THE INFLUENCE OF INCREASED PHYSICAL ACTIVITY ON WEIGHT

RETENTION, BODY COMPOSITION, PSYCHOLOGICAL PROFILES,

AND CARDIOVASCULAR FUNCTION IN POSTPARTUM

AFRICAN AMERICAN WOMEN

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THE INFLUENCE OF INCREASED PHYSICAL ACTIVITY ON WEIGHT RETENTION, BODY COMPOSITION, PSYCHOLOGICAL PROFILES, AND CARDIOVASCULAR FUNCTION IN POSTPARTUM AFRICAN AMERICAN WOMEN

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A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Requirements for the

Degree of

Doctor of Philosophy

Auburn, Alabama
December 17, 2007

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DISSERTATION ABSTRACT

THE INFLUENCE OF INCREASED PHYSICAL ACTIVITY ON WEIGHT RETENTION, BODY COMPOSITION, PSYCHOLOGICAL PROFILES, AND CARDIOVASCULAR FUNCTION IN POSTPARTUM AFRICAN AMERICAN WOMEN

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166 Typed Pages

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High postpartum weight and physical inactivity levels in black females have been shown to be greater than in any other group of women and may be associated with obesity, negatively altered mood, depressive symptoms and low cardiorespiratory fitness levels. This study determined the use of the pedometer to increase walking (physical activity) in African American women who were between 6 weeks to 6 months postpartum. This study also investigated the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest in this population: 1) weight retention and body composition; 2) mood and depressive symptoms and

3) resting heart rate and resting blood pressure. Methods to increase physical activity in thirty-two postpartum African American women (aged 18-40) are described. Results from a paired t-test showed a significant difference in the mean steps/day before and after the study. A negative relation was found between increased average steps/day and change in body mass index (BMI (kg/m^2)). While no significant correlation was found between increased average daily steps and waist to hip ratio (WHR), results of paired sample t-test indicated a reduction in waist and hip circumferences as well as WHR in this group. Findings were unsuccessful in showing a relationship between increased average steps/day and mood states as well as depressive symptoms. Also, no significant difference in the pre and post Profile Of Mood States scores was found suggesting maintenance of a stable mood, conversely, the results of a paired t-test indicated that the post Beck Depression Inventory (BDI) total scores were significantly lower than the pre BDI scores after the intervention. Results confirm a negative relationship between increased physical activity and resting heart rate. No relationship between average steps/day and resting blood pressure or the time it takes to reach a predetermined target heart rate (TTT) was found. Paired t-tests revealed no significant differences in mean resting values or TTT before and after the study implying the possible need for more time after childbearing for the cardiovascular responses to exercise to return to normal. In conclusion, the present study yielded no significant results regarding cardiorespiratory fitness. However, other findings provide evidence that increasing physical activity, by increasing daily steps, in African American women who are between 6 weeks to 6 months postpartum has the potential to reduce retained weight, waist and/or hip girth, as well as depressive symptoms and maintain mood stability.

ACKNOWLEDGEMENTS

The author would first like to extend her gratitude to Dr. Beverly Love (OB/GYN) for his suggestion to look into ways of addressing the dilemma of postpartum weight retention in African American women as well as Drs. Pena, Elliott, and Zimmerman for their medical expertise and support. A sincere appreciation is due to her advisory committee members Dr. Daniel Blessing, Dr. Henry “Hank” Williford, Dr. Erica Jackson, Dr. Bernadette Chapple and Dr. Peter Grandjean for their suggestions and continued support. The author cannot express the words to thank Dr. Lorraine Walker for her expertise in postpartum studies, Dr. Senobia Crawford for “table talks”, Dr. Sonja Harrington for statistical help, Mr. Bob Garrie for graphs and tables, Dr. Lynda Woodruff for the “words” and to all of her fellow colleagues, especially Dr. Denise Chapman and Mrs. Marilyn Watkins, in the College of Health Sciences at Alabama State University for technical support and class coverage. Finally, a very special “thank you” is given to all the members of her family, particularly the grandchildren, and friends who have assisted in so very many ways and shown unwavering patience throughout this endeavor. Appreciation is especially extended to her daughters, Ricci and Vera, who transported her back and forth to the main campus over the years; her sister-in-law, Dr. Patricia Aaron, who edited and advised; her mother, Vera Harris, for inspiration and prayers, and most of all her loving husband, Ernie, for EVERYTHING.

Style manual or journal used: Publication Manual of the American Psychological Association, 5th Edition, 2001-2007

Computer software used: Microsoft Office 2003, SPSS 14.0

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I. INTRODUCTION

Obesity is a major worldwide public health problem (Khan & Bowman, 1999) with epidemic proportions reported in the United States (Pi-Sunyer, 2002) and still rising. The prevalence of obesity, defined as a body mass index (BMI: weight (kg)/ height (m^2) of 30 or higher, increased by approximately 8% after being fairly stable from 1960-1980 (Kuczmarski, Flegal, Campbell & Johnson, 1994). Obesity and overweight, defined as a BMI between 25 to 29, rose to an estimated 64 % of adults in the United States (Flegal, Carroll, Ogden & Johnson, 2002). Moreover, non Hispanic black women demonstrate the highest prevalence of both overweight and obesity (49.7%) as compared to white women (30.1%) (Flegal et al, 2002) and retain twice as much weight during postpartum than white women (Parker & Abrams, 1993; Keppel & Taffel, 1993).

Although pregnancy is a natural time for fat storage, the increased contribution of childbearing to weight gain and consequential obesity found among black women (Rosenburg et al, 2003; Parker & Abrams, 1993; Keppel & Taffel, 1993; Lederman, Alfasi & Deckelbaum, 2002; Walker, Timmerman, Sterling, Kim & Dickson, 2004; Greene, Smiciklas-Wright, Scholl & Karp, 1988) is of increasing concern. Primarily because African American women have greater difficulty in losing the retained weight postpartum, thus leading to the development of obesity and chronic disease (Walker et al, 2004; Parker & Abrams, 1993; Khan, Williams and Stevens,1991). The apparent excess of weight among African American women, particularly during the postpartum period,

poses an interesting question which provides the framework for the present study. Also of concern is the physically inactive lifestyle developed by the six weeks postpartum period (McCory, 2002). Hence, there is a pressing need to identify ways to address postpartum weight gain in African American women.

Various factors have been noted to influence postpartum weight retention. These include pre-pregnancy BMI (Keppel & Taffel, 1993), gestational weight (Keppel & Taffel, 1993; Lederman, 1993; Ohlin & Rossner, 1996), lactation (Kac, 2004), smoking (Schauberger, Rooney & Brimer, 1992; Ohlin & Rossner, 1990; Boardley, Sargent, Coker, Hussey & Sharpe, 1995), parity (Manson,Colditz & Stampfer, 1994), dietary intake (Boardly et al, 1995; Ohlin & Rossner, 1994), and physical activity levels (Boardly et al, 1995; Sampselle, Seng, Yeo, Killian & Oakly 1999; McCrory, 2000; O'Toole, Sawiciki & Artal, 2003; Walker et al, 2004). Most of these factors are difficult to change; however, physical activity can be modified and measured during the postpartum period (McCrory, 2000). Surprisingly, only a few studies have considered the effects of physical activity on postpartum weight retention, specifically between six weeks and six months postpartum (Walker et al, 2004; McCrory, 2000; O'Toole, Sawicki and Artal, 2003).

Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Casperson, Powell & Christenson, 1985). Obesity and overweight are positively associated with physical inactivity (USDHHS Report of Surgeon General of Physical Activity and Health, 1996) and African-American females are reportedly less active than their majority counterparts (Dubbert, 1997; Adams-Campbell et al, 2000; Tuten et al, 1995) which may lead to a predisposition for obesity. According to McCrory (2000), many new mothers establish daily routines that fail to

include regular physical activity and most are unacquainted with the importance of physical activity during the early postpartum period (Walker et al, 2004). Additionally, as part of the 6 weeks postpartum care plan, physicians usually give advice on proper diet; yet, overlook the opportunity to address recommendations for physical activity (Sampselle et al, 1999).

To date, there are less than five published studies on physical activity in the early postpartum period. Only two included African-American women and both studies utilized qualitative research only. Therefore, further investigation of the influence of increased physical activity on postpartum weight gain in African-American women is warranted.

In the interest of overall health and well-being during the early postpartum period, secondary variables of resting cardiovascular values (Capeless & Clapp, 1991; Sady et al, 1990) as well as mood and depressive symptoms (Boury, Larkin and Krummel, 2004) associated with physical activity levels (Walker et al, 2004) were examined as part of this major study and may serve as pilots for future studies. Cardiovascular resting values and mood and depressive symptoms are variables that have been introduced by researchers as salient to overall postpartum health and well being. Limited research found on the influence of physical activity and changes in early postpartum cardiovascular values yielded varied results (Capeless & Clapp, 1991; Sady et al, 1990; Lovelady, Garner, Mareno, and Williams, 2000; O'Toole, Sawicki and Artal, 2003). Two studies (Walker et al, 2004; Boury, Larkin & Krummel, 2004) support the importance of physical activity in maintaining psychological stability during the postpartum period in minority populations. With the reported high prevalence of increased weight and low levels of

physical activity found in the African American female population, particularly postpartum, it was not surprising to find elevations in mood and depressive symptoms in this group of mothers (Walker et al, 2004). Notwithstanding, the potential contributions of studies focusing on the improvement of postpartum quality of life suggest that data specific findings need to be generated if healthcare providers are to confidently advise this cohort of women. To date, no study using objective measures of physical activity exclusively in African-American postpartum women has been documented. Therefore, the present study determined the use of the pedometer to increase walking (physical activity) in African-American women who were between 6 weeks to 6 months postpartum. This study also investigated the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest in this population: 1) weight retention and body composition; 2) mood and depressive symptoms and 3) resting heart rate and resting blood pressure.

Statement of the Purpose

This study determined the use of the pedometer to increase walking (physical activity) in African-American women who were between 6 weeks to 6 months postpartum. This study also investigated the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest in this population: 1) weight retention and body composition; 2) mood and depressive symptoms and 3) resting heart rate and resting blood pressure. Measurable outcomes from the present study provide assistance in clinical decisions for health care professionals to manage

weight as well as mood and depressive states and cardiorespiratory fitness levels in African American women during the early postpartum period.

The following research questions were answered in this study:

1. Did the use of the pedometer increase walking (physical activity) in African American women who were between 6 weeks and 6 months postpartum?
2. Was there a relationship between increased physical activity and body mass index of African American women who were between 6 weeks and 6 months postpartum?
3. Was there a relationship between increased physical activity and waist/hip ratio of African American women who were between 6 weeks and 6 months postpartum?
4. Was there a relationship between increased physical activity and heart rate of African American women who were between 6 weeks and 6 months postpartum?
5. Was there a relationship between increased physical activity and blood pressure in African American women who were between 6 weeks and 6 months postpartum?
6. Was there a relationship between increased physical activity and the time to target (TTT) in African American women who were between 6 weeks and 6 months postpartum?
7. Was there a relationship between increased physical activity and postpartum mood states in African American women who were between 6 weeks and 6 months postpartum?
8. Was there a relationship between increased physical activity and postpartum depressive symptoms in African American women who were between 6 weeks and 6 months postpartum?

The null hypotheses were:

1. The use of the pedometer would not increase walking (physical activity) in African American women who were between 6 weeks and 6 months postpartum.
2. Increased physical activity would have no relationship to retained weight and body composition in African American women who were between 6 weeks and 6 months postpartum.
3. Increased physical activity would have no relationship to mood states and depressive symptoms in African American women who were between 6 weeks and 6 months postpartum.
4. Increased physical activity would have no relationship to resting heart rate and resting blood pressure in African American women who were between 6 weeks and 6 months postpartum.

Assumptions

It was assumed that all participants accurately and honestly recorded daily steps in the activity log for the researcher. It was assumed that all participants honestly responded to the Profile of Mood Stated (POMS) and Beck Depression Inventory (BDI) questionnaires. Furthermore, it was assumed that each participant was the sole user of the pedometer and was responsible for its return as well as the return of the activity log upon completion of this investigative effort.

Limitations

1. This study was limited solely to apparently healthy African American women who were between 6 weeks and 6 months postpartum with no contraindications for minimal to moderate physical activity.
2. This study unexpectedly contained a homogenous group of women. Participants in this study were mostly college educated professionals and in the mid to upper socioecomonic (SES) category with an awareness of the importance of health and research. Findings of this study may not be generalized to postpartum women in a lower SES.
3. African American adolescents were not included. Ages under 18 years required parental consent for participation.
4. Weight lost was not analyzed for composition (fat mass (FM) or fat free mass ((FFM) (muscle, bone, water, other)). Further research would include the use of an instrument that would assess the composition of weight lost or gained.
5. Participants with a body mass index (BMI) below 24 were excluded because the primary focus of this study was to address excessive postpartum weight retained.

Operational Definitions

Gestational weight: the amount of weight gained from pre-pregnancy to childbirth

Postpartum weight: the difference between pre-pregnancy weight and weight after childbirth

Puerpurium: the period of 42 days (6 weeks) following childbirth and expulsion of the placenta and membranes. The generative organs usually return to normal during this time.

Parity: the ability of a woman to carry a pregnancy to a point of viability (500g or 20 weeks) regardless of outcome.

Pedometer: a mechanical or digital device that measures vertical movement at the hip; a step counter

Tension/Anxiety: state of apprehension, tension, and worry

Depression/Dejection: depression is a mood disorder characterized by sadness and dejection, lowered self-esteem and decreased motivation and interest in life, negative thoughts, confusion and cognitive dysfunction, and such physical symptoms as sleep disturbances, loss of appetite and chronic fatigue.

Anger/Hostility: a tendency to be easily or persistently angry toward others or about one's life.

Vigor/Activity: a mood of vigorousness, ebullience, and high energy.

Fatigue/Inertia: a mood of weariness, inertia, and low energy level.

Confusion/Bewilderment: refers to disturbed, emotional, and unclear thinking.

II. REVIEW OF THE LITERATURE

The purpose of this study was to determine if the use of the pedometer increased walking (physical activity) in African American women who were between 6 weeks and 6 months postpartum. A second purpose was to investigate the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest: 1) weight retention and body composition; 2) mood and depressive symptoms and 3) resting heart rate and resting blood pressure in African American women living in the south-central region of Alabama who were between 6 weeks to 6 months postpartum.

This chapter will review the following: 1) obesity and overweight in black women; 2) postpartum weight and obesity; 3) physical activity and postpartum weight and 4) other variables of interest. The studies reviewed frequently use the terms "African American" or "black" when referencing people of African descent. For the purpose of this paper, these terms will be used interchangeably.

Obesity and Overweight in Black Women

Prevalence and Trends of Obesity/ Overweight Among U.S. Black women

Obesity is a major epidemic in the United States with a disproportional prevalence among black women (Flegal, Carroll, Ogden, & Johnson, 2002). In order to classify individuals into different weight categories national trends have been analyzed. National

trends in the prevalence of overweight and obesity were based on comparisons of data from the National Health Examination Survey I (NHES I 1960-1962), National Health and Nutrition Examination Survey I (NHANES I 1971-1974), NHANES II (1976-1980), NHANES III (1988-1991) and NHANES 1999-2000.

In 1994, Kuczmarski, Flegal, Campbell and Johnson investigated the increasing prevalence of overweight among U.S. adults from 1960 to 1991. Between 6000 and 13,000 adults aged 20 to 74 years old were examined in each of four data collection periods (NHANES): 1) 1960-1962 2) 1971-1974 3)1976-1980 and 4) 1988-1991. Criteria were established for weight classification. Obesity was defined as a body mass index (BMI: weight/ height^2) of 30 kg/m^2 or higher and overweight as a BMI of 27.8 kg/m^2 for men and 27.3 kg/m^2 for women (Kuczmarski et al,1994). However, in a later study (Kuczmarski, Carroll, Flegal & Troiano, 1997), the criterion for overweight was lowered to a BMI of 25.0-29.9 kg/m^2. Results of the investigation (Kuczmarski et al, 1994) indicated that between NHANES II and NHANES III the mean BMI increased 1.0 kg/m^2 from 25.3 to 26.3 kg/m^2 with an associated weight gain of 3.6 kg (~8 lbs). The prevalence of overweight ranged from 32.9% for non-Hispanic white women to 48.6% for non-Hispanic black women, indicating that nearly 50% of all adult non-Hispanic black women in the United States are overweight or obese. Flegal (1996) also compared data from the NHANES II (1976-1980) and NHANES III (1988-1994). According to Flegal the NHANES III survey showed an obvious rise in the prevalence of overweight in the United States. Moreover, Flegal et al (2002) examined data from the NHANES 1999-2000 survey and reported that in the United States, black women were twice as likely to be obese than white women and 80% of black women were classified as overweight.

Pi-Sunyer (2002) reported similar findings, concluding that obesity in African American women out ranks Caucasian women at a ratio of 2:1. Reasons for this very high prevalence of obesity among U.S. black women are unknown (Allison, Edlen-Nezin, Clay-Williams, 1997).

Body Composition in Black women

Body Mass Index

Researchers (Kuczmarski et al, 1994; Kuczmarski et al, 1997; and Flegal et al, 2002) agree that the NHANES data based on measured weight and height (BMI) provide a great opportunity for tracking trends in weight. As previously stated, the overweight criteria for NHANES II and past surveys was defined as a BMI >/= 27.3kg/m² for women. However, data gathered from NHANES III indicated changes in height and weight criteria. Thus, the cutoff for BMI was lowered to 25.0 kg/m² establishing a new definition (Kuczmarski et al, 1997). There was no modification to the obesity criteria. Moreover, Flegal et al (2002) reported a progressive increase over time in the high prevalence of obesity found in black women.

According to BMI criteria, black women were classified as overweight in NHANES II and III and continued with NHANES (1999-2000). However, white women indicated a greater percent change from normal weight classification to overweight. The greater BMI found in black women between the ages of 20-39 is of concern, because this age interval is well documented in the literature as prime time for childbearing. In a word, BMI in black women was continuously found to be significantly higher when compared to white women at varied ages.

Pi-Sunyer (2002) suggested that 30% to 40% of the differences reported in BMI between black and white women, could be credited to genetics and 60% to 70% to environment and the interaction between these two factors should be investigated.

Body fat

Pi-Sunyer (2002) and Kumanyika (1987) both agree that American women of African descent are more likely to have a lower body pattern of fat distribution. However, according to Kumanyika (1987), as black women gained weight, they were shown to be more apt to develop abdominal and upper-body fat, which has been reported to be associated with an increased risk of developing chronic diseases.

In their study, Tuten, Petosa, Sargent and Weston (1995) investigated the biracial differences in physical activity and body composition among women. Recruits for this study included 76 white adult females and 66 black adult females between the ages of 25-44. Body composition was measured by bioelectric impedance and physical activity by a 24hour recall instrument (PAS Physical Activity Scale). Results showed black women had significantly higher body fat (32.2 %) than white women (27.7%) with a similar difference in weight (4.4 kg). Using 30.0% body fat as criteria for defining obesity, 56% black females compared to 32% white females were found to be obese. Wagner and Heyward (2000) also supported the findings that black women showed a significantly higher percent body fat when compared to white women.

Health Risks Associated with Overweight and Obesity in Black Women

Mokdad et al (2003) studied the prevalence of obesity, diabetes and obesity related health risk factors. The researchers telephoned 195,000 adults 18 years and older and

concluded that increases in obesity and diabetes among U.S. adults persist in both black and white females. Additionally, obesity was noted to be a risk factor for many other chronic conditions including, hypertension, hypercholesterolemia, stroke and heart disease (Flegal et al, 2002; Mokdad et al, 2003; Pi-Sunyer, 2002).

Predictors of Obesity in Black Women

A number of researchers have investigated multiple predictors in an attempt to unravel the mystery of obesity in black women. It would not be practical or purposeful for this study to review each of these studies. Therefore, the following section contains only those studies that have made a unique contribution to this body of knowledge.

In this section the selected predictors to be reviewed are divided into a) metabolic factors b) energy imbalance c) cultural issues and d) pregnancy related weight gain.

Metabolic factors

There has existed widespread belief that resting energy expenditure (REE) (Luke et al, 2000), resting metabolic rate (RMR) (Melby et al, 2000; Pi-Sunyer, 2002), sleep metabolic rate (SMR) (Weyer, Snitker, Bogardus & Ravussin, 1999) and low oxygen consumption (VO_2) (Hunter, Weinsier, Darnell, Zuckerman, & Goran, 2000) were related to obesity and weight gain, particularly in African American women. This may largely be due to the fact that African American women have consistently shown lower values in these metabolic factors regardless of age, than any other ethnic group (Kumanyika, 1987). Energy metabolism in African Americans as a potential risk factor for obesity was explored by Weyer et al (1999). They compared 24hr measurements of energy

metabolism between African American and white men and women. Results of their study revealed lower SMR (sleep metabolic rate) in African Americans and increased respiratory quotient (RQ) as compared to whites. Wong et al (1998) found similar RQ (fuel utilization) results in young non-obese African American females.

Melby et al (2000) studied the comparison of risk factors for obesity in young, non-obese African American and Caucasian women. Twenty-four participants were involved in this study (13 African American and 11 Caucasian women). Cross-sectional comparisons of peak oxygen consumption (VO_2 peak), resting metabolic rate (RMR) and total daily energy expenditure (TDEE) were performed. Their findings indicated lower VO_2 peak and TDEE (due to lower physical activity) in African American women with no significant difference in RMR.

In another study, Hunter, Weinsier, Zuckerman and Darnell (2004) examined the aerobic fitness, physiologic difficulty and physical activity in Black and White women. Seventy-four (35 black and 39 white) sedentary pre-menopausal women participated in this study. Findings indicated that black women had lower VO_2 max and PAEE (physical activity energy expenditure) than white women and increased difficulty with performing sub-maximum activity. The increased difficulty with sub-maximum activity tasks was supported by Kumanyika (1987) who noted that black women performed less moderate intensity activity than whites.

Conversely, Luke et al (2000) recently investigated the comparability of resting energy expenditure (REE) in Nigerian and U.S. Blacks. They sought to determine the influence of environmental factors on REE and its relationship to adiposity in two populations of West African origins, Nigerians and U.S. Blacks of West African origin.

The researchers randomly selected 89 Nigerians and 181 U.S. Blacks. After REE measurement by indirect calorimetry and body composition by bioelectrical impedance analysis, no significant differences were found suggesting no environmental influence. However, the U.S. Black women indicated an increase in fat free mass (FFM) and a higher percent body fat which did not reflect environmental influence. Luke et al (2000) concluded that REE in black populations was not influenced by environmental factors such as climate, diet, or physical activity; and not predictive of adiposity. Therefore, REE was not likely to contribute to obesity in related populations (Luke et al, 2000). Other factors may possibly be responsible for increased weight in the African American female population.

Energy imbalance: diet and physical activity

Studies have well established the fact that increases in overweight and obesity are generally the result of an energy imbalance: caloric intake (diet) vs. caloric expenditure (physical activity) (Kuczmarski et al, 1994). Moreover, it appears that a significant energy imbalance existed between black and white women.

Adams-Campbell, Rosenburg, Washburn, Rao and Palmer (2000) conducted a large study examining the physical activity levels in 64,101 African-American women between the ages of 21 and 69 years. Data gathered from mail questionnaires revealed low levels of physical activity in this population. This finding was well supported in the literature (Kumanyika, 1987; Tuten et al, 1995; Jacobson, Morton, Jacobson, Sharma, & Garcia, 2002; Breitkoph & Berenson, 2004; Sanchez-Johnson et al, 2004; and Railey, 2000).

According to Kumanyika (1987), data from a self-reported NHANES II survey on physical activity intensity levels revealed that black women engaged in more high and low intensity activity and less moderate intensity activity than white women. Whereas, Tuten et al (1995) reported that black women spend less time overall in physical activity compared to white women 93.5% of the time.

Jacobson et al (2002) assessed the prevalence of obesity and weight control among middle-aged African American women through survey data provided from the Behavioral Risk Factor Surveillance System (BRFSS). They found that of 30 African American participants, 80% attempted weight loss by decreasing caloric intake and only 50% of the 80% added physical activity to their program.

Breitkoph and Berenson (2004) examined the prevalence and correlates of weight reduction behavior among low-income African American, Caucasian, and Latino women. Of the 1,709 participants, African American women were found to consume more fat calories and exhibit lower levels of physical activity when compared to Caucasian and Latina women. Other researchers (Sanchez-Johnson et al, 2004; and Railey, 2000,) agree that the dietary intake of fat calories was higher among African American women than white women.

Sanchez-Johnson et al (2004) studied three potential correlates of obesity (dietary intake, body image, and physical activity) in a sample of 234 Latin-American and 271 Black women. Data collection included recall for physical activity, dietary intake and a body image questionnaire. Black women were found to consume more high fat calories, engaged in more sedentary behavior and report a higher ideal body image.

In a pilot study of 40 obese African American women, Railey (2000) examined whether there were modifiable factors specific to African American women that could lead to an increased prevalence of obesity. A survey was given which included questions regarding socioeconomics, dietary habits, educational level, stress management, exercise role models and exercise patterns. Results of his study revealed sedentary lifestyles with 68% reporting no exercise and the majority reporting that exercise was "no fun"; an increase in the intake of fat calories; stress management through prayer and talking with friends; and 75% were unaware of the importance of physical activity for health purposes. A unique cultural parameter found in this study was that of hair care. Chemically altered hair was reported as not exercise friendly and prevented individuals from an increase in exercise intensity, thus reducing energy expenditure necessary for weight reduction.

According to dietary recall from both NHANES I and II, a lower caloric intake was reported for obese black women as compared to obese white women. In fact, Kumanyika (1987) and Walker (1996) suggested that although excess caloric intake may lead to obesity it may not be a factor in maintaining obesity once it has been established. Additionally, black women were noted to have greater difficulty losing weight that had been gained than white women (Walker, 1996; Khan, Williamson & Stevens, 1991; and Kumanyika, 1987).

Cultural issues

Some studies (Kuczmarski et al, 1994; Kumanyika, 1987; and Railey, 2000) reported that the prevalence of overweight in African American women may be associated with cultural values and beliefs as well as social factors that would limit the specific behaviors of proper dietary intake and physical activity necessary for effective weight control.

