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Relationship of Weight-Related Eating Behaviors and Weight-Loss of Participants in a Proprietary Weight-Loss Program

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RELATIONSHIP OF WEIGHT-RELATED EATING BEHAVIORS AND WEIGHT-LOSS OF PARTICIPANTS ENROLLED IN A PROPRIETARY WEIGHT-LOSS PROGRAM

BY

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This thesis is approved as a credible and independent investigation by a candidate for the Master of Science in Nutrition and Exercise Science degree and is acceptable for meeting the requirements of this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusion of the major department.

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ABSTRACT

RELATIONSHIP OF WEIGHT-RELATED EATING BEHAVIORS AND WEIGHT-LOSS OF PARTICIPANTS ENROLLED IN A PROPRIETARY WEIGHT-LOSS PROGRAM

MEGAN TSCHAKERT

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The aim of this study is to evaluate weight-related eating behaviors of participants with clinically significant weight loss (CSWL) in a proprietary weight loss program. A cross-sectional sample of participants (n=1,454) enrolled in a proprietary weight-loss program that includes meal replacements and health coaching were queried for weight-related eating behaviors (using Weight Related Eating Questionnaire) of routine restraint (RR), compensatory restraint (CR), susceptibility to external cues (SEC), and emotional eating (EE) in relation to CSWL (defined as having achieved a weight loss greater than 10% of starting weight). Participants were dichotomized into those with CSWL (n=973) and with no CSWL (n=481) the relationship between CSWL (controlling for age and sex) as the dependent variable and weight-related eating behaviors as the independent variable was assessed using logistic regression (Stata/SE 14). Those with CSWL have higher odds of having RR (OR: 1.3, $p<0.05$) and CR (OR: 1.1, $p<0.05$) and lower odds of having SEC (OR: 0.7, $p<0.05$) and EE (OR: 0.8, $p<0.05$) than those without CSWL. Weight-related eating behaviors of participants in proprietary meal replacement weight-loss programs who have successfully lost weight differ compared to those who have not. Knowledge of the relationship between CSWL and weight-related eating behaviors can be used by coaches to assist participants in reinforcing those behaviors that support

weight-loss. These results are limited to participants who self-select for proprietary meal-replacement weight-loss programs and cannot be generalized to other weight-loss or maintenance programs.

CHAPTER 1: INTRODUCTION

Obesity is a predominant disease that is progressive and continuously relapsing.[1] Regaining weight after weight loss is a common problem for anyone overweight or obese who has recently lost weight.[2] After one year nearly half of the lost weight is regained and most dieters acquire their first weight within three to five years.[3] Many Americans look for guidance on appropriate weight loss strategies. A variety of weight loss methods are used ranging from self-help attempts at dieting or physical activity, professional counseling, pharmacological interventions, and surgical interventions.[4] Furthermore, to assist in weight loss many adults use commercial or proprietary weight loss programs.

Safe and effective commercial and proprietary weight loss programs are needed. Poor food choices, large portion sizes, eating frequently, and over consuming high fat and energy foods contribute to diet failure.[5-7] Changing long-term eating habits can be difficult and should possibly be added to developing solutions for weight control.[8] A weight loss approach that has shown potential is a partial meal replacement program, which involves following a low-energy diet while replacing one to two main meals with meal replacements each day.[1] Therefore, meal replacements may be a helpful way to assist men and women who are not able to change their eating habits enough to maintain a lower weight. Rohrer et al. discovered that body weight was reduced by 15-25% in partial meal replacement programs.[9] Partial meal replacement programs often tend to be more successful when there is a health coach available to the participants.[1]

Using health coaches to improve weight, nutrition, physical activity, and smoking behavior among individuals at risk is somewhat new and experimental in the health promotion field.[10,11] New weight loss programs have added a health coaching component

to encourage and guide the participants in the direction of a healthy lifestyle. The purpose of a health coach is to help the participant reassess his or her own readiness to make lifestyle changes.[10] The coach is there to support the participants plan of action, encourage their success, and help them re-group after a relapse or setback.[10] Integrating health coaching into primary care practice has shown to be effective in corporate wellness and weight loss programs. A study by Merrill et al., concluded that a coach helps to persistently re-asses an individual's willingness to make a lifestyle change.[10,12] Mental status, social functioning, and mood in adult men and women has shown positive improvement due to nutrition wellness coaching.[13] Health education has been shown to benefit an individual's eating behaviors.[14]

