

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF KINESIOLOGY

DIET AND EXERCISE STRATEGIES OF POST-PARTUM WOMEN INTENDING
TO LOSE OR MAINTAIN WEIGHT

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Spring 2011

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Science
with honors in Kinesiology

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ABSTRACT

Studies indicate that less than half of all women gain the amount of gestational weight recommended by the Institute of Medicine (IOM)²⁴. Therefore, many women retain significant weight and fat mass in the post-partum period. The main objective of this study was to report the types of weight loss strategies women are using from 6-12 months post-partum. We used data from the Fostering Optimal Growth Through Prevention and Intervention Strategies (FOOTPRINTS) longitudinal, observational study of mother-infant dyads to investigate this research question. Subjects consist of 37 mothers living in Centre County, Pennsylvania. Pregravid weight and gestational weight gain for each participant were self-reported. Air displacement plethysmography was used to measure weight and percent fat mass at 1, 6, 9, and 12 months post-partum. The French Survey was administered at 12 months post-partum to document the weight loss strategies used during the previous 6 months³⁴. The data from the French Survey was analyzed for trends in the frequency and prevalence in which women participated in healthy and unhealthy weight loss strategies. When participants were asked a single item question, “Are you currently dieting or exercising to lose weight?” the majority of women (75%) reported “No.” However, a little over half (56%) reported currently trying to maintain their weight. Of the 20 women who tried to lose weight from 6-12 months post-partum, 14 (70%) felt they succeeded. Only 4 (20%) of these women consider their weight loss “very successful”. The most prevalent weight loss strategies were eating more fruits and vegetables (56%), increasing exercise (44%), and eliminating sweets (44%). Unhealthy strategies were not readily practiced, the most

prevalent including skipping meals (17%) and fasting (9%). Dieting was always used in combination with exercise. Future research needs to be conducted to determine which strategies are the most effective at reducing both the weight and fat mass of post-partum women.

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ACKNOWLEDGEMENTS

First and foremost I would like to thank Dr. Cynthia Bartok, my thesis supervisor, for taking me under her wing and allowing me to work with her. Without her guidance, patience, and support, completion of this research project would not have been possible. I would also like to thank Dr. Jennifer Savage Williams. Her expertise and prowess in field of statistics was indispensable in interpreting the data. Furthermore, I could not have completed this research without Darcy Gungor, who taught me how to manage the research data and was always willing to help me when I ran into obstacles.

I would like to extend my gratitude to my thesis readers, Dr. Cynthia Bartok, Dr. Jennifer Savage Williams, and Dr. Stephen Piazza, for their comments and support throughout the writing process of this thesis. Finally, I would like to thank everyone who contributed to the FOOTPRINTS research project. Without the FOOTPRINTS project, I would not have had the opportunity or the pleasure conducting research on post-partum weight retention. I thank all of you.

Chapter 1

Literature Review

Despite the myriad of global initiatives established to help people lose weight, obesity is still a worldwide epidemic. Some estimates indicate that as many as 250 million people, or 7% of the human population, are obese²⁷. Furthermore, the prevalence of people who are classified as overweight may be 2-3 times greater than that of obesity. To make matters worse, the prevalence of obesity is increasing in most parts of the world, even in locations where obesity has historically been rare. However, the highest rates of obesity are in wealthy nations like the United States. An article published in 2010 revealed that over one-third (33.8%) of U.S. adults are obese and over two-thirds (68%) are overweight or obese¹.

Obesity substantially increases the risk of developing comorbid conditions such as coronary heart disease, hypertension, stroke, cardiovascular disease, and diabetes mellitus¹³⁻¹⁷. Other implications of obesity include increased rates of hypertriglyceridemia and low levels of high-density lipoprotein (HDL) cholesterol. Additionally, obese men and women have an increased risk of colorectal cancer and endometrial cancer, respectively. Postmenopausal breast cancer and kidney cancer is associated with obesity as well. Furthermore, more severe cases of obesity can lead to sleep apnea, hypoxia and hypercapnia, gout, gallbladder disease, and degenerative joint disease²⁹⁻³¹.

The high prevalence of obesity coupled with related comorbidities generates tremendous medical expenditures. Finkelstein *et al.* calculated that U.S. medical costs associated with obesity totaled approximately \$92.6 billion in 2002². Such expenditures accounts for approximately 10% of the overall annual medical costs, which incurs a substantial strain on the United States health care system. Additionally, the annual medical expenditure of an obese adult under the age of 65 is approximately \$395 (36%) higher than that of a person of normal weight². The adverse health effects and economic costs associated with obesity are second only to smoking¹⁸.

A major contributory factor of obesity in women is childbearing³⁻⁶. Specifically, many women gain too much weight during pregnancy. The amount of weight a woman should gain during pregnancy has been a subject of contention over the last several decades¹¹. Although many reports have been published on the topic since the early 1970's, a consensus was not reached until the Institute of Medicine (IOM) released a report in 1990 in an attempt to standardize recommendations for gestational weight gain. Three of the main objectives of the report included¹¹:

- To determine how nutritional status prior to pregnancy and dietary intake during gestation influence the pattern of total amount of weight gain.
- To determine which, if any, anthropometric measurements are useful in assessing nutritional status during pregnancy.
- To determine how weight gain recommendations should be modified for pregnant women of black, Hispanic, and Southeast Asian origin and for those under age 20 or over age 35.