Furthermore, Johnson and Broadnax (2003) suggested that obesity in African American women may be deeply rooted in the very soul of the women's historical, psychosocial and cultural well-being. In the case of black women in the United States, "food was the only thing that they (during slavery) could hold on to. Families were disrupted as spouses were taken, children were taken, and friendships ended. Food remained the only constant and comfort in their lives" (Johnson & Broadnax pg.70, 2003).

Pregnancy related weight gain

A detailed review can be found in the next major section.

Summary

To summarize this section, obesity in black women is multifaceted and highly complex. The issue of overweight and obesity is of particular concern to African American women, especially since African American women are reported to have a significantly higher BMI and twice as likely to be obese than Caucasian women.

Additionally, when compared to white women, black women showed a lower basal metabolic rate (Weyer et al, 1999); however, when compared to blacks of other ethnicities, there was no significant difference found (Luke et al, 2000). This lack of variance suggested that black women may be energy efficient giving them a survival advantage (Kumanyika, 1987; Luke et al, 2000). The researchers (Luke et al, 2000) concluded that REE was not predictive of increased adiposity and not likely to contribute to the prevalence of obesity in the African American female population. Consistent findings in the literature of low physical activity levels and high dietary fat intake in African American women compared to white women, revealed a significant energy imbalance and a propensity for the development of obesity. However, black women, in general, were not found to be at greater risk of gaining weight but rather they are less likely to lose weight (Khan, Williams and Stevens, 1991).

Although evidence supported environmental factors such as dietary intake, physical activity, lifestyles, culture, and metabolic influences, genetic differences, such as fuel utilization and fat patterning cannot be ruled out (Pi-Sunyer, 2002).

Overall, no clear mechanism for the excess obesity in black women has been identified. Nonetheless, in view of the vast amount of health problems that obesity poses, additional information is needed on causes and prevention of weight gain among African-American women.

Postpartum Weight and Obesity

Childbearing is a time when mandatory weight and fat storage are natural physiological changes that occur in women. In fact, a gain of approximately 7-8 lbs of fat is usually expected for a healthy pregnancy. Of concern for this study, is the increased contribution of childbearing to weight gain and consequential obesity found among black women (Rosenburg et al 2003; Parker & Abrams, 1993; Keppel & Taffel, 1993; Lederman, Alfasi & Deckelbaum, 2002; Walker, Timmerman, Sterling, Kim & Dickson, 2004; Greene, Smiciklas-Wright, Scholl & Karp, 1988) and the physically inactive behavior usually established among new mothers by the 6th week postpartum period (McCrory, 2000). For the promotion of good health, recognizing the variables that put black women at risk for excessive postpartum weight is important to prevent the onset of obesity and associated risk factors for chronic disease.

Postpartum Weight

To avoid confusion of this complex issue, three clinical definitions need to be clarified. First, postpartum weight has been defined by Keppel and Taffel (1993) as "the difference between pre-pregnancy weight and postpartum weight at any interval". Second, maternal weight is "the difference between gestational weight and infant weight" (Keppel & Taffel, 1993) and third, gestational weight is defined as "the difference between pre-pregnancy weight and at the end of pregnancy" (Walker, 2004). Some studies have shown evidence of a connection between pregnancy and the development of obesity.

Ohlin and Rossner (1990) investigated the maternal body weight development after pregnancy in 1423 all white Scandinavian women participating in the Stockholm Pregnancy & Weight Development Study to identify predictors for postpartum weight retention. Data were gathered from patient records and questionnaires. The following were identified as predictors of postpartum weight retention: 1) gestational weight gain 2) age directly affected pregnancy weight gain and indirectly affected postpartum weight 3) parity produced increased weight with each parity (0.5 kg per parity) 4) smoking cessation and 5) lactation produced a weak correlation.

Moreover, Schauberger, Rooney & Brimer (1992) studied factors that influence weight loss in the puerperium (42 days after childbirth (6 weeks)) and determined that 1) excessive gestational weight gain can lead to long-term obesity 2) breastfeeding was not associated with weight loss in the postpartum period 3) smokers have a greater weight loss at 6 months as compared to non-smokers 4) primiparas (first pregnancy) had a greater weight loss than multigravids (multiple pregnancies) 5) no report was given on the relationship between postpartum exercise and weight loss.

Olson, Strawderman, Hinton and Pearson (2003) studied gestational weight and postpartum behaviors associated with weight change from early pregnancy to one year postpartum. Of the 622 adult women who responded to the questionnaires in this prospective cohort study, 96% were white. Results suggested that gestational weight gain, frequency of exercise, change in the amount of calories and breast feeding at one year postpartum are significantly related to weight retention. However, no blacks were involved in these studies so questions remain if all of these factors can be generalized to black women.

A major limitation in these studies is the exclusion of African American women. However, several researchers (Greene, Smiciklas-Wright, Scholl & Karp, 1988; Parker& Abrams,1993; Parker,1994; Walker, 1996; Keppel &Taffel,1993; Smith, Lewis,Caveny, Perkins et al,1994; Lederman, 1993; Boardley,Sargent, Coker, Hussey, & Sharp, 1995; Ohlin & Rossner, 1996; Khan, Williamson, & Stevens,1991) have suggested that race, particularly being a black woman, may also be a predictor of postpartum weight retention, but not necessarily gestational weight gain.

Postpartum Weight in African American Women

Race has consistently been associated with postpartum weight gain (Greene et al, 1988; Parker & Abrams, 1993; Parker, 1994; Keppel & Taffel, 1993, Boardley et al, 1995; Khan, Williamson, & Stevens, 1991; Walker, Timmerman, Sterling, Kim, & Dickson,, 2004). Several investigations of weight retention by race revealed that at each level of weight gain, black women reported greater weight retention than white women (Boardly et al, 1995; Smith et al,1994; Scholl, Hediger, Schall, Ances, & Smith,1995; Parker & Abrams,1993) and pre-pregnant overweight women retained more weight postpartum than pre-pregnant normal weight women (Ohlin & Rossner,1990).

Data analyzed from the 1988 National Maternal and Infant Health Survey (NMIHS), a nationally representative sample of mothers with live births, still births, and infant deaths, indicated differences between pre-pregnant weight and weight 10-18 months postpartum (Parker, 1994). Parker reported 1) a median weight retention of 3.4 pounds 2) a small increase in the number of pounds with subsequent pregnancies 3) prenatal (gestational) weight was the strongest contributor to postpartum weight changes and

4) about 40% of the black women participants retained 9 or more pounds postpartum.

In another study, Keppel and Taffel (1993) examined pregnancy-related weight gain and retention and the potential implications of compliance with the 1990 Institute of Medicine (IOM) Guidelines. Data analysis was based on information gleaned from the 1988 NMIHS. A large sample of fairly evenly distributed black and white mothers aged 15 and older who were between 10-18 months postpartum served as respondents. Results showed that postpartum weight was three times greater in black mothers as compared to white mothers, with retained weight of 7.2 lbs (3.3 kg) and 1.6 lbs (0.7 kg) respectively. Further analysis of the 1988 NMIHS indicated that 45% of African American women compared to 25 % white women retained at least 9 lbs at 10-18 months postpartum (Keppel & Taffel, 1993). On the contrary, black mothers typically were noted to gain less weight during pregnancy than white mothers.

Parker and Abrams (1993) investigated differences in postpartum weight retention between 990 black and 1129 white mothers and examined additional factors that potentially related to postpartum weight retention by race. Data were gathered from the 1988 NMIHS to study postpartum weight retention of 20 lbs or more. They found that blacks were not significantly at risk for gaining excessive weight, but had difficulty losing the weight gained. This finding is consistent with the findings of Khan et al (1991) and Walker et al (2004).

Khan et al (1991) examined race and weight change in U.S. women. Results showed support for the belief that black women are not necessarily at greater risk of gaining weight, but rather are less likely to lose weight. Black women were also noted, by Khan et al (1991) to be more likely to gain weight following pregnancy than white women.

Thus, childbearing appears to be more of a detriment for black women than white women.

A recent study (Walker et al, 2004) of 419 low-income women (White, Hispanic, and African American) recruited from the Austin New Mothers Study (ANMS), showed that most women failed to attain their pre-pregnant weight by the 6th week postpartum period. Additionally, African American women showed an increase in postpartum weight as well as difficulty in losing the weight retained. In an earlier study by Walker (1996), the researcher noted that high postpartum weight gains promote the increased risk for obesity related disorders.

Lederman et al (2002) investigated pregnancy associated obesity in black women in New York City. The purpose of the study was to determine weight gain during pregnancy and weight changes postpartum in first time (primiparous) mothers delivering at or near term. Forty-seven black and Hispanic women were interviewed at 2 weeks, 2 months, and 6 months after delivery. The findings revealed that 66% of the women gained excessive weight during pregnancy and at 2 months postpartum, women were found to average 18 lbs above pre-pregnant weight. None of the women reported either additional weight loss by 6 months postpartum or breast feeding beyond 2 weeks postpartum.

Dissimilar results were reported by Gunderson, Abrams, & Selvin (2001). They assessed relationships between gestational gain, race/ethnicity, reproductive history, age, education, and the risk of becoming overweight after pregnancy in 1300 healthy women between the ages of 18-41 years who had a single, full term, live birth, followed by a second birth. The researchers found that only 6.4% of all the women in the study became overweight following the first birth and blacks showed no major differences from whites.

Gestational Weight

Gestational weight has been determined to be the strongest predictor of postpartum weight retention (Ohlin & Rossner, 1990; Walker, 1996; Greene et al, 1988 Schauberger et al, 1992). Gestational weight has been defined as "the difference between pre-pregnancy weight and at the end of pregnancy" (Walker, 2004). According to Lederman, Paxton, Heymsfield, Wang, Thornton and Pierson (1997), the most beneficial gestational weight gain is one that supports the birth of a healthy baby and provides enough postpartum maternal fat stores to sustain lactation without the risk of obesity. Conversely, this retention of gestational weight gain may lead to the development of obesity among women of childbearing age (Siega-Riz, Evenson, & Dole, 2004).

Greene et al (1988) studied postpartum weight change to determine how much of the weight gained in pregnancy would be lost after delivery. Based on data analyzed from 7116 participants who had two pregnancies within a 6 year period, researchers concluded that the more gestational weight a woman gained above the recommended 20lb (9.1 kg), the more she retained by the start of her next pregnancy.

Later, in 1990, the IOM established new recommendations for pregnant women to assure proper fetal development. The cutoff values were based on research regarding gestational weight and infant weight/development. Thus, gestational weight increased in an attempt to decrease the prevalence of low birth weight infants. Unfortunately, these larger weight gains have been associated with the growth of obesity in some populations.

Adverse findings were reported by Lederman et al (1997). They explored fat deposition during pregnancy in women gaining according to the 1990 IOM recommendation and the relationship of weight gain to fat gains in women of different

starting weights as evidenced by body mass index (BMI). Body composition measurements were taken at 14 and 37 weeks of pregnancy from an ethnically diverse sample of 200 healthy women between the ages of 18-36 years. Body fat percentage was estimated. Results indicated that women following IOM recommendations gained fat weight as follows: underweight gained ~7 kg, normal weight 4 kg, overweight 3 kg, and obese 1 kg. Of note, body water was not found to be different among the four groups. Researchers in this study concluded that following the IOM recommendations does not cause obesity.

In 2002, Rooney and Schauberger estimated the impact of excess pregnancy weight gain and failure to lose weight by 6 months postpartum on excess weight 8 to 10 years later. A sample of 540 predominately white (97%) middle class women served as participants. The researchers concluded that overweight in women generally occurs during middle age. However, the most likely time for the development of future weight problems was found to most likely occur in the early adult child-bearing years.

A pilot study conducted by Walker (1996) studied predictors of weight gain at 6 months and 18 months after childbirth in a sample of predominately white (98%) mothers. Respondents of a mail survey included 88 mothers at 6 months postpartum and 75 mothers at 18 months postpartum. Walker found gestational weight gain to be the most important predictor of postpartum weight. Other findings included an average 2-8.4 lbs postpartum weight retention.

Ohlin and Rossner (1990) compared the average weight gain at 1 year postpartum in 1423 of the 2295 women that remained in the Stockholm Pregnancy and Weight Development Study. The average weight gain reported was 0.5 kg (1.1 lb). Thorsdottir

and Bergisdottir (1998) studied 200 Icelandic women to determine different weight gain in women of normal weight before pregnancy. Results showed that high gestational weight gain among women of normal weight prior to pregnancy increased birth weight and women's weight postpartum, compared with moderate weight gain. Researchers concluded that pre-pregnancy weight was more indicative of postpartum weight.

Scholl et al (1995) examined the risks of excessive gestational weight gain against the risk of impaired fetal development in 274 low-income minority women. They found that women with excessive weight gain retained more weight, had higher levels of subcutaneous fat and higher postpartum BMI. Additionally, childbearing adolescent black females were reported to possibly be at greater risk for increased postpartum weight and future adult obesity. This presents a potential problem since there is a greater prevalence of overweight and obesity in African American females.

Lactation and Postpartum Weight Loss

The majority of studies examining the relationship between lactation and postpartum weight loss have been inconclusive. For instance, Parker (1994) noted that weight loss may be enhanced if lactation occurs for at least 6 months postpartum. Yet, Li and Grummer-Strawn, (2002) found that the effects of breastfeeding on weight retention was only noticeable among women who breastfed for 4 months or more and not significantly associated with weight retention. Interestingly, blacks in this study (Li & Grummer-Strawn, 2002) showed significantly lower rate for exclusive breastfeeding at 4 months than whites. Lifestyle factors related to postpartum weight gain and body image in 101 bottle and 106 breast feeding women was explored by Walker and Freedland-Graves

(1998). Data were collected from the predominately white respondents at 4 months postpartum. Findings indicated no association between infant feeding method and postpartum weight gain. In another study, Parker and Abrams (1993) reported that lactation had no significant effect on weight loss. Additionally, Khan et al (1991) found no significant association between breastfeeding and weight loss in the first 6 weeks postpartum. Recently, Kac, Benicio, Velasquez-Mendez, Valente and Struchiner (2004) assessed a cohort of Brazilian breastfeeding women at intervals of 0.5, 2, 6, and 9 months postpartum. In contrast, findings supported an association between prolonged breastfeeding and decreased postpartum weight retention.

In order to examine racial and ethnic disparities in breastfeeding rates, Li and Grummer-Strawn, (2002) compiled and analyzed data from NHANES III. Results indicated that only 26% of African Americans ever breast fed their babies compared to 60% whites. By 6 months postpartum, there was a reduction in rate to 9% for blacks compared to 27% for whites. However, the effects of infant feeding methods in African American women and weight loss postpartum has not been extensively examined to determine if breastfeeding offers a protection against weight retention (Khan et al, 1991).

Parity

The higher risk of parity related weight retention in African American women compared to white women has been well documented in the literature (Wolfe et al, 1997; Parker & Abrams, 1993; Manson et al, 1994; Smith et al, 1994; Keppel & Taffel, 1993; Rosenberg et al, 2003; Weng, Bastian, Taylor & Moser, 2004). Parker and Abrams (1993) indicate high parity associated with postpartum weight retention in black women.

The 5 year prospective CARDIA study (Smith et al, 1994) also shows parity as a positive factor for postpartum weight retention in black women. Manson et al (1994) explored parity, ponderosity, and the paradox of a weight-preoccupied society. African American women of child-bearing age were found to be at high risk for obesity. The researchers conclude that the reproductive history of women may assist in the explanation of the excessive obesity rate among African American women.

In the CARDIA study, Smith et al (1994) examined the longitudinal association between a pregnancy and persistent changes in adiposity in young black and white women. Participants of this 5 year prospective study included 2788 women (53% black) between the ages of 18 and 30 years. Findings showed that black women demonstrated greater adverse changes in adiposity than did white women at each level of parity. This was supported by cross-sectional studies which indicated that black women weigh more at each level of parity and are more apt to retain greater postpartum weight (Keppel & Taffel (1993) and Parker& Abrams (1993)). Smith et al (1994) further noted that primiparous (first pregnancy) black women gained 3.3 kg (7.2 lbs) more than did black women who were nulliparous (no pregnancies). Black women were shown to gain almost twice as much as white women in general. Black women had larger waist to hip ratio (WHR) than white women (Smith et, 1994).Wolfe et al (1997) examined the association between parity and body weight. Data collected from NHANES III included 5,707 female respondents. Results indicated that the average amount of weight gained postpartum in white women, was 1.1 lb (0.5 kg) per child; however, this value was found to be higher in black women between the ages of 18 and 45 years. Rosenburg et al (2003) prospectively assessed the influence of bearing a first, second, or later child on weight gain among

African American women in the context of other risk factors. Respondents to mailed questionnaires included 11,196 African American women between 21 and 39 years of age who were parous (had children) or nulliparous (no children). Changes in BMI were assessed during the 4 year Black Women Health Study. Results showed an average BMI increase of 1.6 kg/m². Primiparous women appeared to gain more than nulliparous and/or multiparous. Weng and colleagues (2004) studied associations between the number of children and obesity in 4523 mostly obese African American couples participating in the Health and Retirement Study. Findings indicated a 7% increased risk of obesity with each child. Results support the hypothesis of increased weight with parity. Walker (1996) found that in predominately white women, parity was associated with a gain of 1.2 lbs with each birth.

Smoking

Smoking during postpartum was found to be associated with a decrease in postpartum weight gain and smokers experienced greater weight loss at 6 months postpartum as compared to non-smokers (Schauberger et al, 1992). Moreover, cessation of smoking was found to lead to increased postpartum weight gain (Ohlin & Rossner, 1990). However, smoking was reported to be less in black women than white women (Boardley et al, 1995) which may lead to weight gain.

Body Image

Predominately white bottle feeding mothers with high weight gain were found to have a greater intake of fat calories, less physical activity and increased body

dissatisfaction (Walker & Freedland-Graves, 1998). Conversely, Morin, Brogan and Flavin (2002) studied attitudes and perceptions of body image in postpartum African American women. Results showed that all of the 45 African American participants, regardless of size, perceived themselves to be larger than they actually were. However, they had high positive attitudes toward their bodies.

Summary

Gestational weight has been identified in the literature as the most significant predictor of postpartum weight retention. However, among black women, race may be the most important factor. Investigations of postpartum weight retention by race revealed that at every level of weight gain, black women reported retaining more weight than white women (Boardley et al, 1995; Smith et al, 1994; Scholl, 1995; Parker & Abrams, 1993) and overweight women retain more weight than normal weight (Ohlin & Rossner, 1990). Overall, postpartum white women were more likely to breastfeed, smoke, exercise, consume less fat calories, be less parous, have greater body dissatisfaction, and retain less weight than postpartum black women. Thus, Keppel and Taffel (1993) suggested that in addition to advice about how much to gain during pregnancy, black women should be given advice concerning weight loss following delivery. Clearly, more studies are warranted for a better understanding of weight retention among black females during the crucial postpartum period.

The apparent excess of weight among African American women, particularly during postpartum periods, poses an interesting question which provides the framework for this study.

Physical Activity and Postpartum Obesity

Physical Activity and Postpartum Weight Retention

According to James O. Hill (1997), "physical activity is a major determinant of fat balance, and obesity is a result of a positive fat balance". Hill further noted that physical activity levels were directly related to total energy expenditure; therefore, physical activity should be an important factor in the regulation of weight especially in special populations. However, studies have indicated deficiencies in physical activity in minority populations. For example, physical activity levels were examined in 64,101 African-American women between the ages of 21 and 69 by Adams-Campbell, Rosenburg, Washburn, Rao and Palmer, (2000). Data collected from mail questionnaires revealed low levels of physical activity in this population. This finding was well supported in the literature (Kumanyika, 1987; Tuten et al, 1995; Jacobson, Morton, Jacobson, Sharma, Garcia, 2002; Breitkoph & Berenson, 2004; Sanchez-Johnson et al, 2004; Railey, 2000) and mirrored in a study (Boardley et al, 1995) that reported postpartum physical activity levels in African American women.

Six studies (Leermakers, Anglin & Wing,,1998; O'Toole et al, 2003; Sampselle, Seng,Yeo, Killian & Oakly, 1999; Ohlin & Rossner, 1994 ; Schauberger et al, 1992; Boardley et al, 1995) focusing on postpartum weight and physical activity were found in the literature. Two studies were intervention studies (Leermakers et al, 1998 and O'Toole et al, 2003) and 4 were based on self-report. Schauberger et al (1992) was the only study to report no effect between physical activity and postpartum weight.

Of note, in 5 out of these 6 studies, African American (AA) participation was low or non-existent (Leermakers et al (1998) had 3 AA of 90 sample total; O'Toole et al (2003) 1 AA of 39 sample total; Sampselle et al (1999) 30AA of 1003; Ohlin & Rossner (1994) (zero) 0 AA of 1423; Schauberger et al (1992) (zero) 0 AA of 795). Boardley et al (1995) was the only study found in the literature that had acceptable African American representation (224AA of 345 total sample).

In a randomly assigned intervention study, Leermakers, Anglin and Wing (1998) examined whether a six months correspondence behavioral weight control program delivered in the postpartum year could help women return to their pre-pregnancy weight. Ninety women, 97% white, who had given birth within 3 to 12 months, were non-lactating, and who had exceeded their pre-pregnancy weight by at least 6.8 kg were included in the study. The control group (n=43) were given brochures and participated in assessments at the beginning of the study and 6 months later. The intervention group (n=47) received correspondence materials, telephone contacts and educational sessions which focused on diet and exercise. Results indicated that women in the correspondence group lost 79% of their excess postpartum weight as compared to 44 % weight loss in the control group. This study, however, failed to consider exercise without dietary changes and to include African American postpartum women.

Schauberger et al (1992) examined weight loss during the puerperium (< 42 days post delivery) and correlated this weight loss with pregnancy data and postpartum behavioral characteristics. Of the 795 women who participated in the study, 97% were white and 3% were South Asian. Results, based solely on self-report from the white participants, showed that physical activity was not related to weight loss during the early

postpartum period. Conversely, Ohlin and Rossner (1994) studied 1423 women participants of the Stockholm Pregnancy and Weight Development Study and found an inverse relationship between postpartum weight and physical activity levels.

In another experimental study, O'Toole et al (2003) investigated the impact of a structured intervention of diet and physical activity initiated during the first 6 months postpartum on weight retention. Forty women (39 white and 1 black) between 6 weeks and 6 months postpartum were recruited for the randomized clinical trial. The women were randomly assigned to either a structured diet and physical activity group or a self-directed diet and physical activity group with a goal of a 500 calorie deficit per day. Women in the structured group successfully lost more fat weight compared to the self-directed group in this one year study.

Sampselle, Seng, Yeo, Killian, & Oakly (1999) conducted an exploratory investigation of physical activity and postpartum well-being. The purpose of their study was to describe reported patterns of postpartum physical activity and to identify benefits or risks associated with postpartum physical activity at 6 weeks postpartum. One thousand and three women (90.1% white, 6.9% Asian and 3% African American) completed a questionnaire at 6 weeks postpartum. Weight retention at 6 weeks postpartum was found to be about 4.8 kg (10.6 lbs). The investigators noted that women with higher levels of activity retained less weight (3.9 kg/ 8.6 lbs) than their less active counterparts (5.1 kg/ 11.2 lb).The researchers concluded that women with high levels of physical activity retained less weight at 6 weeks postpartum. Although low in black participants, the authors suggested that from a cultural standpoint, some African Americans may value rest over physical fitness during the early postpartum period.

Boardley et al (1995) was the only study found that included a large sample of African American women. They studied the relationship between diet, activity and other factors, with postpartum weight change by race. Their purpose was to identify the impact of dietary intake and activity levels on postpartum weight change. Survey respondents included 224 black and 121 white women who were 7 to 12 months postpartum and were participants in the Special Supplementation Feeding Program for Women, Infants, and Children (WIC) in South Carolina. Data collected over a 4 month period revealed that black women had a greater intake of fat calories and less physical activity than white women; and that pre-pregnancy physical activity predicted postpartum weight loss better than postpartum physical activity. The authors concluded that increased postpartum weight among black women was related to higher postpartum energy intake, higher dietary calories from fat and low levels of physical activity. These findings agree with other studies that have reported that black women consume a diet high in fat calories and engage in less physical activity than white women.

Rossner (1999) reviewed the literature for a relationship between physical activity and weight development during and after pregnancy and found that most studies focus on physical activity during pregnancy with special attention devoted to the well-being of the child not the mother. McCrory (2000) and Larson-Myer (2002) reviewed the literature and agree that most of the studies addressing the influence of physical activity on postpartum weight were based solely on observation and self-report. Moreover, these studies lacked African American representation. McCrory further stated the need for experimental studies to provide more conclusive results.

Overall, researchers agree that little is known and limited information is available about the effects of physical activity on postpartum weight retention (Wolfe et al, 1997; Greene et al, 1988; Shauberger et al, 1992; Larson-Meyer, 2002; Sampselle et al, 1999; McCrory, 2000; Rossner, 1999).

Barriers

The postpartum period has been associated with many lifestyle concerns that raise the level of perceived barriers to physical activity. These challenges include work schedules, time constraints, house care, lack of social support (Ainsworth et al, 1993), physiological changes and overall responsibility for a newborn (Sampselle et al, 1999). Additional barriers noted for black women were lack of access to fitness facilities, lack of equipment and lack of organized groups (Sampselle et al, 1999) which may provide useful information for the treatment of postpartum weight retention in African American women.

Pedometry to Increase Physical Activity

Effective means of promoting increased physical activity and reducing barriers are important to the prevention of obesity and its associated diseases within a population that continues to live increasingly sedentary lifestyles. For the past 30 years, pedometers have been used successfully in Japan to increase physical activity. According to Hatano (1993), North Americans are just now discovering the usefulness in assessing physical activity behavior. Therefore, the simple pedometer is probably an ideal choice for

increasing physical activity in less active populations (Bassett, Cureton & Ainsworth, 2000).