Individual characteristics and eating behaviors can be critical when determining the risks for gaining weight. Some individuals eating patterns and weight gain is related to neurocognitive responses caused from food.[15] There are four eating behaviors, routine restraint, compensatory restraint, emotional cues, and external cues, which revolve around three main theories. The theory of externality represents susceptibility to external cues, which is described as eating in response to an external stimulus regardless of the internal state of hunger or satiety.[14] A study completed by Herman et al. separated external cues into two categories, normative cues and sensory cues.[16] Normative cues affects all eaters indiscriminately whereas sensory cues have a stronger effect on specific individuals such as obese and dieting people.[16] Compensatory restraint and routine restraint are represented by the dietary restraint theory.[17-19] Compensatory restraint is defined as intentionally restricting the intake of food following a period of overeating.[20] Routine restraint is defined as intentional repetition of restricting food to control or

maintain weight.[20] Dietary restriction has to result in a balance between intake and output for weight maintenance or negative energy balance for weight loss.[21] The psychosomatic theory represents emotional eating, which is defined as eating in response to negative emotions.[22] Metabolic and behavioral risk factors are linked with exposure to weight gain resulting in a long-term energy imbalance where energy intake is greater than energy expenditure.[20,23] Therefore, there is interest in the assessment of eating behaviors that impact energy intake. However, the amount of research determining which of the four eating behaviors and their relationship to weight status and/or weight loss is limited.

Based on the noted evidence, there is a need for improving long-term success in meal replacement programs and identifying the variables that affect weight loss and maintenance in a proprietary weight loss program that includes health coaching. This proprietary meal replacement program (MRP) with a health coaching component was designed to help participants lose weight and provide sustainable long-term success. This MRP provides access to a health coach that individually works with their members to help them adopt healthy nutrition, physical activity, and lifestyle practices that support long-term success. The aim of this paper is to evaluate the weight related eating behaviors (WREB) of participants on a proprietary weight loss program.

Variables

1. Dependent Variables
    a. Not achieving clinically significant weight loss-10% of starting weight
    b. Achieving clinically significant weight loss-10% of starting weight
2. Independent Variables
    a. Weight-related eating behaviors

Limitations

1. No ability to assess differences between those who chose to complete the questionnaire and those who did not respond.
2. Self-reported height and weight

Delimitations

1. Limit generalization to meal replacement weight loss programs
2. Only participants who are/were a part of Profile could take the survey

Research Hypothesis

Aim 1: The aim of this study is to evaluate weight-related eating behaviors of participants with clinically significant weight loss in a proprietary weight loss program.

Hypothesis 1: Those with clinically significant weight loss will possess restraint eating behaviors versus those who do not have clinically significant weight loss.

CHAPTER 2: REVIEW OF LITERATURE

A literature review was conducted to better understand weight-related eating behaviors and their relationship with CSWL. Proprietary meal replacement weight loss programs that include health coaching were reviewed. The prevalence of overweight and obesity was also reviewed.

Prevalence of Overweight and Obesity

Three decades ago, obesity was a concern but today it is a public health crisis in the United States. Due to technological advances in the eighteenth century a gradual increase in food supply became accessible, which increased the amount, quality, and variety of food allowing humans to increase their longevity and body size. Humans enhanced economic growth, which resulted in a reduced workload, increased leisure time, and a decrease in physical activity. Today, humans have easy access to a limitless choice of food and delicacies from all over the world with little energy used to acquire them. Obesity first became recognized as a cause of ill health in the middle of the nineteenth century and in the first decades of the twentieth century its morbid complications and increased mortality were recognized.[24] According to the National Health and Nutrition Examination Survey (NHANES), the prevalence of obesity in 2007-2008 was 33.8%, which represents a 100% increase from 1976-1980 and a 50% increase from 1988-1994.[25] Current evidence suggests prevalence is likely to remain on the rise and if trends continue linearly 51% of the adults in the United States will be obese by the year 2030.[25,26]

