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COMPARING MINDFULNESS-ENRICHED WEIGHT MANAGEMENT TO CURRENT STANDARD PRACTICES

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COMPARING MINDFULNESS-ENRICHED WEIGHT MANAGEMENT TO
CURRENT STANDARD PRACTICES

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture, Food and Environment at the University of Kentucky

By

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ABSTRACT OF THESIS

COMPARING MINDFULNESS-ENRICHED WEIGHT MANAGEMENT TO CURRENT STANDARD PRACTICES

Mindfulness-based interventions have been shown to be effective for numerous diet-related conditions. Mindfulness skills have been theorized to be helpful in improving eating behaviors, and thereby weight management. The purpose of this study was to compare the effectiveness of a mindfulness-enriched weight management program to a standard weight loss program over the course of a 12-week intervention, and weight maintenance over six months. This was a two-group randomized experimental design. One group received a standard weight loss program, while the other group received the same program with an additional mindfulness component. Follow up assessments were conducted twice at three-month intervals.

Fifty-three adults with a BMI between 28 and 45 kg/m² enrolled. Both programs produced significant weight loss. However, the two groups were not significantly different at twelve weeks. Mindful eating scores and weight loss were significantly correlated in the mindful group ($R=-0.358$, $p=0.044$), but not the standard group ($R=0.735$, $p=0.060$). A change in mindful eating was correlated with weight loss in women ($R=0.444$, $p=0.008$), but not men ($R=-0.833$, $p=0.167$) in the entire sample. The differences in weight maintenance between the two groups were not significantly different at the two follow-up assessments. Additional exploration of mindfulness and weight control is needed.

KEYWORDS: Obesity, mindfulness, mindful eating, weight loss, weight maintenance

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April 6, 2017

COMPARING MINDFULNESS-ENRICHED WEIGHT MANAGEMENT TO
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Chapter One: Introduction

More than two-thirds of adults in the United States (U.S.) are overweight or obese, and obesity is related to numerous health conditions including hypertension, dyslipidemia, type 2 diabetes, osteoarthritis, sleep apnea, and some cancers (Apovian, 2013). Modest levels of weight loss (5-10% of initial body weight) can reverse many of these related health conditions, and many treatment options for achieving weight loss are available (Johnston et al 2014). Typical approaches to weight loss have been programs focused on modifying diet and exercise with a caloric prescription and self-monitoring of weight-related behaviors (Dombrowski et al, 2014).

However, despite numerous options for weight management, obesity remains a serious problem, and people who lose weight have difficulty keeping it off, often returning to or exceeding their initial weight within three to five years (O'Reilly et al, 2014). Because maintaining weight loss is necessary to reap the health benefits, better solutions to helping people maintain weight loss over time are crucial.

Comprehensive approaches to weight loss that incorporate behavioral components are needed to address barriers to long-term weight loss maintenance. Investigating the practice of mindfulness as a behavioral tool to enrich weight loss programs and promote weight loss maintenance is an emerging field of current research (Olson & Emery, 2015). Mindfulness is defined as a state of non-judgmental awareness and acceptance of the present moment (Katterman, Kleinman, Hood, Nackers, Corsica, 2014). Mindfulness-based interventions have been shown to be highly effective in other areas of human health, including stress, depression, substance abuse, and eating disorders (Caldwell, Baime, Wolever, 2012).

Problem

Over the past five decades, the prevalence of obesity among adults has increased in the U.S. from 13.4% to 35.7% (Ogden, Carroll, Kit, Flegal, 2014). The health issues related to obesity result in medical costs of more than \$147 billion per year in the U.S alone (Finkelstein, Trogon, Cohen, Dietz, 2009). The costs of obesity are not only in term of dollars; those with the diagnosis exhibit poorer quality of life, and are more likely to struggle with depression (Apovian, 2013). Long-term weight loss maintenance continues to be unachievable for many people who desire it; evidence-based information on how to maintain weight loss is critically needed.

The practice of mindfulness has been applied to many comprehensive interventions for various types of health conditions. Mindfulness is defined as being consciously aware of one's present surroundings, experiences, thoughts, and feelings with an objective perspective (O'Reilly, Cook, Spruijt-Metz, Black, 2014). The skills that mindfulness practice can strengthen are theorized to be helpful in eating behaviors.

Purpose

The primary objective of this study was to assess the effectiveness of a mindfulness-enriched weight management program on weight loss maintenance over time. This was accomplished by comparing the mindfulness-enriched program to a standard behavioral weight loss program over twelve weeks of intervention and six additional months of follow-up. One group received a standard weight loss program based on the National Diabetes Prevention Program (Albright & Gregg, 2013) and the

2013 Guidelines for the Management of Overweight and Obesity published by the American Heart Association, American College of Cardiologists, and The Obesity Society (Jensen et al., 2013). The other group received the same intervention enriched with mindfulness practice content from Duke Integrative Medicine's *Mindful Diet* book (Wolever & Reardon, 2015). The primary outcomes assessed were changes in weight, body mass index (BMI), body fat percentage, waist circumference, and blood pressure. Secondary outcomes assessed included changes in perceived stress, physical activity, diet, mindful eating, and mindfulness.

Research Questions

1. What is the difference in weight loss at twelve weeks between the standard group and the mindful eating group?
2. What is the difference in weight loss maintenance at six months and nine months between the standard group and the mindful eating group?
3. What is the difference in secondary outcome measures at three, six, and nine months between the standard group and the mindful eating group?

Research Hypotheses

1. Over the course of a twelve-week weight loss intervention, adults randomized to receive the mindful eating intervention will lose more weight than adults randomized to receive the standard intervention.
2. The mindful eating group will maintain their weight loss significantly better than the standard group at six- and nine-month follow-up evaluations.
3. The mindful eating group will demonstrate significantly better improvements than the standard group in secondary outcome measures such as mindful eating scale scores, physical activity, perceived stress, and general mindfulness between baseline and post intervention assessments.

Justification

Obesity is unquestionably a significant global health threat and one of the greatest causes of preventable morbidity and mortality (Dombrowski et al, 2014). It is encouraging, however, that weight loss can reduce these related risks, health care spending, and can improve psychological elements like depression and quality of life (Apovian, 2013).

Utilizing mindfulness within weight management programs offers promise for a future approach to teach people long-term, sustainable changes that can foster weight loss and permanent health behavior change. Because this area of research is relatively new as compared to other behavioral strategies, more rigorous, high quality studies are needed to provide further support.

The contribution of this research is a determination of the impact of a mindfulness-enriched program on weight loss and weight loss maintenance over time as compared to current recommendations for the management of overweight and obesity. This research contributes new insights regarding strategies for treating obesity.

Chapter 2: Literature Review

Introduction

Because obesity is currently one of the most significant worldwide health threats, a vast body of research regarding its prevalence, prevention, and treatment exists (Apovian, 2013). Several principles have been generally accepted as effective for inducing weight loss – including behavioral, pharmacological, and surgical treatments. However, with behavioral interventions, long-term weight loss success has been found to be poor, and standardized practices for maintaining weight loss have not yet been established (Stevens et al., 2006). Overall, the evidence base lacks consensus on best practices to provide sustainable weight loss for people with obesity. More research investigating weight loss programs that address barriers to maintaining weight loss is needed.

Using mindfulness as a means to enrich weight loss programs is an emerging field of current research, but the body of evidence is still limited (Dombrowski et al, 2014). The purpose of this literature review is to examine currently published evidence related to mindfulness, weight loss, and weight loss maintenance in an effort to navigate a promising path towards creating sustainable weight loss to combat the obesity epidemic.

Obesity

More than one-third of adults in the United States (U.S.) are obese, according to the 2011-2012 National Health and Nutrition Examination Survey (NHANES) (Ogden, Carroll, Kit, & Flegal, 2014). Obesity status is defined as a body mass index (BMI) of 30 kg/m² or greater (Apovian, 2013). The causes of obesity are numerous and vary from

person to person. Weight can be a result of a combination of factors including behavioral choices (diet and physical activity), genetics, hormones, and metabolism, among other factors (Ng et al., 2014).

A systematic review published in the *Lancet* estimated the global, regional, and national prevalence of overweight and obesity in children and adults from 1980 – 2013 by identifying 1769 published studies, and found that the proportion of adults with a body mass index (BMI) of 25 kg/m² or greater increased by 27.5% for adults and 47.1% for children worldwide (Ng et al., 2014). According to the authors, changes in diet, physical activity, and gut microbiome are to blame for the significant increases in obesity over the past three decades. Although rates of obesity have slowed in some parts of the developed world, the rates are predicted to continue to increase in many countries in the developing world. The authors do point out, however, that the limitations of the review include some self-reported BMI's, some systematic bias, some regions that are not generalizable to national figures, and sparse data from earlier years in the 1980's.