It is important to recognize that the focus of this report was how gestational weight gain affects the welfare of the infant rather than the mother. These standards can be seen in

Table 1-1.

Table 1-1 The BMI standards established by the IOM in 1990.

Weight Classification	Pre-pregnancy BMI (weight/height²)	Recommended Weight Gain (kg)	Recommended Weight Gain (lb)
Underweight	<19.8	12.5-18	28-40
Normal Weight	19.8-26.0	11.5-16	25-35
Overweight	26.1-29.0	7-11.5	15-25
Obese	>29.0	at least 6.8	at least 15

Since 1990, changes in the health and disease patterns of women of childbearing age have prompted reconsideration of these guidelines. Women are having children at an older age, resulting in an increased prevalence of pregnant women with chronic diseases such as hypertension or diabetes²⁴. These conditions ultimately put women at greater risk for pregnancy complications. Also, pre-pregnancy BMI and gestational weight gain has increased in all population subgroups²⁴. Finally, high rates of overweight and obesity are prevalent in subpopulations that are at high risk for negative maternal and child health outcomes. Therefore, the IOM was charged with re-examining the guidelines that considered the short-term and long-term health of both the mother and the child²⁴.

Specifically, the IOM was asked to:

- Determine the relationships between weight gain patterns before, during, and after pregnancy, and maternal and child health outcomes

- Determine factors within a life-stage framework associated with outcomes such as lactation performance, post-partum weight retention, and chronic diseases such as cardiovascular disease
- Recommend revisions to the existing guidelines

These new objectives prioritized not only the health of the developing fetus, but the mother as well. The revised IOM guidelines for gestational weight gain are shown in **Table 1-2**.

Table 1-2 The 2009 IOM guidelines for gestational weight gain based on pre-pregnancy BMI.

New 2009 IOM Guidelines for Gestational Weight Gain			
Weight Class	Pre-pregnancy BMI (weight/height²)	Recommended Weight Gain (kg)	Recommended Weight Gain (lb)
Underweight	<18.5	12.5-18	28-40
Normal weight	18.5-24.9	11.5-16	25-35
Overweight	25.0-29.9	7-11.5	15-25
Obese	≥30.0	5-9	11-20

Overweight and obese pregravid women are much more likely to gain too much weight during pregnancy as compared to normal weight women. In 2002-2003, only about a quarter of overweight women gained the recommended amount of weight during pregnancy. Obese women also showed gestational weight gains outside of the range recommended by the IOM (1990). By 2003, only a third of obese women met the IOM guidelines for gestational weight gain. Overall, studies indicate that less than half of all women gain the amount of weight recommended by the IOM²⁴.

Women who gain above the IOM recommendation for gestational weight tend to retain their excess weight¹⁰. Parker and Abrams used data from the 1988 National

Maternal and Infant Health Survey (NMIHS) to determine the factors of post-partum weight retention, including gestational weight gain (GWG)¹². They discovered that excessive GWG lead to a 2-fold increase in the risk of retaining weight. Furthermore, significant research has been conducted on two different data sets, one collected from the Pregnancy Nutrition Surveillance System (PNSS), and the other from the Infant feeding Practices Study II (IFPS II)²⁴. The PNSS provided information on 49,000 women regarding their gestational weight gain and post-partum weight retention. Six months after delivery, the average weight retention was 15.3 pounds. Approximately half of the women retained more than 10 pounds. A quarter of the women retained more than 20 pounds. Importantly, more than 60% of women who exceeded the weight recommended by the IOM retained more than 10 pounds. Finally, more than 40% of women who gained an excessive amount of weight retained more than 20 pounds. After about a year, 24% of the 4,000 women retained more than 10 pounds and 12% retained more than 20 pounds. The important finding from these two studies is that mean weight retention increased with increased gestational weight gain in every category of women. These results suggest a very strong link between post-partum weight retention and excessive gestational weight gain.

Gestational weight gain is composed of a variety of tissues and fluids.

Throughout a pregnancy, protein, fat, water, and minerals are deposited in the fetus, placenta, amniotic fluid, uterus, mammary glands, blood, and adipose tissue. Each of these components contributes to gestational weight gain, as can be seen in **Figure 1-1**⁷.