Goals of Adult Obesity Treatment

One of the biggest challenges in obesity treatment is long-term weight loss maintenance. Helping people lose weight and keep it off continues to be a troublesome issue in public health.[27] Obesity treatment should create changes in lifestyle behaviors that contribute to both sides of energy balance in adults. Therefore, an individual's diet should be transformed so that there is a decrease in excessive energy intake and enhancements in dietary quality.[28] Adults with a BMI of 30 kg/m^2 or greater and those with a BMI of 25 kg/m^2 or higher who have weight-related comorbidities are recommended to receive weight loss treatment.[29] An intentional weight loss of at least five percent has been shown to improve some clinical complications, but in order to preserve health improvements, weight loss needs to be maintained.[28,30] There is no standard definition the length of time of successful weight loss maintenance, but a period of one year is used most often.[28] Behavioral weight loss programs, on average, generate weight losses of 10% of initial body weight over a 30-week period. Although, some individuals are successful at both losing weight and maintaining their weight loss, many individuals on a weight loss program have the tendency to regain weight. Even with the large amount of data on obesity rates and efficacy of clinical trials on weight loss treatments, there is a limited amount of information that exists about the epidemiology of individuals achieving long-term weight loss maintenance.[27]

Proprietary Weight Loss Programs and their Influence on Weight Loss

Given the prevalence of obesity, the harmful consequences on human health, and the lack of effective treatment options, meal replacement diet plans exemplify a viable strategy for controlling weight and positively impacting health outcomes. Nutrient-rich, portion controlled meal replacements are a strategic tool that may assist dieters by

providing a convenient alternative to over-sized, high fat, empty calorie choices.[31] The American Heart Association, the American College of Cardiology, and The Obesity Society issued guidelines for the management of overweight and obesity in adults, which recommend participation in a comprehensive lifestyle program that includes a reduced caloric diet along with exercise and a behavioral change component. The goal of the guidelines are to have overweight and obese individuals achieve CSWL of at least five to ten percent in a six-month period.[32,33] Evidence supports the use of meal replacements as a part of a structured approach to obesity treatment because they have been shown to be a safe and effective tool for limiting calorie intake and promoting weight loss and weight maintenance among overweight and obese individuals.[32,34,35] According to a study by Davis et al., a meal replacement diet plan with a fixed micronutrient composition produced CSWL for 93% of the participants who were obese. The data shows that a meal replacement diet plan is a successful strategy for producing healthy initial weight loss and for achieving improvements among different health parameters.[31] Like meal replacements, health coaching has also been proven to be an effective form of assisting individuals to lose weight.[10]

Health Coaching

It is a challenge to assist and motivate people to choose healthy lifestyle behaviors, but it is an important responsibility for health professionals. Health coaching is a nonclinical health profession that is rapidly growing and offers an accessible, client-centered, well-rounded approach to changing attitudes, behavior, and lifestyle habits of individuals for improved health and well-being. The health coach's relationship is patient-centered so they can build a trusting alliance with their clients, providing them

with education, feedback, and support. This helps patients determine their own goals, discover inner strengths and capabilities, build action plans, and monitor progress. Health coaching is a recommended intervention for helping people achieve behavioral change and improve health.[36,37] The most predominant behavioral change strategy used by health coaches is personal goal setting and goal follow-up. Short term goals and the use of simpler objectives that are reachable, employing small steps adopted gradually, can help increase success rates. Another coaching strategy involves discovering the deeper intrinsic motivations and values that motivate the individual to make the proposed behavior change. The intrinsic reason(s) then becomes the long-term focus for the coaching process.[11] Recent research suggests that involving people in decision-making is encouraging their sense of self-determination, self-responsibility, and ownership, and has positive effects in relations with their motivation, satisfaction, adherence to an intervention, and even health outcomes. The number of patients that pursue more active participation in healthcare decisions is growing, although not all of them to the same degree.[38,39] A review by Olsen et al. suggests that health coaching effectively contributes to improving healthy lifestyle behaviors, with significant results reported in the areas of improved nutrition, increased levels of physical activity, weight management, and medication adherence.[36] The amount of research studies on health coaching is increasing, which indicates there is a growing interest in health coaching interventions.