The increased prevalence of obesity is a public health concern (Apovian, 2013). Evidence has established a clear relationship between obesity status and related comorbidities, including cardiovascular disease risk factors including hypertension and dyslipidemia, as well as type 2 diabetes, osteoarthritis, sleep apnea, and some cancers. Due to this relationship, obesity bestows a significant economic burden on society. Some estimates have placed expenses of people with obesity as more than 41% higher than people at a normal weight (Apovian, 2013). In terms of 2008 dollars, the estimated total U.S. expenditures in one year were over \$200 billion, or one-fifth of all medical costs. Another important economic issue related to obesity examined in the article was that of

employer costs. Research has found that employees with obesity incur greater costs than their lower-weight coworkers because of lower productivity, absenteeism, and medical expenditures covered by the employer. Lastly, a less tangible burden of obesity exists – poorer quality of life for those affected. Two large studies showed significant increases in risk of performing poorly in basic activities of daily living and related psychological elements. Because obesity exerts such a heavy burden on so many people and is now the fifth-most common cause of death globally, interventions to treat obesity using a variety of approaches are studied.

Weight Loss

Although obesity can seem like an insurmountable obstacle to our society at times, weight reduction can positively impact many of the negative effects—even a 5% reduction of total body weight can reverse or reduce obesity-related health problems (Apovian, 2013). Countless options are available to people who are seeking weight loss – examples include commercial businesses, online programs, books, and mail order services, just to name a few. Collectively, these options make up a multi-billion-dollar business in the United States alone (Johnston et al., 2014). Most weight loss strategies focus on reduction of calorie intake and increasing physical activity.

A historical review examining various approaches and related effectiveness of diet and exercise in obesity was published in *Medicine and Science in Sports and Exercise* in 1999 (Miller). The primary objective was to determine the best future approach for treating obesity. Since attempts at weight control have become a major public concern, different types of diets have gained and lost popularity, and to highlight

this, the author reviewed commonly-utilized approaches over the past few decades. A thorough review of popular methods of weight loss described diet composition, time frame, average amount of weight lost, and any related side effects or safety hazards. In the early days of weight loss during the 1950's and 1960's, total fasting was commonly used for obesity. This was effective at producing significant weight loss, but it also could result in serious health complications such as loss of lean body mass and electrolyte imbalance.

After this approach lost popularity, low-carbohydrate/high-protein diets fell into favor through the 1960's and 1970's. Again, this approach provided desirable results, but weight regain was often significant when the diet was discontinued (Miller, 1999). Later in the same decade, medically-supervised very low-calorie liquid diets programs became available. The daily calorie allowance usually totaled 300 – 400 calories, and even with medical supervision, numerous deaths were reported. More moderate liquid diet programs were then introduced, such as Optifast and Health Management Resources, both of which are still commonly utilized by dieters today (Miller, 1999).

Commercial pre-packaged foods for weight loss appeared on the market soon after in the 1980's, and have also continued to be a common strategy for weight loss. Fat restriction also became a prominent method of weight control in the 1980's with the popularity of the Ornish diet and the proliferation of low-fat and fat-free food products on the market. As the new millennium came and went, more fads and research brought even more theories and gimmicks on weight loss. Even though new offerings for weight management continue to appear on a seemingly daily basis, the obesity epidemic remains a serious problem, and the authors conclude that because no diets have been effective at

long-term weight loss, shifting the paradigm to look for a new alternatives other than extreme diets are needed (Miller, 1999).

Another approach to finding the most effective eating pattern for achieving weight loss is by comparing the composition of various diets to see if there are measurable differences in weight loss. Johnston et al. (2014) conducted a meta-analysis to compare weight loss outcomes for popular diets based on different macronutrient compositions by extracting data from 59 eligible studies. Selection criteria for the studies included participants who were overweight or obese (BMI greater than or equal to 25 kg/m²) randomized to a popular self-administered named diet and reporting weight or BMI data at 3-month follow up or longer. They found that the largest weight loss was associated with low-carbohydrate and low-fat diets, an estimated average 18 pounds at 6 months compared with no diet. However, on average 2 – 4 pounds were regained by the 12-month follow-up. More specifically, the authors found that weight loss differences between named or branded diets were minimal. They concluded that their findings support recommending any diet that a person will adhere to over time. The primary limitations provided by the study authors included heterogeneity between studies, some trials at high risk of bias due to missing participant outcome data, and analyses based on original prescribed diet, not actual diet consumed by study participants (Johnston et al., 2014).

Considering the wide breadth of available weight loss strategies available to the public, both credible and questionable, there is consensus on some standard approaches to induce weight loss. Two recent publications from prominent authorities on the subject have outlined general guidelines for health professionals counseling people who desire

weight loss. The 2013 American Heart Association (AHA), American College of Cardiologists (ACC), and The Obesity Society (TOS) Guidelines for the Management of Overweight and Obesity in Adults (Jensen et al. 2014) provides treatment standards for primary care providers, while the Position of the Academy of Nutrition and Dietetics: Interventions for the Treatment of Overweight and Obesity in Adults is geared toward practicing Registered Dietitian Nutritionists (AND, 2016). Together, a summary of broadly accepted principles for weight loss includes the following:

- A collaborative, realistic weight loss goal should be established – up to two pounds per week, up to 10% of baseline body weight, or a total of 3 – 5% of baseline weight;
- Treatment should produce changes in lifestyle behaviors including self-monitoring, structured meal plans, meal replacements, portion control, goal setting, and problem solving. Motivation, readiness and self-efficacy should be considered throughout lifestyle change interventions;
- Accurate assessments for height, weight, BMI, waist circumference, and caloric needs should be collected at least annually;
- Diet should be altered to reduce excessive energy intake (1200 – 1500 kcal/day for women and 1500 – 1800 kcal/day for men) and enhance diet quality to maintain nutrient adequacy and meet 2010 Dietary Guidelines for Americans;
- Dietary intervention prescription should be evidence-based and reflect patient preferences – many different approaches are effective as long as target reduction in calorie level is achieved;

- Meal patterns should be individualized to distribute calories at meals and snacks evenly throughout the day;
- Treatment should encourage increases in physical activity to meet 2008 Physical Activity Guidelines for Americans of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week;
- Treatment should allow frequent contact with health care professional – at least 14 encounters over 6 months or monthly encounters over 1 year (AND, 2016 & Jensen et al. 2014).

Weight Loss Maintenance

Compared to the expansive body of work dedicated to weight loss initiation, the amount of research examining strategies to maintain weight loss over time is much smaller. In 2006, a review in *The International Journal of Obesity* examined published expert opinions and definitions of weight maintenance for adults used in 35 studies because there is not a definite consensus on the definition of weight maintenance (Stevens, Truesdale, McClain, Cai). The authors posited that issues to consider when trying to develop such a consensus include “expert opinion, precedents set in previous studies, public health and clinical applications, comparability across body sizes, measurement error, normal weight fluctuations, and biologic relevance,” and that such a standardized recommendation would have to account for these considerations (Stevens et al., 2006).

To achieve such a standardized recommendation, the authors reviewed definitions presented by expert committees such as the National Heart, Lung and Blood Institute and

the Institute of Medicine (Stevens, Truesdale, McClain, Cai, 2006). The authors also identified 35 studies between 1999 and 2004 that defined weight maintenance to assess previously-set precedents. Next, they considered the best definition language options for public health and clinical applications by reviewing published research for terms used. Some settings utilize percent change in weight, while others use BMI, and still others simplify even further for public messaging by simply using change in pounds/kilograms. Along this same vein, another important component examined by the authors was differences in body size. Researchers pointed out that defining maintenance in terms of absolute measures ignores baseline variability (Stevens, Truesdale, McClain, Cai, 2006). For example, a ten-pound weight change would have varying amounts of significance depending on an individual's total weight. The authors then described measurement error and fluid balance, and reviewed studies that examined these factors in regards to body weight. They concluded that a weight maintenance definition must be greater than the changes expected with fluid fluctuations and basic measurement error. Lastly, the authors discussed biological relevance to explain the importance of considering what amount of weight gain or loss will show changes in obesity-related health effects (Stevens, Truesdale, McClain, Cai, 2006).

With all of these considerations in mind, the authors recommend that weight maintenance be defined as a weight change of less than 3%. As an example, a person that typically weighs 200 pounds is within weight maintenance if their weight remains within 6 pounds above or below 200 (6 is 3% of 200) or between 194 – 206 pounds. More specifically, the authors additionally determined that it is also important to further distinguish weight changes between 3 – 5% as 'small weight fluctuations' and changes

greater than 5% ‘possibly clinically relevant,’ because significant health changes can occur with weight changes of more than 5% of body weight (Stevens et al., 2006). It is evident that a formal consensus has not yet been reached and is an important first step to helping develop strategies to improve weight maintenance for those who have lost weight.

