

PERCEIVED IMPORTANCE OF AND WILLINGNESS TO ENGAGE IN
WEIGHT LOSS BEHAVIORS AMONG OVERWEIGHT ADULTS

by

Tina Marie Mathur

BA, University of Pittsburgh, 1999

MPH, University of Pittsburgh, 2001

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This dissertation was presented

by

Tina Marie Mathur

It was defended on

April 24, 2007

and approved by

Beth Venditti, PhD., Assistant Professor, Department of Psychiatry

Tom Kamarck, PhD., Professor of Psychology and Psychiatry, Department of Psychology

Amy Otto, PhD., RD, LDN, Research Assistant Professor, Department of Health and Physical Activity

John M. Jakicic, PhD., Associate Professor/Department Chairperson, Department of Health and
Physical Activity

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Behavioral weight loss interventions are the standard approach to weight loss for overweight adults; however, adherence to the components of these programs is a challenge and an area of extensive interest in the field of obesity prevention and treatment. **Purpose:** This study examined whether perceived importance of and willingness to engage in weight loss behaviors predicted weight loss in overweight, previously sedentary adult men and women. In addition, these variables were examined in relation to actual engagement in weight loss behaviors, namely self-monitoring and attendance. **Methods:** Data from 30 overweight (body mass index (BMI) = $32.4 \pm 2.7 \text{ kg/m}^2$) men and women (age = 42.5 ± 8.1 years) who participated in a standard behavioral weight loss intervention that included behavioral modification strategies, moderate caloric restriction, and progressive exercise prescriptions. Body weight, perceived importance, and willingness were assessed at 0 and 12 weeks. **Results:** The intervention resulted in a decrease in body weight, body mass index, caloric intake, and fat intake ($p < 0.05$) and an increase in energy expenditure (kcal/week) ($p < 0.05$). Individuals reported lower total perceived importance and willingness scores at week 12 ($p < 0.05$). Perceived importance and willingness for self-monitoring, eating, and exercise behaviors were correlated at both baseline and week 12. However, neither perceived importance of or willingness to engage in self-monitoring and eating behaviors at baseline were found to be predictive of weight loss. Willingness to self-monitor at week 12 was positively correlated with weight loss ($r = 0.40$, $p = 0.03$). In addition, negative correlations were found for perceived importance of exercise behaviors at week 12 and weight

loss and willingness to engage in exercise behaviors at baseline and weight loss. **Conclusion:** The present study provides preliminary support for the relationship between perceived importance of and willingness to engage in weight loss behaviors; however, the ability of these two variables to predict weight loss is unclear. Further understanding of perceived importance of and willingness to engage in behavioral weight loss strategies among adults participating in weight reduction programs may allow for personalized interventions and more successful weight losses.

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PREFACE

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In loving memory of my mother.

1 INTRODUCTION

1.1 Definition, Prevalence, and Consequences

Obesity is a prevalent and chronic disease that is classified by body mass index (BMI). Overweight is defined as a BMI between 25.0 and 29.9 kg/m², while obesity is defined as a BMI greater than or equal to 30 kg/m², with extreme obesity defined as a BMI greater than or equal to 40 kg/m² [1]. Epidemiological data shows that obesity and overweight in the United States have reached epidemic proportions and are now considered to be a significant public health problem. It is estimated that approximately 64.5% of adults in the United States are overweight, and 30.5% are obese [2, 3]. The prevalence of obesity has increased more than 50% between 1980 (14.5%) and 1994 (22.5%) [4]. In addition, the prevalence of extreme obesity has increased from 0.78% to 2.2% over the past decade [5].

Obesity has been linked to increased morbidity and mortality due to many negative health consequences including diabetes mellitus, coronary heart disease, hypertension, dyslipidemia, gallbladder disease, osteoarthritis, sleep apnea, and certain type of cancers (colon, breast, endometrial, and gall bladder) [1]. The economic toll of obesity is just as notable as the health consequences of this condition. In the United States, obesity is estimated to cost society nearly \$100 billion per year [6]. This estimate includes direct costs (e.g., medical care, hospital time, physician services, and medications) and indirect costs (e.g., increased absenteeism and decreased work productivity) due to obesity [6].

1.2 Weight Loss

In 2000, 46% of women and 33% of men in the United States reported trying to lose weight [7]. Of those who have tried to lose weight and have achieved a weight loss, only about 50% maintain their weight loss for at least one year [8]. While these data suggest that a significant portion of the U.S. adult population is trying to lose weight, and despite vast information and widespread efforts to promote weight control, weight loss success has proven to be a difficult endeavor to achieve.

Weight loss is most commonly achieved by reducing energy intake and increasing physical activity [1]. Behavioral interventions which focus on modifying eating and physical activity behaviors continue to be the cornerstone of weight loss programs. These programs use cognitive behavioral strategies to help individuals reduce energy intake, increase physical activity, and make lifestyle changes. Participants in these programs usually lose approximately 10% of their initial body weight over the length of the treatment (usually 4 to 6 months) [9]. This amount of weight loss has been shown to have a significant impact on health-related outcomes such as blood pressure, low-density lipoprotein (LDL), total cholesterol, triglycerides, insulin levels, and cardiorespiratory fitness [1, 10-13].

1.3 Rationale

Among individuals entering a behavioral weight loss intervention, there is a significant amount of variability between those who achieve significant weight loss (responders) and those

who do not (non-responders). For example, Wing et al. reported that the mean weight loss in response to a 6-month diet and exercise intervention was 10.3 kg; however, the standard deviation of this reported weight loss was 7.3 kg [14]. Moreover, Jakicic and colleagues reported 12-month weight losses ranging from 6.3 to 8.9 kg with a standard deviation ranging from 5.6 to 7.6 kg [15]. Thus, these data reflect the large variability in weight loss in response to behavioral interventions. In addition, it is not uncommon to have approximately 20% of the subjects who begin the study drop out before the intervention ends [16]. Those individuals who fail to lose weight or drop out may prove reluctant to engage in the change process. More specifically, these individuals may not be willing to engage in specific behaviors known to contribute to weight loss. Therefore, it is important to better understand factors which determine the behavior change process and may account for the varying degrees of responsiveness commonly observed in behavioral weight loss interventions.

Behavioral weight loss interventions have typically been based on well-accepted theoretical approaches to behavior modification. For example, the Transtheoretical Model (Stages of Motivational Readiness to Change) has been used to better understand, explain, and/or predict health related behaviors, including weight loss efforts [17]. Through evaluation of an individual's current readiness to change as defined by the different stages of the model, it is possible to tailor intervention strategies so as to help facilitate the behavior change process and consequentially, adoption of healthier lifestyle behaviors. Moreover, the strategies employed in weight loss interventions to move individuals along the stage of change continuum are based on cognitive behavioral theories such as Social Cognitive Theory [18] and other well-accepted theoretically based approaches to behavior change [19-23]. However, even when interventions

utilize well-accepted theoretically-grounded strategies to promote weight loss, not all participants are successful at modifying weight loss behaviors (e.g., eating and exercise behaviors), which ultimately impact weight loss success. Therefore, it is important to better understand why some individuals respond to these interventions and others do not.

To date, numerous studies have examined behavior change determinants, or those factors thought to motivate or determine a behavior [24-28]. What influences a person to take a particular action has been categorized into external and internal determinants. While both external and internal determinants help explain some behaviors, they fail to conclusively predict which individuals will adopt the theory-based strategies and/or lose weight during a behavioral weight loss program.

1.4 Clinical Justification

To further understand why some individuals engage in some behaviors and not others during a weight loss program, perceived importance and willingness were introduced as two potential predictors of weight loss. Perceived importance is a person's opinion of how important a specific behavior is in successfully achieving weight loss. Willingness is defined in this study as the openness to engaging in a specific weight loss behavior. The concept of willingness originated from our clinical observations of weight loss participants. It is common for participants to express the weight loss behavior that they are willing or not willing to engage in. Most participants use this specific word (as opposed to another word such as intention) to express their plans to engage in weight loss behaviors. Therefore, we developed a clinical

rationale to support the concept of willingness to engage in specific weight loss behaviors and theoretically support behavioral strategies.

Based on this clinical rationale, the proposed pathway to understand the interaction between perceived importance and willingness is shown in Figure 1. The proposed pathway suggests that perceived importance of a behavior influences the reported willingness to engage in the behavior, which influences actual engagement in the behavior that improves weight loss. Thus, willingness to engage in either specific weight loss strategies (i.e., self-monitoring, measuring body weight, attending intervention sessions, etc.) or behaviors (i.e., diet or physical activity) may partially explain the difference in actual weight loss between individuals. While it is assumed that an overweight or obese individual entering a weight loss program has the desire to lose weight, it is unknown whether this same individual is willing to engage in theoretically-based strategies and/or behaviors that result in weight loss. This study is examining the proposed associations shown in Figure 1 to determine the viability of this pathway, which may increase the understanding of the factors on weight loss and inform future research in this area of study.

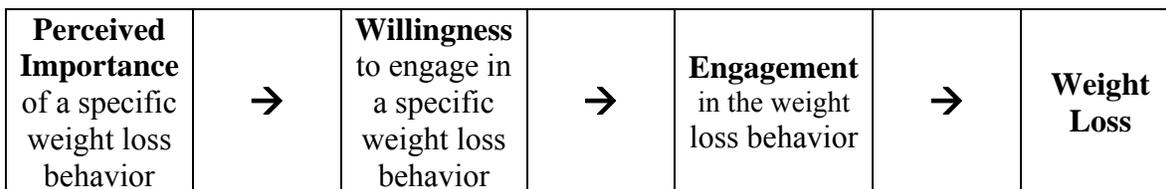


Figure 1. Proposed Pathway for the Clinical Rationale to Determine the Influence of Perceived Importance and Willingness on Engagement of a Behavior and Weight Loss.

To determine the extent to which this proposed pathway has been examined, a review of existing literature was conducted. Based on this review, the proposed pathway and the concept of willingness to engage in specific weight loss behaviors does not appear to have been previously examined. However, examination of the literature may indicate that the proposed pathway shown in Figure 1 closely resembles components of the pathway described within the Theory of Planned Behavior (see Figure 2). Specifically, the Theory of Planned Behavior identifies intention as the pre-cursor to an actual behavior, which may mirror the proposed concept of willingness serving a pre-cursor to weight loss behaviors. It is proposed that behavior intention is influenced by three factors: attitude towards the behavior, subjective norms, and perceived behavioral control. Attitude toward the behavior may be similar to perceived importance in the proposed pathway shown in Figure 1. Thus, the potential overlap of the proposed pathway for this current study with the Theory of Planned Behavior is illustrated in Figure 3.

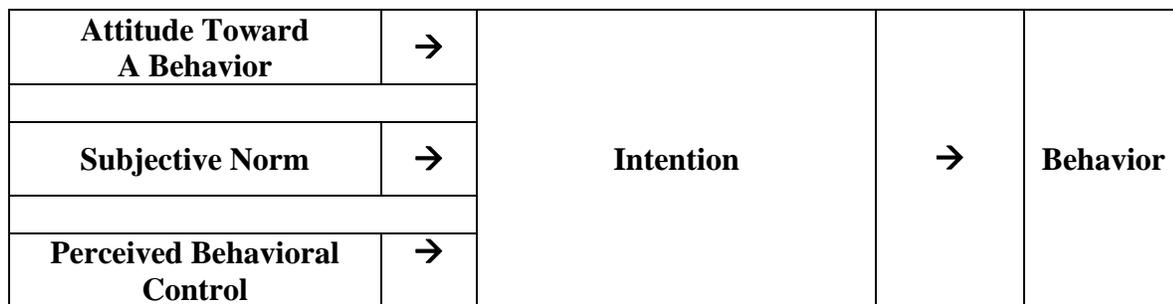


Figure 2. Components of the Theory of Planned Behavior.

<u>Proposed Pathway to be Examined in the Current Study</u>						
Perceived Importance of a specific weight loss behavior	→	Willingness to engage in a specific weight loss behavior	→	Engagement in the weight loss behavior	→	Weight Loss
<u>Components of the Theory of Planned Behavior</u>						
Attitude Toward specific weight loss behavior	→	Intention to engage in a specific weight loss behavior	→	Engagement in the weight loss behavior	→	Weight Loss

Figure 3. Comparison of Proposed Pathway and Components of the Theory of Planned Behavior.

This raises interest in the distinction between intention and willingness. Intention has been implicated as the antecedent of actual behavior in numerous theories in social and health psychology [90]. Intentions have been defined as the self-instructions to perform a certain behavior and indicate how much effort an individual will exert to achieve the desired outcome [168, 169]. The theory of planned behavior identifies intentions, perceived control, subjective norms, and attitudes as contributing variables to the occurrence of a behavior [169]. Schifter & Ajzen (1985) examined the success of the theory of planned behavior to explain weight loss among college women and reported that perceived control and intentions together only moderately predicted the amount of weight that the participants actually lost over a 6-week period [102]. Thus, an exploratory aim of this study is to examine whether intention and willingness are equally predictive of behavior change and weight loss.

This exploratory study examined factors that may help explain the disconnect between the desire to lose weight and the actual adoption of weight loss behaviors, which is based on a clinical rationale that may also be closely linked to the Theory of Planned Behavior. The goal of this study was to provide a better understanding into the variability of behavior adoption among individuals participating in a behavioral weight loss program. More specifically, this study examined perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors during a 12-week behavioral weight loss intervention.

1.5 Specific Aims

The specific aims of this study were the following:

- To examine the change from baseline to week 12 for perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors.
- To examine the relationship between perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors at baseline and at week 12.
- To examine if perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors are associated with weight loss during a 12-week behavioral weight loss intervention.

1.6 Research Hypotheses

This study proposed the following hypotheses:

- Perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors will increase from baseline to week 12.
- There will be a significant positive correlation between perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors.
- Perceived importance of and willingness to engage in self-monitoring, eating, and exercise behaviors at baseline will be significantly associated with weight loss.

1.7 Significance

Obesity is one of the leading health concerns in our country. Standard behavioral weight loss interventions elicit weight losses by creating a negative energy balance through decreased energy intake and increased energy expenditure. Combinations of theoretically derived behavioral strategies (for example: self-monitoring, stimulus control, and goal setting) are used to facilitate these changes in eating and activity patterns. However, even within the initial stages of a program, adoption of these behavioral strategies to facilitate the modification of eating and activity behaviors in overweight/obese individuals resulting in weight loss has proved to be a complicated and difficult goal to attain. Therefore, it is important to better understand factors that impact the adoption of theoretically-based, specific behavior strategies related to eating and exercise change during the weight loss process.

This study will examine the perceived importance and willingness to engage in theoretically-based strategies to modify eating and exercise behaviors to facilitate weight loss. These factors may be predictive of the variability or responsiveness to specific behavioral strategies among weight loss participants. If it is determined that these factors are predictive of actual engagement in specific behaviors that lead to weight loss, then future behavioral weight loss interventions could potentially use this information to screen individuals before beginning treatment, and tailor interventions and weight loss strategies. Subsequently, more personalized approaches could lead to improved adherence to weight loss treatments thus resulting in greater weight losses and more successful interventions to address this significant public health problem.

2 REVIEW OF LITERATURE

2.1 Introduction

The need for effective weight loss programs is important given the large number of individuals attempting to lose weight and the fact that two out of three adults are considered overweight in the United States [3, 7]. Behavioral interventions which focus on modifying eating and physical activity behaviors continue to be the cornerstone of weight loss programs [29]. The goal of behavioral weight loss interventions is to assist in the adoption and maintenance of eating and physical activity behaviors to affect energy balance. Cognitive behavioral therapy provides both the structure and the strategies to create permanent behavioral changes. Behavioral weight loss interventions that produce weight losses between 8% and 10% of starting weight within 4 to 6 months of weight loss treatment are considered effective at reducing health risks associated with excess weight and physical inactivity [29-31]. However, not all participants achieve this level of weight loss during a standard behavioral weight loss intervention implying that there is a need to better understand factors affecting the behavioral change process for weight loss.

In order to make a successful behavior change, a number of researchers have posited certain key elements that must be present, such as motivation to make the change, knowledge or skills of how to make the change, and an environment conducive to making the change [32]. Implied within these key elements are two very important concepts: (1) that the person perceives the behavioral strategies and/or behaviors related to making the change as important and

meaningful to the success of their change efforts, and (2) that the person is willing to engage in the behavioral strategies and/or behaviors as much or as often as needed to achieve their goal.

Perceived importance and willingness to engage in specific behavioral strategies may be two important areas that help to explain the variability of weight loss outcomes common to behavioral interventions for overweight and obese adults and thereby potentially affecting future weight loss interventions. Therefore, the purpose of this study was to identify those behaviors deemed to be important to the weight loss process and understand the relationship between willingness to engage in specific behaviors and weight loss success. This literature review will highlight the benefits and limitations of health behavior theories and models currently applied to behavioral weight loss interventions. It will also review published studies examining the correlations between psychosocial factors and weight loss behaviors and provide support for the current investigation into the perceived importance and willingness to engage in weight loss behaviors.

2.2 Obesity Prevalence

Overweight and obesity among adults has increased to incredible proportions resulting in a major public health problem [33]. Recent research states that 65% of the adults in the United States are classified as overweight or obese, and approximately 31% are classified as obese [3]. In 2000, the prevalence of obesity was 19.8% among adults in the United States, or approximately 38.8 million Americans [33]. Over the past two decades, prevalence rates of overweight have increased 40% while the prevalence rates of obesity have increased 110% [2].

In addition, obese individuals who do not seek treatment tend to gain even more weight over time [34]. Consequently the prevalence of obesity is steadily increasing [35].