Behavior Changes

According to the transtheoretical model (TTM) of behavior, a change in behavior requires awareness and knowledge of the relevant problem. The TTM offers an integrative framework for understanding and intervening with human intentional

behavior change.[38,40] The model contains three constructs: the stages of change, the process of change, and the levels of change. The stages signify the dynamic and motivational aspects of the process of change over time. There are five identified stages: precontemplation, contemplation, preparation, action, and maintenance. The precontemplation stage is when an individual believes they do not have a problem or are not willing to change their problematic behavior. In the contemplation stage, the individual is aware a problem exists and is thoroughly considering taking action but has not yet made the commitment. The preparation stage is when the individual is determined to take action soon and often reports some steps in the direction of change. During the action stage the individual is aware a problem exists and modifies their behavior, experiences, and environment in order to overcome the problem. There is clear commitment and a large amount of effort is expended towards making changes. The individual moves into the maintenance stage if they are successful for a sustained period of three to six months. In this stage the individual has made a persistent change and a new pattern of behavior has replaced the old. The processes of change facilitate the movement through the stages of change. These processes were created from many different theories of behavior change and are the heart of the TTM.[40,41] There are ten processes: consciousness raising, self-reevaluation, environmental reevaluation, dramatic relief, social liberation, counterconditioning, stimulus control, reinforcement management, and helping relationship. According to the TTM, these processes are used at particular stages to help individuals continue throughout the stages of change. Along with the stages and processes of change, the TTM acknowledges that changing any one addictive behavior is usually complicated by other problems that restrict or enable the

ability to change. There are five levels of change identified as symptom/situational, maladaptive cognitions, interpersonal conflicts, family/systems problems, and intrapersonal conflicts. The levels of change are the least studied construct of the TTM.[40]

It is rare for an individual to go through the stages of change in a linear style. For example, understanding there is a problem, accepting the need for change, making the decision, and then taking action that would be successfully continued throughout a lifetime. For most health behavior changes movement through the stages is not best represented by a single, successful series of transitions from one stage to the next. Instead most individuals move through the stages in a cyclical pattern rather than a linear style. An individual goes through several cycles of the stages of change before successful behavior change is achieved long-term. There are many different ways to assess an individual's readiness to change. The individual should show some intention toward a specific targeted behavior change and it should be clear what behavior(s) establish successful action so the preaction stages can be distinguished from the action and maintenance stages. The process of intentional human behavior change is complicated and requires continued research to understand the entire process of change.[40]

Factors Influencing Food Intake

Obesity is influenced by a variety of factors which include social and environmental factors, genetic background, lifestyle, and eating behaviors. Understanding why humans eat and the factors that drive their food choices is important. Individuals are influenced by the presence and eating behaviors of others. Depending on the circumstances, the company of others can enable or suppress eating. Individuals often model the intake amount of their eating partners. The modeling of food intake can

occur under circumstances of extreme hunger or fullness. Portion size is another factor that influences the amount of food individuals consume. Many individuals often find it irritating to constantly monitor their food consumption so they rely on consumption norms to help them regulate how much they should consume. Other factors that influence the amount of consumption include how much one buys, package size, variety, and plate size.[42-45] The taste of food also affects food preferences and intake, which directly influences eating behavior, although not all individuals perceive taste in the same way. Food choices are influenced by the differences in taste perception and food preferences, which can have a major impact on nutrient and calorie intake.[46] Overall, eating behaviors are a complex trait that contain both genetic and environmental influences.

Weight Related Eating Behaviors

Understanding the interactions between health and eating would be useful to develop nutritional prevention programs, however, better knowledge of the different eating behaviors and their predominance in the general population would be helpful.[47] The first measure of dietary restraint was developed in 1975, the Restraint Scale (RS), although it was a popular form of measuring dietary restraint, the validity of this instrument was criticized.[18,20] Two other eating behavior instruments were created in the 1980s to improve the validity of the RS, the Three Factor Eating Questionnaire (TEFQ) and the Dutch Eating Behavior Questionnaire (DEBQ).[20,48,49] The TEFQ and DEBQ were used to assess a different aspect of dietary restraint that had negative associations with binge eating and was predictive of reduced energy intake whereas the RS was used to predict non-constricted eating and had a positive association with binge eating.[20,50] There