Pedometers are small electronic counters that work by counting the number of steps per day. They are cost effective (Welk et al, 2000) and objective (Bassett et al, 2000; Welk et al, 2000). The pedometer can also provide immediate and direct feedback to the wearer (Freedson & Miller, 2000). The extensive use of pedometers offers potential as a descriptive tool, an outcome measure in physical activity intervention and a possible motivational or interventional tool (Tudor-Locke & Myers, 2001). Furthermore, there are no similar methods that are currently practical, sensitive to ambulatory movement, acceptable to participants, able to provide data, inexpensive (Tudor-Locke & Myers, 2001) and high in participant compliance (Rooney, Smalley, Larson & Havens, 2003).

The uncomplicated/simple design of the step counter eliminates apprehension and makes it user friendly for the wearer. Moreover, the pedometer has been shown to be an effective incentive with other populations including people with type II diabetes (Tudor-Locke, Myers, Bell, Harris & Rodger, 2002) and physical disabilities. The First Step Program, a daily physical activity intervention, serves as a model for pedometer intervention designed to increase walking behaviors in sedentary individuals with type II diabetes (Tudor-Locke et al, 2002). In the First Step Program, a timed self-paced walk while wearing the pedometer allowed for the conversion of steps per day to time in minutes per day. Participants were found to significantly improve their walking behavior during and post-intervention. Pedometers have also been used as a monitoring device in many other studies targeting special populations. These studies focused on individuals 1) receiving breast cancer treatments (Curran, Beacham, & Andrykowski, 2004) (Rogers et

al, 2005), 2) with metabolic syndrome (Chan, Spangler, Valcour & Tudor-Locke, 2003), 3) who are pregnant (Lindseth & Patty, 2005), 4) who are aging (King et al, 2003), 5)who suffer from fibromyalgia (www.Hopkins-arthritis.org), 6) with peripheral arterial occlusive disease (Sieminski, Cowell, Montgomery, Pillai, & Gardner ,1997), 7) with chronic lung disease (Schönhofer, Ardes, Geibel, Köhler & Jones, 1997) and 8) osteoarthritis (Talbot, Gaines, Huynh & Metter, 2003). Furthermore, physicians are beginning to use the pedometer in conjunction with counseling and health promotion handouts as a means of increasing walking activity in their patients (Stovitz, VanWormer, Center & Bremer, 2005). Additionally, Sequeira, Rickenbach, Wietlisbach, Tullen & Schutz (1995) found the use of the pedometer to be helpful in identifying patterns of daily activity in free-living populations.

Steps/ day

Pedometer research has indicated a target goal of 10,000 steps a day as a means to achieving public health recommendations for physical activity (Bassett et al, 2000; Hatano, 1993; Welk et al, 2000). This target may provide an opportunity to determine clinical significance related to public health recommendations to accumulate 30 minutes of moderate physical activity on most if not all days of the week (Pate et al, 1995). However, information gathered from the ACSM "Walking and Measurement" Conference held at the University of Illinois, Urbana-Champaign, IL October 13-15,2005 indicated that 10,000 steps does not address intensity as does the ACSM-CDC recommendations. Still, both recommendations were stated to require lifestyle changes particularly in sedentary individuals. Y. Hatano (personal communication, October 14,

2005 ACSM "Walking and Measurement" Conference held at the University of Illinois, Urbana-Champaign, IL.) suggested that "intentional walking" of specific steps per day coupled with daily routine walking (normally 4000 steps per day) would increase the number of steps taken daily. Rooney et al (2003) found that simply knowing the number of steps/per day provided by the pedometer, does lead to increased physical activity. However, the question remains "how many steps are enough?". In an attempt to answer this question, Tudor-Locke and Basset (2004) found 10,000 steps to be reasonable for apparently healthy adults but not sustainable or attainable for some populations, including older adults and those with chronic disease. Their proposed indices for public health are: <5000 steps/day for sedentary, 5000-7499 steps/day for low active, 7500-9999 for somewhat active, > /= 10,000 steps/day for active and > 12, 500 steps/day for highly active adults. Moreover, Tudor-Locke & Myers (2001) established norms of 3,500 -5,000 steps/day for individuals with disabilities and chronic diseases. Ironically, Henderson, Ainsworth, Stolarzcyk, Hootman & Levin (1999) reported similar values in healthy U.S. ethnic minority women.

Given the current epidemic of obesity, researchers conclude that the low activity levels in African-American women should send a message to take action.

Summary

After childbirth, most women have increased concerns about retained weight and returning to normal weight. Gunderson (1999) noted that some of the factors likely to influence postpartum weight include dietary intake, lactation, smoking, and physical activity. Rosenberg et al (2003) agreed that a low level of exercise was a strong predictor

of postpartum weight gain. Moreover, postpartum women have been reported to display physical inactive behaviors of eating, sleeping, standing still, sitting, and television viewing (Dietz, 1996; Ainsworth et al, 1993), and by 6 weeks postpartum, have established a routine that fails to be inclusive of regular physical activity (McCory, 2000). Furthermore, extended periods of reduced physical activity may establish a sedentary lifestyle (Wilkinson et al, 2004) and possibly exacerbate postpartum depressive symptoms (Boury et al, 2004). Walker et al (2004) also suggested that ethnic differences in retained weight may emerge between 6 weeks and 6 months postpartum. Even though the benefits of regular physical activity have been well established for the general population, exercise recommendations have seldom been included as part of the postpartum care plan (Sampselle et al, 1999) and the immediate postpartum period may be a more crucial time for increased physical activity in African American mothers.

Of the six studies investigating the influence of postpartum physical activity on weight retention four have been retrospective and dependent on self-reported data and only two used random assignment. Still, findings of 5 of the 6 report a negative correlation between physical activity and postpartum weight. One study (Schauberger et al, 1992) found no effect; however, the postpartum interval involved in the study was during the initial 6 weeks following delivery when many physiological adaptations are occurring.

Because researchers agree that an energy imbalance of increased fat intake and low physical activity levels exists more in postpartum black women than white women, one major limitation to most of these studies was the insufficient number of African American participants, thus questioning if findings can be generalized to this population.

Other Variables of Interest

Other variables of interest that exist postpartum include the new mother's psychological and cardiovascular fitness levels and the effect that physical activity may have on these factors.

Postpartum Depression and Physical Activity

Postpartum depression defined by Steiner (1990) as "the development of mood disturbance two weeks to one year after delivery, with symptoms most often found during the third through ninth postpartum months". However, African American women were noted by Amankwaa (2003) to ignore or be secretive of postpartum depressive symptoms mostly because they feared disclosure would result in their children being taken away. Additionally, these women show a tendency to follow cultural traditions such as being a "strong black women", "superwoman", or "good mother" (Amankwaa, 2003). Walker et al (2004) found higher depressive symptoms reported from African American women at 6 weeks, 6 months, and 12 months postpartum. These researchers also found low levels of physical activity and higher weight gain in this group. In another study, Koltyn and Schultes (1997) noted positive psychological effects in postpartum women with one bout of aerobic exercise.

Boury, Larkin and Krummel (2004) explored the relationship of depressive symptoms in low-income women to psychosocial and lifestyle variables in postpartum women. They found that stress and social support were the major factors related to postpartum depressive symptoms. Further stressed was the need for stress management

including increasing physical activity levels. This recommendation is supported by the American College of Obstetrics and Gynecology (ACOG). The ACOG notes that a return to physical activity postpartum has been associated with lower incidence of postpartum depression but only if the exercise is stress relieving not stress provoking. Suggested exercise prescription included the ACSM recommended 30 minutes a day of moderate activity on most or all days of the week.

Cardiovascular Responses Postpartum

It is well known that physiological changes occur during pregnancy, including changes in cardiovascular function. However, little has been reported regarding cardiovascular responses postpartum.

Capeless and Clapp (1991) wanted to know when pregnancy related cardiovascular parameters would return to their preconception levels. The purpose of their investigation was to determine if the postpartum period is indicative of a mother's cardiovascular status before she became pregnant. Thirteen women participated in serial studies pre-pregnancy and at 6 and 12 weeks postpartum. They found that stroke volume and end-diastolic volume were constantly higher than pre-conception values at 6 weeks and 12 weeks. Vascular resistance was noted to be lower at 12 weeks postpartum. The researchers concluded that stroke volume and end-diastolic volume failed to return to pre-pregnancy baseline at 12 weeks postpartum; however, there continued to be a reduction in systemic vascular resistance.

In 1997, Capeless and Clapp investigated cardiovascular function before, during and after the first and subsequent pregnancies. Estimates of heart rate, cardiac output (CO),

arterial pressure, left ventricular volumes, and vascular resistance were gathered pre-pregnancy, at 8 week intervals during pregnancy, and at 12, 24, and 52 weeks postpartum in 30 women. Mean arterial pressure (MAP) was calculated using the sum of diastolic blood pressure and 1/3 pulse pressure. Heart rate was measured at the same time as the ventricular sizes from electrocardiogram or ultrasound trace and systemic vascular resistance was calculated (MAP/ CO x 80). Results indicated steady increases in all measured values except vascular resistance (which decreased) until delivery. Heart rate returned to baseline by 12 weeks postpartum and was maintained throughout the first year. Other values were shown to gradually return to baseline; still, they continued to be significantly different compared to preconception values up to 52 weeks postpartum.

Sady et al (1990) investigated the cardiovascular response at rest and during upright cycle exercise. Nine women were tested on three occasions, during their 2nd trimester (~26 weeks gestation), 2 and 7 months postpartum. Results of this study found that resting cardiac output, heart rate and stroke volume were higher before labor than at 2 and 7 months postpartum. Testing consisted of a 10 minute rest period on the cycle followed by three consecutive 6 minute power outputs of 0, 30, and 60 watts which was noted to be approximately 30%, 50%, and 70% maximal aerobic power. Cardiac output during submaximal cycle testing was shown to be greater during pregnancy than postpartum. Submaximal pregnancy heart rate and stroke volume were higher, in general, than at 7 months postpartum. This study concluded that during exercise the enhanced antepartum cardiovascular responses of cardiac output, stroke volume and heart rate are lower by 2 months postpartum and more time may be needed for complete return of these cardiovascular changes caused by pregnancy.

Generally, clinical exercise testing reported during pregnancy or postpartum involved a submaximal cycle test and occasionally treadmill protocols (Lovelady, Garner, Mareno, and Williams, 2000; O'Toole et al, 2003). While investigating the effects of weight loss in overweight lactating women on the growth of their infants, Lovelady et al (2000) tested the cardiovascular fitness of 40 overweight postpartum participants. A modified Balke protocol was used following the guidelines of the American College of Sports Medicine (ACSM). Data were collected at baseline (4 weeks postpartum) and at the end of the study (14 weeks postpartum). Tests were terminated when the participant reached 85 % of predicted maximal heart rate (220-age) or maximal heart rate reserve ((220-age) – (resting heart rate (RHR)) x (0.85)) + RHR. Predicted oxygen consumption was calculated using the ACSM walking equation (3.5 ml/kg/min + (0.1 x speed (m/min)) + (1.8 x speed x % grade)). An exercise prescription was then established consisting of 45 minutes of aerobic activity, 4 days a week at 60-80% heart rate reserve. At the end of the 10 week study, participants in the experimental and control groups showed 13% and 2% increases respectively in their predicted maximal oxygen consumption thus improving cardiorespiratory fitness levels.

O'Toole et al (2003) used a graded maximal exercise test (GXT) to assess cardiorespiratory fitness in 40 postpartum women by measuring peak oxygen uptake (VO2 peak) with standard ACSM indications for termination. The GXT was initially set at a zero percent grade and elevated 2% in 2-minute stages. This was performed as part of a larger study that investigated structured physical activity and the prevention of postpartum weight retention. This experimental study consisted of two groups, experimental (structured) and control (self). The structured group received an

individualized activity of moderate intensity monitored by heart rate. Results revealed that cardiorespiratory fitness in relative units (ml/kg/min) was increased in the structured group as compared to the control group; however, no significant difference was noted in either group with reported absolute units (ml/min) at 12 weeks and one year postpartum. The structured physical activity group was found to be successful in losing weight at a rate of approximately one pound per week for the first 12 weeks tapering up to one year postpartum. The greatest limitation of this study was reportedly the retention rate.

Although the relationship between increased physical activity and postpartum mood/depression as well as postpartum cardiovascular responses were examined, these factors were not the major focus of this study. However, information gleaned may lead to further investigation of these variables during the postpartum period.

Having completed the review of the literature the next section details the research method.

III. METHODS

The purpose of this study was to determine if the use of the pedometer increased walking (physical activity) in African American women who were between 6 weeks and 6 months postpartum. A second purpose was to investigate the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest: 1) weight retention and body composition; 2) mood and depressive symptoms and 3) resting heart rate and resting blood pressure in this sample. This chapter presents the methods used to explore these relationships and will discuss: 1) participants 2) pre-test 3) forms 4) anthropometric measures 5) cardiovascular fitness testing 6) intervention 7) data collection and 8) statistical analysis. This project was approved by the Institutional Review Boards (IRB) of Auburn University and Alabama State University.

Participants

Thirty-two postpartum African-American women between 18 and 40 years of age from the south central region of Alabama volunteered to be participants in this 12- week correlation study. New mothers meeting inclusion criteria were between 6 weeks and 8 weeks postpartum, had a BMI of ≥ 1.0 above self-reported pre-pregnancy BMI of ≥ 24, had a normal vaginal delivery, had a single viable birth (no twins, triplets, etc.) , were non-breast-feeding, non-smoker, free from major chronic disease, had a least a high school education, were sedentary (exercise less than 30 minutes a day 5-7 days per week)

and had no contraindications for a low to moderate physical activity program. All eligible women were recruited through flyers, area university/college campuses e-mail, church announcements, newspapers, radio, television, postpartum support groups (i.e. Mocha Moms) and word-of-mouth. Flyers were distributed to the offices of area obstetricians/ gynecologists, pediatricians and Women Infants and Children (WIC) counselors. Flyer placement was also included at neo-natal hospital wards, day-care centers, nurseries, child-birthing classes, merchant bulletin boards, area university/colleges and local military bases.

Table 1. Characteristics of Participants (n=31)

Characteristic	Mean	SD	Range
Age (yrs)	29.58	5.188	19-36
Height (in)	64.33	2.623	60.25-69.25
Weight (lbs)	189.29	41.25	142-281
BMI(kg/m²)	32.13	5.837	24.5-41.2
Family Income*	3.87	1.821	1-6

*Family Income ($K)
1=10-19
2=20-29
3=30-39
4=40-49
5=50-59
6=60-60+

Pre-test

Prior to testing, 1) the ambient temperature of the lab was set to 72º F, 2) a calibration check was performed on equipment used, 3) all equipment and forms were organized and set for a continuous flow. To address the barrier of child-care, participants were pre-screened for inclusion criteria and given American College of Sports Medicine (ACSM) standard pre-test instructions via phone.

Forms

The women were greeted and given an overview of the study. Women that met the inclusion criteria were asked: 1) to read and sign an Alabama State University approved IRB informed consent form 2) to read and sign a physical activity readiness questionnaire (PAR-Q) and 3) to complete an investigator administered form that included the following sociodemographic data: age, education, income, employment, marital status, number of children, pre-pregnancy weight, gestational weight and infant feeding method as well as an exercise history (Appendix B).

Mood and Depressive Symptoms

Additional forms for this portion of the study included the completion of two psychological questionnaires (Appendix C).The psychological tests were administered in the following order: Profile of Mood States (POMS), a highly reliable (McNair, Lorr, & Droppleman, 1981) 65 item self -reported questionnaire that is designed to measure six dimensions of mood, including tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment; and Beck Depression Inventory (BDI), a highly reliable (Beck, Steer & Garbin, 1988) 21 item self-report rating inventory measuring characteristic attitudes and symptoms of depression in adolescents and adults. The women completed the POMS with responses based on "how you feel right now" and the BDI with responses based on "how you have been feeling for the past few days". Based on a Likert scale of 1 (not at all) to 5 (extremely), the total scoring for POMS is determined by subtracting the "vigor-activity" score from the sum of the other

five dimensions. BDI is computed from the sum of the scores selected by the participant in response to each question. The mothers were informed of the confidentiality of their responses.

Anthropometric Measures

Height was measured without shoes to the nearest ¼ inch and weight to the nearest ¼ pound using a Detecto® stadiometer/balance scale (www.detecto.com). These measures were converted into metric units of centimeters and kilograms, respectively. Body mass index (BMI: kg/m^2 ($weight/height^2$)) was then calculated. Waist and hip circumferences were measured to the nearest ½ cm with a standard flexible tape measure to assess body fat distribution. The mothers were instructed to stand with abdominal muscles relaxed. Waist circumference was measured at the narrowest part of the torso (above the umbilicus and below the xiphoid process); hip circumference at the maximal girth of the buttocks-hip area, above the gluteal fold.

Cardiovascular Fitness Testing

A modified Balke protocol using the 85% predicted maximal heart (HRmax) method estimated the individual cardiovascular fitness level at baseline and at the end of the 12 week study. This test was also utilized to determine the time period for each of the mothers to reach the predicted target heart rate (time to target (TTT)). The test was performed on a *CATEYE EC-T220 Fitness Treadmill* (Cateye Cycling & Fitness Manufacturing of Japan) with heart rate display and 12 % maximal incline. The women were fitted with a Cateye MSC wireless single lead heart rate monitor and the electrode

placed over the xiphoid process. A general overview of the test was then explained to the new mother (Appendix B). The explanation for monitoring intensity included ACSM instructions for subjective Ratings of Perceived Exertion (RPE) response gleaned from a large wall poster. According to the ACSM guidelines, RPE is a reliable gauge for monitoring exercise tolerance. For safety, the women were asked to straddle the treadmill in preparation to begin the test. After a 3 minute warm-up period on the treadmill at 0% grade, the speed was increased to the most comfortable walking speed that could be maintained without discomfort or abnormal gait pattern. Every two minutes the incline of the treadmill was increased by 2.5 percent. Following ACSM criteria, testing continued until the target heart rate (85% predicted HR max) was reached or the subject asked to terminate the test. At each two minute stage, the heart rate (HR) and RPE, based on a revised Borg's scale of 1-10 (0= not tired to 10 = exhausted), were recorded. Upon reaching the target heart rate goal, the time was recorded. The incline was lowered to 0% and the speed gradually decreased to zero over a four minute time frame. Heart rate was continually monitored and recorded at the end of each minute. After the 4 minute cool-down period, an immediate post-exercise blood pressure was taken while standing on the treadmill. This was followed by two consecutive two minute intervals in which blood pressure and heart rate were monitored in seated position to assess satisfactory recovery and stabilization.

Intervention

The general purpose of the study was explained to each subject. A Yamax Digiwalker SW-200 pedometer (step counter) (New-Lifestyles, Inc. /

DIGIWALKER.com) was given to the mother. The women were shown how to set and reset the step counter to zero. The pedometer attachment was placed at the waist centered over the dominant foot. Women with greater abdominal girth were instructed to place the pedometer on their waist at the axillary line in order for the instrument to maintain an upright position. The mother was informed that if she wears clothing that does not have a waist site suitable for attachment, it is suggested by the investigators at the Cooper Institute of Aerobics Research in Dallas, Texas that the pedometer be placed on the waist ban of the undergarment. Prior to monitoring, the subject evaluated the pedometer's performance and accuracy during three brief walking trials as recommended by McClung and colleagues (2000). Each trial consisted of resetting to zero and walking while verbally counting a predetermined number of steps (50 steps). Pedometers were then checked for accuracy. The women were instructed to wear the pedometer daily for a total of 12 weeks excluding times of bedtime and bathing. The mothers received a structured physical activity pedometer program. All physical activity was performed at the convenience of the participant. Participants were instructed to wear the pedometer for three days, record the numbers of daily steps and calculate an average before changing their normal ambulatory routine. Participating individuals received a telephone call or e-mail on the third day of the study to obtain the average number of steps taken daily. This served as a pedometer baseline value.

The women were instructed to intentionally increase their average number of steps by at least 500 steps each week. Additionally, a target of 5000 steps per day (Hultquist, Albright & Thompson, 2005) at the American College of Sports Medicine (ACSM) recommended frequency of 3 to 5 days per week was given to encourage an increase in

ambulatory activity. Printed suggested methods to increase daily steps and prevent relapse were thoroughly explained/ demonstrated and included the use of audio and video walking tapes, music, and other ambulatory activities (Appendix A). Additional instructions were given for maintaining an accurate activity log. As suggested by Tudor-Locke and Myers (2001) steps per day were recorded on activity calendar (log). Activity calendars also served as an individual reminder of future scheduled follow-up dates. The women were encouraged to adhere to their physician's advice regarding dietary intake during the postpartum period and make no changes during the study. A printed "take home instruction" sheet, with contact information, was handed out to each participant as a reminder of what to do in the study (Appendix B). Incentive gifts were given to each of the mothers. These gifts included a less expensive pedometer so that the women could walk with a buddy (social support) and two AA batteries to be used with a new portable CD player with headphones to help them get started and stay motivated. Throughout the study, contact was made by phone/ e-mail every two weeks. At week four, participants received a motivational letter (Appendix A) by postal mail informing them of their individual expected four week goal and a CD with current upbeat music suitable for moderate walking. At week eight, a second motivational letter (Appendix A) was sent informing them of their individual expected 8 week goal and a "Walk Your Way Slim" video (Prevention Fitness Systems distributed by Anchor Bay Entertainment, Troy MI 48084). The week 8 letter also included a reminder of when to schedule their follow-up session. All initial measurements were reassessed at the final session week 12. All pedometers and activity calendars with self-reported data were collected at the end of the study.

Data Collection

Data were collected during two sessions: pre and post study (12 wks). The pedometer was reset to zero at the beginning of each day. Participants recorded the pedometer readings (steps/day) on a calendar provided by the researcher. This allowed for daily and weekly totals to be attained and examined later for day to day variability. Primary data of height, weight, BMI, waist and hip girth as well as WHR (ratio) were assessed at the initial session and at the end of the study (week 12). Additionally, secondary data of resting heart, resting blood pressure, time to reach predetermined target heart rate (TTT), scores from Profile of Mood States (POMS) and Beck Depression Inventory (BDI) scores were collected.

Data Reduction

An average of the first three days of normal ambulation served as an individual baseline. Step counts based on a minimum of 36 out of 84 days (3 days x week for 12 weeks) of wearing the pedometer served as the validation measure. Pre and post values of the dependent variables were averaged in order to determine the mean differences over time. These mean differences were correlated with the average change in steps taken per day to determine the existence of significant relationships. The magnitudes of effect were estimated by dividing the mean differences by the pre mean values.

Statistical Analysis

Change in Physical Activity

Data were analyzed using a paired-sample t-test. The principal data analysis assessed the difference between the average steps/day before the study and the average steps/day after the study (12 weeks). Data analysis was performed using SPSS (Version 14.0). An alpha level was established at $p<0.05$ for statistical significance.

Physical Activity: 1) weight retention and body composition; 2) mood states/depressive symptoms; and 3) cardiovascular values

Data were analyzed using Pearson Product Coefficient. The principal data analysis assessed the relationship between changes in physical activity (average steps/day) and 1)body mass index (BMI) as well as waist to hip ratio (WHR); 2) POMS (postpartum mood states) as well as BDI (postpartum depressive symptoms); 3) changes in a) resting heart rate (RHR) b) resting blood pressure (RBP) and c) time to target (TTT). The independent variable of changes in physical activity was quantified using self-reported steps per day determined from the pedometer values. A secondary analysis used a paired-samples t-test to assess the 1) pre and post differences in weight, BMI, waist girth, hip girth, WHR; 2) pre and post changes in physical activity, POMS scores and BDI scores; 3) pre and post changes resting heart rate, resting blood pressure and time to target; and 4) average steps/day. The magnitude of effect was estimated by dividing the mean difference by the pre mean value. Data analysis was performed using SPSS (Version 14.0). An alpha level was established at $p<0.05$ for statistical significance

IV. RESULTS

This chapter presents the findings of this research. The results are divided into four sections. The first section reports the change in physical activity followed by three sections which individually address the areas of interest.

Characteristics of participants

A sample group of 32 apparently healthy postpartum African American females, 18-40 years of age (M = 29.58, SD = 5.188), met the inclusion criteria to participate in this study. One dropped out of the study due to relocation out of state. Therefore, the results reported are based on 31 participants that have completed the 12 week study. To avoid the possible confounds of daily biovariations pre and post study, participants were individually scheduled for lab assessments at the same time of day (morning: 9am-12 noon, afternoon: 12pm-5pm and evening: after 5:00).

Changes in Physical Activity

To determine the use of the pedometer to increase walking in African American women who were between 6 weeks and 6 months postpartum, the difference between the average number of daily steps taken at the beginning and end of this study was analyzed using a paired-samples t-test. Results revealed a significant difference in the average steps/day scores before and after the study (Mean difference = 3402, SD= 2309

t (30) = -8.204, p < .001). This indicates that the mean average steps/day after the study (M= 8749, SD = 2864) was statistically significantly higher than the mean before the study (M = 5347, SD = 2380). An alpha level was established at the 0.05 level (Figure 1). The magnitude of effect indicated a 63.6 % increase in the average number of steps taken per day by postpartum African American women over the 12 week study period.

