Master of Philosophy Thesis

Weight retention in the postpartum period

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This research project is submitted in partial fulfillment of the requirements if the degree of Master of Philosophy (Nutrition and Dietetics).

October 2012
STATEMENT OF ORIGINALITY

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent for the final version of my thesis being made available worldwide when deposited in the University of Newcastle library, subject to the provision of the Copyright Act 1968.

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Candidature signature: Julia Martin
ACKNOWLEDGEMENT OF AUTHORSHIP

I hereby certify that the work embodied in this thesis contains a published paper of which I am a joint author. I have included as part of the thesis a written statement, endorsed by my supervisor, attesting to my contribution to the joint publication/s.

The ADRT does not have to endorse this.

__________________________________

Candidature signature: Julia Martin
ACKNOWLEDGMENTS

I would like to recognise the following people who have contributed to my thesis.

I would firstly like to acknowledge my supervisors, Professor Clare Collins, Dr Alexis Hure, Dr Lesley MacDonald-Wicks and Professor Roger Smith. I will be forever thankful for their endless patience and support, continuous encouragement and passion for research.

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I would also like to thank Mum for being forever positive and showering me with praise.

This research was supported by an Australian Postgraduate Award, and scholarship.
PUBLICATIONS AND PRESENTATION ARISING FROM THIS THESIS

I hereby certify that the work embodied in this thesis contains a published paper of which I am a joint author. I have included as part of the thesis a written statement, endorsed by my supervisor, attesting to my contribution to the joint publication/s.

The ADRT does not have to endorse this.

**Manuscripts in peer reviewed journals: Under review**


**Conference abstracts in peer reviewed journals: Published**


**Conference abstracts in peer reviewed journals: To be published**

STATEMENT OF CONTRIBUTION OF OTHERS

I, Professor Clare Collins, attest that Research Higher Degree candidate Ms Julia Martin contributed all chapters of this thesis and as lead author of the following publications:


Martin JE, Hure AJ, MacDonald-Wicks L, Smith R. Bouncing Back to your Pre-baby Body: A randomized controlled trial to reduce postpartum weight retention. In preparation for submission to Obesity.
(Signature of Co-Author)

Professor Clare Collins

(Full Name of Co-Author)

Date:
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ABSTRACT

Overweight and obesity in women contributes to preventable morbidity and is associated with significant health care costs. Weight gain is multifactorial. However, many women attribute their adult weight gain to childbearing and this weight has a tendency to be retained for many years.

Although the research on postpartum weight retention (WR) is limited, numerous contributing factors have been identified. These factors include pre-pregnancy Body Mass Index (BMI), excessive gestational weight gain (GWG) and breastfeeding duration. Unfortunately, breastfeeding duration rates are suboptimal in the Australian population and fail to meet national and international recommendations. In addition to this, evidence has revealed women with a high BMI have reduced breastfeeding rates compared to women with a lower BMI.

Postpartum women need to be targeted to improve their long-term health outcomes with particular focus on maximizing the benefits of breastfeeding and to reduce WR. This thesis has two main objectives. The first objective is to firstly further identify factors which contribute to excessive WR. This was achieved using data from an established prospective longitudinal cohort of 180 women. From this data, increasing GWG, parity and breastfeeding were identified as factors associated with WR.
The second thesis objective was to assess the feasibility of performing a randomised controlled trial (RCT) of a weight management program versus a control arm for overweight and obese mothers, delivered through maternal health clinics. To achieve this objective a pilot RCT was performed. This RCT enrolled 36 pregnant women who were followed from 26 weeks gestation up until six months postpartum. Data were collected on anthropometry, socio-demographics, medical and psychosocial variables as well as glucose and lipid blood biomarkers. Women were randomised to receive a weight management program during pregnancy with or without support from an International Board Certified Lactation Consultant (IBCLC) or to a control group. The control group received the same weight management program deferred until three months postpartum.

Results revealed no statistically significant differences between the three groups for WR, breastfeeding initiation or duration or markers of lipid and glucose metabolism at three or six months postpartum. The sample size (n=36) was too small to detect significance. Despite this, results were in the expected direction and favored the intervention groups over the control group and suggest that this study design is feasible.

In conclusion, the findings presented in this thesis provide evidence from a pilot RCT of 36 women that investigation of support for women in the postpartum period to reduce WR and increase
breastfeeding success is warranted. Controlling postpartum weight retention will potentially improve the long-term health profile of mothers.
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<thead>
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<tr>
<td>AES</td>
<td>Australian Eating Survey</td>
</tr>
<tr>
<td>ANCOVA</td>
<td>Analysis of covariance</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>BBPBB</td>
<td>Bouncing Back to your Pre-baby Body</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>C</td>
<td>Control</td>
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<tr>
<td>CFP</td>
<td>Current feeding practices</td>
</tr>
<tr>
<td>CHD</td>
<td>Coronary heart disease</td>
</tr>
<tr>
<td>Chi²</td>
<td>Chi-squared</td>
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<tr>
<td>DVD</td>
<td>Digital video disc</td>
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<tr>
<td>GWG</td>
<td>Gestational weight gain</td>
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<tr>
<td>HAPS</td>
<td>Hunter Area Pathology Service</td>
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<tr>
<td>HDL</td>
<td>High density lipoprotein</td>
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<tr>
<td>IBCLC</td>
<td>International board certified lactation consultant</td>
</tr>
<tr>
<td>IFP</td>
<td>Infant feeding practices</td>
</tr>
<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
</tr>
<tr>
<td>ISAK</td>
<td>International Society for Kianthropometry</td>
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<tr>
<td>LDL</td>
<td>Low density lipoprotein</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
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<tr>
<td>RR</td>
<td>Risk Ratio</td>
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<tr>
<td>SMART</td>
<td>Specific measurable attainable time</td>
</tr>
<tr>
<td>TC</td>
<td>Total cholesterol</td>
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<tr>
<td>TEMplate™</td>
<td>Total Eating Management system</td>
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<tr>
<td>WATCH</td>
<td>Women and Their Children’s Health</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WM</td>
<td>Weight management</td>
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<td>WM+LC</td>
<td>Weight management plus lactation consultant</td>
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<td>WR</td>
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Chapter One: INTRODUCTION
1. BACKGROUND AND CONTEXT

1.1 Overweight and obesity in reproductive age women

In 2008, the World Health Organization (WHO) estimated that nearly 300 million women aged 15 years and over were obese worldwide [1]. Results from the 2007-08 National Health Survey revealed approximately 54% of Australian women of reproductive age were overweight or obese (BMI > 25.0 kg/m$^2$), which is an increase of six percent in the last 12 years [2, 3]. In addition to this, younger women (18-23 years) are gaining weight at a higher rate than previous generations and other age groups [3-5]. These statistics are of concern given the impact of overweight and obesity on the health of women [6].

In 2004, overweight and obesity was responsible for five percent of deaths worldwide [7]. In Australia, 4.3% of the total burden of disease and injury is attributable to women with a high body mass index (BMI >25 kg/m$^2$) [8]. A high BMI is a significant risk factor for lifestyle diseases, such as Type 2 diabetes, cardiovascular disease, some cancers, osteoarthritis and psychological disorders [8-10]. Results from a cohort of 114, 281 women indicated that those with a BMI $> 29$ kg/m$^2$ had a risk ratio (RR) of 3.56 (95% CI 2.96-4.29) for coronary heart disease (CHD), compared to women with a lower BMI [11, 12]. Results from a sub group of the same cohort also showed waist-to-hip ratio and waist circumference were independently associated with an increased risk of CHD [13].
1.1.1 Overweight and obesity during the childbearing years

1.1.1.1 Weight retention

The link between childbearing and the development of overweight and obesity in women has been established, with research suggesting it is common for women to increase their BMI as a result of a single pregnancy [14]. Postpartum weight retention (WR) is calculated by subtracting the pre-pregnancy weight from weight anytime during the postpartum period (up to 12 months). Fifty to eighty percent of women retain 1.4-5 kg up to 12 months postpartum and 20-50% will retain 5-10 kg during this time [15-19]. Retaining weight after birth places women at risk of progressing to a higher BMI category [20, 21]. This retained weight will then be carried into subsequent pregnancies, increasing the risk for adverse pregnancy outcomes and, in the long term, obesity-related conditions such as Type 2 diabetes and heart disease [22, 23]. In order to reduce postpartum overweight and obesity, evidence is required to determine the factors contributing to WR. Research has established that excessive gestational weight gain (GWG) increases postpartum WR [24]. There is some evidence to suggest that pre-pregnancy BMI and breastfeeding status contribute to WR [18, 25, 26] however, this evidence remains inconclusive.
**Pre-pregnancy BMI**

As the prevalence of overweight and obesity increases, many women enter pregnancy with a high BMI [27]. In 2009, the Centre for Disease Control reported 45% of women commence pregnancy with a BMI in the overweight or obese categories, which is a 21% increase since the mid 1980’s [28]. A high BMI before pregnancy increases the risk of maternal mortality [29] and numerous adverse pregnancy and birth outcomes [30]. Overweight and obesity can double the risk of gestational diabetes (RR=2.1; 95% CI 1.7-2.7 for BMI >25.0-29.9 kg/m² and RR=2.1; 95% CI 2.2-3.9 for BMI > 30 kg/m²) [31, 32], and increase the risk of pre-eclampsia by up to 5.2 times [33]. There is also an increase in the frequency of delivery intervention [30], macrosomia (Odds Ratio (OR) 1.6; 95% CI 1.5-1.6 for BMI >25.0-30.0 kg/m² and 2.4; 95% CI 2.2-2.5 for BMI > 30 kg/m²) [34] and reduced rates of breastfeeding success [35-37]. To treat these conditions, additional health care resources are required, placing a cost burden on the health care system [38]. A more cost effective mechanism may be to prevent or reduce overweight and obesity with healthy lifestyle initiatives in this cohort, however, the health economics are yet to be evaluated.

The evidence for an increased risk of WR is not strong for the association between pre-pregnancy BMI and WR. Overweight and obesity before pregnancy has been associated with both low [39] and high WR [40, 41]. The discrepancies in findings may, in part, be
mediated by factors like GWG and breastfeeding initiation and duration rates. While this relationship between pre-pregnancy weight and WR is unclear, there is considerable evidence that a high pre-pregnancy BMI or GWG increases the risk of adverse maternal and infant outcomes and also increases postpartum BMI [30-34].

*Excessive gestational weight gain*

Excess GWG is also associated with maternal and infant morbidity. It can lead to a number of negative conditions, including pre-eclampsia (OR=2.8; 95% CI 2.4-3.2) [42], gestational diabetes (OR=1.7; 95% CI 1.2-2.6) [43], caesarean section delivery (OR=1.4; 95% CI 1.3-1.5) [42], babies that are large for gestational age, (OR=2.6; 95% CI 2.4-2.8) [42] and both short and long term maternal overweight and obesity [24].

The revised 2009 Pregnancy Weight Gain Guidelines (see Table 1), endorsed by the United States of America’s Institute of Medicine (IOM), aim to assist women to achieve a healthy weight gain during pregnancy based on current evidence [44]. The previous guidelines (1990) also had recommendations based on pre-pregnancy BMI categories, however, the weight gain ranges have been decreased and an obese category added [45]. Based on the current guidelines, the highest weight gain range is recommended for those in the underweight category and lowest gains are recommended for those in the obese category [44]. The guidelines were revised in 2009 as a result of the recognition that a number of
characteristics of pregnant women in America have changed since
the previous recommendations in 1990 [44]. These include increases
in the average age of childbearing, pre-pregnancy weight, GWG and
infant birth weight [44].

*Table 1.1: Institute of Medicine 2009 pregnancy weight
guidelines.*

<table>
<thead>
<tr>
<th>Body Mass Index (kg/m²)</th>
<th>Category</th>
<th>Pregnancy weight gain</th>
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<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight</td>
<td>12.5-18 kg</td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>Normal weight</td>
<td>11.5-16 kg</td>
</tr>
<tr>
<td>25.0-29.9</td>
<td>Overweight</td>
<td>7.5-11 kg</td>
</tr>
<tr>
<td>≥ 30</td>
<td>Obese</td>
<td>5-9 kg</td>
</tr>
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</table>

Institute of Medicine, *Weight gain during pregnancy: re-examining the

GWG has been associated with both short and long term WR [17, 21, 24, 46-51]. Results from a recent meta-analysis report that
women who gained above the IOM GWG recommendations are more
than four kg heavier up to 15 years postpartum compared to those
whose weight gain matched with the recommendations [24]. Results
from a longitudinal study of more than 2000 British women found
those with excessive GWG (based on the IOM guidelines) had
adverse health outcomes 16 years after birth compared to women
who gained within recommendations [47]. These long term
consequences support the appropriateness of the IOM recommendations.
Breastfeeding

Infant benefits

Breast milk is the best source of nutrition for infants [52] and it is recommended infants be exclusively breastfed for the first six months of life [53, 54]. Evidence indicates breastfeeding reduces the risk of childhood diseases including gastrointestinal [55] and respiratory infection [56], otitis media [57], type 1 diabetes [58, 59], overweight and obesity [60] and childhood cancer [61]. Breastfeeding duration has also been associated with improved cognitive development [62].

Maternal benefits

Breastfeeding also has important maternal health benefits including reduced risk of osteoporosis, breast cancer and Type 2 diabetes, and improved psychological health [63, 64]. The impact of breastfeeding on long term metabolic risk factors was examined in a retrospective longitudinal study of 212 Finnish women [65]. Compared to women whose duration of breastfeeding was shorter than recommendations (<6 months), women who breastfed for a longer duration were more likely to have reduced health risks, including lower fat mass, lower body weight (6-7 kg less), lower fasting glucose, insulin, total and LDL cholesterol, 16-20 years postpartum (p<0.05) [65]. These results remained after adjustment for education level [65]. This study provides support for the maternal metabolic benefits of
breastfeeding, however, more research is needed to expand on these particularly in the current obesogenic environment.

**Breastfeeding statistics in Australia**

Australian women are successful at meeting recommendations for breastfeeding initiation. However, breastfeeding duration rates are suboptimal [66, 67]. Results from the 2010 Australian National Infant Feeding Summary (ANIFS) found an initiation rate of 96% but duration rates were below national guidelines, which recommend infants be exclusively breastfed up to six months postpartum [67, 68]. The ANIFS revealed in 2010 that 39% and 15% of infants were being exclusively breastfed at three and five months, respectively [68].

Overweight and obese women are at a greater risk of not initiating breastfeeding and of having shorter breastfeeding durations [69-71]. In a longitudinal cohort, overweight and obese women (USA, n=405) were 1.8 and 2.2 times more likely to have delayed lactogenesis compared to underweight and normal weight women, respectively [70]. In a similar study on Danish women (n>37, 000), overweight and obese women had shorter breastfeeding duration rates compared to normal weight women (RR: 1.12, 95% CI: 1.09-1.16 for overweight and RR:1.39, 95% CI: 1.19-1.63)) [72].
Breastfeeding and WR

Breastfeeding increases maternal energy demand [73] and as a result can be a mechanism by which energy expenditure is increased and weight loss induced in some women. However, findings on the effects of breastfeeding and weight loss remain inconsistent across previously reported reviews and studies [74-77]. Some studies have reported weight loss in women who are breastfeeding [78] while others have found no weight loss in comparison to those not breastfeeding [74-77]. Even when lactation is reported to reduce postpartum weight, the effects are only minor with small amounts of weight loss per week [75, 79]. In a large scale study involving over 36,000 Danish women, participants lost between 0.06 - 0.09 kg for every week of exclusive breastfeeding [46]. Reasons for this small effect between breastfeeding and WR may be related to the lack of detail reported on breastfeeding status. Lovelady (2011) suggests that some breastfeeding women have an energy imbalance by increasing their kilojoule intake above requirements for breastfeeding [75, 79]. However, this is difficult to evaluate as dietary intake data for breastfeeding women is not commonly reported.

1.1.2 Conclusion

WR in the postpartum period is common for many women. Evidence suggests potential contributors to WR include excessive GWG, poor breastfeeding outcomes and possibly pre-pregnancy BMI. However, more research is required to determine the contributors to
WR in order to allow the development of interventions to assist women to reduce WR. The ante- and postnatal period is an ideal time to educate women about improving their health and support behavior change because they have frequent contact with health care professionals and interest in the health and nutrition of their offspring.
1.2 Research aims and hypotheses

Overall, the primary objective of this thesis was to explore the potential predictors and pathways of WR after birth.

More specifically, the aims of the thesis are:

1. To investigate socio-demographic, weight, obstetric and breastfeeding variables that may contribute to WR up to 12 months postpartum in a prospective longitudinal cohort of women.

2. To establish the feasibility of a pilot RCT with overweight and obese pregnant women who are randomised to one of three groups:
   i. Group one receives a weight management (WM) program during pregnancy to reduce postpartum WR; this group is known as the WM group.
   ii. Group two receive the same weight management program as group one as well as additional education and support from an International Board Certified Lactation Consultant (IBCLC); this group is known as the WM+LC group.
   iii. A control group who receive the same weight management program but not until three months postpartum.

3. To compare the efficacy of providing weight loss advice, lactation support, or both to reduce WR at three and six months after birth between the three groups.
4. To compare insulin resistance markers, measured by homeostatic model assessment (HOMA-IR); and CVD risk markers, measured by total cholesterol (TC), low density lipoprotein (LDL) & high density lipoprotein (HDL) cholesterol at three and six months between the three groups.

5. To assess whether lactation consultant support increases the proportion of exclusive and/or any breastfeeding at three and six months postpartum.

The subsequent hypotheses are:

1. Of participants in the prospective longitudinal cohort, those who gain the greatest amount of weight in pregnancy and who breastfeed for a short duration will retain the greatest amount of weight relative to their pre-pregnancy BMI.

2. Women in the WM and WM+LC groups will have a lower WR at six months postpartum compared to those in the control group.

3. Women in the WM+LC group will have an increased proportion of exclusive breastfeeding and the mean duration of ‘any’ breastfeeding at three and six months postpartum.

4. Women in the WM and WM+LC groups will have lower HOMA-IR scores and improved plasma lipid profiles at six months postpartum, compared to those in the control group.
1.3 Thesis structure

This thesis has two primary chapters (Chapter 2 and 3) both encompassing maternal health in the postpartum period. Chapter 2 details WR, breastfeeding and socio-demographic results of postpartum women from a prospective longitudinal cohort. This longitudinal cohort is known as the Women and Their Children’s Health (WATCH) study and comprises 180 women recruited during pregnancy and followed up for more than 12 months postpartum [80]. Chapter 2 has been accepted for publication [81]. Results from this cohort were used to guide the RCT described in Chapter 3.

Chapter 3 details the methods, results and discussion of the pilot RCT, known as the Bouncing Back to your Pre-baby Body (BBPBB) study. The purpose of the study was to reduce postpartum WR and improve breastfeeding success at 3 and 6 months. Thirty-six overweight and obese pregnant women were recruited and randomized at 26 weeks gestation to receive a weight management program with or without lactation consultant support. A commercial self-management weight loss program was used for the study and is known as the Total Eating Management system (TEMplate). Women in the WM and WM+LC groups received this program in the third trimester and control participants received it at three months postpartum. An IBCLC was employed to provide extra support to the participants in the WM+LC group. Data collection was conducted at 26 and 35 week’s gestation and three and six months postpartum.
Collected data consisted of socio-demographic, medical, anthropometric, breastfeeding, physical activity and nutritional intake variables. This chapter is being prepared for submission to a peer reviewed journal.
Chapter 2: PREDICTORS OF POSTPARTUM WEIGHT RETENTION IN A PROSPECTIVE LONGITUDINAL COHORT

2. OVERVIEW

2.1 Abstract

Postpartum weight retention (WR) occurs in 60-80% of women with some retaining $\geq$ 10 kg with contributing factors reported as pre-pregnancy body mass index (BMI), gestational weight gain (GWG) above the Institute of Medicine (IOM) guidelines and breastfeeding. A longitudinal study of pregnancy, with 12 month postpartum follow up was conducted to determine factors associated with WR.

Pregnant women (n=152) were recruited from John Hunter Hospital antenatal clinic in 2006 in New South Wales, Australia. Pre-pregnancy weight was self-reported; weight was measured four times during pregnancy (for GWG) and in the first 12 months postpartum. Infant feeding data were obtained via questionnaires. Breastfeeding was categorised as exclusive, predominant, complementary or not breastfeeding. Linear mixed models tested the predictors of WR, with and without adjustment for potential confounders.

Compared to pre-pregnancy weight, 68% of women retained weight at 12 months, median [IQR] 4.5 [2.1-8.9] kg. After controlling for sociodemographic variables, parity and infant sex, GWG was positively associated with WR (p<0.01), but pre-pregnancy weight did not predict WR. For each additional week of any breastfeeding, 0.04 kg less weight was retained. Compared to women who retained
weight, those women who did retain had higher rates of exclusive breastfeeding at three months \((p<0.05)\), but the number of weeks of exclusive breastfeeding failed to predict WR for all women.

WR following childbirth is common and associated with amount of GWG, while the number of weeks of ‘any’ breastfeeding contributed to postpartum weight loss. Whether these are modifiable strategies to optimise the weight status of women at this life stage requires further research.
2.2 Introduction

Thirty-five per cent of women in Australia, aged 25 to 35 years, are overweight or obese (BMI >25 kg/m$^2$) [82]. Many women attribute weight gain to childbearing, particularly with successive pregnancies [22, 39, 83, 84]. Therefore, pregnancy and the postnatal period could be an important time to motivate and educate women to make healthy lifestyle changes [85]. However, women require knowledge, skills and/or support to undertake these changes [86]. Clinicians, such as obstetricians and midwives, have regular contact with women during pregnancy and are well placed to assist women to achieve a healthy weight and make lifestyle changes. Further knowledge of the factors predicting greater postpartum weight retention will help identify those at risk.

Previous studies have reported that 50 – 80% of women retain 1.4 – 5 kg up to 12 months after birth, which may become permanent [15-18]. Furthermore, 20 – 50% will retain five to ten kg 12 months after birth [15, 17, 19]. Excessive weight gain in pregnancy is associated with later overweight and obesity [20, 21] which is a risk factor for obstetric complications in subsequent pregnancies as well as cardiovascular disease, metabolic syndrome and diabetes [22, 23].
Gestational weight gain (GWG) has been associated with both short and long term weight retention (WR), which has been confirmed in more than 10 observational studies, one systematic review and a meta-analysis [17, 21, 24, 46-51, 87]. The meta-analysis of nine observational studies demonstrated that women who gained above the Institute of Medicine (IOM) GWG recommendations are on average 4.7 kg heavier up to 15 years postpartum compared to those whose weight gain matched with the recommendations [24]. Results from a longitudinal study of 2356 British women found those who had excessive gestational weight gain (based on the IOM guidelines) had adverse health outcomes 16 years after birth compared to women who gained within recommendations [47]. Those with excessive GWG were 3.6 times more likely to have a of BMI $\geq 25$ kg/m$^2$ (95% CI 2.6-4.9) and 2.8 times more likely to have a waist circumference $\geq 80$ cm (95% CI 1.8-4.0) 16 years postpartum [47].

The evidence is equivocal as to the association between pre-pregnancy BMI and WR. A lower pre-pregnancy BMI has been associated with higher WR (coefficient=-0.5; p-value=<0.001) [39]. However, the inverse has also been reported [40, 41]. These results are based on observational studies with differing sample sizes (n=247-1423), socioeconomic status, country of origin (Brazil, USA and Stockholm) and length of follow up (nine months – 15 years). This inconsistency indicates that further research is needed [39-41]. While the relationship between pre-pregnancy BMI and WR is
unclear, there is considerable evidence that a high BMI increases the risk of adverse maternal and infant outcomes [30-34]. For example, a high pre-pregnancy BMI increases the risk for adverse outcomes including gestational diabetes (RR=2.1; 95% CI 1.7-2.7 for BMI>25.0-29.9 kg/m² and RR=2.1; 95% CI 2.2-3.9 for BMI ≥ 30 kg/m²) [31, 32], pre-eclampsia (OR=2.1-5.2 for overweight and obese) [33], delivery intervention [30], macrosomia (OR 1.6; 95% CI 1.5-1.6 for BMI >25.0-30 kg/m² and 2.4; 95% CI 2.2-2.5 for BMI ≥ 30 kg/m²) [34] and reduced rates of breastfeeding initiation and duration [35, 36]. Excessive postpartum weight retention has also been linked with increased health risks including overweight and obesity [24]. Furthermore, the postpartum period has been associated with disordered eating, diminished self-esteem and depression [88-90], all of which can compound WR [91, 92].