are two subscales of restraint, rigid control (RC) and flexible control (FC). RC is an all or nothing approach to eating, dieting, and weight control and shows positive correlations with BMI while FC is less routine and shows negative correlations with BMI.[20] There have been few studies that explored the dietary restraint eating behavior and its relationship to obesity and eating disorders.[47] Questionnaires have been developed to measure restraint, which consist of questions about frequency of dieting, attitudes toward eating, and patterns of weight fluctuation.[18,51] Individuals that have high scores on dietary restraint measures are thought to be those whose weights are below the normal range because they strictly monitor and restrict their food intake.[51] Schembre et al. conducted a study to create an improved weight-related eating questionnaire that contained the recent advancements of theory-based eating behaviors using male and female college students. Schembre found that there was a negative association between BMI and compensatory restraint and a positive association between BMI and routine restraint. Positive associations of healthier eating patterns, especially fruit and vegetable consumption, were also found.[20] Dieters with compensatory beliefs believe they have the right to overeat by promising to compensate for the indulgence at a later point in time. Compensatory beliefs are known as the negative effects of engaging in an indulgent behavior, eating high caloric food, that can be counteracted by the positive effects of another behavior, skipping dinner. Compensatory intentions are formed when dieters are confronted with the decision to choose between high caloric foods and low caloric foods.[52] A study by Kronick et al., discovered that it is possible to predict the caloric intake in dieters if they have compensatory beliefs and are developing compensatory intentions.[53] Compensatory

beliefs and intentions stimulate the consumption of high caloric foods in dieters, which elicits diet-breaking behavior.[53]

The role of external stimuli affect the food intake of individuals, which has been previously acknowledged but is not fully understood. External cues have been split into two categories: normative and sensory cues. Normative cues are considered environmental factors of what an individual should eat or how much an individual should eat, such as portion size or social influences.[16,54] Portion size is an indicator of how much an individual should eat based on an appropriate or suitable amount to eat. Therefore, if an individual is looking for advice on how much to eat portion size provides the guidance they need. Substantial hunger and satiety are often overruled by social influences. The presence of others often facilitates eating. According to a study by de Castro, it is not always true that individuals eat more when they are with others because they eat faster instead the rate of food intake remains continuous or may even decrease while the length of the meal increases, therefore, increasing intake.[44] Sensory cues are properties of the food that make an individual more or less likely to eat it, palatability. Palatability does not indicate how much an individual should eat but instead gives them a signal that overrides any of their deliberations, particularly among those who are vulnerable. Sensory cues appeal directly to the five senses and tend to maximize an individual's food intake. Food consumption is increased or decreased based on the palatability of the food, individuals are going to eat more good-tasting food than bad-tasting food.[16]

Although environmental characteristics are important, personal factors also play an important role in determining how individuals respond to the toxic food environment. Emotional eating, a personal factor, has often been associated with overeating.

Emotional eaters are not able to distinguish hunger from the psychological state associated with negative emotions. When experiencing negative emotions individuals react by eating when this would normally result in a loss of appetite.[55] The Emotional Eating Scale, which measures self-reported tendency to eat when being emotional, is used to assess whether an individual qualifies as an emotional eater. Individuals with high self-reported scores not only eat in response to hunger but also when emotional.[55,56] According to a study by Geliebter et al., overweight individuals report eating more when experiencing negative emotions than normal weight and underweight individuals. The same study also found that underweight individuals reported eating more when experiencing positive emotions than normal weight and overweight individuals.[57] Although more research is need to understand the weight-related eating behaviors they could be a valuable instrument to further our understanding of how to develop a successful weight loss program.

CHAPTER 3: MANUSCRIPT

Introduction

Obesity is a predominant disease that is progressive and continuously relapsing.[1] Regaining weight after weight loss is a common problem for anyone overweight or obese who has recently lost weight.[2] After one year nearly half of the lost weight is regained and most dieters acquire their first weight within three to five years.[3] Many Americans look for guidance on appropriate weight loss strategies. A variety of weight loss methods are used ranging from self-help attempts at dieting or physical activity, professional counseling, pharmacological interventions, and surgical interventions.[4] Furthermore, to assist in weight loss many adults use commercial or proprietary weight loss programs.

Safe and effective commercial and proprietary weight loss programs are needed. Poor food choices, large portion sizes, eating frequently, and over consuming high fat and energy foods contribute to diet failure.[5-7] Changing long-term eating habits can be difficult and should possibly be added to developing solutions for weight control.[8] A weight loss approach that has shown potential is a partial meal replacement program, which involves following a low-energy diet while replacing one to two main meals with meal replacements each day.[1] Therefore, meal replacements may be a helpful way to assist men and women who are not able to change their eating habits enough to maintain a lower weight. Rohrer et al. discovered that body weight was reduced by 15-25% in partial meal replacement programs.[9] Partial meal replacement programs often tend to be more successful when there is a health coach available to the participants.[1]