2.3 Obesity Health Consequences

Obesity, sedentary lifestyles, and poor nutrition have all been associated with increases in morbidity and mortality rates [29, 36-38]. In 2000, mortality research estimated obesity to be responsible for about 400,000 preventable deaths [39]. In addition, overweight and obesity are associated with many chronic conditions including cardiovascular disease [40], diabetes mellitus [41], osteoarthritis [42], and certain types of cancers [43]. Research estimates that 90% of individuals with type 2 diabetes are obese [44]. Obesity has also been associated with increases in dyslipidemia [45] and sleep apnea [46]. Furthermore, the quality of life may be compromised for obese individuals. Overweight and obese individuals are frequently socially stigmatized with some experiences resulting in psychological distress. The psychosocial consequences of obesity include significant prejudice and discrimination and greater percentages of binge eating disorder [47-50].

2.4 Obesity Economic Consequences

Treatment of obesity and obesity-related health problems is a financial burden in the United States. Research has shown that the lifetime economic consequences for people with

higher body mass indexes are substantial [51]. In addition to increasing risk for developing hypertension, hypercholesterolemia, type 2 diabetes mellitus, coronary heart disease, and stroke, obesity also increases medical care costs associated with these diseases. The medical expenses associated with overweight and obesity accounted for 9.1 percent of total medical expenditures in the United States in 1998 [52]. Furthermore, the national costs of overweight and obesity is estimated to exceed \$100 billion per year [6]. This data emphasizes the unfavorable economic consequences of a highly preventable condition.

2.5 Causes and Contributing Factors of Obesity

Obesity is the result of a chronic imbalance in the amount of energy consumed versus energy expended where the energy intake exceeds the energy expenditure. Obesity has been conceptualized as a complex and multi-factorial condition that develops from an interaction of various factors including genetics, physiological regulation (metabolism), environmental influences (social and cultural), and behavioral determinants [53]. Energy balance is influenced by genetics and may explain the differences or similarities between individuals body weights and body compositions [54]. Adoption, twin, and family studies have shown that obesity has a strong heritable factor with genetic factors accounting for an estimated 25% to 40% of the variance in body weight or body fat [55-57]. For example, identical twins raised together or apart show a striking resemblance to each other, irrespective of family environment [58, 59]. Furthermore, considering the history of mankind has been at greater risk for starvation than for obesity, the

genetic predisposition of the physiological regulation of body weight may have a propensity to be more efficient at preserving body weight and storing fat than burning fat [60].

In addition to a genetic predisposition to obesity, the environment also has a significant impact on the body's physiological regulatory mechanisms and the resulting energy balance. In the United States, physical inactivity, food abundance, easy access to inexpensive and high fat foods, excessive nutritional intakes, and sedentary lifestyles have all been major forces in leading to energy imbalances in both adults and children [61]. The conveniences of modern society have led to the need for specific behavioral changes, including environmental changes and increased cognitive control, to help support and sustain healthy weights.

2.6 Obesity Treatment

The National Institutes of Health (NIH) guidelines recommend weight loss for individuals with a BMI ≥ 30 kg/m² and for individuals with a BMI > 25 kg/m² who also have two or more obesity-related risk factors [1]. Proper treatment can help reduce and/or reverse the dangerous health effects linked to obesity. The approaches to obesity treatment vary widely, including low-calorie diets, very-low-calorie diets (400-800 kilocalories per day), pharmacotherapy, increased physical activity and exercise, and surgery. The general goal of obesity treatment is to reduce energy intake below energy output to achieve weight loss [62].

The National Heart, Lung, and Blood Institute currently recommends an initial weight loss of 10% of body weight achieved over six months [1]. A 10% weight loss is associated with improvements in blood pressure, total cholesterol levels, low-density lipoprotein-cholesterol

levels, serum triglyceride levels, high-density lipoprotein-cholesterol levels, blood glucose levels, and sleep apnea [10, 13, 29]. Larger weight losses are generally associated with greater health improvements [63]. The health benefits associated with weight loss are extensive and include reduced risk of cardiovascular disease and type II diabetes mellitus, increased longevity, and enhanced mood and psychological well-being [64].

2.7 Behavioral Weight Loss Interventions

According to previous literature, the four main components of obesity treatment that contribute to a successful weight loss program include: increased physical activity, caloric restriction, dietary self-monitoring, and attendance at intervention sessions [65-67]. Behavioral weight loss interventions are common treatments for obesity that combine these four components to achieve moderate weight losses (i.e., 10% of initial body weight) with minimal side effects. These weight loss interventions are structured programs that focus on balanced, low-calorie diets, regular physical activity, and cognitive behavioral therapy [29]. The goal of these programs is to produce a negative energy balance by creating a 500 calorie deficit per day through modest reductions in caloric intakes and increased energy expenditures through physical activity [68]. Most individuals in weight loss treatment studies can lose 5-10% of their initial body weight and with continued adherence to the behavioral weight loss strategies, can maintain this weight loss for up to one year [69, 70].

Modification of behaviors occurs through education and various cognitive behavioral strategies including goal setting, self-monitoring, and stimulus control [30, 31]. The behavioral

modification method assumes that maladaptive behaviors (where behaviors include actions, thoughts, and feelings) are learned and can be changed using specific learning principles. The approach includes identifying factors that trigger unhealthy behaviors, defining specific goals and strategies to change the antecedents of these behaviors, and development of the skills to prevent and/or manage the behaviors [71].

Behavioral weight loss interventions have made substantial progress since the first studies began in the early 1970s evidenced by greater overall weight losses and higher levels of success among the participants [70]. The early behavioral programs produced weight losses of approximately 4.5 kg over a 10-week program [72]. More recent behavioral programs consist of a 6-month treatment phase where participants lose approximately 9.0 kg [30]. The more evolved behavioral programs focus on energy balance with participants prescribed specific dietary (calorie and fat gram) goals usually totaling 1,000-1,500 kilocalories [kcal]/day with dietary fat intake restricted to 20% to 30% of total calories [30]. Frequent contact with the participants and weekly instruction helps to support weight loss efforts [73]. Research has shown that attending intervention sessions is consistently related to weight loss [66]. Furthermore, weekly weigh-ins may provide motivation for the participants to adhere to the prescribed behaviors [74].

Despite improvements in weight loss strategies, adherence to recommended weight loss behaviors and continued commitment to the intervention remain problematic. Retaining individuals is a main focus of behavioral weight loss programs since drop out is a major concern. Wadden and Foster (2000) examined the results of standard behavioral treatments for obesity among ten randomized clinical trials between 1988 and 1995 and reported a mean attrition rate of 22% within six months of treatment [75]. Furthermore, of the individuals who complete the

treatment, there is a varying degree of weight loss responsiveness observed. It is not uncommon to have a range varying from substantial weight loss to no weight loss at all to weight gain during the intervention period. Among those who do lose weight, weight regain is common with the majority of individuals regaining two-thirds of the weight loss within one year and almost 100% of the weight loss within 5 years [31]. To help improve behavioral treatment programs for obesity it is important to examine adherence to weight loss behaviors, and more specifically to better understand the variability among participants in regards to engaging in the specific behavioral weight loss strategies. Thus, it is important to identify behaviors which impact weight loss and then identify and understand the predictor variables of successful behavior change.

In addition to increased education in nutrition and exercise, standard behavioral weight loss interventions include self-monitoring, stimulus control, cognitive restructuring, goal-setting, and relapse prevention [65, 76]. A general description of each of these components and relevant supporting research is provided in the following section.

2.7.1 Self-Monitoring

Self-monitoring is the systematic and methodical recording of specific behaviors that is the cornerstone of behavior modification [77, 78]. The goal of self-monitoring is to increase an individual's awareness of their behaviors thereby allowing them to better self-regulate their behaviors and identify patterns of behavior that can be modified to help achieve goals [77]. In behavioral weight loss interventions, a food and activity diary is commonly used to record types of foods and drinks consumed, time of ingestion, amount consumed, total caloric intake, total fat

intake (in grams of fat), and the frequency, duration, and perceived exertion of exercise. Although, underreporting and/or inaccurate reporting of energy intake is common [79], self-monitoring is considered a key component of any behavioral change or weight loss program [77]. Research has shown that individuals who consistently self-monitor their eating and exercise behaviors lose more weight than those who fail to consistently self-monitor behaviors [80, 81]. Furthermore, self-monitoring has consistently been associated with both short- and long-term weight loss [82].

2.7.2 Stimulus Control

Stimulus control is the direct manipulation of environmental cues to encourage and/or discourage overeating and inactivity. Through observation (like self-monitoring), specific environmental cues or triggers (sights, smells, thoughts, activities, emotions, people, places, and events) are identified and then either eliminated or avoided [65]. Modification of the environment and stimulus control are considered to be fundamental components of a behavioral weight loss program [76]. Examples of stimulus control include using a shopping list, leaving exercise clothes/shoes out in plain sight, removing “problem” foods from the house, and eating at a table (instead of on the couch or while watching television). One study reported that stimulus control was more effective than cognitive rehearsal and social support in acting as an effective tool for changing behaviors [83].

2.7.3 Cognitive Restructuring

Cognitive restructuring is the systematic identification and modification of distorted or negative thoughts and beliefs that affect and/or interfere with weight loss efforts. The goal is to first raise awareness of self-defeating thoughts, and second, change, eliminate, or replace the thoughts with more efficacious and positive ones. This process helps to enhance feelings of self-efficacy [65]. Cognitive strategies are also used to deal with food cravings or urges. Individuals trying to lose weight are taught to understand the urge process as a wave that they can “ride out” and thereby avoid succumbing to their desire.

2.7.4 Goal-Setting

Goal setting is the process of defining specific, quantifiable, and realistic behaviors or acts that help achieve the ultimate goal of weight loss. Goal setting is a main focus in weight loss programs and it is recommended that individuals set realistic weight loss goals such as reducing body weight by 5 to 10 percent of starting weight [84, 85]. In addition, small goals for nutrition and exercise are set and encouraged throughout the weight loss program.

2.7.5 Relapse Prevention

Relapse prevention is a behavioral self-control approach that teaches individuals how to anticipate and cope with the problem of relapse. Relapse prevention is most important during the weight maintenance phase [86]. There are different types of relapse based on the amount of time

that passes when the newly adopted behavior is not being practiced. Lapse is when an individual returns to their old behaviors for a few days or experiences a temporary cessation of a new behavior. Relapse is when an individual returns to their old behaviors for an extended period of time longer than a few days. And collapse is the complete return to old behaviors. The goal of relapse prevention is to first identify, define, and predict the high risk situations, create and implement a coping plan, and use behavioral strategies to support relapse prevention.

2.8 Health Behavior Research

Health behavior research has focused on applying theoretically based models to help predict and understand the performance or nonperformance of behaviors. Behavioral prediction theories may help explain why some individuals engage in behaviors and others do not. Studies on adherence problems center around two general areas of interest: motivation and action. This is in accord with the major health behavior prediction theories: the Health Belief Model [87, 88], the Theory of Reasoned Action, or the more recent version of this theory known as the Theory of Planned Behavior [23, 89], and Social Learning Theory [22]. These theories maintain that health behaviors are the product of motivational factors and action components. Motivational or cognitive-perceptual factors include attitudes, social norms, perceptions of vulnerability to a health threat or the consequence of a health threat [90]. Action components include intention to act [91] or perceived self-efficacy (defined as the perceived ability to accomplish the action) [22]. The relationship between the two components is such that the actions are the products of the motivational factors.

Numerous psychological models and theories have guided the development of health promotion and behavior change programs. These models include the Health Belief Model [87], the Theory of Reasoned Action [92], the Theory of Planned Behavior [23], Self-Efficacy Theory[22], Social Cognitive Theory [93], and the Transtheoretical Model of Behavior Change [94]. Application of theoretical models is necessary for explaining and predicting behavior and for designing effective interventions. Therefore, a description of the prediction theories commonly applied to behavioral modification interventions for weight control will be discussed.

2.8.1 The Health Belief Model

The Health Belief Model states that an individual becomes motivated to take action to maintain their health status when they perceive that their health is threatened by a potential disease or illness, and that their action will be effective at reducing the posed threat [95]. This model identifies four key factors that affect one's decision to take action: (1) the perceived susceptibility to the health threat; (2) the perceived severity of the health threat; (3) the perceived likelihood that a preventive action will result in a reduction of the health threat; and (4) perceived barriers to performing the preventive action. While this model has been successfully applied to adherence to medical regimens, research on its application to obesity prevention has been limited.

2.8.2 The Theory of Reasoned Action

The theory of reasoned action is a conceptual model, based on the assumption that human behavior is guided by a rational, decision-making process. This theory states that an individual's behavioral intention explains and predicts social behaviors that are mainly under volitional control [92, 96]. A person's behavioral intention is a representation of their plan of action and is considered to be the immediate antecedent of behavior and also an indicator of a person's level of motivation to engage in a behavior [23, 96].

The theory of reasoned action posits that an individual deliberates the potential outcomes of one's actions, decides on a behavior (or series of behaviors), then takes action. This process is a function of an individual's attitudes about the behavior and their perceptions of the subjective norm (other people's opinions regarding the appropriateness of the behavior). According to the theory of reasoned action, three components are involved in the determination of volitional behavior: (1) behavioral intention (the propensity to act); (2) attitude (overall feeling of "favorableness or unfavorableness"); and (3) subjective norms (perceptions of significant peoples beliefs) [92]. However, Ajzen and Fishbein (1980) have stated that the influence of attitudes and subjective norms on intentions and behaviors varies widely across individuals and there is no conceivable method of accurately determining the true influence of these two variables on behavior engagement [92].

While attitudes and subjective norms are the determinants of behavioral intentions, the theory of reasoned action also identifies determinants for each of these constructs also. Ajzen and Fishbein (1980) have explained the attitudinal construct by suggesting that an individual

possesses a range of beliefs about the outcome of a behavior. These beliefs about probable outcomes are termed behavioral beliefs and are considered to be the substance of attitudes [92]. Behavioral beliefs can be strong or weak, persist over time, or be replaced by other beliefs. In addition, each behavioral belief has a corresponding outcome evaluation, defined as the overall feeling of perceived favorableness or unfavorableness [92]. For example, an individual may believe that walking every day for 30 minutes will lead to improved fitness (behavioral belief), and may think that improved fitness is important to good health (outcome evaluation). For the subjective norms, Ajzen and Fishbein (1980) have explained that an individual's subjective norms are shaped by the favorable or unfavorable opinions and expressions of those opinions by people in that individual's life. However, the individual only feels pressure to comply with the opinions of the most important people to him or her.

2.8.3 The Theory of Planned Behavior

The theory of planned behavior is an extension of the theory of reasoned action, which helps explain and predict volitional behaviors, but does not address factors that may be outside the realm of voluntary control for a behavior. More specifically, the theory of reasoned action fails to account for factors such as lack of skills or lack of opportunity which may influence an individual's intention to and/or actual ability to engage in a behavior. These factors are independent of the attitudinal and subjective norm components which comprise the theory of reasoned action. For example, a person might have a favorable attitude toward a behavior and have people in their life that support this attitude, but, this person may not have the ability or

opportunity to take action and therefore does not engage in this behavior. Therefore, the theory of planned behavior was developed in an attempt to address this problem.

The theory of planned behavior focuses on the idea that performance of any behavior is codetermined by behavioral intention and perceived behavioral control [23, 96]. This theory, like the theory of reasoned action, states that behavioral intentions are predicted by two major factors: attitudes and subjective norms. Attitude refers to the degree to which a person has a favorable or unfavorable opinion regarding the behavior while subjective norm refers to the perceived social pressure to perform the behavior [23, 96]. In addition to these two constructs, the theory of planned behavior adds a third determinant of intention and behavior known as perceived behavioral control [97]. Perceived behavioral control is thought to directly affect behavior and is representative of the individuals perceived ease or difficulty of performing the behavior [23, 96]. Perceived behavioral control has been defined by Ajzen (1988) as “the perceived ease or difficulty of performing the behavior” which is based on an individual’s “past experience and anticipated impediments and obstacles” [98]. Perceived behavioral control is similar to the concept of self-efficacy, or the degree to which an individual believes in their ability to successfully achieve a behavior [98]. For example, an individual’s perceived behavioral control to walk 30 minutes every day would encompass their sense of ability to walk every day, their past experiences of adhering to a regular walking program, and perceived barriers of doing this behavior every day. It should be noted, that perceived behavioral control is completely comprised of an individual’s perceptions and does not necessarily reflect actual reality of any of these factors, but, still has an influence on intentions and actual engagement in behaviors.

The theory of reasoned action and the theory of planned behavior have been used in explaining or predicting a variety of health-related behaviors. These theories assume that intentions are the immediate antecedent of behavior and that intentions are predictive of the corresponding behavior [99]. In a meta-analysis by Sheeran (2002), an overall correlation of 0.53 was reported between intention and behavior, suggesting that intentions accounted for approximately 28% of the variance in behavior [100]. Similarly, Armitage & Conner (2001) conducted a meta-analysis on the predictive potential of the theory of planned behavior for a variety of health behaviors and found that it explained 27 and 39 percent of the variance in behavior and intention, respectively [101].

The predictive value of the theory of reasoned action and of the theory of planned behavior may be limited for complex behaviors such as diet, physical activity, and weight loss [101, 102]. The ability of these theories to predict adherence to a reduced fat diet and different types of exercise, including general regular exercise, have been varied [103-113]. Godin et al. (1993) found that perceived behavioral control related to the intention to exercise but did not predict actual exercise behavior [114]. Hausenblas et al. (1997) conducted a meta-analysis of 31 studies using the theory of reasoned action and the theory of planned behavior in predicting exercise, and reported generally large effect sizes (averaging 1.09) for the prediction of behavior from intention [115]. Other studies have reported similar findings and state that intention accounts for an average of approximately 30% of the variance in exercise behavior [116, 117]. In addition, research by Schifter & Ajzen (1985) found that perceived control and intentions together were only moderately successful in predicting weight loss in college women [102]. Other research supporting the Theory of Planned Behavior to predict weight loss is lacking. In

summary, it is clear that intentions play an important role in actual behavioral engagement; however, the research presented here highlights the complexities involved in translating only intentions into actual behavior. Further research on intentions, perceived behavioral control, attitudes, and other possible predictive variables is needed.