Figure 1-1

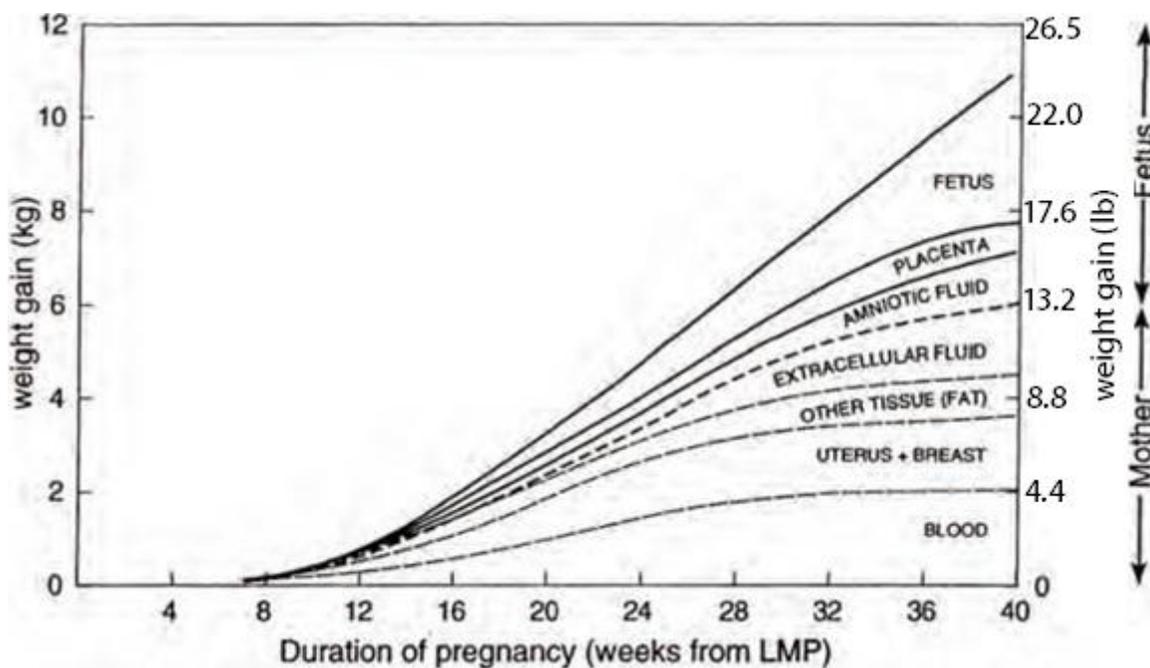


Figure 1-1 Components of gestational weight gain and their change in mass throughout pregnancy.⁷

Figure 1-1 illustrates the major components of gestational weight gain for a singleton pregnancy when the mother gains approximately 25 lb. The majority of gestational weight gain consists of increased maternal tissues and fluids, as opposed to tissues and fluids associated with the developing fetus. Importantly, maternal adipose tissue constitutes only a small proportion of gestational weight gain.

The excess gestational weight gain that contributes to post-partum weight retention is largely fat mass. Lederman *et al.* conducted a study in which 200 healthy women between 14 and 37 weeks of gestation were studied to determine the effect of pregravid BMI and gestational weight gain on fat mass²⁵. They found that fat accretion

paralleled gestational weight gain. Underweight women accumulated the most fat mass (in kg) while obese women accumulated the least fat mass. These results were consistent regardless of how much weight women gained. Furthermore, obese women who gained within the IOM guidelines accumulated a negligible amount of fat mass. The main components of their weight gain were mostly fluid and non-fat soft tissue. Therefore, Lederman *et al.* concluded that women who gain weight within the IOM guidelines do not retain excess fat. Another study conducted by Butte *et al.* measured fat mass, fat free mass, total body potassium (TBK), total body water (TBW), body volume, and bone mineral content in 63 women 2, 6, and 27 weeks after delivery²⁶. Gains in TBW, TBK, protein, and fat free mass did not differ among the 3 different BMI groups. Gains in fat mass were increased in the high BMI group, paralleling the groups high weight gain; all other components of gestation remained relatively constant across the different BMI groups. Additionally, post-partum weight retention is positively correlated with gestational weight gain and fat mass gain, but not TBW, TBK, or fat free mass gain. At 27 weeks post-partum, fat mass retention was higher in those who gained more weight than recommended by the IOM (2009) compared to those who gained within the IOM guidelines.

Increasing the fat mass of the mother does not contribute to increased birth weight of the baby. Lederman *et al.* found that birth weight positively correlated with gains in maternal weight and fat free mass, but not fat mass²⁵. Similarly, Butte *et al.* observed a positive correlation among gains in weight, TBW, TBK, protein, and fat free mass, but not fat free mass. These findings are significant because they indicate that maternal gains

in fat mass do not contribute to the development of a healthier baby. Therefore, women can minimize their gains in fat mass without negatively influencing the health of the fetus.

Although dieting post-partum has been shown to decrease the risk of post-partum weight retention, exercising after pregnancy is also a viable strategy for women to lose excess weight gained during their gestation period. Some studies have been published that support exercise as an effective intervention strategy for preventing women from maintaining this weight. In the Stockholm Pregnancy and Weight Development Study, Ohlin and Rossner assessed the diet and exercise patterns of 1423 Swedish women from pre-pregnancy until 1 year post-partum. They found that the more exercise reported by women post-partum, the less weight they retained⁸. A more recent study by Sampsel *et al.* determined that women who were physically active (vigorous exercise with a frequency of 3 times per week) between delivery and 6 weeks post-partum retained significantly less weight²¹. On average, the more active women retained only 3.9 kg (8.6 lb) while their less active counterparts retained 5.1 kg (11.3 lb).