After clearly defining weight maintenance, practices associated with weight maintenance must be examined. Identifying these practices informs future program approaches and also distinguishes if these practices are similar to or differ from those associated with inducing weight loss. A 2011 cross-sectional survey of a random sample of 1165 U.S. adults addressed this gap in the evidence to examine whether practices associated with successful weight loss differ from practices associated with weight loss maintenance (Sciamanna et al.). Thirty-six different weight-control practices were assessed and only 8 were found to be associated with both weight loss and maintenance. In the end, the authors concluded that results from the survey indicated that successful weight loss and weight loss maintenance may require two different sets of practices, and that interventions designed with this principle in mind may be more effective. The authors reported several limitations, including the cross sectional design, the survey was novel and not yet validated, and the dietary intake and weights were self-reported (Sciamanna et al., 2011).

As stated previously, the evidence base for supporting maintenance of weight loss is minimal compared with that of weight loss initiation, and further investigation to determine the most effective methods is necessary to make a lasting impact on the public health problem of obesity. Few people who successfully lose weight are able to keep the

weight off long term – in general, weight loss success peaks 6 months after initiation, and is unfortunately followed by a gradual regain of weight in most people (Dombrowski et al., 2014). Interventions that are specifically designed to foster weight maintenance have been designed to combat this issue. A 2014 systematic review published in the *British Medical Journal* analyzed currently available approaches to actively supporting maintenance of weight loss in obese adults and assessed the effectiveness of these interventions (Dombrowski et al.). The authors accomplished this by identifying 45 randomized trials of interventions to maintain weight loss of at least 5% with long-term follow-up of at least 12 months.

Overall, they found that lifestyle interventions targeting both diet and exercise are effective in reducing weight regain within 12 months of initial weight loss. The evidence for sustaining weight loss to 24 months or beyond is weaker, however. The principle limitation of the review provided by the authors was the limited application of conclusions to specific localities where studies took place and lack of global generalizability.

Active interventions aimed at maintaining weight loss, however, have their own limitations. They cost time and money to facilitate, and require continued commitment of the intervention participants. A more ideal solution for time and cost effectiveness for providers and participants would be to integrate weight maintenance skills into weight loss interventions. To accomplish this, factors that influence weight maintenance or regain must be identified.

Ohsiek and Williams (2011) carried out a systematic review of 25 studies published between 2003 and 2009 that assessed psychological factors associated with

weight loss maintenance and relapse. The authors found that factors most frequently cited included: unrealistic weight loss expectations, failure to achieve weight loss goals, dichotomous thinking style, eating to regulate mood, disinhibition versus dietary restraint, perceived cost versus benefit, depression, and body image. The concept of unrealistic weight loss expectations yielded different findings within their review – at times it improved weight maintenance, and at other times it promoted weight regain. These discrepancies necessitate further investigation into this principle. With regard to the factor ‘failure to achieve weight loss goals,’ the review found that those people who were able to meet their goals were more likely to maintain their weight loss than those who were not able to achieve their goals. The third factor, dichotomous thinking style related to food and weight, was found to be significantly higher in people who had regained weight than people who had maintained. Eating to regulate mood was another practice found to increase likelihood of weight regain overtime.

The authors next assessed level of eating restraint, and indicated that their results support the assertion that people with the ability to maintain restraint over eating are better able to maintain weight loss over time. They also pointed out that disinhibited attitudes towards eating in response to internal cues like feelings directly increase risk of weight regain. Another valuable factor identified by the review authors was a person’s perceived weight loss costs versus benefits; they found that lack of sustained rewards and perceived high costs increase weight regain. The last two factors recognized by the authors were depression and body image. Overall, they found that higher levels of depression and more negative feelings about one’s body were associated with weight regain. They concluded by emphasizing that it is usually not one single factor that leads

to weight regain after weight loss, but rather a combination, and that comprehensive interventions are crucial to prevent weight regain in people who desire long term weight loss. Limitations that were pointed out were the homogeneity of subjects in the studies examined, lack of a standard definition for weight loss maintenance, and small sample sizes used in many of the studies reviewed (Ohsiek, Williams, 2011).

Mindfulness & Eating Behaviors

The practice of mindfulness is a behavioral element being integrated into many different types of comprehensive and sustainable interventions. Mindfulness is defined as being consciously aware of one's present surroundings, experiences, thoughts, and feelings with an objective perspective. Practitioners of mindfulness assert that this awareness can be manifested over time by special training that involves meditation and specific exercises (O'Reilly, Cook, Spruijt-Metz, Black, 2014). There are many mindfulness-based programs that have been developed for use in other realms, including stress, depression, other psychiatric disorders, chronic pain, cancer, speech pathologies, substance abuse, and eating disorders (O'Reilly et al., 2014).

The skills that mindfulness practice are known to strengthen have been theorized to be helpful in eating behaviors. Changes in the U.S. food culture over the past 40 years have led to eating behaviors based on cues other than hunger, such as environment, visibility, packaging, and marketing (Jordan, Wang, Donatoni, Meier, 2014). This is thought to contribute to "mind-less" eating and overconsumption, which leads to weight gain and obesity. Mindfulness is a promising strategy to bring to focus and awareness back to experience food in a different way that will help reduce overeating and aid in

making healthier food choices (Jordan et al, 2014). A series of four studies published together by Jordan, Wang, Donatoni, and Meir (2014), found a positive relationship between mindfulness and healthier eating, and a negative relationship between mindfulness and impulsive eating as well as calorie consumption. However, the authors did not describe any limitations to their studies, and it is evident to the reader that the findings are not generalizable because the samples of all four studies were mostly Caucasian, female college students.

The degree of influence that mindfulness-based interventions may have on certain eating behaviors associated with overweight and weight regain after weight loss has been investigated. Specifically, Alberts and Raes assessed changes in food cravings, dichotomous thinking, body image concern, emotional eating, and external eating after an eight-week mindfulness-based intervention (2012). At the end of the study, individuals reported significantly lower levels of food craving, dichotomous thinking, body dissatisfaction, emotional eating, and external eating, compared to a waitlist control group. The authors explained that mindfulness facilitates self-regulation and reduces impulsivity, and improvement is seen because these types of behaviors are related to poor self-regulation and increased impulsivity. Limitations described were relatively small sample size, self-reported measures, and the waitlist control group. The authors acknowledged that adding a standard treatment group to the design instead of a waitlist control would have provided a better comparison.

O'Reilly, Cook, Spruijt-Metz, and Black (2014) conducted a review to assess mindfulness-based interventions (MBIs) and their effectiveness for treating obesity-related eating behaviors including binge eating, emotional eating, and external eating.

These are defined as follows: binge eating – the consumption of large amounts of food and loss of control; emotional eating – the consumption of food in response to emotional arousal; and external eating – eating in response to external food-related cues such as sight and smell of foods. The authors posit that these factors are not usually addressed in standard interventions and may contribute to a lack of long-term success. Binge and emotional eating can be used as coping mechanisms for psychological distress and have been linked to depression, stress, and anxiety. The authors also explored the dysregulation of hunger and satiety cues that can occur in a state of obesity, where self-regulation of eating behavior is poor, increasing susceptibility to binge eating and external eating.

The authors found 21 published papers that met their requirement criteria. Approaches used to carry out the interventions included combined mindfulness and cognitive behavioral therapies, mindfulness-based stress reduction, acceptance-based therapy, mindful eating programs, and combinations of mindfulness exercises. The majority (86%) of the reviewed studies showed significant improvements in binge eating, emotional eating, and external eating. The authors highlighted that mindfulness skills can help dieters pay attention to feelings or factors that hurt their chances of success and accept them objectively rather than acting on them without reflection. This may ease those feelings and factors over time and help with a more healthful attitude towards eating. The limitations described were similar to those in the previous review—that the samples were mostly homogeneous and small, and they only reviewed articles that were published in English, so these findings may not be generalizable to more diverse ethnic groups (O'Reilly et al., 2014).

A similar systematic review was published in *Eating Behaviors* and assessed interventions where mindfulness meditation was the primary approach to work with people who struggle with maladaptive eating behaviors and weight but do not have an eating disorder diagnosis (Katterman, Kleinman, Hood, Nackers, Corsica, 2014). Fourteen studies met eligibility criteria and assessed binge eating, emotional eating, and weight loss. The author's reviewed each study's dose of mindfulness training and daily practice to determine optimal outcomes. Timeframes that they found ranged from 8 – 30 minutes per day. Overall, they found that primarily mindfulness-focused programs are effective for binge eating and emotional eating, but are not enough to invoke weight change. They recommend standard weight management to supplement mindfulness practice in future research in order to see significant weight change. There were reported limitations to the studies reviewed—some low retention rates, and publication bias, meaning only those published in peer-reviewed journals were reviewed—so some studies on the same topic might have been left unpublished because results were found to be insignificant, skewing the impact found by the authors.

Mindfulness & Weight Loss

As it becomes more obvious that comprehensive approaches to weight loss are necessary to provide long-term, meaningful weight change, new treatment approaches are incorporating behavioral components. Looking more closely at mindfulness within the context of weight loss programs can provide insight into the effectiveness such training might have on improving success. Timmerman and Brown (2012) designed a randomized controlled trial to evaluate the effect of a 'Mindful Restaurant Eating' program on weight

management in 35 women ages 40-59 living in the greater metropolitan area of Austin, Texas who eat out at restaurants frequently. The authors conducted a 6-week intervention focused on reducing calories and fat through education, behavior change, and mindful eating meditations. They found that compared to the waitlist control, women in the intervention group lost significantly more weight, had lower daily calorie and fat intake, had increased self-efficacy, and reported fewer barriers to weight management when eating out. The main limitations of this provided by the authors were the small convenience sample and the self-reported dietary intake. They also pointed out the risk for weight regain in such an intervention, and suggested that future interventions address this limitation (Timmerman, Brown, 2012).