2.8.4 The Transtheoretical Model of Behavior Change

The Transtheoretical Model of Behavior Change originated from a desire to identify generic aspects of behavior change, and which was initially developed based on the observation of individuals participating in self-help smoking cessation initiatives [118]. Prochaska and DiClemente noted that there was an observed process followed by individuals engaging in these efforts, which was distinguishable by a series of stages [118]. Each stage of behavior change exhibits covert and overt behaviors that influence the process that is followed when attempting behavior change. The recognition that behavior change unfolds through a series of stages over time, not as an event that occurs once at one point in time, has become a key aspect of the Transtheoretical Model [118].

2.8.5 The Stages of Change

The Transtheoretical Model is an integrative model of behavior change that contains three basic dimensions; temporal, qualitative, and quantitative [118]. These dimensions represent important core constructs like stages of change, self-efficacy, decisional balance and processes of change. Five distinct stages of behavioral change have been established. Stage is defined as the

temporal dimension in which change occurs (usually measured by a six-month period). Research findings suggest that when people change from a negative behavior to a positive alternative, they tend to progress through each of the stages of change of the Transtheoretical Model [118]. The following are the five stages of behavior change which have been proposed.

1. **Precontemplation Stage:** This is the stage at which there is no intention to change behavior in the foreseeable future. This group is characterized as the most resistant to change [19].

2. **Contemplation Stage:** This is the stage in which people have identified a problem, are deciding whether or not there is a need to take action to correct the problem, and are weighing the pros and cons of changing and comparing them to the pros and cons of not changing.

3. **Preparation Stage:** This is the stage in which a decision has been made that there is a need to take some action towards behavior change.

4. **Action Stage:** This is the stage in which intention to change behavior is translated into specific action steps to facilitate behavior adoption within the past six months. This stage identifies those individuals who have made changes to their behavior and have attained specific, predetermined objectives for a given behavior.

5. **Maintenance Stage:** This is the stage in which people have sustained the modified behavior for a period of at least six months.

The Transtheoretical Model conceptualizes that the five stages are relatively stable, yet changeable, falling between unstable states and stable traits [18]. It is presumed that individuals will move through each of the stages when making a successful behavior change, however,

individuals may progress and regress through the stages several times before successful change is achieved. In addition, individuals may remain in certain stages for considerable lengths of time. Each stage has specific qualities and strategies that define its place in the process of change. This has resulted in tailored and targeted health-related interventions being developed based on the stages of change. Research has provided strong support for the reliability and validity of the stages and processes of change [119-121].

The Transtheoretical Model and Stages of Readiness for Change are based on a number of theory-based components. One of these components is self-efficacy, which is the confidence in one's ability to perform a specific behavior [22]. Self-efficacy theory is drawn from the broader Social Cognitive Theory, which emphasizes the interactions between intrapersonal, social, and physical influences on behavior [22]. Efficacy expectations are partly responsible for behavioral choices, effort expended on behavior, duration of perseverance, and level of self-assurance approaching a task [93]. Whether or not an individual approaches an activity with confidence and high expectations for a favorable outcome is dependent upon their evaluation of existing capabilities relevant to the activity. High efficaciousness in social, intellectual, and physical pursuits leads to high expectations of positive outcomes, whereas, low efficaciousness leads to low outcome expectations [93]. The importance of self-efficacy is highlighted by Herrick et al. who reported a significant relationship with stage of change [122]. Thus, within the stages of change model, self-efficacy is present in each stage and is regarded as positively influencing the adoption of behaviors across the stages. As a result, individuals in more advanced stages within the model have greater self-efficacy, which suggests that increasing self-efficacy for a specific behavior may allow for advancement to different stages of behavior change.

Additional components of the Transtheoretical Model are decisional balance and processes of change. Decisional balance represents the relative value attached to the "pros" and "cons" associated with making a significant behavior change, with a favorable balance of "pros" to "cons" increasing the likelihood of behavior change [20]. Thus, a favorable balance of "pros" to "cons" may be associated with stage advancement for a specific behavior [123]. It has also been suggested that different processes of behavior change may be important to allow for progression through the various stages of behavior change. Processes of change are strategies used to increase readiness for change and have been defined as the “covert and overt activities that individuals use to modify problem behaviors” and these are classified as either experiential (covert processes) or behavioral (overt processes) [121].

In summary, the Transtheoretical Model of Behavior Change has been used extensively in health promotion interventions to encourage behavioral change. The model determines the stage of readiness to change and provides stage-specific strategies to increase the probability of transition to a higher stage. In the case of exercise adoption, it is critical to understand and identify the stage an individual is in before a successful intervention can be designed and applied. The Transtheoretical Model categorizes individuals into stages based on their intentions of adopting an active lifestyle. Furthermore, the model serves as a measurement in determining the impact of the intervention amongst the participants. Therefore, the Transtheoretical Model can serve as a useful tool in exercise adoption interventions.

2.8.6 Summary

Behavior change theories and models provide the framework for standard behavioral weight loss interventions. These same theories also provide behavioral or cognitive strategies to help facilitate the change process. However, the theoretical framework upon which the interventions are based does not conclusively explain why some subjects achieve significant weight loss while others drop out, gain weight, or fail to achieve even the minimal amount of weight loss necessary to improve health and quality of life. Therefore, a better understanding of the determinants of behavior change may help to explain individual variability in weight loss outcomes in behavioral interventions.

2.9 Determinants of Behavior Change

Behavioral treatment of obesity developed from the belief that individuals could change their eating and activity habits by following learning principles that teach new ways of thinking or acting. Though behavioral therapy can assist individuals to learn and implement healthier skills, it fails to offer an explanation as to why some individuals readily adopt specific skills and others do not. To better understand the variability of behavior change success, determinants of behavior changes have been examined.

Individual variability commonly seen in obesity treatments has resulted in research focusing on identification of variables that explain for whom treatment works and under what conditions [26-28, 124]. To date, however, evidence shows that variability in weight loss

outcomes cannot be accurately predicted. Many different variables have been tested as predictors of successful weight loss with only a few variables having confirmed associations [24, 25]. Teixeira et al. conducted a study to examine the baseline characteristics of middle-aged women to try and distinguish responders from non-responders. The study found that six different variables (higher number of recent dieting attempts and recent weight loss, more stringent weight outcome evaluations, a higher perceived negative impact of weight on quality of life, lower self-motivation, higher body size dissatisfaction, and lower self-esteem) were associated with less weight loss [24].

Research on behavior change has stated that diet and physical activity behaviors are determined by a complex combination of motivations, abilities, and opportunities [32]. However, it is possible and common that an individual has all three of these factors but still does not make a positive behavior change. The explanation for this may reside in an individual's degree of willingness to engage in the strategies or behaviors that lead to achievement of the behavior change. For example, if a person knows what he or she should do and is able to do it, this does not mean that he or she will do it (i.e., having knowledge about a behavior is only one factor but other factors influence decisions). People often learn about a behavior long before they are willing to adopt it. Furthermore, if a person wants to do a behavior, it does not mean that he or she will do it. Wanting to engage in a behavior does not equate being willing to actually engage in that behavior. Therefore, willingness to engage may be the single most relevant factor necessary for and determining of the action component of behavior change.

2.10 Conclusion

Theories of behavior change provide information on identification of what behaviors to change, ways to increase motivation to change these behaviors, and strategies to help facilitate the behavior change process. These theoretical approaches influence how to design and implement interventions. However, while grounded in theory, the interventions are not effective for all individuals as indicated by the variability commonly seen in behavioral weight loss interventions. This variability may be a result of the theoretically based strategies not being perceived favorably by the participants and/or the lack of willingness to engage in or intention to do these strategies. Research on the perceived importance of and willingness to engage in behavior change strategies is lacking. In addition, willingness to engage may be some how linked to the concept of intention to do a behavior as described by the Theory of Planned Behavior. Further information on behavioral change determinants such as willingness to engage and intention may add to the effectiveness of behavioral weight loss interventions.

3 METHODS

3.1 Introduction

It is estimated that more than 65 percent of adults are overweight (BMI \geq 25 kg/m²), with an excess of 30 percent of adults classified as obese (BMI \geq 30 kg/m²) [1]. Behavioral weight loss interventions that are based on well-accepted theoretical approaches to behavior modification typically result in weight losses of approximately 10 percent within the initial 6 months of treatment [9]. However, there is substantial variability between individuals in response to these weight loss interventions. Therefore, it is important to understand why some individuals are less responsive than others to these theoretically-based weight loss interventions. This study examined the perceived importance of and willingness to engage in theoretically-based behavioral strategies for self-monitoring, eating, and exercise behaviors related to weight loss.

3.2 Subjects

The subjects for this investigation were thirty-seven sedentary, overweight and obese adult men and women participating in a behavioral weight loss study at the Physical Activity and Weight Management Research Center at the University of Pittsburgh. Participants were 29 to 55 years of age and had a body mass index (BMI) of 27.7 to 39.0 kg/m². Inclusion and exclusion criteria for participation in this study are listed in Table 1.

Table 1: Study Inclusion and Exclusion Criteria

Inclusion Criteria

- Male or Female
- 18 to 55 years of age
- Body Mass Index of 25.0 to 39.9 kg/m²
- Ability to provide informed consent

Exclusion Criteria

- Weight loss of >10% of their total body weight in the previous 12 months.
- Participation in a research project involving weight loss or physical activity in the previous 12 months.
- Participation in any other research study that may impact the outcome of the current study.
- Participation in regular physical activity (defined as 30 minutes per day three or more days per week) over the previous six months.
- Women currently pregnant, report pregnancy during the previous 6 months, or plan on becoming pregnant in the following six months.
- Report current treatment for any cardiovascular, orthopedic, psychological, neurological, or metabolic disorder or any other medical condition that could impact body weight, diet, or physical activity.
- History of heart disease, stroke, myocardial infarction, angina, diabetes, cancer, or orthopedic complications that would prevent optimal participation in the exercise component of the study.
- Currently taking any medications and/or supplements that could affect heart rate and/or blood pressure responses to exercise.
- Currently taking any medications and/or supplements that could affect metabolism and/or weight loss.
- Report an inability to attend weekly sessions or possibility of re-locating out of the Greater Pittsburgh area during the study period.

3.3 Recruitment and Screening Procedures

The participants for this study were recruited using newspaper and television advertisements (see Appendix A). The recruitment messages advised interested individuals to contact the University of Pittsburgh Physical Activity and Weight Management Research Center by phone whereby they were provided with an explanation of the study and description of the risks of participating in the phone screen. After giving verbal consent to complete a brief telephone screening interview, the staff proceeded to determine initial eligibility using the following forms: Risk Review Form, Phone Screening Interview Form, and Contact Tracking Form (see Appendix B).

Participants deemed eligible for the study were invited to attend a group orientation session at which time they received a detailed description of the study and answers to any questions or concerns they had regarding the study. Potential subjects completed a physical activity readiness questionnaire (PAR-Q) and a detailed medical history [125] (see Appendices C and D). Individuals who answered yes to any question on the PAR-Q were referred to their primary care physician and deemed ineligible to participate in the study. In order to minimize potential risk to the subject, all subjects were required to provide written medical clearance from their personal physician prior to participating in the study (see Appendix E). Individuals who agreed to participate in the study read and signed a written informed consent form (see Appendix F). All experimental conditions and related participation forms were approved by the University of Pittsburgh's Institutional Review Board (IRB) prior to initiating the study (IRB #0511001).

3.4 Experimental Procedures

This investigation was a 12-week clinical behavioral weight loss intervention that was conducted at the Physical Activity and Weight Management Research Center at the University of Pittsburgh. This study was a descriptive and prospective study with assessments performed at 0 and 12 weeks of participation.

3.5 Intervention Details

3.5.1 Study Time Period Rationale

This study was a 12-week behavioral weight loss program. While it is recognized that behavioral interventions are typically at least 16 to 24 weeks in duration, unpublished data from studies conducted at the Physical Activity and Weight Management Research Center at the University of Pittsburgh demonstrate that the majority of weight loss occurs within the initial 12-weeks of an intervention program. Therefore, for this preliminary study, a 12-week intervention was proposed. The time line for this investigation is illustrated in Table 2. If the results of this study provide a rationale for additional studies in this area of research, future studies should include a longer intervention period.

Table 2. Study Timeline

Recruitment				12-Week Intervention												Data Entry/Analysis			
↑ Baseline Assessment																↑ Week 12 Assessment			
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20
Month 1				Month 2				Month 3				Month 4				Month 5			

3.5.2 Overview of the Standard Behavioral Therapy Intervention

All subjects participated in a standard 12-week behavioral weight loss intervention that required decreased energy intake, increased energy expenditure, and engagement in social-cognitive behavioral strategies. The diet and exercise components of this intervention are consistent with the American College of Sports Medicine recommendations for healthy weight loss. These recommendations result in an average weight loss of 1 to 2 pounds per week [68]. Weight was measured each week prior to group meetings. Each meeting addressed a different topic related to behavioral modification of eating and exercise behaviors and provided a forum for participants to discuss barriers and problem solving strategies. Written materials were provided to complement each topic (see Table 3). The group session was facilitated by staff trained in behavioral modification, nutrition, and exercise physiology. Participants who were unable to attend a weekly group meeting were re-scheduled for an individual make-up visit prior to the next group meeting. If a make-up session could not be scheduled, then the interventionist provided brief counseling by telephone and mailed written materials.

Table 3. Lesson Topics

Week	Lesson Topic
1	The Behavioral Approach to Changing Your Eating and Exercise Behaviors
2	Healthy Food Choices
3	Developing and Implementing Your Exercise Program
4	Energy Balance: The Impact on Body Weight
5	Motivation for Weight Loss
6	Goal Setting and Time Management
7	Stimulus Control: Cues in Your Physical Environment for Eating and Exercise
8	Eating Out in Restaurants and Portion Control
9	Barriers to Adoption of Healthy Eating and Exercise Behaviors
10	Problem Solving Strategies
11	The Role of Thoughts in Weight Management
12	Evaluating Your Progress: Where Have You Been – Where Are You Going?

3.5.3 Overview of the Standard Dietary Intervention

All subjects were advised to follow a balanced diet with a macronutrient composition consisting of 55% carbohydrate, 20-25% fat, and 10-25% protein. These recommendations were based on previous research studies showing successful weight control following this nutritional intake [15, 65]. The goal of the dietary intervention was to reduce both total energy and fat intake. Subjects were instructed to restrict energy intake to 1200-1800 kilocalories (kcal) per day based on initial body weight (see Table 4).

Table 4. Caloric Recommendations Categorized by Body Weight

Body Weight	Prescribed Energy Intake (kcal/d)
≤ 200 pounds	1200 kcal/d
200 to 250 pounds	1500 kcal/d
> 250 pounds	1800 kcal/d

Dietary recommendations focused on choosing a variety of foods from the five different food groups, understanding portion sizes, and moderation of food intake. These

recommendations result in healthy weight losses of approximately 1 to 2 pounds per week and are in agreement with those outlined by the United States Department of Agriculture's Center for Nutrition Policy and Promotion [126]. Eating plans with sample meals were provided to the participants to help them achieve a balanced, restricted calorie diet. Participants were instructed to weigh and measure all food portions. In addition, subjects were taught about the nutritional content of different types of foods and how to read and understand food labels. Subjects were given a copy of the "The Complete and Up To Date Fat Book" [127] to use as a reference for caloric and fat content when information from food labels was not available.

3.5.4 Overview of the Standard Exercise Intervention

All subjects were given a weekly exercise goal and encouraged to participate in activities that were aerobic in nature and at least moderate intensity on 5 days per week. Moderate intensity activity was defined as a rating of perceived exertion (RPE) of 11 to 13 on a 15-point RPE scale and/or heart rate range between 55% to 70% of age-predicted maximal heart rate (e.g., brisk walking) [128]. Participants were taught to monitor exercise intensity using these parameters. The duration of exercise began with 100 minutes per week (20 minutes on 5 days per week) and was progressively increased to 200 minutes per week (40 minutes on 5 days per week) by the 9th week of the intervention (See Table 5). This recommendation is based on the findings that 200 to 300 minutes of exercise per week is associated with improvements in long-term weight loss and management of body weight [15, 68, 129, 130] .

Table 5. Description of Progressive Aerobic Exercise Prescription

Week	Days/Week	Duration Minutes/Day	Duration Minutes/week	Intensity (RPE*)	Intensity (%HRmax**)
1	5	20	100	11-13	55-70
2	5	20	100	11-13	55-70
3	5	20	100	11-13	55-70
4	5	20	100	11-13	55-70
5	5	30	150	11-13	55-70
6	5	30	150	11-13	55-70
7	5	30	150	11-13	55-70
8	5	30	150	11-13	55-70
9	5	40	200	11-13	55-70
10	5	40	200	11-13	55-70
11	5	40	200	11-13	55-70
12	5	40	200	11-13	55-70

* RPE – Rating of Perceived Exertion
** HRmax – Heart Rate Maximum

Self-monitoring is a key behavioral strategy that is associated with successful weight loss [131-133] . Therefore, subjects were instructed to self-monitor and record all eating and exercise behaviors including all food and drink items, the time foods were consumed, the caloric and fat content of each item, and the type, duration, and intensity of each exercise session in a weekly diary. The diaries were reviewed weekly by the interventionists and feedback was provided regarding food choices, compliance with caloric and fat goals, eating patterns, adherence to weekly exercise goals, exercise consistency, and mode of exercise. If unhealthy dietary patterns were observed (e.g., severe energy restriction), the participant was counseled and, if necessary, they were referred to their personal physician for additional treatment. Furthermore, participants identified as engaging in excessive amounts of exercise (duration or intensity) or unsafe exercise practices were counseled by the Principal Investigator and appropriate action was taken if the participant failed to comply with the study recommendations.