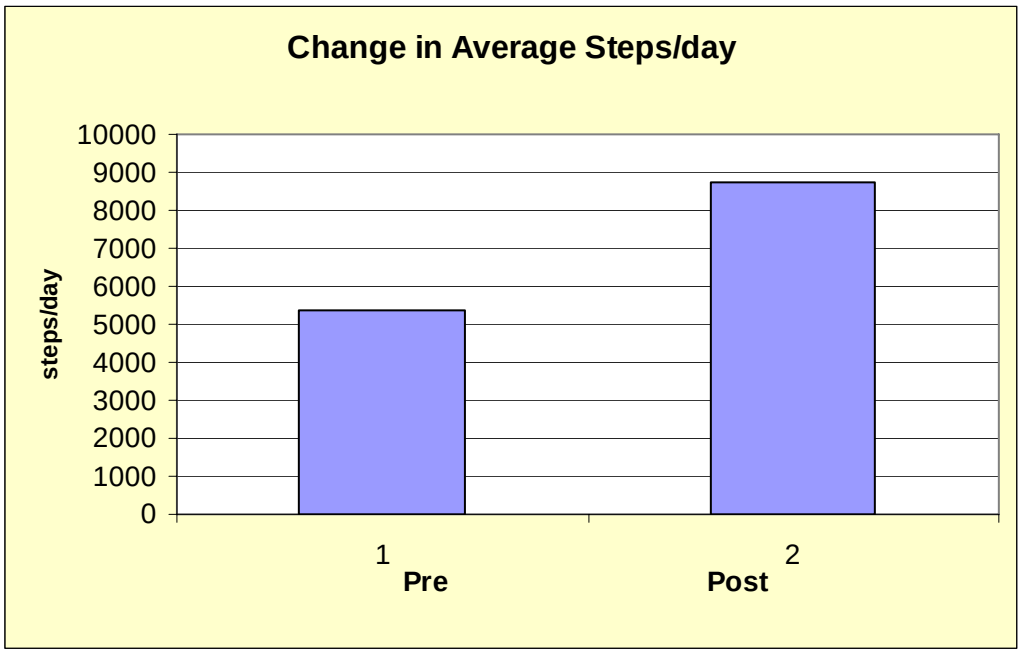

Figure 1. Average steps/day before and after the 12 week physical activity intervention (p < .001).

Physical Activity: postpartum weight and body mass index

A bivariate correlation analysis was used to determine if there was a significant relationship between increased physical activity and changes in body mass index (BMI) of African American women who were between 6 weeks and 6 months postpartum. Analysis revealed that a moderate correlation between the change in average steps taken per day and the change in BMI was statistically significant and in the expected inverse direction ($r = -.543$, $p < .002$) (Figure 2). This negative relationship failed to support the null hypothesis. A calculated coefficient of determination showed a shared variance between the change in average steps and change in BMI, $r^2 = 0.295$.

A paired samples t-test revealed a statistically significant difference in body mass index (BMI) before and after the 12 week pedometer based physical activity intervention, $t(30) = 4.967$, $p < .001$. This indicates that the mean BMI after the physical activity intervention was significantly lower than the mean before the intervention (Mean difference = .8297, SD = .9300) (Figure 3). To investigate further, a second correlation was performed between the change in average steps/day and the change in weight (kg). Correlation results indicate a statistically significant inverse relationship between change in steps and change is weight ($r = -.597$, $p < .001$) (Figure 4) and an r^2 value of 0.356.

Additionally, a paired samples t-test revealed a statistically significant difference in weight (kg) before and after the 12 week pedometer based physical activity intervention, $t(30) = 3.970$, $p < .001$. The results indicate that the post mean weight (kg) was significantly lower than the mean before the intervention (Mean difference = 2.118, SD =

2.970) (Figure 5). An estimate of the magnitude of the effect showed a 2.5 % decrease in postpartum weight (kg) as a result of increased physical activity.

These analyses provide evidence that the pedometer driven intervention was effective in leading to a reduction in weight (kg) retained and BMI in this sample.

Physical Activity: waist to hip ratio

Bivariate correlation was used to establish if there was a relationship between increased physical activity and waist/ hip ratio (WHR) of African American women that are between 6 weeks and 6 months postpartum.

While the correlation between change in average steps/day and change in WHR was not significant ($r = .124$, $p < .508$) (Figure 6), a fairly moderate significant negative correlation existed between change in average steps/day and change in hip circumference (cm) ($r = -.447$, $p < .012$) (Figure 7). The amount of shared variance accounted for between these variables was found to be 0.20. No significant association was found between change in average steps/day and change in waist girth (cm) ($r = -2.46$, $p <.183$) (Figure 8). Upon further investigation, a statistically significant correlation was found in the positive direction between change in waist circumference (cm) and change in weight (kg) ($r = .574$, $p < .001$) (Figure 9) and 33% of the variance in waist girth was accredited to weight change.

A paired samples t-test revealed a significant difference in waist circumference (cm) before and after the 12 week pedometer based physical activity intervention, $t (30) = 5.083$, $p < .001$. This implies that the mean waist girth (cm) after the physical activity intervention was significantly lower than the mean before the intervention (Mean

difference = 4.508, SD = 4.938) (Figure 10). An estimate of the magnitude of effect reveals a 4.7% decrease in waist circumference as a result of the intervention.

A second paired samples t-test revealed a significant difference in hip circumference (cm) before and after the 12 week pedometer based physical activity intervention, $t(30) = 4.217$, $p < .001$. The results indicate that the mean hip girth (cm) after the physical activity intervention was significantly lower than the mean before the intervention (Mean difference = 2.901, SD =3.830) (Figure 11). The magnitude of the effect estimates a 2.5% reduction in the circumference of the hip (cm) after the 12 week intervention.

A third paired samples t-test revealed a significant difference in waist to hip ratio (WHR) before and after the 12 week pedometer based physical activity intervention, $t(30) = 2.927$, $p < .006$. This indicates that the mean WHR after the physical activity intervention was significantly lower than the mean before the intervention (Mean difference = .0201, SD= .0383) (Figure 12). An estimated magnitude of effect showed a 2.5% decrease in WHR values at the end the study.

The secondary pre and post test analyses conclude that the pedometer driven intervention was seemingly effective in leading to a reduction in waist and hip circumference (cm) as well as the WHR in African American women that are between 6 weeks to 6 months postpartum.

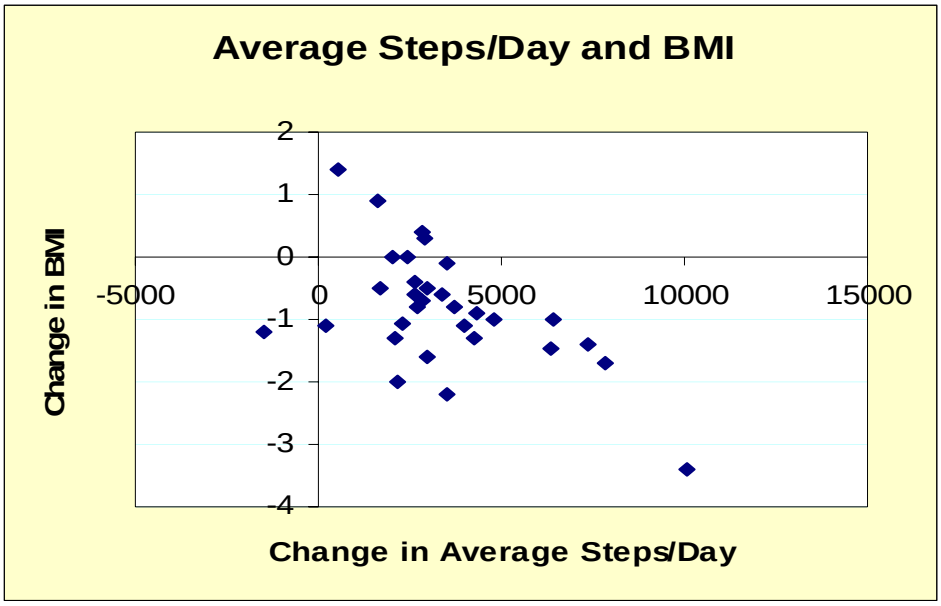

Figure 2. Scatterplot of change in average steps/day and change in BMI (kg/m²)

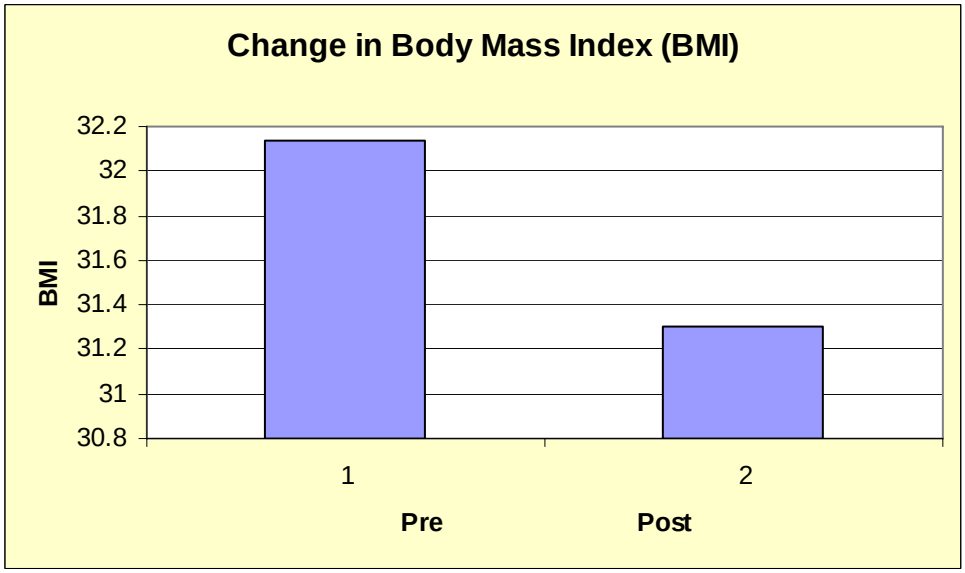

Figure 3. Body mass index (kg/m²) before and after the 12 week physical activity intervention ($p < .001$).

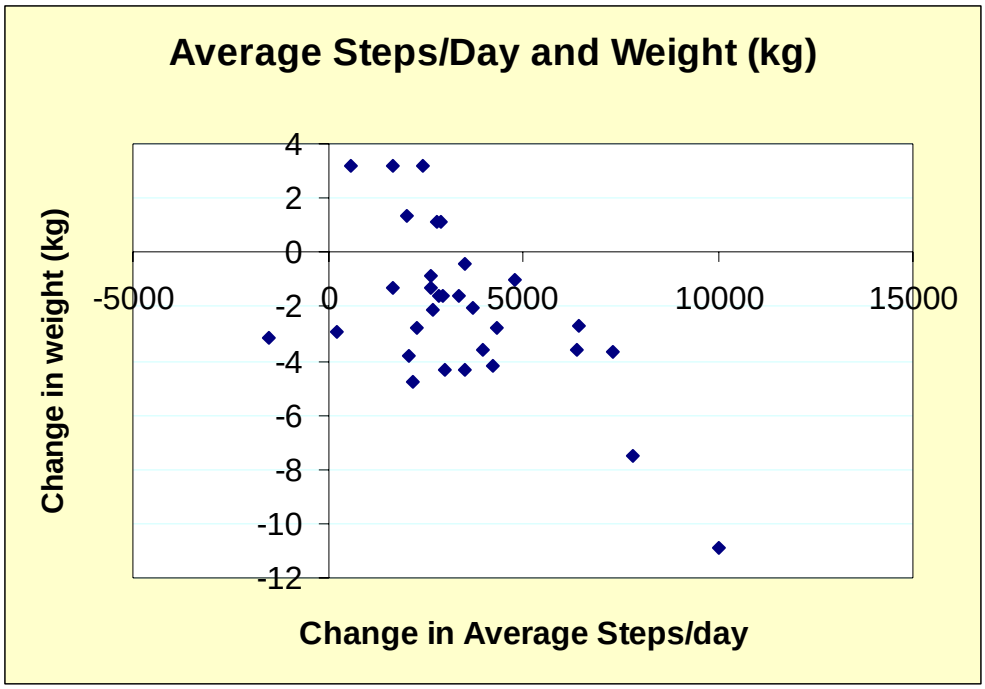

Figure 4. Scatterplot of change in average steps/day and change in weight (kg).

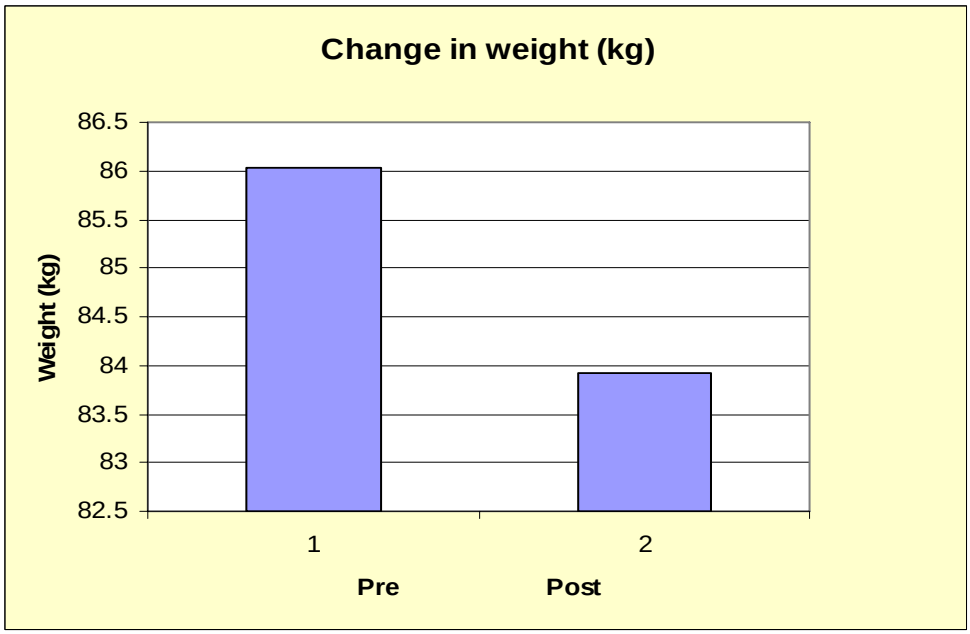

Figure 5. Weight (kg) before and after the 12 week physical activity intervention ($p < .001$).

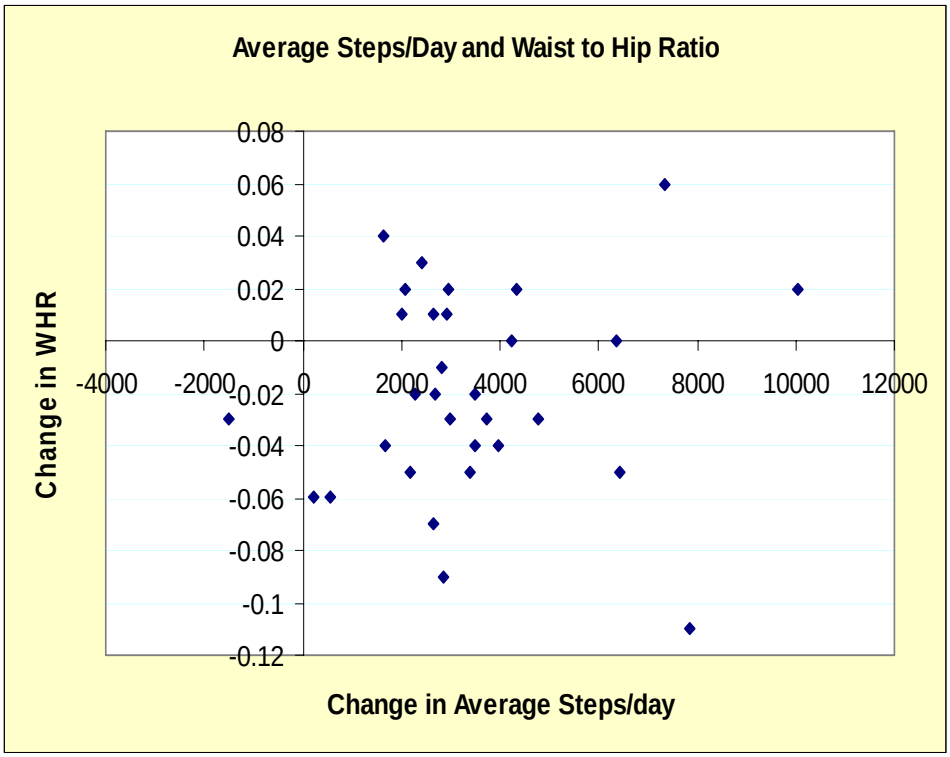

Figure 6. Scatterplot of change in average steps/day and change in waist-to-hip ratio (WHR).

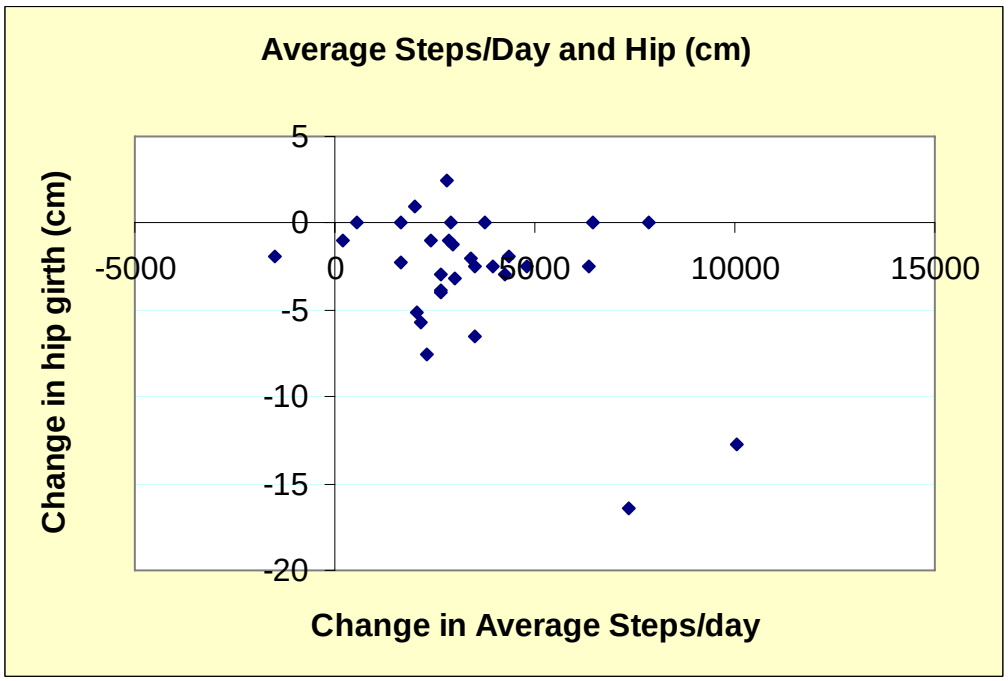

Figure 7. Scatterplot of change in average steps/day and change in hip girth (cm).

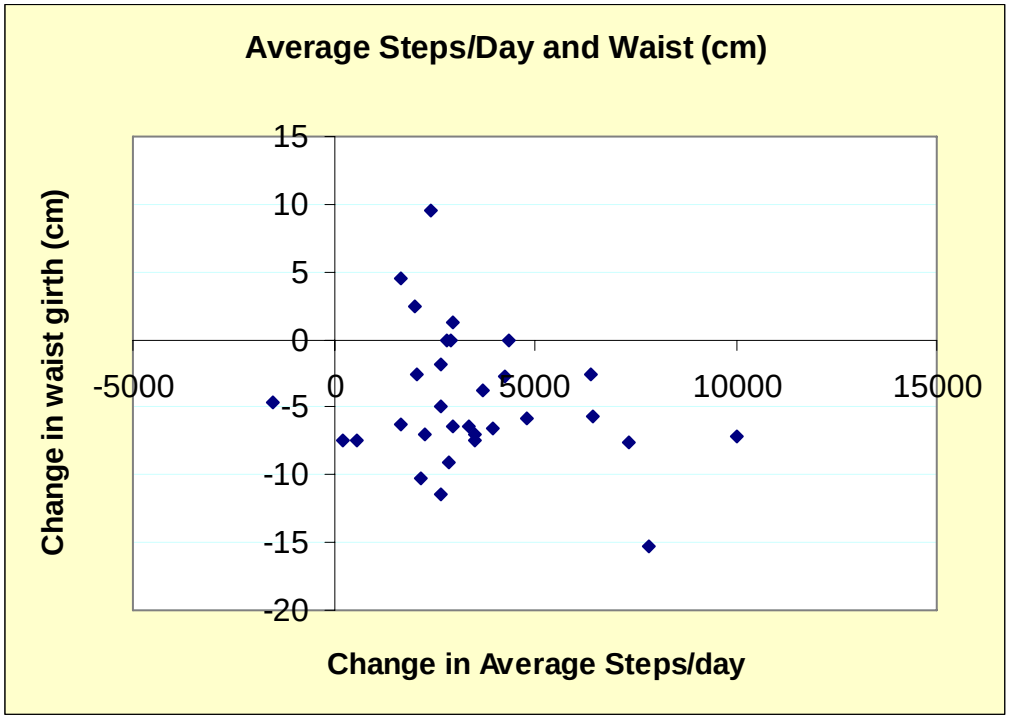

Figure 8. Scatterplot of change in average steps/day and change in waist girth (cm).

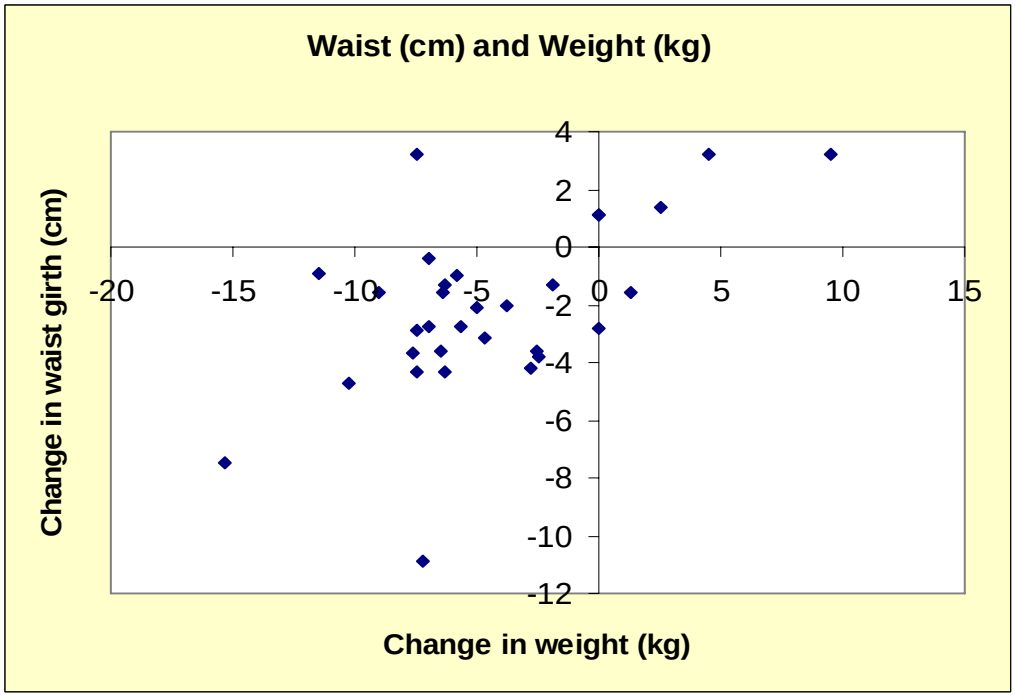

Figure 9. Scatterplot of change in waist circumference (cm) and change in weight (kg).

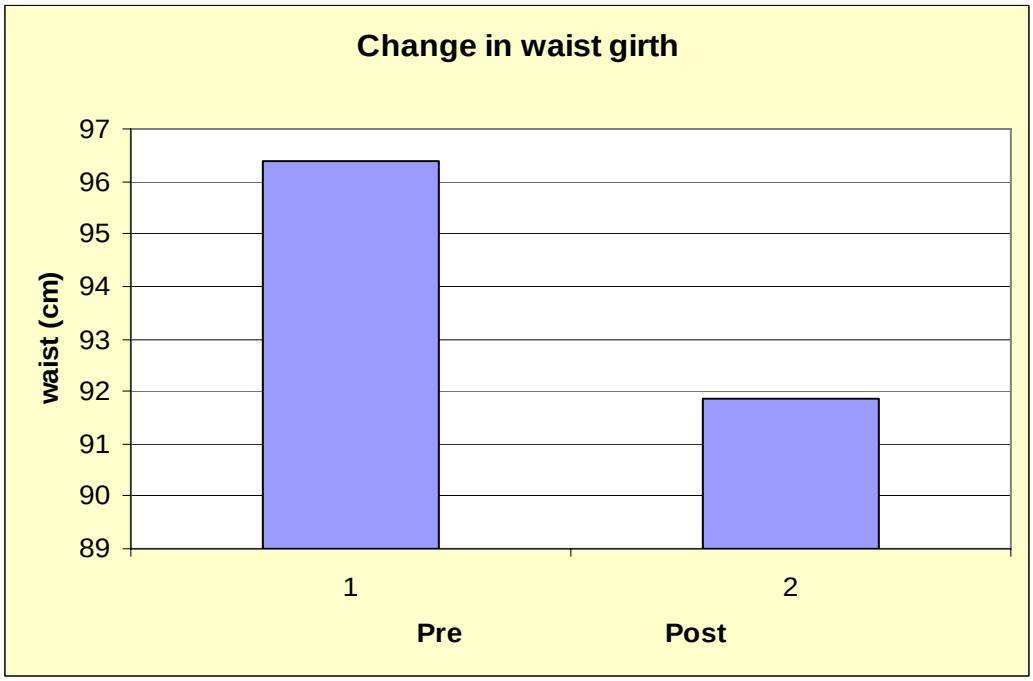

Figure 10. Waist girth before and after the 12 week physical activity intervention ($p < .001$).