A 2009 randomized controlled trial of 62 women explored the efficacy of a mindfulness-based weight loss intervention to supplement independent weight loss (Tapper, Shaw, Ilsley, Hill, Bond, Moore, 2009). The intervention group attended four 2-hour workshops centered on Acceptance and Control Therapy (ACT), a mindfulness-based therapy, while the control group was asked to continue with their current diet. BMI, physical activity, and mental health were assessed at baseline and 6 months. At 6 months, intervention participants demonstrated higher levels of physical activity but no differences in weight loss or mental health compared to the control group. However, when respondents who reported that they did not continue to apply these principle to their daily lives after the completion of the workshops (n=7) were removed, the changes in weight were found to be significant. The authors cited the following limitations: the no-treatment control—they recommended a standard control be used in future research; the

limited evaluation length of 6 months; and the lack of matching intervention and control groups for physical activity and binge eating at baseline (Tapper et al., 2009).

Mantzios and Wilson (2014) conducted a series of three studies in which food diaries were used to induce mindfulness and self-compassion during independent active weight loss. Participants either focused on concrete construals of eating (*how* they are eating) or abstract construals of eating (*why* they are eating). Construal-level theory describes the extent to which a person's thinking is abstract or concrete, along a continuum. The authors used validated scales to assess self-compassion, mindful attention and awareness, automatic thoughts, and cognitive behavioral avoidance. They found that mindfulness and self-compassion are directly related to weight loss, and that they mediate the inverse relationship of avoidance and negative thoughts with weight loss. Additionally, the authors found that concrete construals increased mindfulness and self-compassion, while abstract construals decreased them. Limitations provided by the authors were short study duration (five weeks), high dropout rates, use of a student population, lack of a control group, and the lack of pre-test to assess whether concrete diaries influence construal levels (Mantzios, Wilson, 2014).

A 2015 systematic review by Olson and Emery evaluated 19 studies for effects of MBIs on weight among people attempting to lose weight. Studies were graded according to characteristics of design methods described, and unfortunately none met the Class A criteria of “a randomized controlled trial design, inclusion of a validated measure of mindfulness, assessment of weight change, and statistical analyses evaluating the relationship between mindfulness and weight loss.” They did find that 13 of the 19 studies documented significant weight loss in participants within mindfulness

interventions, but methodological weaknesses and important variations between the studies limited the strength of the evidence. The authors noted that more rigorous research designs are needed in the future, including constructive research design (only difference between control and intervention groups is mindfulness), and use of an intervention of known efficacy instead of a new or combined approach. The authors did not acknowledge any limitations to their review (Olson, Emery, 2015).

Until now, no studies have added mindfulness practices to weight loss programs to assess outcomes, as recommended numerous times by the articles reviewed so far in this paper. A brand new study published in *Obesity* (2016) carried out this very type of intervention. The study included 194 adults with obesity, which were randomized to a 5.5-month program with or without mindfulness training and equal diet-exercise guidelines, with weight change being the primary outcome assessed. At the end of the intervention, the investigators found that the group that received mindfulness training did not lose significantly more weight than the other group but saw improvements in other long-term health measures like fasting blood glucose and triglyceride/HDL ratio. The authors discussed at length limitations to their study and possible areas for improvement in future research. They noted that in an effort to mask participants to which intervention arm they were enrolled in, they may have randomized some people into the mindfulness group who were not interested in mindfulness. Related to this, they noted high dropout rates in the mindfulness group due to limited interest. Additionally, the authors suggested that the efficacy of mindfulness training depends heavily on the skill of the instructor—the study actually had three different instructors facilitating the mindfulness arm of the intervention. Instructors were rated by participants and those that were rated more highly

were found to have statistically significantly better outcomes than the instructor who was found to be least helpful. The authors conclude that continued research is needed to examine whether similar or more promising outcomes can be found.

Mindfulness & Weight Loss Maintenance

Reiterating assertions previously made in regard to successful transitions from active weight loss to weight maintenance, research shows that different skill sets may be needed and should be considered separately. Caldwell, Baime, and Wolever (2012) reviewed key mindfulness skills for mental health counselors looking specifically at weight loss maintenance. The authors posit that weight maintenance requires strong self-regulation skills, and that because mindfulness has been adapted to treat many self-regulation disorders like substance abuse, stress, and eating disorders, an apparent opportunity for utilizing mindfulness for weight maintenance is available. Topics in mindfulness-based weight maintenance programs have included cognitive diffusion, acceptance of difficult feelings and sensations, nonjudgmental attitudes, and commitment to personal values. Because a mindful approach does not aim to change thoughts and feelings, but rather view them more objectively, a weight maintenance intervention can help people notice their feelings and reflect rather than automatically react. For example, with regard to dichotomous thinking style, a commonly cited factor influencing weight loss maintenance, mindfulness may help people notice this tendency and become less responsive to it (Caldwell, Baime, Wolever, 2012).

Conclusion

The fact that obesity is a significant threat to the worldwide population is rarely disputed. It is undoubtedly one of the greatest causes of preventable morbidity and mortality, and weight loss is shown to reduce these risks (Dombrowski et al, 2014). Diagnoses such as type 2 diabetes, dyslipidemia, sleep apnea, and many more are significantly improved with even modest levels (5-10% of body weight) of weight loss. Weight loss also reduces health care spending, and can improve psychological elements like depression, and quality of life (Apovian, 2013).

Despite numerous options for weight management, obesity remains a serious problem, and people who lose weight have difficulty keeping it off. Studies have shown that people with obesity who lose weight often regain half of the weight within the first year, and most return to or exceed their initial weight within 3 – 5 years (O'Reilly et al, 2014). Because maintaining weight loss is crucial to reap the health benefits it provides, better solutions to helping people maintain weight loss over time are crucial. Although active weight loss maintenance interventions provide valuable skills, a more time and cost effective approach would be to develop an intervention that combined the skill sets of active weight loss and weight maintenance, instead of treating them as two separate entities. Utilizing mindfulness within weight management programs offers promise for a future approach to teach people long-term, sustainable changes that can foster weight loss and permanent health behavior change. Because this area is still very much in its infancy, more rigorous, high quality studies are needed to provide further support.

Chapter 3: Methodology

Research Design

The current study was a two-group randomized experimental design study. The first group received a standard weight loss program based on the National Diabetes Prevention Program and the 2013 Guidelines for the Management of Overweight and Obesity published by the American Heart Association, American College of Cardiologists, and The Obesity Society. The second group received the same program with an additional mindfulness component based on Duke Integrative Medicine's *The Mindful Diet* book. These weight loss programs ran concurrently and lasted three months, and follow-up evaluations occurred at six months and nine months. Primary and secondary outcome assessments were taken at baseline, three months, six months, and nine months. The active intervention started in May 2016 and ended in August 2016. Six-month follow up evaluations occurred in November 2016 and nine-month follow up evaluations occurred in February 2017.

Study Sample

Adults between the ages of 25 and 65 with body mass index (BMI) between 28 and 45 kg/m² were recruited. Exclusion criteria specified that participants must not: (1) have bone or joint problems that prohibit regular exercise; (2) endorse any of the first three items on the Physical Activity Readiness Questionnaire (PAR-Q): heart problems, chest pain, faintness or dizzy spells; (3) endorse any of the other items on the PAR-Q without a physician's consent; (4) have had a hospitalization for a psychiatric disorder within the last year; (5) have a history of anorexia or bulimia nervosa; (6) have a medical

diagnosis of cancer or HIV; (7) have a diagnosis of a major psychiatric disorder (i.e. bipolar disorder or schizophrenia) or taking anti-psychotic medications; (8) be pregnant, nursing, or planning to become pregnant within the study period; (9) be less than nine months post-partum; (10) or have a weight loss of greater than ten pounds in the last six months. All of this information was self-reported in the initial telephone screening.

Participants were enrolled on a first come, first served basis, and limited to approximately 50 total participants based on staffing and administration capacity. After providing informed consent and completing baseline assessments, individuals (n=53) were randomized to one of two groups; each of which received the twelve-week face-to-face intervention. The twelve-week active intervention period was then followed by a three-month no-contact period. Measurements were again taken in November 2016 and an additional three-month no-contact period followed. The final assessment took place in February 2017.