3.6 Description of Assessments

Outcomes of this study were assessed at 0 and 12 weeks on all participants. These assessments included body weight, height, energy intake, exercise (physical activity), and questionnaires that evaluated perceived importance of and willingness to engage in behaviors for weight loss. Questionnaires were given to the participants to complete at home. Body weight and height assessments were completed in approximately 15 minutes and were performed at the Physical Activity and Weight Management Research Center at the University of Pittsburgh. Participants were paid a stipend of \$25.00 upon completion of both the baseline and week 12 assessments. These assessments are described in detail below.

3.6.1 Weight

Body weight was assessed at 0 and 12 weeks using a calibrated medical balance-beam scale (Health-O-Meter Inc., Bridgeview, IL) with subjects wearing a lightweight hospital gown. This measurement was recorded to the nearest 0.25 kg.

3.6.2 Height

Height was measured at 0 and 12 weeks using a calibrated, wall-mounted stadiometer (Perspective Enterprises, Inc., Kalamazoo, MI). Subjects were instructed to remove their shoes and stand upright with the back of their heels against the wall for the measurement. This measurement was recorded to the nearest 0.1 cm.

3.6.3 Macronutrient Intake

Macronutrient intake was assessed at baseline and at week 12 with the 1998 version of the Block Food Frequency Questionnaire (FFQ) (Block-98 Dietary Data Systems, Berkeley, CA). The FFQ provides data for energy intake and macronutrient composition by inquiring about 109 food items and the corresponding usual portion sizes. This questionnaire also queries about the use of dietary supplements, eating out in restaurants, and the frequency of eating low-fat foods. This measurement of energy intake has been shown to be valid and reliable compared to 4-day food records [134].

3.6.4 Physical Activity

Self-reported physical activity was assessed at 0 and 12 weeks using the Paffenbarger Physical Activity Questionnaire (Exercise Habits)[135]. This questionnaire provides information about an individuals' total energy expenditure as assessed through exercise patterns (such as average number of flights of stairs climbed each day, average number of city blocks walked each day, and other sports, fitness, or recreational activities over the previous seven days). This questionnaire has been shown to be a valid and reliable assessment of physical activity [135, 136].

3.6.5 Weight Loss Behaviors Questionnaires

These four weight loss behaviors questionnaires were developed specifically for use in this study (see Appendix G). The questionnaires asked the participants to quantify their perceived importance, willingness, actual frequency, and intentions to engage in 17 different behaviors. The 17 questions represent three main categories of behaviors: self-monitoring, eating, and exercise. The self-monitoring questions included using a diary, tracking calories and fat, measuring food portions, tracking exercise, and checking weight. The eating questions included following menu plans, eating smaller portions of food, planning meals, modifying cooking, eating out in restaurants, and changing thoughts about healthy eating. The exercise questions included exercising at least 30 minutes each day, participating in supervised exercise sessions, making exercise a priority, exercising when not in the mood to do so, and changing thoughts related to physical activity. Question number seven asked about attendance at weekly weight loss meetings and responses to this question were examined in relation to actual attendance. The questionnaires are described below:

- Weight Loss Behaviors (Perceived Importance): This questionnaire was created to capture a participants' opinion of how important a specific behavior was in achieving a successful weight loss (i.e., the perceived importance of a behavior). This questionnaire examined 17 different weight loss behaviors and was administered at baseline and at week 12. Responses to this questionnaire ranged from zero to five (the scale ranged from not at all important to very important). Descriptive data from this questionnaire was

categorized into one of two groups: responses of 0 to 2 were considered “Not at all Important” and responses of 3 to 5 were considered “Somewhat to Very Important.”

- Willingness Questionnaire: This questionnaire was created to capture the number of days a participant was willing to engage in 17 different weight loss behaviors during a 12-week behavioral weight loss intervention. This questionnaire was administered at baseline and at week 12. Responses to this questionnaire ranged from zero to seven. Descriptive data from this questionnaire was categorized into one of two groups: responses of 0 to 2 were considered “Not Willing to engage in behavior frequently” and responses of 3 to 7 were considered “Somewhat to Very Willing to engage in behavior frequently.”
- Behavior Frequency Questionnaire: This questionnaire was created to quantify the number of days a participant reported engaging in 17 different weight loss behaviors. This questionnaire was administered at baseline, week 4, week 8, and then again at week 12. Responses to this questionnaire ranged from zero to seven indicating the number of times the behavior was done on average during the previous four weeks. The baseline questionnaire wording was slightly modified to capture the current frequency of the 17 behaviors. Descriptive data from this questionnaire was categorized into one of two groups: responses of 0 to 2 were considered “Not Frequent” and responses of 3 to 7 were considered “Somewhat to Very Frequent.”
- Intention Questionnaire: This questionnaire was created to capture the number of days a participant intended on engaging in 17 different weight loss behaviors during a 12-week

behavioral weight loss intervention. This questionnaire was administered at baseline and at week 12. Responses to this questionnaire ranged from zero to seven.

3.7 Statistical Analyses

All data were entered and analyzed using SPSS software for Windows (version 14.0) [137]. The data from the questionnaire responses were double entered and compared for discrepancies. The data were examined for normality and appropriate transformations were used for data that was not normally distributed. Results are expressed as mean \pm standard deviation (s.d.) unless specified otherwise. The p-value $\leq .05$ was used as a criterion for statistical significance. The following are the specific analyses that were performed:

1. Descriptive analyses were done on subject characteristics (age, body weight, BMI), energy intake, energy expenditure, retention rates, and specific adherence measures (frequency of diary use, frequency of reported exercise, and attendance at weekly group sessions). In addition, changes in process measures (weight, percentage weight loss, BMI, energy intake, and energy expenditure) were analyzed for significance.
2. Descriptive analyses were done on the total scores and the sub-scores (self-monitoring, eating, and exercise behaviors) for perceived importance, willingness, behavior frequency, and intention.
3. Correlation coefficients were computed between perceived importance of self-monitoring, eating, and exercise behaviors at baseline and at week 12 and willingness to engage in self-monitoring, eating, and exercise behaviors at baseline and week 12.

Because data from the questionnaires are categorical, correlation coefficients were computed using Spearman Rank Order correlation coefficient analyses.

4. Correlation coefficients were computed between perceived importance of, willingness to engage in, behavior frequency of, and intention for self-monitoring, eating, and exercise behaviors and weight loss.

3.8 Power Analysis

A power analysis was performed to determine the appropriate sample size. This power analysis was based on the analyses that were proposed for the specific aims. Considering that a sample of 37 participants were recruited to participate in this study, this allowed for correlations of $r = 0.43$ for the relationships being examined to be detected at 0.80 power with a two-tailed alpha of 0.05. However, because only 30 participants completed the intervention this allowed for the correlations of $r = 0.47$ to be detected at 0.80 power with a two-tailed alpha of 0.05.

4 RESULTS

The purpose of this study was to examine perceived importance of and willingness to engage in weight loss behaviors during a standard 12-week behavioral weight loss program. This study was a pretest-posttest clinical weight loss intervention with assessments performed at 0 and 12 weeks of participation. The results from this study are presented in the following sections.

4.1 Descriptive Analyses

4.1.1 Attrition

Thirty-seven subjects were randomized and started the weight loss intervention. Retention of participants who provided complete assessments at 0 and 12 weeks (N = 30) was 81%; these individuals are referred to as “completers” whereas the participants who failed to provide 12 week data (N = 7 or 19%) are referred to as “non-completers.” Table 6 lists participants’ reasons for dropout and the week number that dropout occurred.

Table 6. Descriptive Data for Dropouts

Participant	Reason for dropout	Week of dropout
1.	Could lose weight on own	Week # 2
2.	Had different expectations for program	Week # 2
3.	Had different expectations for program	Week # 4
4.	Too much effort to attend group sessions	Week # 4
5.	Too much effort to attend group sessions	Week # 5
6.	Too much effort to attend group sessions	Week # 7
7.	Too much effort to attend group sessions	Week # 9

4.1.2 Baseline Subject Characteristics

The participants who began the behavioral weight loss intervention consisted of 37 overweight adult men and women (14 males and 23 females). All of the participants had a body mass index ranging from 25.0 to 39.9 kg/m² and were between the ages of 18 to 55 years of age at the start of the study. Descriptive statistics (mean \pm standard deviation) for the subjects are presented in Table 7.

Table 7. Baseline Characteristics of Total Subjects, Completers, and Non-Completers

Characteristics	Total (N = 37) (mean \pm s.d.*)	Completers (N = 30) (mean \pm s.d.*)	Non-Completers (N = 7) (mean \pm s.d.*)
Age (years)	42.4 \pm 7.7	42.5 \pm 8.1	42.3 \pm 6.2
Weight (kg)	94.3 \pm 12.7	93.4 \pm 12.7	97.7 \pm 13.0
Body Mass Index (kg/m²)	32.5 \pm 2.8	32.4 \pm 2.7	33.0 \pm 3.1
Gender			
% Males	37.8% (N = 14)	36.7% (N = 11)	42.9% (N = 3)
% Females	62.2% (N = 23)	63.3% (N = 19)	57.1% (N = 4)
Energy Intake (kcal/d)	2134.6 \pm 1288.8	1970.2 \pm 1352.9	2839.5 \pm 636.9
Percent Dietary Fat Intake (%)	39.8 \pm 6.4	39.0 \pm 6.4	43.0 \pm 5.4
Percent Carbohydrate Intake (%)	45.7 \pm 7.5	46.9 \pm 7.5	40.7 \pm 5.8
Percent Protein Intake (%)	14.7 \pm 3.0	14.6 \pm 2.9	15.4 \pm 3.5
Physical Activity (kcal/wk)	500.7 \pm 418.0	440.2 \pm 383.3	759.7 \pm 491.8
* s.d. = standard deviation			
** Note: No statistically significant differences between completers and non-completers.			

For all subjects (N = 37), age was 42.4 ± 7.7 years, body mass index was 32.5 ± 2.8 kg/m² and weight was 94.3 ± 12.7 kg. Energy intake was 2134.6 ± 1288.8 kcal/d, with macronutrients being 39.8 ± 6.4 % fat, 45.7 ± 7.5 % carbohydrates, and 14.7 ± 3.0 % protein. The physical activity energy expenditure was 500.7 ± 418.0 kcal/wk. Independent t-tests revealed no significant baseline differences between completers and non-completers for age, weight, BMI, gender, macronutrient intake, and physical activity energy expenditure (see Table 7).

4.1.3 Adherence Measures

Descriptive statistics on attendance at group sessions and completion of food diaries are presented in Table 8. Attendance percentage was calculated as the total number of treatment sessions attended divided by the total number of possible group sessions over the 12 week intervention. Data are presented as the average per week during weeks 1-12, 1-4, 5-8, and 9-12 for all randomized subjects. The average number of participants attending the total weekly group meetings was 9.2 ± 3.4 . The average number of sessions attended during weeks 1-4 was 3.7 ± 0.7 , weeks 5-8 was 2.8 ± 1.5 , and weeks 9-12 was 2.7 ± 1.6 . The average number of diaries returned during weeks 1-12 was 8.4 ± 4.6 ; during weeks 1-4 was 3.2 ± 1.4 , during weeks 5-8 was 2.8 ± 1.7 , and during weeks 9-12 was 2.3 ± 1.9 . Descriptive statistics for percentage of diaries submitted per week, percentages of participants meeting weekly exercise goal per week, and percentage attendance per week are presented in Table 9.

Table 8. Adherence Measures: Attendance and Diaries Returned

	Average attendance at weekly sessions (N = 37) (mean \pm s.d.*)	Average number of diaries turned in (N = 37) (mean \pm s.d.*)
Total Weeks 1-12	9.2 \pm 3.4	8.4 \pm 4.6
Weeks 1-4	3.7 \pm 0.7	3.2 \pm 1.4
Weeks 5-8	2.8 \pm 1.5	2.8 \pm 1.7
Weeks 9-12	2.7 \pm 1.6	2.3 \pm 1.9
* s.d. = standard deviation		

Table 9. Diary Submittal, Attendance, and Attainment of Weekly Exercise Goals

Week	Number of subjects returning a diary N (%)*	Weekly exercise goal (min/week)	Number of subjects meeting weekly exercise goal N (%)*	Number of subjects attending weekly group sessions N (%)*
1	30 (81%)	100	13 (35%)	37 (100%)
2	30 (81%)	100	13 (35%)	35 (94.6%)
3	29 (78%)	100	17 (46%)	32 (86.5%)
4	29 (78%)	100	13 (35%)	33 (89.2%)
5	28 (76%)	150	17 (46%)	26 (70.3%)
6	26 (70%)	150	14 (38%)	27 (73.0%)
7	26 (70%)	150	20 (54%)	26 (70.3%)
8	26 (70%)	150	19 (51%)	25 (67.6%)
9	22 (60%)	200	17 (46%)	26 (70.3%)
10	22 (60%)	200	15 (41%)	22 (59.5%)
11	21 (57%)	200	14 (38%)	23 (62.2%)
12	21 (57%)	200	15 (41%)	29 (78.4%)
* Note: N values are derived from the number applicable out of a total N of 37 participants				

4.1.4 Weight and BMI

The weight for completers (N = 30) at baseline was 93.4 ± 12.7 kg and at week 12 was 87.3 ± 13.0 kg ($p < 0.01$). There was a significant decrease in weight among the completers (6.2 ± 4.2 kg). The percentage of weight loss was 6.7 ± 4.2 . Of the 30 participants who completed the program, 2 gained weight; 12 had a weight loss between 1 and 5 kg; 11 had a weight loss between 5 and 10 kg; and 5 achieved weight losses greater than 10 kg. The BMI for completers (N = 30) at baseline was 32.4 ± 2.7 kg/m² and at week 12 was 30.3 ± 3.1 kg/m² ($p < 0.01$). The intent-to-treat analysis for weight and BMI revealed a pattern that was consistent with the results for the completer's data (see Table 10).

4.1.5 Energy Intake and Energy Expenditure

Energy intake decreased from 1970.2 ± 1352.9 (kcal/d) at baseline to 1396.1 ± 800.2 (kcal/d) at week 12 ($p < 0.01$). Percentage of fat decreased from 39.0 ± 6.4 at baseline to 31.6 ± 6.9 at week 12 ($p < 0.01$); percentage of carbohydrates increased from 46.9 ± 7.5 at baseline to 52.9 ± 8.0 at week 12 ($p < 0.01$); and percentage of protein increased from 14.6 ± 2.9 at baseline to 16.6 ± 3.6 at week 12 ($p < 0.01$). Physical activity energy expenditure increased from 440.2 ± 383.3 kcal/wk at baseline to 1762.9 ± 1549.3 kcal/wk at week 12 ($p < 0.01$). The intent-to-treat analysis for energy intake and energy expenditure was similar to that of the completers (see Table 10).

Table 10. Change in Intervention Outcomes

Variable	Assessment Period	Intention-to-Treat (N = 37) (mean ± s.d.*)	Completers (N = 30) (mean ± s.d.*)
Weight (kg)	Week 0	94.3 ± 12.7	93.4 ± 12.7
	Week 12	89.2 ± 13.4	87.3 ± 13.0
	**Difference	-5.1 ± 0.7	-6.1 ± 0.3
	p-value	.000	.000
Body Mass Index (kg/m²)	Week 0	32.5 ± 2.8	32.4 ± 2.7
	Week 12	30.8 ± 3.3	30.3 ± 3.1
	**Difference	-1.7 ± 0.5	-2.1 ± 0.4
	p-value	.000	.000
Energy Intake (kcal/d)	Week 0	2134.6 ± 1288.8	1970.2 ± 1352.9
	Week 12	1669.2 ± 954.9	1396.1 ± 800.2
	**Difference	-465.4 ± -333.9	-574.1 ± -552.7
	p-value	.000	.000
Percent Fat Intake (%)	Week 0	39.8 ± 6.4	39.0 ± 6.4
	Week 12	33.7 ± 8.0	31.6 ± 6.9
	**Difference	-6.1 ± 1.6	-7.4 ± 0.5
	p-value	.000	.000
Percent Carbohydrate Intake (%)	Week 0	45.7 ± 7.5	46.9 ± 7.5
	Week 12	50.6 ± 9.0	52.9 ± 8.0
	**Difference	4.9 ± 1.5	6.0 ± 0.5
	p-value	.000	.000
Percent Protein Intake (%)	Week 0	14.7 ± 3.0	14.6 ± 2.9
	Week 12	16.4 ± 3.6	16.6 ± 3.6
	**Difference	1.7 ± 0.6	2.0 ± 0.7
	p-value	.000	.000
Physical Activity Energy Expenditure (kcal/wk)	Week 0	500.7 ± 418.0	440.2 ± 383.3
	Week 12	1573.1 ± 1460.4	1762.9 ± 1549.3
	**Difference	1072.4 ± 1042.4	1322.7 ± 1166.0
	p-value	.000	.000
* s.d. = standard deviation			
** Difference = Week 12 – Week 0			

4.1.6 Weight Loss Behaviors Questionnaires

The results from the four questionnaires are presented using the following abbreviations: Perceived Importance (PI), Willingness (WIL), Behavior Frequency (BF), and Intention (INT). Responses were divided into three different sub-scores based on key behaviors of a weight loss program (see Table 11). Self-monitoring (SM), eating (EAT), and exercise (EX) sub-scores were computed at weeks 0 and 12 for PI, WIL, and INT and at weeks 0, 4, 8, and 12 for BF. The sub-scores were computed as a sum of the following questions:

- Self-monitoring behaviors (SM) – questions 1, 3, 4, 5, 8, 17
- Eating behaviors (EAT) – questions 2, 6, 10, 12, 13, 16
- Exercise behaviors (EX) – questions 9, 11, 14, 15, 16

Table 11. Weight Loss Behaviors Questionnaires

Questionnaire	Sub-score	Abbreviation
Perceived Importance	Self-monitoring behaviors	PI _{SM}
	Eating behaviors	PI _{EAT}
	Exercise behaviors	PI _{EX}
Willingness	Self-monitoring behaviors	WIL _{SM}
	Eating behaviors	WIL _{EAT}
	Exercise behaviors	WIL _{EX}
Behavior Frequency	Self-monitoring behaviors	BF _{SM}
	Eating behaviors	BF _{EAT}
	Exercise behaviors	BF _{EX}
Intention	Self-monitoring behaviors	INT _{SM}
	Eating behaviors	INT _{EAT}
	Exercise behaviors	INT _{EX}

4.1.7 Perceived Importance Questionnaire Total and Sub-Scores

Data from this questionnaire (N = 30) were analyzed both as a total score and divided into three different sub-scores (PI_{SM}, PI_{EAT}, PI_{EX}). There was a decrease between the perceived importance total score (maximum = 85) from baseline (73.0 ± 7.9) to week 12 (67.7 ± 10.5) (p = .01). The sub-scores increased for PI_{SM} from 25.1 ± 4.1 at baseline to 26.2 ± 4.2 at week 12 (p = .12) (maximum = 30); decreased for PI_{EAT} from 25.9 ± 2.9 at baseline to 24.8 ± 4.5 at week 12 (p = .19) (maximum = 30); and also decreased for PI_{EX} from 22.4 ± 2.2 at baseline to 21.2 ± 3.4 at week 12 (p = .04) (maximum = 25) (see Table 12).