Breastfeeding should theoretically reduce WR due to the energy cost of lactation of approximately 2100 to 2800 kJ per day [93-95]. However, research on the relationship between breastfeeding and WR has shown minimal or no effect [25, 26]. Ohlin et al (1990) found a significant but very weak correlation (r=-0.09, p<0.01) between breastfeeding and weight loss at 12 months postpartum [18], while Baker et al (2008) found that for every one unit increase in breastfeeding score (1 point given for each week of full breastfeeding), WR was decreased by 0.01-0.04 kg [46]. Two additional studies found that women exclusively breastfeeding were 1
[96] and 2 [97] kg lighter at six months and 12 months, respectively, compared to those formula feeding (p<0.05). A methodological problem is that these studies define breastfeeding as “any” breastfeeding, without using the standard World Health Organization (WHO) definitions of exclusive, predominant, complementary, or no breastfeeding [40, 96, 97] (Table 1).

Table 2.1: Criteria for the World Health Organisation (WHO) infant feeding categories.

<table>
<thead>
<tr>
<th>Breastfeeding category</th>
<th>Food sources the infant can receive</th>
<th>Food sources the infant cannot receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive</td>
<td>Breastmilk as the main food source, medicine, vitamins, minerals</td>
<td>Anything else</td>
</tr>
<tr>
<td>Predominant</td>
<td>Breastmilk as the main food source, liquids (water, fruit juice, oral rehydration salts, ritual fluids, medicine, vitamins, minerals)</td>
<td>Anything else</td>
</tr>
<tr>
<td>Complementary</td>
<td>Breastmilk AND solid/semi solid food or any other liquid (non-human milk, food based fluid, water, fruit juice, oral rehydration salts, ritual fluids, drops, syrups)</td>
<td></td>
</tr>
<tr>
<td>No breastfeeding</td>
<td>Solid/semi solid food, liquid (non-human milk, food based fluid, water, fruit juice, oral rehydration salts, ritual fluids, drops, syrups)</td>
<td>Breastmilk</td>
</tr>
</tbody>
</table>

Therefore the aim of this study is to assess the contribution of factors associated with WR up to 12 months postpartum, including pre-pregnancy BMI, GWG, and breastfeeding variables, including breastfeeding category and duration.

2.3 Materials and methods

A detailed description of the methods has been previously published [80]. Briefly, the Women and their Children’s Health (WATCH) study is an ongoing prospective cohort spanning pregnancy and early childhood conducted at the John Hunter Hospital, Newcastle, Australia [98]. Women who were less than 18 weeks pregnant were considered eligible to participate, including those receiving maternal care from private obstetricians or shared-care from general practitioners. The WATCH Study received ethics approval from the Hunter New England and the University of Newcastle Human Research Ethics Committees. Recruitment occurred from July 2006 to December 2007 with a total of eight study visits by one year after birth; four scheduled during pregnancy at approximately 19, 25, 30 and 36 weeks gestation and four during the first year postpartum at three, six, nine and 12 months.

Anthropometric assessments were performed by a dietitian with Level One Anthropometry accreditation from the International Society for the Advancement of Kinanthropometry [99]. Pre-pregnancy
weight was self-reported at the first study visit and subsequent weights were measured on annually calibrated electronic scales at each visit (A&D FV-150K, A&D Mercury Pty Ltd, Thebarton, South Australia). Height (cm) was measured at two assessments using the same wall mounted stadiometer (Seca Deutschland, Hamburg, Germany) and the mean was used in analysis. BMI was calculated (weight (kg) / height$^2$ (m$^2$)). GWG was calculated by subtracting the weight at 36 weeks gestation from the pre-pregnancy weight. WR was calculated by subtracting the pre-pregnancy weight from the 12 months postpartum weight. Participants were divided into two groups based on WR; (i) those who retained > 0 kg (known as retainers) and (ii) those who retained ≤ 0 kg (known as non-retainers).

Infant feeding data were collected during the first year after birth using two questionnaires: an Infant Feeding Recall, and a Current Feeding Practices questionnaire, modified from Hector et al [100]. These questionnaires were interviewer administered by an Accredited Practising Dietitian who had been trained to administer the questionnaires in a standardised manner. Responses were used to determine breastfeeding initiation, duration and exclusivity. Time taken to complete the interview was five to ten minutes. Breastfeeding initiation was a binary outcome (Yes / No) and phrased as ‘Has your child ever been breastfed?’ Breastfeeding duration was measured as ‘Is your child currently being breastfed?’ (Yes / No) at three, six, nine and 12 months postpartum, and ‘What is the total time for which your
child was breastfed (weeks)?’ The questionnaires were used to determine the number of weeks of any breastfeeding and of exclusive breastfeeding. Breastfeeding exclusivity was determined using responses from 24 questions from the Infant Feeding Recall and Current Feeding Practices (Hector et al., 2004), that asked about intake of breastmilk, infant formula, tinned/powered/fresh milk, plain/sweet water, juice, medicine, vitamins, minerals, oral rehydration salts and solids. Breastfeeding was further defined by the WHO infant feeding categories [101] displayed in Table 1.

A range of socioeconomic and maternal outcomes were captured via questionnaire at study visit one or were recorded in the Obstetrix database. Obstetrix is the major repository in New South Wales for recording antenatal data, patient and family history and birth outcomes [102]. Data on marital status, education level, country of birth, Index of Relative Socioeconomic Disadvantage (IRSAD) based on postcode, smoking status, age at conception, parity, gestational age at birth and infant sex were recorded. The IRSAD uses national census data including household income and employment, to derive a measure of social advantage and disadvantage based on area of residence (postcode) [103].

2.3.1 Statistical Analyses

To be included in the analyses, women in the WATCH study had to have attended one or more postpartum follow up visits.
Women were excluded if they became pregnant in the postpartum follow up period (n=11) or had twins (n=1). One repeat participant only had data from her first pregnancy (of two) included in the analyses.

Data were analysed using the statistical software package Intercooled Stata, version 11 (StataCorp LP, College Station, Texas, USA) and statistical significance was set at $\alpha=0.05$. All data was tested for normality and the median [interquartile range] was recorded for non-normally distributed data. Chi-2, Fisher’s exact and Ranksum tests were used to determine the characteristics of women who differed by WR groups. Linear mixed models with random effects were used to determine the variables that predicted WR over the 12 months postpartum. Pre-pregnancy BMI, GWG, breastfeeding categories and weeks spent breastfeeding were used as the main predictors of WR (as a continuous variable), with and without adjustment for potential confounders. The potential confounders that were tested comprised of infant sex, maternal age at conception, smoking during pregnancy, IRSAD, education level, marital status and parity. Model 1 was analysed without adjustment and Model 2 was adjusted for age, smoking, IRSAD and parity as these were the confounders which remained in the model at $p<0.2$.

We conducted an additional comparative analysis between those who withdrew and those who remained in the study. This was
done to determine any differences in socio-demographic, weight and breastfeeding variables. The variables tested were maternal age, marital status, country of birth, education level, IRSAD (Index of Relative Socioeconomic Advantage and Disadvantage), parity, pre-pregnancy weight and BMI, gestational weight, breastfeeding initiation and duration.

Women who did not attend a postpartum visit or those who withdrew from the study during pregnancy were excluded from the comparative analysis. They were excluded on the basis that they did not have any available data on WR. We conducted a comparative analysis to determine any differences in socio-demographic, weight and breastfeeding variables between those excluded and included from the analysis. The variables tested were maternal age, marital status, country of birth, education level, IRSAD (Index of Relative Socioeconomic Advantage and Disadvantage), parity, pre-pregnancy weight and BMI, gestational weight, breastfeeding initiation and duration.
2.4 Results

The proportion of women who were still enrolled in the WATCH study at the 12 month follow-up was 81% (n=146). Reasons for withdrawal included ‘too busy’ (n=9), had moved (n=4), fetal or child death (n=4), lost contact (n=4), ‘too much effort to participate’ (n=3), or other reasons (n=9). Results of the comparative analysis between withdrawals and those who remained in the study revealed there was only one difference between the groups, which was age (p=0.03). Participants who had withdrawn were younger (mean + SD, 26.7 + 5.5 years) compared to those who remained in the study (mean + SD, 29.2 + 5.5). In addition to this, results of the comparative analysis in Table 2 between those excluded and those included from the comparative analysis in Table 2 revealed there was only one difference between the groups, which was marital status (p=0.03). Excluded participants were less likely to be in a defacto or married relationship (30%) compared to included participants (13%).
Table 2.2: Characteristics of all participants (n=152), non-retainers and retainers at 6 (n=129) and 12 (n=114) months

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All (n=152)</th>
<th>WR(^b) at 6 months (n=129)</th>
<th>p-value</th>
<th>(WR) (^b) at 12 months (n=114)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age(^c)</td>
<td>28.6 [25.2-32.8]</td>
<td>29.8 [26.7-36.6]</td>
<td>0.17</td>
<td>29.4 [26.2-34.0]</td>
<td>29.6 [26.3-33.2]</td>
</tr>
<tr>
<td><strong>Height(^c)</strong></td>
<td>164.3 [160.1-169.2]</td>
<td>165.2 [161.5-170.0]</td>
<td>0.34</td>
<td>162.9 [158.8-166.9]</td>
<td>165.0 [160.0-16.9]</td>
</tr>
<tr>
<td>Born in Australia n (%)</td>
<td>142 (93.4)</td>
<td>25 (86.2)</td>
<td>0.16</td>
<td>35 (94.6)</td>
<td>70 (93.5)</td>
</tr>
<tr>
<td>Married or defacto n (%)</td>
<td>132 (86.8)</td>
<td>25 (86.2)</td>
<td>0.56</td>
<td>32 (86.5)</td>
<td>68 (88.3)</td>
</tr>
<tr>
<td>Education ≥ year 12 n (%)</td>
<td>104 (71.7)</td>
<td>21 (72.4)</td>
<td>0.70</td>
<td>27 (73.0)</td>
<td>59 (76.6)</td>
</tr>
<tr>
<td>Infant sex n (%) male</td>
<td>77 (50.7)</td>
<td>17 (58.6)</td>
<td>0.36</td>
<td>15 (40.5)</td>
<td>41 (53.3)</td>
</tr>
<tr>
<td>Smoking n (%)</td>
<td>18 (11.8%)</td>
<td>3 (10.3)</td>
<td>0.49</td>
<td>3 (8.1)</td>
<td>9 (11.7)</td>
</tr>
<tr>
<td><strong>Weight variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-pregnancy weight(^c)</td>
<td>65.0 [58.0-78.8]</td>
<td>75.0 [63.0-83.5]</td>
<td>&lt;0.01*</td>
<td>66.0 [59.0-80.0]</td>
<td>65.0 [58.0-76.0]</td>
</tr>
<tr>
<td>GWG(^c,d)</td>
<td>12.7 [8.9-17.1]</td>
<td>8.8 [6.4-12.2]</td>
<td>&lt;0.01*</td>
<td>10.3 [6.8-14.3]</td>
<td>14.7 [1142-18.1]</td>
</tr>
<tr>
<td>Weight at each time(^c)</td>
<td>69.2 [60.3-79.6]</td>
<td>71.0 [61.3-83.4]</td>
<td>0.90</td>
<td>62.9 [57.1-78.5]</td>
<td>70.4 [63.1-83.5]</td>
</tr>
<tr>
<td>BMI at each time(^c)</td>
<td>25.5 [22.4-30.4]</td>
<td>24.8 [21.8-31.1]</td>
<td>0.72</td>
<td>22.7 [20.8-29.1]</td>
<td>26.1 [23.3-30.6]</td>
</tr>
<tr>
<td>WR at each time(^c)</td>
<td>2.3 [-0.7-6.8]</td>
<td>-1.8 [-5.7-1.35]</td>
<td>&lt;0.01*</td>
<td>-1.8 [-4.4-0.9]</td>
<td>4.5 [2.1- 8.9]</td>
</tr>
</tbody>
</table>

Breastfeeding variables
<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>p-value</th>
<th>n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initiated breastfeeding n (%)</strong></td>
<td>136 (93.2)</td>
<td>27 (93.1)</td>
<td>94 (94.0)</td>
<td>0.57</td>
<td>36 (97.3)</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Exclusive breastfeeding at 3 months n (%)</strong></td>
<td>76 (52.1)</td>
<td>17 (58.6)</td>
<td>51 (52.0)</td>
<td>0.82</td>
<td>25 (67.6)*</td>
<td>0.046*</td>
</tr>
<tr>
<td><strong>Any breastfeeding at each time n (%)</strong></td>
<td>34 (28.8)</td>
<td>16 (55.2)</td>
<td>57 (57.0)</td>
<td>0.86</td>
<td>14 (37.8)</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>Total weeks breastfeeding</strong></td>
<td>29.0 [7.0-52.0]</td>
<td>7.0 [0.0-14.0]</td>
<td>26.0 [0.6-26.0]</td>
<td>0.17</td>
<td>40.0 [7.0-52.0]</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Number of weeks exclusively breastfeeding</strong></td>
<td>24.0 [20.0-26.0]</td>
<td>24.0 [21.0-25.0]</td>
<td>24.0 [20.0-26.0]</td>
<td>0.50</td>
<td>24.0 [20.0-25.0]</td>
<td>0.59</td>
</tr>
</tbody>
</table>

a This excludes those who withdrew during pregnancy and who were enrolled but did not attend any postpartum visits.
b Weight retained is pre-pregnancy weight (kg) subtracted from weight at three, six, nine and 12 months postpartum.
c Median [25th - 75th percentile] reported for non-normally distributed continuous data.
d Gestational weight gain (GWG) is pre-pregnancy body weight subtracted from weight at 36 weeks gestation.
Of those who attended the six month follow up, 22.4% (n=29) had returned to or weighed less than their pre-pregnancy weight, defined as non-retainers, while 77.5% (n=100) remained above their pre-pregnancy weight, defined as retainers (Table 2.2). Non-retainers at six months had a significantly higher median pre-pregnancy BMI (25.8 [IQR: 21.1 - 26.6] kg) and pre-pregnancy weight (75 [IQR: 63 to 83.5] kg) but lower GWG (8.8 [IQR: 6.4 -12.2]) compared to retainers (Ranksum: W=2.31, p=0.02 and Ranksum: W=-4.67, p<0.001, respectively). There were no differences in baseline height, demographics; or breastfeeding (category or number of weeks) characteristics between the two groups.

At 12 months postpartum, only 32.5% (n=37) of participants had returned to their pre-pregnancy weight or lower (Table 2). There were no significant differences in baseline demographic characteristics between retainers and non-retainers at 12 months after birth. Retainers were 7.5 kg heavier (70.4 [IQR: 63.1-83.5] kg; Ranksum: W=-2.52, p=0.01) and had a higher BMI (26.1 [IQR: 23.3-30.6]; Ranksum: W=-2.47, p=0.01) compared to non-retainers at 12 months postpartum. Weight retainers at 12 months postpartum also gained 4.4 kg more during pregnancy (Median 14.7 [IQR: 11.4-18.1] kg) and a lower proportion were exclusively breastfeeding (49.3%) at three months postpartum, compared to non-retainers (Ranksum: -4.09, p<0.001 and Fisher’s exact: no test statistic, p=0.046
respectively). However, there was no difference in the total number of weeks of exclusive or any breastfeeding between groups.

Figure 2.1 displays the 25th, median and 75th percentiles of WR over 12 months, divided into weight retainers and non-retainers. The trajectories of median weight loss were very different across the groups. On average, non-retainers had predominantly returned to their pre-pregnancy weight or less within the first three months postpartum, while retainers had a median of 5.3 [IQR: 2.9 – 9.9] kg above their pre-pregnancy weight at three months postpartum. A further 2.3 kg was lost between three and 12 months after birth in non-retainers, compared to less than one kilogram loss in retainers.

![Figure 2.1: Percentiles of postpartum weight retention (WR) for all participants (n=152) and by WR status](image)
In the adjusted linear mixed model GWG significantly predicted WR over the 12 months (â=1.5, p<0.001). The number of weeks spent breastfeeding was inversely associated with WR and for every one week increase in time spent breastfeeding, WR was reduced by 0.04 kg (p<0.001). The type of breastfeeding (e.g. exclusive, partial, complementary or not breastfeeding) was not associated with WR. For every child a woman had, WR was increased by 1.5 kg (p<0.001).

2.5 Discussion

The aim of this study was to examine the determinants of WR in a cohort of pregnant women who were followed up to 12 months postpartum. We found 68% of women from this cohort had retained some of their pregnancy weight gain at 12 months postpartum, with GWG being the main predictor of WR. The results for the breastfeeding variables were less clear. In the comparison of retainers versus non-retainers, there were no differences in the number of weeks of ‘any’ or exclusive breastfeeding. However, results from the longitudinal analyses (linear mixed models) showed that the number of weeks of ‘any’ breastfeeding did inversely predict weight retention. The median WR for the entire cohort after one year was just over two kilograms, with more than a third of women still five kilograms above their self-reported pre-pregnancy weight. This is of concern as weight gained by adult women increases the risk of developing type 2 diabetes and cardiovascular disease. Results from
the Nurses’ Health Study (n>230,000) found that every kilogram gained from the ages of 18 to 28 years starting from a normal weight range BMI of 18 kg/m², increased the risk for developing type 2 diabetes by 49% and 3.1% for cardiovascular disease [11, 12, 104].

The median 12 month WR of 2.3 kg in this study concurs with the literature which indicates women retain from 1.5 to 4 kg up to 12 months postpartum [15, 18, 107]. Previous studies report 14-25% of women (Europe and USA) retain five or more kg and even up to 20 kg [15, 16, 18, 19, 107] which can be carried into subsequent pregnancies and also move a woman into a higher BMI category. This is significant for women and their future children considering the adverse effects of a high BMI on antenatal and postpartum maternal and infant health [22, 23, 30, 36, 108]. Additionally, WR has been shown to accumulate at central rather than peripheral sites [109], which is an independent risk factor of cardiovascular disease in middle aged women (RR=3.1; 95% CI 1.5-6.1 for a waist circumference ≥ 96.5 cm and RR=3.3; 95% CI 1.8-6.0 for a waist to hip ratio of ≥ 0.88) [13].

In this study when participants were divided into retainers and non-retainers, pre-pregnancy BMI was not a predictor of WR. Previous studies are inconsistent when examining this association. A USA cohort of 985 women found self-reported pre-pregnancy BMI to be associated with long term (median two years), but not short term
(six weeks postpartum) WR [110]. Women with a higher pre-pregnancy BMI had greater two years postpartum WR (postpartum weight loss -4.2 ± 0.2, -3.4 ± 0.6, -0.3 ± 0.7 kg for normal weight, overweight and obese women, respectively; p<0.001) after adjustment for confounders including ethnicity, smoking, age, parity and mode of delivery [110]. Also in the USA (n=2006) women who had a high self-reported pre-pregnancy BMI were 40% less likely to retain more than 4.5 kg compared to normal and underweight women at three months postpartum (RR=0.6; 95% CI 0.4-0.8 and RR=0.4; 95% CI 0.3-0.6 for overweight and obese women respectively) [111]. At 12 months, underweight women were twice as likely to retain 0.5 - 4.5 kg compared to normal weight women (RR=2.0; 95% CI 1.6-2.7) after adjustment for marital status, parity, income, delivery mode and depression score [111].

In contrast, there is convincing evidence to support the association between greater GWG with short [19, 39, 48, 112, 113] and long term WR [21, 47, 114]. A recent meta-analysis of nine observational studies involving >65, 000 women [24] demonstrated that women who had a GWG above the IOM guidelines were 3.1 kg (95% CI 1.5-4.6 kg) and 4.7 kg (95% CI 2.9-6.5 kg) heavier at three and 15 years postpartum, respectively, compared to women who gained within the guidelines [24]. Five studies had short-term follow up (1.5 to 12 months postpartum) while four studies had longer-term follow up (3 to 15 years) [24]. Pooled results remained consistent
after adjustment for social class, however, adjustment for confounding within the individual studies was poor [24]. The true effect of GWG on WR requires further investigation with consideration given to the confounders of weight gain in women.

The revised 2009 IOM guidelines recommend appropriate GWG based on pre-pregnancy body mass index (BMI) with the aim of reducing the adverse maternal and infant outcomes including postpartum WR [44]. Excessive gestational weight gain (≥ 16 kg) increases the risk of pre-eclampsia (OR=2.8; 95% CI 2.4-3.2) [42], gestational diabetes (OR=1.7; 95% CI 1.2-2.6) [43], caesarean section delivery (OR=1.4; 95% CI 1.3-1.5) [42] and babies that are large for gestational age (OR=2.6; 95% CI 2.4-2.8) [42]. The guidelines were revised in 2009 as a result of the recognition that a number of characteristics of pregnant women in America have changed since the previous recommendations in 1990 [44]. These include an increase in the average age of childbearing, pre-pregnancy weight, gestational weight gain and infant birth weight [44]. The guidelines also include a range of weight gain for each BMI category with the recognition of diversity between women, including stature and ethnicity [44].

The IOM guidelines are an international standard that is frequently cited. However a number of experts consider there are too few quality studies informing these guidelines to justify recommending
changes in clinical practice [115]. This is mainly due to the evidence consisting of predominantly observational studies and only cohorts of women with similar demographics, suggesting the guidelines are not applicable to a range of demographics [116]. Despite this, there is evidence to suggest weight gain above the IOM guidelines is a risk factor for long term WR and adverse pregnancy outcomes [22, 23].

The association between breastfeeding and WR in this cohort was variable. The greatest decrease in WR for all women was observed during the first three months and non-retainers had higher rates of exclusive breastfeeding at three months. However when infant feeding was further categorised (exclusively breastfeeding, predominantly breastfeeding, complementary or not breastfeeding) it was not predictive of WR after adjustment for demographic, social and pre- and antenatal weight variables. Although women who are exclusively breastfeeding have a significantly greater energy output than those not breastfeeding, evidence suggests weight loss may be minimised due to compensatory increases in appetite and energy intake [117]. In the current study, when examining total duration of ‘any’ breastfeeding over 12 months measured in weeks, the longer a woman breastfed the less weight retained. Women who maintained any breastfeeding over the 12 months had a 2 kg lower weight retention. Previous studies have found that during the first three to six months postpartum, compared to not breastfeeding, exclusive breastfeeding can lead to weight loss of up to 2 kg [46, 97, 118],
although a greater weight loss (-1.4 kg) in women who are formula feeding compared to those breastfeeding up to three months postpartum has also been reported [26]. Two studies found no relationship between breastfeeding and WR [25, 119].

Comparison of results between studies is problematic due to the inconsistent definitions of breastfeeding status. Women may be referred to as ‘exclusively’, ‘fully’, ‘predominantly’ or ‘prolonged’ breastfeeding, and as an example ‘exclusively’ could be defined as any of the following: a) breastmilk as a measurement of infant’s energy intake [118] b) measuring breastmilk plus up to 120 mL/d of other milk [97] or c) solely breastmilk with the inclusion of vitamins, minerals and/or water [46]. Three studies defined exclusivity as breastfeeding with no introduction of formula, other milk or fluids [97, 120, 121] and two studies did not provide definitions for the infant feeding categories [40, 96]. As a result no comparison of the different analyses of energy expenditure in relation to output of milk can be made.