Procedures

Recruitment advertisements were distributed and instructed participants to contact study personnel via phone. A phone screening was conducted, and participants who met all initial inclusion/exclusion criteria were invited to a study information session. Interested and qualified participants then signed study consent forms, and filled out questionnaires: basic demographics, the International Physical Activity Questionnaire, NHANES Dietary Screener Questionnaire, Mindful Eating Scale, and Five Facet Mindfulness Questionnaire (FFMQ), and the Perceived Stress Scale. An individual assessment appointment was scheduled prior to the first group meeting where baseline

anthropometric measurements were taken including height, weight, body composition, and waist circumference. Blood pressure was taken at that time.

The total pool of participants was randomized into either the control group or the intervention group, and then further subdivided into two smaller groups of eight to thirteen participants each. Each group met once per week (sixty-minute sessions) for twelve weeks on the University of Kentucky campus. The control group followed a weight loss program led by Teresa Lee, RD, LD and based on the National Diabetes Prevention Program and the 2013 Guidelines for the Management of Overweight and Obesity published by the American Heart Association, American College of Cardiologists, and The Obesity Society. The intervention group followed the same curriculum plus a mindfulness supplement based off Duke Integrative Medicine's publication *The Mindful Diet*, also led by Teresa Lee, RD, LD. Participant attendance, weight, and weekly task compliance were recorded at each meeting. The same measurements and assessments completed at baseline were taken at twelve weeks, six months, and nine months. Each participant received \$25 for attending the 6-month evaluation and \$25 for attending the final evaluation to ensure adequate follow-up rates.

Measurement Instruments

Data used in this study for analysis were collected through a variety of instruments. Anthropometric measurements were obtained at baseline, three months, six months, and nine months by Teresa Lee. Per guidelines established by the American Heart Association (Pickering, Ogedegbe, Artinian, 2009) blood pressure was taken using a validated, automated blood pressure cuff after checking for appropriate fit and after the

participant was allowed to rest for five minutes. The participant was seated with his or her arm supported on a flat surface at the level of the heart. Waist circumference was taken in inches with a tape measurer at one inch above the umbilicus.

Height was assessed using a wall-mounted stadiometer, and recorded in inches. Weight and body composition were assessed by a BOD POD (Life Measurement, Inc., CA), which uses whole body air-displacement plethysmography to assess body fat and lean body mass, and has been compared to other body composition assessment techniques to establish reliability and validity in children and adults (Fields, Goran, McCrory, 2002). To improve accuracy of measurement, participants wore minimal spandex clothing or swim suits and swim caps to cover their hair, and removed all jewelry and eyeglasses prior to entering the BOD POD. Participants were also asked to avoid eating and exercising for two hours prior to testing. They were asked to remain still and breathe normally while inside the BOD POD.

Basic demographic information was gathered at baseline, and five reliable, validated questionnaires were completed by each participant at baseline, 12 weeks, 6 months, and 9 months:

- Short Form International Physical Activity Questionnaire
- NHANES Dietary Screener Questionnaire
- Mindful Eating Scale
- Five Facet Mindfulness Questionnaire
- Perceived Stress Scale

The short form International Physical Activity Questionnaire (IPAQ) has been developed and tested as a valid, reliable tool for use in adults, assessing physical activity

over the past week (van der Ploeg et al. 2010 & Craig et al, 2003) The IPAQ short form asks about different types of activities as well as time spent sitting. The specific types of activity that are assessed are walking, moderate-intensity activities and vigorous intensity activities. Frequency (measured in days per week) and duration (time per day) are collected separately for each specific type of activity (Guidelines for Data Processing and Analysis of the IPAQ - Short Form, Version 2.0, 2004).

The Dietary Screener Questionnaire (DSQ) was developed for the National Health and Nutrition Examination Survey (NHANES) administration year 2009 – 2010 (NCI, n.d.). NHANES is a major program of the National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention (CDC), and assesses the health of Americans on an annual basis through interviews and physical examinations (CDC, 2014). The DSQ asks about the regularity of consumption of selected foods and drinks in the past month. The DSQ captures intakes of fruits and vegetables, dairy/calcium, added sugars, whole grains/fiber, red meat, and processed meat (NCI, n.d.). Considerable development and testing of the reliability and validity of the questionnaire has been completed to test the performance of the 26 individual questions (Thompson, et al. 2004 & Thompson, et al. 2005).

The Mindful Eating Scale (Hulbert-Williams, Nicholls, Joy, & Hulbert-Williams, 2013) assesses mindfulness in terms of eating behaviors. Each of the 28 questions refers to food, eating, or hunger on a Likert-type scale from (1) never to (4) usually. Numerous items are reverse-scored, and several subscales comprise entirely negatively worded items. All subscales are scored so that higher scores reflect a more mindful or intuitive

eating style same as above. Being a newer measurement tool, it has only been successfully validated in a sample of college students (Hulbert-Williams et al., 2013).

The Five Facet Mindfulness Questionnaire was developed from an analysis of five separate mindfulness questionnaires by Baer, Smith, Hopkins, Krietemeyer, and Toney (2006). Five “facets” or factors were determined to be primary indicators of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. The questionnaire specifically assesses each of these factors, and is one of the most commonly used measures of generic mindfulness (Hulbert-Williams et al. 2013). The original form has 39 items, and a 24-item short form was published by Bohlmeijer et al. in 2011. The short form questionnaire has been shown to have better construct validity in community samples, as opposed to the long form questionnaire which has been satisfactorily tested in college student populations (Bohlmeijer et al., 2011).

The Perceived Stress Scale (PSS) was utilized to assess the perception of stress in the participant’s daily life. The scale was designed to determine how unpredictable, uncontrollable, and overloaded survey-takers identify their lives (Cohen, Kamarck, & Mermelstein, 1983). Mindfulness has been utilized to treat stress successfully, and weight loss has been found to relieve stress (O’Reilly et al., 2014). Although developed over thirty years ago, a recent review found that “the PSS is an easy-to-use questionnaire with established acceptable psychometric properties” (Lee, 2014).

Data Analysis

Descriptive statistics were used to characterize the sample. Paired t-tests were used to compare participants' changes in continuous variables over the first three months. Independent t-tests were used to compare changes in continuous variables over time between the two groups over the first three months. The differences in changes of categorical variables were compared using Chi-square tests. Repeated measures analyses were performed to assess differences between the groups at six and nine months. The IBM SPSS Statistics Version 23 (2015) and SAS 9.3 software (SAS Institute, Inc.) were used for the data analyses.

Chapter 4: Results

Initial Participants

There were 118 people who were screened for eligibility; of those that were screened, 47 did not meet inclusion criteria, or chose not to attend informational sessions. A total of 55 people attended informational sessions, and two people chose not to participate. A total of 53 participants initiated the study, and of the total participants, 90.6% (n=48) were female and 9.4% (n=5) were male. The overall mean age was 47.7(11.3) years old. The majority of the participants were white (88.7%, n=47) and the remaining were black (11.3, n=6%). None of the participants identified themselves as a race other than black or white. The highest level of education completed was assessed, and results are shown in Figure 1. Annual household income was also assessed, and results are shown in Figure 2. Out of the 53 participants, 64.2% (n=34) were employees at the University of Kentucky. The participants were divided into two intervention groups; 36 participants were placed the mindfulness group and 17 participants were placed the standard group.