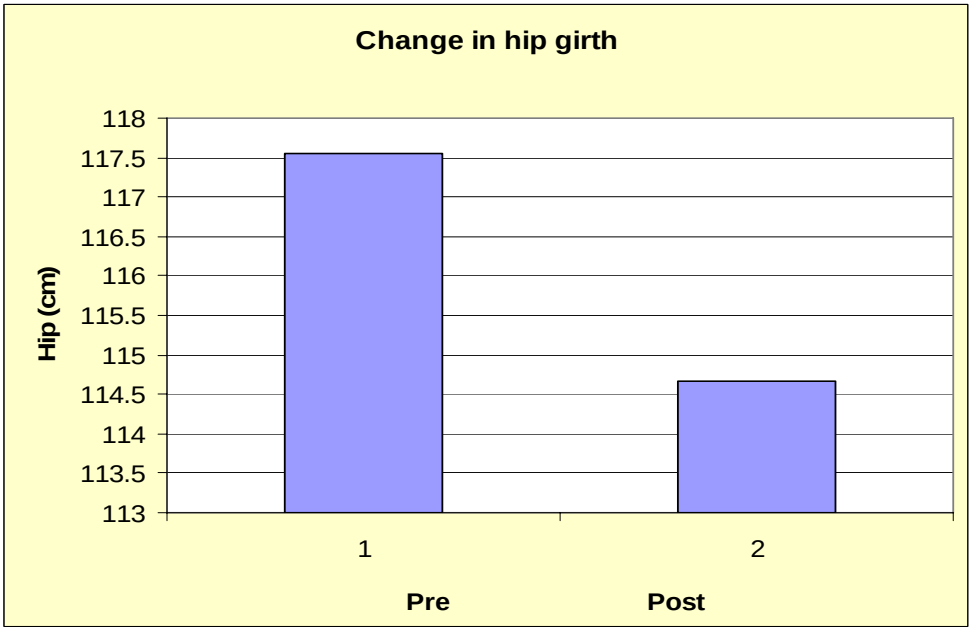

Figure 11. Hip girth (cm) before and after the 12 week physical activity intervention ($p < .001$).

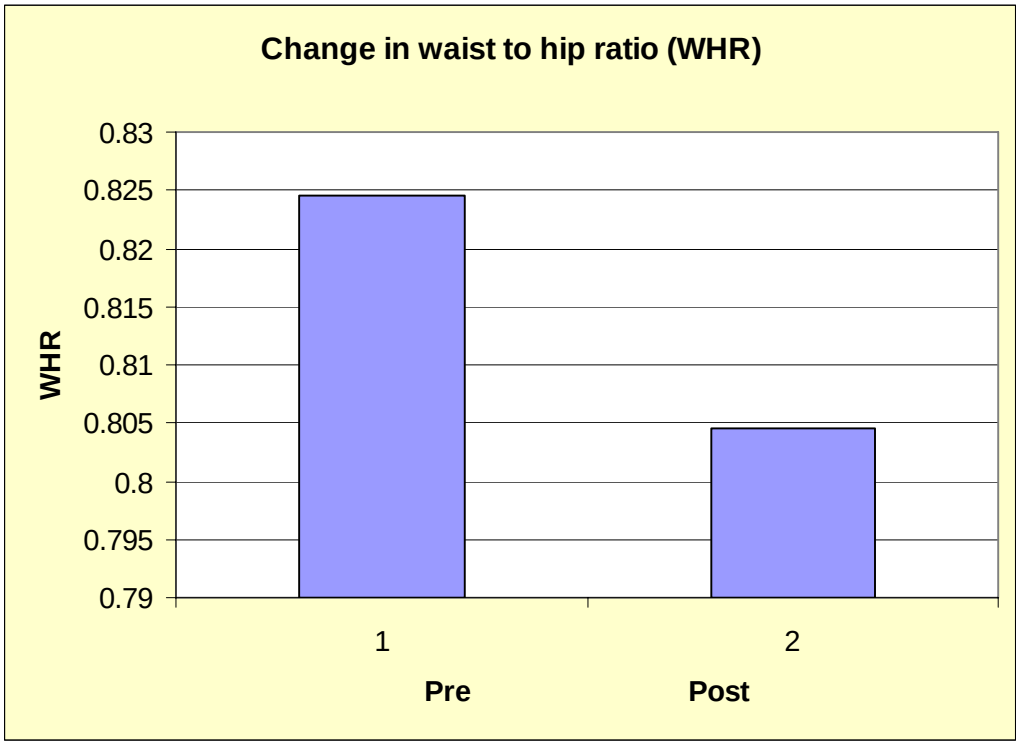

Figure 12. Waist to Hip ratio before and after the 12 week physical activity intervention ($p < .006$).

Mood States and Depressive Symptoms

Physical Activity: postpartum mood

To establish if a relationship existed between increased physical activity and postpartum mood states in African American women who were between 6 weeks and 6 months postpartum a bivariate correlation analysis was applied. Correlation between the change in average steps/day and the change in total scores from the Profile of Mood States (POMS) were found to be non significant. Although the mood levels did not significantly correlate, there was by chance evidence of a very weak inverse relationship ($r = -.224$, $p < .243$) (Figure 13) indicating that the women showed only slight improvement, but overall maintained a stable mood.

To assess changes in POM total scores before and after the study, a paired samples t-test was conducted. The results revealed that the post POM total score mean (M= 46.58) and the pre POM total score mean (M= 52.65) were not significantly different, $t(30) = 1.306$, $p < .201$(Figure 14).

Physical Activity: postpartum depression

Bivariate correlation was employed to determine if there was a relationship between increased physical activity and postpartum depressive symptoms in African American women who were between 6 weeks and 6 months postpartum. Correlations between change in average steps/day and change in the total scores of the Beck Depression Inventory (BDI) were also found to be non significant at the $p < .05$ level ($r = -.077$, $p < .681$) (Figure 15). The results of a paired samples t-test indicated that the post BDI total score mean (M= 4.52) was significantly better than the pre BDI total score mean (M= 7.10), $t(30)= 3.947$, $p<.001$ (Figure 16). The magnitude of effect showed a 36.4% decrease (improvement) in BDI scores after the 12 week physical activity intervention.

There was a significant positive correlation shown between the change in total scores of both POMS and the BDI ($r = .591$, $p < .001$) (Figure 17) suggesting a relationship between an individual's mood and depressive symptoms. A 34.9% shared variability was accounted for between scores of POMS and BDI. Of importance for this study is the statistically significant negative correlation found between change in vigor scores and change in score of BDI ($r = -.525$, $p < .002$) (Figure 18) which suggests that an increase in mild to moderate activity may reduce symptoms of early postpartum depression. A 27.7% shared variance in vigor scores was attributed to BDI total score.

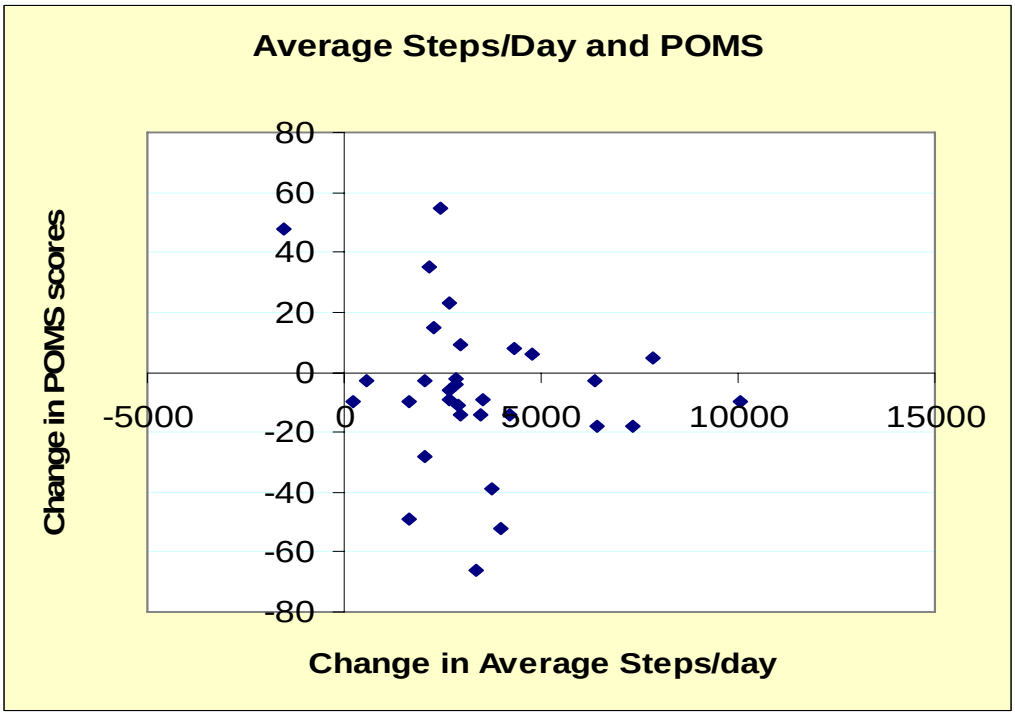

Figure 13. Scatterplot of change in average steps/day and change in total scores from the Profile of Mood States (POMS).

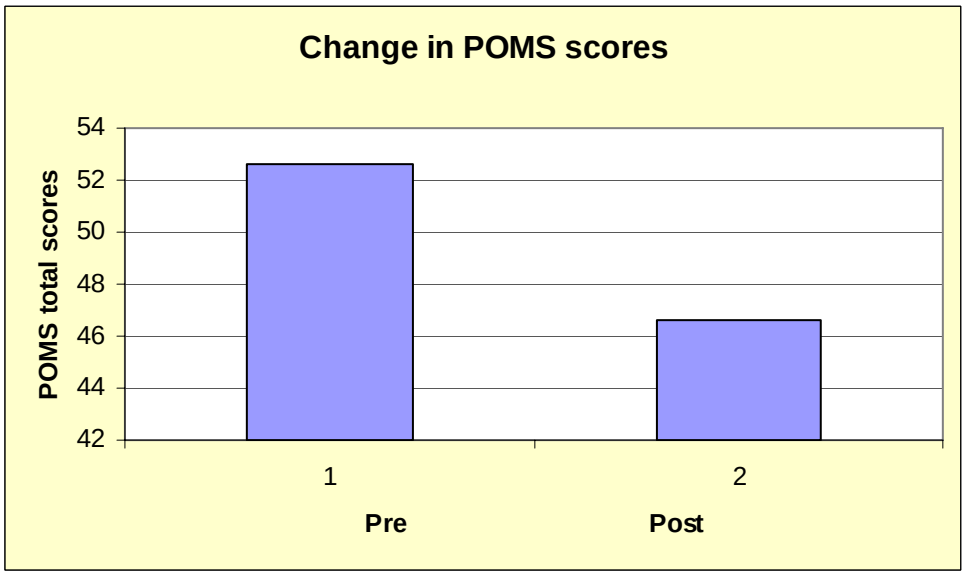

Figure 14. Changes in total scores of Profile of Mood States (POMS) before and after the 12 week study ($p < .201$).

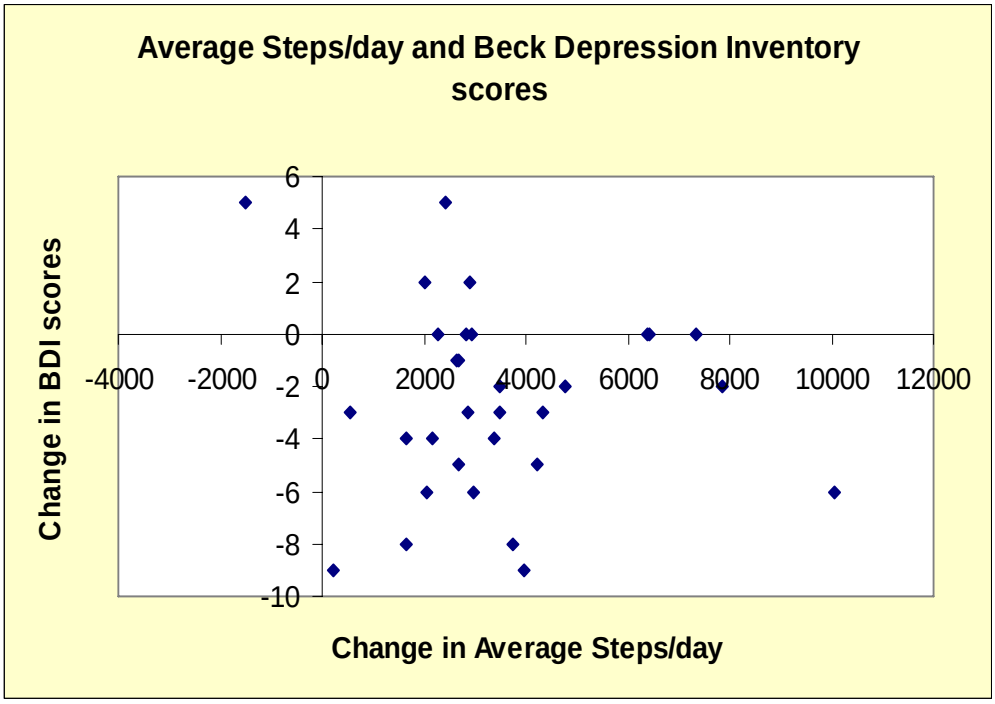

Figure 15. Scatterplot of change in average steps/day and change in total scores of Beck Depression Inventory (BDI).

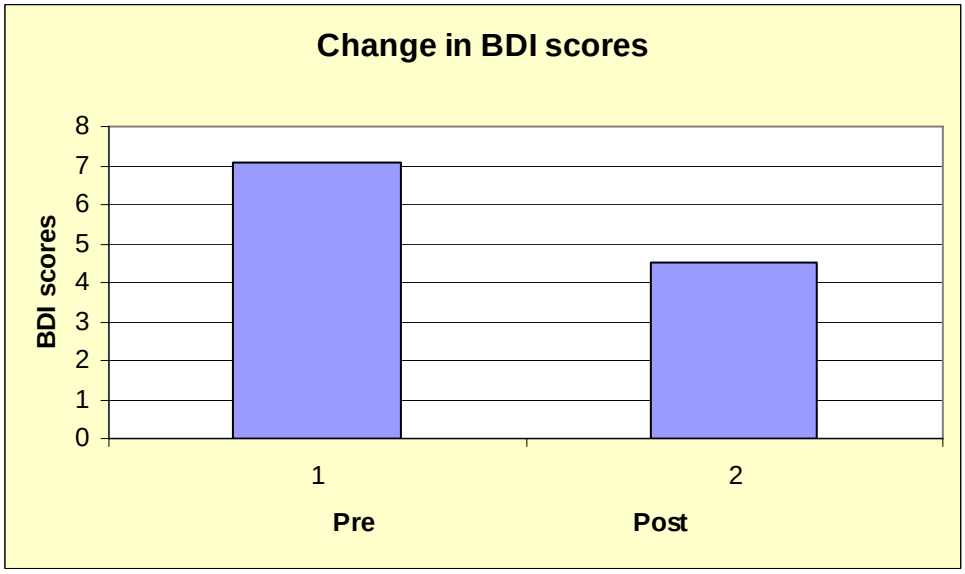

Figure 16. Change in Beck Depression Inventory (BDI) total scores before and after the 12 week study ($p < .001$).

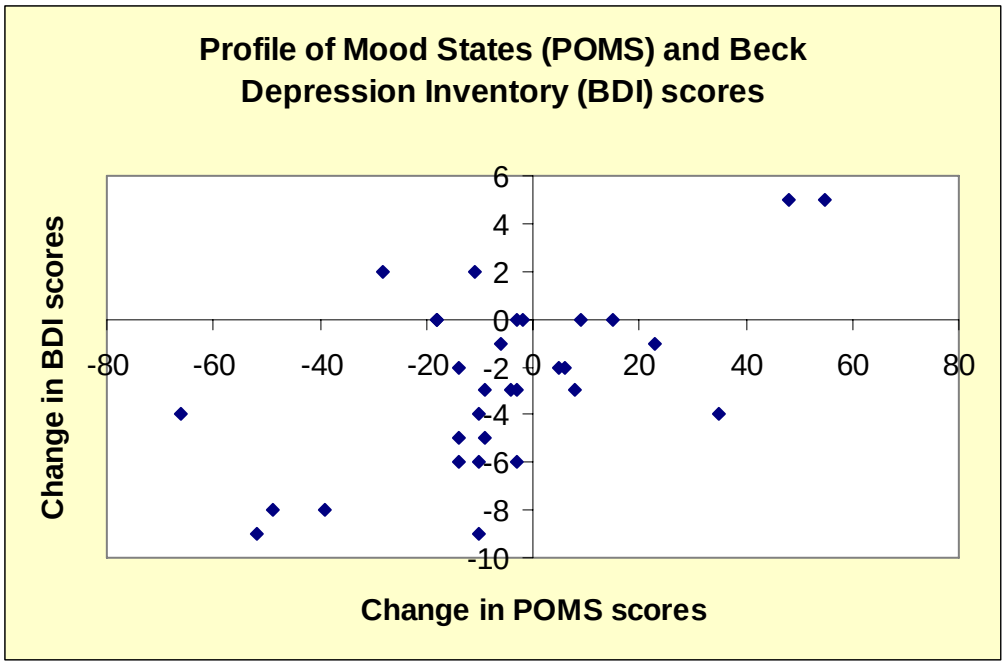

Figure 17. Scatterplot of change in total scores of both POMS and BDI.

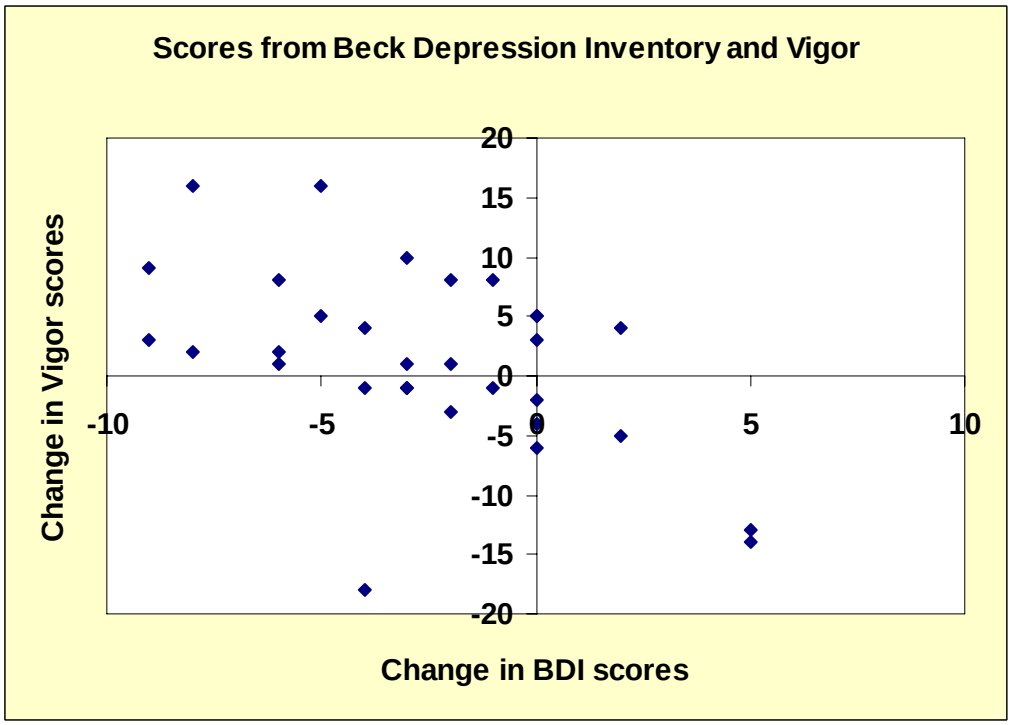

Figure 18. Scatterplot of change in scores of both vigor and Beck Depression Inventory.

Cardiovascular Values

Physical Activity: resting heart rate

To determine if there was a significant relationship between increased physical activity and heart rate of African American women who were between 6 weeks and 6 months postpartum a bivariate correlation analysis was used. A moderate negative correlation between change in average steps/day and change in resting heart rate (RHR) was found to be statistically significant at the 0.05 level ($r = -.496$, $p < .005$) (Figure 19). There was 24.6 % shared variance accounted for between these variables. It is to be noted that the RHR used in this study is actually a rested pre-test heart rate. This measure was taken after a ~20 minute rest period at the beginning of the initial and final study sessions. To investigate changes over time, a paired samples t-test was conducted and revealed no significant difference in mean resting heart rate before ($M= 74.00$) and after ($M= 76.48$) the 12 week pedometer based physical activity intervention, $t (30) = -1.880$, $p < .070$.

Physical Activity: resting blood pressure

There was no statistically significant correlation found between the change in average steps/day and change in resting systolic or diastolic blood pressures (RBP) in African American women who were between 6 weeks and 6 months postpartum. However, a weak positive relationship at the 0.05 level was indicated between change in RHR and the change in resting diastolic blood pressure ($r = .379$, $p < .036$) (Figure 20). A 14.3% shared variance was found between changes in RHR and the diastolic value of

RBP. To assess changes in resting systolic and diastolic blood pressure values before and after the study, paired sample t-tests were conducted. The results indicate that post resting systolic mean (M= 123.16) showed no significant difference than the pre resting systolic mean (M= 122.26), $t(30) = -.458$, $p < .650$; and the post resting diastolic mean (M= 77.00) was not significantly different than the pre resting diastolic mean (M= 76.81), $t(30) = -.117$, $p < .907$ (Appendix H).

Physical Activity: time to target

A bivariate correlation analysis revealed no significant relationship between the change in average steps/day and change in the time to reach target heart rate during the sub maximal treadmill test ($r = .020$, $p < .917$) (Figure 21) in African American women who were between 6 weeks to 6 months postpartum. A paired samples t-test was also used to analyze the changes in the time to reach target heart rate (TTT) before and after the study. The results indicated that the post TTT mean (M = 7.8287) was not significantly different than the pre TTT mean (M= 7.8026), $t(30) = -.107$, $p < .915$ (Figure 22).

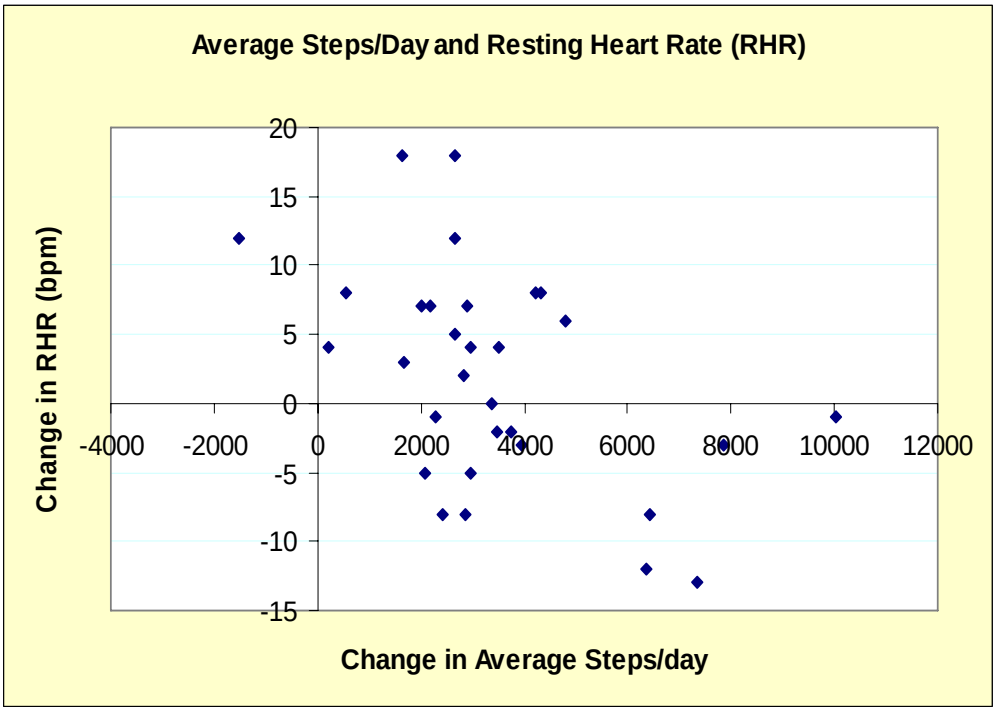

Figure 19. Scatterplot of change in average steps/day and change in resting heart rate (RHR).

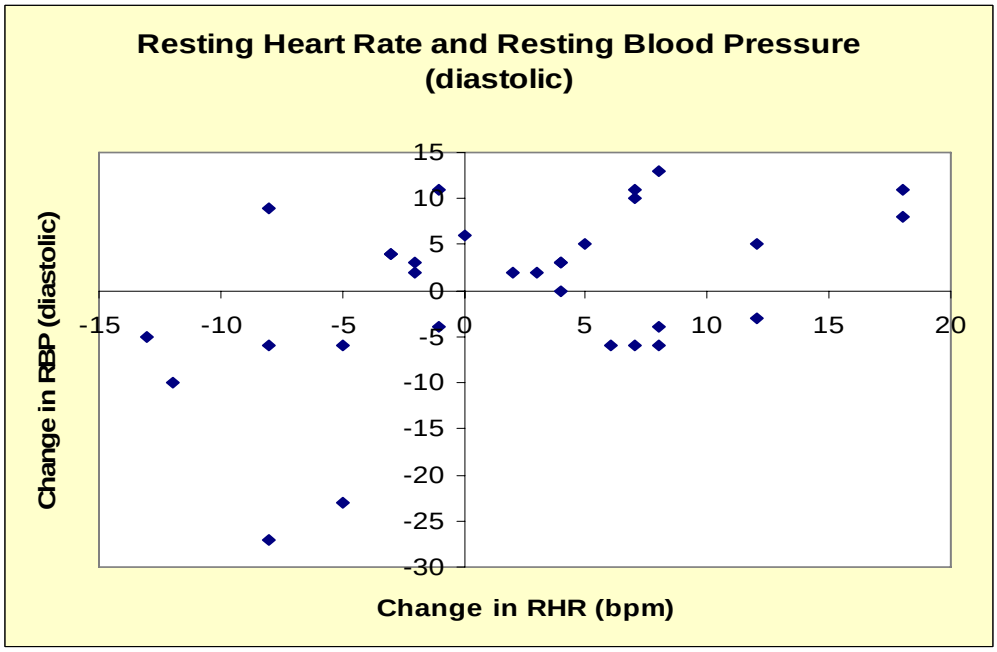

Figure 20. Scatterplot of change in resting heart rate (RHR) and change in resting diastolic blood pressure.