In the current study, the WHO infant feeding categories (Table 1) to define breastfeeding patterns were used [101] as these are considered the gold standard definitions. We propose future research uses the WHO infant feeding guidelines to standardise research in this area.
The limitations of the current study need to be acknowledged. Postpartum weight change is multi-factorial and a limitation of the current study is that it has not adjusted for all known factors which may influence weight gain, such as dietary intake and physical activity. Without including these factors, it is difficult to determine what truly affects postpartum WR. There are no known studies which include data on energy intake, energy expenditure (including physical activity), postpartum smoking, hormonal changes influencing weight, and the energy cost of lactation production and output all in the one study. Other factors that could also be considered include psychological health, hours of sleep, social support, lactation support, contraceptive use and birthing experience (mode of delivery, length of hospital stay, infant hospitalisation). Furthermore, reliable and validated data collection techniques need to be considered rather than the use of subjective self-report methods. The small sample size of the present study also needs to be recognised when determining associations and may explain some of the differences between the findings of this study and others mentioned in the discussion. Regardless of the limitations, the study still provides sufficient evidence on maternal factors which are associated with WR.

An additional limitation is the difference between those who withdrew and those who remained in the study. We found that the withdrawals were younger, on average, in comparison to those who remained in the study. This introduces a potential selection bias.
indicating that our study sample may not be representative of the true population. As a result, interpretation of the data should be done with caution and also emphasises the need for further research on WR in postpartum women. Similarly, there was a difference in marital status between those who were excluded and included from the comparative analysis in Table 2. This introduces a potential bias that should be considered when extrapolating the data to other populations.

In conclusion, we found that the majority of women in the WATCH cohort retained excess weight one year after childbirth. Excessive gestational weight gain, parity and less time spent breastfeeding were associated with weight retention. These factors could be targeted as part of routine ante- and postnatal care within current maternal health services, as a strategy to optimise health and wellbeing of mothers and their offspring.

Women can be more motivated during pregnancy to make positive lifestyle changes and this, combined with regular clinician contact, presents an ideal opportunity to target improvements in their health behaviours [122]. This is important because research suggests behavioural changes adopted during pregnancy can be maintained throughout the postpartum period and into the long term [123, 124]. However, clinicians report difficulty in educating women about weight before and during pregnancy due to time constraints, inadequate training, apprehension due to the potentially sensitive nature of the
topic, self-perception of body weight, inability to believe the patient can lose weight or a belief that treatment will be ineffective [86, 125, 126]. During the postpartum period, paediatricians and child and family health nurses are in a position to provide brief advice and/or to make referrals to dietitians, exercise physiologists and physiotherapists who can then provide education on nutrition, behavioural management and physical activity.

2.5.1 Key messages

An improved understanding of why WR occurs and its impact on the health of the mother and infant is crucial to the development of guidelines on how to manage postpartum WR.

Ante- and postnatal factors, including excessive GWG and decreased time of any breastfeeding, are associated with WR and should be considered in ante- and postnatal weight management advice.

Many women are heavier at 12 months postpartum which can increase their BMI category. Women who are overweight or obese have an increased risk of unfavourable short and long term health outcomes, including unfavourable pregnancy outcomes, diabetes and cardiovascular disease and research is urgently required to address this within current maternal services.
2.6 Conflict of interest statement

The authors declare that they have no conflicts of interest.

2.7 Source of funding

Clare Collins is funded by a Career Development Fellowship from the National Health and Medical Research Council. The WATCH study was funded by the University of Newcastle, the John Hunter Hospital Charitable Trust, the Newcastle Permanent Charitable Foundation and Hunter Medical Research Institute.
Chapter 3: BOUNCING BACK TO YOUR PRE-BABY BODY STUDY – A PILOT RANDOMISED CONTROLLED TRIAL TO IMPROVE MATERNAL POSTPARTUM HEALTH

The following chapter is in preparation for submission to a peer review journal.
3. Pilot study intervention paper

3.1 Abstract

Overweight and obesity is prevalent among Australian women of reproductive age (aged 25 years and over) with 54% having a BMI >25.0 kg/m² [2, 5]. Additionally, these rates are higher when compared to women of other age groups [2, 3]. Childbearing is often associated with weight gain in women, particularly short and long term WR. In addition to this, women who carry excess weight often have poorer breastfeeding outcomes. The postpartum period is a significant time for change in women’s lives and presents an ideal opportunity to improve health outcomes for women and their families.

Women with a self-reported pre-pregnancy BMI of 25-35 kg/m² (n=36) were recruited during pregnancy from the John Hunter Hospital antenatal clinic in New South Wales, Australia. Participants were stratified by BMI and randomised to one of three groups and followed up to six months postpartum, with the primary endpoint three months postpartum. Women received a weight management program with (WM+LC, n=11, n=11) or without (WM) additional breastfeeding support, or were assigned to a wait-list control group (n=12) up to three months postpartum. Data collection included anthropometric, medical, socio-demographic, infant feeding methods and plasma biochemistry (glucose, insulin and lipids) variables. Analysis of
variance and covariance was conducted to determine if differences existed in key variables between the three groups.

Sixty-nine per cent of women were still enrolled in the study at six months postpartum. There were no statistically significant differences in any variables at baseline, three or six months postpartum between the WM+LC, WM and control groups. However results were in the direction expected, in the intervention groups for weight, lipid, glucose and breastfeeding variables at both three and six months postpartum.

In conclusion, the approach is feasible as a strategy to reduce postpartum WR and requires testing in an adequately powered RCT.
3.2 Introduction

In 2008, the WHO estimated that nearly 300 million women worldwide were obese [1]. In 2004-05, approximately 45% of Australian women were overweight or obese, with younger women (18-23 years) gaining weight at a higher rate than previous generations and other age groups [2, 4]. Many women attribute adult weight gain to childbearing which can subsequently contribute to long term overweight and obesity[114].

Postpartum WR is calculated by subtracting the pre-pregnancy weight from the weight at any time postpartum (up to 12 months). Fifty to eighty percent of women retain 1.4-5 kg up to 12 months postpartum, with 20-50% retaining ≥5 kg [15-19], increasing their risk of Type 2 diabetes and heart disease long-term [22, 23]. This retained weight can potentially place some women in the overweight or obese BMI categories, which is associated with an increased risk for subsequent poor pregnancy outcomes [23, 30]. These outcomes include gestational diabetes (RR=2.09 for BMI ≥ 30 kg/m²) [32], delivery intervention [30], macrosomia (OR=1.57 for BMI >25.0-30.0 kg/m² and 2.36 for BMI ≥ 30 kg/m²) [34] and poorer rates of breastfeeding initiation and duration [37]. Women with a high BMI have been reported to have a 7% lower breastfeeding initiation rate and breastfeed for an average of six weeks less compared to women with a normal BMI [35].
Childbearing presents significant physiological, psychological and social changes which can be barriers or facilitators to a healthy lifestyle to support this decrease in WR [127]. Reported changes include a decrease in diet quality [128], gestational weight gain (GWG) above the Institute of Medicine (IOM) guidelines (see Table 1.1) [24], decreased physical activity compared to pre-pregnancy or pregnancy, return to work [129], change in family dynamics [129] and lack of social support [130]. Postnatal depression may also occur, with one in seven Australian women diagnosed [131].

A recent study was conducted with mothers who had a BMI of > 25 kg/m², to determine barriers to postpartum weight loss [132]. Results from 10 women participating in face-to-face interviews reported the major barriers as a lack of time, low energy levels, weight loss as a low priority, low motivation and psychological concerns [132] and these were thought to contribute to high WR [133, 134]. Despite this, there is evidence to suggest that women can be motivated to make healthy choices for themselves and their families and frequently seek advice and support from family, friends and health professionals during pregnancy and motherhood [135, 136]. In addition to this, women have frequent contact with clinicians in the postpartum period which provides an avenue to implement education to encourage healthy lifestyles.
Australia achieves the national breastfeeding initiation target, with a rate of more than 90% [62, 66]. Despite this, Australian breastfeeding duration rates fail to meet both national and international recommendations, which advocate exclusive breastfeeding until six months of age [66, 67]. Results from the 2010 Australian National Infant Feeding Summary found an initiation rate of 96% but duration was sub-optimal [66]. At three months postpartum, 39% of infants were exclusively breastfed [62] At four and six months of age 69% and 60% of infants were receiving any breastmilk, respectively [62]. Only 15% of infants were exclusively breastfed up to five months [62]. The National Health and Medical Research Council (NHMRC) recommend exclusive breastfeeding for all infants up to six months of age [67].

Overweight and obese women are at a greater risk of not initiating breastfeeding and having shorter breastfeeding durations [69-71]. In a longitudinal cohort, overweight and obese women (USA, n=405) were 1.8 and 2.2 times more likely to have delayed lactogenesis compared to underweight and normal weight women, respectively [70]. In a similar study on Danish women (n>37, 000), overweight and obese women had shorter breastfeeding duration (described as risk of termination) rates compared to normal weight women (RR: 1.12, 95% CI: 1.09-1.16 for overweight and RR:1.39, 95% CI: 1.19-1.63)) [72]. This suggests women with a higher BMI may need to be targeted for additional breastfeeding support.
Due to the benefits of breastfeeding, it is important that women receive education and support during pregnancy and into the postpartum to increase initiation and duration rates. Results from two Cochrane reviews examined a variety of antenatal and postnatal educational methods to increase breastfeeding initiation [137] and duration [138]. The breastfeeding interventions included in the reviews consisted of formal and informal education, one-on-one and group education, workshops, peer counseling, discussion groups, practical skills and a combination of these. The antenatal interventions which improved breastfeeding initiation were peer counseling and regular education from an IBCLC [137, 138]. However no one intervention was more favourable than another for improving breastfeeding duration [138]. Due to the wide variety of interventions, poor study methodology and lack of quality RCTs included in all three reviews, no consistent conclusion can be drawn to promote a particular education tool to improve breastfeeding success. More well-conducted RCTs are required to determine the best interventions to improve breastfeeding initiation and duration rates, with a particular focus on those at risk of suboptimal rates such as overweight and obese women.

Research to manage postpartum WR has only recently been a topic of research interest. There have been 10 RCT’s which aim to reduce postpartum WR or increase weight loss [49, 107, 133, 134,
139-141]; however none of these studies include a breastfeeding support intervention. There are a number of methodological differences between our study and other RCTs so comparisons may not be valid. For instance, two interventions incorporated physical activity as the only weight loss strategy [142, 143] and another excluded women who were breastfeeding [140]. Of the remaining seven studies, four targeted overweight and obese women [133, 134, 141, 144] while three included women of any BMI [49, 139, 145]. Six studies included women who were either breastfeeding only or mixed feeding (breastfeeding and formula feeding) while one study did not indicate the infant feeding status [141]. Five studies [49, 134, 141, 144, 145] were successful in reducing postpartum WR or weight loss in the intervention compared to control group. Only one other study had a similar target group to the BBPBB study which was overweight and obese women who were planning to breastfeed [144]. A summary of results are presented in Table 3.8.
Table 3.1: Study characteristics of randomised controlled trials on postpartum weight loss

<table>
<thead>
<tr>
<th>Author (date)</th>
<th>BMI/n</th>
<th>Follow up period</th>
<th>Intervention group details</th>
<th>Weight variable outcome</th>
<th>Results (kg)</th>
<th>p-value</th>
<th>Withdrawal rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBPBBa</td>
<td>OWb, OBc</td>
<td>3 months</td>
<td>• Breastfeeding support&lt;br&gt;• Self-management weight loss program (diet and physical activity)</td>
<td>WRd</td>
<td>C&lt;sup&gt;e&lt;/sup&gt;: 7.7 ± 6.7&lt;br&gt;WM&lt;sup&gt;f&lt;/sup&gt;: 1.6 ± 7.0&lt;br&gt;WM+LC&lt;sup&gt;g&lt;/sup&gt;: 3.7 ± 8.1</td>
<td>0.17</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>n=36</td>
<td>postpartum</td>
<td></td>
<td></td>
<td>C&lt;sup&gt;e&lt;/sup&gt;: 5.9 ± 4.9&lt;br&gt;WM&lt;sup&gt;f&lt;/sup&gt;: 0.8 ± 7.2&lt;br&gt;WM+LC&lt;sup&gt;g&lt;/sup&gt;: 5.6 ± 8.8</td>
<td>0.26</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>6 months</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>postpartum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinnunen (2007)[139]</td>
<td>Any n=92</td>
<td>10 months</td>
<td>• Individual diet and physical activity counseling</td>
<td>WRd</td>
<td>Intervention: 1.8 (+ 4.3)&lt;br&gt;Control: 1.0 (+ 4.4)</td>
<td>0.42</td>
<td>8</td>
</tr>
<tr>
<td>Huang (2011) [49]</td>
<td>Any n=189</td>
<td>6 months</td>
<td>• Individual diet and physical activity counseling</td>
<td>WRd</td>
<td>Intervention (pregnancy + postpartum): 2.3 (+ 2.7)&lt;br&gt;Intervention (postpartum only): 4.1 (+ 3.6)&lt;br&gt;Control: 5.1 (+ 2.3)</td>
<td>&lt;0.001</td>
<td>21</td>
</tr>
<tr>
<td>McCrory (1999)[145]</td>
<td>OWb, OBc</td>
<td>11 days</td>
<td>• Individual diet with or without physical activity education</td>
<td>WLh</td>
<td>Diet only: -1.9 (+ 0.7)&lt;br&gt;Diet + exercise: 1.6 (+ 0.5)&lt;br&gt;Control: -0.2 (+ 0.6)</td>
<td>&lt;0.001</td>
<td>N/A</td>
</tr>
<tr>
<td>Study</td>
<td>Group Description</td>
<td>Duration</td>
<td>Intervention</td>
<td>WL</td>
<td>Control</td>
<td>p Value</td>
<td>Weight Loss</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>--------------</td>
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<td>---------</td>
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<td>-------------</td>
</tr>
<tr>
<td>Craigie (2011)[141]</td>
<td>All n=54</td>
<td>12 weeks</td>
<td>Individual lifestyle education</td>
<td>WL</td>
<td></td>
<td>N/A</td>
<td>-1.6 (+ 2.0) Control: 0.2 (+ 2.2)</td>
</tr>
<tr>
<td>O'Toole (2003) [134]</td>
<td>OW b n=40</td>
<td>12 months postpartum</td>
<td>Individual and group diet and physical activity counseling</td>
<td>WL</td>
<td></td>
<td>&gt;0.05</td>
<td>7.3 (+ 9.8) Control: -1.3 (+ 7.5)</td>
</tr>
<tr>
<td>Lovelady (2000)</td>
<td>OW b n=40</td>
<td>10 weeks</td>
<td>Diet and physical activity counseling</td>
<td>WL</td>
<td></td>
<td>&lt;0.001</td>
<td>-4.8 (+ 1.7) Control: -0.8 (+ 2.3)</td>
</tr>
<tr>
<td>Ostbye (2009)</td>
<td>OW b, OB c n=450</td>
<td>12 months postpartum</td>
<td>Individual and group diet and physical activity counseling</td>
<td>WL</td>
<td></td>
<td>&gt;0.05</td>
<td>0.9 (+ 5.1) Control: 0.4 (+ 4.9)</td>
</tr>
</tbody>
</table>

a Bouncing Back to your Pre-baby Body study
b Overweight (BMI 25.0–29.9 kg/m²)
c Obese (BMI 30.0–34.9 kg/m²)
d Weight retention (kg)
e Control
f Weight management
g Weight management + lactation consultant support
h Weight loss
While postpartum weight loss and breastfeeding advice have been studied separately, the two have not been combined in an RCT. Therefore, the aim of this pilot RCT was to determine the feasibility, acceptability and efficacy of providing breastfeeding support with and without weight loss advice in the antenatal clinical setting on postpartum weight changes and breastfeeding patterns.

3.3 Materials and methods

The primary focus of my Masters degree is the pilot RCT titled *Bouncing Back to your Pre-Baby Body* (BBPBB). We aimed to investigate the qualitative and quantitative effect of breastfeeding education with or without weight loss support on weight retention (WR), breastfeeding patterns, and biomarkers of cardiovascular (CVD) and insulin sensitivity. More specifically, we targeted overweight and obese women as a result of their increased risk of reduced breastfeeding success [63]. The interventions were conducted during pregnancy and after birth and we followed participants up until six months postpartum. The primary endpoint for evaluating weight loss was three months. This chapter describes the methods and results of the BBPBB study.

3.3.1 Ethics

This study was approved by the Hunter New England Health Human Research Ethics Committee and registered with the Human
Participants gave written informed consent.

3.3.2 Study sample

3.3.2.1 Bouncing Back to your Pre-baby Body Randomised Controlled Trial

The main research component was undertaken as a pilot project to inform a NHMRC Project Grant application. A number of researchers and clinicians were involved in this study which was undertaken at the John Hunter Hospital, Newcastle, New South Wales. When participants were unable to attend the hospital a home-visit was offered. My role included recruitment, data collection, delivery of intervention, and participant follow up.

3.3.3 Recruitment and eligibility

The BBPBB RCT recruited overweight and obese pregnant women from the Hunter region (population 550,000) of New South Wales, Australia between October 2010 and September 2011. Recruitment was predominantly through verbal recruitment by the antenatal clinic midwives. The pamphlet-style information statement (Appendix 1) and recruitment brochure (Appendix 2) were also provided to potential participants and were made publically available in the antenatal clinic waiting room. Interested potential participants were encouraged to contact the researcher directly to determine eligibility. Inclusion and exclusion criteria are presented in table 3.2.
Table 3.2: Inclusion and exclusion criteria for participants of the Bouncing Back to your Pre-baby Body study.

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aged &gt; 18 years</td>
<td>• BMI &lt; 25.0 or &gt; 35.0 kg/m²</td>
</tr>
<tr>
<td>• &lt; 26 weeks gestation</td>
<td>• Major medical problems such as Type 1 or 2 diabetes</td>
</tr>
<tr>
<td>• Pre-pregnancy BMI(^1) of 25-35 kg/m²</td>
<td>mellitus or heart conditions</td>
</tr>
<tr>
<td>• Intending to breastfeed</td>
<td>• Inability to exercise due to orthopedic or joint problems</td>
</tr>
<tr>
<td>• Delivering at the John Hunter Hospital</td>
<td>• Taking medications that may cause weight gain or loss</td>
</tr>
<tr>
<td>• Agree to not participate in other weight loss programs during the</td>
<td></td>
</tr>
<tr>
<td>study period</td>
<td></td>
</tr>
<tr>
<td>• Pass a health-screen and be available to attend study visits</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) BMI: Body Mass Index, kg/m²

Women in the overweight and obese class I category were targeted because of their increased risk of postpartum complications with breastfeeding and/or weight retention. Women with a pre-pregnancy BMI in the obese class II and III category (BMI > 35 kg/m²) were excluded because of their potential for increased medical care during the study period. Only women who were planning to breastfeed were included as breastfeeding education was part of one of the intervention arms. Eligibility was assessed using a health screen questionnaire (Appendix 3) and was conducted over the
phone or in person. Eligible participants were provided with an
information statement (Appendix 1) detailing the study requirement,
intervention details, anticipated benefits and names of the
researchers involved in the study and a consent form (Appendix 4).

3.3.4 Randomisation and allocation concealment

Once screened, deemed eligible and informed consent was
given, participants were randomised once to one of three groups.
Researchers involved in the data collection and/or intervention
delivery were blinded to group allocation. Participants were
randomized in blocks of three using a stratified randomised block
design based on pre-pregnancy BMI category (BMI 25 to <30 kg/m$^2$;
30 to 35 kg/m$^2$). This was done to ensure an equal distribution of pre-
pregnancy BMI category across the intervention groups. The opaque
sealed envelopes were pre-prepared with the study identification (e.g.
1001) on the front and the weight management allocation group
inside (i.e. weight management or control weight management) and
were given to the research dietitian (JM). Participants were given the
subsequent envelope in the sequence depending on their BMI i.e.
overweight or obese. These envelopes did not contain details of the
third intervention arm; therefore participants were blinded to allocation
to the IBCLC support group. Once a participant was recruited, their
details and study identification were sent to the researcher with the
randomisation codes (LMW). This independent researcher was
located at a different site would identify whether the participant was to
receive the third intervention arm, which was the IBCLC supported intervention. If they were allocated to this group, the IBCLC was provided with the participants details, by the independent researcher.
3.3.5 Intervention

The BBPBB study participants were randomised once to receive one of the following three intervention groups:

1. A self-directed weight management program called the Total Eating Management System (TEMplate™) provided in the third trimester at approximately 35 weeks, to implement when the baby is born. This group was known as the WM group;

2. Additional support to breastfeed from an IBCLC which included two face to face education sessions during pregnancy, a home visit after birth and follow up phone calls in the postpartum period, as well as the TEMplate™ program. This group was known as the WM+LC group;

3. A wait-list control group who received the TEMplate™ program at three months postpartum. This group was known as the control group.

3.3.5.1 The TEMplate™ system

Materials provided to the participants as part of the TEMplate™ program consisted of an information booklet and digital video disc (DVD), lunchbox, portion control dinner disc and water bottle [146].
The TEMplate™ program is based on Social Cognitive Theory which posits that behavior change is influenced by the individuals’ physical and social environment, personal factors and the behaviour itself [146, 147]. The TEMplate™ program encourages improving self-efficacy of diet and physical activity through goal setting and monitoring weight, intake and physical activity. An additional component of the program is to encourage energy deficit to enable weight loss of 0.5-1 kg per week or energy balance for weight maintenance. To achieve this, participants are encouraged to consume breakfast, pre-prepare lunch and snacks in the lunchbox provided and control portion sizes with the dinner disc. The TEMplate™ program provides recommendations of the five food groups for each meal. Participants also have an extras allowance (1 extra=500 kilojoules) based on their age, weight and breastfeeding status and were encouraged to items from the food groups to make to their extras. Women who were exclusively breastfeeding were given an additional four extras, those who were partially breastfeeding were given an additional two extras and women not breastfeeding were not given any additional extras. Participants were encouraged to consume their extras through nutrient-dense foods such as wholegrain breads and cereals, fruit, vegetables and low-fat dairy. A list of suggested extras was developed by the research dietitian and provided to the participants.
Participants were encouraged to monitor their energy intake and output (including physical activity and breastfeeding) on the ‘Tracking your Progress’ form (Appendix 5). Firstly, participants were to tick a box if they consumed breakfast, lunch and snacks, and dinner according to the TEMplate™ program (as shown in table 3.3). Secondly, they were to write down the number of extras they were allocated to enable weight loss and provide a tick for each extra they consumed. Thirdly, participants were to provide a tick for each activity block they had completed (e.g. walking for 30 minutes). An equation was used to assess whether the participants were likely to be losing, maintaining or gaining weight. This equation consisted of adding the number of extras allowed with the number of activity blocks completed and then subtracting the number of extras eaten. If the resulting number was zero, then energy balance was theoretically achieved. A negative number indicated weight gain (energy intake was more than energy output) while a positive number indicated weight loss. An example of this equation is shown in Table 3.3.
Table 3.3: Tracking your Progress form for the TEMplate™ program (Permission to copy and communicate this work has been granted by Prima Health Solutions)

<table>
<thead>
<tr>
<th>Date</th>
<th>STEP 1</th>
<th>STEP 2</th>
<th>STEP 3</th>
<th>STEP 4 — Extras</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMplate breakfast</td>
<td>TEMplate lunch &amp; snacks</td>
<td>TEMplate dinner</td>
<td><strong>X</strong> Extras Allowance</td>
<td><strong>Y</strong> Activity Blocks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Write the number of extras allowed each day using the extras calculator</td>
<td>(tick one box for each activity block performed)</td>
</tr>
<tr>
<td>dd/mm</td>
<td></td>
<td></td>
<td><strong>4</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Z</strong> Extras eaten per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(tick one box for every extra you eat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>X + Y - Z = 0</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Balance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Your balance should equal zero</td>
</tr>
</tbody>
</table>

An additional monitoring form was provided to participants, to enable more detail on eating habits (Appendix 6). This included type of food and amount, feelings when eating this food and hunger levels before the food/drink was eaten. The completion of this form was encouraged but was optional and offered as an additional self-monitoring strategy.