Table 12. Perceived Importance Questionnaire Results

Score	Baseline (N = 30) (mean ± s.d.*)	Week 12 (N = 30) (mean ± s.d.*)	P-value
PI Total Score	73.0 ± 7.9	67.7 ± 10.5	.01
Sub-Score for PI _{SM}	25.1 ± 4.1	26.2 ± 4.2	.12
Sub-Score for PI _{EAT}	25.9 ± 2.9	24.8 ± 4.5	.19
Sub-Score for PI _{EX}	22.4 ± 2.2	21.2 ± 3.4	.04
* s.d. = standard deviation Note: Sub-scores may not equal total score since question number seven was not included in any of the three sub-scores and question number sixteen was included in both the eating and exercise sub-scores.			

4.1.8 Willingness Questionnaire Total and Sub-Scores

Data from this questionnaire (N = 30) were analyzed as a total score and divided into sub-scores (WIL_{SM}, WIL_{EAT}, WIL_{EX}). The total score (maximum = 119) decreased from 102.9 ± 13.2 at baseline to 83.3 ± 19.3 at week 12 (p < 0.01). The sub-scores for WIL_{SM} decreased from 36.6 ± 6.3 at baseline to 34.1 ± 8.7 at week 12 (p = .06) (maximum = 42); for WIL_{EAT} decreased from 38.8 ± 4.0 at baseline to 33.6 ± 7.8 at week 12 (p < 0.01) (maximum = 42); and for WIL_{EX} also decreased from 30.1 ± 4.7 at baseline to 24.4 ± 6.9 at week 12 (p < 0.01) (maximum = 35) (see Table 13).

Table 13. Willingness Questionnaire Results

Score	Baseline (N = 30) (mean ± s.d.*)	Week 12 (N = 30) (mean ± s.d.*)	P-value
WIL Total Score	102.9 ± 13.2	83.3 ± 19.3	.00
Sub-Score for WIL _{SM}	36.6 ± 6.3	34.1 ± 8.7	.06
Sub-Score for WIL _{EAT}	38.8 ± 4.0	33.6 ± 7.8	.00
Sub-Score for WIL _{EX}	30.1 ± 4.7	24.4 ± 6.9	.00
* s.d. = standard deviation Note: Sub-scores may not equal total score since question number seven was not included in any of the three sub-scores and question number sixteen was included in both the eating and exercise sub-scores.			

4.1.9 Behavior Frequency Questionnaire Total and Sub-Scores

Data from this questionnaire (N = 30) were analyzed as a total score and divided into sub-scores (BF_{SM}, BF_{EAT}, BF_{EX}). The total score (maximum = 119) increased from 15.8 ± 18.2 at baseline to 79.7 ± 22.5 at week 12 (p < 0.01). The sub-scores for BF_{SM} increased from 4.4 ± 7.4 at baseline to 31.8 ± 11.4 at week 12 (p < 0.01) (maximum = 42); for BF_{EAT} increased from 8.3 ± 7.8 at baseline to 30.8 ± 8.2 at week 12 (p < 0.01) (maximum = 42); and BF_{EX} also increased from 4.3 ± 6.7 at baseline to 23.1 ± 7.3 at week 12 (p < 0.01) (maximum = 35) (see Table 14).

Table 14. Behavior Frequency Questionnaire Results

Score	Baseline (N = 30) (mean ± s.d. *)	Week 12 (N = 30) (mean ± s.d. *)	P-value
BF Sum Score	15.8 ± 18.2	79.7 ± 22.5	.00
Sub-Score for BF _{SM}	4.4 ± 7.4	31.8 ± 11.4	.00
Sub-Score for BF _{EAT}	8.3 ± 7.8	30.8 ± 8.2	.00
Sub-Score for BF _{EX}	4.3 ± 6.7	23.1 ± 7.3	.00
* s.d. = standard deviation Note: Sub-scores may not equal total score since question number seven was not included in any of the three sub-scores and question number sixteen was included in both the eating and exercise sub-scores.			

4.1.10 Intention Questionnaire Total and Sub-Scores

Data from this questionnaire (N = 30) were analyzed as a total score and divided into sub-scores (INT_{SM}, INT_{EAT}, INT_{EX}). The total score (maximum = 119); decreased from 99.0 ± 16.1 at baseline to 91.6 ± 19.5 at week 12 (p = .07). The sub-scores for INT_{SM} increased from 34.8 ± 7.9 at baseline to 35.0 ± 8.6 at week 12 (p = .93) (maximum = 42); for INT_{EAT} decreased from 37.4 ± 5.1 at baseline to 34.9 ± 6.6 at week 12 (p = .07) (maximum = 42); and for INT_{EX} also decreased from 29.7 ± 5.0 at baseline to 26.0 ± 6.8 at week 12 (p = .01) (maximum = 35) (see Table 15).

Table 15. Intention Questionnaire Results

Score	Baseline (N = 30) (mean ± s.d.*)	Week 12 (N = 30) (mean ± s.d.*)	P-value
INT Total Score	99.0 ± 16.1	91.6 ± 19.5	.07
Sub-Score for INT _{SM}	34.8 ± 7.9	35.0 ± 8.6	.93
Sub-Score for INT _{EAT}	37.4 ± 5.1	34.9 ± 6.6	.07
Sub-Score for INT _{EX}	29.7 ± 5.0	26.0 ± 6.8	.01
* s.d. = standard deviation Note: Sub-scores may not equal total score since question number seven was not included in any of the three sub-scores and question number sixteen was included in both the eating and exercise sub-scores.			

4.1.11 Correlates of Intervention Outcomes with Self-Monitoring Behaviors

Correlation analyses were performed to examine the relationships between the self-monitoring sub-scores for perceived importance and willingness. A significant positive correlation coefficient was found between PI_{SM} at baseline and WIL_{SM} at baseline: $r = .66$ ($p < 0.01$) and PI_{SM} at week 12 and WIL_{SM} at week 12: $r = .45$ ($p = .01$). Correlation analyses were performed to examine the relationship between the self-monitoring behaviors for perceived importance and behavior frequency. A significant positive correlation coefficient was found between PI_{SM} at baseline and BF_{SM} at week 4: $r = .42$ ($p = .02$).

Correlations analyses were performed for the self-monitoring sub-scores and weight loss and total diaries. A significant positive correlation coefficient was found between WIL_{SM} at week 12 and weight loss: $r = .40$ ($p = .03$) and between BF_{SM} at week 4, 8, and 12 and weight loss: $r = .38$ ($p = .05$); $r = .53$ ($p = .01$); and $r = .41$ ($p = .02$). Significant positive correlation coefficients were found between WIL_{SM} at week 12 and total diaries: $r = .41$ ($p = .03$); and BF_{SM} at week 4, 8, and 12 and total diaries: $r = .57$ ($p = .00$); $r = .68$ ($p = .00$); and $r = .65$ ($p = .00$).

Perceived importance self-monitoring sub-score correlated significantly with willingness self-monitoring sub-score at baseline ($r = .66$, $p < 0.01$). However, neither perceived importance nor willingness to engage (self-monitoring sub-scores) at baseline predicted successful weight loss. Behavior frequency responses for self-monitoring behaviors at weeks 4, 8, and 12 were significantly correlated with weight loss and diaries returned. In addition, weight loss was significantly correlated with diaries returned ($r = .71$, $p < 0.01$) (see Table 16).

Table 16. Correlations for Self-Monitoring Behaviors

Variable	WIL_{SM} Week 0	WIL_{SM} Week 12	Weight Loss	Diaries Returned
PI_{SM} Week 0	.66**	.13	-.28	.07
PI_{SM} Week 12	-----	.45**	-.16	-.02
WIL_{SM} Week 0	-----	-----	.02	.19
WIL_{SM} Week 12	-----	-----	.40*	.41*
Weight Loss	-----	-----	-----	.71**
* p < .05. ** p < .01.				

4.1.12 Correlates of Intervention Outcomes with Eating Behaviors

Correlation analyses were performed to examine the relationship between eating behaviors sub-scores for perceived importance and willingness. Significant positive correlation coefficients were found between: PI_{EAT} at baseline and WIL_{EAT} at baseline: $r = .43$ ($p = .01$) and PI_{EAT} at week 12 and WIL_{EAT} at week 12: $r = .52$ ($p < 0.01$). Correlations analyses were performed on the eating behaviors sub-scores for perceived importance and willingness with weight loss and macronutrient content (energy intake (kcal) at week 12, percent dietary fat intake at week 12, and also the change scores for both these variables), however, no significant correlations were found (see Table 17).

Table 17. Correlations for Eating Behaviors

Variable	WIL_{EAT} Week 0	WIL_{EAT} Week 12	Weight Loss	Energy Intake (kcal) Week 12	Percent Dietary Fat Intake Week 12
PI_{EAT} Week 0	.43**	.17	-.27	-.01	.14
PI_{EAT} Week 12	-----	.52**	-.12	-.27	.00
WIL_{EAT} Week 0	-----	-----	-.14	-.07	.09
WIL_{EAT} Week 12	-----	-----	.03	-.25	-.05
* p < .05. ** p < .01.					

4.1.13 Correlates of Intervention Outcomes with Exercise Behaviors

Correlation analyses were performed to examine the relationship between the exercise sub-scores for perceived importance and willingness. Significant positive correlation coefficients were found between: PI_{EX} at baseline and WIL_{EX} at baseline: $r = .44$ ($p = .01$) and PI_{EX} at week 12 and WIL_{EX} at week 12: $r = .56$ ($p < 0.01$). Correlations analyses were performed on the exercise behaviors sub-scores and weight loss. Significant negative correlation coefficients were found between: PI_{EX} at week 12 and weight loss: $r = -.45$ ($p = .01$) and WIL_{EX} at baseline and weight loss: $r = -.38$ ($p = .04$) (see Table 18).

Table 18. Correlations for Exercise Behaviors

Variable	WIL_{EX} Week 0	WIL_{EX} Week 12	Weight Loss	Energy Expenditure Week 12
PI_{EX} Week 0	.44**	.38*	-.31	-.28
PI_{EX} Week 12	-----	.56**	-.45*	-.15
WIL_{EX} Week 0	-----	-----	-.38*	-.10
WIL_{EX} Week 12	-----	-----	-.07	.05
Weight Loss	-----	-----	-----	.41*
* p < .05. ** p < .01.				

4.2 Summary of Results

The results of this study revealed a significant change from baseline to week 12 in the self-monitoring behaviors sub-scores for willingness and behavior frequency; for the eating behaviors sub-scores for willingness, behavior frequency, and intention; and for the exercise behaviors sub-scores for perceived importance, willingness, behavior frequency, and intention. The correlation analyses revealed positive relationships between perceived importance of and willingness to engage in self-monitoring behaviors, eating behaviors, and exercise behaviors at both baseline and week 12. None of the sub-scores for perceived importance at baseline were predictive of weight loss; however, willingness to engage in self-monitoring behaviors at week 12 was positively correlated with weight loss and willingness to engage in exercise behaviors at baseline was negatively correlated with weight loss.

5 DISCUSSION

5.1 Introduction

Considering the high prevalence rates of obesity in the United States [35] and its corresponding health consequences [56], it is important for research to focus on increasing the effectiveness of weight loss treatment programs. Of interest is that while behavioral intervention programs have been shown to reduce initial body weight within six months of initiating treatment, the ability to sustain this weight loss may be problematic with 30% to 50% of weight regained within the following period of 12 months [138]. This may be a result of the inability of participants to continue to remain adherent to the changes in behavior that resulted in their initial weight loss success.

There are several important weight loss strategies that appear to be important for successful weight loss, and these include self-monitoring, regular physical activity, and measuring food portions [65]. However, actual engagement in these behavioral strategies is varied and not clearly understood. For example, with regard to exercise, Jakicic et al. reported that some individuals are able to adopt and maintain relatively high levels of exercise which is associated with improved long-term weight loss, whereas others do not adopt adequate levels of exercise which contributes to less weight loss achieved and maintained [139, 140]. While many potential psychosocial factors have been examined in an attempt to explain the variability in exercise adoption, none of the factors examined have been shown to fully explain the observed variance in behavior adoption and maintenance in overweight adults [141]. The research

literature consists of similar observations with regard to other commonly used weight loss strategies such as self-monitoring and changes in eating behavior [142-146]. Therefore, additional research to understand the factors that may contribute to the adoption of these weight loss behaviors appears to be warranted.

Perceived outcomes and personal attributes are two areas of measurement that have been considered when trying to explain behavior and behavior change [90]. Although previous research on perceived importance of and willingness to engage in weight loss behaviors is lacking, these two variables may influence whether or not an action is taken by an individual. For example, if an individual believes that a behavior is advantageous to successful weight loss (i.e., perceived importance) and is willing to engage in that behavior (i.e., willingness), then logically it follows that that same individual should be more inclined to engage in the behavior. Therefore, willingness to engage in a behavior appears to be a function of the value attached to the behavior in question. It may be assumed that the greater the perceived importance or utility of the targeted behavior the more willing the individual may be to engage in this behavior. Jakicic and Otto suggested that an individual's willingness to engage in behavioral strategies such as self-monitoring, exercising more, and changing eating patterns, may be an important consideration in achieving weight loss [129]. However, despite this conceptual rationale, review of the weight loss literature indicates that little is known about the perceived importance of or the willingness to engage in the highly recommended and commonly used weight loss behaviors. The primary aim of this study was to examine perceived importance and willingness to engage as predictors of weight loss among adults participating in a behavioral weight loss intervention. It was hypothesized that there would be a significant positive correlation between perceived importance

of weight loss behaviors and willingness to engage in the same specific behaviors and that these two variables would predict weight loss.

5.2 Summary of Major Findings and Discussion

Participant Attrition: The attrition rate for this 12-week intervention was 19%, with 30 of the 37 randomized subjects completing the study. This attrition rate appears to be somewhat higher than the attrition rate reported by other behavioral weight loss studies of similar duration. For example, in a weight loss study that was 12 weeks in duration, the attrition rate was 9%; and in another weight loss study that was 14 weeks in duration, the attrition rate was 11% [147, 148]. It is unclear why the attrition rate in the current study is somewhat higher than other studies of similar duration that are reported in the scientific literature. However, an interesting finding was that four of the seven (57%) participants who discontinued participation in this study reported that attending group sessions required too much effort as the main reason for discontinuing their participation (see Table 6). This is of interest because regular contact with the intervention team is a cornerstone of behavioral weight loss interventions, yet these findings demonstrate that some individuals may not perceive the benefits of these sessions and are unwilling to attend these sessions as part of the weight loss process.

Weight Loss: The weight loss in this 12-week study was 6.2 ± 4.2 kg. For the purpose of comparison, studies ranging from 10 to 12 weeks in duration have reported weight losses ranging from 6.6 kg to 9 kg [9, 149]. Thus, in the current study, the average weight loss per week was approximately 0.5 kg. This average weekly weight loss is somewhat more than the average

weekly weight loss of 0.34 kg reported in a review of weight loss studies averaging 26 weeks in duration [9]. However, whether the weekly magnitude of weight loss achieved in this current study will be sustained beyond the initial 12-week period of the intervention is unclear, but would result in greater overall weight loss if this were accomplished.

Self-Monitoring: This study demonstrated that across the intervention there was a non-significant increase in the perceived importance of self-monitoring ($p = .12$) (see Table 12). These data may suggest that as participants are taught how to self-monitor and are encouraged to engage in self-monitoring activities, that there is a subsequent increase in the perceived importance of self-monitoring. This is an important finding because other investigators have highlighted the importance of self-monitoring of weight loss behaviors. For example, Wadden et al. (2001) reported significant correlations between completion of food records in the first two months and weight loss at month four ($r = .57, p < 0.01$) and at month 6 ($r = .55, p < 0.01$) [150]. The current study also demonstrated a corresponding decrease in the willingness to self-monitor across the 12-week intervention, and these data are presented in Table 13. Thus, there may be a disconnect between one's perceived importance of self-monitoring and the willingness to continue to engage in this important behavioral exercise. This may be a result of the effort required to continue to complete detailed daily records of eating and exercise behaviors [151]. Thus, alternative self-monitoring strategies may be needed to facilitate self-monitoring for individuals who continue to perceive the benefit as important but are unwilling to engage in current self-monitoring techniques. A recent study by Helsel et al. (manuscript in review at Journal of the American Dietetics Association) reported that transitioning to a less detailed form of self-monitoring eating and exercise behaviors resulted in an increase in self-monitoring diaries

completed by participants with no negative impact on weight loss. These findings should be considered when determining appropriate self-monitoring techniques for individuals participating in weight loss interventions.