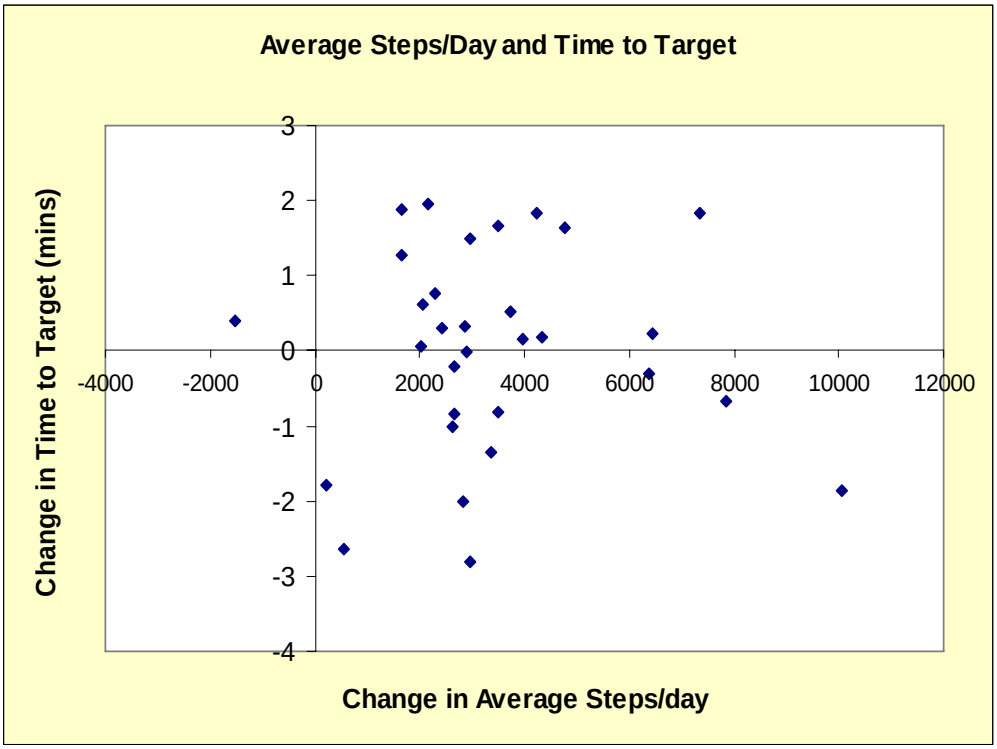

Figure 21. Scatterplot of change in average steps/day and change in the time to reach target heart rate.

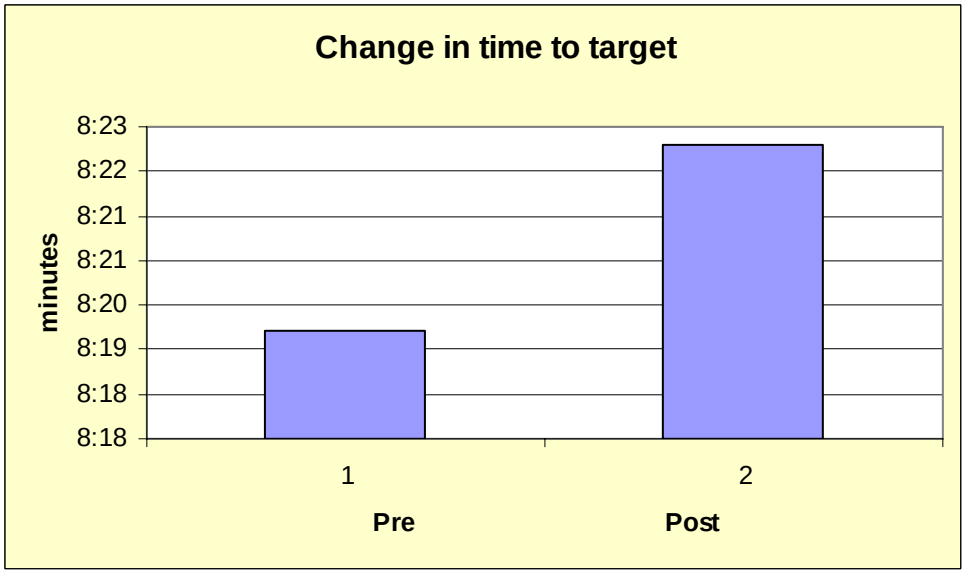

Figure 22. Difference in the time to reach target heart rate before and after the study ($p < .915$).

V. DISCUSSION

This chapter discusses the findings of this research. The discussions are divided into four sections. The first section discusses the change in physical activity followed by three sections which individually address the areas of interest.

Changes in Physical Activity

The first hypothesis predicted that the use of the pedometer would increase walking (ambulatory activity) in African American women who were between 6 weeks and 6 months postpartum. As an approach to addressing this issue, this study used highly recommended (Bassett, Cureton & Ainsworth, 2000) small electronic pedometers, that count the number of steps taken per day. All of the participants received a pedometer, a structured physical activity prescription, and an activity calendar. The women wore the pedometer for the entire length of the study. After a paired t-test analysis, the results failed to support the null hypothesis and revealed a 64% increase in daily walking activity at the end of the 12 week study. At the beginning of the study, the women reportedly averaged~ 5347 steps/day and increased ~3402 steps/day to an average of ~8749 daily steps by the end of the study. According to Tudor-Locke & Bassett (2004), the proposed indices for public health are: <5000 steps/day for sedentary, 5000-7499 steps/day for low

active, 7500-9999 for somewhat active, ≥ = 10,000 steps/day for active and > 12, 500 steps/day for highly active adults.

The findings of this study, thus indicate a shift in activity levels from the lower end of the "low active" classification to the upper end of the "somewhat active" classification. One limitation of this study was that these findings are based on collective results. A more focused study would be to explore individual differences and to compare the average increase in the daily steps of postpartum African American women who have low baseline values as compared to those who have high baseline values. Another limitation of this study is the sole inclusion of African American participants. A replication of the present study with the inclusion of women of other ethnicities is warranted to compare possible differences in the outcome measures.

The importance of this portion of the present study is that it provides a prototype for future studies in this area and with this population. Millions of dollars are currently being spent on physical activity interventions, such as the FitWIC (Women Infants and Children) program that issues pedometers to new mothers anticipating an increase in physical activity levels. However, there is a lack of evidence on how successful these interventions will be for African American females during the early postpartum period. The results gleaned from this study begin to fill the void that presently exists in the literature. Overall, the analysis provides confirmation that the pedometer driven intervention was, indeed, successful in leading to an increase in walking (physical activity) in postpartum African American women as measured by the average steps taken per day.

Physical Activity: Postpartum Weight Retention and Body Composition

The second hypothesis predicted that increased physical activity (steps per day) as measured and monitored by the pedometer would have an inverse relationship with changes in postpartum weight retention and body composition (waist to hip ratio (WHR)). In the present study, the relationship between increased physical activity, as measured in average daily steps, and weight (kg), waist girth (cm) and hip girth (cm) was examined. These anthropometric values allowed for the determination of body mass index (BMI) and waist-to-hip ratio (WHR), respectively.

Overall, increased physical activity, as evidenced by the increase in measured steps/day, was found to have a moderate inverse relationship with weight and therefore BMI. In fact, approximately 36% and 30 % of variance in weight and BMI change, respectfully, can be attributed to an increase in daily steps. This suggests that African American women who increase their daily ambulatory movement during the 6 week to 6 month postpartum period may tend to see a decrease in the amount of excess weight retained after pregnancy. Although this study failed to show an apparent relationship between physical activity and waist-to hip ratio directly, there was a moderately strong positive relationship between the amount of weight that was lost and the reduction of waist girth. Surprisingly, increased physical activity revealed a significant negative relationship with the circumference of the hips. This finding may suggest that an increase in walking activity may influence a reduction of postpartum weight retained in the gluteal region. However, it should be noted that in heavier participants a large portion of the "hip measure" included the excess post-pregnancy abdominal area so the apparent loss could

possibly be the result of a decrease in the abdominal region. It is possible that these findings may only be generalized to a very select group because of the strict criteria (African American, 6wks to 6months postpartum, etc.) set for this study.

One of the limitations of the study was that the apparent weight that was lost was not analyzed for composition of fat mass (FM) or fat free mass (FFM). Future research should allow for body composition analysis for better understanding of postpartum weight retention particularly in African American women.

According to Smith et al (1994) black women gain almost twice as much weight as white women in general. Additionally, black women have larger waist to hip ratio (WHR) than white women (Smith et al, 1994). The larger WHR would mathematically suggest a larger waist circumference and perhaps smaller hip girth. This seems to be implied with the findings of this study as well. However, in terms of body structure and/or fat distribution, black women are not all the same. Based on empirical data, many black women possess larger gluteal mass and an apparently smaller waist, therefore, producing a smaller WHR. This was quite noticeable with some of the participants of this study. In a study of majority white women, Sampselle et al (1999) noted that the more physically active women retained the least amount of weight at 6 weeks postpartum. The authors also suggested that African American women may choose to rest rather than exercise in the early postpartum period. This was substantiated by self-reported data gleaned from this study. When asked "If you had an hour to yourself, what would you do with it?", the majority of the participants listed very sedentary, restful activities as their choices (i.e. sleep, read, or watch a movie). The cultural and generational advice "to rest" encourages new black mothers to be less active thus promoting a sedentary lifestyle. On

the other hand, black women have been found to have obstinate weight in general, whether active or not. Researchers have reported that black women do not necessarily gain more weight than white women, but have greater difficulty in losing weight (Khan, 1991; Kumanyika, 1987; Walker, Timmerman, Sterling, Kim, & Dickson, 2004). This can be a potential problem since African American women appear to have a greater sensitivity to childbearing weight.

The results of this study support the findings of Khan (1991); Kumanyika (1988); and Walker et al (2004). Although, there was a collective weight loss found in this study, many of the women were frustrated with the minimal weight loss noted. A few participants began the study with ~10,000 steps at baseline and maintained this average or slightly better for 12 weeks. However, these participants stated that they just "couldn't seem to increase" beyond the upper limit, yet they were noted to "walk" 5-7 days a week without much change in their weight. This seems to validate the previous studies on difficult weight loss in this population. Conversely, those who significantly increased steps showed larger amounts of weight loss and the three participants who were at the very upper end of the weight scale (approaching 300 lbs) lost the greatest amount of weight and increased their average daily steps. Perhaps these three were more determined or the weight that was lost was due to physiological changes that occur during the early postpartum period.

As noted in the literature, physicians are failing to give adequate information regarding physical activity to early postpartum women. Thus, these women are unaware of its importance for overall health (Walker, 1996; McCrory et al, 2000). The physical activity used in this study was a quantitative measure of steps taken per day and the

instrument used was the Digiwalker SW-200 pedometer. "Walking" for this study was considered to be a combination of incidental and intentional steps taken daily. The study was designed to increase ambulatory movement and positive lifestyle changes during the early postpartum period. The use of the pedometer did seem to have a positive effect as evidenced by the increase in the number of daily steps measured at the end of the study as compared to baseline. Although the women were given a structured physical activity prescription for using the pedometer, many of the participants failed to follow with the progression of an average 500 steps/wk as prescribed. Some mothers would sleep/rest during the day and would stay awake at night which prevented outdoor walking. To address this issue and to encourage an increase in the number of steps by an average of 500/ week, all of the participants were contacted bi-weekly for the duration of the study. At weeks 4 and 8, a motivational letter was sent with a reminder of their individual goal, at week 6 an upbeat CD of current songs from a variety of genre was mailed, at week 8, the women also received a "Walk Your Way Slim" (Prevention Fitness) video, and at week 11, a reminder to schedule the follow-up session. E-mail contact was also bi-weekly and the mothers were free to contact the investigator as needed. It is to be noted that at the beginning of the study, the women were each given a portable CD player (with headphones and AA batteries) and a second, less expensive, pedometer to share with a "buddy" for social support.

In general, there was a staggered increase in steps per day. The mothers made sincere attempts to reach their daily goal as time permitted over the 12 week period. The women were perfectly aware that they had not reached their personal goals as indicated by the logging in of data in the activity calendar. At the end of the study, several of the women

wanted to continue walking and be reassessed within the following 3 to 6 months. A follow-up of these women is currently in progress. Some of the participants stated that they missed wearing their pedometer ("felt naked") and were seeking to purchase one for personal use.

The limitations of this study are as follows:

1. The new mothers in this study were quite homogenous. They were mostly college educated professionals in the mid to upper socioeconomic (SES) category and fully understood the importance of health and research. Findings of this study may not be generalized to postpartum women in a lower SES and further research is warranted.
2. This study was limited to African American women between the ages of 18 and 40 years. Females younger than 18 required parental consent for participation. However, there is a need for future research of weight retention in adolescent black females during the postpartum period.
3. Age related weight changes were not addressed in this study but should be considered in future investigations.
4. This study was limited to 12 weeks, which may not be long enough to see major changes in weight or body composition in this population. Thus, there is a need for a longitudinal study.

The average expected weight loss during this time frame was reported to be ~0.5-1.0 kg/wk with diet and exercise programs (Lovelady et al, 2000; Leermakers et al, 1998; and O'Toole et al, 2003). However, these studies were mainly composed of white women. Also, the expected weight loss may be influenced by other factors such as breast feeding (Kac, 2004), smoking (Schauberger et al, 1992), and parity (Manson et al, 1994).

Although the magnitudes of change in weight and body composition found in the present study appear to be small, in reality, they are quite noteworthy when addressing the weight issues of this population. Additionally, the physical activity intervention was not equally effective in all participants so there is no assurance that increasing daily steps will influence retained weight and body composition in all postpartum African American females. Identifying other factors and individualizing interventions is of immediate concern. Nonetheless, the outcome of this study encourages lifestyle changes and provides assistance in clinical decision-making for health care providers to manage weight gain in African American women during the early postpartum period.

Physical Activity: Mood States and Depressive Symptoms

The third hypothesis predicted that increased physical activity (steps per day) as measured and monitored by the pedometer would have an inverse relationship with changes in both postpartum mood states and depressive symptoms. All participants received Profile of Mood States (POMS) and Beck Depression Inventory (BDI) questionnaires to determine a psychological profile and a pedometer driven structured physical activity prescription to explore the relationship between the variables. The study was designed to last for 12 weeks and the participants wore the pedometer for the entire length of the study.

The findings of this part of the present study failed to reject the null hypothesis. There was no correlation found between the average steps/ day as measured by the pedometer and the total scores from the Profile of Mood States (POMS). Even though the

mood levels did not significantly correlate, there was by chance evidence of a very weak inverse relationship indicating that the women showed only slight improvement but generally maintained a stable mood. Additional findings revealed no significant relationship between increased physical activity, as measured by pedometer, and postpartum depressive symptoms but BDI scores were found to be lower at the end of the current study. However, upon further investigation, a significant positive correlation was shown between the scores of POMS and the BDI suggesting a relationship between the participants' postpartum mood and postpartum depressive symptoms. It is to be noted that participants with pre BDI scores indicating possible borderline clinical depression or more severe depression were excluded from this study. While examining this relationship, significant correlations were found between BDI and 5 of the 6 identified mood factors (depression, anger, vigor, fatigue, and confusion). Of importance, however, for this study was the significant negative correlation found between vigor-activity and BDI which suggests that an increase in mild to moderate activity may reduce symptoms of early postpartum depression. This finding is supported by Walker et al (2004) who found higher depressive symptoms and low levels of physical activity in African American women at 6 weeks and 6 months postpartum.

Throughout this study, some of the participants expressed complex feelings and emotions associated with being a new mother. Many reported that they were occasionally overwhelmed, resentful, and annoyed. Individual POMS scores indicated that some of the single mothers were frustrated with having to bear most of the responsibility of child care usually while holding a job. The novelty of having a newborn was becoming a reality and some primiparous mothers reported increased demands of having a baby was

not what they expected. One subject was going through a divorce after having her third child. Divorce, single parenting, loneliness, lack of social support, and increased financial worries seem to be of major concern. Single mothers verbalized feelings of disgust and fatigue when engaging in one on one conversation with the investigator, but that was not apparent in the profile scores. Perhaps these women didn't want their true feelings to be documented which support the finding of Amankwaa (2003) of how black women respond to situations. Amankwaa (2003) noted that African American women may be secretive of postpartum depressive symptoms perhaps out of fear that disclosure would result in their children being taken away. Additionally, these women may follow the generational and cultural traditions of being a "strong black women", "superwoman", or "good mother" (Amankwaa, 2003). Information gleaned from casual conversation stated that illness and irritability of the baby, their other children, or themselves coupled with the responsibilities of housework and/or job produced altered sleep patterns which ultimately lead to physical and emotional fatigue. The results of this study are an addition to the body of knowledge that postpartum African American women may differ from other ethnicities in their response to given situations (Amankwaa, 2003).

The women in this study were mostly professional and in the mid-to-upper income bracket, yet the findings are similar to those of Boury, Larkin, and Krummel (2004). They explored the relationship of depressive symptoms in low-income women to psychosocial and lifestyle variables in postpartum women. They found that stress and social support were the major factors related to postpartum depressive symptoms and further stressed the need for increasing physical activity levels. This recommendation is supported by the American College of Obstetrics and Gynecology (ACOG). The ACOG

notes that a return to physical activity postpartum is associated with a lower incidence of postpartum depression but only if the exercise is stress relieving and not stress provoking. Suggested exercise prescription included the ACSM recommended 30 minutes a day of moderate activity on most or all days of the week. However, a limitation of this study is that the pedometer driven physical activity prescription of increasing an average of 500 steps/week for 12 weeks may not have been rigorous enough to positively alter postpartum mood in all of the participants or to satisfy the American College of Sports Medicine (ACSM) recommendations of moderate intensity exercise.

Another limitation to the present study was the lack of information found in the literature that centers on early postpartum mood and depressive symptoms in this population. However, the empirical data gleaned from the postpartum African American women in this study should possibly be explored, most notably, the similarities of psychological outcomes within the different socioeconomic groups. From a clinical standpoint, if health care providers are to advise diverse populations with confidence, there is a need for population specific evidence and understanding.

Physical Activity: Resting Heart Rate, Resting Blood Pressure and Time to Target

The fourth hypothesis predicted that increased physical activity (steps per day) as measured and monitored by the pedometer would have an inverse relationship with resting heart rate as well as resting blood pressure and a direct relationship with the time to reach a predetermined heart rate during a submaximal treadmill test. The results of this study confirm that a negative relationship exists between increased physical activity and resting heart rate (RHR). However, it should be noted that the RHR used in this study

is actually a rested pre-test heart rate. This measure was taken after a ~20 minute rest period at the beginning of the initial and final study sessions. Additional findings suggest no relationship between increased physical activity and resting systolic or diastolic blood pressures (RBP) which supports the null hypothesis; yet, a weak positive correlation was found between resting heart rate and the resting diastolic value. This may imply a relaxed favorable response to the pedometer driven physical activity program used in the present study.

Other studies (Sady et al, 1990 and Capeless & Clapp, 1991) compared cardiovascular responses at the pre-pregnancy, pregnancy and varied postpartum intervals. However, the current study was confined only to the 6 weeks to 6 month postpartum period with no preconception or pregnancy measures. Nonetheless, the collective conclusion of those studies and the present study is that more time after childbearing may be needed for the resting cardiovascular adaptations of heart rate and blood pressure to return to normal. No significant correlation was found between increased physical activity and the time it takes to reach the predetermined target heart rate (TTT) of the subject. However, during the submaximal treadmill testing portion of this study 5 of 31 participants failed to reach their target HR (85% of predicted maximum HR) pre study; only 1 of 31 failed post study. The women who were unsuccessful in reaching their target HR during the pre or post testing intervals volitionally terminated the test due to subjective complaints of leg muscle fatigue. Although no significant changes were found in the time to reach target heart rate, 24 of 31 participants reported a reduction in RPE; 2 of 31 increased and 5 of 31 stated no change at the end of the study.

In the present study, it was noticed that there was an apparent increase in HR just prior to follow-up testing in most of the participants, perhaps due to increased anxiety of performing the test. A higher initial HR would suggest less time to reach the pre-determined target HR. Nevertheless, Lovelady et al (2000) and O'Toole et al (2003) used modified treadmill protocols to test the cardiorespiratory fitness in postpartum women. Both investigators observed improvement in the aerobic fitness level of their participants by the end of each study. However, a limitation of both these studies was the lack of postpartum African American participants; therefore, the generalization of these studies to this population is uncertain. A replicated study including postpartum African American women may be warranted for future research.

Limitations that affected the outcome measures of this study were unforeseen. During the study sessions, the mothers were occasionally accompanied with their new baby. This was mainly due to a lack of home child care coupled with a strong desire to participate in the study; however, child care service was available during testing sessions. Although ACSM guidelines indicate no distractions or confounds during testing, this researcher found it necessary to be flexible with the guidelines due to the narrow time frame (6-8weeks) set for eligible participants; some of the mothers would have failed to qualify if rescheduled.

During sub-maximal testing, it was noticed that the heart rate response was elevated at the sound of their infant crying. When performing the sub-maximal treadmill test the infant needed to be positioned near the mother so that the child could visibly see her. This was particularly noticeable with first time mothers. This may be a unique topic to be explored in future research. Another limitation was the accuracy of the resting heart rate.

As stated above, the RHR was actually rested a pre–testing HR not a true RHR. Participants were seated for approximately 20 minutes, while filling out the required forms, in order to reduce the heart rate prior to measurement. The location of the lab is on an upper floor; the subject walked up stairs or took an elevator and then walked down a lengthy corridor, occasionally with the infant, carrier, diaper bag, etc., all of which would cause an elevation in heart rate, consequently the need to rest. Blood pressure was not assessed during the submaximal treadmill test due to unintentional noises which made audible pressure sounds difficult to accurately measure. However, immediate post-exercise blood pressure was measured and compared pre and post to observe normal post exercise response and differences in systolic /diastolic pressures values. Additionally, the pedometer driven physical activity prescription of increasing an average of 500 steps/week for 12 weeks, may not have been rigorous enough to produce a training effect, to elicit significant aerobic fitness changes or to satisfy the American College of Sports Medicine (ACSM) recommendations of moderate intensity exercise.

Clinical relevance of this study is to assist health promoters and exercise science professionals in the appropriate expected outcomes of exercise prescription for postpartum African American women. Also, further research is warranted to gain a greater insight to the cardiovascular changes occurring during the postpartum period and to fill the void that exists in the current literature.

Conclusion

The development of obesity, negatively altered mood, depressive symptoms and low cardiorespiratory fitness levels may be associated with the high postpartum weight and

physical inactivity levels in black females that are reportedly greater than in any other group of women. Limited studies addressing ways to control excessive postpartum weight have failed to have adequate representation of African American women. This omission is surprising since the literature clearly states that this population retains twice as much or more weight during this period than their majority counterparts, thus enhancing the chance of obesity and chronic diseases.

The following aspects of this study make it unique: 1) It uses an objective measure to determine the changes in daily physical activity; 2) There is an inclusion of postpartum African American women only; 3) It focuses on the early period between 6 and 8 weeks up to 6 months postpartum. The 6 week to 8 week period is immediately after the 42 day puerpurium in which much of the pregnancy weight that is lost is due to natural physiological changes; 4) This study includes postpartum psychological profiles and cardiovascular values. Since increased levels of physical activity have been shown to positively affect weight, mood, depression, and cardiovascular values in the general population it was expected that these responses would be mirrored in a population of postpartum African American women. Therefore, this study determined the use of the pedometer to increase walking (physical activity) in African-American women who were between 6 weeks to 6 months postpartum. This study also investigated the influence of increased physical activity as measured and monitored by the pedometer on three areas of interest in this population: 1) weight retention and body composition; 2) mood and depressive symptoms and 3) resting heart rate and resting blood pressure.

The following conclusions are based on the findings:

Physical activity and the pedometer

This study provides evidence that a pedometer driven intervention is an effective means of promoting increased walking (physical activity) in African American women who were between 6 weeks and 6 months postpartum.

Physical activity and weight

Weight loss is a complex phenomenon and responses vary among individuals. This study concludes that African American women that increase their daily ambulatory movement during the 6 week to 6 month postpartum period may experience a decrease in the amount of excess weight retained after pregnancy.

Physical activity and mood/depressive symptoms

While no significant relationship between increased physical activity and mood or depressive symptoms was found, depressive symptoms were found to be less at the end of the study which suggests that an increase in mild to moderate activity may reduce symptoms of early postpartum depression and perhaps maintain mood stability in African American women.

Physical activity and cardiorespiratory fitness

There is a gap in the literature concerning the return of cardiovascular parameters postpartum. The present study found no significant outcomes in cardiorespiratory fitness. Even though increasing the average steps taken per day was found to be inversely

associated with resting heart rate in African American women who were between 6 weeks and 6 months postpartum, more time after delivery may still be needed for the cardiovascular responses to increased physical activity to return to normal.

Although significant outcomes from this study emerged in areas of weight retention and the use of the pedometer for increasing ambulatory movement in this cohort, the postpartum time frame for this study may have been too early to detect adequate changes in mood or cardiovascular values. It is speculated that this may be due to the low to moderate intensity of the intervention or perhaps the low levels of activity of new mothers in general. Therefore, a longer time period may be needed to truly capture physiological changes that occur postpartum or to determine if time is of importance. Thus, this study raised more questions than it answered.

Nonetheless, this correlation study provided valid assessment to detect physical activity change and its relationship to the three areas of interest in postpartum African American women. Data for the 12 week study were collected over an 8 month period. This was due to a staggered enrollment of eligible participants that suited the narrow time frame of 6 to 8 weeks postpartum. Despite the limitations, this study is significant in that it is the first to objectively document the health benefits of increased physical activity during the early postpartum period exclusively in African American women. Moreover, it provides data specific evidence for physicians and healthcare providers to advise with confidence and subsequently complement a culturally appropriate postpartum care plan. Although this study is in the embryonic stage, the findings begin to fill a void that exists in the literature and provide the framework for future studies in this area.

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APPENDICES

APPENDIX A

MOTIVATIONAL COMMUNICATIONS

Hi

How is everything coming along?

Your baseline average # steps was_____.

You are now 4 weeks into your walking program.

You should be walking at least _____steps per day. If more---GREAT!!

At 8 weeks you should be up to at least _____steps per day OR MORE

Remember your GOAL is to increase by at least 500 steps each week.

Find a friend.....DANCE.....Push the stroller.....Window shop....Go to the park

Be FINE by Christmas.....Come on....YOU CAN DO IT!!!

Thanks again for your participation.

Valda H. Montgomery
(334) 229-8778 or 229-4707

vamontgomery@alasu.edu

KEEP STEPPIN'

Hi

HOORAY!!!!