Diet and exercise are effective methods for reducing not only post-partum weight, but also excess fat mass accumulated during the gestation period. Although research concerning the effects of diet and exercise on body composition during the post-partum period is scant, some studies demonstrate the utility of these strategies. O'Toole *et al.* published an intervention study in which 12 out of the 13 women who participated in the structured diet and exercise program lost a significant amount of body fat³². Subjects reduced their fat mass at an average of 1 pound per week for 12 weeks. Another study by

Lovelady *et al.* demonstrated the efficacy of diet and exercise in reducing both weight and fat mass of post-partum women³³. In this intervention study, 21 mothers were assigned to a diet and exercise group and 19 mothers were assigned to a control group. The diet and exercise group restricted their diet by 500 kcal per day and exercised for 45 minutes for 4 days per week while the control group did not restrict their diet and did not exercise more than once a week. The diet and exercise group lost between 1.7 and 8.3 kg (mean loss of 4.8 kg). On the other hand, the weights of the women in the control group varied between a gain of 4.6 kg and a loss of 4.6 kg (mean loss of 0.8 kg). The weight lost in both groups was mostly fat mass. The results from these two studies demonstrate the significant effects of diet and exercise on reducing both weight and fat mass in post-partum women.

In summary, obesity continues to plague society today. It causes a multitude of illnesses and costs billions of dollars in medical expenses. Pregnant women are especially at risk for developing obesity because most women exceed the IOM guidelines for gestational weight gain. Consequently, women retain the excess weight post-partum. One of the most significant aspects regarding excess gestational weight gain is that it consists of fat mass, not fat free mass. This excess fat mass is not associated with increased gains in birth weight. Women who regularly diet and exercise can reduce not only excesses post-partum weight, but retained fat mass. Little is known about effective weight loss strategies for post-partum women. The main objective of this study is to report the types and prevalence of weight loss strategies women are using from 6-12 months post-partum.

The data originate from the Fostering Optimal Growth Through Prevention and Intervention Strategies (FOOTPRINTS) study, a longitudinal study of mothers and babies followed from birth until 24 months post-delivery. We will evaluate the percentage of mothers using key weight loss and weight maintenance strategies during 6-12 months post-partum. These results could inform future research studies that seek to design safe and effective weight management interventions for post-partum women. Specifically, we suggest that researchers conduct a longitudinal intervention study with a larger sample size. Gestational weight gain, post-partum weight retention, body composition (fat mass/fat free mass), and diet and exercise patterns should be recorded.

Chapter 2

Manuscript

DIET AND EXERCISE STRATEGIES OF POST-PARTUM WOMEN INTENDING
TO LOSE OR MAINTAIN WEIGHT

NICHOLAS J. JULIUS, JENNIFER SAVAGE, CYNTHIA BARTOK

Abstract

OBJECTIVES: The main objective of this study was to report the types of weight loss strategies women are using from 6-12 months post-partum.

Design: We used data from the Fostering Optimal Growth Through Prevention and Intervention Strategies (FOOTPRINTS) longitudinal, observational study of mother-infant dyads to investigate this research question.

Subjects: Thirty-seven mothers living in Centre County, Pennsylvania.

MEASUREMENTS: Pregravid weight and gestational weight gain for each participant were self-reported. Weight and percent fat mass were measured at 1, 6, 9, and 12 months post-partum. The French Survey was administered at 12 months post-partum to document the weight loss strategies used during the previous 6 months³⁴.

ANALYSIS: The data from the French Survey was analyzed for trends in the frequency and prevalence in which women participated in healthy and unhealthy weight loss strategies.

RESULTS: Most women (86%) were actively engaging in weight loss strategies from 6-12 months post-partum. However, after 1 year post-partum, the number of women currently trying to lose weight was only 25% and a little over half (56%) were currently trying to maintain their weight. Of the 20 women that tried to lose weight from 6 months to 12 months post-partum, 70% (n=14) of them felt they succeeded. However, only 20% (n=4) of these women consider their weight loss “very successful”. The most prevalent weight loss strategies were eating more fruits and vegetables (56%), increasing exercise (44%), and eliminating sweets (44%). Unhealthy strategies were not readily practiced,

with the most prevalent of these strategies including skipping meals (17%) and fasting (9%). Dieting was always used in combination with exercise.

CONCLUSION: From 6-12 months post-partum, most women are actively trying to maintain or lose weight; with the majority of these women exclusively using healthful strategies to do so. Future research needs to be conducted to determine which strategies are the most effective at reducing both the weight and fat mass of post-partum women.

Introduction

A major factor contributing to obesity is childbearing³⁻⁶. Specifically, many women gain too much weight during pregnancy and then retain that weight. In 2009, the Institute of Medicine (IOM) published guidelines for how much weight women should gain in order to produce a healthy baby while limiting the post-partum weight retention of the mother²⁴. Research consistently demonstrates that women who gain beyond the guidelines recommended by the IOM (2009) are more likely to retain excess weight^{10, 12}. This excess weight can lead to the development of comorbid conditions, including coronary heart disease, hypertension, stroke, cardiovascular disease, and diabetes mellitus¹³⁻¹⁷. Additionally, many post-partum women simply wish to return to their pre-pregnancy weight and figure⁹.