Using health coaches to improve weight, nutrition, physical activity, and smoking behavior among individuals at risk is somewhat new and experimental in the health

promotion field.[10,11] New weight loss programs have added a health coaching component to encourage and guide the participants in the direction of a healthy lifestyle. The purpose of a health coach is to help the participant reassess his or her own readiness to make lifestyle changes.[10] The coach is there to support the participants plan of action, encourage their success, and help them re-group after a relapse or setback.[10] Integrating health coaching into primary care practice has shown to be effective in corporate wellness and weight loss programs. A study by Merrill et al., concluded that a coach helps to persistently re-asses an individual's willingness to make a lifestyle change.[10,12] Mental status, social functioning, and mood in adult men and women has shown positive improvement due to nutrition wellness coaching.[13] Health education has been shown to benefit an individual's eating behaviors.[14]

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Based on the noted evidence, there is a need for improving long-term success in meal replacement programs and identifying the variables that affect weight loss and maintenance in a proprietary weight loss program that includes health coaching. This proprietary meal replacement program (MRP) with a health coaching component was designed to help participants lose weight and provide sustainable long-term success. This MRP provides access to a health coach that individually works with their members to help them adopt healthy nutrition, physical activity, and lifestyle practices that support long-term success. The aim of this paper is to evaluate the weight related eating behaviors (WREB) of participants on a proprietary weight loss program.

Methods

Sample

Data from participants enrolled in a proprietary MRP with a health coaching component were used for this cross-sectional study. Twenty thousand individuals currently or previously enrolled were emailed and invited to complete an electronic

questionnaire. Questionnaires were completed by 1,482 participants (n=1,454 Caucasian, n=28 non-while). The study was approved by the Institutional Human Subjects Review Board at South Dakota State University.

Data Collection

Participants were queried for demographics and WREB using the weight-related eating questionnaire, which included a total of sixteen questions. The weight-related eating questionnaire queried four constructs: routine restraint (three questions), compensatory restraint (three questions), susceptibility to external cues (five questions), and emotional eating (five questions). The questions were Likert scale questions with response options as not at all, slightly, more or less, pretty well, and completely. The questions in each eating behavior category were scored 1(not at all) to 5(completely). The scores were calculated as the average of the sum of each WREB category.[20] A lower score indicates an individual is less likely to possess the respective eating behavior.

Data Analysis

Participants were dichotomized into those who achieved clinically significant weight-loss (CSWL) (n=973) and those who did not (nonCSWL) (n=481). CSWL was defined as losing at least 10% of one's body weight, when comparing current weight to program start weight.[28,30] Comparisons in demographics between weight loss categories were evaluated using chi-square analysis. A logistic regression was used to assess the relationship of CSWL and WREB. Variables associated with the outcome but with sample sizes too small to allow for comparison among groups were excluded (n=28). Age and sex were controlled in the regression analysis as differences in weight-related eating questionnaire scores due to sex (two sample t-test) and age (linear regression) were

detected. Statistical significance was set at $p \leq 0.05$. Data was analyzed using Stata/SE 14.

Results

Demographics are presented in Table 1. There were no differences in age, education, income, and employment status between CSWL categories. Average age for individuals in the CSWL group was 47.0±12.1 and nonCSWL was 48±12.6. Participants in both groups were predominantly female, married, and college graduates, which includes bachelor's degree, master's degree, professional school degree, and doctoral degree. Approximately one-third of participants in both groups earned a household income of less than $30,000 per year and one-third had income range from $30,000-$79,000. Greater than 80% of participants in both groups were employed.

WREB scores of routine restraint, compensatory restraint, susceptibility to external cues, and emotional eating scores by weight loss groups are reported in Table 2. Individuals with routine restraint and compensatory restraint behaviors, respectively, were 1.26 (CI 1.10, 1.44) and 1.13 (CI 1.01, 1.27) times more likely to achieve CSWL than those who did not. Individuals with higher scores in susceptibility to external cues and emotional eating behaviors, respectively, are 0.74 (CI 0.66, 0.83) and 0.79 (CI 0.72, 0.87) times less likely to achieve CSWL (Table 2).

Discussion

The primary objective of this study was to evaluate the weight-related eating behaviors of participants on a proprietary weight loss program. The weight-related eating behaviors assessed in the current study were routine restraint, compensatory restraint, susceptibility to external cues, and emotional eating. The results indicate that participants

with routine restraint and compensatory restraint eating behaviors are more likely to lose weight while on a meal replacement program versus those with susceptibility to external cues and emotional eating behaviors.