Despite the established importance of self-monitoring in achieving weight loss [77, 78], this study failed to find either perceived importance of or willingness to engage in self-monitoring at baseline to be predictive of weight loss (see Table 16). However, this study did find a significant positive correlation between weight loss and the 12-week score for willingness to self-monitor ($r = 0.40$, $p = 0.03$). These findings may indicate that the intervention affects an individual's level of willingness to self-monitor and that those who continue to be willing to engage in self-monitoring will experience the most weight loss. This appears to confirm the importance of self-monitoring within the context of a behavioral weight loss intervention.

Eating Behaviors: Reducing energy intake and changing eating patterns are necessary behaviors for weight loss and so it was expected that perceived importance of and willingness to engage in healthier eating behaviors would increase across the intervention period. Weight loss has been consistently associated with lower total caloric intakes and the participants in this study did alter their eating behaviors as evidenced by the significant decrease in caloric intake [9, 152-154]. However, this study did not find a significant change for perceived importance of eating behaviors (see Table 12) and did find a significant decrease in the willingness to engage in eating behaviors from baseline to week 12 (see Table 13). These two findings are contrary to what one might expect to observe in a weight loss program. It is possible that participants entering a weight loss program already have a high perceived importance of healthy eating behaviors and this perception is maintained and captured at the end of the study. As for the willingness to

engage in healthy eating behaviors, it is surprising to that a significant decrease was reported. It is possible that the willingness sub-score for eating behaviors did not capture actual behavior changes or it may represent the openness of the participants to continue with altered eating behaviors. If it is the latter, then this would be an important area to investigate further, especially in trying to explain weight loss maintenance. This decreased willingness to continue engaging in specific weight loss-oriented eating behaviors could potentially help to identify why many individuals end up regaining weight within a few years after achieving weight loss.

This study found a positive relationship between perceived importance and willingness for eating behaviors (PI_{EAT} and WIL_{EAT}) at baseline and at week 12. These data suggest that participants entering a weight loss program perceive eating behaviors to be important to weight loss and are also willing to engage in these same behaviors. However, neither perceived importance nor willingness to engage in eating behaviors was predictive of weight loss (see Table 17). This finding may indicate that participants in a weight loss program realize the beneficial role of dietary changes for weight loss and are willing to alter eating patterns but fail to make considerable changes that result in significant weight losses. For example, at baseline, 89% of the participants indicated that it was somewhat to very important to plan meals and 84% indicated that it was somewhat to very important to eat out in restaurants less often. These data offer a speculation that the majority of the individuals participating in a weight loss program believe that specific eating behaviors are important; however, their actual eating behavior changes may not be sufficient to achieve weight loss.

Exercise Behaviors: Adherence to a regular physical activity program is considered to be a key contributor to weight loss and weight maintenance [155-157]. Maintenance of adequate

energy expenditure through exercise has been positively associated with successful long-term weight control in cross-sectional, longitudinal, and retrospective studies [158]. Increases in perceived importance of and willingness to engage in exercise behaviors were expected as direct consequences of the behavioral intervention. However, there was a significant decrease in both the perceived importance of and the willingness to engage in exercise behaviors (see Tables 12 and 13). This finding is problematic given the cumulative evidence on the positive role of regular physical activity in weight loss [158]. However, this finding may explain the decrease in exercise adherence that is commonly observed in weight loss programs that are greater than six months in duration [159]. This is of serious concern considering that exercise is the single best predictor of long-term maintenance of weight loss [160].

The relationships between perceived importance of and willingness to engage in exercise behaviors and weight loss revealed two unexpected findings. The first one was the negative correlation for perceived importance of exercise behaviors at week 12 and weight loss and the second one was the negative correlation for willingness to engage in exercise behaviors at baseline and weight loss. The former indicates that those participants who stated having high perceived importance of exercise behaviors at week 12 had lower weight losses. This finding may indicate that these participants place high emphasis on exercise behaviors as important to weight loss but may fail to recognize the difficulty of losing weight through exercise alone. Previous research has indicated that physical activity without caloric restriction produces only modest weight losses, if any at all. Miller, et al. conducted a meta-analysis of weight loss studies and reported that aerobic exercise programs produce weight losses of 2.9 kg over 21 weeks while caloric restriction programs produce weight losses of 11 kg over 15 weeks [161]. This same

study also found that diet plus exercise at one-year follow-up was the most effective at weight maintenance [161] thus highlighting the importance of a combined approach of diet and exercise to achieve weight loss.

Another explanation for the finding of high perceived importance of exercise behaviors at week 12 and lower weight losses may indicate that individuals who fail to lose weight may perceive exercise as important for weight loss but may have barriers that prevent or limit them from engaging in regular exercise. For example, research has shown that cost of activity engagement, accessibility, convenient location, and flexible schedules are factors that contribute to physical activity [162, 163]. In addition, low self-efficacy and low willpower are other possible factors that may help to explain the important links between beliefs and behaviors [164].

This study found a negative correlation between weight loss and willingness to engage in weight loss behaviors at baseline. Participants who indicated a high level of willingness to engage in exercise behaviors at baseline ultimately lost less weight than other participants. This finding may signify that individual's who initially indicate a high willingness to exercise, may rely too much on exercise and not enough on caloric restriction or may later come to realize the difficulty in adopting a regular exercise program and thus become less willing to engage in exercise behaviors (this speculation is supported by the significant decrease in willingness to engage in exercise behaviors from baseline to week 12). Another explanation may involve faulty perceptions regarding the amount of exercise being done as being sufficient for weight loss. For example, previously sedentary individuals may perceive that engaging in 10-20 minutes of exercise per day is an active level that is enough to result in weight loss, when really it is not. Research shows that a significant caloric deficit is needed to cause weight loss either through

caloric restriction or physical activity energy expenditure; however, the latter requires much more effort to produce the same caloric deficit as the former [165]. Research by Ross et al. and Sopko et al. found that when the negative energy balance induced either by diet only or by exercise only is equal, the weight losses achieved over 12 weeks are similar [166, 167]. However, to produce a caloric deficit of one hundred calories through exercise, the average person has to walk one mile at a moderate intensity which requires a larger commitment than cutting out one hundred calories from their diet. Participants leaning on exercise to create caloric deficits or those not adhering to the prescribed exercise durations and intensities most likely are not achieving sufficient physical activity energy expenditure to result in weight loss. In addition, these individuals may not be willing to engage in the prescribed amount of activity or may wrongly perceive that their level of activity is adequate for weight loss.

Additional findings suggest that perceived importance of and willingness to engage in weight loss behaviors are not predictive of weight loss achievement and may suggest that there are other psychosocial variables at play. Based on the findings of this study, it is unclear whether these two variables are predictive of actual engagement in specific weight loss behaviors. Since weight loss is an outcome (not a behavior) that results from an interaction of many different factors, both internally and externally, it is likely that multiple factors and/or an interaction of multiple factors will ultimately lead to explaining weight loss achievement. Future research should include an examination of other factors to help increase the understanding of adoption and maintenance of behavioral strategies for weight loss.

A final area of interest raised in this study was the distinction between intention and willingness. Intention has been implicated as the antecedent of actual behavior in numerous

theories in social and health psychology [90]. Intentions have been defined as the self-instructions to perform a certain behavior and indicate how much effort an individual will exert to achieve the desired outcome [168, 169]. The theory of planned behavior identifies intentions, perceived control, subjective norms, and attitudes as contributing variables to the occurrence of a behavior [169]. Schifter & Ajzen (1985) examined the success of the theory of planned behavior to explain weight loss among college women and reported that perceived control and intentions together only moderately predicted the amount of weight that the participants actually lost over a 6-week period [102].

The findings of this study suggest that intentions and willingness may identify similar steps in the behavior change process. The theory of planned behavior has identified intentions as the direct precursor to actual behavior [97]. This theory states that an individual's intention is a direct link between their attitudes and their behavior. The current study examined perceived importance and willingness as antecedents to weight loss. To determine whether willingness and intention were capturing the same information, an intention questionnaire was developed using the same behaviors as included on the willingness questionnaire (see Appendix G). The results from the intention questionnaire were similar to those from the willingness questionnaire suggesting that it may be possible that willingness and intention are capturing the same construct. Furthermore, willingness and intention variables for self-monitoring, eating, and exercise behaviors were highly correlated in this study. Based on the results of this study; it is recommended that further investigations be conducted on both willingness and intention as predictors of weight loss.

5.3 Limitations and Recommendations for Future Research

There were limitations to this study which may have contributed to the observed results.

Therefore, future studies should take into consideration the following issues:

1. The small sample size of the study may have resulted in the failure to detect significant correlations between perceived importance and willingness and weight loss. The power analysis indicated that 50 subjects were needed for the relationships being examined to be detected at 0.80 power with a two-tailed alpha of 0.05. The actual number of participants completing the study was only 30. Therefore, insufficient statistical power could have contributed to the lack of statistically significant findings and/or magnitude of correlations that would have provided better indication of the observed relationships. Future studies should be conducted with larger sample sizes to allow for adequate statistical power.
2. This study was 12 weeks in duration which may have limited the ability to capture significant changes in the variables that may take longer to occur. Future studies should examine perceived importance and willingness to engage in weight loss behaviors among participants involved in interventions lasting longer than 12 weeks in duration.
3. The perceived importance and willingness questionnaires were created for use in this study. Future research on perceived importance and willingness should include reliability and validity tests on these questionnaires. Further examination of the validity of the willingness questionnaire would help to prove that this

questionnaire is actually measuring willingness to engage in weight loss behaviors and not some other variable such as intention.

4. The Theory of Planned Behavior states that attitudes and social norms influence intentions which are the causal mediator of behavior [97]. As stated above, results from this study raised the question of whether willingness might actually be capturing information related to intentions. Therefore, future research should seek to differentiate the willingness variable from other moderators of weight loss, possibly intention.
5. This study did not examine the relationship between perceived importance and willingness to engage in weight loss behaviors with other potentially important psychosocial variables, such as attitudes, self-efficacy and perceived control. Future research should examine all these factors in relation to the weight loss process in order to determine which variables and/or combination of variables best predict weight loss success.

5.4 Conclusion

In conclusion, the present study provides preliminary support for the relationship between perceived importance of and willingness to engage in weight loss behaviors; however, the ability of these two variables to predict weight loss is unclear. This study also identified the need for additional research to differentiate between willingness and intention. Future behavioral weight loss studies should seek to further understand subjective attitudes, belief systems, and weight

loss outcomes. The ability to predict success in a weight loss program would have profound implications for obesity treatment, service provision, and health promotion. Better understanding of an individuals' sense of control, thoughts, emotions, beliefs, and other variables, such as perceived importance of and willingness to engage in specific weight loss behaviors, would be useful in developing personalized behavioral weight loss programs and consequentially more successful interventions.

Appendix A

RECRUITMENT ADVERTISEMENT

Research Subjects Needed for Weight Loss Study

- Are you 18-55 years of age?
- Are you overweight and interested in losing weight?
- Do you exercise less than 3 days per week and are you interested in becoming more active?

Women and Men who meet the above criteria and do not currently participate in a weight loss or exercise program may be eligible to participate in a 6-month study to examine strategies to achieve weight loss. This study is being conducted at the Physical Activity and Weight Management Research Center at the University of Pittsburgh. Eligible subjects will be compensated for their participation in this study. **Women who are pregnant are not eligible to participate in this study.**

For more information please call 412-648-4312

Appendix B

RECRUITMENT FORM

1. Thank you for your interest in our program. My name is _____ and I would briefly like to tell you about this research program.
2. **Procedure for Describing the Study and Obtaining Verbal Consent to Conduct the Phone Screen:** A description of the study will be read to participants, and this description includes important components of the informed consent process (see attached script). Individuals who express an interest in participating in this study will be told the following to obtain verbal consent:

Investigators Component of Informed Consent: This study is being conducted by Dr. John M. Jakicic and colleagues at the University of Pittsburgh.

Source of Support Component of Informed Consent: This study is sponsored by the School of Education.

Description Component of Informed Consent: We are interested in recruiting 50 men and women to participate in this study. **This study will focus on examining strategies for weight loss and the effect of weight loss on resting energy expenditure and body composition.** To do this, eligible individuals will participate in a 6-month program that will assist you with changing your dietary habits and increasing your exercise. You will receive a weight loss program that includes changes in your diet and exercise. You will also attend group meetings weekly for 6 months. Please understand that these meetings will be held at the University of Pittsburgh in Southside, and meetings will start between 5:30 and 6:15 in the evening, and these will be held on (Day of Week to be determined). Individuals who are eligible to participate in this study will undergo assessments. **These assessments will be completed before you start the study, 4 weeks after your initial assessments, and**

following at 12 and 24 weeks of participation in the weight loss program. In addition, eligible individuals will complete questionnaires about their exercise and other health-related behaviors before starting the study and following at 4, 8, 12, 16, 20 and 24 weeks of participation. Everyone will be paid \$25 in the form of a check upon completion of the 4 week, 12-week and 24-week assessments which means that you can earn a total of \$75 in incentives for your participation in this study.

If you are interested in participating in this study, I will need to ask you a few questions about your demographic background and questions about your physical health and medical history to determine if you appear to be eligible to participate in this study. It will take approximately 5 minutes to ask you all of the questions. If we complete the interview, I will ask you for some specific information (your complete name, date of birth, and mailing address) so that we can contact you regarding your participation in this study. I will then schedule you to attend an orientation session that will explain all of the procedures of this study in greater detail. The average time to complete this Phone Screen is approximately 5 minutes."

Risks and Benefits Component of Informed Consent: *The only known risk to you for completing the Phone Screen is that it will take a few minutes of your time and you may experience disappointment if it is determined that you are not eligible to participate in the larger study. It is likely that you will experience one or both of these situations by completing this Phone Screen, which means that this occurs in more than 25% of people (more than 25 out of 100 people). The benefit of completing this Phone Screen is that you may be able to participate in the weight loss study that I described to you.*

Costs and Payments Component of Informed Consent: *You will not incur any cost nor will you receive any payment for participating in the Phone Screen.*

Confidentiality Component of Informed Consent: *If your answer to a particular question tells me clearly that you will not be eligible for this study, I will stop the interview, and not ask you any more personal questions.*

Right to Participate or Withdraw from Participation Component of Informed Consent: *Your participation in this phone screen is voluntary. You may refuse to answer any of the questions asked. Your responses to these questions are confidential, and the information related to your health history or current behaviors that you are about to give me will be destroyed after this interview.*

Do you have any questions related to any of the information that I have provided to you? Staff member will answer any questions or will defer these questions to the Principal Investigator or Co-Investigator when appropriate prior to proceeding. If the individual would like to think about their participation prior to proceeding with the Phone Screen, they will be provided with the telephone number that they can call if they decide to participate in the future.

Voluntary Consent Component of Informed Consent: *Do you agree that the procedures that will be used to conduct this Phone Screen have been described to you, all of your questions have been answered, and you give me permission to ask you questions now as part of the initial Phone Screen? If "YES" indicate the participant's agreement with this statement on the top of the next page, and sign your name and date the form, and then complete the Phone Screen. If "NO", thank the individual for calling and do not complete the Phone Screen.*

Phone Screen Interview

The caller gives verbal permission to conduct the Phone Screen: _____ YES _____ NO

Verbal Assent was given to: _____

Date: ____/____/____

Eligible based on telephone screening: _____ Yes _____ No

1. Gender: _____ Male _____ Female

2. Age: _____ **(18-55)** Date of Birth: ____/____/____

3. Which of the following best describes your racial heritage? (you may choose more than one category):

_____ American Indian or Alaska Native

_____ Asian

_____ Black or African-American

_____ Hispanic, Latino, or Cape Verdean

_____ Native Hawaiian or Other Pacific Islander

_____ White

_____ Other (Specify: _____)

4. Current Weight: _____ pounds

5. Current Height: _____ feet _____ inches *Office Use: BMI = _____ (25-39.9 kg/m²)*

6. Are you able to walk for exercise? _____ **YES** _____ No

If “no”, specify reason: _____

7. Do you currently exercise regularly at least once per week at a moderate intensity for at least 20 minutes? _____ Yes _____ **NO**

If “yes”, How many days per week? _____

If “yes”, How long have you been exercising this way? _____

8. Have you ever been told by a doctor or other medical person that you have any of the following conditions? If “yes”, Specify:

- a. Heart Disease Yes **NO** _____
- b. Angina Yes **NO** _____
- c. Hypertension Yes **NO** _____
- d. Heart Attack Yes **NO** _____
- e. Stroke Yes **NO** _____
- f. Diabetes (sugar) Yes **NO** _____
- g. Cancer Yes **NO** _____

9. Are you presently being treated by a doctor or other medical person for any other physical or psychological problems? Yes **NO**

If “yes”, specify: _____

10. Do you take any prescription medications (includes psychotropics)? Yes **NO**

If “yes”, specify the following:

Medication Name	Used to Treat:

11. Are you taking any medications for the purpose of weight loss? Yes **NO**

If “yes”, specify: _____

12. Do you currently smoke? Yes **NO**

If “yes”, specify: _____

13. Are you currently a member of another organized exercise or are you participating in an organized weight reduction program? Yes **NO**

If "yes", specify: _____

14. Have you lost 10 or more pounds within the past year? Yes **NO**

If "yes", specify number of pounds: _____ Method used: _____

15. Are you currently participating in other research studies? Yes **NO**

If "yes", specify: _____

16. Have you been a participant in a previous exercise or weight control study?

Yes **NO**

If "yes", specify: _____

WOMEN ONLY COMPLETE THE FOLLOWING QUESTIONS

17. Are you currently pregnant? Yes **NO**

A. Have you been pregnant in the last 6 months? Yes **NO**

B. Do you plan on becoming pregnant in the next 6 months? Yes **NO**

If "yes", specify: _____

18. Do you plan to spend any time out of town on vacation or business in the next 6 months that may affect your ability to attend weekly group meetings? Yes **NO**

If "yes", specify: _____

19. Do you plan on relocating outside of the Greater Pittsburgh Area within the next 6 months?

Yes **NO**

If "yes", specify: _____

Contact Tracking Form

**** THIS PAGE IS COMPLETED ONLY IF THE RESPONDANT APPEARS TO QUALIFY FOR PARTICIPATION IN THIS STUDY AND IS SCHEDULE FOR THE ORIENTATION VISIT. ****

Date: ___/___/___ Staff Member Completing Form: _____

Name: _____

Street Address: _____

City: _____ State: ___ Zip Code: _____

Home Phone: _____ Work Phone: _____

OFFICE USE ONLY: Eligible: _____ Yes _____ **NO**

Invited to Orientation: _____ Yes _____ **NO**

Date: ___/___/___

If eligible schedule the participant for their group orientation session based on the schedule of available dates. A follow-up reminder will be send via the mail.