Little is known about effective weight management strategies for post-partum women. We know diet and exercise are effective methods for decreasing both weight and fat mass in the post-partum period³³. We also know that moderate exercise without a specific calorie restriction does not promote significant weight or fat loss⁴⁵. However, the clinical significance of short-term calorie restriction is unknown⁴⁶. We also do not know whether exercise preserves lean-mass while restricting calorie or protein intake⁴⁶. Finally, we do not have exercise guidelines for post-partum women⁴⁶. Therefore, the objective of this study is to report the types of weight loss strategies women are using from 6-12 months post-partum. We will use surveys to examine the strategies in which post-partum women are engaging. Furthermore, women will report whether they are successful in managing their weight.

Methods/Materials

Study Design and Selection Criteria

This research was a secondary analysis of data from the longitudinal, observational Fostering Optimal Growth Through Prevention and Intervention Strategies (FOOTPRINTS) study. This larger longitudinal study included a convenient sample of 54 women from Centre County, Pennsylvania, that were recruited during pregnancy. The women were recruited via flyers and posters distributed throughout the community. In order to be considered for the FOOTPRINTS study, subjects had to be at least 18 years old, speak English, and live in or near the State College area. Women who satisfied these requirements were scheduled to meet 7 times over the next 6 months. Most visits consisted of baby measurements (weight, length, head circumference, body composition). Mothers' weight, height, and fat mass were measured during the 1 month and 6 month visits. Subjects were provided incentives to participate.

Fifty-one subjects from the original pool participated in the study of maternal weight retention until 1 year post-partum. Women reported to the laboratory at 9 and 12 months post-partum to be measured and to complete surveys.

Data Collection and Measurements

Pregravid weight and gestational weight gain for each participant was self-reported. Body composition and body weight was measured at 1, 6, 9, and 12 months post-partum using an air-displacement plethysmography device (Bod Pod, Life Measurement, Inc., Concord, CA). Height was measured at 1 month post-partum using a standard wall-mounted stadiometer (Seca 240 Stadiometer, Seca Corp., Hamburg, Germany). The weight and height measurements were used to calculate BMI (————) for each subject. The French Survey was used at visits 9 and 12 to collect data regarding each subject's exercise and diet patterns over the previous 6 months³⁴. The French survey consists of 2 components (see **Appendix A**). The first component consists of 24 items assessing the frequency in which subjects participate in specific weight loss strategies (examples include reducing Calories, eating less fat, and fasting). Items were measured on a 5-point response scale ranging from “never” to “always”. The second component consists of 3 single item questions regarding past and present diet and exercise practices. In the event that a mother was unable to attend a session, the survey was mailed to her with an enclosed return envelope.

Statistical Analyses

The weight loss strategies have been categorized as either “Healthy” or “Unhealthy” strategies, as defined by French *et al*³⁴. The “Healthy” strategies include: reducing caloric intake, eliminating snacks, increasing exercise, increasing fruit and veggie intake, decreasing fat intake, decreasing alcohol consumption, eliminating sweets, reducing the amount of food consumed, changing the types of foods eaten, eating less meat, eating less high-carbohydrate foods, and eating low-calorie foods. The “Unhealthy” weight loss strategies include: fasting, skipping meals, increasing cigarettes smoked, laxative use, diuretic use, appetite suppressant use, the use of diet pills, vomiting and liquid diets.

We considered women who selected “Sometimes” or more often to be actively participating in a given weight loss strategy (coded “Yes”), and women who selected “Rarely” or “Never” to be not participating in the given strategy (coded “No”). This allowed us to assess general trends in weight loss strategies. Items that were rare (ie. using laxatives or enemas to lose weight, attending weight loss groups, etc.) were coded a “Yes” if subjects selected “Rarely” or more often. The first reason we made this adjustment is because even if the “Unhealthy” weight loss strategies are practiced rarely, they are extreme behaviors that may impact the health and well-being of the mothers. Second, “Unhealthy” weight loss strategies are more likely to be underreported.

Results

At 12 months post-partum, complete data sets were available for 37 of the original 51 mothers. Women dropped out of the study for several reasons, including health complications, missed appointments, traveling out of the country, and subject termination resulting from noncompliance. The remaining subjects (n=37) were mostly white (94.6%), educated, middle to upper class mothers from or near State College, Pennsylvania. Subject characteristics at 12 months post-partum can be seen in **Table 2-1**. The average age and weight of our sample was 30.0 ± 6.3 years old and 65.8 ± 10.8 kg, respectively. The mean percent fat mass of the sample was $29.3 \pm 9.3\%$. All of the women were married at 12 months post-partum. Few subjects (n=4) had more than 2 children. Most women (52%) were either unemployed with no benefits or on paid leave with benefits.