A final component of this program was goal setting. Participants were asked to set a main goal relating to weight loss and then break this goal into sub-goals incorporating nutrition and physical activity. Participants were supported by the research dietitian to create Specific, Measurable, Achievable, Realistic and Time bound (SMART) goals and to regularly evaluate these goals.
3.3.5.2 International Board Certified Lactation Consultant support

The second intervention component for this RCT incorporated additional IBCLC support and education for WM+LC participants. In addition to receiving the TEMplate™ program, these participants received individual breastfeeding support from an IBCLC over three visits (two antenatal visits + one postpartum home visit plus ≥ 1 postpartum phone call) and were offered postnatal phone calls. During the antenatal period, participants attended two 30 minute face-to-face education sessions with the IBCLC to discuss the fundamental elements of breastfeeding, previous breastfeeding experience, infant feeding expectations, goals and to build rapport. This education was individualised to the participants’ experiences and knowledge and as a result, varied between individuals. A home visit was conducted up to two weeks post-delivery to ensure breastfeeding was established and for the participant to discuss any concerns. Follow up phone calls were conducted as required, thereafter.

3.3.6 Data collection

Antenatal visits were conducted at the John Hunter Hospital. Initially, postpartum visits were completed at the hospital. However, a number of participants found it difficult to attend these post-partum visits due to their location from the hospital or were unable to find the time to attend or it was inconvenient with an infant. As a result, the research team successfully applied for an ethics variation to offer
participants a choice of a home visit or to attend the hospital for the postpartum phase of the study, which was approved.

Table 3.4 provides an overview of the data that has been collected for the BBPBB study over four study visits, from pregnancy up to six months postpartum.
### Table 3.4: Data collection details for the Bouncing Back to your Pre-baby Body study.

<table>
<thead>
<tr>
<th>Details</th>
<th>Health professional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visit 1: 26 + 2 weeks</strong></td>
<td></td>
</tr>
<tr>
<td>WM + LC participants provided with breastfeeding education</td>
<td>IBCLC</td>
</tr>
<tr>
<td>Maternal fasting blood test</td>
<td>HAPS</td>
</tr>
<tr>
<td>Maternal anthropometry [148] (current weight, height, skinfold thicknesses, girths)</td>
<td>Level 1 Anthropometrist</td>
</tr>
<tr>
<td>Maternal blood pressure</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>Questionnaires: AES, medical, sociodemographic, physical activity [149], weight related behavior [150]</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>24-hour recall of maternal dietary intake</td>
<td>Dietitian*</td>
</tr>
<tr>
<td><strong>Visit 2: 35 + 2 weeks</strong></td>
<td></td>
</tr>
<tr>
<td>WM and WM + LC participants provided with TEMplate [146] program</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>WM + LC participants provided with breastfeeding education</td>
<td>IBCLC</td>
</tr>
<tr>
<td>Maternal fasting blood test</td>
<td>HAPS</td>
</tr>
<tr>
<td>Maternal anthropometry [148] (current weight, skinfold thicknesses, girths)</td>
<td>Level 1 Anthropometrist</td>
</tr>
<tr>
<td>Maternal blood pressure</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>Questionnaires: AES, physical activity [149], weight related behavior [150], breastfeeding history, health professional education on GWG</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>24-hour recall of maternal intake</td>
<td>Dietitian*</td>
</tr>
<tr>
<td><strong>Home visit: 1 week + 4 weeks</strong></td>
<td></td>
</tr>
<tr>
<td>WM + LC participants provided with breastfeeding education</td>
<td>IBCLC</td>
</tr>
<tr>
<td><strong>Visit 3: 13 weeks + 2 weeks</strong></td>
<td></td>
</tr>
<tr>
<td>Control participants provided with TEMplate program [146]</td>
<td>Dietitian*</td>
</tr>
<tr>
<td>Maternal fasting blood test</td>
<td>HAPS</td>
</tr>
<tr>
<td>Maternal anthropometry [148] (current weight, skinfold thicknesses, girths)</td>
<td>Dietitian*</td>
</tr>
</tbody>
</table>
girths)

Maternal blood pressure  
Dietitian*

Questionnaires: AES, physical activity [149], lactation support  
Dietitian*

24-hour recall of maternal intake  
Level 1 Anthropometrist

Infant anthropometry [148] (current weight, length, head circumference, skinfold thicknesses, girths)  
Level 1 Anthropometrist

Infant blood pressure  
Dietitian*

Infant feeding history  
Dietitian*

24-hour recall of infant intake  
Dietitian*

<table>
<thead>
<tr>
<th>Visit 4: 26 weeks ± 2 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal fasting blood test</td>
</tr>
<tr>
<td>HAPS</td>
</tr>
</tbody>
</table>

Maternal anthropometry [148] (current weight, skinfold thicknesses, girths)  
Level 1 Anthropometrist

Maternal blood pressure  
Dietitian*

Questionnaires: AES, physical activity [149], lactation support, process evaluation of intervention, medical, back to work  
Dietitian*

24-hour recall of maternal intake  
Dietitian*

Infant anthropometry [148] (current weight, length, head circumference, skinfold thicknesses, girths)  
Level 1 Anthropometrist

Infant blood pressure  
Dietitian*

Infant feeding history  
Dietitian*

24-hour recall of infant intake  
Dietitian*

* JM (first author) was the study dietitian. BMI: Body Mass Index (kg/m²); HAPS: Hunter Area Pathology Service; AES: Australian Eating Survey; GWG: Gestational weight gain; WM: Weight Management; LC: Lactation Consultant
3.3.6.1 Maternal fasting blood test

Four maternal blood tests were scheduled for each participant and were collected and assayed by Hunter Area Pathology Service (HAPS). The sample was analysed for the following biomarkers:

Glucose metabolism
- Fasting glucose (mmol/L)
- Fasting insulin (mmol/L)
- Glycosylated Hemoglobin (HbA1c %)

Lipid metabolism
- Total cholesterol (mmol/L)
- Triglycerides (mmol/L)
- High density lipoprotein (HDL)-cholesterol (mmol/L)
- Low density lipoprotein (LDL)-cholesterol (mmol/L)
- HDL-LDL ratio

Inflammation
- C-Reactive protein (CRP)

Additional blood was collected and prepared for storage. Three mLs each of red blood cells, plasma and serum was stored in a -20°C freezer.

3.3.6.2 Anthropometry

Maternal

All maternal anthropometry was collected by one of two dietitians with level one certification from the International Society for the Advancement of Kinanthropometry (ISAK). The same side of the
body was used for each study visit and two measurements were taken and averaged. A third measure was taken if the second measurement was not within 10% and 2.5% of the first measurement for skinfold and girth measurements, respectively [148]. From this, the median value was calculated.

Skinfolds

Skinfold measurements were taken at six sites on the body. The location of the sites included the biceps®, triceps®, subscapular®, supraspinale®, front thigh® and medical calf® and are shown in Figure 3.1.
Girths were taken at six sites on the body. The location of the sites included the arm (relaxed), waist, wrist, gluteal hips, mid-thigh and calf and are shown in figure 3.2.
Figure 3.2: Location of girth sites, according to the International Society for the Advancement of Kinanthropometry [148]

Height

Height was measured standing without shoes to the nearest millimeter at two study visits. Two measurements were taken on a wall mounted Seca stadiometer (Seca Deutschland, Hamburg, Germany) and were averaged. A third measure was taken if the second measure was not within 1.5% of the first measure and the median value was calculated.

Weight

Pre-pregnancy weight was self-reported during the eligibility screen. Antenatal and postpartum weights were measured at each
study visit. During study visits, weight was measured using the AND™ FV-150K electronic weighing scales (A&D Mercury Pty Ltd, Thebarton, South Australia) which are calibrated annually.

**Infant**

All infant anthropometric measurements were completed at study visit 3 and 4.

**Skinfolds**

Infant skinfold measurements were taken at four sites on the body. The location of the sites included the biceps®, subscapular®, iliac crest®, and medical calf® and are shown in Figure 3.1.

**Girths**

Infant girths were taken at six sites on the body. The location of the sites included the arm (relaxed)®, abdomen, wrist, gluteal hips®, mid-thigh and calf® and are shown in Figure 3.2.

**Length**

Infant length was measured from crown-to-heel to the nearest one millimeter. Length was measured using a tape measure with the infant lying on a firm surface with one leg straightened. Each measure was taken twice and from this the mean was calculated. If these measurements differed by 1.5% or more, a third measure was taken and the median value was used.
Head circumference

Infant head circumference was measured using a paper tape measure and was obtained by locating the widest circumference, from the forehead to the back of the head. Two measurements were taken and the mean was calculated.

3.3.6.3 Dietary data

Maternal

Two dietary intake collection methods were used to allow for assessment of dietary intake and were completed at all four study visits. These methods included a food frequency questionnaire (FFQ), known as the Australian Eating Survey (AES), and a 24 hour recall.

Australian Eating Survey for Adults

AES (Appendix 7) was provided to participants to complete at home and then send back to the researchers. The AES is designed to collect information about typical frequency of intake of 120 food and beverage items over the previous six months. It is a semi-quantitative FFQ with a standard portion size for each food and beverage item and determined using ‘natural’ serving size (e.g. a slice of bread). If a natural serving size was unavailable, portion sizes were obtained from the 1995 National Nutrition Survey (unpublished data from the ABS). A single response is required for each food and beverage item, with frequency options for most items ranging from ‘never’ to ‘four or more times per day’ however, the response options varied. Food
items were organised according to food group, which includes; drinks, breads and cereals, dairy, main meals, sweets and snacks, fruit (11 items) and vegetables (19). The frequency categories for seasonal fruit were listed as for other food items and participants were questioned on intake when the fruit is available. The average intake of seasonal fruit was calculated by adjusting for the number of months per year the fruit was available.

There were 15 additional questions about age, vitamin supplements; food-related behaviours (e.g. take away consumption) and sedentary activity (e.g. television watching). Individual mean daily macro- and micronutrient intakes are calculated using FFQ-specific programs using the Australian food composition database, AusNut 1999, Revision 14 [151]. The AES has been validated in comparison to weighed food records in adult males and females [152]. During antenatal visits, participants were asked to record the frequency of food items during the previous six months; while during the postpartum visits, participants were asked to record their food intake frequency for the previous three months.

The food items in the AES include bread, fruit, vegetables, dairy, eggs, fat spreads, snack foods, take away foods, and alcoholic and sweetened beverages. There are also 12 questions relating to food behaviours. Each question contains up to eight responses with most responses starting with ‘Never’.
24 hour recall

Within 1 ± 2 weeks of a study visit, an Accredited Practicing Dietitian (APD) conducted a 24 hour phone call of each participant. The recall consisted of a structured interview in which the APD obtained a detailed description of food and beverage items consumed by the participant in the previous 24 hours. A description of the food item including the type of food, amount, brand and time consumed were recorded. Participants were also asked about vitamin, mineral and herbal supplementation, physical activity and water intake in the previous 24 hours. This was administered by the same study dietitian (JM), using a standardised method. See Appendix 8 for the questionnaire format.

Infant

Infant feeding data in the study was the same as that used in the Women and Their Children’s Health (WATCH) study [80]. Data were collected from the participants at study visit 3 and 4 using a structured 24 hour recall and two questionnaires; the Infant Feeding Recall (IFR) and the Current Feeding Practices (CFP) [153]. Infant feeding status was categorised according to the WHO definitions of exclusively, predominantly, complementarily or not breastfed, as shown in Table 3.4 [101, 154]. The questionnaires and 24 hour recall were administered by an APD and were completed within 10 minutes.
Table 3.5: Criteria for the World Health Organization infant feeding categories.

<table>
<thead>
<tr>
<th>Breastfeeding category</th>
<th>Food sources the infant can receive</th>
<th>Food sources the infant cannot receive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exclusive</strong></td>
<td>Breastmilk as the main food source, medicine, vitamins, minerals</td>
<td>Anything else</td>
</tr>
<tr>
<td><strong>Predominant</strong></td>
<td>Breastmilk as the main food source, liquids (water, fruit juice, oral rehydration salts, ritual fluids, medicine, vitamins, minerals)</td>
<td>Anything else</td>
</tr>
<tr>
<td><strong>Complementary</strong></td>
<td>Breastmilk AND solid/semi solid food or any other liquid (non-human milk, food based fluid, water, fruit juice, oral rehydration salts, ritual fluids, drops, syrups)</td>
<td>-</td>
</tr>
<tr>
<td><strong>No breastfeeding</strong></td>
<td>Solid/semi solid food, liquid (non-human milk, food based fluid, water, fruit juice, oral rehydration salts, ritual fluids, drops, syrups)</td>
<td>Breastmilk</td>
</tr>
</tbody>
</table>


The Infant Feeding Recall

The IFR, modified by Hector et al [100], and consisted of 13 questions on the timing of introduction and frequency of breastmilk, infant formula, breastmilk substitutes, cow’s milk and solids. This questionnaire was used to determine breastfeeding initiation (phrased as ‘has your child ever been breastfed?’), duration (‘what is the total time for which your child was breastfed (weeks)?)’ and infant feeding category. See Appendix 9 for a copy of this questionnaire.
Current Feeding Practices

The CFP questionnaire was used to further define infant feeding category as defined in Table 3.4, and consisted of 14 questions. Specifically, this questionnaire determined if the infant had received any of the following in a 24 hour period; Vitamin or mineral supplements, medicine, plain water, sweetened or flavored water, fruit juice, tea or infusion, infant formula, tinned, powdered or fresh milk, solid or semi-solid food, oral rehydration salts or any other items not listed. See Appendix 10 for a copy of this questionnaire.

24 hour recall

A recall was conducted to further define the infant feeding category according to the definitions in Table 3.5. This recall consisted of a structured interview in which the APD obtained a detailed description of fluid and solid food items consumed by the infant in the previous 24 hours. A description of the food/fluid item was recorded, including the type, amount, brand and time of intake.

3.3.6.4 Physical activity

The Pregnancy Physical Activity Questionnaire (PPAQ, Appendix 11) was administered at study visit 1, 3 and 4 [149]. This self-administered questionnaire has previously been validated on pregnant women in the USA and contains 32 activities, including household chores, carer responsibilities; occupational, sports/exercise, transport and inactive behaviors. Participants were
required to select the option which best represented the amount of time (per day or week) they spent performing the listed activity.

3.3.6.5 Medical and socio-demographic variables

Participants were provided with a medical questionnaire consisting of 13 questions to determine medical history and intake of prescribed and/or non-prescribed medication; including vitamin and mineral supplements. This questionnaire was administered a second time at study visit 4. At study visit 1, participants were also provided with an additional questionnaire consisting of six questions relating to education level, individual and household income and marital status. Both questionnaires (Appendix 12) were provided at study visit 1 for participants to fill out and send back upon completion.

3.3.6.6 Weight Related Behaviors

Psychosocial constructs were determined through the Weight Related Behaviors questionnaire which was created by Kendall et al [150]. The questionnaire (Appendix 13) consisted of four primary constructs: body image, locus of control, feelings about motherhood and career orientation. This questionnaire was self-administered at study visit 1 and consisted of 38 questions with a Likert scale for responses (Strongly agree – strongly disagree; too heavy - too light; very satisfied – not at all satisfied).
3.3.6.7 Program Evaluation

Participants were provided with a program evaluation (Appendix 14) at study visit 4 to provide feedback on the breastfeeding support they received and on the TEMplate™ program. This evaluation was used to determine the feasibility and acceptability of the pilot RCT. The evaluation was in two parts with Part One consisting of 29 questions relating to the TEMplate™ program including any changes made to diet and physical activity, adherence to program requirements, ease of use, satisfaction and barriers to using the program. Part Two of the evaluation was given to the WM+LC participants only to determine the feasibility of the IBCLC support. Questions were related to the quality of the education provided by the IBCLC, rapport with the IBCLC and any breastfeeding problems experienced by the participant.

3.3.6.8 Additional information

During the study period, additional details were obtained through self-reported questionnaires. During study visit 2, participants were provided with a breastfeeding and obstetric history questionnaire (Appendix 15). Nine questions were used to obtain information on previous obstetric history, previous breastfeeding experiences and current breastfeeding support. At the same study visit, an APD also obtained details on any education the participant had received about gestational weight gain (Appendix fifteen).
3.3.7 Statistical analyses

To be included in the final analysis, participants had to have attended at least one postpartum visit. Statistical analyses were performed using Intercooled Stata, version 11 (StataCorp LP, College Station, Texas, USA) with statistical significance set at $\alpha=0.05$. Normality tests were conducted on all data and for non-normal data the median [interquartile range] was recorded. Kruskal-Wallis and Fisher’s exact tests were used to determine differences in the baseline characteristics of women by intervention groups. Comparisons were also made between those who withdrew and those who remained in the study.

Analysis of variance (ANOVA) and covariance (ANCOVA) were used to determine the differences in continuous variables including WR, glucose and lipid biomarkers, and the number of weeks of breastfeeding between the three groups (WM, WM+LC and control). ANOVA was conducted on the biomarkers and breastfeeding variables rather than ANCOVA as there were no baseline results for these variables. ANCOVA was conducted on the weight outcomes (WR, weight and BMI) and pre-pregnancy weight was the covariate. Chi$^2$ analysis and Fisher’s exact test were used to determine differences in categorical variables including initiation and rates of ‘any’ breastfeeding. These analyses were conducted at study visit 3 and 4.
Intention to treat analysis was not conducted as it was a feasibility study and therefore the pilot had small participant numbers within each group.

3.3.8 Sample Size
The sample size was based on a study of a continuous response variable (fasting insulin) from independent control and experimental subjects with 1 control(s) per experimental subject. We have previously shown in the Women and Their Children’s Health (WATCH) Study that the response within each subject group had a standard deviation of about 5.0 mIU fasting insulin. If the true difference in the experimental and control means is 4.0 mIU, we will need to study 26 experimental subjects and 26 control subjects to be able to reject the null hypothesis that the population means of the experimental and control groups are equal with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05. The experimental subjects were then split into 2 groups; not only did all participants in this group receive the weight loss intervention, half also received additional breastfeeding support.
423 pamphlets provided to potential participants

47 screened for eligibility

40 eligible & randomized
(24 OW & 16 OB)

36 consented
(20 OW & 14 OB)

Visit 1
n=34 (with consent)
(26.0 ± 0.9 weeks gestation)

12 C randomized & attended
(7 OW & 5 OB)

11 WM randomized & attended
(7 OW & 4 OB)

11 WM+LC randomized & attended
(6 OW & 5 OB)

Visit 2, n=29
(35.0 ± 0.9 weeks gestation)

4 WD: 1 moved interstate, 1 too busy, 1 delivered < 35 weeks, 1 lost to follow up.
1 delivered <35 weeks but continued with the study

11 C
(7 OW & 4 OB)

10 WM
(6 OW & 4 OB)

8 WM+LC
(4 OW & 4 OB)

Visit 3, n=27
(13.6 ± 1.4 weeks postpartum)

2 WD: 1 too busy, 1 lost to follow up
1 did not attend visit

11 C
(7 OW & 4 OB)

9 WM
(5 OW & 4 OB)

7 WM+LC
(4 OW & 3 OB)

Visit 4, n=25
(26.6 ± 3.3 weeks postpartum)

2 WD: 1 too busy, 1 lost to follow up

9 C
(6 OW & 3 OB)

9 WM
(5 OW & 4 OB)

7 WM+LC
(3 OW & 4 OB)

7 ineligible
- 1 planning to bottle feed
- 1 BMI > 35 kg/m²
- 2 BMI < 25 kg/m²
- 1 < 18 years
- 1 > 26 weeks gestation
- 1 having twins

4 failed to provide written consent

2 lost to follow up

Visit 1
n=34 (with consent)
(26.0 ± 0.9 weeks gestation)

Figure 3.3: Recruitment flow diagram for the Bouncing Back to your Pre-baby Body study

OW: Overweight, OB: Obese, WM: Weight management group, WM+LC: Weight management plus lactation consultant group, C: Control, WD: Withdrew. Control participants received the WM program at study visit 3.
Results

Figure 3.3 displays the flow of participants through the trial with participant numbers at each study visit and withdrawal details. The total number of participants who consented to the study and were randomised to a treatment or control group was 36. This consisted of 22 overweight women and 14 obese women. Twelve participants were randomised to each of the intervention groups. Thirty-four participants attended study visit 1; two were lost to follow up prior to visit 1. Hence 34 participants were included in the results and analyses. At six months postpartum, 69% (n=25) of participants who consented remained in the study. Seventeen per cent (n=6) withdrew during pregnancy while 14% (n=5) withdrew during the postpartum period. Reasons for withdrawal included participants reporting that they were too busy to continue with the study (n=5) or had moved interstate (n=1). A total of 5 participants were lost to follow up, despite numerous phone calls and reminder letters. There were no significant differences in baseline socio-demographic or weight variables between those who withdrew and those who remained in the study (data not shown). Two participants delivered before study visit 2 (35 weeks gestation); one of these participants remained in the study.

Table 3.6 outlines the baseline socio-demographic, weight and metabolic biomarkers for all participants as well as by intervention group. Thirty-one participants self-reported their socio-demographic data. The mean ± SD age for this study population was 30.9 ± 6.0
years. The majority of participants were married or in a defacto relationship (81%, n=25/31) and had completed at least 12 years education or equivalent (84%, n=26/31). Self-reported mean pre-pregnancy weight was 80.5 ± 12.0 kg and the majority of women were nulliparous (85%, n=29/34). There were no significant differences in baseline socio-demographic or weight variables between the three intervention groups.

All participants initiated breastfeeding (100%). At three months postpartum, the majority of participants had continued breastfeeding (74%). The WM+LC group had the highest breastfeeding rates (as shown in Table 3.7) at both three and six months postpartum and a longer duration by an average of seven weeks though this was not a significant difference (p>0.05).