PAGE 1 WILL BE RETAINED FOR DEMOGRAPHIC STATISTICS

PAGES 2-3 MUST BE SHREDDED AT THE CONCLUSION OF THIS INTERVIEW

Appendix C

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

Subject ID: _____

Please read the questions carefully and answer each one honestly: check YES or NO

1. Has your doctor ever said you have a heart condition and that you should only do physical activity recommended by a doctor?

_____ Yes _____ **NO**

2. Do you feel pain in your chest when you do physical activity?

_____ Yes _____ **NO**

3. In the past month, have you had chest pain when you were not doing physical activity?

_____ Yes _____ **NO**

4. Do you lose your balance because of dizziness or do you ever lose consciousness?

_____ Yes _____ **NO**

5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?

_____ Yes _____ **NO**

6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

_____ Yes _____ **NO**

7. Do you know of any other reason why you should not do physical activity?

_____ Yes _____ **NO**

Reference: American Medical Association: Guides to the Evaluation of Permanent Impairment.
AMA, Chicago, 1990.

Appendix D

GENERAL HEALTH HISTORY

Subject ID: _____

1. Do you have or have you ever had any of the following medical conditions?

			Approximate Date of Diagnosis	Describe the Problem
a.	Heart Attack	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
b.	Angina (chest pain on exertion)	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
c.	Irregular Heart Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
d.	Other Heart Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
e.	Stroke	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
f.	Fainting Spells	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
g.	High Blood Pressure	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
h.	High Cholesterol	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
i.	Thyroid Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
j.	Cancer	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
k.	Kidney Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
l.	Liver Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
m.	Gout	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
n.	Diabetes	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
o.	Emotional/Psychiatric Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____
p.	Drug/Alcohol Problems	<input type="checkbox"/> yes <input type="checkbox"/> no	_____	_____

2. Do you have any medical problems that would prevent you from participating in a regular walking program? __yes __no

If yes, please describe the problem: _____

3. Have you participated in a regular exercise program over the past 6 months which consists of at least 20 minutes of activity, 3 days per week? __yes __no

Please describe: _____

4. Do you have to sleep with extra pillows or have to sit up in the middle of the night because of shortness of breath? __yes __no

5. Please list all medications that you are currently taking on a regular basis (make sure to indicate if you are taking medication for high blood pressure or cholesterol):

MEDICATION	REASON FOR TAKING
_____	_____
_____	_____
_____	_____
_____	_____

6. Over the last 6 months, on how many weekdays (Monday through Friday) do you usually drink wine, beer, or liquor on average?

- | | |
|-------------------------------|----------------------|
| (0) __Never | (4) __2 days/week |
| (1) __Less than once/month | (5) __3 days/week |
| (2) __1-2 times/month | (6) __4 days/week |
| (3) __1 day/week | (7) __5 days/week |

7. On those weekdays that you drink wine, beer, or liquor how many drinks do you have?

8. Over the last 6 months, on how many weekend days (Saturday and Sunday) do you usually drink wine, beer, or liquor?

- (0) Never (4) 1 weekend day/week
(1) Less than once/month (5) 2 weekend days/week
(2) 1-2 times/month

9. On those weekend days that you drink wine, beer, or liquor how many drinks do you have?

10. In the past year, have you regularly smoked cigarettes, pipes, cigars, or used chewing tobacco?

Please describe daily habit

Cigarettes	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
Pipe	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
Cigars	<input type="checkbox"/> yes <input type="checkbox"/> no	_____
Chewing Tobacco	<input type="checkbox"/> yes <input type="checkbox"/> no	_____

11. Do you plan to spend frequent time out of town on business or vacation during the next 18 months? yes no

Please describe: _____

12. Is it possible that you will relocate in the next 18 months? yes no

Please describe: _____

WOMEN ONLY ANSWER THE FOLLOWING QUESTIONS

13. Are you currently pregnant? yes no

14. Were you pregnant within the past 6 months? yes no

15. Do you plan to become pregnant in the next 18 months? yes no

16. Have you gone through menopause or the change of life? yes no

17. Have you had a hysterectomy? yes no

18. When was your last menstrual period? Date:____/____/____

19. Do you take :

Birth Control Pills? yes no

Estrogens (i.e. Premarin)? yes no

Progesterone (i.e. Provera)? yes no

Appendix E

PHYSICIAN CONSENT/MEDICAL CLEARANCE FORM

PHYSICIAN CONSENT TO PARTICIPATE IN A DIET AND EXERCISE PROGRAM AT THE
UNIVERSITY OF PITTSBURGH

TO:		RETURN TO: (envelope provided)
	Physician's Name	John M. Jakicic, Ph.D.
	Address	University of Pittsburgh Department of Health and Physical Activity Physical Activity and Weight Management Research Center
	City	2100 Wharton Street, Suite 600
	State	Pittsburgh, PA 15203
	Zip	Telephone: (412) 488-4184
	()	FAX: (412) 488-4174
	Telephone Number	

Your patient _____ has asked to participate in a diet and exercise program at the University of Pittsburgh. This is a 6 month research study designed to help patients change their eating and exercise habits and to examine the impact that this will have on weight loss. This will involve the following:

1. A walking program that will be home-based. The exercise will gradually be progressed from 20 minutes per day to as much as 40 minutes per day, 5 days per week. Exercise intensity will be set at 60-70% of the patient's maximal heart rate.
2. A diet program that will reduce energy intake to 1200-1500 calories per day, with dietary fat reduced to 20-30% of total energy intake.
3. Behavioral modification techniques for changing eating and exercise behaviors.
4. A list of additional factors that you should consider is listed on the attached sheet.

Please indicate below if this program seems appropriate for your patient or if you see any contraindications for their participation (*please check the appropriate box below*).

I know of no contraindications to this patient participating in any of the above components of the program.

I feel that this program would not be appropriate for this patient for the following reason(s):

Signature of Physician

Date

Please consider the following Inclusion and Exclusion Criteria as you evaluate whether your patient is capable of safely participating in the weight loss research study at the University of Pittsburgh.

Inclusion Criteria

1. 18-55 years of age.
2. Body mass index (BMI) between 25.0-39.9 kg/m².
3. Male or Female.

Exclusion Criteria

1. Report participating in a research project involving weight loss or physical activity in the previous 12 months.
2. Report participating in any other research study that may impact the outcome of the current proposed study.
3. Report a weight loss of >10% of their body weight in the previous 12 months.
4. Report participating in regular physical activity (defined as 30 minutes per day three or more days per week) over the previous six months.

5. Currently pregnant, report pregnancy during the previous 6 months, or plan on becoming pregnant in the following six months.
6. Report being treated for any cardiovascular, orthopedic, psychological, neurological, or metabolic disorder or any other medical condition that could impact body weight, diet, or physical activity.
7. Report a history of heart disease, stroke, myocardial infarction, angina, diabetes, or cancer.
8. Report taking any medications and/or supplements that would affect heart rate or blood pressure responses to exercise.
9. Report taking any medications and/or supplements that could affect metabolism and/or weight loss.
10. Report an inability to attend weekly sessions or possibility of re-locating out of the greater Pittsburgh area during the study period.

Appendix F

IRB-APPROVED CONSENT FORM

Approval Date:
Renewal Date:
University of Pittsburgh
Institutional Review Board
IRB #0511001

CONSENT TO ACT AS A SUBJECT IN A RESEARCH STUDY

TITLE: PERCEIVED IMPORTANCE AND WILLINGNESS TO ENGAGE IN WEIGHT
LOSS BEHAVIORS AMONG OVERWEIGHT ADULTS

PRINCIPAL INVESTIGATOR: John M. Jakicic, Ph.D.
Associate Professor
Department of Health and Physical Activity
University of Pittsburgh
Suite 600 Birmingham Towers
2100 Wharton Street
Pittsburgh, PA 15203
Telephone: 412-488-4184

CO-PRINCIPAL INVESTIGATOR:
Tina Mathur, MPH
Department of Health and Physical Activity
University of Pittsburgh
Suite 600 Birmingham Towers
2100 Wharton Street
Pittsburgh, PA 15203
Telephone: 412-488-4184

CO-INVESTIGATOR:
Amy D. Otto, Ph.D.
Department of Health and Physical Activity
University of Pittsburgh
Suite 600 Birmingham Towers
2100 Wharton Street
Pittsburgh, PA 15203
Telephone: 412-488-4184

CO-INVESTIGATOR:
Ruth Kowallis, MS
University of Pittsburgh
149B Trees Hall
Pittsburgh, PA 15261
(412) 648-9182

SOURCE OF SUPPORT: School of Education

DESCRIPTION:

The number of overweight and obese adults in the United States has been increasing at a rapid rate. Both reducing your food intake and increasing your exercise are important components of a weight loss program. This study will examine factors that may influence your use of weight loss strategies and how these factors affect your weight loss process, and the short-term effects of reduced calorie intake on resting energy expenditure (REE) in overweight and moderately obese women. Resting Energy Expenditure (REE) is the number of calories you burn in energy to allow your body to perform basic functions such as breathing, having your heart beat, and other functions to sustain life.

You are being invited to take part in this research study because you are within the body weight range for this study, have not lost more than 10% of your body weight within the past year, and do not have any medical conditions that would prohibit you from participating in moderate to vigorous activity. People invited into this study have to be men or women between 18-55 years of age. Women participants cannot be pregnant, and if you are a woman you will be required to accurately report whether you are pregnant to the investigators prior to beginning this study and during the study if your status should change. This study is being performed on a total of 50 individuals at the University of Pittsburgh.

If you decide to take part in this research study, you will undergo the following procedures that are not part of your standard medical care:

Screening Procedures:

Procedures to determine if you are eligible to take part in a research study are called “screening procedures”. For this research study, the screening procedures include:

You will complete a physical activity readiness questionnaire (PAR-Q), and this will take approximately 5 minutes to complete. You will also complete a detailed medical history, and this will take approximately 20 minutes to complete. These questionnaires will allow the investigators to determine if you have any significant medical condition that would indicate that eligibility is unsafe for you.

If you are a woman and report a pregnancy during the previous six months, report that you are currently pregnant, that you plan to become pregnant in the next six months, or if you become pregnant during the study period then you will not be eligible to participate or continue participating in the study. If you are pregnant you will be excluded from this study since the study requirements of decreasing the amount and types of food that you eat and increasing your level of physical activity may be harmful to your health and the health of your unborn child.

You will also be required to provide written clearance from your personal physician before starting this study. You will be provided a Physician Consent form and it will be your responsibility to have this form signed by your personal physician and returned to the principal investigator prior to participating in the experimental procedures of the weight loss program described below.

Experimental Procedures:

If you qualify to take part in this research study, you will undergo the following experimental procedure assessments which will be conducted on weekdays during the hours of

7:30 AM to 10:30 AM at the University of Pittsburgh's Physical Activity and Weight Management Research Center:

Body Weight and Height: Your body weight will be measured in private room using a standard medical scale. Your height will be measured with a ruler that is attached to a flat wall. These will be measured at 0, 12, and 24 weeks during this study.

Exercise, Dietary Patterns, and Factors that Influence Behavior Change: You will complete questionnaires about the amount of exercise that you do in the presence of study personnel which will take approximately 20 minutes. You will also be given questionnaires to take home and complete on your own time. These questionnaires will include information about the amount and types of foods that you eat, your mood, general health, and other factors that may affect your exercise and eating behaviors. You will be required to complete approximately 12 different questionnaires at 0, 12, and 24 weeks during this study. It is estimated that you will be able to complete these questionnaires in approximately 60-90 minutes. In addition, you will complete 1 questionnaire at 0, 4, 8, 12, 16, 20, and 24 weeks, and 1 questionnaire only at week 24. It is estimated that you will be able to complete these additional questionnaires in approximately 5-10 minutes.

Note: One of the questionnaires that you will complete will provide information about your mood and if you have symptoms of depression. If it is determined that you have symptoms of depression then you will be notified immediately and will be referred to your primary care physician for follow-up screening. If this is extreme and requires immediate medical care, and you are in the presence of the study investigators, you will be transported to the hospital.

Resting Energy expenditure (REE): Resting Energy Expenditure (REE) is the number of calories you burn in energy to allow your body to perform basic functions such as breathing, having your heart beat, and other functions to sustain life. On the morning of the test you will need to be transported to the research center by car, mass transportation such as a bus, or other form of motorized transportation. You will also be required not to participate in exercise or other vigorous forms of activity for at least one day (24 hours) before completing this measurement. You will also be required to avoid all food and beverages (other than water), and over-the-counter medications for 12 hours before this measurement.

After arriving at the research center on the day of this test, you will lie in a resting position for 30 minutes. The air that you breathe out (exhale) will then be measured for an additional 15-30 minutes using a metabolic cart. A metabolic cart is a machine that allows investigators to determine how much air you breathe in and out, and how much of that is oxygen and carbon dioxide. This information will allow the investigators to determine how many calories you burn if you were to remain in a resting position all day. This will require that a plastic canopy be placed over your head as this will allow all of the air you breathe out to be analyzed. It is important for you to realize that you will not breathe any special mixes of air, but rather will breathe normal room air. This test just allows for that air to be measured to determine your resting energy expenditure.

This test will be performed twice, one time before you start the study and then 4 weeks after the study begins. This test will require approximately 60 minutes to complete for each measurement period.

Body composition: Body composition is the amount of fat weight and lean weight (muscle and bone) that you have on your body. Your body composition will be measured using a technique known as Bioelectrical Impedance Analysis (BIA). This procedure requires that a small electrode be placed on your hand, wrist, ankle, and foot. A low-level signal that is not harmful to you and that you will not feel is transmitted between the electrodes. There is no harm or risk associated with this procedure. This test will require approximately 15 minutes to complete at each measurement period. This test will be performed twice, one time before you start the study and then 4 weeks after the study begins.

Description of the Weight Control Program:

If you consent to participate in this study you will be assigned to one of two weight loss interventions. Your assignment to the weight loss intervention will be random, which means that you can not choose your group but rather this is determined in a method that is similar to flipping a coin. These weight loss groups are: 1) Weight Loss Intervention Group, or 2) Delayed Weight Loss Intervention Group. These weight loss groups are described below.

Weight Loss Intervention Group: If you are assigned to the weight loss intervention group you will receive the following

- a.) Group Meetings and Contacts: You will attend a total of 24 weekly group meetings over 6 months at the University of Pittsburgh's Physical Activity and Weight Management Research Center. You will not have the ability to select the day or time of the group meetings, but rather the group meetings will be held at a set day and time and this information will be provided to you prior to you agreeing to participate in this study. Each group meeting will last 45 to 60 minutes. These weekly meetings will be held on the same night every week, and the group will have approximately 20 to 25 members that will be dieting and participating in exercise to lose weight. If you decide to discontinue your participation in this weight loss program you will need to provide written notification to the principal investigator listed on page 1 of this document.
- b.) Diet: It will be recommended that you reduce the amount of food that you eat and change some of your food choices. This will result in you eating fewer calories and reducing the amount of fat that you eat. If you are less than 200 pounds, you will be placed on a 1200 calorie per day diet. If you are 200 pounds or greater, you will be placed on a 1500 calorie per day diet. You will also be taught how to decrease the amount of fat that you eat, and will be encouraged to decrease fat intake to 20-30% of your total calories. You will record the food that you eat in a diary, and this will be returned to the investigators weekly.
- c.) Exercise: It will be recommended that you increase your participation in regular exercise. You will be instructed to exercise 5 days per week, with the walking duration on each day increasing from 20 to 40 minutes during the first 12-weeks of the program, and you will maintain this level of exercise throughout the remainder of the program. You will be allowed to divide your exercise into periods of at least 10 minutes to make it easier for you to exercise. You will exercise at an intensity of 60-70% of your maximal capacity, which is the

equivalent of taking a brisk walk for most individuals. Brisk walking will be recommended, however you can self-select to participate in other forms of activity for your exercise provided you follow the guidelines described above. You will record your exercise in a diary that is returned to the investigators weekly.