The French Survey posed 3 single item questions. When participants were asked, “Are you currently dieting or exercising to lose weight?” the majority of women (75%) reported “No.” However, in response to another single item question, “Are you currently dieting or exercising to maintain weight?” a little over half (56%) reported “Yes.” The final question asked, “How successful were you in the past 6 months in losing weight?” Seventy percent (n=14) of women who were trying to lose weight from 6-12 months post-partum reported feeling like they had succeeded. However, only 20% (n=4) of these women considered their weight loss strategy “very successful”

Table 2-2 shows the number of women reporting the use of each specific weight loss strategy at 12 months post-partum while also capturing the frequency of use. The

prevalence of these strategies can be seen in **Table 2-3**. These two tables indicate that the majority of women avoided the unhealthy methods of losing weight. The most common weight loss strategy was to increase fruit and vegetable consumption (56%), closely followed by increasing exercise (44%) and eliminating sweets (44%). In addition to the unhealthy strategies, the least common strategies included eating less meat, joining a weight loss group, and using diet centers. These results are compared to those found in the original French study (see **Table 2-4**).

When examining patterns of specific weight loss strategies, several trends emerge. From 6-12 months post-partum, 86% (n=31) of women actively engaged in weight loss strategies. While most women avoided unhealthy diet practices, 30% (n=11) used a combination of healthy and unhealthy strategies to lose weight. However, 54% (n=20) only engaged in healthy weight loss strategies and 16% (n=6) did not try to lose any weight. The use of exercise to manage post-partum weight was always used in combination with dieting.

Discussion

This research was significant because it identified the most common strategies used by women to manage weight from 6-12 months post-partum. It not only examined some weight loss strategies women are engaging in, but the prevalence of each strategy. Most women (86%) were actively engaging in weight loss strategies from 6-12 months post-partum. However, after one year post-partum, the number of women currently trying to lose weight was only 25%. Furthermore, the vast majority of women who were dieting and exercising reported participating in what would be considered healthy weight loss strategies (see Table 2-3). Eating more fruits and vegetables, increasing exercise, eliminating sweets, reducing dietary fats, refraining from snacking, reducing overall food consumption, reducing Calorie intake, and reducing alcohol consumption were the most common weight loss strategies. Notably, all of these strategies were considered “healthy”. The most common unhealthy strategies were skipping meals and fasting. Of the 20 women that tried to lose weight from 6 months to 12 months post-partum, 14 (70%) of them felt they succeeded. However, only 4 (20%) of these women considered their weight loss strategy “very successful”. It is important that we analyzed the data as a multidimensional construct because it provided us with information not readily observed from the survey results. This approach revealed that women who reported using at least 1 healthy or unhealthy strategy also reported exercising. In summary, the results of our study indicate that most women are using healthy strategies to lose weight from 6-12 months post-partum, but further research should be done to determine why the prevalence of women engaging in weight loss strategies decreased by 61% after 12 months post-partum.

The original French Survey (1995) generated similar results to those recorded in this study, but with a few notable differences. The article first featuring the French Survey was designed to assess the prevalence of specific dieting behaviors in a sample of female adolescents and to examine the differences among these practices³⁴. It was administered to 1,015 female high school students, 89% of whom were white. **Table 2-4** compares the original French results to those of the present survey. In general, both the high school subjects and the post-partum subjects had a much higher prevalence of participating in healthy weight loss strategies than unhealthy strategies. However, it is possible that subjects in both studies under-reported unhealthy behaviors due to denial, embarrassment, etc. When comparing these two studies, it is also worth noting that the high school girls were more likely to participate in unhealthy weight loss strategies than the post-partum women. This finding is consistent with the fact that adolescents are more likely to develop an eating disorder than women in other age groups⁴³. Additionally, women in the present study have a higher level of education than do the high school girls. Studies suggest that the prevalence of healthy dieting practices is directly related to the subjects' education level⁴⁴. It is important to note that while the present study evaluated the subjects' strategies over the course of 6 months, the French study assessed the subjects' strategies over the course of 1 year. Therefore, the overall prevalence of subjects actively engaging in weight loss strategies will be higher than that of the present study.

There are many strengths associated with this study. First, this study examined the prevalence of diet and weight loss strategies used by post-partum women, which is useful for guiding future intervention studies seeking to identify the efficacy of different

weight loss strategies. Additionally, the present study has identified strategies in which women are willing to engage. This information is useful for researchers to develop intervention studies that will be well-received by post-partum women. Another strength of this study is the long follow-up period (1 year). According to an epidemiologic review by The Johns Hopkins University School of Hygiene and Public Health, one of the major limitations to current studies in this field is the relatively short follow-up periods for post-partum women⁶. A long follow-up period allows us to determine what long-term strategies women are using to manage weight. Finally, there was a very low rate of attrition (27%). High dropout rates appear to be a prevalent problem for researchers trying to conduct longitudinal studies dealing with post-partum weight retention^{6,32}. Our success may be attributable to the fact that the study was observational (no imposed diet restrictions or exercise regimens), our subjects were local (<20 miles away from the lab), and they were provided incentives to participate.