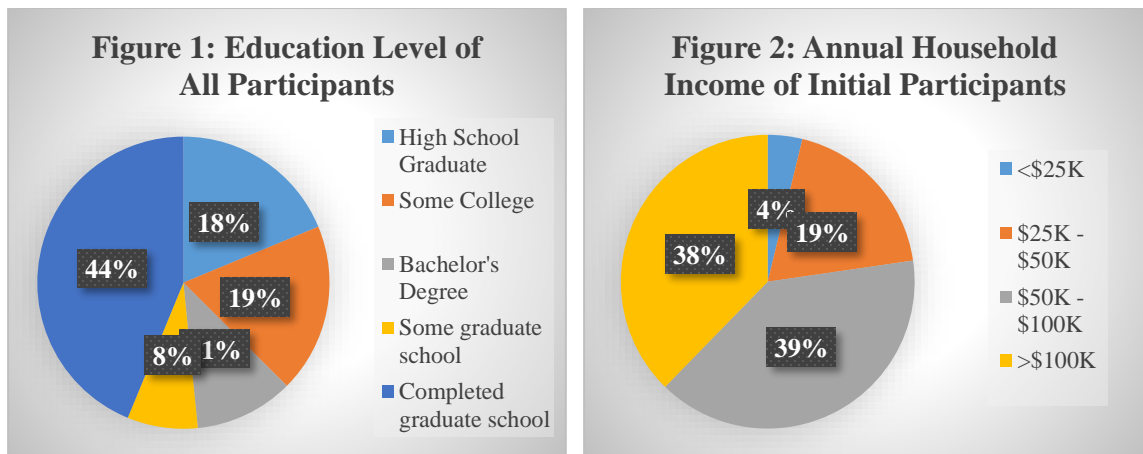


Table 1: Baseline Characteristics of All Participants

	Initial Participants	Completers	Non-Completers	p-value (Completers vs. Non-Completers)
Race (% white)	88.7	90	84.6	0.60
Sex (% female)	90.6	90	92.3	0.81
Age (years)	47.7 (11.3)	47.8 (11.6)	47.2 (11.0)	0.87
Weight (pounds)	211.6 (33.4)	206.2 (30.0)	228.0 (38.9)	0.04
BMI (kg/m ²)	34.5 (4.75)	33.9 (4.3)	36.4 (5.8)	0.18
Body Fat %	47.1 (6.1)	46.6 (6.0)	48.8 (6.3)	0.25
Waist (inches)	42.6 (4.9)	42.4 (4.8)	43.2(5.3)	0.62
Systolic Blood Pressure (mmHg)	124.5(13.3)	125.1(13.2)	122.5(14.0)	0.55
Diastolic Blood Pressure (mmHg)	78.6 (6.5)	78.8(8.3)	78.2(9.4)	0.85
Mindful Eating Scale	72.4 (11.3)	71.9 (10.8)	73.9 (13.1)	0.58
Five Facet Mindfulness	57.0 (8.3)	57.2 (7.7)	56.5 (10.1)	0.82
Perceived Stress Scale	18.4 (6.6)	18.5 (6.5)	18.1 (7.2)	0.86
IPAQ (MET-minutes)	1749.2 (2146.8)	1842.6 (2360.2)	1461.9 (1321.9)	0.58
Sitting time (minutes)	480.6(195.8)	471.1 (188.8)	510.0 (222.3)	0.56
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.2(0.8)	2.1 (0.8)	2.49 (0.6)	0.13
Daily Intake of Dairy (cups)	1.4(0.8)	1.37 (0.9)	1.4 (0.5)	0.93
Daily Intake of Added Sugars (teaspoons)	11.9(5.9)	12.0 (5.9)	1.39 (0.5)	0.88
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	4.0(5.7)	4.0 (5.5)	4.0 (6.7)	0.99
Daily Whole Grain Intake (ounces)	0.6(0.7)	0.49 (0.55)	0.87 (1.06)	0.11
Daily Fiber Intake (grams)	13.3(4.0)	12.9 (4.1)	14.5 (3.8)	0.22

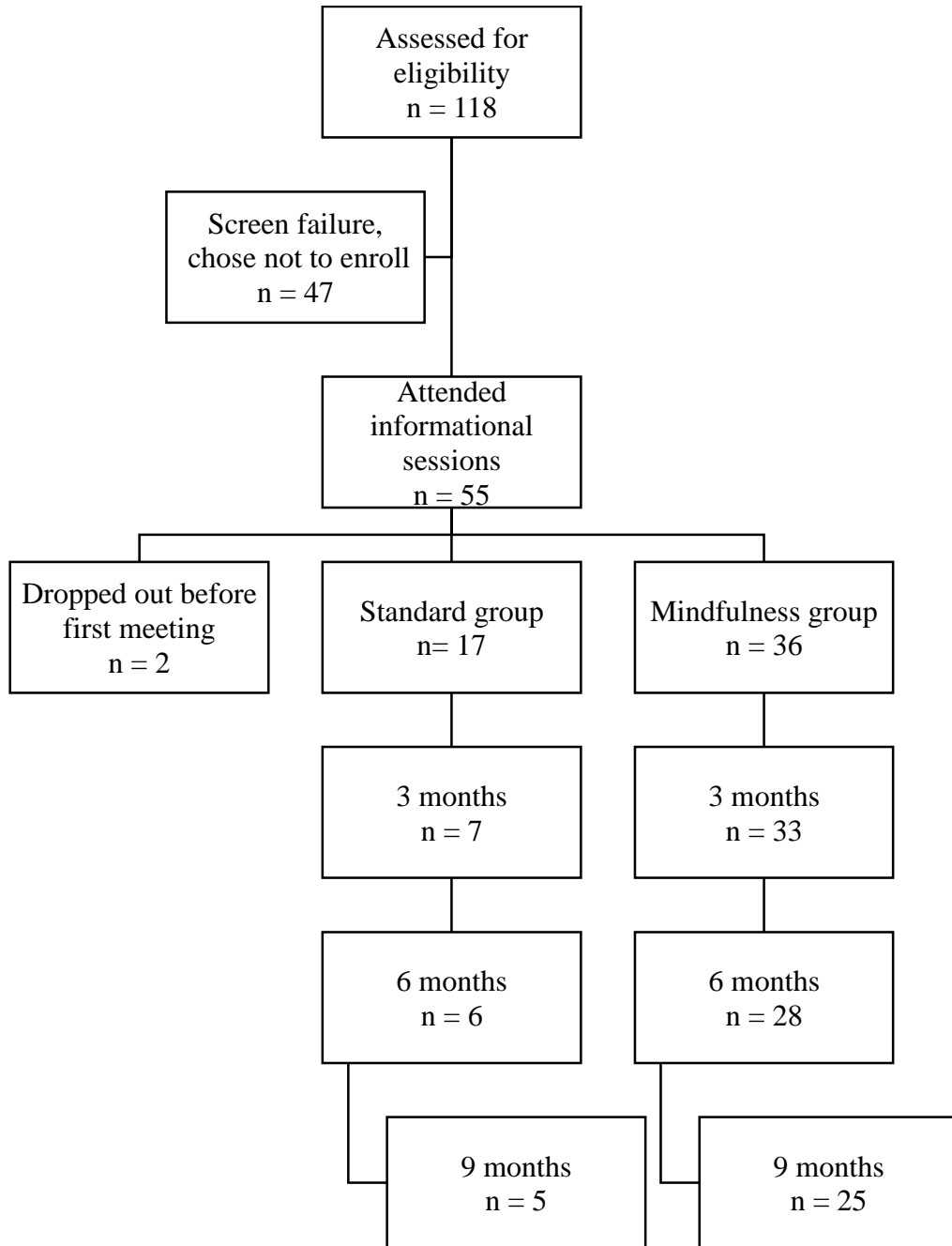
Completed Participants

Over the course of the three-month program, some participants dropped out for various reasons. A total of 40 participants completed the study and completed follow-up assessments, representing a 75.5% retention rate. The rate of attrition was different between intervention groups; 58.8% (n=10) of participants in the standard group did not complete the study, while only 8.3% (n=3) of participants in the mindful group did not complete the study ($p<0.001$).

Table 2: Baseline Characteristics (Completers Only)

	Mindfulness Group	Standard Group	p-value
Race (% white)	93.4	71.4	0.28
Sex (% female)	87.9	100.0	0.04
Age (years)	46.8 (11.5)	52.6 (11.6)	0.24
Weight (pounds)	206.4 (31.4)	205.4 (23.9)	0.94
BMI (kg/m ²)	33.6 (4.3)	35.4 (4.4)	0.32
Body Fat %	45.9 (6.2)	49.5 (3.9)	0.16
Waist (inches)	42.2 (5.1)	43.5 (3.6)	0.53
Systolic Blood Pressure (mmHg)	124.6 (13.4)	127.6 (13.2)	0.59
Diastolic Blood Pressure (mmHg)	78.7 (8.6)	79.1 (7.2)	0.89
Mindful Eating Scale	72.4 (10.9)	69.6 (10.8)	0.53
Five Facet Mindfulness	57.5 (7.6)	55.6 (8.9)	0.56
Perceived Stress Scale	18.3 (7.0)	19.0 (3.5)	0.81
IPAQ (MET-minutes)	2017.1 (2468.2)	1019.9 (1661.8)	0.32
Sitting time (minutes)	482.9 (194.9)	410.0 (152.6)	0.39
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.05 (0.83)	2.3 (0.81)	0.53
Daily Intake of Dairy (cups)	1.44 (0.92)	1.01 (0.34)	0.27
Daily Intake of Added Sugars (teaspoons)	12.1 (6.2)	11.6(5.2)	0.87
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	4.1 (5.9)	3.8 (2.6)	0.91
Daily Whole Grain Intake (ounces)	0.49 (0.55)	0.48 (0.58)	0.95
Daily Fiber Intake (grams)	12.8 (3.9)	13.2 (5.4)	0.84

Figure 3: Participant Sample Size Flow Chart



Three Month Evaluation of Intervention Groups

At the three-month assessment, the average weight for those in the mindfulness group was 197.6(29.3) pounds, which was an average of 8.75(7.8) pounds lower than at baseline ($p<0.001$). This represents a reduction of 4.3% of the original mean body weight. The remainder of the findings from the 3-month follow-up assessment are provided in Table 3.