Individuals engage in the behavior of eating, every day for survival. Therefore, the choices of what to eat, when to eat, and how much to eat can be difficult for an individual that is monitoring their calorie intake to lose weight. Individuals that consume meal replacement products are concerned about their weight and likely follow self-imposed dietary rules to control their weight.[58] Integrating one to two meal replacements per day has been shown to be an effective way of treating overweight and obese patients. Meal replacements help limit the complication of food choices by eliminating the decisions about portion size and calorie content; therefore, meal replacements have the potential to require less thinking and self-control.

WREB of routine restraint, compensatory restraint, susceptibility to external cues, and emotional eating have been reported to influence weight. A study by Snoek et al.[59] concluded that there was a positive relationship between dietary restraint and being overweight. Snoek suggests that, skipping meals can cause irregular eating patterns, which tends to cause binge eating that can lead to weight gain. An article by van Strien et al.[60] discusses how dietary restraint is often associated with the tendency to overeat, as in emotional eating or external eating. van Strien posits that dietary restraint does not allow the body to differentiate between true food shortage and voluntary food restriction causing the body to act like it is in starvation mode, thus, an individual's feelings of hunger increase.

Kronick et al.[53] conducted a study that examined 67 individuals who were currently on a diet to lose weight. The study reported that individuals with compensatory beliefs and compensatory intentions were more likely to have a higher caloric intake. Therefore, individuals with compensatory beliefs and compensatory intentions were more likely to provoke diet-breaking behavior. Kronick posits that a dieter's caloric intake is suggested to be largely influenced by the compensatory thinking that one can indulge now because they will make up for it later. Thus, having compensatory beliefs and compensatory intentions offer individuals who diet the luxury of releasing the restraint followed by the promise of restraint, which helps when diet-breaking behavior is broken.

External stimuli plays a role in the food intake of individuals. A study by Schachter[61] reported that obese individual's food intake is not affected by their internal, visceral state but is determined by external cues such as sight, smell, and taste. The sight, smell, and taste of food could affect anyone's eating behavior, however, in normal weight individual's external cues work together with the internal state. The susceptibility to external cues may affect what, how much, and where a normal weight individual eats but primarily when they are hungry. Schachter posits that in obese individuals, the internal state is irrelevant and their food intake is predominantly determined by external cues. An obese individual is more likely to eat a larger amount of food than a normal weight individual when external cues are present.[61]

There is limited evidence on the eating behavior of emotional eating and weight status; however, past research shows an association with emotional eating and overeating. Masheb et al.[62] conducted a study on a sample of 220 overweight adults with binge eating disorder who were pursuing treatment. The participants completed an Emotional

Overeating Questionnaire which assessed the overeating frequency of anxiety, sadness, loneliness, tiredness, anger, and happiness. This study reported that individuals were more likely to overeat when experiencing emotions of anxiety and less likely to overeat when experiencing emotions of happiness. Masheb posits that emotional overeating is associated with the occurrence of episodes of binge eating.

Research regarding meal replacements and their association with WREB is limited. Hartmann et al.[58] conducted a study on a sample of 221 women addressing the eating behaviors and nutrition knowledge of individuals who consume meal replacements. The study reported that individuals with restrained eating behaviors were more likely to consume meal replacement products. The current study reported that those with CSWL possessed the WREB of routine restraint and compensatory restraint. These results may indicate that routine restraint and compensatory restraint eaters select meal replacement products as an easy alternative for meals. This may also imply that meal replacements contribute to the adherence of a proprietary weight loss program when an individual possesses the diet breaking eating behavior of compensatory restraint.

Susceptibility to external cues and emotional eating have been found to complicate the relationship between dietary restraint, food intake, and changes in body weight. This supports the results to the current study, which found that those who engage in the eating behaviors of susceptibility to external cues and emotional eating are less likely to achieve CSWL on a proprietary weight loss program. In the study by Hartmann et al., it was concluded that individuals who engage in the eating behavior of susceptibility to external cues are less likely to consume meal replacement products. Although adherence to the meal replacement program for the current study was not

measured, this may imply that those with the eating behavior of susceptibility to external cues are less likely to adhere to a meal replacement program. Therefore, understanding the eating behavior that supports weight loss enriches the knowledge of the health coach to aid in an individual's weight loss while on a proprietary weight loss program.