The mean ± SD GWG for the whole cohort was 13.6 ± 6.6 kg and there was no significant difference between intervention groups. Overweight women had gained 14.1 ± 6.2 kg by 35 weeks gestation, which is above the IOM pregnancy weight gain recommendations of 7-11.5 kg (Table 3.1) for this BMI category for the entire pregnancy [44]. Similarly, obese women gained above the IOM pregnancy weight gain guidelines of 5-9 kg [44] with a mean gain of 13.0 ± 7.4 kg.
Table 3.6: Baseline socio-demographic, weight and metabolic variables for all participants (n=34) and by randomised group

<table>
<thead>
<tr>
<th>Participant Characteristic</th>
<th>All (n=34)</th>
<th>Control (n=12)</th>
<th>WM group (n=11)</th>
<th>WM + LC group (n=11)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>30.9 ± 6.0</td>
<td>31.3 ± 5.6</td>
<td>29.5 ± 7.8</td>
<td>31.6 ± 5.1</td>
<td>0.27</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.4 ± 6.2</td>
<td>164.4 ± 6.5</td>
<td>165.1 ± 6.5</td>
<td>166.8 ± 5.7</td>
<td>0.44</td>
</tr>
<tr>
<td>Born in Australia n (%)</td>
<td>33/34 (97)</td>
<td>12/12 (100)</td>
<td>10/11 (91)</td>
<td>11/11 (100)</td>
<td>0.65</td>
</tr>
<tr>
<td>Married or defacto n (%)</td>
<td>25/31 (81)</td>
<td>10/12 (83)</td>
<td>7/10 (70)</td>
<td>8/9 (89)</td>
<td>0.63</td>
</tr>
<tr>
<td>Education ≥ year 12 n (%)</td>
<td>26/31 (84)</td>
<td>9/12 (75)</td>
<td>9/10 (90)</td>
<td>8/9 (89)</td>
<td>0.79</td>
</tr>
<tr>
<td>Infant sex, male n (%)</td>
<td>14/33 (42)</td>
<td>5/11 (45)</td>
<td>3/12 (25)</td>
<td>6/10 (60)</td>
<td>0.23</td>
</tr>
<tr>
<td>Smoking n (%)</td>
<td>4/34 (12)</td>
<td>1/11 (9)</td>
<td>2/12 (17)</td>
<td>1/11 (9)</td>
<td>1.00</td>
</tr>
<tr>
<td>Birth weight (kg)a</td>
<td>3.7 [3.3, 4.0]</td>
<td>3.5 [3.2, 4.0]</td>
<td>3.9 [3.7, 4.1]</td>
<td>3.5 [3.1, 3.7]</td>
<td>0.19</td>
</tr>
<tr>
<td>Parity: at least 1 born child n (%)</td>
<td>5/34 (14.7)</td>
<td>2/12 (17)</td>
<td>1/12 (8)</td>
<td>2/11 (18)</td>
<td>0.39</td>
</tr>
<tr>
<td>Gestational diabetes n (%)</td>
<td>3/31 (9)</td>
<td>0/11 (0)</td>
<td>2/12 (16.7)</td>
<td>1/11 (9)</td>
<td>0.76</td>
</tr>
<tr>
<td>Weight variables</td>
<td>80.5 ± 12.0</td>
<td>78.5 ± 11.3</td>
<td>81.5 ± 15.1</td>
<td>81.6 ± 9.8</td>
<td>0.79</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>------------</td>
<td>------</td>
</tr>
<tr>
<td>Pre-pregnancy weight</td>
<td>80.5 ± 12.0</td>
<td>78.5 ± 11.3</td>
<td>81.5 ± 15.1</td>
<td>81.6 ± 9.8</td>
<td>0.79</td>
</tr>
<tr>
<td>Pre-pregnancy BMI^a^c</td>
<td>28.8 [25.4, 32.3]</td>
<td>28.9 [25.2, 32.9]</td>
<td>27.7 [25.1, 33.7]</td>
<td>29.4 [25.5, 32.3]</td>
<td>0.98</td>
</tr>
<tr>
<td>GWG^b</td>
<td>13.6 ± 6.6</td>
<td>16.0 ± 6.7</td>
<td>9.8 ± 4.5</td>
<td>15.3 ± 7.2</td>
<td>0.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metabolic variables</th>
<th>4.2 ± 0.4</th>
<th>4.2 ± 0.2</th>
<th>4.3 ± 0.5</th>
<th>4.2 ± 0.4</th>
<th>0.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting glucose (mmol/L)</td>
<td>4.2 ± 0.4</td>
<td>4.2 ± 0.2</td>
<td>4.3 ± 0.5</td>
<td>4.2 ± 0.4</td>
<td>0.99</td>
</tr>
<tr>
<td>Fasting insulin (mIU/L)</td>
<td>9.1 ± 3.6</td>
<td>10.1 ± 3.4</td>
<td>8.3 ± 3.0</td>
<td>8.8 ± 4.4</td>
<td>0.46</td>
</tr>
<tr>
<td>HbA1c (%)^a^d</td>
<td>5.3 [5.2, 5.5]</td>
<td>5.4 [5.2, 5.6]</td>
<td>5.3 [5.1, 5.5]</td>
<td>5.3 [5.1, 5.5]</td>
<td>0.48</td>
</tr>
<tr>
<td>HOMA-IR^e</td>
<td>1.7 ± 0.8</td>
<td>1.9 ± 0.7</td>
<td>1.6 ± 0.7</td>
<td>1.7 ± 0.9</td>
<td>0.62</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>6.8 ± 1.2</td>
<td>7.1 ± 1.4</td>
<td>6.7 ± 1.0</td>
<td>6.6 ± 1.2</td>
<td>0.77</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>2.3 ± 0.7</td>
<td>2.6 ± 0.7</td>
<td>2.0 ± 0.4</td>
<td>2.3 ± 0.8</td>
<td>0.11</td>
</tr>
<tr>
<td>LDL-cholesterol (mmol/L)</td>
<td>3.9 ± 1.1</td>
<td>4.1 ± 1.3</td>
<td>4.0 ± 0.7</td>
<td>3.6 ± 1.1</td>
<td>0.56</td>
</tr>
<tr>
<td>HDL-cholesterol (mmol/L)</td>
<td>1.9 ± 0.5</td>
<td>1.9 ± 0.4</td>
<td>1.9 ± 0.6</td>
<td>1.9 ± 0.5</td>
<td>0.95</td>
</tr>
<tr>
<td>Ratio</td>
<td>3.8 ± 0.8</td>
<td>3.9 ± 0.7</td>
<td>3.7 ± 0.8</td>
<td>3.7 ± 1.0</td>
<td>0.78</td>
</tr>
<tr>
<td>CRP (mg/L)(^{a,f})</td>
<td>7.3 [4.8, 12.9]</td>
<td>7.3 [5.2, 9.5]</td>
<td>11.1 [6.3, 13.7]</td>
<td>6.7 [3.0, 14.6]</td>
<td>0.91</td>
</tr>
</tbody>
</table>

- **a** Median [25th - 75th percentile] reported for non-normally distributed continuous data.
- **b** Gestational weight gain (GWG) is pre-pregnancy body weight subtracted from weight at 35 weeks gestation.
- **c** Body Mass Index (BMI); kg/m\(^2\)
- **d** Glycosylated haemoglobin (HbA1c); %
- **e** Homeostatic Model Assessment of Insulin Resistance (HOMA-IR, fasting glucose (mmol/L) × fasting insulin (μU/ml)/22.5)
- **f** C-reactive protein (CRP); mg/L
Table 3.7 and Figure 3.4 display the three and six month results for all participants and by intervention group. At three months postpartum the mean ± SD WR was 4.6 ± 7.4 kg for all participants. There were no significant differences in WR between the three groups. However, table 3.7 shows that the WM and WM+LC groups had on average a 6.7 kg and 3.5 kg lower WR compared to the control group, respectively, who had a WR of 7.7 ± 6.8 kg (p=0.56, Table 3.7). This trend also remained for maternal weight and BMI at three months postpartum (p=0.56 and p=0.18, respectively; Table 3.7). At three months postpartum, control participants had commenced the TEMplate™ program. At six months postpartum WR, weight and BMI remained higher for the control group compared to the WM group, although this was not significant (p=0.26, 0.54 and 0.91; Table 3.7).

Figure 3.4: Weight retention at three and six months postpartum by randomized group (n=27 and 24, respectively). P>0.05 for between group comparison.
There were no differences between groups for fasting glucose, insulin, HbA1c, total cholesterol, triglycerides, HDL and LDL-cholesterol, total/HDL ratio or CRP at either three or six months postpartum. Figure 3.5 displays the box plots for triglycerides, insulin, total cholesterol and fasting glucose at three and six months by intervention group.

\[\text{Figure 3.5: Metabolic variables at three and six months (n=27 and 24, respectively) postpartum by randomized group.}\]

<table>
<thead>
<tr>
<th>C</th>
<th>WM</th>
<th>WM+LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Insulin (mU/L)</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Glucose (mmol/L)</td>
<td>4.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>

* - p<0.05, P=0.04 for both triglycerides and total cholesterol at three months postpartum. P>0.05 for between group comparison for insulin and glucose.
Majority of the participants failed to return the evaluation questionnaire. Thirty-nine per cent (n=14) of participants returned the evaluation for the TEMplate™ program. Of those who returned the questionnaire, 43% (n=6) agreed that the TEMplate™ program was easy to understand. On completion of the TEMplate™ program, the majority of participants reported that they now weigh themselves (71%, n=10), keep a record of what they eat (36%, n=5), try to be more active (100%, n=14), and plan (64%, n=9) and cook (93%, n=13) healthier meals. Fourteen per cent (n=2) found the TEMplate™ program too time consuming and 43% (n=6) found it difficult to use the program whilst also caring for a new baby. Additional barriers that were reported included time constraints (50%, n=7) and tiredness (43%, n=6). Fourteen per cent also suggested they would prefer face-to-face contact with a dietitian (14%, n=2) during the program.
Table 3.7: Three and six month weight, metabolic and breastfeeding variables for all participants (n=34) and by randomised group

<table>
<thead>
<tr>
<th>Weight variables</th>
<th>All participants (n=34)</th>
<th>Control (n=12)</th>
<th>WM group (n=11)</th>
<th>WM+LC group (n=11)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWG a</td>
<td>13.6 ± 6.6</td>
<td>16.0 ± 6.7</td>
<td>9.8 ± 4.5</td>
<td>15.3 ± 7.2</td>
<td>0.06</td>
</tr>
<tr>
<td>Weight at 3 months</td>
<td>84.9 ± 13.7</td>
<td>84.8 ± 14.3</td>
<td>84.2 ± 14.0</td>
<td>85.9 ± 14.3</td>
<td>0.56</td>
</tr>
<tr>
<td>Weight at 6 months</td>
<td>85.3 ± 13.0</td>
<td>82.7 ± 13.1</td>
<td>84.2 ± 14.7</td>
<td>89.9 ± 11.3</td>
<td>0.25</td>
</tr>
<tr>
<td>BMI at 3 months</td>
<td>30.8 ± 4.2</td>
<td>31.1 ± 3.9</td>
<td>30.7 ± 4.1</td>
<td>30.6 ± 5.4</td>
<td>0.18</td>
</tr>
<tr>
<td>BMI at 6 months</td>
<td>30.7 ± 3.7</td>
<td>30.3 ± 3.0</td>
<td>30.6 ± 4.3</td>
<td>31.2 ± 4.4</td>
<td>0.33</td>
</tr>
<tr>
<td>WR at 3 months</td>
<td>4.6 ± 7.4</td>
<td>7.7 ± 6.8</td>
<td>0.91 ± 7.03</td>
<td>4.4 ± 7.6</td>
<td>0.56</td>
</tr>
<tr>
<td>WR at 6 months</td>
<td>3.3 ± 4.0</td>
<td>5.9 ± 4.9</td>
<td>0.8 ± 7.2</td>
<td>5.6 ± 8.8</td>
<td>0.67</td>
</tr>
<tr>
<td>Returned to or below pre-pregnancy weight n (%)</td>
<td>5/25 (20)</td>
<td>1/9 (11)</td>
<td>3/9 (33)</td>
<td>2/7 (29)</td>
<td>0.21</td>
</tr>
<tr>
<td>Retained ≥ 5 kg n (%)</td>
<td>10/25 (40)</td>
<td>5/9 (56)</td>
<td>1/9 (11)</td>
<td>4/7 (57)</td>
<td>0.06</td>
</tr>
<tr>
<td>Metabolic markers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting glucose (mmol/L) at 3months</td>
<td>4.6 ± 0.5</td>
<td>4.7 ± 0.5</td>
<td>4.5 ± 0.5</td>
<td>4.4 ± 0.4</td>
<td>0.58</td>
</tr>
<tr>
<td>Fasting glucose (mmol/L) at 6 months</td>
<td>4.5 ± 0.4</td>
<td>4.6 ± 0.4</td>
<td>4.5 ± 0.5</td>
<td>4.5 ± 0.4</td>
<td>0.91</td>
</tr>
<tr>
<td>Fasting insulin (mIU/L) at 3 months*</td>
<td>5.5 [3.3,6.8]</td>
<td>5.4 [3.2, 6.8]</td>
<td>5.2 [4.6,10.3]</td>
<td>5.5 [3.2, 6.4]</td>
<td>0.61</td>
</tr>
<tr>
<td>Fasting insulin (mIU/L) at 6 months*</td>
<td>5.4 [3.2, 6.1]</td>
<td>5.4 [2.9, 6.0]</td>
<td>5.8 [4.5,10.2]</td>
<td>3.5 [2.7,9.3]</td>
<td>0.55</td>
</tr>
<tr>
<td>HbA1c (%) at 3 months</td>
<td>5.3 ± 0.2</td>
<td>5.5 ± 0.4</td>
<td>5.3 ± 0.2</td>
<td>5.3 ± 0.2</td>
<td>0.39</td>
</tr>
<tr>
<td>HbA1c (%) at 6 months</td>
<td>5.3 ± 0.3</td>
<td>5.3 ± 0.3</td>
<td>5.3 ± 0.4</td>
<td>5.3 ± 0.2</td>
<td>0.88</td>
</tr>
<tr>
<td>HOMA-IR* at 3 months</td>
<td>1.0 [0.7, 1.4]</td>
<td>1.1[0.6,1.4]</td>
<td>1.0 [0.8, 2.2]</td>
<td>1.2 [0.6,1.4]</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>6 months</td>
<td>3 months</td>
<td>6 months</td>
<td>3 months</td>
<td>6 months</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>HOMA-IR&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.1[0.6,1.4]</td>
<td>1.0[0.6,1.3]</td>
<td>1.1[0.87,1.83]</td>
<td>0.7[0.5,2.0]</td>
<td>0.7[0.5,2.0]</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>4.8±1.2</td>
<td>5.2±0.7</td>
<td>4.7±1.6</td>
<td>4.8±1.0</td>
<td>4.8±1.0</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>1.0±0.6</td>
<td>1.0±0.6</td>
<td>1.2±0.8</td>
<td>0.7±0.2</td>
<td>0.7±0.2</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>0.9[0.5,1.2]</td>
<td>0.9[0.5,1.4]</td>
<td>1.0[0.5,1.4]</td>
<td>0.8[0.7,1.1]</td>
<td>0.8[0.7,1.1]</td>
</tr>
<tr>
<td>LDL&lt;sup&gt;g&lt;/sup&gt;-cholesterol (mmol/L)</td>
<td>3.0±0.7</td>
<td>3.1±0.7</td>
<td>2.9±0.7</td>
<td>2.6±0.6</td>
<td>2.6±0.6</td>
</tr>
<tr>
<td>HDL&lt;sup&gt;h&lt;/sup&gt;-cholesterol (mmol/L)</td>
<td>1.6±0.4</td>
<td>1.6±0.4</td>
<td>1.7±0.7</td>
<td>1.5±0.3</td>
<td>1.5±0.3</td>
</tr>
<tr>
<td>Total/HDL&lt;sup&gt;h&lt;/sup&gt; Ratio</td>
<td>3.4[2.5,3.6]</td>
<td>3.4[2.5,4.4]</td>
<td>3.5[2.7,3.8]</td>
<td>3.0[2.9,3.4]</td>
<td>3.0[2.9,3.4]</td>
</tr>
<tr>
<td>CRP&lt;sup&gt;i&lt;/sup&gt; (mg/L)</td>
<td>6.2±4.9</td>
<td>3.1[3.0,4.4]</td>
<td>3.3[2.0,6.1]</td>
<td>5.2[2.5,6.6]</td>
<td>5.2[2.5,6.6]</td>
</tr>
</tbody>
</table>

Breastfeeding variables

| Initiated breastfeeding n (%) | 100 | - | - | - | - |
| Exclusive breastfeeding at 3 months n (%) | 9/27 (33) | 3/11 (27) | 3/9 (33) | 3/7 (43) | 0.58 |
| Any breastfeeding at 3 months n (%) | 20/27 (74) | 8/11 (73) | 5/9 (56) | 7/7 (100) | 0.15 |
| Any breastfeeding at 6 months n (%) | 16/25 (64) | 5/9 (56) | 5/9 (56) | 6/7 (86) | 0.51 |
| Total weeks breastfeeding | 19.1±10.9 | 20.1±11.5 | 15.4±11.7 | 22.4±9.1 | 0.11 |

<sup>a</sup> Gestational weight gain is pre-pregnancy body weight subtracted from weight at 35 weeks gestation.
<sup>b</sup> Body Mass Index is kg/m²
<sup>c</sup> Weight retained is pre-pregnancy weight (kg) subtracted from weight at three, six, nine and 12 months postpartum
<sup>d</sup> Median [25<sup>th</sup> - 75<sup>th</sup> percentile] reported for non-normally distributed continuous data.
<sup>e</sup> Glycosylated haemoglobin; %
<sup>f</sup> Homeostatic Model Assessment of Insulin Resistance (HOMA-IR, fasting glucose (mmol/L) × fasting insulin (μU/ml)/22.5)
<sup>g</sup> Low density lipoprotein; mmol/L
<sup>h</sup> High density lipoprotein; mmol/L
<sup>i</sup> C-reactive protein; mg/L
3.5 Discussion

To the best of our knowledge, this is the first trial to evaluate a program that used breastfeeding support and weight loss advice to improve breastfeeding success and postpartum weight outcomes for overweight and obese women. There were no significant differences between the intervention and control groups for breastfeeding, weight or glucose and lipid metabolic variables. However, the results of program evaluation suggest that the design is feasible and that the methodology could be adapted to a larger, adequately powered RCT to address whether improved breastfeeding duration rates and weight loss advice can effectively facilitate a reduction in postpartum WR.

There has been one previous RCT which targeted US obese mothers with the aim to improve breastfeeding success [155]. This previous study compared two breastfeeding interventions with usual care. In the first intervention, half of the participants were given postpartum breastfeeding support in hospital and by telephone (n=20) and were compared to those receiving usual care (n=20) [155]. These women were followed up for 90 days postpartum and results revealed no significant differences in breastfeeding duration or exclusivity between the groups [155].

The second intervention had the same aim, which was to improve breastfeeding success in obese women. Obese pregnant
women were recruited and randomised to compare breastfeeding success between those who received a manual (n=9) or electric breast pump (n=13) with usual care (n=12) and were followed up for 14 days postpartum [155]. Women receiving the pumps were provided with instructions and hands-on support and were advised to express after five breastfeeding sessions every day for 10 minutes (each breast). For the first and second study components, women who received the intervention (extra breastfeeding support and provision of pumps) had a higher pre-pregnancy BMI (p-value not reported) and results showed there were no significant differences in breastfeeding duration between all intervention groups compared to usual care (p>0.05) [155]. This was likely due to small numbers and therefore inadequate power to detect a significant difference, a lack of stratification by BMI and failure to adhere to study protocol [155]. This breastfeeding intervention was conducted after birth and results may have been more favourable if the education commenced in the antenatal period and carried on into the postnatal period [155].

Suboptimal breastfeeding initiation and duration rates have been frequently cited for women with a high BMI [35, 72, 156-158]. A systematic review of observational studies was conducted to determine the effect of maternal overweight and obesity on breastfeeding initiation and duration [63]. Fifteen studies were identified which examined the impact of BMI on breastfeeding durations [35, 72, 156-158]. Rates for any breastfeeding at six months
for overweight women was 17 to 52% while rates for obese women were 17 to 37% [63]. Breastfeeding duration rates for the BBPBB study were above these ranges with 64% of the cohort breastfeeding at six months. However, comparisons may not be valid because intention to initiate breastfeeding was a selection criterion for the current study. Participants from the WM+LC group had the highest rates from all three groups although, this was not significant. Due to the small sample size we cannot rule out that IBLCL support is feasible and acceptable to overweight obese mothers and may improve breastfeeding outcomes in this cohort of women. Particularly as this cohort of women are known to have a greater number of difficulties in establishing and maintaining successful lactation [63].

During pregnancy, metabolic markers such as serum cholesterol, triglyceride, LDLs and HDLs increase above the normal adult range [159, 160]. The mechanisms behind these changes in metabolic risk factors are unknown, however evidence suggests it may be associated with the pregnancy hormones progesterone, oestral and human placental lactogen [161]. Further evidence suggests insulin sensitivity, maternal hormones, placental and adipose tissue metabolism contribute to changes in lipid levels [162].

There is limited research on the impact of breastfeeding on maternal metabolic biomarkers. The small number of existing studies suggests a non-linear relationship between glucose and lipid
metabolism both in the short and long term [163-165]. Two observational studies have examined the short [164] and long [65] term impact of breastfeeding on these markers. Lenz et al (1981) conducted a small observational study of 23 women eight weeks postpartum, comparing the markers of glycaemia [164]. Women who were breastfeeding had lower fasting glucose (n=13) and insulin levels compared to women who were not breastfeeding (n=10; values not shown, p<0.05) [164]. The direction of these results are similar to the BBPBB, though our findings were not statistically significant. Women who were in the WM+LC group had lower levels of glucose at three and six months and lower levels of insulin and HOMA-IR at six months compared to the WM and control groups.

The impact of breastfeeding on long term maternal metabolic risk factors has also been examined in a retrospective longitudinal study of 212 Finnish women [65]. Compared to women who had a history of short duration of breastfeeding (≤ 6 months), women who breastfed for a longer duration were more likely to have reduced health risks, including lower fat mass, lower body weight (6-7 kg less); lower fasting glucose, insulin, total and LDL cholesterol, 16-20 years postpartum (p<0.05) [65]. These results remained after adjustment for education level [65]. This preliminary evidence provides support of the long and short-term maternal benefits of breastfeeding. However, more research is needed to expand on these findings particularly in an obesogenic environment.
Table 3.2 details previous RCT on postpartum weight loss. There are a number of differences between these studies and the BBPBB study. Firstly, four of the studies report the primary outcome as weight loss, which is the difference between two weights (pre and post intervention) during the postpartum period. While others, including the our study, report WR which is the difference between postpartum weight and pre-pregnancy weight. WR is a better indicator of postpartum weight patterns, as we are able to see the magnitude of weight gain or loss over the pregnancy and postpartum period. A limitation to using WR is the use of self-reported pre-pregnancy weight. Despite this, weight loss only provides a snapshot of weight gain or loss in a smaller amount of time and does not take GWG into consideration. There is also a wide range of follow up between the studies, with the shortest study being 11 days and the longest 12 months postpartum.

BBPBB participants in the WM group retained less weight at both three and six months compared to the two other studies reporting WR as the primary outcome [49, 139]. The controlled trial by Kinnunen et al (2007) was conducted during the postpartum period including the weight loss intervention [139]. Conversely, the RCT by Huang, Yeh and Tsai (2011) provided intervention participants with weight management education during pregnancy, similar to the
BBPBB study, which could contribute to the success in weight loss for both studies. However, the aim of the antenatal intervention provided by Huang, Yeh and Tsai (2011) was to control GWG rather than prepare the participants solely for weight loss in the postpartum period [49]. This makes it difficult to determine the postpartum impact of this intervention because GWG is a significant determinant of WR.

The postpartum period is associated with many adjustments for a mother, including time constraints, a change in priorities and child care concerns [166, 167]. These adjustments can make it difficult for women to achieve a healthy lifestyle [166, 167] and have been reported to contribute to the small or lack of success in postpartum weight loss interventions. This is evidenced by high dropout (up to 40%) and low attendance rates [133, 134, 140]. Researchers from the Active Mothers Postpartum (AMP) study conducted participant interviews, after they discovered they had low retention rates from their postpartum weight loss intervention [167]. Results revealed a number of barriers preventing postpartum women from achieving a healthy lifestyle. These included lack of time in a busy schedule, health of the family as first priority, lack of social support, lack of child care during the intervention education and location from the study centre [167]. Results from this intervention revealed no significant weight loss between the intervention and control groups [133]. Our aim was to overcome these issues in the development of the BBPBB study methodology to maximize women
achieving successful weight loss. We provided women with a self-management program to complete in their own time, which eliminated the need for child care and could be completed in their own time. We also offered phone calls and home visits for women who were unable to visit the hospital due to geographical location or who had child care issues. In addition to this, we provided the weight management education during an antenatal visit towards the end of pregnancy to help prepare women for the requirements of the study after birth. This enabled women to have more time to learn about the program requirements and to be prepared and organised for the postpartum period. Despite trying to compensate for these issues, the majority of the withdrawals occurred during the antenatal period (see table 4.5).

Weight retention and breastfeeding outcomes for this RCT were not significant; however results were in the expected direction to favour the intervention groups. As this was a feasibility study, we sought to determine the strengths and weaknesses of the interventions. This was central to our research given the limitations of previous RCTs. Results from the evaluation suggest majority of participants who completed the questionnaire improved their eating and exercise behaviours as a result of the intervention. This includes recording intake, monitoring weight, increasing everyday exercise, planning meals and making healthier food choices. Half of the women found it difficult to complete the program with a new baby, despite this being an intervention which they could complete in their own time. It
would be ideal to use this feedback as a guide for future postpartum RCTs however it should be noted that this evaluation is more than likely completed by compliant participants.