Table 3: Three-Month Evaluation of Mindfulness Group

	Baseline	3 months	p-value
Weight (pounds)	206.4 (31.4)	197.6(29.3)	<0.001
BMI (kg/m ²)	33.6 (4.3)	32.2(3.8)	<0.001
Body Fat %	45.9 (6.2)	43.4(6.3)	<0.001
Waist (inches)	42.2 (5.1)	39.0(4.9)	<0.001
Systolic Blood Pressure (mmHg)	124.6 (13.4)	122.1 (15.7)	<0.001
Diastolic Blood Pressure (mmHg)	78.7 (8.6)	76.0(9.5)	<0.001
Mindful Eating Scale	72.4 (10.9)	82.6(8.5)	0.009
Five Facet Mindfulness	57.5 (7.6)	61.4(8.0)	0.007
Perceived Stress Scale	18.3 (7.0)	14.7(7.7)	0.002
IPAQ (MET-minutes)	2017.1 (2468.2)	2697.1(2184.5)	0.002
Sitting time (minutes)	482.9 (194.9)	350.7(188.7)	0.001
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.05 (0.83)	2.2(0.8)	<0.001
Daily Intake of Dairy (cups)	1.44 (0.92)	1.3(1.1)	0.002
Daily Intake of Added Sugars (teaspoons)	12.0 (6.4)	7.3 (3.4)	0.001
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	4.1 (5.9)	1.5 (2.0)	0.001
Daily Whole Grain Intake (ounces)	0.49 (0.55)	0.52 (0.6)	0.344
Daily Fiber Intake (grams)	12.8 (3.9)	12.4 (3.2)	0.037

At the 3-month assessment, the average weight for those in the standard group was 199.0 (25.0) pounds, which was an average of 6.35 (6.8) pounds lower than at baseline (p=0.001). This represents a reduction of 3.1% of the original mean body weight. The remainder of the findings from the 3-month follow-up assessment are provided in Table 4.

Table 4: Three-Month Evaluation of Standard Group

	Baseline	Three months	p-value
Weight (pounds)	205.4 (23.9)	199.0 (25.0)	0.001
BMI (kg/m ²)	35.4 (4.4)	31.5 (10.8)	0.016
Body Fat %	49.5 (3.9)	46.7 (4.3)	0.005
Waist (inches)	43.5 (3.6)	40.6 (4.2)	0.024
Systolic Blood Pressure (mmHg)	127.6 (13.2)	122.1 (14.7)	0.122
Diastolic Blood Pressure (mmHg)	79.1 (7.2)	73.9 (7.9)	0.124
Mindful Eating Scale	69.6 (10.8)	74.3 (10.2)	0.007
Five Facet Mindfulness	55.6 (8.9)	56.0 (6.0)	0.831
Perceived Stress Scale	19.0 (3.5)	16.9 (5.2)	0.245
IPAQ (MET-minutes)	1019.9 (1661.8)	3458.0 (2553.7)	0.813
Sitting time (minutes)	410.0 (152.6)	402.0 (115.4)	0.043
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.29 (0.81)	2.01 (0.70)	0.190
Daily Intake of Dairy (cups)	1.01 (0.34)	0.85 (0.21)	0.653
Daily Intake of Added Sugars (teaspoons)	11.6(5.2)	8.07 (3.8)	0.742
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	3.8 (2.6)	3.0 (2.9)	0.767
Daily Whole Grain Intake (ounces)	0.48 (0.58)	0.23 (0.14)	0.553
Daily Fiber Intake (grams)	13.2 (5.4)	9.7 (1.0)	0.561

Table 5: Comparison of Three-Month Changes Between Intervention Groups

	Mindfulness Group (n=33)	Standard Group (n=7)	p-value
Weight changes (pounds)	-8.75(7.8)	-6.35(6.8)	0.454
Percent Weight Loss	0.041	0.031	0.494
BMI (kg/m ²)	-2.3(5.8)	-3.9(7.5)	0.531
Body Fat %	-2.52(1.7)	-2.7(1.8)	0.774
Waist (inches)	-3.19 (92.2)	-2.56(2.5)	0.782
Systolic Blood Pressure (mmHg)	-3.1(13.1)	-3.7(12.7)	0.928
Diastolic Blood Pressure (mmHg)	-2.7(7.8)	-5.3(6.5)	0.415
Mindful Eating Scale	10.3(10.5)	4.7(4.9)	0.047
Five Facet Mindfulness	4.0(8.0)	0.43(11.2)	0.326
Perceived Stress Scale	-3.4(7.1)	-2.1(4.6)	0.671
IPAQ (MET-minutes)	617.6(2265.5)	2438.1(2888.0)	0.075
Sitting time (minutes)	-140.7(174.9)	-6.0(85.9)	0.104
Daily Intake of Fruit, Vegetables, Legumes (cups)	0.13 (0.7)	-0.28 (0.7)	0.181
Daily Intake of Dairy (cups)	-0.14 (1.0)	-0.16 (0.35)	0.951
Daily Intake of Added Sugars (teaspoons)	-4.7 (5.2)	-3.6 (5.8)	0.643
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	-2.7 (5.2)	-0.8 (3.6)	0.401
Daily Whole Grain Intake (ounces)	0.04 (0.8)	-0.25 (0.6)	0.387
Daily Fiber Intake (grams)	-0.09 (3.8)	-3.5 (5.2)	0.077

Table 6: Correlations in Changes Over Three Months of Mindfulness Group – Both Males and Females

N=33	Weight	Body Fat %	Waist	Systolic BP	Diastolic BP
PSS	R=. 515 p=. 003	R=. 387 p=. 032	R=. 435 p=. 014	R=-.109 p=.561	R=-.277 p=.131
MES	R=-. 358 p=. 044	R=-.101 p=.581	R=-.128 p=.484	R=.054 p=.440	R=.131 p=.464
IPAQ score	R=-. 424 p=. 016	R=-. 416 p=. 018	R=-.311 p=.084	R=-.100 p=.584	R=.046 p=.805
Fruit, Vegetables, Legumes	R=-. 505 p=. 007	R=-.346 p=.077	R=-.354 p=.070	R=-.197 p=.325	R=.214 p=.283

Table 7: Comparison of Three-Month Findings in Mindfulness Group Between Sexes

	Females (n=29)	Males (n=4)	p-value
Weight changes (lbs.)	-8.76 (7.85)	-8.69 (8.25)	0.986
Body Fat %	-2.41 (1.69)	-3.35 (1.60)	0.302
Waist (in.)	-3.17 (2.34)	-3.31 (1.34)	0.908
Mindful Eating Scale	11.46 (9.89)	1.75 (11.84)	0.082
Five Facet Mindfulness	4.33 (8.02)	1.33 (8.39)	0.545
Perceived Stress Scale	-3.148 (7.46)	-2.14 (4.56)	0.682

Table 8: Correlations in Changes Over Three Months in Mindful Group – By Sex

	Females n=29	Males n=4
Weight & MES	R=-.541 p= 0.003	R=0.833 p= 0.167
Weight & FFM	R=-.346 p= 0.077	R=0.646 p= 0.553
Weight & PSS	R=0.622 p= 0.001	R=-0.795 p= 0.205
MES & FFM	R=.698 p <0.001	R=0.963 p= 0.174
FFM & PSS	R=-.720 p <0.001	R=-0.947 p= 0.208
MES & PSS	R=-.651 p <0.001	R=-0.968 p= 0.032

Six- and Nine-Month Evaluation of Intervention Groups

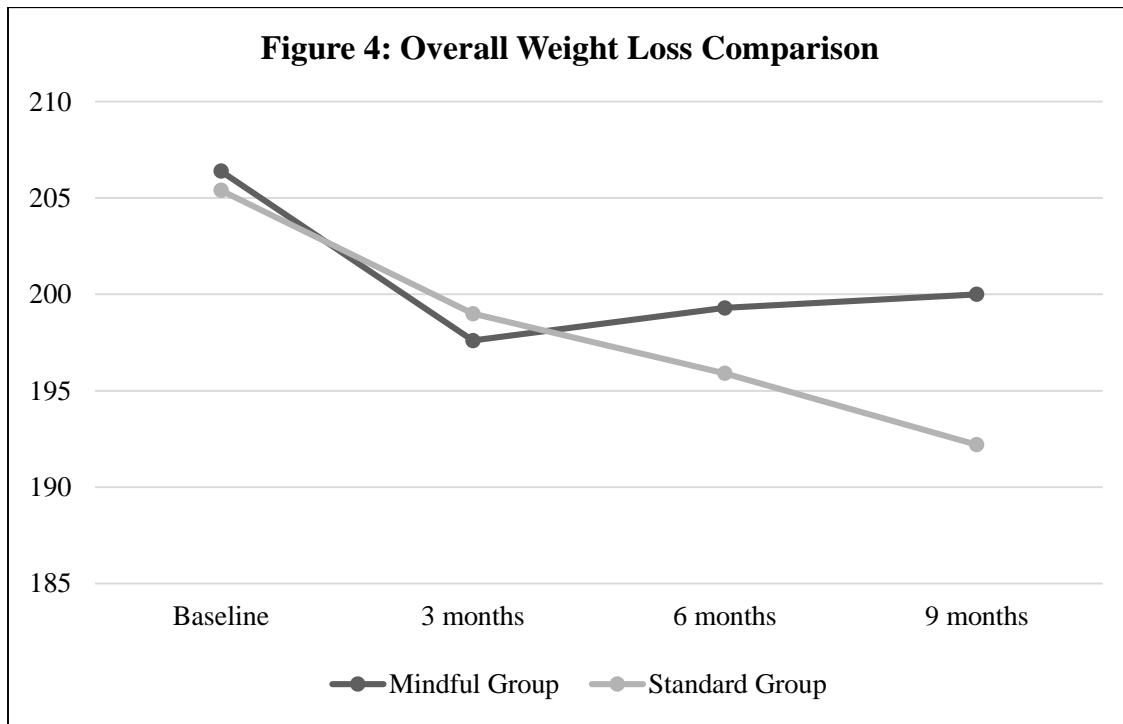
A total of 34 participants completed the six-month follow-up assessments, representing an 85.5% retention rate from the three- to six-month assessments. In the mindfulness group, 28 of the 33 participants came back for the six-month follow-up, while 6 of the 7 participants in the standard group returned for assessment. Of those who completed six-month assessments, 91.2% (n=31) were female and 8.8% (n=3) were male. The majority of the participants who completed the 6-month assessments were white (88.2%, n=30) and the remaining were black (11.8%, n=4).

