can be gained from moderate physical activity such as brisk walking or cycling at moderate pace during which you may or may not sweat.

### Activities-To-Steps Conversion Chart

1 minute of bicycling	150 steps
1 minute of swimming	150 steps
1 minute of aerobics (low intensity)	115 steps
1 minute of muscle strength training	100 steps

### Target Heart Rates (HR)

When doing physical activity after a long break such as having children, it is important to pace yourself and not get tired too quickly.

When starting physical activity, aim for 50% of the target HR during the first few weeks. Gradually build up to 75%, and after six months or more regular physical activity aim for 85% of the target HR. [www.americanheart.org](http://www.americanheart.org)

Age	Target HR Zone 50–85 %	Average Maximum HR 100 %
30 years	95–162 beats per minute	190 beats per minute
35 years	93–157 beats per minute	185 beats per minute
40 years	90–153 beats per minute	180 beats per minute

### Send us your family's favorite recipes or cooking ideas

Please send in the recipe that was a hit with your family last week or the tricks you use to increase fruit, vegetables, legumes and fish in your everyday meals. Email: [g.monteiro@curtin.edu.au](mailto:g.monteiro@curtin.edu.au)

## Eating Before Exercising

The general recommendation is to eat

- meals 3-4 hours before exercising OR
- have a small light snack 1-2 hours before exercising.

Food consumed before exercise is only useful once it has been digested and absorbed. The time required for digestion depends on the type and quantity of food consumed. You need to experiment to find the timing and amount of food that best suits your individual needs.

## Eating After Exercising

The general recommendation is to eat within two hours after exercising. It is best to eat a meal/snack with high-fibre carbohydrate and protein after exercising so that the body's energy stores are replenished and muscles cells are rebuilt. Examples of meals/snacks include:

- 1 cup of fruit smoothie made with low fat milk
- 1 bowl of high fibre breakfast cereal with low fat milk
- 1/2 can baked beans on 2 slices of wholegrain toast
- 1 wholemeal bread roll with reduced fat cheese+ banana
- 1 bowl of fruit salad or banana with 200g low fat yoghurt
- 1 baked potato with low fat cottage cheese filling

Remember: Count the number of serves of each of the five food groups you eat (breads, meat, dairy, vegetables/legumes, fruit) and total them at the end of the day. Try to eat the recommended number of serves from each of the food groups every day-check the **REFRESH** family activity and menu planner (fridge magnet) for more information.

## Does eating before exercise affect my ability to lose weight?

Loss of fat occurs due to a negative energy balance. That is, you burn more energy/kilojoules than you consume. Exercising in a fasted state (8 hours since the last meal) results in a greater proportion of fat being used as the exercise fuel compared to doing the same workload after a carbohydrate-containing meal or snack.

Consider the goals of your session: If your primary goal is to improve performance, have something to eat before exercise. If your primary goal is weight loss, and you will do the same amount of exercise regardless of whether you eat or not, save your meal until after the exercise session.

<http://www.ussport.gov.au/gis/nutrition/faq>

## Can fat cells change to muscle with muscle strength exercises?

You can burn fat and build muscle, but a fat cell will never turn into a muscle cell. Body fat is a storage place of extra energy when you consume more kilojoules than you can burn via physical activity as well as every day activities.

If you continue to consume more calories than the body needs, the size of their existing fat cells increases. When we "burn fat" we are actually shrinking the size of our fat cells by using the energy that has been stored there.

When doing muscle strength activity, we are increasing the size of the muscle cells. If you use your body weight to do muscle strength exercises every week as described in the REFRESH magazine, your muscle cells will increase and burn more energy and the fat cells will decrease in size.



FAT



MUSCLE

## Myth: Muscle weighs more than fat

Muscle and fat weigh the same. However, muscle takes up less space or is lesser in volume than fat.

For more information on the different types of fat in the body go to pages 47 and 48 of the REFRESH magazine

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## Confused about Carbohydrates?

**Myth: Eating carbohydrates after 5pm makes you gain weight**

False. Carbohydrate rich foods can be eaten at any time of the day.

The body gains weight when more kilojoules are consumed than is expended through daily activity and exercise. Therefore, if you are consuming too many kilojoules - it doesn't matter if it is from carbohydrate, protein, fat or alcohol - this will result in weight gain.



To learn more about carbohydrates read on...

**Why are carbohydrates important?**

Carbohydrates are the body's primary source of energy. Eating regular meals and spreading carbohydrates evenly throughout the day, helps to maintain energy levels.