Limitations

This pilot RCT has a number of limitations which will be considered for larger RCTs targeting WR reduction and BF success in postpartum women. The primary limitation is the small sample size, making it difficult to detect significant differences in outcome variables and limiting the applicability of the study to the general population. In addition to this, the retention rate was suboptimal suggesting the need for further consideration with this population and their unique stage of life. The low retention rate may be a result of the change in lifestyle associated with having a newborn. To improve the study sample size and retention rates, regular contact with a health professional and incentives to complete the study could be considered. It should also be acknowledged that we haven’t analysed energy intake using the dietary data collection tools as this potentially has an impact on WR and breastfeeding. Using details from previous RCTs could also guide sample size, power and successful intervention strategies. Additionally, providing the participant with the opportunity to fill in evaluations during the appointment may improve feedback and retention in the study.
Conclusion

Overweight and obesity in women is an independent risk factor for lifestyle disease such as type 2 diabetes and heart disease [13, 168]. Pregnancy can further compound this risk if women experience excessive gestational weight gain, postpartum WR and have lower rates of successful breastfeeding initiation and duration. Lifestyle changes, such as healthy eating and exercise, which are used in traditional weight loss programs, may be difficult for postpartum women to achieve considering the difficulties they may face during this time, such as time constraints and change in priorities. Despite postpartum WR being common and a health concern for women, there are currently no programs or strategies routinely offered to assist women to optimize postpartum weight related health. Our pilot study provides evidence to support the feasibility and preliminary efficacy of providing overweight and obese women with targeted breastfeeding support and weight loss advice in improving weight, breastfeeding and metabolic outcomes. An adequately powered RCT is now required to determine the true effect, if any, of these interventions and the costs involved in implementing those that are effective on a larger scale.
Chapter 4: FINAL DISCUSSION
4. DISCUSSION

4.1 Introduction

The research described in this thesis was based on two objectives:

1. Define weight retention and breastfeeding patterns of women participating in the Women and Their Children’s Health (WATCH) cohort up to 12 months postpartum.

2. Determine the feasibility and efficacy of a RCT aimed at assisting overweight and obese women to improve breastfeeding duration, reduce postpartum WR and improve metabolic biomarkers.

The first chapter of this thesis identified WR patterns in postpartum women which helped to shape the study design including intervention targets and program content for the pilot RCT in this specific target group.

The findings described in Chapter 2 present the breastfeeding and WR patterns of a cohort of 180 women from the WATCH study. This prospective longitudinal study followed women from pregnancy up until 12 months postpartum. Results from this cohort indicate the majority of women fail to return to their pre-pregnancy weight by 12 months postpartum, with some increasing their BMI into the overweight or obese group. Other studies suggest women commonly retain this weight beyond 12 months and even up to 15 years postpartum [114]. Our results also indicate that excessive GWG and parity are
associated with increased WR as previously observed [19, 39, 48, 112].

An additional factor that was found to influence WR in the longitudinal analysis was breastfeeding duration. Results revealed any type of breastfeeding (exclusive, partial) slightly decreased WR; however the association between WR and breastfeeding is far from clear [111, 169]. Unfortunately, breastfeeding rates for duration on ‘any’ breastfeeding within the WATCH study were below national and international recommendations [67]. Chapter 2 helped to identify the WR patterns of women after birth clarifying the importance of the postpartum period as a time where provision of support to optimize breastfeeding initiation and duration from approximately qualified health professionals could be trialed as a strategy to improve breastfeeding outcomes and achieve a healthy weight. Conventional weight loss techniques (e.g. calorie counting) and programs may not be successful with this group of women due to the demands of caring for a newborn and prioritising the health of their families over themselves.

Previous research has identified that overweight and obese women have reduced breastfeeding initiation and duration rates [63]. This group of women are also at risk of failing to return to their prepregnancy weight, which places them at a higher risk of permanent WR and a life time pattern of an increasing BMI trajectory. Our pilot
RCT randomised overweight and obese women to three groups to compare breastfeeding success and WR. Women received a weight management program during the 35 week antenatal visit in pregnancy, with or without additional breastfeeding support or were allocated to usual care and formed the control group who received the same weight management program, but at three months after birth. Although not significant, women who received the weight management program and/or breastfeeding support had glucose and lipid biomarkers in the expected direction as well as trends for higher rates of exclusive and ‘any’ breastfeeding. This suggests this type of intervention has potential to improve postpartum health outcomes in women and results warrant a full-scale RCT. The pilot study was underpowered to detect significant differences in the metabolic markers of interest.

To determine the feasibility of the interventions from the participants’ perspective, women were provided with a 50-question program evaluation to complete at home. Results showed participants responded well to the both the self-directed weight management program. However, these results may be biased as only 39% returned the evaluation form. To improve these rates, a new method needs to be considered for postpartum women. For example, administering the questionnaire during the study visit by a blinded researcher or providing incentives upon return.
4.2 Clinical Significance and Future Directions

The results of the WATCH study identified WR patterns in postpartum women. Breastfeeding and, more so, GWG were associated with WR. The pilot RCT was then conducted to confirm the effect of breastfeeding on WR. To achieve this, we used a self-directed WM program with breastfeeding support and results revealed that this study design has some potential to improve breastfeeding success and the health status of overweight and obese women. However, this needs to be confirmed in a larger trial.

This pilot RCT is the first if its kind. There are 10 previous RCTs which aim to reduce WR for overweight and obese women; although none of these have a breastfeeding support component and only one other RCT provides the WR program during pregnancy. However, the current study was a pilot and as result, requires a larger RCT to demonstrate a stronger effect.

A number of areas were identified which could be used to guide future research or programs targeting postpartum women. Components of the WM program that women responded to was the portion control for breakfast, lunch and snacks as well as the use of the dinner disc. Weight loss during the postpartum period is potentially more difficult compared to other stages in adulthood as a result of the demands on a mother with a new baby, as indicated by 39% of those who returned the questionnaire.
4.3 Challenges and Limitations

Obtaining an accurate pre-pregnancy weight and measure of GWG is difficult to achieve with pregnant women as it is often dependent on self-reported data or estimates. To calculate the GWG, we used subtracted self-reported weight from the weight at the last visit which was 36 weeks gestation. Unfortunately, this does not accurately represent the entire weight gain for pregnancy therefore; total GWG may be slightly less than true amount.

Conducting a trial during the postpartum period is challenging and requires flexibility to women and their changing priorities and lifestyles. To improve retention rates, we gave the participants the option of a home visit. Participants responded well to this option however, we were not able to provide a phlebotomist to this appointment and as result, not all participants who attended the postpartum visits conducted a blood test. Additionally, many women did not return their evaluation questionnaires.

4.4 Recommendations for future practice

This thesis highlights the importance of improving the health of postpartum women, particularly at a life stage which may not be conducive to successful weight loss. Excessive GWG and reduced breastfeeding success are components that influence increasing WR.
Undoubtedly, much of the research on treatment of overweight and obesity targets male and female adults. However, it should be recognised that childbearing can contribute to excessive weight retention and as a result this time period should be targeted to prevent projection of women into a higher BMI category.

Breastfeeding provides many short and long term benefits to the mother and infant. Among these benefits is maternal weight loss and results from this thesis suggest breastfeeding can be utilised to assist women to return to their pre-pregnancy weight or less. Women should be supported to continue to breastfeed into the postpartum period to help reduce weight retention and to receive the numerous other benefits of breastfeeding.
REFERENCES


APPENDICES
Appendix One: Bouncing Back to you Pre-baby Body study - Information statement
Risks:

⇒ Bruising, dizziness &/or fainting as a result of the blood test. This risk is minimised through the use of qualified & experienced staff.

⇒ Some individuals who are overweight or obese may feel vulnerable &/or sensitive when discussing issues relating to body weight or when participating in the skinfold tests. A list of Hunter counselling services is available if you require it.

⇒ Participants may experience some discomfort during the skinfold test due to the light pinching of the skin.

How will your privacy be protected?

Any information you provide for this study will be confidential & will be stored in a locked filing cabinet or password protected computer file. Only the research team will have access to your information. All participants will have a study code so that you are not easily identifiable. Personal details that identify you, such as your name & address, will be removed when the study is complete. Personal information will be accessed, used & stored in accordance with the Commonwealth Privacy Laws & the NSW Health Records & Information Privacy Act 2002.

How will the information collection be used?

The results will be used to work out if the combination of breastfeeding & a weight management program reduces the risk for weight related health problems such as diabetes.

The results will be presented in scientific journals & at conferences. Some results will be included in a thesis written by Ms Julia Martin for her postgraduate degree. No person will be identified in these presentations or publications.

What do you need to do to participate?

If you have any questions or would like further information please contact Julia Martin on 4985 5620. You may also phone the Chief Investigator, Professor Clare Collins on 4921 5646.

If you'd like to participate & you think that you are eligible, please contact Julia Martin on 4985 5624. Your details will be taken & you will be contacted within 2 weeks. An eligibility phone screen will be conducted to ensure that you are eligible to be part of the project. If you are, you will be sent a consent form.

Complaints about this research

This project has been approved by the Hunter New England Human Research Ethics Committee (HNEHREC) OF Hunter New England Health, Reference Number: 10/07/21/5.04.

Any concerns or complaints about the manner in which this research is conducted may be given to the researcher. If an independent person is preferred, please contact Dr Nicole Gerrand, Manager Research Ethics and Governance, Hunter New England Health, Locked Bag 1, New Lambton NSW 2305, Ph: (02) 4921 4950, Email: Nicole.Gerrand@hneh.health.nsw.gov.au

The Research Team

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Ms Julia Martin
Research Dietitian
University of Newcastle

In partnership with our community

HMRI
The University of Newcastle
Hunter New England Health

Bouncing Back to your Pre-Baby Body

INFORMATION STATEMENT

A research initiative within the Mothers and Babies Research Centre of John Hunter Hospital
Why is the research being done?
For women, having children enhances the likelihood of increasing body weight & also holding on to that increased weight gain. Some women may also have excess body weight pre-pregnancy, excessive weight gain during pregnancy, or an inability to shed the weight gain after the baby is born. As weight gain & obesity are risk factors for developing diabetes & other metabolic diseases, this is of particular concern. Weight loss is a strategy recommended to lower health risks associated with excess weight. We are interested in exploring whether or not mothers who breastfeed & use a weight management program lower their risk for developing diabetes & also help to bounce back to their pre-baby body!

Who can participate in the research?
Any pregnant woman can participate in this project if you:

⇒ Are aged over 18 years
⇒ Are overweight, determined as a body mass index (BMI) between 25 & 35 kg/m² (calculated using your weight before pregnancy)
⇒ Intend to breastfeed your baby
⇒ DO NOT have any medical condition or take medications that could affect body weight, appetite, blood sugar or insulin levels. You WILL be able to participate if you have gestational diabetes.

What would you be asked to do?
Once you indicate that you are interested in participating (see leaflet for contact details) you will complete a questionnaire over the phone to check that this study is suitable for you. If it is, you will be sent a consent form to read through & sign.

You will be allocated, by chance to 1 of 3 groups:

All groups:
⇒ Receive a weight management program tailored to individual breastfeeding needs.
⇒ Receive breastfeeding education materials. You may also be contacted by a breastfeeding counsellor (lactation consultant) for extra support.
⇒ Will receive usual breastfeeding care by the Hospital plus standard information.

Groups 1 & 2 will receive the weight management program & materials at about 35 weeks in pregnancy. The program will start after your baby is born & breastfeeding has started.

Group 3 will receive the weight management education & materials 3 months after your baby is born.

You will be asked to refrain from using any other weight management or weight loss programs during participation in the project. Participation in this project is for at least six months. During this time you will be asked to come to the hospital at 4 time points so we can collect some information from you. You will be asked to come in at 26 & 35 weeks gestation & then again at 3 & 6 months after the birth of your baby. We will also collect information on your baby at the 3 & 6 month time points. You will need to contact us before you are ~26 weeks pregnant so you do not miss your first data collection session.

We will collect the following information:

During pregnancy & after birth we will:
⇒ Take blood samples
  ⇒ These are in addition to your usual antenatal care at the John Hunter Hospital
  ⇒ The total amount of blood is about 20 ml in total (just over a tablespoon). Blood samples will be analysed for important indicators of health, primarily those relating to diabetes.
⇒ Measure your blood pressure.
⇒ Measure your body composition including height, weight, waist circumference & skin fold measurements.

Skin fold measurements determine body fat composition by a skinfold test, whereby a pinch of skin is measured at various sites on the body.

After each data collection, you will also be asked to:
⇒ Complete questionnaires about medical history, personal details, breastfeeding history, food intake, exercise & mental health. These should take ~1 hour to complete.
⇒ Complete a recall over the phone with a dietitian of the all of the food & drinks you have consumed over the past 24 hours. This phone call will take ~30 minutes.

After your baby is born, we will:
⇒ Look at your child’s growth & body composition including length, weight as well as head, arm, leg & abdominal circumferences.
⇒ Measure your baby’s blood pressure.
⇒ Ask you to complete an Infant Feeding Questionnaire & record your baby’s dietary intake for 2 days.

These measurements will be taken at 3 & 6 months after birth.

What are the risks & benefits of participating?
Benefits:
⇒ Additional blood tests & measures of health status beyond standard antenatal & postnatal care.
⇒ Potentially reduce your risk of diabetes in later life.
⇒ The purpose of this study is to help you lose weight & improve your health & wellbeing through developing skills & knowledge to increase levels of physical activity & improve food choices.
Appendix two: Bouncing Back to you Pre-baby Body study – recruitment brochure
How will the information collection be used?
The results will be used to work out if both breastfeeding & a weight management program lowers health problems caused by being overweight such as diabetes.

What do you need to do to participate?
If you would like to be part of this study or if you have any questions please ask your midwife and she will contact the researcher Julia Martin to come and see you today. Also you can contact Julia on 4985 5620. You may also phone the Chief Investigator, Professor Clare Collins on 4921 5646. You will also receive a more detailed information statement about the study. This project has been approved by the Hunter New England Human Research Ethics Committee Reference Number: 10/07/21/5.84. Health, Locked Bag 1, New Lambton NSW 2305, Ph: (02) 4921 4950, Email: Nicole.Gerrand@hnehealth.nsw.gov.au

The Research Team
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The University of Newcastle

Dr Alexis Hure
Post Doctoral Research Dietitian for Mothers & Babies Research Centre John Hunter Hospital

Dr Lesley MacDonald-Wicks
Lecturer & Accredited Practicing Dietitian
University of Newcastle

Professor Roger Smith
Endocrinologist
Director of Mothers & Babies Research Centre John Hunter Hospital

Ms Julia Martin
Research Dietitian
University of Newcastle

If you would like to be part of this study, please let your midwife know

Bouncing Back to your Pre-Baby Body

Need help getting back to your pre-baby weight?

A research initiative within the Mothers and Babies Research Centre of John Hunter Hospital
We are pleased to invite you to join a study with the Mothers & Babies Research Centre at John Hunter Hospital.

Would you like to take part in a research study to help you manage your weight after your baby?

Who can join the study?
Any pregnant woman can join in this project if you:
⇒ Are aged over 18 years
⇒ Have a body mass index (BMI) between 25 & 35 kg/m² & want assistance to loose the extra weight gained while you are pregnant
⇒ Want to breastfeed
⇒ DO NOT have any medical conditions or take medications that could affect body weight, appetite or blood sugar levels.

What would you be asked to do?
All mothers part of the research will:

✦ Receive a free weight management program given by a dietitian
✦ Receive breastfeeding education materials
✦ Be asked to come into the hospital at 26 & 35 weeks pregnant & then again at 3 & 6 months after the birth

What are the benefits of participating?
⇒ Help you lose weight & improve your health & wellbeing by increasing levels of exercise & improve food choices
⇒ Possibly reduce your risk of diabetes in later life

We will collect the following information:
⇒ A blood sample
⇒ Body measurements
⇒ Get you to complete questionnaires

After your baby is born, we will:
⇒ Look at your baby’s growth
⇒ Measure your baby’s blood pressure
⇒ Get you to complete questionnaires on what your baby is eating and drinking

You will need to contact us before you are 26 weeks pregnant so you do not miss your first study appointment.

Version 2, 07/03/2011
Appendix three: Bouncing Back to you Pre-baby Body study – health screen
Bouncing back to your pre-baby body

Eligibility Phone Screen

Please complete for ALL potential participants to assess eligibility for entry into TBL study.

Telephone Eligibility Screen Script

Hi my name is ................................ I am a researcher from the Mothers and Babies Research Centre working with the Bouncing back to your pre-baby body study.

I am ringing you today to check if you are still interested in joining our research project? (If “Yes” continue with the script, if “No” thank them for showing some interest in the study).

So what I would like to do is to first just run through some more information about the study and make sure you still want to continue, confirm your contact details and then we go through the eligibly screen. For some women, having children enhances the likelihood of increasing body weight and also holding on to that increased weight after the baby is born. Some women may also have excess body weight before they become pregnant, have a large weight gain during pregnancy, or find it hard to shed the weight gain after the baby is born. As weight gain and being overweight are risk factors for developing diabetes and other chronic diseases later in life, this is of particular concern.

Weight loss is a strategy recommended to lower health risks associated with excess weight. We are interested in exploring whether or not mothers who use a weight management program are able to lower their risk for developing diabetes and also bounce back to their pre-baby body!

You will be randomly allocated to 1 of 3 groups:
All groups will receive a weight management program tailored to individual breastfeeding needs. Those who are selected to Group 1 or 2 will receive the weight management program and materials at about 35 weeks in pregnancy and start the program after the baby is born and breastfeeding has started. Those in Group 3 will receive the weight management education and materials 3 months after birth. You will be asked to refrain from using any other weight management or weight loss programs during participation in the project.

You will also be asked to come into the John Hunter Hospital for data collection sessions. During this time we will ask you to fill in some questionnaires, provide a blood sample, have body measurements and blood pressure taken and also receive some dietary education. This will take about 2 hours. These data collection sessions will be done twice during pregnancy and twice when your baby is born. We will also take some measurements on your baby, if you are happy for us to do so. We will collect body measurements (such as length and weight) and blood pressure.

Does this project sound like something you would like to participate in?
1. Are you intending to breastfeed your baby?

☐ Yes
☐ No – Not eligible to participate

2. What is your current age _______. Is their age within the required range (18-60 years)?

☐ Yes
☐ No – Not eligible to participate

3. What is your current height and weight? It needs to be your weight before pregnancy. (Please explain that you need to calculate their body mass index which is their weight divided by their height in metres squared).

Height (cm) ______________
Weight (kg) ______________
Body Mass Index (kg/m²) ______________

Is their BMI within range (25-35 kg/m²)?

☐ Yes
☐ No – Not eligible to participate

4. If you are accepted into the study, do you agree NOT to participate in any other weight loss programs for at least six months after the birth of your baby?

☐ Yes
☐ No – Not eligible to participate

5. To collect data for the study you will be required to attend assessment days on a workday (i.e. Monday to Friday). Are you available to attend the assessments on one of these days?

☐ Yes. Please specify if any day is NOT convenient ______________________________
☐ No – Not eligible to participate

6. You will be asked to attend assessment sessions at the John Hunter Hospital when you are around 26 weeks pregnant and then around 35 weeks pregnant. Following the birth of your child, you will be asked to attend two more session, one when your baby is 3 months old and another when your baby is 6 months. Are you able to attend these assessment sessions? (Note: Participants will be reminded about the assessment days).

☐ Yes
☐ No – Not eligible to participate
7. Would you be willing to let the researchers conduct measurements and blood pressure on your baby when he/she is 3 and then 6 months old?

☐ Yes
☐ No

“YES” to Question 8 - 11 – indicates INELIGIBILITY to participate in the study OR their case might need to be considered.

8. Have you taken medication(s) to lose or gain weight in the last 6 months? If yes, please specify the medication(s)

☐ Yes – Not eligible to participate
☐ No

9. Do you have any of the following conditions or disabilities? If yes, please specify in the space(s) provided any details:

- Major heart disease (e.g. heart attack, coronary heart surgery)

- Diabetes requiring insulin treatment

- Orthopaedic or joint problems

☐ Yes – Not eligible to participate
☐ No

10. Do you currently take any medications that have caused noticeable weight gain or loss? If yes, please specify the name(s) and duration of use. (Note: if the medications have caused noticeable weight gain or loss AND duration is less 6 months AND on the medication checklist they are ineligible).

☐ Yes – Not eligible to participate
☐ No
☐ Unsure – Research team will need to decide eligibility

11. Did the pre-exercise screen (attached) classify the participant as “high risk”?

☐ Yes - Require medical clearance
☐ No
☐ Unsure – Research team will decide eligibility
# Pre-exercise Screening Questionnaire

**Name** ______________________________  
**Date** __________

**Age (yrs)** ________________

## PART 1:

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you ever had a heart attack or coronary revascularisation surgery?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you ever had a stroke?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has your doctor ever told you that you have heart trouble or vascular disease?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Has your doctor ever told you that you have a heart murmur?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you suffer from pains in your chest, especially when you exercise?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you ever get pains in your calves, buttocks or the backs of your legs during exercise, which are not due to soreness or stiffness?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you ever feel faint or have spells of severe dizziness, particularly with exercise?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you experience swelling or accumulation of fluid around the ankles?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you ever get the feeling that your heart is suddenly beating faster, racing or skipping beats, either at rest or during exercise?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you have chronic obstructive pulmonary disease, interstitial lung disease or cystic fibrosis?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Have you ever had an attack of shortness of breath, which developed when you were not doing anything strenuous, in the last 12 months?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Have you ever had an attack of shortness of breath, which developed after you stopped exercising, at any time in the last 12 months?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you have diabetes (Type I or Type II)?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

If YES, do you have trouble controlling your diabetes?

Do you have any ulcerated wounds or cuts on your feet that don’t seem to heal? No | Yes

Do you have any liver, kidney or thyroid disorders? No | Yes

Do you experience unusual fatigue or shortness of breath with usual activities? No | Yes

Is there any other physical reason or medical condition that could prevent you from undertaking exercise or that you are concerned about? No | Yes
**PART 2:**

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you smoke tobacco or cannabis regularly OR have you quit smoking in the last 6 months?</td>
<td>No</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Do you have a close male relative (father, son, brother) who has had a heart attack, coronary bypass surgery or died suddenly due to a heart attack before the age of 55 years?</td>
<td>No</td>
<td>Yes</td>
<td>Don't know</td>
</tr>
<tr>
<td>Do you have a close female relative (mother, daughter, sister) who has had a heart attack, coronary bypass surgery or died suddenly due to a heart attack before the age of 65 years?</td>
<td>No</td>
<td>Yes</td>
<td>Don't know</td>
</tr>
<tr>
<td>Do you have impaired fasting blood glucose?</td>
<td>No</td>
<td>Yes</td>
<td>Don't know</td>
</tr>
<tr>
<td>Do you have high resting blood pressure or do you take medication for blood pressure?</td>
<td>No</td>
<td>Yes</td>
<td>Don't know</td>
</tr>
<tr>
<td>Do you have high serum cholesterol or low HDL levels or take lipid-lowering medication?</td>
<td>No</td>
<td>Yes</td>
<td>Don't know</td>
</tr>
<tr>
<td>Do you have an occupation where you sit for long periods of time?</td>
<td>No</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Do you do less than 150 minutes of moderate physical activity per week?</td>
<td>No</td>
<td>Yes</td>
<td>None</td>
</tr>
</tbody>
</table>

**PART 3:**

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you currently use any medication for asthma?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Do you have any medical condition that the people conducting this exercise test need to be aware of for your safety during exercise testing?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>If yes, please provide details below</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other medical conditions: ________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

What is your risk classification? HIGH MODERATE LOW

Developed from:
Sports Medicine Australia (SMA) pre-exercise screening system 2005
Australian Government Department of Health and Ageing [www.sma.org.au]
Interpreting the Pre-Exercise Screening Questionnaire

Purpose: Stratify risk
- Filter out people at high risk of exercise-related complications

Questionnaire components
- Age – risk increases with age
- Gender – age-related risk differs with gender (M risk higher at younger age)
- Height and weight – used to determine BMI – indicator of overweight/obesity
- Occupation – influences physical activity status

Part 1 – Known OR signs and symptoms of diseases or conditions
- If answer YES to any questions in Part 1, classify as HIGH RISK
- Should get medical clearance before beginning an exercise program or undergoing an exercise test

Part 2 – Risk factors for cardiovascular disease
- If male and aged ≥ 45 years, then at MODERATE RISK
- If female and aged ≥ 55 years, then at MODERATE RISK
- If younger and answer YES to 2 or more questions in PART 2, then at MODERATE RISK
- If younger and answer YES to none or 1 questions, then at LOW RISK

What if you don't know the answer to some of the questions in PART 2?
- Ideally, see your GP for check-up

Part 3 – Additional information
- Medication for asthma – if going to supervise exercise, desirable to know asthma status and encourage carrying reliever medication
- Other medical conditions – CV disease is not the only situation that can limit exercise capability or safety. Consider:
  - Orthopaedic problems
  - Pregnancy
  - Overweight/obesity
  - Epilepsy
  - Recent illness (cold/flu, GI upset, etc)
  - Recent surgery
  - Recovering from illness or treatment (e.g., cancer)

What is your risk classification?
Appendix four: Bouncing Back to you Pre-baby Body study – consent form
Consent for the Bouncing Back to your Pre-baby Body study

Researchers: Professor Clare Collins, Dr Alexis Hure, Dr Lesley MacDonald-Wicks, Professor Roger Smith, Ms Julia Martin

I have been invited to participate in this research project and give my free consent by signing this form.