Delayed Weight Loss Intervention Group: If you are assigned to the Delayed Weight Loss Intervention group you will receive the following:

- a) Group Meetings and Contacts: Following your baseline assessment you will participate in a 4 week period where you will be instructed to maintain your current eating and exercise behaviors that will allow you to maintain your body weight. Following this 4-week period, you will then attend a total of 24 weekly group meetings over 6 months at the University of Pittsburgh's Physical Activity and Weight Management Research Center. You will not have the ability to select the day or time of the group meetings, but rather the group meetings will be held at a set day and time and this information will be provided to you prior to you agreeing to participate in this study. Each group meeting will last 45 to 60 minutes. These weekly meetings will be held on the same night every week, and the group will have approximately 20-25 members that will be dieting and participating in exercise to lose weight. If you decide to discontinue your participation in this weight loss program you will need to provide written notification to the principal investigator listed on page 1 of this document.
- b) Diet: Following your baseline assessment you will participate in a 4 week period where you will be instructed to maintain your current eating behaviors that will allow you to maintain your body weight. Following this 4-week period, it will be recommended that you reduce the amount of food that you eat and change some of your food choices. This will result in you eating few calories and reducing the amount of fat that you eat. If you are less than 200 pounds, you will be placed on a 1200 calorie per day diet. If you are 200 pounds or greater, you will be placed on a 1500 calorie per day diet. You will also be taught how to decrease the amount of fat that you eat, and will be encouraged to decrease fat intake to 20-30% of your total calories. You will record the food that you eat in a diary, and this will be returned to the investigators weekly.
- c) Exercise: Following your baseline assessment you will participate in a 4-week period where you will be instructed to maintain your current exercise behaviors that will allow you to maintain your body weight. Following this 4-week period, it will be recommended that you increase your participation in regular exercise. You will be instructed to exercise 5 days per week, with the walking duration on each day increasing from 20 to 40 minutes during the first 12-weeks of the program, and you will maintain this level of exercise throughout the remainder of the program. You will be allowed to divide your exercise into periods of at least 10 minutes to make it easier for you to exercise. You will exercise at an intensity of 60-70% of your maximal capacity, with is the equivalent of taking a brisk walk for most individuals. Brisk walking will be recommended, however you can self-

select to participate in other forms of activity for your exercise provided you follow the guidelines described above. You will record your exercise in a diary that is returned to the investigators weekly.

RISKS and BENEFITS:

The possible risks of this research study may be due to the exercises that you will be performing.

Risks of Exercise: There are risks associated with participating in an exercise program. During exercise, you may experience a serious cardiac event (i.e., heart attack), an arrhythmia (i.e. irregular heart beat), or chest pain. The risk of a serious cardiac event, arrhythmia, or chest pain would be infrequent (less than 10% or less than 10 persons out of 100 people). In addition, during exercise, you may experience an increase in heart rate, an increase in blood pressure, shortness of breath, or general fatigue. The risk of increased heart rate and blood pressure, shortness of breath, or general fatigue is common (greater than 10% or more than 10 out of 100 people). Because the exercise sessions that you will be asked to do will not be supervised by the staff, the staff cannot provide medical assistance to you in the event of an emergency during these exercise sessions.

Risks of Reducing Your Caloric and Fat Intake: Consuming a moderately low fat and low calorie diet appears to be safe and effective for weight loss. However, if you reduce your calorie or fat intake below recommended levels you may experience dry skin and thinning of your hair. This is common and occurs in 1% to 25% of people (1 to 25 out of 100 people). You may also experience problems with your gall bladder like Cholelithiasis (also known as gallstones). Symptoms for this condition include abdominal pain or back pain. If severe, surgery may be required to remove your gall bladder. This is infrequent and occurs in less than 1% of people (less than 1 out of 100 people).

Risk Associated with Completion of Questionnaires: You may experience non-physical risks such as boredom, frustration, stress, and time constraints when completing the questionnaires. The risk of this happening to you is common because this occurs in more than 10% of people (more than 10 out of 100 people). To minimize the occurrence of these risks you will be allowed to take the questionnaires home and complete them at your leisure provided they are returned to the investigators by the date specified to you.

Risk Associated with Participating in the Group Intervention: Attending group sessions has been shown to be effective for weight loss. However, attendance at these sessions may involve you sharing information about yourself and your weight loss efforts to other group members. You can elect not to share this private information about yourself to other group members. Members of the group will be instructed to keep all information shared in the group sessions confidential. However, because the investigators can not guarantee that all group members will keep this information confidential, there is risk that group members may share information about the group session with individuals not participating in this study. The risk of

this happening to you is common because this may occur in more than 10% of people (more than 10 out of 100 people).

Risk Associated with measurement of Body Composition using BIA: It is infrequent that you will feel any discomfort as a result of participating in the body composition measurement using the BIA (occurs in less than 10% of people or less than 10 out of 100 people).

Risk Associated with Measurement of Resting Energy Expenditure (REE): Risks associated with measurement of REE may include mild discomfort as a result of having the plastic canopy placed over your head. This is common to occur during the assessment (occurs in more than 10% of people or more than 10 out of 100 people), but may be more common in those individuals who are uncomfortable in enclosed areas.

There are also possible benefits of this research study that may be due to the exercises that you will be performing and the diet that will reduce the amount and types of foods that you will be eating. However, there is no guarantee that any or all of these changes will occur as a result of you participating in this study.

Benefits of Exercise: The benefits of participation in an exercise program have been shown to include improvements in physical fitness, weight loss, improvements in blood pressure, and improvements in blood cholesterol levels. However, there is no guarantee that any or all of these changes will occur as a result of you participating in this study.

Benefits of Reducing your Caloric and Fat Intake: Consuming a low fat and low calorie diet appears to be safe and effective for weight loss. Additional benefits of eating this type of diet can be improvements in blood pressure and improvements in blood cholesterol levels. However, there is no guarantee that any or all of these changes will occur as a result of you participating in this study.

If we should find out about a medical condition you were unaware of, with your written permission, this information will be shared with the doctor of your choice.

NEW INFORMATION:

You will be promptly notified if any new information develops during the conduct of this research study, which may cause you to change your mind about continuing to participate.

COSTS and PAYMENTS:

Neither you, nor your insurance provider, will be charged for the costs of any of the procedures performed for the purpose of this research study. These costs will be paid by the sponsor of this research study.

If you are assigned to the Weight Loss Intervention Group you will be paid \$25 for completing the assessment following 4-weeks of the intervention, \$25 for completion of the assessments following 12-weeks of the intervention, and \$25 for completing the assessments following 24-weeks of the intervention.

If you are assigned to the Delayed Weight Loss Intervention Group you will be paid \$25 for completing assessments following the 4-week period where you are to maintain your body weight, \$25 for completion of the assessments following 12-weeks of the intervention, and \$25 honorarium for completion of the assessments following 24-weeks of the intervention.

COMPENSATION FOR INJURY:

University of Pittsburgh researchers and their associates who provide services at the University of Pittsburgh Medical Center (UPMC) recognize the importance of your voluntary participation in their research studies. These individuals and their staffs will make reasonable efforts to minimize, control, and treat any injuries that may arise as a result of this research. If you believe that you are injured as a result of the research procedures being performed, please contact immediately the Principal Investigator or a co-investigator listed on the first page of this form.

Emergency medical treatment for injuries solely and directly related to your participation in this research study will be provided to you by UPMC. It is possible that UPMC may bill your insurance provider for the costs of this emergency treatment, but none of these costs will be charged directly to you. If your research-related injury requires medical care beyond this emergency treatment, you will be responsible for the costs of this follow-up care unless otherwise specifically stated below. There is no plan for monetary compensation. You do not, however, waive any legal rights by signing this form.

CONFIDENTIALITY:

Any information about you obtained from this research will be kept as confidential (private) as possible. All records related to your involvement in this research study will be stored in a locked file cabinet. Your identity on these records will be indicated by a case number rather than by your name, and the information linking these case numbers with your identity will be kept separate from the research records. In addition, all research databases will have password controlled access, and this will be controlled by the researchers. Only the researchers listed on the first page of this form and their staff will have access to your research records. You will not be identified by name in any publication of research results unless you sign a separate form giving your permission.

This research study will involve the recording of current and/or future identifiable medical information from your hospital and/or other health care provider (e.g., physician office) records. The information that will be recorded will be limited to information concerning medical clearance from your physician to participate in this research study. This may include information related to coronary heart disease risk factors such as blood pressure, blood cholesterol, or other medical conditions that may increase the risk of heart disease and/or indicate that exercise participation may be unsafe for you. This information will be used to determine whether it is safe for you to participate in this research study.

The investigators listed on the first page of this authorization (consent) form and their research staff will or may have access to identifiable information (which may include your identifiable medical record information obtained as part of the initial screening and physician consent) related to your participation in this research study.

In unusual cases, your research records may be required to release identifiable information (which may include your identifiable medical record information) related to your participation in this research study in response to an order from a court of law. If the researchers learn that you or someone with whom you are involved is in serious danger or potential harm, they will need to inform, as required by Pennsylvania law, the appropriate agencies.

Authorized representatives of the University of Pittsburgh will review and/or obtain identifiable information (which may include your identifiable medical record information) related to your participation in this research study for the purpose of monitoring the accuracy and completeness of the research data and for performing required scientific analyses of the research data. While the study sponsor understands the importance of maintaining the confidentiality of your identifiable research and medical record information, UPMC and the University of Pittsburgh cannot guarantee the confidentiality of this information after it has been obtained by the study sponsor.

The investigators involved in the conduct of this research study may receive funding from the sponsor to perform the research procedures and to provide the sponsor with identifiable research and medical record information related to your participation in the study.

Authorized representatives of UPMC or other affiliated health care providers may have access to identifiable information (which may include your identifiable medical record information) related to your participation in this research study for the purpose of (1) fulfilling orders, made by the investigators, for hospital and health care services (e.g., laboratory tests, diagnostic procedures) associated with research study participation; (2) addressing correct payment for tests and procedures ordered by the investigators; and/or (3) for internal hospital operations (i.e., quality assurance).

The investigators may continue to use and disclose, for the purposes described above, identifiable information (which may include your identifiable medical record information) related to your participation in this research study for 5 years following the completion of this study, as per University policy, or when such is approved by the sponsor of this study, whichever should occur last.

RIGHT TO PARTICIPATE or WITHDRAW FROM PARTICIPATION:

Your participation in this research study, to include the use and disclosure of your identifiable information for the purposes described above, is completely voluntary. (Note, however, that if you do not provide your consent for the use and disclosure of your identifiable information for the purposes described above, you will not be allowed, in general, to participate in the research study.) Whether or not you provide your consent for participation in this research study will have no effect on your current or future relationship with the University of Pittsburgh. Whether or not you provide your consent for participation in this research study will have no effect on your current or future medical care at a UPMC hospital or affiliated health care provider or your current or future relationship with a health care insurance provider.

You may withdraw, at any time, your consent for participation in this research study, to include the use and disclosure of your identifiable information for the purposes described above. (Note, however, that if you withdraw your consent for the use and disclosure of your identifiable information for the purposes described above, you will also be withdrawn, in general, from further participation in this research study.) Any identifiable research or medical record information recorded for, or resulting from, your participation in this research study prior to the date that you formally withdrew your consent may continue to be used and disclosed by the investigators for the purposes described above.

To formally withdraw your consent for participation in this research study you should provide a written and dated notice of this decision to the principal investigator of this research study at the address listed on the first page of this form.

Your decision to withdraw your consent for participation in this research study will have no affect on your current or future relationship with the University of Pittsburgh. Your decision to withdraw your consent for participation in this research study will have no affect on your current or future medical care at a UPMC hospital or affiliated health care provider or your current or future relationship with a health care insurance provider.

It is possible that you may be removed from the research study by the researchers if, for example, your health status changes and it does not appear that it is safe for you to continue to reduce your food intake, exercise, or lose weight. You will also be removed if you should become pregnant during this study.

VOLUNTARY CONSENT

All of the above has been explained to me and all of my current questions have been answered. I understand that I am encouraged to ask questions about any aspect of this research study during the course of this study, and that such future questions will be answered by the researchers listed on the first page of this form.

Any questions I have about my rights as a research participant will be answered by the Human Subject Protection Advocate of the IRB Office, University of Pittsburgh (1-866-212-2668). By signing this form, I agree to participate in this research study. A copy of this consent form will be given to me.

Participant's Signature

Date

CERTIFICATION OF INFORMED CONSENT

I certify that I explained the nature and purpose of this research to the above-named individual, and I have discussed the potential benefits and possible risks of study participation. Any questions the individual has about this study have been answered, and we will always be available to address future questions as they arise.

Printed Name of Person Obtaining Consent

Role in Research Study

Signature of Person Obtaining Consent

Date

Appendix G

WEIGHT LOSS BEHAVIORS QUESTIONNAIRES

Weight Loss Behaviors

Directions: The following items ask about what you believe to be important behaviors for successful weight loss and weight maintenance. Please read each statement carefully and answer all items. For each item, please indicate how important you believe or feel that each behavior will contribute to your weight loss success by using the following scale:

		Not at all important		Somewhat important		Very important
1.	To use a diary to write down everything I eat or drink everyday.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2.	To follow menu plans when making food choices.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3.	To keep track of the number of calories I eat.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4.	To keep track of the amount of fat I eat.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
5.	To measure my food portions using scales, spoons, cups, etc.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
6.	To purposely eat smaller portions of food.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
7.	To attend group weight loss meetings each week.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
8.	To keep track of the exercise I do.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
9.	To exercise at least 30 minutes every day.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
10.	To take time to plan my meals.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
11.	To participate in supervised exercise sessions at the weight loss clinic.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
12.	To modify the way I cook and prepare food.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
13.	To eat out in restaurants less often than I currently do.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
14.	To change my schedule to make exercise time a priority.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
15.	To exercise even when I don't feel like it.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
16.	To change my thoughts related to healthy eating and physical activity.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
17.	To weigh myself at least once a week.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Willingness Questionnaire

Directions: The following items relate to how willing you are to participate in specific behaviors that contribute to successful weight loss. Please read each statement carefully and answer all items. For each item, please indicate the number of times per week you are willing to do the specific behavior during your weight loss program (0-7).

	Circle the number indicating how many times per week you are willing to do the behavior							
1. To use a diary to write down everything I eat or drink.	0	1	2	3	4	5	6	7
2. To follow menu plans when making food choices.	0	1	2	3	4	5	6	7
3. To record the number of calories I eat.	0	1	2	3	4	5	6	7
4. To record the amount of fat I eat.	0	1	2	3	4	5	6	7
5. To measure my food portions using scales, spoons, cups, etc.	0	1	2	3	4	5	6	7
6. To purposely eat smaller portions of food.	0	1	2	3	4	5	6	7
7. To attend group weight loss meetings.	0	1	2	3	4	5	6	7
8. To record the exercise I do.	0	1	2	3	4	5	6	7
9. To exercise at least 30 minutes at a moderate intensity.	0	1	2	3	4	5	6	7
10. To take time to plan my meals.	0	1	2	3	4	5	6	7
11. To participate in supervised exercise sessions at the weight loss clinic.	0	1	2	3	4	5	6	7
12. To modify the way I cook and prepare food.	0	1	2	3	4	5	6	7
13. To eat out in restaurants less often than I currently do.	0	1	2	3	4	5	6	7
14. To change my schedule to make exercise time a priority.	0	1	2	3	4	5	6	7
15. To exercise even when I don't feel like it.	0	1	2	3	4	5	6	7
16. To change my thoughts related to eating and physical activity.	0	1	2	3	4	5	6	7
17. To weigh myself.	0	1	2	3	4	5	6	7

Behavior Frequency Questionnaire

Directions: The following items relate to how often you engage in each of the specific behaviors. Please read each statement carefully and answer all items. For each item, please indicate on average how many days per week (0-7) you engaged in each specific behavior during the last four weeks of your weight loss program.

	Circle the number indicating how many times per week you have engaged in the behavior							
1. To use a diary to write down everything I eat or drink.	0	1	2	3	4	5	6	7
2. To follow menu plans when making food choices.	0	1	2	3	4	5	6	7
3. To record the number of calories I eat.	0	1	2	3	4	5	6	7
4. To record the amount of fat I eat.	0	1	2	3	4	5	6	7
5. To measure my food portions using scales, spoons, cups, etc.	0	1	2	3	4	5	6	7
6. To purposely eat smaller portions of food.	0	1	2	3	4	5	6	7
7. To attend group weight loss meetings.	0	1	2	3	4	5	6	7
8. To record the exercise I do.	0	1	2	3	4	5	6	7
9. To exercise at least 30 minutes at a moderate intensity.	0	1	2	3	4	5	6	7
10. To take time to plan my meals.	0	1	2	3	4	5	6	7
11. To participate in supervised exercise sessions at the weight loss clinic.	0	1	2	3	4	5	6	7
12. To modify the way I cook and prepare food.	0	1	2	3	4	5	6	7
13. To eat out in restaurants less often than I currently do.	0	1	2	3	4	5	6	7
14. To change my schedule to make exercise time a priority.	0	1	2	3	4	5	6	7
15. To exercise even when I don't feel like it.	0	1	2	3	4	5	6	7
16. To change my thoughts related to eating and physical activity.	0	1	2	3	4	5	6	7
17. To weigh myself.	0	1	2	3	4	5	6	7

Intention Questionnaire

Directions: The following items inquire about your intentions to participate in specific behaviors that contribute to successful weight loss. Please read each statement carefully and answer all items. For each item, please indicate the number of times per week you intend on doing the specific behavior during your weight loss program (0-7).

	Circle the number indicating how many times per week you intend on doing the behavior							
1. To use a diary to write down everything I eat or drink.	0	1	2	3	4	5	6	7
2. To follow menu plans when making food choices.	0	1	2	3	4	5	6	7
3. To record the number of calories I eat.	0	1	2	3	4	5	6	7
4. To record the amount of fat I eat.	0	1	2	3	4	5	6	7
5. To measure my food portions using scales, spoons, cups, etc.	0	1	2	3	4	5	6	7
6. To purposely eat smaller portions of food.	0	1	2	3	4	5	6	7
7. To attend group weight loss meetings.	0	1	2	3	4	5	6	7
8. To record the exercise I do.	0	1	2	3	4	5	6	7
9. To exercise at least 30 minutes at a moderate intensity.	0	1	2	3	4	5	6	7
10. To take time to plan my meals.	0	1	2	3	4	5	6	7
11. To participate in supervised exercise sessions at the weight loss clinic.	0	1	2	3	4	5	6	7
12. To modify the way I cook and prepare food.	0	1	2	3	4	5	6	7
13. To eat out in restaurants less often than I currently do.	0	1	2	3	4	5	6	7
14. To change my schedule to make exercise time a priority.	0	1	2	3	4	5	6	7
15. To exercise even when I don't feel like it.	0	1	2	3	4	5	6	7
16. To change my thoughts related to eating and physical activity.	0	1	2	3	4	5	6	7
17. To weigh myself.	0	1	2	3	4	5	6	7

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