We also recognize the weaknesses associated with this study. One such weakness is the homogeneity of the sample in terms of ethnicity, geographic location, and socioeconomic status. A relatively large body of evidence suggests that white, educated, middle to upper class women retain less weight post-partum than other groups^{10,12,38}. For example, in a study of 345 low-income white and African-American mothers participating in the Special Supplemental Feeding Program for Women, Infants, and Children were assessed for activity level, dietary intake, body weight, and other characteristics⁴⁷. On average, the African-American women retained 6.4 pounds more than did the white women. This finding was attributed to the higher mean energy intake and lower prenatal and post-partum physical activity. Thus, our results may not reflect

the diet and exercise habits of the general population. Another weakness of this study is that pregravid weight and gestational weight gain were self-reported. Although it is common-place in the literature, it is still not ideal for obtaining accurate measurements^{40,41,42}. Finally, the subjects of this study were self-selected. Subjects who volunteer in a research study may be more health conscious than the general population³⁹.

In summary, the main objective of this study was to report the types and prevalence of weight loss strategies women are using from 6-12 months post-partum. This objective was satisfied – the majority of women are trying to lose weight from 6-12 months post-partum by using healthy weight loss strategies. At 1 year post-partum, only a quarter of the women are attempting to lose weight and approximately half are trying to maintain weight. Finally, most women who are engaging in weight loss strategies feel that they are succeeding. However, future research needs to be conducted to determine which strategies are the most effective at reducing both the weight and fat mass of post-partum women.

Tables

Table 2-1 Characteristics of the sample at 12 months post-partum .*

Characteristics		Mean \pm SD	Range	n
Age (years)		30.0 \pm 6.3	23.5 - 40.1	37
Weight (kg)		65.8 \pm 10.8	46.9 - 92.5	36
Pre-pregnancy BMI(kg/m ²)*		24.0 \pm 4.2	17.3 - 34.8	36
Highest BMI during pregnancy(kg/m ²)*		29.5 \pm 4.7	23.2 - 43.8	36
Gestational Weight Gain (kg)*		15.1 \pm 4.6	6.8 - 34.0	37
% body fat		29.3 \pm 9.3	12.6 - 48.1	35
Parity	Description	Frequency	Percent (%)	
	1	18	48.7	
	2	15	40.5	
	3	2	5.4	
	4	2	5.4	
Education Level	13-15 years	3	8.1	
	16 years	16	43.2	
	17+ years	18	48.7	
Race	American Indian or Alaskan Native	0	0	
	Asian	2	5.4	
	Black of African American	0	0	
	Native Hawaiian or Pacific Islander	0	0	
	White	35	94.6	
Employment	Paid leave and benefits	9	24.3	
	On leave/benefits only	3	8.1	
	On leave/no benefits	3	8.1	
	Working full-time	3	8.1	
	Working part-time	7	18.9	
	Unemployed/no benefits	10	27.8	
	Unemployed/some benefits	1	2.7	
	other	1	2.7	
Family Income	<19,999\$	1	2.7	
	20,000-39,999\$	10	27.0	
	40,000-59,999\$	4	10.8	
	60,000-79,000\$	14	37.8	
	80,000-99,999\$	2	5.4	
	100,000\$	5	13.5	
	Refused	1	2.7	

*Items are not measurements at 12 months post-partum

Table 2-2 Summary of weight loss strategies used by post-partum women (n=37).^a

Weight Loss Strategy ^b	Never	Rarely	Sometimes	Often	Always
1. Increase Exercise	7	6	14	7	3
2. Eat more fruit and vegetables	6	1	7	19	4
3. Eat less fat	8	6	12	9	2
4. Eliminate Snacking	13	7	12	4	1
5. Eliminate sweets and junk	7	6	15	9	0
6. Reduce Calories	10	10	11	5	1
7. Reduce amount of food	11	8	11	6	1
8. Eat low-calorie food	10	7	14	6	0
9. Skip meals*	28	5	3	1	0
10. Eat less meat	19	13	3	2	0
11. Fast*	32	4	1	0	0
12. Diet Pills*	37	0	0	0	0
13. Vomiting*	37	0	0	0	0
14. Eat less high-carbohydrate foods	11	16	9	1	0
15. Change type of food eaten	11	11	11	3	1
16. Appetite suppressants*	37	0	0	0	0
17. Liquid diets*	36	1	0	0	0
18. Drink less alcohol	20	6	2	4	4
19. Increase cigarettes smoked*	36	0	0	0	0
20. Laxatives or enemas*	37	0	0	0	0
21. Diet centers with food	37	0	0	0	0
22. Weight loss groups	36	1	0	0	0
23. Diuretics*	37	0	0	0	0
24. Other					

^a Mothers asked about weight loss strategies used from 6-12 months post-partum.

^b Items from the French survey³⁴

*Unhealthy weight loss strategies

Table 2-3 Prevalence of each weight loss strategies dichotomized as “yes” or “no”.