**Low carbohydrate diets explained**

Low carbohydrate diets focus on avoiding carbohydrate in order to decrease the number of kilojoules that are consumed, thus resulting in weight loss. In the initial phase of carbohydrate restriction, there appears to be dramatic weight loss. However most of that loss is from water, not fat. Low carbohydrate diets are a 'quick fix' solution, and are not healthy or sustainable over time. Weight management needs a healthy approach and involves eating a variety of healthy foods every day and having healthy eating habits.

To view a sample menu for a mother go to page 11 of the RE-FRESH magazine

**Watching the type of carbohydrates: The Glycemic Index (GI)**

The Glycemic Index or GI, is a number given to a food depending on how fast the carbohydrate is digested and enters the bloodstream.



- ♦ **Low GI** foods are slowly digested and absorbed, and provide a gradual supply of energy. These include wholegrain breads, cereals and legumes.
- ♦ **High GI** foods are quickly digested and absorbed, therefore you can feel hungry soon after eating them. These include white bread, processed cereals and white rice.

For more information on the GI of foods go to page 18 of the REFRESH magazine

## For mothers with young children

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### Myth: Butter is pure and natural and therefore better than margarine

**False.** Butter is higher in saturated fat and too much saturated fat can raise 'bad' LDL cholesterol, increasing the risk of heart disease. Margarine made from canola, sunflower, olive or dairy blends, contain the 'healthier fats' which are mono and polyunsaturated fats. 'Healthier fats' help to lower the 'bad' LDL cholesterol, and raise the 'good' HDL cholesterol.

Table 1 Switching from butter to margarine can help lower blood cholesterol.

	1 tablespoon	
	Butter	Margarine, canola blend
KJ	620	480
Total fat (g)	16	13
Saturated fat (g)	10	3
Cholesterol (mg)	50	0

### Myth: Healthier foods cost more

**False.** When comparing price per kg, foods that have undergone little processing, such as vegetables, legumes, and wholegrain breads and cereals, are usually less expensive and healthier than more processed foods such as biscuits, sugary breakfast cereals and confectionery.

Aim to spend your food budget in the same way that you balance the foods in your everyday eating. As per figure 1, you want to spend **most** in the eat most group, spend **some** in the eat some group, and spend **least** in the eat least group.



Figure 1 Eat-Spend Food Pyramid

## Fats and Oils

Fats perform vital functions in the body, however too much fat can be detrimental to your health. Saturated and trans fat are 'unhealthy fats' as they raise your 'bad' LDL cholesterol. Monounsaturated and polyunsaturated fat are 'healthy fats' as they can lower your 'bad' LDL cholesterol and raise the 'good' HDL cholesterol. Therefore the *type* and *amount* of fat are both important when adding fat to your food.

### 5 quick tips to choosing healthy fats:

1. **Choose liquid vegetable oils** such as olive, canola and sunflower oil when cooking and baking. Vegetable based oils are rich in the 'healthier fats'.



2. **Go lean on meat and reduced fat on dairy.** Red meat, skin of poultry, lunch meats, butter and full fat dairy, cheese and yoghurt are high in saturated fat. Choose lean cuts of meat, remove the skin from poultry, and select reduced fat milk, cheese and yoghurt.

3. **Swap butter for polyunsaturated or monounsaturated margarine spreads.** Choose margarine spreads made from canola, sunflower, olive or dairy blends and check the Nutrition Information Panel to make sure it has zero grams of trans fat.

4. **Avoid trans fat.** Trans fat are found in deep fried foods, biscuits, pies and other baked products. In the supermarket, read the Nutrition Information Panel to select foods that are trans fat free.

### 5. Use healthier fats in your meals and snacks:

- Monounsaturated fats are found in foods such as avocados, cashews and almonds.
- Polyunsaturated fats are found in foods such as fish, walnuts, brazil nuts, pine nuts and tahini (sesame seed spread).
- Try consuming 2-3 serves of oily fish a week. Omega-3 fats are a type of polyunsaturated fat, and are found in high amounts in oily fish such as sardines, tuna, salmon and blue mackerel.



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## For mothers with young children

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### Eating out, Eating healthy

Eating out with the family is fun, however it is easy to indulge in foods high in fat, sugar and salt. So how can you make healthy choices when eating out?

Here are some tips to help you eat out and eat healthy too:

- **Curb your hunger:** Have a high fibre snack, like an apple, before you head out. This will help to control your appetite, so you don't over indulge as soon as you sit down at the table.
- **'Undress your food':** Order salad dressings on the side so you can decide how much you want to add, or swap the mayonnaise dressing for olive oil and vinegar.
- **Menu selection:** For your main course, select items which are grilled, roasted, steamed, poached, sautéed, braised *instead of* fried, basted, batter-dipped, crispy, Alfredo, au gratin, or in cream sauce.
- **Watch portion size:** Consider ordering an entrée and side dish instead of a main meal. Or, why not share an entrée or dessert with a friend?
- **Drink water:** Try plain water, soda water with lemon or sparkling water with lime for a zero kJ beverage.
- **Avoid liquid kJ:** If drinking alcohol, pace yourself and alternate alcoholic beverages with water. Ask for reduced fat milk instead of whole milk in hot drinks or try a herbal tea.
- **Eat mindfully:** Eat slowly and savour each bite. Listen to your stomach and stop when you're full.