I agree to participate in the above research project and give my consent freely.

I understand that the project will be conducted as described in the Information Statement, a copy of which I have retained.

I understand I can withdraw from the project at any time and do not have to give any reason for withdrawing.

I consent to:

☐ The researchers accessing my medical records for study purposes
☐ Attending 4 data collection sessions throughout my pregnancy and after the birth of my baby (at ~ 26 and 35 weeks gestation and then three and six months after birth)
☐ Having the following taken/measured at the data collection sessions:
  ☐ Body composition measured, including height, weight, waist circumference and skin fold measurements (Skin fold measurements determine body fat composition by a skinfold test, whereby a pinch of skin is measured at various sites on the body).
  ☐ Blood pressure taken
  ☐ Providing a 20 mL blood sample (just over a tablespoon) to evaluate my health status
  ☐ Completing 5 questionnaires about medical history, personal details, food intake, physical activity, breastfeeding history and mental health (these can be completed at home or at the data collection session)
☐ Completing a 24 hour food recall (a description of the foods you have eaten in 24 hours) over the phone on at least 4 separate occasions
☐ Receiving a weight management program which is to be implemented after the birth of my baby
☐ Receiving information about breastfeeding from a lactation consultant

I understand that my personal information will remain confidential to the researchers.

I have the opportunity to have questions answered to my satisfaction.

PRINT NAME......................................................

SIGNATURE......................................................

DATE......................................................

Bouncing Back to your Pre-baby Body Study
HNEHREC Reference No: 10/07/21/5.04
Consent for the Bouncing Back to your Pre-baby Body study

Researchers: Professor Clare Collins, Dr Alexis Hure, Dr Lesley MacDonald-Wicks, Professor Roger Smith, Ms Julia Martin

I agree for my child to participate in the above research project and give my consent freely.

I understand that the project will be conducted as described in the Information Statement, a copy of which I have retained.

I understand I can withdraw my child from the project at any time and do not have to give any reason for withdrawing.

I consent to:

- The researchers accessing my child’s medical records for study purposes
- My child attending 2 data collection sessions (at three and six months after birth)
- Having the following taken/measured on my child at the data collection sessions:
  - Body composition including length, weight as well as head, arm, leg and abdominal circumferences
  - Blood pressure
  - Completing 2 questionnaires about my child’s food intake (these can be completed at home or at the data collection session)
- Recording my child’s food intake for two days after each data collection session

I understand that my child’s personal information will remain confidential to the researchers.

I have the opportunity to have questions answered to my satisfaction.

PARENT / GUARDIAN NAME..............................................................................

PARENT / GUARDIAN SIGNATURE........................................................................

DATE.................................
Appendix five: Bouncing Back to you Pre-baby Body study – TEMplate tracking
your progress form
**Tracking Your Progress Form**

Keep track of your energy balance by recording with a tick (✓) each time you eat a TEMplate breakfast, a TEMplate lunch and snackbox and a TEMplate dinner.

Consult the extras calculators on p24 (for weight loss) or p25 (for weight maintenance) and record the number of Extras you are allowed at column X.

Place a tick (✓) for each Extra you consume at column Z and for each Activity Block you perform during the day at column Y.

Aim for energy balance between extras consumed & extras allowed plus Activity Blocks. (Remember you can enjoy additional extras for every additional Activity Block you complete.)

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Weight (kg)</th>
<th>Waist (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STEP 1</td>
<td>STEP 2</td>
</tr>
<tr>
<td></td>
<td>TEMplate breakfast</td>
<td>TEMplate lunch &amp; snacks</td>
</tr>
<tr>
<td></td>
<td>dd/mm</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>□</td>
<td>□</td>
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<td>□</td>
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</tbody>
</table>

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Appendix six: Bouncing Back to you Pre-baby Body study – TEMplate diet and activity journal
Diet and Activity Journal

Recording information such as food intake and physical activity as well as information about the times, places and feelings associated with eating and activity increases your awareness of, and helps you identify, detrimental habits or patterns of behaviour.

Remember, this journal is NOT a test and there are no wrong answers. It is simply designed to help you and your supporting healthcare professional identify areas where you may be able to modify habits to assist with weight loss or weight maintenance.

Remember keep a pen and paper handy and fill in your journal during the day as you go, don’t wait until the end of the day and try to rely on your memory – it doesn’t work and you will miss recording some entrenched or subconscious habits. Remember to include any little snacks that you may have on the run.

Complete a journal for at least one typical weekend day and 2 typical weekdays. Ideally you should review your completed journal entries with your supporting healthcare professional – they will be able to help you identify some unhealthy habits that you may like to modify.

<table>
<thead>
<tr>
<th>Day and time of day</th>
<th>List all food and drink (including the amount) as it is consumed</th>
<th>Hunger level before eating or drinking</th>
<th>Description and duration of physical activity and relaxation activity</th>
<th>Where did you eat and with who?</th>
<th>How were you feeling at the time?</th>
</tr>
</thead>
</table>

1. Scale: 0 = full, 1 = comfortable, 2 = slightly hungry, 3 = moderately hungry, 4 = very hungry, 5 = starving
2. Example: 30 minute comfortable walk with the dog, 2 hours playing computer games
3. Example: At home watching TV with wife
4. Example: positive, enthusiastic, happy, content, relaxed, bored, nervous, sad, depressed, lonely, stressed

Photocopy this page as required

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Appendix seven: Australian Easting Survey
Please write your name in pencil only:

The University of Newcastle Australia

Australian Eating Survey 2010

Please leave this space for the researchers to complete:

<table>
<thead>
<tr>
<th>ID</th>
<th>Date of Birth</th>
<th>Weight</th>
<th>Height</th>
<th>Date of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

158
PLEASE READ THESE INSTRUCTIONS BEFORE YOU START

This is a survey about the food you eat. Read it carefully and fill in the ovals to show what you usually eat.

REMEMBER: There are no right or wrong answers.

How to fill in this survey
• Use a blue/black ballpoint pen or 2B pencil
• Do not use a red or felt tip pen
• If you make a mistake, either erase or place a cross through the incorrect oval and fill in the correct oval
• Fill in only one oval for each question
• Do not make any extra marks on this form

1. How old are you?

2. When is your birthday?

   Month
   ○ January
   ○ February
   ○ March
   ○ April
   ○ May
   ○ June
   ○ July
   ○ August
   ○ September
   ○ October
   ○ November
   ○ December
   ○ Not sure

   Day
   ○ 1
   ○ 2
   ○ 3
   ○ 4
   ○ 5
   ○ 6
   ○ 7
   ○ 8
   ○ 9
   ○ 10
   ○ 11
   ○ 12
   ○ 13
   ○ 14
   ○ 15
   ○ 16
   ○ 17
   ○ 18
   ○ 19
   ○ 20
   ○ 21
   ○ 22
   ○ 23
   ○ 24
   ○ 25
   ○ 26
   ○ 27
   ○ 28
   ○ 29
   ○ 30
   ○ 31
   ○ Not sure

   Year

3. Are you?
   ○ Male
   ○ Female
   ○ Not sure

4. Do you take vitamins?
   ○ No
   ○ Yes

   a. How many vitamin tablets do you take each week?
      ○ 2 or less
      ○ 3-5
      ○ 6-9
      ○ 10 or more

   b. How many years have you been taking them?
      ○ 0-1 years
      ○ 2-4
      ○ 5-9
      ○ 10 years or more

Please go to page 3.
Think about what you ate over the last 6 months when you answer these questions

GENERAL QUESTIONS

A. How many days per week do you usually have something to eat for breakfast?
   - Never
   - 1-2 days
   - 3-4 days
   - 5 or more days
   - Not sure

B. Where do you usually eat breakfast?
   - At home
   - On the way to school/work/TAFE/college/university
   - At school/work/TAFE/college/university
   - Don’t eat breakfast
   - Other

C. How many pieces of fruit do you eat?
   - (include all types)
   - None
   - Less than 1 per week
   - 1-2 per week
   - 3-4 per week
   - 5-6 per week
   - Once per day
   - 2-3 per day
   - 4 or more per day

D. How many times a week do you eat vegetables with your meal at night?
   - (not including hot chips)
   - Never
   - Less than once per week
   - 1-2 per week
   - 3-4 per week
   - 5 or more per week

E. How often do you eat takeaway foods?
   - eg, chinese, fish and chips, hamburger and chips/ries, pizza
   - Never
   - Less than once per week
   - 1-2 per week
   - 3-4 per week
   - 5-6 per week
   - Once a day
   - 1 or more per day

F. How many times a week do you eat your meal at night in front of the television (TV)?
   - Never
   - Less than once per week
   - 1-2 per week
   - 3-4 per week
   - 5-6 per week
   - Every day

G. How much time each day do you spend watching television?
   - 0-1 hour per day
   - 2-3 hours per day
   - 4-5 hours per day
   - 6 or more hours per day

H. How much time each day do you spend on the computer or playing video games?
   - 0-1 hour per day
   - 2-3 hours per day
   - 4-5 hours per day
   - 6 or more hours per day
Think about what you ate over the last 6 months when you answer these questions

GENERAL QUESTIONS (continued)

I. How much money do you usually spend each week on buying lunches, snacks and drinks (e.g. coffee)?
   - Less than $5 per week
   - $5-$15 per week
   - $15-$25 per week
   - $25-$35 per week
   - $35-$49 per week
   - $50 or more per week

J. How many times a day do you eat snacks?
   - Less than once per day
   - 1-2 per day
   - 3-4 per day
   - 5-6 per day
   - 7 or more per day

EXAMPLE QUESTION

Add up how many times a day you have a glass of milk, a tub of yoghurt or a slice of cheese

If you eat:
   - 2 slices of cheese on sandwich per day
   - 1 glass milk with Milo per day
   - 1 tub yoghurt per day
   4 times total for the day ... you would answer like this

   - Never
   - Less than 1 per month
   - 1 per week or less
   - 2-6 per week
   - 1 per day
   - 2-3 per day
   - 4-6 per day
   - 7 or more per day

K. Add up how many times a day you have a glass of milk, a tub of yoghurt or a slice of cheese
   - Never
   - Less than 1 per month
   - 1 per week or less
   - 2-6 per week
   - 1 per day
   - 2-3 per day
   - 4-6 per day
   - 7 or more per day

L. Add up how many glasses of softdrink or cordial you have each day? (all types)
   - Less than 1 per day
   - 1 per day
   - 2-3 per day
   - 4-6 per day
   - 7 or more per day

EXAMPLE QUESTION

How often do you eat the following foods:

If you drink:
   - One can of diet softdrink 2-3 times per week
Then your answer should look like this

Diet softdrink (1 can or glass)
   - Never
   - 1-3 per month
   - 1 per week
   - 2-6 per week
   - 1 per day
   - 2 or more per day
Think about what you ate over the last 6 months when you answer these questions

**DRINKS**

**Fill in one oval for each food item**

| D1 | DIET softdrink  
|    | eg. Diet coke  
|    | (1 can or glass)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D2 | Softdrink (NOT DIET) including flavoured mineral water  
|    | eg. lemonade, coke, tanta, flavoured mineral water  
|    | (1 can or glass)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D3 | Water – including bottled water, unflavoured mineral water, tap water  
|    | (1 glass)  
|     | ○ Never  
|     | ○ Less than 1 per day  
|     | ○ 1-3 glasses per day  
|     | ○ 4-6 glasses per day  
|     | ○ 7 or more glasses per day  

| D4 | Fruit juice-based drinks  
|    | eg. orange juice or Popper  
|    | (1 serving)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D5 | Cordial or ‘make up’  
|    | eg. Cottie’s crush, raspberry  
|    | (1 glass)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D6 | Tea or Coffee  
|    | (1 cup or mug)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D7 | Beer  
|    | (1 can, bottle or glass)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D8 | Wine or wine coolers  
|    | eg. West Coast cooler  
|    | (1 can, bottle or glass)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

| D9 | Spirits eg. vodka, bourbon  
|    | (1 drink or shot)  
|     | ○ Never  
|     | ○ Less than 1 per month  
|     | ○ 1-3 per month  
|     | ○ 1 per week  
|     | ○ 2-6 per week  
|     | ○ 1 per day  
|     | ○ 2 or more per day  

**EXAMPLE QUESTION**

If you eat:
- 1 glass plain milk with cereal per day
- 2 glasses milk with Milo per day
3 glasses total for the day ... you would answer like this

- 2-3 glasses per day
- 4 or more glasses per day

- Milk – glass or with cereal  
| (1 glass)  
| ○ Never  
| ○ Less than 1 per month  
| ○ 1 glass per week or less  
| ○ 2-6 glasses per week  
| ○ 1 glass per day  
| ○ 2-3 glasses per day  
| ○ 4 or more glasses per day
**Think about what you ate over the last 6 months when you answer these questions**

**BREADS AND CEREALS**

**Fill in one oval for each food item**

**B1** Muesli
(1 bowl)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5-7 per week
- 2 or more per day

**B2** Cooked porridge
(1 bowl)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5-7 per week
- 2 or more per day

**B3** Breakfast cereal
eg. Weet-bix, Nutri-grain,
Cornflakes Sultana Bran
(1 bowl)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 times per week
- 5-7 times per week
- 2 or more times per day

**B4** What type of bread do you usually eat?
- Brown (multigrain, wholemeal)
- White
- Other
- Not sure

**B5** Bread, pita bread, roll or toast
all types
(1 slice)
- Never
- Less than 1 per month
- 1 per week or less
- 2-4 per week
- 5-7 per week
- 2-3 per day
- 4 or more per day

**B6** English muffin, bagel or crumpet
(1)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**B7** Rice
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**B8** Other grains
eg. cous cous, bulghul
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**B9** Noodles
eg. egg noodles (yellow),
rice noodles (white)
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**B10** Pasta
eg. spaghetti, lasagne, pasta bake
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week
Think about what you ate over the last 6 months when you answer these questions

SWEETS AND SNACKS

Fill in one oval for each food item

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Cakes, sweet muffins, scones, pikelets, pancakes, hot cakes eg. apple muffin, chocolate cake, lamington (1 serving)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>Less than 1 per month</td>
</tr>
<tr>
<td></td>
<td>Once per week</td>
<td>2-4 per week</td>
</tr>
</tbody>
</table>

| S2 | Sweet pies or sweet pastries eg. apple pie, danish (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S3 | Other puddings or desserts (not ice cream) eg. chocolate mousse, sticky date pudding (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S4 | Plain sweet biscuits eg. Arrowroot, Morning Coffee, Tiny Teddies (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S5 | Cream or chocolate biscuits eg. Tim Tams, shortbread cream (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S6 | Dry or savoury biscuits, crisps, bread, crackers eg. Saos, Vita Weats, Jatz, Shapes, rice crackers, Cruskits (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S7 | Savoury combination snacks – biscuits and cheese eg. Le Snak, Snack abouts (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S8 | Sweet combination snacks eg. Dunkaroos (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S9 | Snack noodles eg. 2-minute noodles, Monster noodles (1 serving) |   |
|   | Never | Less than 1 per month | 1-3 per month |
|   | Once per week | 2-4 per week | 5 or more per week |

| S10 | Fruit bars eg. Roll Ups (1 bar) |   |
|     | Never | Less than 1 per month | 1-3 per month |
|     | Once per week | 2-4 per week | 5-6 per week |

| S11 | Snack bars eg. K-time twist bar (1 bar) |   |
|     | Never | Less than 1 per month | 1-3 per month |
|     | Once per week | 2-4 per week | 5-6 per week |

| S12 | Muesli bars eg. Yoghurt Tops (1 bar) |   |
|     | Never | Less than 1 per month | 1-3 per month |
|     | Once per week | 2-4 per week | 5-6 per week |
**MAIN MEALS**

**Think about what you ate over the last 6 months when you answer these questions**

Fill in one oval for each food item

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Mince dish eg. spaghetti bolognese, rissoles, shepherd's pie, lasagne (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M2</td>
<td>Beef or lamb pieces and sauce WITHOUT vegetables eg. beef stroganoff (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M3</td>
<td>Beef or lamb pieces and sauce WITH vegetables eg. stir fry (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M4</td>
<td>Plain meat (beef or lamb) (eg. roast, chops, steak) WITHOUT vegetables or salad (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M5</td>
<td>Plain meat (beef or lamb) (eg. roast, chops, steak) WITH vegetables or salad (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M6</td>
<td>Chicken pieces and sauce WITHOUT vegetables eg. satay chicken (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M7</td>
<td>Chicken pieces and sauce WITH vegetables eg. stir fry (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M8</td>
<td>Chicken crumbed eg. chicken nuggets, KFC pieces, schnitzel (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 times per week, 5 or more times per week</td>
</tr>
<tr>
<td>M9</td>
<td>Plain chicken (eg. roast or BBQ) WITHOUT vegetables (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M10</td>
<td>Plain chicken (eg. roast or BBQ) WITH vegetables (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M11</td>
<td>Pork pieces and sauce WITHOUT vegetables eg. sweet and sour pork (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>M12</td>
<td>Pork pieces and sauce WITH vegetables eg. stir fry (1 serving)</td>
<td>Never, less than 1 per month, 1-3 per month, once per week, 2-4 per week, 5 or more per week</td>
</tr>
</tbody>
</table>
### MAIN MEALS (continued)

#### M13 Plain pork
(eg. roast or chops)
**WITHOUT vegetables**
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M14 Plain pork
(eg. roast or chops)
**WITH vegetables**
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M15 Liver – beef, calf, chicken
(Including paté)
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M16 Fish crumbed or battered
eg. fish & chips, fish fingers
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M17 Fresh fish not crumbed or battered
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M18 Canned tuna, salmon, sardines
Including patties
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M19 Other seafood
eg. prawns, lobster
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M20 Creamy soup
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M21 Clear soup with rice or noodles
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M22 Tacos, burritos, enchiladas
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M23 Sausages, frankfurts, Pluto Pup
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

#### M24 Hamburger – all types
*(1 serving)*
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week
**MAIN MEALS**

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<table>
<thead>
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<tbody>
<tr>
<td>M25</td>
<td>Pizza</td>
<td>(1 serving)</td>
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<tr>
<td>M26</td>
<td>Pie, sausage roll, chiko roll</td>
<td>(1 serving)</td>
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</tr>
<tr>
<td>M27</td>
<td>Hot dog</td>
<td>(1 serving)</td>
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**OTHER FOODS**

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</thead>
<tbody>
<tr>
<td>O1</td>
<td>Chips (not potato) eg. Twisties, corn chips, burger rings</td>
<td>(1 packet)</td>
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<tr>
<td>O2</td>
<td>Potato chips or crisps eg. plain, salt and vinegar</td>
<td>(1 packet)</td>
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<tr>
<td>O3</td>
<td>Ice block - creamy eg. Paddle Pop, Magnum, Cornetto</td>
<td>(1 ice block)</td>
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<tr>
<td>O4</td>
<td>Ice block – water eg. Frosty Fruti, lemonade</td>
<td>(1 ice block)</td>
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<tr>
<td>O5</td>
<td>Chocolate eg. plain chocolate, Mars Bar, Snickers, Milky Way</td>
<td>(1 serving)</td>
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<tr>
<td>O6</td>
<td>Lollies without chocolate eg. lollipops, snakes, Skittles, Starburst</td>
<td>(1 serving)</td>
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</tbody>
</table>
Think about what you ate over the last 6 months when you answer these questions

OTHER FOODS (continued)

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low fat salad dressing or mayonnaise</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Salad dressing or mayonnaise – not low fat</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Nuts</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Jam, honey, golden syrup, marmalade</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 times per week, 5-6 times per week, Once per day, 2 or more times per day</td>
</tr>
<tr>
<td>Peanut butter, Nutella</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 times per week, 5-6 times per week, Once per day, 2 or more times per day</td>
</tr>
<tr>
<td>Vegemite, Mighty Mite, Promite, Marmite</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 times per week, 5-6 times per week, Once per day, 2 or more times per day</td>
</tr>
<tr>
<td>Tomato sauce, barbecue sauce</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Devon, salami</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Bacon, ham</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Eggs eg. boiled, scrambled</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
<tr>
<td>Jelly</td>
<td>Never, Less than 1 per month, 1-3 per month, Once per week, 2-4 per week, 5 or more per week</td>
</tr>
</tbody>
</table>

You have nearly finished.

Only “FRUIT AND VEGETABLES” to go!
### FRUIT AND VEGETABLES

#### Fill in one oval for each food item

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Description</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 Hot chips bought from a shop</td>
<td>eg. McDonald’s fries</td>
<td>Never</td>
</tr>
<tr>
<td>F2 Hot chips cooked at home</td>
<td>eg. oven fries, wedges</td>
<td>Never</td>
</tr>
<tr>
<td>F3 Potato</td>
<td>boiled, mashed, baked</td>
<td>Never</td>
</tr>
<tr>
<td>F4 Pumpkin</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F5 Sweet potato</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F6 Cauliflower</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F7 Green beans</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F8 Spinach</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F9 Cabbage or brussel sprouts</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F10 Peas</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F11 Broccoli</td>
<td>1 serving</td>
<td>Never</td>
</tr>
<tr>
<td>F12 Carrots</td>
<td>1 serving</td>
<td>Never</td>
</tr>
</tbody>
</table>
Think about what you ate over the last 6 months when you answer these questions

FRUIT AND VEGETABLES (continued)  Fill in one oval for each food item

<table>
<thead>
<tr>
<th></th>
<th>Zucchini, eggplant, squash (1 serving)</th>
<th>Capsicum (1 serving)</th>
<th>Corn, sweetcorn, corn on the cob (1 serving)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Never</td>
<td>Never</td>
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<tr>
<td></td>
<td>Less than 1 per month</td>
<td>Less than 1 per month</td>
<td>Less than 1 per month</td>
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<td>1-3 per month</td>
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<td>Once per week</td>
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<td>2-4 per week</td>
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<td>5 or more per week</td>
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<table>
<thead>
<tr>
<th></th>
<th>Mushrooms (1 serving)</th>
<th>Tomatoes (1 serving)</th>
<th>Lettuce (1 serving)</th>
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<tbody>
<tr>
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<td>Never</td>
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<td>Less than 1 per month</td>
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<td>5 or more per week</td>
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<thead>
<tr>
<th></th>
<th>Celery, cucumber (1 serving)</th>
<th>Avocado (1 serving)</th>
<th>Onion, spring onion, leek (1 serving)</th>
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<tbody>
<tr>
<td></td>
<td>Never</td>
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<td>Less than 1 per month</td>
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<td>1-3 per month</td>
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<td>5 or more per week</td>
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<table>
<thead>
<tr>
<th></th>
<th>Soybeans, tofu (1 serving)</th>
<th>Baked beans (1 serving)</th>
<th>Other beans, lentils (1 serving)</th>
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<tbody>
<tr>
<td></td>
<td>Never</td>
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<td>Less than 1 per month</td>
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<td>5 or more per week</td>
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Think about what you ate over the last 6 months when you answer these questions

### FRUIT AND VEGETABLES (continued)

**F25** Canned fruit
e.g. peaches, Two fruits
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**F26** Fruit salad
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**F27** Dried fruit
e.g. sultanas, dried apricots
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**F28** Apple or pear
(1 serving)
- Never
- Less than 1 per month
- 1-3 times per month
- Once per week
- 2-4 times per week
- 5-6 times per week
- Once per day
- 2 or more times per day

**F29** Orange, mandarin, grapefruit
(1 serving)
- Never
- Less than 1 per month
- 1-3 times per month
- Once per week
- 2-4 times per week
- 5-6 times per week
- Once per day
- 2 or more times per day

**F30** Banana
(1 serving)
- Never
- Less than 1 per month
- 1-3 times per month
- Once per week
- 2-4 times per week
- 5-6 times per week
- Once per day
- 2 or more times per day

### WHEN THE FOLLOWING FRUIT IS IN SEASON, HOW OFTEN DO YOU USUALLY EAT IT?

**FS1** Peach, nectarine, plum or apricot
(1)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**FS2** Mango or paw-paw
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**FS3** Pineapple
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**FS4** Grapes, strawberries, blueberries
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week

**FS5** Melon
e.g. watermelon, rockmelon, honeysuckle melon
(1 serving)
- Never
- Less than 1 per month
- 1-3 per month
- Once per week
- 2-4 per week
- 5 or more per week
Think about what you ate over the last 6 months when you answer these questions

Please list any foods that you regularly eat that you have not been asked about:

You have finished. Thank you!
Appendix eight: Bouncing Back to you Pre-baby Body study – 24 hour recall
Bouncing Back to your Pre-Baby Body Study

24 Hour Recall – Script

“Hi. This is __________ from the Bouncing Back to your Pre-Baby Body study at the John Hunter Hospital. At your appointment ___ days ago, I mentioned that I would be giving you a call about the foods you have eaten in the last 24 hours. Do you have about 15 to 30 minutes so I can perform this recall?