Weight Loss Strategy	NO ^a	YES ^b
1. Increase Exercise	56%	44%
2. Eat more fruit and vegetables	44%	56%
3. Eat less fat	57%	43%
4. Eliminate Snacking	69%	32%
5. Eliminate sweets and junk	56%	44%
6. Reduce Calories	69%	31%
7. Reduce amount of food	67%	33%
8. Eat low-calorie food	63%	37%
9. Skip meals*	83%	17%
10. Eat less meat	91%	9%
11. Fast*	91%	9%
12. Diet Pills*	100%	0%
13. Vomiting*	100%	0%
14. Eat less high-carbohydrate foods	81%	19%
15. Change type of food eaten	72%	28%
16. Appetite suppressants*	100%	0%
17. Liquid diets*	98%	2%
18. Drink less alcohol*	70%	30%
19. Increase cigarettes smoked*	100%	0%
20. Laxatives or enemas*	100%	0%
21. Diet centers with food*	100%	0%
22. Weight loss groups*	98%	2%
23. Diuretics*	100%	0%
24. Other		

^aItems coded “NO” if subject selected “Never” or “Rarely”

^bItems coded “YES” if subjects selected “Sometimes” or more often

*Items were coded a “YES” if subjects selected “Rarely” or more often

Table 2-4 Comparison of the original French study with the present study.

Weight Loss Strategy	Original French Study	Present Study
	YES	YES
1. Increase Exercise	32%	44%
2. Eat more fruit and vegetables	27%	56%
3. Eat less fat	26%	43%
4. Eliminate Snacking	25%	32%
5. Eliminate sweets and junk	24%	44%
6. Reduce Calories	22%	31%
7. Reduce amount of food	22%	33%
8. Eat low-calorie food	14%	37%
9. Skip meals*	12%	17%
10. Eat less meat	11%	9%
11. Fast*	8%	9%
12. Diet Pills*	5%	0%
13. Vomiting*	4%	0%
14. Eat less high-carbohydrate foods	5%	19%
15. Change type of food eaten	22%	28%
16. Appetite suppressants*	3%	0%
17. Liquid diets*	3%	2%
18. Drink less alcohol	3%	30%
19. Increase cigarettes smoked*	15%	0%
20. Laxatives or enemas*	2%	0%
21. Diet centers with food	2%	0%
22. Weight loss groups	2%	2%
23. Diuretics*	1%	0%
24. Other	1%	0%

*Unhealthy weight loss strategies

Chapter 3

Integrations and Future Directions

The significance of this study is its utility in guiding future research projects. For instance, we have determined that, at 1 year post-partum, most women are still attempting to either lose or maintain their weight, but we do not know if this generalization applies across all populations/ethnicities. We have also determined that women are using mostly “healthy” weight loss strategies. However, we do not know any details about the physical activity patterns of our sample. Finally, most of the women that are actively trying to lose weight from 6-12 months post-partum report feeling that they are succeeding; however, these reports are subjective and are not supported with any empirical data.

We suggest that future research designs have a much larger sample size than that of the present study (n=37). We also suggest selecting a more diverse cohort, including subjects of varying ethnicities, socioeconomic backgrounds, and geographic locations. Implementation of these suggestions will allow for results that apply to a much larger population. Furthermore, we recommend that an intervention study be conducted to appropriately control for different variables, including the frequency, intensity, duration, and type of exercise, as well as manipulation of varying diet practices. A study of this fashion will allow researchers to determine the most effective strategy women should adopt to reduce post-partum weight. Conversely, researchers would be able to deduce which strategies are least effective. Moreover, such a study could determine which

strategies are most effective (and least effective) for reducing fat mass for post-partum women.

In summary, the present study has generated useful information about how women are dealing with post-partum weight retention. However, more research needs to be conducted to understand the complexities of post-partum weight management. Once a better understanding is achieved, healthcare providers will be more able to create programs tailored to the needs of their post-partum patients, women will be more empowered to lose the weight accumulated during gestation, and people will ultimately be more equipped to combat the growing obesity epidemic.

Appendix A:

Example of the French Survey

Weight Loss Strategy	Never	Rarely	Sometimes	Often	Always
1. Increase Exercise					
2. Eat more fruit and vegetables					
3. Eat less fat					
4. Eliminate Snacking					
5. Eliminate sweets and junk					
6. Reduce Calories					
7. Reduce amount of food					
8. Eat low-calorie food					
9. Skip meals					
10. Eat less meat					
11. Fast					
12. Diet Pills					
13. Vomiting					
14. Eat less high-carbohydrate foods					
15. Change type of food eaten					
16. Appetite suppressants					
17. Liquid diets					
18. Drink less alcohol					
19. Increase cigarettes smoked					
20. Laxatives or enemas					
21. Diet centers with food					
22. Weight loss groups					
23. Diuretics					
24. Other*					

Describe Other: _____

1. Are you currently dieting or exercising to LOSE weight? 0) No 1) Yes
2. Are you currently dieting or exercising to MAINTAIN weight? 0) No 1) Yes
3. How successful were you in the past 6 months in losing weight?
 0. I haven't tried to lose weight
 1. Not at all
 2. Fairly successful
 3. Very successful

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