A strength of this study is that all eligible individuals were invited to participate. A limitation is that results were from those who completed the questionnaire. Therefore, there was no ability to assess differences between those who chose to complete the questionnaire and those who did not respond. Another limitation is that height and weight were self-reported. However, as a component of the proprietary weight loss program health coaches encourage self-monitoring of weight.

Conclusion

The objective of this study was to determine the association between WREB and CSWL in participants on a proprietary weight loss program. In this study, the eating behaviors of routine restraint and compensatory restraint had higher odds of achieving CSWL, while individuals with higher scores for susceptibility to external cues and emotional eating had lower odds of achieving CSWL. This knowledge on the type of eating behavior that supports weight loss may be used to enhance the health coach's ability to assist in weight loss in proprietary weight loss programs.

THESIS TABLES

Table 1: Participant baseline demographics

Demographics[a]	Clinically Significant Weight Loss (CSWL) (n=973)	Those without Clinically Significant Weight Loss (nonCSWL) (n=481)
Age (mean±SD)	47.0±12.1	48.0±12.6
Sex[b] (n, %)		
• Female	803 (84%)	346 (89%)
• Male	148 (16%)	42 (11%)
Education[c] (n, %)		
• High School or less	97 (10%)	33 (7%)
• Some College	347 (36%)	184 (38%)
• College Graduate	527 (54%)	262 (55%)
Marital Status[d] (n, %)		
• Married	764 (79%)	387 (81%)
• Single	207 (21%)	92 (19%)
Household Income (n, %)		
• <$30,000	346 (36%)	175 (37%)
• $30,000-79,999	315 (33%)	151 (32%)
• $80,000-119,000	54 (6%)	29 (6%)
• ≥$120,000	237 (25%)	112 (24%)
Employed (n, %)	847 (87%)	418 (88%)

a. Variations from total due to missing data.
b. Significant differences in weight loss categories due to gender. $x^2=5.08$ $P\leq0.024$ There were no differences in age, education, income, and employment status between weight loss categories.
c. College graduate includes: Bachelor's Degree, Master's Degree, Professional School Degree, and Doctoral Degree.
d. Non-married includes: Never Married, Widowed, Divorced, and Separated.

Table 2: The weight-related eating behavior scores and their association to clinically significant weight loss.

WREQ Scores of those with clinically significant weight loss	**Odds Ratio**	**95% Confidence Interval**	**Clinically Significant Weight Loss (CSWL) (n=973) (mean±SD)**	**Those without Clinically Significant Weight Loss (nonCSWL) (n=481) (mean±SD)**
Routine Restraint	1.26	(1.10, 1.44)	2.5±0.8	2.3±0.8
Compensatory Restraint	1.13	(1.01, 1.27)	2.9±1.0	2.7±1.0
Susceptibility to External Cues	0.74	(0.66, 0.83)	2.7±1.0	3.0±1.0
Emotional Eating	0.79	(0.72, 0.87)	2.5±1.1	2.9±1.2
* Higher scores indicate greater frequency of measured behavior. ** Significance was set at $p \leq 0.05$.				

THESIS APPENDIX

Appendix A: Weight-Related Eating Questionnaire

1. I purposefully hold back at meals in order not to gain weight.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

2. I tend to eat more when I am anxious, worried, or tense.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

3. I count calories as a conscious means of controlling my weight.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

4. When I feel lonely I console myself by eating.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

5. I tend to eat more food than usual when I have more available places that serve or sell food.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

6. I tend to eat when I am disappointed or feel let down.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

7. I often refuse foods or drinks offered because I am concerned about my weight.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

8. If I see others eating, I have a strong desire to eat too.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

9. Some foods taste so good I eat more even when I am no longer hungry.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

10. When I have eaten too much during the day, I will often eat less than usual the following day.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

11. I often eat so quickly I don't notice I'm full until I've eaten too much.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

12. If I eat more than usual during a meal, I try to make up for it at another meal.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

13. When I'm offered delicious food, it's hard to resist eating it even if I've just eaten.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

14. I eat more when I'm having relationship problems.
    - Not at all
    - More or less
    - Pretty well
    - Completely

15. When I'm under a lot of stress, I eat more than I usually do.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

16. When I know I'll be eating a big meal during the day, I try to make up for it by eating less before or after that.
    - Not at all
    - Slightly
    - More or less
    - Pretty well
    - Completely

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