You're almost at the finish line!!!!

You are now 8 weeks into your walking program.

You should be walking at least _____steps per day. If more---GREAT!!

At 12 weeks (final) you should be up to at least _____steps per day OR MORE.

Your final day is _____. We will need to schedule your follow-up for sometime during your final week.

Remember your GOAL is to increase by at least 500 steps each week.

Get a head start on the NEW YEAR 2007.....Come on.....
YOU CAN DO IT!!!

Thanks again for helping me to reach my goal.

Valda H. Montgomery
(334) 229-8778 or 229-4707

HAPPY HOLIDAYS

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KEEP STEPPIN'

GET TO STEPPIN'

There are many ways to increase your daily steps. Use your imagination and come up with your own list:

- Take a walk with your spouse, child, or friend
- Walk the dog
- Use the stairs instead of the elevator
- Park farther from the store
- Better yet, walk to the store
- Get up to change the channel
- Window shop
- Plan a walking meeting
- Walk over to visit a neighbor
- Get outside to walk around the garden or do a little weeding

- Get off your train or bus a stop early and walk the rest of the way
- Take a walk in your lunch hour, and explore the neighborhood
- Walk the dog
- Use the stairs instead of the lift
- Park further away from the shops
- Don't use the car for short trips – walk instead
- Get up to change the channel (hide the remote)
- Put on some lively music while you clean your house and dance while you're dusting!
- Walk over to visit a friend, instead of driving
- Get outside to mow the lawn or do some weeding
- Walk, run and play actively with your children or grandchildren
- Walk up escalators
- Walk your child to school
- Window shop
- Plan a walking meeting
- Take a walking break instead of a coffee break at work
- Take up dancing — ballroom, clogging, you name it. Most of us love music, and it's fun!
- Take a walk after dinner
- Don't phone or email your office colleagues; walk over to see them whenever possible
- Walk around while you are on the phone. You can add about 100 steps in a five-minute conversation

Walking meetings
Walk up and down the aisles at the grocery store or Walmart
Use a "WALK" exercise video
Zoo walks with your child/ children
Activity walks during commercials
Entertain your child by marching in place to his/her favorite music
Dance to the childrens TV programs----"**they learn while you burn"**

APPENDIX B

STUDY FORMS AND SCRIPT

SCRIPT: Postpartum Weight and Physical Activity Research Project

1. Pre-screen via phone for inclusion criteria which includes:
    a. African American female
    b. 18-40 yrs old
    c. 6-8 weeks postpartum
    d. Not breast feeding
    e. Normal vaginal delivery
    f. Single birth
    g. Non smoker
    h. Exercise less than 3 days a week

2. Hello. Welcome to the study. This study is designed to see if there is a relationship between increased physical activity and the amount of weight retained after having your baby.
3. Please read the informed consent form which will better explain the project and the benefits. Please sign at the bottom of the page if you agree to participate.
4. Next, please read and answer the questions on the following forms:
    a. PAR-Q--- this yellow form will let me know if you have any problems with beginning a physical activity program at this time. Please circle yes or no to each statement given and sign and date at the bottom of the page.
    b. POMS---pink form/questionnaire. Please let me know how you feel " right now" by circling a score from 1-5 with 1 being "not at all" to 5 being " extremely" by each word on the front and back of the form. If there are any words that you don't fully understand, please ask me for an explanation.
    c. BDI—purple form/questionnaire. Please read each question and let me know how you have been feeling for the "past few days" by circling between 0-4 on the choices given on the front and back of the form.
    d. Intake/Exercise History---green form. Please answer the following questions:

        1. What do you do for a living?
        2. What is your estimated family income?
        3. What is your marital status? Married/Single/ Divorced
        4. How far did you go in school? High School/ High School +/ College/ College +
        5. How would you describe your health? Excellent/Good/Fair/ Poor
        6. What was your weight before you were pregnant?
        7. How much did you weigh at the height of your pregnancy?
        8. What did you weigh after delivery?
        9. How much did your baby weigh?
        10. Did you have a boy or a girl?

11. Were you physically active before pregnancy? If yes, what type of activity did you do? How hard? (low/ moderate/high) How long did you engage in your activity? How often did you engage in you activity?
12. Were you physically active during your pregnancy? If yes, what type of activity did you do? How hard? (low/moderate/high) How long did you engage in your activity? How often did you engage in your activity?
13. Do you presently exercise more than 30 minutes a day/ 3-5 days a week? If yes, you can not be included in this study. Thank you for your interest.
14. What type of activity do you do for fun? How hard? How long?/How often?
15. If you had 1 hour for yourself, what would you do?
16. What is your major reason for exercising?
17. What is your major reason for not exercising?

5. I am now going to take your resting (pre-activity) blood pressure and heart rate while you are in a seated position.
6. Your target heart rate will be calculated based on your age ((220-age) x .85).
7. Let's go over to the scale and get your height and weight.
8. I will now measure your waist. Please try not to hold in your stomach.
9. Next, I need to measure your hips.
10. We will now move over to the treadmill to test to see how long it takes your heart to reach your target heart rate. This test is known as a modified Balke submaximal walking test.
11. Please fasten the heart rate monitor around your chest with the electode placed as close to your breastbone as possible. Your heart rate will we displayed on the treadmill panel.
12. Before I turn on the treadmill, let me explain what you are about to do. You will have a 3 minute warm-up period. You will begin walking on the treadmill at a speed of 1.7 mph at 0% incline for 1 minute. Your speed will then be increased to 2.5mph at 0% incline for 1 minute. Next we will determine your most comfortable walking speed at 0% incline. You will maintain this speed for the duration of the test. Every two minutes, your incline will be increased by 2.5% until you have reached your target heart rate. If you, begin to feel fatigued or uncomfortable before the test is over, please feel free to tell me and the test will immediately be ended.
13. At the end of each minute, your heart rate will be recorded. I will ask you "how do you feel" and I would like for you to respond by giving me a number between 1-10 from the modified RPE scale attached to the treadmill.
14. Once you have reached your target heart rate goal, your time will be recorded. The incline will be lowered to 0% and the speed will be decreased to 2.5mph for 1 minute followed by a decrease in speed to 1.7 mph with HR continually being recorded/monitored each minute. After your cool-down period, your blood

pressure will be immediately taken while standing on the treadmill. You will then be asked to be seated. After 2 minutes, your blood pressure and pulse will be taken again followed by a second seated measure to monitor recovery.

15. For your safety, please straddle the treadmill while I press the start button to begin your test.
16. Are you ready to begin?
17. (After treadmill testing) Please have a seat while I explain what you are to do for the next 12 weeks.
18. Let me first explain, the use of the pedometer. Let's go out in the hall and practice proper fitting of the pedometer. It should be placed on the waist band between the navel and the axillary line. (Overweight persons have greater abdominal girth which makes manufacturers recommended placement (over hip flexors) difficult). Open the pedometer and press the yellow re-set button to zero out any steps that may have been recorded. Next, walk down the hall while counting aloud each step that you take up to 50 steps. Check your pedometer to see if your recordings are accurate. If not, reposition and try again.
19. You will wear your pedometer daily from the time you wake until you go to bed at night. You are NOT to wear it while taking a bath.
20. Here is your activity calendar. You are to record your daily steps at the end of each day. On the first 3 days you are to walk normally (incidental steps) and average the number of steps. This will serve as your baseline. After that you are to increase your steps on the average of 500 steps/ day each week. Please record any activity that prevented you from wearing your pedometer (i.e. illness, forgot, travel, etc.)
21. Here is a "take-home instruction" sheet to remind you of everything that I just said. It is colored hot pink so that you can find it when you need it.
22. This bright orange sheet ("Get to Steppin") gives you a list of ideas of how to increase your daily steps.
23. The white and blue sheets are informational and further explain the use of the pedometer.
24. Please pass these flyers (project) to any interested women.
25. To thank you for your participation, I am giving you a free 30 minute massage compliments of Taylor Therapeutic Massage. Also, a water bottle which is filled with two loofah pads, a less expensive pedometer so that you can walk with a buddy (social support) and two AA batteries to be used with……your own portable CD player with headphones to help you get started and say motivated.
26. I will be in contact with you by phone, e-mail or regular mail every two weeks.
27. Please feel free to contact me at any time. My information can be found on the flyer or in the front of your activity calendar.
28. Your final date is……. I will call and schedule your follow-up test.
29. Do you have any questions or comments?
30. Thank you very much for coming and ENJOY!!

FINAL Session:
Repeat steps 5-16; Collect pedometer and activity log; Thank you for participating.

POSTPARTUM STUDY INTAKE FORM

Participant #_____ Phone_____E-mail_____

Instructions: *Respond to each question by filling in the blanks or circling your choice.*

Age		**Occupation/Income**	
# wks postpartum		**Education**	HS HS+ College College+
# of children		**Smoking**	Yes No
Breast feeding	Yes No	**Single birth**	Yes No
Normal vaginal delivery	Yes No	**Health status**	Excellent Good Fair Poor
Pre-pregnancy wgt		**Pregnancy wgt**	
Wgt after delivery		**Baby's birth wgt**	
EXERCISE HISTORY			*Intensity: Low/ Moderate/ High
Were you physically active before pregnancy?	Yes No Sometimes	**If yes, what type of activity did you do? How hard? How long? How often?**	Type: Intensity: Time: Frequency:
Were you physically active during your pregnancy?	Yes No Sometimes	**If yes, what type of activity did you do? How hard? How long? How often?**	Type: Intensity: Time: Frequency:
Do you presently exercise <u>more than</u> 30 minutes a day/ 3-5 days a week?	Yes No	**What type of activity do you do for fun?**	Type: Intensity: Time: Frequency:
What is your major reason for exercising?		**What is your major reason for <u>not</u> exercising?**	
Comments:			
MEASURES	**PRE**	**POST**	**COMMENTS**

Height (in) / (cm)			
Weight (lbs) / (kg)			
BMI (kg/m^2)			
Waist (in) / (cm)			
Hip (in) / (cm)			
Waist-to-Hip Ratio			
Resting HR (bpm)			
Ex. HR (bpm)			
Resting BP			
Exercise BP			
Time to Target/ RPE (1-10)			
Profile of Mood (POMS)			
Beck Depression Inventory (BDI)			
Avg. # Steps/ day			

DATA COLLECTION

Participant #_____ # weeks PP _____

Starting date_____ Completion date_____

Example of EX RX using a pedometer

Mode	Frequency	Duration	Intensity	Progression
Walking/Stepping (Start: 2000 intentional steps (~1.0 mile) Ex. Walking/ stepping to music	3-5 days/ wk (in or out of the home— convenience	Start: 15-20 minutes	Moderate 40-60% HR max	Increase at least 500 intentional steps/weekly sessions (¼ mile)
Minimum GOALS				
GOAL: 4 weeks 3500 intentional steps (~1.75 miles)	As above	20-30 minutes	Moderate 40-60% HR max	As above
GOAL: 8 weeks 5500 intentional steps (~2.25 miles)	As above	30-45 minutes	Moderate 40-60% HR max	As above
GOAL: 12 weeks 7500 intentional steps (~3.75 miles)	As above	40-60 minutes (or 20-30 x 2)	40-60% HR max	As above

- Incidental walking (normal daily ambulation) = 2500-3500 steps/day
  (Hatano ACSM Walking Conference Oct. 2005)
- Intentional walking/stepping (purposeful)
- Intentional + incidental= an increase in steps per day with the goal of 10,000 steps/day

INFORMED CONSENT FORM

FOR: The influence of increased physical activity on postpartum weight and body composition in African American women

Alabama State University
Department of Physical Therapy

You are invited to participate in this 12 week study to investigate the influence of increased physical activity on postpartum weight retention in African American women. It is the intent that this study will help to provide a way to increase physical activity levels in postpartum African-American women. You may benefit from your participation in that you may experience weight loss and an increase in your overall well-being.

You have been chosen as a participant because you: 1) are a healthy African-American female between the ages of 18-40 years 2)are between 6 weeks and 8 weeks postpartum 3)are at least 8 lbs over your pre-pregnancy weight 4) are a non-smoker 5)are not breastfeeding 6) you have completed high school and 7) have accurately disclosed all past medical history and there is no reason that you are aware of that would prohibit you from participating in this study. If you choose to participate measures of your height, weight, waist and hip will be taken in order to assess your body composition; you will be asked to complete the Profile of Moods States (POMS) and Beck Depression Inventory (BDI) questionnaires to determine the influence of physical activity on your overall postpartum health; and you will be given a submaximal treadmill test in which your current level of physical activity will be assessed. Following your initial assessments, you will be given a research pedometer and an activity calendar. Detailed instructions for proper use will then be given as well as an individualized physical activity plan. There will be a follow-up evaluation at 12 weeks which is the end of the study.
All measures will be taken in the Fitness Assessment Lab (room 302) Buskey Health Science Building at Alabama State University.

The personal risk to you is minimal; however, should you experience any persistent discomfort you will be referred to your physician.

Any personal information obtained for this study will be identified by numerical code only in all written materials. Only those individuals directly involved in the study will have access to the research information. Individual personal data will be filed under lock and key in the office of the investigator. This office is in room 302 of the Buskey Health Science Building on the campus of Alabama State University. No mention of your name or your specific identities will be used in any written or oral presentation of the data collected. Your decision whether or not to participate will not prejudice you from future relations with the investigator. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions or concerns regarding the procedures or the study, please feel free to contact Valda H. Montgomery at (334) 229-8778 or e-mail vamontgomery@alasu.edu.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE.
YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

_____ _____
Partipant's signature Date Time

_____
Print participants name

_____ _____
Witness Investigator's signature

Submaximal Exercise Test Data Form

Subject_____ Age_____ Date_____Time_____

Hgt_____cm_____in Wgt_____kg_____lbs

Max HR_____Protocol_____ Mode_____

Resting BP:_____/_____mmHg Position_____ Clinician_____

Resting HR: _____bpm Target HR (85% HRmax)_____bpm

A F C H H D S O_____risk factors_____stratification

Min	Speed (mph)	% grade	HR (bpm)	BP (mmHg)	RPE 1-10	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

POSTPARTUM STUDY PARTICIPANTS

Calendar Check

Code	Address/ e-mail	Start date	4week	8week	11 wk

New Mother's Project: POSTPARTUM WEIGHT AND PHYSICAL ACTIVITY

Take-home instructions:

1. Record in your calendar what you ate for 3 consecutive days (at the beginning and end of the study).
2. You are to wear your pedometer during waking hours except when bathing
3. Reset your pedometer at the beginning of each day
4. Record the number of steps taken at the end of each day in your activity calendar
5. Re-adjust your placement if necessary, but remember to re-count for accuracy
6. Contact me by phone or e-mail with the average # of steps from your 1st 3 days (baseline)
7. **GOAL: add at least and average of 500 extra daily steps/week**
8. Record any additional activities that you might do (i.e cycling, swimming, etc.)
9. Record reasons for not increasing your # of steps (i.e. illness, forgot to put on pedometer, etc.)
10. Use your "***GET TO STEPPIN'***" sheet for new ways to increase your steps
11. Someone will be in contact with you ~2 week intervals to monitor your progress
12. RULES:

    a. Do NOT change your present eating habits during the study
    b. Do NOT let others use your research pedometer
    c. Pedometers and activity logs will be returned at the end of the study
    d. If, for any reason, you choose to discontinue the study, please return your pedometer and activity logs. You may keep your gifts out of appreciation

13. PLEASE feel free to contact me at any time if you have a question or are having problems or simply need a little boost:

    Valda H. Montgomery
    (334) 229-8778 (leave message if necessary) or vamontgomery@alasu.edu

THANK YOU SO VERY MUCH FOR YOUR PARTICIPATION

Physical Activity Readiness Questionnaire

Name			Date
DOB	Age	Home Phone	Work Phone

Regular exercise is associated with many health benefits. Increasing physical activity is safe for most people. However, some individuals should check with a physician before they become more physically active. Completion of this questionnaire is a first step when planning to increase the amount of physical activity in your life. Please read each question carefully and answer every question honestly:

Yes	No	1) Has a physician ever diagnosed you with a heart condition **and** indicated you should restrict your physical activity?
Yes	No	2) When you perform physical activity, do you feel pain in your chest?
Yes	No	3) When you were not engaging in physical activity, have you experienced chest pain in the past month?
Yes	No	4) Do you ever faint or get dizzy and lose your balance?
Yes	No	5) Do you have an injury or orthopedic condition (such as a back, hip, or knee problem) that may worsen due to a change in your physical activity?
Yes	No	6) Do you have high blood pressure or a heart condition in which a physician is currently prescribing a medication?
Yes	No	7) Are you pregnant?
Yes	No	8) Do you have insulin dependent diabetes?
Yes	No	9) Are you 69 years of age or older **and** not used to being very active?
Yes	No	10) Do you know of any other reason you should not exercise or increase your physical activity?

If you answered yes to any of the above questions, talk with your doctor **before** you become more physically active. Tell your doctor your plan to exercise and to which questions you answer yes.

If you honestly answered no to all questions you can be reasonably certain you can safely increase your level of physical activity **gradually**.

If your health changes so you then answer yes to any of the above questions, seek guidance from a physician.

Participant signature	Date

APPENDIX C

PSYCHOLOGICAL QUESTIONNAIRES

Profile of Mood States

Subject's Initials_____
Birth Date_____
Date_____
Subject code No._____

Directions: Describe HOW YOU FEEL RIGHT NOW by checking one space after each of the words listed below:

FEELING	**Not at all**	**A little**	**Mod.**	**Quite a bit**	**Extremely**
Friendly	1	2	3	4	5
Tense	1	2	3	4	5
Angry	1	2	3	4	5
Worn Out	1	2	3	4	5
Unhappy	1	2	3	4	5
Clear-headed	1	2	3	4	5
Lively	1	2	3	4	5
Confused	1	2	3	4	5
Sorry for things done	1	2	3	4	5
Shaky	1	2	3	4	5
Listless	1	2	3	4	5
Peeved	1	2	3	4	5
Considerate	1	2	3	4	5
Sad	1	2	3	4	5
Active	1	2	3	4	5
On edge	1	2	3	4	5
Grouchy	1	2	3	4	5
Blue	1	2	3	4	5
Energetic	1	2	3	4	5
Panicky	1	2	3	4	5
Hopeless	1	2	3	4	5
Relaxed	1	2	3	4	5
Unworthy	1	2	3	4	5
Spiteful	1	2	3	4	5
Sympathetic	1	2	3	4	5
Uneasy	1	2	3	4	5
Restless	1	2	3	4	5
Unable to concentrate	1	2	3	4	5
Fatigued	1	2	3	4	5
Helpful	1	2	3	4	5
Annoyed	1	2	3	4	5
Discouraged	1	2	3	4	5
Resentful	1	2	3	4	5

Nervous	1	2	3	4	5
Lonely	1	2	3	4	5
Miserable	1	2	3	4	5
Muddled	1	2	3	4	5
Cheerful	1	2	3	4	5
Bitter	1	2	3	4	5
Exhausted	1	2	3	4	5
Anxious	1	2	3	4	5
Ready to fight	1	2	3	4	5
Good-natured	1	2	3	4	5
Gloomy	1	2	3	4	5
Desperate	1	2	3	4	5
Sluggish	1	2	3	4	5
Rebellious	1	2	3	4	5
Helpless	1	2	3	4	5
Weary	1	2	3	4	5
Bewildered	1	2	3	4	5
Alert	1	2	3	4	5
Deceived	1	2	3	4	5
Furious	1	2	3	4	5
Effacious	1	2	3	4	5
Trusting	1	2	3	4	5
Full of pep	1	2	3	4	5
Bad-tempered	1	2	3	4	5
Worthless	1	2	3	4	5
Forgetful	1	2	3	4	5
Carefree	1	2	3	4	5
Terrified	1	2	3	4	5
Guilty	1	2	3	4	5
Vigorous	1	2	3	4	5
Uncertain about things	1	2	3	4	5
Bushed	1	2	3	4	5

Scoring for POMS

Each adjective is awarded the score as circled except *relaxed* and *efficient*, which should be reversed. You then have a raw score (<60) for each subscale. A Total Mood Disturbance (TMD) can be calculated by adding the raw scores from tension, depression, anger, fatigue, and confusion and then subtracting the vigour score. This will give a value between -24 and 177, with lower scores indicative of people with more stable mood profiles.

Subscale items:

Tension:

- Tense, shaky, on edge, panicky, uneasy, restless, nervous, anxious
- Add: 2+10+16+20+reverse 22+26+27+34+41

Depression:

- Unhappy, sorry for things done, sad, blue, hopeless, unworthy, discouraged, lonely, miserable, gloomy, desperate, helpless, worthless, terrified, guilty
- Add: 5+9+14+18+21+23+32+35+36+44+45+48+58+61+62

Anger:

- Anger, peeved, grouchy, spiteful, annoyed, resentful, bitter, ready to fight, rebellious, deceived, furious, bad tempered
- Add: 3+12+17+24+31+33+39+42+47+52+53+57

Vigour:

- Lively, active, energetic, cheerful, alert, full of pep, carefree, vigorous
- Add: 7+15+19+38+51+56+60+63

Fatigue:

- Worn out, listless, fatigued, exhausted, sluggish, weary, bushed
- Add: 4+11+29+40+46+49+65

Confusion:

- Confused, unable to concentrate, muddled, bewildered, efficient, forgetful, uncertain about things
- Add: 8+28+37+50+reverse 54+59+64

Others (dummy items):

- Ignore: friendly, clearheaded, considerate, sympathetic, helpful, good-natured, trusting

Beck Depression Inventory

Choose one statement from among the group of four statements in each question that best describes how you have feeling during the **past few days.** Circle the number beside your choice.

1	**0** I do not feel sad **1** I feel sad **2** I am sad all the time and I can't snap out of it. **3** I am so sad or unhappy that I can't stand it.	8	**0** I don't feel I am any worse than anybody else. **1** I am critical of myself for my weakness or mistakes. **2** I blame myself all the time for my faults **3** I blame myself for everything bad that happens.
2	**0** I am not particularly discouraged about the future. **1** I feel discouraged about the future. **2** I feel I have nothing to look forward to. **3** I feel that the future is hopeless and that things cannot improve.	9	**0** I don't have any thoughts of killing myself. **1** I have thoughts of killing myself, but I would not carry them out. **2** I would like to kill myself. **3** I would kill myself if I had the chance.
3	**0** I do not feel like a failure **1** I feel I have failed more than the average person. **2** As I look back on my life, all I can see is a lot of failure. **3** I feel I am a complete failure as a person.	10	**0** I don't cry any more than usual. **1** I cry more now than I used to. **2** I cry all the time now. **3** I used to be able to cry, but now I can't cry even though I want to.
4	**0** I get as much satisfaction out of things as I used to. **1** I don't enjoy things the way I used to. **2** I don't get any real satisfaction out of anything anymore. **3** I am dissatisfied or bored with everything.	11	**0** I am no more irritated by things than I ever am. **1** I am slightly more irritated now than usual. **2** I am quite annoyed or irritated a good deal of the time. **3** I feel irritated all the time now.
5	**0** I don't feel particularly guilty. **1** I feel guilty a good part of the time. **2** I feel quite guilty most of the time. **3** I feel guilty all of the time.	12	**0** I have not lost interest in other people. **1** I am less interested in other people than I used to be. **2** I have lost most of my interest in other people. **3** I have lost all of my interest in other people.
6	**0** I don't feel I am being punished. **1** I feel I may be punished. **2** I expect to be punished. **3** I feel I am being punished.	13	**0** I make decisions about as well as I ever could. **1** I put off making decisions more than I used to. **2** I have greater
7	**0** I don't feel disappointed in myself. **1** I am disappointed in myself. **2** I am disgusted with myself	14	**0** I don't feel that I look any worse than I used to. **1** I am worried that I am looking old or unattractive. **3** I believe that I look ugly.

15	**0** I can work about as well as before. **1** It takes an extra effort to get started at doing something. **2** I have to push myself very hard to do anything. **3** I can't do any work at all.	19	**0** I haven't lost much weight, if any, lately. **1** I have lost more than five pounds. **2** I have lost more than ten pounds. **3** I have lost more than 15 pounds. (Score 0 if you have been purposely trying to lose weight)
16	**0** I can sleep as well as usual. **1** I don't sleep as well as I used to. **2** I wake up 1-2 hours earlier than usual and find it hard to get back to sleep. **3** I wake up several hours earlier than I used to and cannot get back to sleep.	20	**0** I am no more worried about my health than usual. **1** I am worried about physical problems such as aches and pains, or upset stomach, or constipation. **2** I am very worried about physical problems, and it's hard to think of much else. **3** I am worried about my physical problems that I cannot think about anything else.
17	**0** I don't get more tired than usual. **1** I get tired more easily than I used to. **2** I get tired from doing almost anything. **3** I am to tired to do anything.	21	**0** I have not noticed any recent change in my interest in sex. **1** I am less interested in sex than I used to be. **2** I am much less interested in sex now. **3** I have lost interested in sex completely.
18	**0** My appetite is no worse than usual. **1** My appetite is not as good as it used to be. **2** My appetite is much worse now. **3** I have no appetite at all anymore.		