I need to know all of the foods and beverages that you have eaten including brands and amounts if possible. This needs to be as accurate as possible and I am interested in the types of foods and beverages rather than the quality of your diet. Remember there are no good or bad foods – no one eats just the right foods all the time.

So what was the first thing you ate yesterday?”
<table>
<thead>
<tr>
<th>MEAL</th>
<th>TIME</th>
<th>FOOD / DRINK</th>
<th>QUANTITY</th>
<th>DETAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
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<td>Snack</td>
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<td>Lunch</td>
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Vitamin/Mineral/Herbal Supplement(s):__________________________
Physical Activity:___________________________________________
Water:______________________________________________________
Appendix nine: Bouncing Back to you Pre-baby Body study – Infant

Feeding Recall
## Bouncing Back to your Pre-baby body

**Infant Feeding Recall – 3 Months**

### Breastfeeding

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Has your child ever been breastfed (this includes expressed breast milk)?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q2. Is your child currently being breastfed?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q3. Was your child breastfed when they first came home from hospital?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

*Only answer Q4 if you are no longer breastfeeding your child*

<table>
<thead>
<tr>
<th>Q4. Including time of introducing solids, what is the total time your child was breastfed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days / Weeks / Months</td>
</tr>
</tbody>
</table>

### Infant Formula

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5. Has your child ever been given infant formula regularly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q6. At what age was your child first given infant formula regularly?</td>
<td>Days / Weeks / Months</td>
<td></td>
</tr>
</tbody>
</table>

### Cow’s Milk

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q7. Has your child ever been given cow’s milk regularly?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q8. At what age was your child first given cow’s milk regularly?</td>
<td>Days / Weeks / Months</td>
<td></td>
</tr>
</tbody>
</table>

### Other Milk Substitutes

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q9. Apart from breastmilk/infant formula/cow’s milk has your child ever been given any (other) type of milk substitute on a regular basis?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q10. What type of milk substitutes did your child have?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11. At what age was your child first given (this/these) milk substitutes regularly?</td>
<td>Days / Weeks / Months</td>
<td></td>
</tr>
</tbody>
</table>

### Solids

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q12. Has your child ever been given solid food?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Q13. At what age was your child first given solid food regularly?</td>
<td>Days / Weeks / Months</td>
<td></td>
</tr>
</tbody>
</table>
Appendix ten: Bouncing Back to you Pre-baby Body study – Current Feeding Practices
Bouncing Back to your Pre-baby body

Current Feeding Practices – 3 Months

1. How old the child is today? _______________  (Exact DOB: _______________)

2. Since this time yesterday, has your child been breastfed?  
   
   2 (i). If yes, was this your child’s main source of food?  
   
   Yes / No

3. Since this time yesterday, did your child receive any of the following?

   3 (i). If “Yes”, please provide details in the space provided.

<table>
<thead>
<tr>
<th></th>
<th>Yes / No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamins, mineral supplements</td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td></td>
</tr>
<tr>
<td>Plain water</td>
<td></td>
</tr>
<tr>
<td>Sweetened or flavoured water</td>
<td></td>
</tr>
<tr>
<td>Fruit juice</td>
<td></td>
</tr>
<tr>
<td>Tea or infusion</td>
<td></td>
</tr>
<tr>
<td>Infant formula</td>
<td></td>
</tr>
<tr>
<td>Tinned, powdered or fresh milk</td>
<td></td>
</tr>
<tr>
<td>Solid or semi-solid food</td>
<td></td>
</tr>
<tr>
<td>Oral Rehydration salts</td>
<td></td>
</tr>
<tr>
<td>Other (specify....)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix eleven: Bouncing Back to you Pre-baby Body study –

Pregnancy/Maternal Physical Activity Questionnaire
Pregnancy Physical Activity Questionnaire

1. Study No.: __________________________ (completed by research team)
2. Name: __________________________
3. Today’s Date: __________________________
4. Number of Weeks Pregnant: ______

Example: During this trimester, when you are NOT at work, how much time do you usually spend:

E1: Taking care of an older adult

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

If you take care of your mum for 2 hours a day your answer should look like this…”

It is very important you tell us about yourself honestly. There are no right or wrong answers. We just want to know about the things you are doing during the trimester.

During this trimester, when you are NOT at work, how much time do you usually spend:

4. Preparing meals (cook, set table, wash dishes)
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

5. Dressing, bathing, feeding children while you are sitting
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

6. Dressing, bathing, feeding children while you are standing
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

7. Playing with children while you are sitting or standing
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

8. Playing with children while you are walking or running
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

9. Carrying children
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day
10. Taking care of an older adult
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

11. Sitting and using a computer or writing while not at work
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

12. Watching TV or a video or DVD
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

13. Sitting and reading, talking, or on the phone, while not at work
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

14. Playing with pets
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

15. Light cleaning (make beds, laundry, ironing, putting things away)
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

16. Shopping (for food, clothes or other items)
- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

17. Heavier cleaning (vacuuming, mopping, sweeping, washing windows)
- None
- Less than ½ hour per week
- ½ to almost 1 hour per week
- 1 to almost 2 hours per week
- 2 to almost 3 hours per week
- 3 or more hours per week

18. Mowing the lawn while on a ride-on mower
- None
- Less than ½ hour per week
- ½ to almost 1 hour per week
- 1 to almost 2 hours per week
- 2 to almost 3 hours per week
- 3 or more hours per week

19. Mowing the lawn using a walking mower, raking, gardening
- None
- Less than ½ hour per week
- ½ to almost 1 hour per week
- 1 to almost 2 hours per week
- 2 to almost 3 hours per week
- 3 or more hours per week
During this trimester, when you are NOT at work, how much time do you usually spend:

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. Walking slowly to go places (such as to the bus, work, visiting)</td>
<td>- Not for fun or exercise</td>
</tr>
<tr>
<td>O None</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per day</td>
<td>O Less than ½ hour per day</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per day</td>
<td>O ½ to almost 1 hour per day</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per day</td>
<td>O 1 to almost 2 hours per day</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per day</td>
<td>O 2 to almost 3 hours per day</td>
</tr>
<tr>
<td>O 3 or more hours per day</td>
<td>O 3 or more hours per day</td>
</tr>
</tbody>
</table>

For Fun or Exercise...
During this trimester, when you are NOT at work, how much time do you usually spend:

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. Walking slowly for fun or exercise</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>24. Walking more quickly for fun or exercise</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. Walking quickly up hills for fun or exercise</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>26. Jogging</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>27. Antenatal exercise class</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>28. Swimming</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

Doing other things for fun or exercise? Please tell us what they are.

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.</td>
<td>O None</td>
</tr>
<tr>
<td>O Less than ½ hour per week</td>
<td>O Less than ½ hour per week</td>
</tr>
<tr>
<td>O ½ to almost 1 hour per week</td>
<td>O ½ to almost 1 hour per week</td>
</tr>
<tr>
<td>O 1 to almost 2 hours per week</td>
<td>O 1 to almost 2 hours per week</td>
</tr>
<tr>
<td>O 2 to almost 3 hours per week</td>
<td>O 2 to almost 3 hours per week</td>
</tr>
<tr>
<td>O 3 or more hours per week</td>
<td>O 3 or more hours per week</td>
</tr>
</tbody>
</table>
Please complete the next section if you work (paid or voluntary) or if you are a student. If you are a homemaker, out of work, or are unable to work, you do not need to complete this last section.

At Work...
During this trimester, how much time do you usually spend:

32. Sitting at work or in class
- O None
- O Less than ½ hour per day
- O ½ to almost 1 hour per day
- O 1 to almost 2 hours per day
- O 2 to almost 3 hours per day
- O 3 or more hours per day

33. Standing or slowly walking at work while carrying things (heavier than 3.5kg)
- O None
- O Less than ½ hour per day
- O ½ to almost 1 hour per day
- O 1 to almost 2 hours per day
- O 2 to almost 3 hours per day
- O 3 or more hours per day

34. Standing or slowly walking at work not carrying anything
- O None
- O Less than ½ hour per day
- O ½ to almost 1 hour per day
- O 1 to almost 2 hours per day
- O 2 to almost 3 hours per day
- O 3 or more hours per day

35. Walking quickly at work while carrying things (heavier than 3.5kg)
- O None
- O Less than ½ hour per day
- O ½ to almost 1 hour per day
- O 1 to almost 2 hours per day
- O 2 to almost 3 hours per day
- O 3 or more hours per day

36. Walking quickly at work not carrying anything
- O None
- O Less than ½ hour per day
- O ½ to almost 1 hour per day
- O 1 to almost 2 hours per day
- O 2 to almost 3 hours per day
- O 3 or more hours per day

Thank You!
Appendix twelve: Bouncing Back to you Pre-baby Body study – Medical and socio-demographic questionnaires
Bouncing Back to your Pre-baby body
Women’s Medical Data Collection Sheet

1. Have you ever been told by your doctor that you have:
   a) Gestational diabetes
   d) Heart disease
   e) Hypertension (high blood pressure) during pregnancy
   f) Hypertension (high blood pressure) other than during pregnancy
   g) Low iron (iron deficiency or anaemia)
   h) Asthma
   i) Postnatal depression
   j) Depression (not postnatal)
   k) Anxiety disorder

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
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<td>f)</td>
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<td>h)</td>
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<td>i)</td>
<td></td>
<td></td>
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<tr>
<td>j)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Are you currently taking any medications prescribed by your doctor? Yes No
   If Yes, please list including the dose you are taking and how often.

<table>
<thead>
<tr>
<th>Medication name:</th>
<th>Dose:</th>
<th>Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Are you currently taking any medications bought without a prescription at the chemist, supermarket, or health food shop? Yes No
   If Yes, please list including the dose you are taking and how often.

<table>
<thead>
<tr>
<th>Medication name:</th>
<th>Dose:</th>
<th>Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Do you smoke cigarettes or any other tobacco products? Yes No
   If Yes, please specify how many cigarettes you smoke on average per day
Bouncing Back to your Pre-baby body
Socioeconomic Data Collection Sheet

1. What is your current postcode? __________________________

2. What is the highest qualification you have completed? (tick [v] one answer only)
   - No formal qualifications
   - Year 10 or equivalent (e.g. School certificate)
   - Year 12 or equivalent (e.g. Higher School Certificate)
   - Trade/apprenticeship (e.g. Hairdresser, Chef)
   - Certificate/diploma (e.g. Child care, Technician)
   - University degree
   - Higher university degree (e.g. Grad Dip, Masters, PhD)

   Answers questions 3 and 4 by ticking (✓) the appropriate circle in the table below.

3. What is the average gross (before tax) income that YOU receive each week, including pensions, allowances, and financial support from parents?

4. What is the average gross (before tax) income that YOUR HOUSEHOLD (i.e. you and your partner) receive each week, including pensions, allowances, and financial support from parents?

<table>
<thead>
<tr>
<th>Income</th>
<th>SELF</th>
<th>HOUSEHOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1-$119 ($1-$6,239 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$120-$299 ($6,240-$15,999 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$300-$499 ($16,000-$25,999 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500-$699 ($26,000-$36,999 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$700-$999 ($37,000-$51,999 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1,000-$1,499 ($52,000-$77,999 annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1,500 or more ($78,000 or more annually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t want to answer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. How many people, including yourself, are dependent on this household income? _____

6. What is your FORMAL registered marital status?
   (i.e. never married, married, de facto [partner], separated, divorced, widowed)
Appendix thirteen: Bouncing Back to you Pre-baby Body study –
Weight related behaviours questionnaire
Weight-Related Behaviours in Pregnancy

1. MRN: ___________________________(completed by research team)

2. Today's Date: ___________________

3. Number of Weeks Pregnant: ______

Instructions:
Please answer all of the questions on each of the pages according to the scales provided. Circle the number that best represents how you feel. There are no right or wrong answers.

LOCUS OF CONTROL

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

4. Whether my weight changes is up to me.  
   1  2  3  4  5

5. If I eat right, and get enough exercise and rest, I can control my weight the way I want.  
   1  2  3  4  5

6. Being the right weight is mainly good luck.  
   1  2  3  4  5

7. No matter what I try to do, if I gain or lose weight, or stay the same, it is just going to happen.  
   1  2  3  4  5
## Self-Efficacy

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Sure</td>
<td>Sure</td>
<td>Neither Sure nor Unsure</td>
<td>Unsure</td>
<td>Very Unsure</td>
</tr>
</tbody>
</table>

How sure are you that you can:

8. Fit into your regular clothes eventually. | 1 | 2 | 3 | 4 | 5 |
9. Take off any extra weight you gain. | 1 | 2 | 3 | 4 | 5 |
10. Get back into shape. | 1 | 2 | 3 | 4 | 5 |
11. Eat balanced meals. | 1 | 2 | 3 | 4 | 5 |
12. Eat foods that are good for you and avoid foods that are not. | 1 | 2 | 3 | 4 | 5 |
13. Eat foods that are good for you even when family or social life takes a lot of your time. | 1 | 2 | 3 | 4 | 5 |
14. Get regular exercise. | 1 | 2 | 3 | 4 | 5 |
15. Get regular exercise even when family or social life takes a lot of your time. | 1 | 2 | 3 | 4 | 5 |
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. The weight I gain during pregnancy makes me feel ugly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. I worry that I may get fat during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. I am embarrassed at how big I’ve gotten during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. I’m embarrassed whenever the nurse weighs me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. I am trying to keep my weight down so I don’t look pregnant.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21. I would like to gain between 12.5 and 17.5 kilograms during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. I would gain 20 kilograms if it meant a healthier baby.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. I will feel badly if I gain more than 20 kilograms during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. I like being able to gain weight for a change.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. As long as I’m eating a well-balanced diet, I don’t care how much I gain during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. I’m sure I will be able to fully control the amount of weight I will gain during this pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>27. You can’t totally control the amount of weight you gain when you are pregnant.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>28. I feel that women have to be very careful about getting fat during pregnancy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
29. How satisfied are you with your current shape?

<table>
<thead>
<tr>
<th>Very satisfied</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>Very dissatisfied</th>
</tr>
</thead>
</table>

30. How satisfied are you with your current weight?

<table>
<thead>
<tr>
<th>Very satisfied</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>Very dissatisfied</th>
</tr>
</thead>
</table>

31. Do you consider your current weight to be...

<table>
<thead>
<tr>
<th>Too heavy</th>
<th>About right</th>
<th>Too light</th>
</tr>
</thead>
</table>

32. Do you consider your current body shape to be...

<table>
<thead>
<tr>
<th>Too heavy</th>
<th>About right</th>
<th>Too light</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measures of Feelings About Motherhood</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Strongly agree</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Agree</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Neither Agree nor Disagree</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Disagree</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Strongly Disagree</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>33. Having a baby brings a lot of stress into a woman’s life.</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34. I’m not sure how I will manage after I have the baby.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>35. I am afraid I will lose my identity after I have the baby.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>36. After a woman has a baby, she is mainly just somebody’s mother.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>37. I am sure that I will be a good mother.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>38. I felt proud when I found out I was going to have a baby.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>39. I felt scared when I found out I was going to become a mother.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
## CAREER ORIENTATION

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly agree</td>
<td>2</td>
<td>Agree</td>
</tr>
<tr>
<td>40. I want a job that will help me grow as a person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>41. Being able to express myself through a job means a great deal to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>42. I am determined to achieve my educational and work goals.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>43. Success in my work is very important to how I feel about myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>44. I see myself as working for pay my whole adult life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>45. The responsibilities for home and family should be equally shared when both partners work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>46. I need more in life than what being a wife and mother can give me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>47. Women who hope to be successful in a job must do so at the expense of home and family.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>48. Women should seek work that will fit in family needs in terms of work hours, leave time, etc.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>49. Women must make changes in their careers for family needs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>50. Women should not work full time when their children are young.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>51. Feeling loved and needed is more important to me than having a career.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>52. I would be very happy staying at home and not working at a job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Thank you for taking the time to complete this questionnaire.
Appendix fourteen: Bouncing Back to you Pre-baby Body study – Program evaluation
Bouncing Back to your Pre-baby body
Program Evaluation – 6 Months

We want to know what you thought of the TEMplate weight management program. We would be grateful if you could complete the following questions. Your response will help us improve the program for the future.

Please say how much you agree with the following statements and questions by circling the most appropriate response.

*Please be honest in your reply. All responses will be treated in confidence.*

---

**Section A: General**

1. The TEMplate program was easy to understand
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

2. The TEMplate program provided me with useful information about weight loss
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

3. Recording my dietary intake and physical activity in the “Tracking your progress form” was time consuming
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

4. I enjoyed using the TEMplate program
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

5. The dietician who explained the program was easy to understand
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

---

**Section B: Adherence to self-monitoring**

6. I now keep a record of what I eat
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

7. I now keep a record of my physical activity
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

8. I now set myself nutrition goals
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

9. I now set myself physical activity goals
   - 1 Strongly disagree
   - 2 Disagree
   - 3 Neutral
   - 4 Agree
   - 5 Strongly agree

10. I weigh myself regularly
    - 1 Strongly disagree
    - 2 Disagree
    - 3 Neutral
    - 4 Agree
    - 5 Strongly agree
Section C: Acceptability of the program

11. I am satisfied with the TEMplate program
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

12. I was provided with the TEMplate program:
   During pregnancy  At 3 months after the birth

13. I was happy to receive the program at this time?
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

14. The TEMplate program has been long enough so far
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

15. The TEMplate program helped me dispel myths about nutrition, physical activity and weight loss
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

16. I have enjoyed using the TEMplate program so far
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

17. I would prefer being in a program that provides face to face education
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

18. The TEMplate program was too time consuming
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

19. Being a mum with a new baby made it difficult to use the TEMplate program
   1 Strongly disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly agree

Section D: Barriers to using the program

20. Please indicate if any of the following were barriers to using the TEMplate program
   1 Time constraints  2 Not a priority  3 Too tired
   4 Too much effort  5 Lack of social support  6 I have achieved my goal weight
   7 Other
### Section E: Using the TEMplate program has encouraged me to:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>21. Be more active everyday</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>22. Join a gym, fitness centre, health club or sports team</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>23. Discuss my weight loss strategies with others</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>24. Monitor what I eat</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>25. Plan my meals each week</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>26. Cook healthier meals</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### Section F: Comments

27. Please describe which aspects of the TEMplate program were appealing

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

28. Please explain how the TEMplate program could be improved

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

29. Do you have any additional comments about the TEMplate program that might be useful for the researchers

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Bouncing Back to your Pre-baby body

Program Evaluation – 6 Months

The researchers from the Bouncing Back study seek your feedback regarding your satisfaction with the lactation consultant service provided. One of the aims for this survey is to determine whether your appointments with the lactation consultant assisted you to continue breastfeeding your baby. Your response will help us improve the program for the future.

Please say how much you agree with the following statements and questions by circling the most appropriate response.

The questions relate to your breastfeeding experience in the last 6 months. Please answer as honestly as you can. All responses will be treated in confidence.

<table>
<thead>
<tr>
<th>Section A: General</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. a. When you first started breastfeeding how long did/do you plan to breastfeed your baby? ___________ months</td>
</tr>
<tr>
<td>1. b. If you are still breastfeeding, how long are you planning to breastfeed your baby from now? ___________ months</td>
</tr>
<tr>
<td>2. I felt comfortable with the lactation consultant</td>
</tr>
<tr>
<td>3. The lactation consultant was well organised</td>
</tr>
<tr>
<td>4. The advice I was given was easy to understand</td>
</tr>
<tr>
<td>5. The lactation consultant was supportive, empathetic and approachable</td>
</tr>
<tr>
<td>6. I felt I was given the breastfeeding advice I needed</td>
</tr>
<tr>
<td>7. Please circle which aspects of the lactation consultation visits were MOST helpful</td>
</tr>
<tr>
<td>Face to face education during pregnancy</td>
</tr>
<tr>
<td>Section B: Breastfeeding problems</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>8. Please list any breastfeeding problems you have had (e.g. cracked nipples)</td>
</tr>
<tr>
<td>9. I discussed these problem/s (or any others) with the lactation consultant Y N</td>
</tr>
<tr>
<td>10. I found the lactation consultant understood my breastfeeding problem Y N</td>
</tr>
<tr>
<td>11. The lactation consultant addressed and provided information that related directly to my breastfeeding problem Y N</td>
</tr>
<tr>
<td>12. The written information provided by the lactation consultant was helpful</td>
</tr>
<tr>
<td>13. The advice and support provided by the lactation consultant enabled me to resolve my breastfeeding problem/s</td>
</tr>
<tr>
<td>14. I obtained additional help for breastfeeding support from other health professional/s? Y N</td>
</tr>
</tbody>
</table>

If you answered yes, please list the health professional and the advice you received
Section F: Comments

15. Please describe which aspects of the lactation consultant’s visit/education were appealing?

16. Please explain how the lactation consultant’s visit/education could be improved?

17. Do you have any additional comments?

Thank you! You have completed the survey.
Appendix fifteen: Bouncing Back to you Pre-baby Body study – Breastfeeding and obstetric history questionnaire
Bouncing Back to your Pre-baby body
Breastfeeding History Questionnaire

This questionnaire is very important to us. Please complete it during your study visit. If you don’t want to answer any questions, please just put a cross next to the question (like this, ✗ Q1.a.). Your information will remain private and confidential.

Q1. How many times have you had each of the following?

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Live birth (more than 37 weeks gestation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Live preterm birth (36 weeks or less gestation)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>c. Stillbirth</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>d. Miscarriage</td>
<td></td>
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<tr>
<td>e. Medical Termination</td>
<td></td>
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</tr>
<tr>
<td>f. Social Termination</td>
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<td></td>
</tr>
</tbody>
</table>

Q2.a. Please list the date of birth for each of your children (live and stillbirths). If you have twins, please write that date twice.

Q2.b. If any of your children were breastfed, please indicate how long they were breastfed for (in days, or months). If they were never breastfed please write 0.

Q2.c. Please list the current age of each of your living children.

<table>
<thead>
<tr>
<th>a. Child’s Date of Birth</th>
<th>b. Duration of Breastfeeding Days / Months</th>
<th>c. Child’s Age Today in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
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<td>4</td>
<td></td>
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<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MRN: ____________________________

Study ID: _________________________

Date: ____________________________

Q3.a. Outside the hospital environment, who provides you with support to breastfeed?

☐ Partner / Husband
☐ Mother
☐ Mother in law / partner’s mother
☐ Sisters and brothers
☐ Other family member: _____________
☐ Friends
☐ Other: _____________
☐ No one, only health professionals

Q.3.b. Were you breastfed as a baby?

☐ Yes
☐ No
☐ Not sure

Q.3.c. Do any of your friends breastfeed their babies?

☐ Yes
☐ No
☐ Not sure

Thank you – you have completed this questionnaire