## Legumes

Legumes or pulses include beans, peas and lentils, such as split peas, kidney beans, baked beans (navy beans), soy beans, chickpeas, broad beans, and lentils.

### Some of the many nutritional benefits of legumes:

- High in dietary fibre
- Low GI - which can help you feel full longer
- Low in fat
- High in protein
- High in B group vitamins, iron, calcium, zinc, phosphorous and magnesium
- Good source of folate and antioxidants



Legumes are cheaper than meat and makes an ideal substitute for protein!

1 serve (80-100gm) of meat = ½ cup of cooked legumes and pulses

### Tips to increase legumes in your meals:

- Add legumes to **salads, soups, stir-fries, pasta sauces and casseroles** to increase bulk and fibre
- Make **healthy dips** from pureed cooked white beans or chickpeas.
- Try making **lentil burgers** instead of using meat or use a mix of both
- Add **baked beans** to toasted sandwiches or baked potatoes
- Blend red beans with a few herbs to use as **pancake filling**
- Snack on '**chicknuts**' (oven roasted chickpeas)
- Include beans in **tacos** or use along with meat as **lasagne filling**

### Is wholemeal bread just as beneficial as wholegrain bread?

Nutritionally wholegrain and wholemeal foods are similar. Be sure to check the Nutrition Information Panel, and choose breads with 9g or more of fibre per 100g.





## For mothers with young children

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### Overcoming Physical Activity Barriers - From Mums to Mums

We are all very busy people, but how do some mothers still find time to be active while the rest of us can't? Below are some suggestions for overcoming those barriers we all have for not being physically active:

#### I don't have time

Small changes to your daily routine all add up:

- Meet a friend for a walk and talk
- Dance at a party when the opportunity presents

*"I have a girlfriend who always parks at the opposite end of the shopping centre so she has to walk further to get in there. It's a really good idea, and I just have to remind myself to do it."*

#### Active opportunities

- Choosing to walk to the end of the street when you collect the mail from the mailbox
- Walking two laps of the yard when you hang out the washing

#### But I'm on holidays

Although you may not be able to keep your usual activity patterns, holidays are a great time to try a new physical activity, explore the local area on foot or get active with the children. After you come back from a break, set a new goal and get back into a routine.

*"I try and do activities with my son that involve me being active too. A trip to the zoo is a great outing for us both, I push him in the pram and I make sure I wear my walking shoes."*

#### It's boring

If you think exercise is boring then you probably haven't found the activity that is right for you. Try a few different activities to find a few that suit you.



### Weak Bladder and Physical Activity

Research shows that many women with children have weak bladders, but this should not stop you from being active. If you have a weak bladder, try swimming, doing muscle-strength exercises, or walking, along with pelvic floor exercises. This way you can keep active and help to strengthen your pelvic floor muscles.

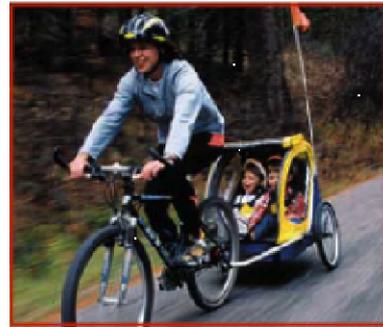
### Physical Activity Opportunities in Your World

Every day you can make choices to help you keep active.

- Workout in your garden by pulling out those annoying weeds, cutting those overhanging branches and turning the soil.
- Walk to the shops instead of driving the car.
- Have a walk break instead of a coffee break.

Other opportunities exist not far away...

- Take your dog and children for a walk along the river.
- Cycle around a park with a friend, with your child in a bicycle buggy.
- Go for a walk along the beach.
- Go for a swim at your local aquatic centre, where you can get childcare.



### Brown and raw sugar are better than white sugar?

**False.** All these sugars provide the same amount of kilojoules with the real difference being the taste and its effect on baked goods.

### Eggs are bad for cholesterol?

**False.** Eggs are not bad for cholesterol. The cholesterol in eggs has only a small effect on 'bad' LDL cholesterol, so you can enjoy up to six eggs each week as part of a healthy balanced diet.



Congratulations to the five mums who won a body shop gift pack for winning the 'Walk to Gold Coast Challenge'!