SCORING

1-10: These ups and downs are considered normal.
11-16: Mild mood disturbance
17-20: Borderline clinical depression
21-30: Moderate depression
31-40: Severe depression
Over 40: Extreme depression

APPENDIX D

CHARACTERISTICS OF PARTICIPANTS

Table D1. Characteristics of Participants in the study

Subj.	Yrs age	Marital status	Income $K	Educ.	Parity	Pre-preg wgt (lbs)	Post-preg wgt (lbs) < 6wks	Beg. Study wgt (lbs)
1	34	Married	60-69	College	3	268	290	278
2	26	Single	10-19	H S +	1	209	240	234.5
3	34	Single	30-39	College +	2	145	160	160.25
4	28	Married	40-49	College	3	138	148	147
5	25	Married	40-49	College	1	132	160	157.5
6	31	Single	20-29	College	3	148	162	159
7	33	Married	40-49	College +	1	198	195	215.5
8	19	Single	10-19	H S +	2	173	182	186
9	29	Married	30-39	College	2	135	140	146
10	35	Divorced	30-39	College +	3	128	140	142
11	22	Single	20-29	College	1	195	216	216.75
12	36	Married	60-69	College +	2	128	140	142
13	23	Single	10-19	College	1	220	247	231
14	36	Married	60-69	College +	2	155	170	173
15	35	Married	50-59	College	3	259	289	268
16	30	Married	50-59	College+	1	149	175	165
17	34	Divorced	40-49	College +	2	155	215	195.5
18	35	Married	60-69	College +	3	149	173	160.5
19	27	Married	60-69	College +	1	174	207	190.5
20	29	Married	60-69	College+	2	140	168	159.4
21	36	Married	50-59	College	3	145	173	158.5
22	29	Married	50-59	College +	1	162	178	172
23	24	Single	30-39	College+	1	236	245	249.5
24	24	Married	40-49	College	1	160	196	190
25	35	Married	60-69	College +	1	158	180	173
26	24	Single	20-29	College	1	175	200	210
27	22	Single	20-29	College	1	260	270	301
28	23	Single	10-19	HS+	1	124	169	180
29	33	Divorced	20-29	College	2	143	169	178
30	31	Married	60-69	College +	3	130	188	199
31	35	Married	60-69	College+	2	200	225	254

Table D2. Descriptive Characteristics of Participants (n=31)

Characteristic	Mean	SD	Range
Age (yrs)	29.58	5.188	19-36
Height (in)	64.33	2.623	60.25-69.25
Weight (lbs)	189.29	41.25	142-281
BMI(kg/m²)	32.13	5.837	24.5-41.2
Family Income*	3.87	1.821	1-6

*Family Income ($K)
1=10-19
2=20-29
3=30-39
4=40-49
5=50-59
6=60-60+

Table D3. Marital status of participants

	Number	Percent
Married	18	58.1
Single	10	32.3
Divorced	3	9.7
Total	**31**	**100**

APPENDIX E

CORRELATION BDI AND 6 DIMENSIONS OF POMS
POMS: PRE-POST

Table E1. Correlations between changes in scores of Beck Depression Inventory (BDI) and changes in score from 6 Dimensions of Profile of Mood States (POMS) (n =31)

BDI	Tension	Depression	Anger	Vigor	Fatigue	Confusion
Pearson correlation	.333	.449 (*)	.616 (*)	-.525 (**)	.414 (*)	.472 (**)
Sig. (2-tailed)	.067	.011	.000	.002	.021	.007

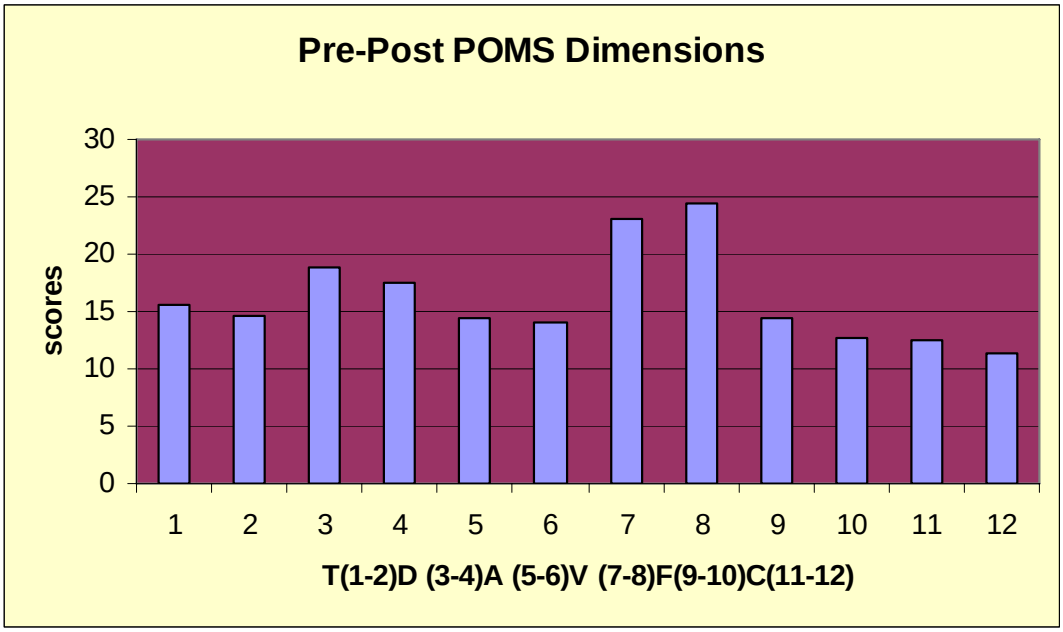

Figure E1. Difference between the POMS means before and after the 12 week study.

T = Tension/anxiety

D= Depression/dejection

A= Anger/hostility

V=Vigor/activity

F= Fatigue/Inertia

C= Confusion/Bewilderment

APPENDIX F

WEIGHT LOSS/PARITY GRAPHS

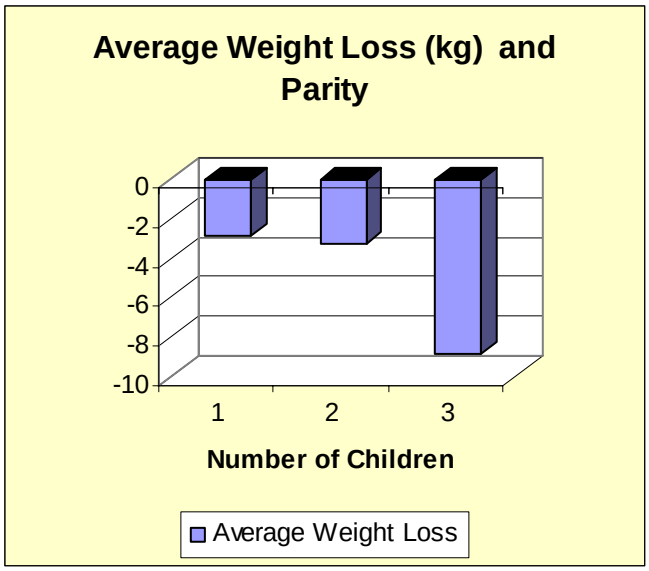

Figure F1. Average Weight Loss (kg) and Parity

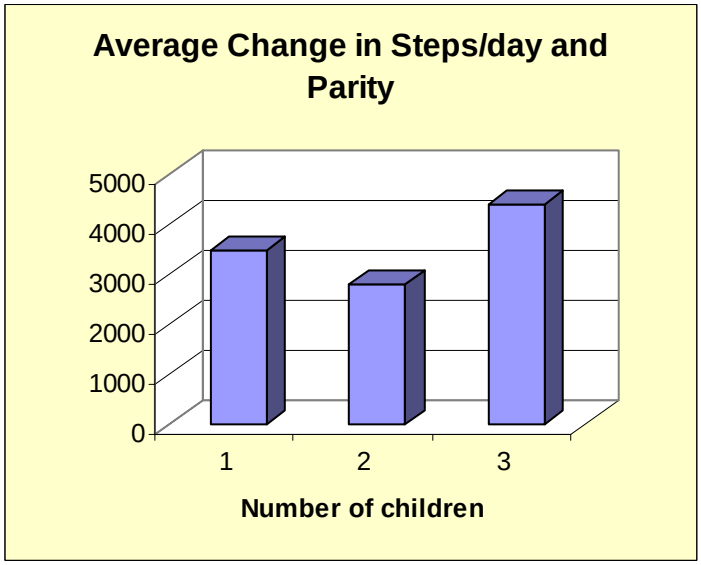

Figure F2. Average Change in Steps/day and Parity

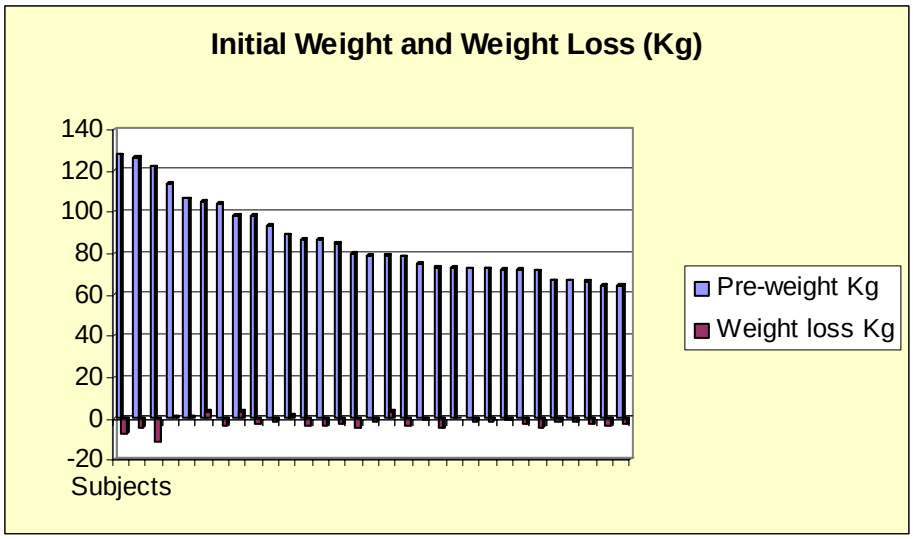

Figure F3. Initial Weight and Weight Loss (kg)

APPENDIX G

CORRELATION TABLE

Table G1. Statistically significant correlations of change in variables (n= 31)

	BMI	RHR	Hip (cm)	Wgt (kg)	Waist (cm)	RBP d
Average Steps	-.543**	-.496**	-.447*	.-597 **		
Wgt (kg)					.574**	
RHR						.379*
Pearson Correlation	.002	.005	.012	.000	.001	.036

* Correlation significant at the 0.05 level (2-tailed)
** Correlation significant at the 0.01 level (2-tailed)

APPENDIX H

RAW DATA: WEIGHT RETENTION AND BODY COMPOSITION

Table H1. Waist circumference before and after the 12 week physical activity intervention.

Participants	PreWaist(cm)	PostWaist(cm)	Pre-Post Waist (cm)
1	107	104.25	-2.75
2	108	108	0
3	96.5	89.5	-7
4	93	84	-9
5	87.5	80	-7.5
6	99	87.5	-11.5
7	113	108	-5
8	99	91.5	-7.5
9	81	74	-7
10	88.5	83.8	-4.7
11	118	110.5	-7.5
12	83.18	77.5	-5.68
13	101	110.5	9.5
14	85	78.7	-6.3
15	105	97.8	-7.2
16	91.5	85.7	-5.8
17	100.5	103	2.5
18	91.5	81.28	-10.22
19	94	86.36	-7.64
20	87.6	88.9	1.3
21	88.9	88.9	0
22	92.7	90.2	-2.5
23	104	104	0
24	86.5	80	-6.5
25	99.5	104	4.5
26	99.7	97.8	-1.9
27	99.1	83.8	-15.3
28	78.7	74.93	-3.77
29	94	87.6	-6.4
30	95.25	88.9	-6.35
31	119.38	116.84	-2.54
Mean	96.37	91.86	-4.51
S.D.	10.07	11.82	2.97

Table H2. Hip circumference before and after the 12 week physical activity intervention.

Participants	Pre Hip (cm)	Post Hip (cm)	Pre-Post Hip (cm)
1	146.5	143.5	-3.0
2	121	123.5	2.5
3	113	110.5	-2.5
4	105	104	-1
5	110.5	104	-6.5
6	112	108	-4
7	132	129	-3
8	113	112	-1
9	104	96.5	-7.5
10	96.52	94.6	-1.92
11	127	127	0
12	99	99	0
13	137	136	-1
14	111.5	109.2	-2.3
15	143.5	130.8	-12.7
16	110.5	108	-2.5
17	114.5	115.5	1
18	97.2	91.44	-5.76
19	118	101.6	-16.4
20	104	102.8	-1.2
21	106.7	104.8	-1.9
22	111.8	106.7	-5.1
23	136	136	0
24	127	124.5	-2.5
25	109	109	0
26	124.5	120.6	-3.9
27	142.2	142.2	0
28	109.2	109.2	0
29	112	110	-2
30	111.8	108.6	-3.2
31	138.43	135.89	-2.54
Mean	117.56	114.66	-2.90
S.D.	14.17	14.45	3.83

Table H3. Waist to Hip Ratio (WHR) before and after the 12 week physical activity intervention.

Subject	Pre WHR	Post WHR	Pre-Post WHR
1	0.73	0.73	0
2	0.89	0.88	-0.01
3	0.85	0.81	-0.04
4	0.89	0.81	-0.09
5	0.79	0.77	-0.02
6	0.88	0.81	-0.07
7	0.86	0.83	-0.02
8	0.88	0.82	-0.06
9	0.78	0.76	-0.02
10	0.92	0.89	-0.03
11	0.93	0.87	-0.06
12	0.83	0.78	-0.05
13	0.78	0.81	0.03
14	0.76	0.72	-0.04
15	0.73	0.75	0.02
16	0.82	0.79	-0.03
17	0.88	0.89	0.01
18	0.94	0.89	-0.05
19	0.8	0.85	0.06
20	0.84	0.86	0.02
21	0.83	0.85	0.02
22	0.83	0.85	0.02
23	0.76	0.77	0.01
24	0.68	0.64	-0.04
25	0.91	0.95	0.04
26	0.8	0.81	0.01
27	0.7	0.59	-0.11
28	0.72	0.69	-0.03
29	0.84	0.79	-0.05
30	0.85	0.82	-0.03
31	0.86	0.86	0
Mean	0.82	0.80	-.02
S. D.	0.07	0.08	0.04

Table H4. Weight (kg) before and after the 12 week physical activity intervention.

Subject	PreWgt (kg)	PostWgt(kg)	Pre-Post wgt
1	126.4	122.2	-4.2
2	106.6	107.7	1.1
3	72.8	72.4	-0.4
4	66.8	65.2	-1.6
5	71.5	67.2	-4.3
6	72.3	71.4	-0.9
7	98	95.9	-2.1
8	84.5	81.6	-2.9
9	66.36	63.6	-2.76
10	64.55	61.4	-3.15
11	98.2	101.4	3.2
12	64.54	61.8	-2.74
13	105	108.2	3.2
14	78.6	77.3	-1.3
15	121.8	110.9	-10.9
16	75	74	-1
17	88.9	90.25	1.35
18	72.95	68.2	-4.75
19	86.6	82.95	-3.65
20	72.5	70.9	-1.6
21	72.1	69.3	-2.8
22	78.2	74.4	-3.8
23	113.41	114.5	1.09
24	86.5	82.9	-3.6
25	78.6	81.8	3.2
26	93.6	92.3	-1.3
27	127.7	120.22	-7.48
28	66.8	64.77	-2.03
29	72.5	70.9	-1.6
30	80	75.7	-4.3
31	103.86	100.23	-3.63
Mean	86.04	83.92	-2.12
S.D.	18.75	18.47	2.97

Table H5. Body Mass Index (BMI) before and after the 12 week physical activity intervention.

Subject	Pre BMI	Post BMI	Pre-Post BMI
1	40.8	39.5	-1.3
2	34.8	35.2	0.4
3	28.7	28.6	-0.1
4	27.3	26.6	-0.7
5	28.8	26.6	-2.2
6	27.9	27.5	-0.4
7	38.3	37.5	-0.8
8	32.6	31.5	-1.1
9	25.7	24.7	-1.07
10	24.5	23.3	-1.2
11	41.2	42.6	1.4
12	24.6	23.6	-1
13	40.4	40.4	0
14	29	28.5	-0.5
15	40.5	37.1	-3.4
16	32	31	-1
17	33	33	0
18	30.4	28.4	-2
19	31.8	30.4	-1.4
20	26.9	26.4	-0.5
21	24.5	23.6	-0.9
22	28.2	26.9	-1.3
23	39.2	39.5	0.3
24	28.2	27.1	-1.1
25	31	31.9	0.9
26	40	39.4	-0.6
27	41.2	39.5	-1.7
28	24.5	23.7	-0.8
29	29.2	28.6	-0.6
30	30.7	29.1	-1.6
31	40.3	38.8	-1.45
Means	**32.14**	**31.31**	-.83
S.D.	5.84	5.97	.93

APPENDIX I

RAW DATA: CARDIOVASCULAR VALUES

Table I1. Resting Heart Rate (RHR) before and after the 12 week physical activity intervention.

Subject	Pre RHR (bpm)	Post RHR (bpm)	Pre-Post RHR (bpm)
1	72	80	8
2	54	56	2
3	93	91	-2
4	84	76	-8
5	66	70	4
6	64	76	12
7	64	69	5
8	64	68	4
9	69	68	-1
10	64	76	12
11	76	84	8
12	76	68	-8
13	88	80	-8
14	64	67	3
15	80	79	-1
16	74	80	6
17	79	86	7
18	53	60	7
19	91	78	-13
20	92	96	4
21	75	83	8
22	64	59	-5
23	73	80	7
24	83	80	-3
25	88	106	18
26	64	82	18
27	67	64	-3
28	64	62	-2
29	88	88	0
30	69	64	-5
31	97	85	-12
Means	**74.2**	**76.2**	**2**
S.D.	11.9	11.8	7.4

Table I2. Resting blood pressure (RBP) systolic values before and after the 12 week physical activity intervention.

Subject	Pre RBP sys (mmHg)	Post RBP sys (mmHg)	Pre-Post RBP (mmHg)
1	112	123	11
2	147	134	-13
3	119	114	-5
4	112	126	14
5	108	107	-1
6	132	120	-12
7	114	122	8
8	104	106	2
9	109	110	1
10	139	119	-20
11	126	116	-10
12	136	120	-16
13	128	133	5
14	120	117	-3
15	123	147	24
16	120	136	16
17	121	125	4
18	107	120	13
19	152	130	-22
20	133	121	-12
21	153	167	14
22	118	118	0
23	135	134	-1
24	113	110	-3
25	116	123	7
26	114	120	6
27	120	133	13
28	110	112	2
29	114	116	2
30	110	111	1
31	125	128	3
Means	**122**	**123**	**.903**
S.D.	13	12	11

Table I3. Resting blood pressure diastolic values before and after the 12 week physical activity intervention.

Subject	Pre RBP dias (mmHg)	Post RBP dias (mmHg)	Pre-Post RBP dias (mmHg)
1	75	88	13
2	77	79	2
3	74	77	3
4	72	81	9
5	68	71	3
6	80	85	5
7	72	77	5
8	57	60	3
9	69	80	11
10	92	89	-3
11	88	84	-4
12	86	80	-6
13	93	66	-27
14	68	70	2
15	88	84	-4
16	89	83	-6
17	82	76	-6
18	50	60	10
19	85	80	-5
20	100	100	0
21	94	88	-6
22	74	68	-6
23	67	78	11
24	66	70	4
25	72	80	8
26	74	85	11
27	68	72	4
28	68	70	2
29	70	76	6
30	78	55	-23
31	85	75	-10
Means	**76.8**	**77**	.194
S.D.	**11.3**	9.5	9.2

Table I4. Exercise Blood Pressure systolic value before and after the 12 week physical activity intervention.

Subject	Pre ExBPsys (mmHg)	PostExBP sys (mmHg)	Pre-Post ExBP sys (mmHg)
1	142	135	-7
2	157	147	-10
3	115	114	-1
4	140	114	-26
5	140	110	-30
6	146	125	-21
7	132	146	14
8	135	142	7
9	140	120	-20
10	147	144	-3
11	146	131	-15
12	130	125	-5
13	149	125	-24
14	116	120	4
15	133	154	21
16	132	150	18
17	135	135	0
18	133	150	17
19	164	155	-9
20	143	143	0
21	166	140	-26
22	133	125	-8
23	147	171	24
24	130	132	2
25	123	132	9
26	137	136	-1
27	164	164	0
28	112	112	0
29	128	115	-13
30	144	160	16
31	130	131	1
Means	**138**	**136**	-2.8
S.D.	13.4	16.1	14.6

Table I5. Exercise Blood Pressure diastolic values before and after the 12 week physical activity intervention.

Subject	Pre ExBP dias (mmHg)	Post ExBP dias (mmHg)	Pre-Post ExBP (mmHg)
1	83	62	-21
2	84	102	18
3	80	96	16
4	90	88	-2
5	100	80	-20
6	84	90	6
7	89	86	-3
8	112	110	-2
9	94	80	-14
10	94	105	11
11	92	94	2
12	71	86	15
13	91	75	-16
14	81	78	-3
15	80	94	14
16	91	84	-7
17	95	87	-8
18	84	70	-14
19	107	90	-17
20	98	99	1
21	100	114	14
22	81	78	-3
23	83	84	1
24	82	80	-2
25	83	96	13
26	81	89	8
27	94	91	-3
28	60	65	5
29	78	98	20
30	80	119	39
31	75	111	36
Means	**87**	**89.7**	**1.021**
S.D.	10.5	13.7	14.8

Table I6. Time to reach target heart rate (TTT) before and after the 12 week physical activity intervention.

Subject	Pre TTT (min)	Post TTT (min)	Pre-Post TTT (min)
1	6.54	8.37	1.83
2	7.51	5.5	-2.01
3	7.55	9.21	1.66
4	8.23	8.55	0.32
5	9.07	8.25	-0.82
6	8.25	8.04	-0.21
7	4.34	3.5	-0.84
8	7.3	5.51	-1.79
9	7.23	8	0.77
10	6.19	6.59	0.4
11	8.01	5.38	-2.63
12	7.14	7.36	0.22
13	7	7.3	0.3
14	7.54	9.43	1.89
15	7.37	5.5	-1.87
16	9.43	11.06	1.63
17	6.01	6.08	0.07
18	9.32	11.27	1.95
19	8.43	10.27	1.84
20	13.15	10.35	-2.8
21	8.03	8.2	0.17
22	6.58	7.2	0.62
23	7.16	7.15	-0.01
24	10.05	10.21	0.16
25	8.23	9.5	1.27
26	8.32	7.32	-1
27	8.21	7.55	-0.66
28	8.49	9	0.51
29	7.39	6.04	-1.35
30	7.51	9	1.49
31	6.3	6	-0.3
Means	**7.80**	**7.83**	.026
S.D.	1.51	1.87	1.36

Table I7. Rate of Perceived Exertion (RPE) response from a modified scale of 1-10 before and after the 12 week physical activity intervention.

Subject	Pre RPE	Post RPE	Pre-Post RPE
1	8	8	0
2	7.5	5.5	-2
3	4	3.5	-0.5
4	7	6	-1
5	5.5	6	0.5
6	6.5	4	-2.5
7	3.5	3	-0.5
8	6	5	-1
9	7	8	1
10	7	5	-2
11	8	5	-3
12	5	2	-3
13	7	5	-2
14	8	7	-1
15	8	5	-3
16	8	6	-2
17	7	6	-1
18	9	9	0
19	6	5	-1
20	9	4	-5
21	7	4	-3
22	4	3	-1
23	7	5	-2
24	8	6.5	-1.5
25	5.5	5	-0.5
26	6	6	0
27	9	8	-1
28	4	4	0
29	6	2	-4
30	9	9	0
31	6	5	-1
Means	**6.7**	**5.3**	**-1.4**
S.D.	1.6	1.8	1.4

APPENDIX J

RAW DATA: POMS AND BDI

Table J1. Total scores from Profile of Mood States (POMS) before and after the 12 week physical activity intervention.

Subject	Pre POMS	Post POMS	Pre-Post POMS
1	51	37	-14
2	31	29	-2
3	53	39	-14
4	53	49	-4
5	49	40	-9
6	41	64	23
7	49	40	-9
8	30	20	-10
9	41	56	15
10	68	116	48
11	36	33	-3
12	49	31	-18
13	57	112	55
14	118	69	-49
15	35	25	-10
16	43	49	6
17	132	104	-28
18	19	54	35
19	39	21	-18
20	42	51	9
21	44	52	8
22	43	40	-3
23	50	39	-11
24	78	26	-52
25	23	13	-10
26	44	38	-6
27	32	37	5
28	95	56	-39
29	110	44	-66
30	45	31	-14
31	32	29	-3
Means	**52.6**	**46.6**	-6.1
S.D.	27.1	24.9	25.8

Table J2. Total scores from Beck Depression Inventory (BDI) before and after the 12 week physical activity intervention.

Subject	Pre BDI	Post BDI	Pre-Post BDI
1	13	8	-5
2	1	1	0
3	7	5	-2
4	8	5	-3
5	6	3	-3
6	5	4	-1
7	12	7	-5
8	15	6	-9
9	9	9	0
10	3	8	5
11	3	0	-3
12	5	5	0
13	14	19	5
14	10	2	-8
15	7	1	-6
16	6	4	-2
17	12	14	2
18	5	1	-4
19	1	1	0
20	5	5	0
21	4	1	-3
22	8	2	-6
23	1	3	2
24	16	7	-9
25	8	4	-4
26	5	4	-1
27	3	1	-2
28	13	5	-8
29	5	1	-4
30	7	1	-6
31	3	3	0
Means	**7.1**	**4.5**	-2.6
S.D.	4.2	4.1	3.6

APPENDIX K

RAW DATA: CHANGES IN PHYSICAL ACTIVITY

Table K1 Average Steps/day before and after the 12 week physical activity intervention.

Subject	Pre Avg steps/day	Post Avg steps/day	Pre-Post Avg steps/day
1	5724	9953	4229
2	3660	6473	2813
3	5206	8695	3489
4	10445	13292	2847
5	2712	6208	3496
6	6301	8962	2661
7	3272	5941	2669
8	13060	13284	224
9	5129	7416	2287
10	5500	3987	-1513
11	7809	8377	568
12	5571	12007	6436
13	5743	8160	2417
14	3120	4784	1664
15	6734	16776	10042
16	4100	8884	4784
17	6003	8023	2020
18	9132	11304	2172
19	3762	11094	7332
20	2159	5107	2948
21	1633	5967	4334
22	5505	7572	2067
23	5516	8428	2912
24	6254	10213	3959
25	5085	6738	1653
26	6198	8842	2644
27	5258	13099	7841
28	3271	7002	3731
29	4957	8334	3377
30	3748	6725	2977
31	3200	9574	6374
Means	**5347**	**8749**	3402
S.D.	2380	2864	2309