A total of 30 participants completed the nine-month follow-up assessments, representing a 75% retention rate from the three- to nine-month assessments. In the mindfulness group, 25 of the 33 participants came back for the nine-month follow-up, while 5 of the 7 participants in the standard group returned for assessment. Of those who completed nine-month assessments, 90% (n=27) were female, and 93.3% were white (n=28).

To assess rates of weight maintenance, participants were classified as a ‘maintainer’ if they continued to lose weight or regained less than 3% of their baseline body weight, or a ‘non-maintainer’ if they regained more than 3% of their original body weight. Weight maintenance rates are displayed in Table 9. No significant difference was found in weight maintenance between the groups. Figure 4 shows how changes in mean weight over time compared between the two groups. The standard group continued to lose weight after the conclusion of the study, increasing their percent weight loss from 3.1% at the end of the three-month program to an overall weight loss of 6.4%. The mindfulness group experienced an average weight regain of 1.2%.

Table 9: Six- and Nine-Month Weight Maintenance Rates

	Six Months	p-value	Nine Months	p-value
Mindfulness Group	n=28 Maintainers: 82.1% Non-maintainers: 17.9%	0.945	n= 25 Maintainers: 64% Non-maintainers: 36%	0.488
Standard Group	n=6 Maintainers: 16.7% Non-maintainers: 16.7%		n= 5 Maintainers: 80% Non-maintainers: 20%	



Repeated measures analyses were performed to determine if measured changes over all the time points were significant. Table 10 shows the findings of the mindfulness group, while Table 11 shows the findings of the standard group. The significance value compares values over all time points for each variable.

Tables 12a, 12b, and 12c compare the differences in changes between groups over time for each outcome measure. Table 12a displays the anthropometric measure variables, Table 12b displays the survey variables except the dietary survey, and Table 12c displays the dietary variables.

Table 10: Six- and Nine-Month Evaluation of Mindfulness Group

	Baseline n=36	Three months n=33	Six months n=28	Nine months n=25	p-value
Weight (lbs.)	206.4 (31.4)	197.6(29.3)	199.3(32.5)	200.0 (32.8)	<0.001
Body Fat %	45.9 (6.2)	43.4(6.3)	42.6(9.3)	42.1 (9.6)	0.024
Waist (in.)	42.2 (5.1)	39.0(4.9)	39.1(5.4)	39.1 (4.8)	<0.001
Systolic Blood Pressure (mmHg)	124.6 (13.4)	122.1 (15.7)	129.5(17.7)	125.4 (15.8)	0.006
Diastolic Blood Pressure (mmHg)	78.7 (8.6)	76.0 (9.5)	80.6 (8.2)	79.4 (12.2)	0.010
Mindful Eating Scale	72.4 (10.9)	82.6(8.5)	83.42 (11.0)	77.9 (10.9)	<0.001
Five Facet Mindfulness	57.5 (7.6)	61.4(8.0)	61.75 (9.0)	60.1 (8.9)	0.014
Perceived Stress Scale	18.3 (7.0)	14.7(7.7)	14.89 (7.0)	15.3 (8.1)	0.037
IPAQ (MET-minutes)	2017.1 (2468.2)	2697.1 (2184.5)	2359.7 (2137.4)	2076.3 (2909.9)	0.513
Sitting time (minutes)	482.9 (194.9)	350.7 (188.7)	383.1 (202.2)	366.3 (162.4)	<0.001
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.1 (0.83)	2.2(0.8)	2.3 (0.62)	2.2 (0.4)	0.469
Daily Intake of Dairy (cups)	1.44 (0.92)	1.3(1.1)	1.40 (0.38)	1.4 (0.4)	0.877
Daily Intake of Added Sugars (teaspoons)	12.0 (6.4)	7.3 (3.4)	13.9 (3.6)	16.0 (5.6)	<0.001
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	4.1 (5.9)	1.5 (2.0)	4.9 (1.6)	6.0 (4.5)	<0.001
Daily Whole Grain Intake (ounces)	0.49 (0.55)	0.52 (0.6)	0.59 (0.22)	0.73 (0.18)	0.567
Daily Fiber Intake (grams)	12.8 (3.9)	12.4 (3.2)	15.3 (2.7)	15.8 (2.8)	<0.001

Table 11: Six- and Nine -Month Evaluation of Standard Group

	Baseline n=17	3 months n=7	Six months n=6	Nine months n=5	p- value
Weight (lbs.)	205.4 (23.9)	199.0 (25.0)	195.9(25.1)	192.2 (25.5)	0.083
Body Fat %	49.5 (3.9)	46.7 (4.3)	41.4(18.3)	47.9 (5.2)	0.522
Waist (in.)	43.5 (3.6)	40.6 (4.2)	40.6(3.3)	40.1 (4.9)	0.036
Systolic Blood Pressure (mmHg)	127.6 (13.2)	122.1 (14.7)	121.5(4.5)	124.6 (23.9)	0.828
Diastolic Blood Pressure (mmHg)	79.1 (7.2)	74.1 (7.3)	79.3(7.1)	77.6 (5.3)	0.183
Mindful Eating Scale	69.6 (10.8)	74.3 (10.2)	81.6 (6.5)	82.5 (8.5)	0.137
Five Facet Mindfulness	55.6 (8.9)	56.0 (6.0)	57.4 (6.6)	58.3 (6.3)	0.949
Perceived Stress Scale	19.0 (3.5)	16.9 (5.2)	16.6 (4.1)	12.5 (5.9)	0.070
IPAQ (MET-minutes)	1019.9 (1661.8)	3458.0 (2553.7)	3247.0 (1717.2)	2323.1 (2386.5)	0.102
Sitting time (minutes)	410.0 (152.6)	402.0 (115.4)	408.0 (149.4)	525.0 (90.0)	0.311
Daily Intake of Fruit, Vegetables, Legumes (cups)	2.29 (0.81)	2.01 (0.70)	2.36 (0.39)	2.4 (0.8)	0.190
Daily Intake of Dairy (cups)	1.01 (0.34)	0.85 (0.21)	1.39 (0.44)	1.2 (0.2)	0.291
Daily Intake of Added Sugars (teaspoons)	11.6(5.2)	8.07 (3.8)	14.9 (2.1)	12.7 (2.8)	0.027
Daily intake of Sugar from Sugar-Sweetened Beverages (teaspoons)	3.8 (2.6)	3.0 (2.9)	4.9 (1.2)	4.2 (0.6)	0.419
Daily Whole Grain Intake (ounces)	0.48 (0.58)	0.23 (0.14)	0.67 (0.22)	0.70 (0.18)	0.213
Daily Fiber Intake (grams)	13.2 (5.4)	9.7 (1.0)	14.9 (1.3)	15.8 (2.8)	0.038

Table 12a: Comparison of Overall Anthropometric Changes Between Groups

	<u>Mindfulness Group</u> T0: n=36; T1: n=33; T2: n=28; T3: n=25	<u>Standard Group</u> T0: n=17; T1: n=7; T2: n=6; T3: n=5	Difference Between Groups
Weight (lbs.)	T0: 206.4 (31.4) T1: 197.6(29.3) T2: 199.3(32.5) T3: 200.0 (32.8) p=<0.001	T0: 205.4 (23.9) T1: 199.0 (25.0) T2: 195.9(25.1) T3: 192.2 (25.5) p= 0.083	p=0.9108
Body Fat %	T0: 45.9 (6.2) T1: 43.4(6.3) T2: 42.6(9.3) T3: 42.1 (9.6) p=0.024	T0: 49.5 (3.9) T1: 46.7 (4.3) T2: 41.4(18.3) T3: 47.9 (5.2) p=0.522	p=0.525
Waist (in.)	T0: 42.2 (5.1) T1: 39.0(4.9) T2: 39.1(5.4) T3: 39.1 (4.8) p=<0.001	T0: 43.5 (3.6) T1: 40.6 (4.2) T2: 40.6(3.3) T3: 40.1 (4.9) p=0.036	p=0.5885
Systolic Blood Pressure (mmHg)	T0: 124.6 (13.4) T1: 122.1 (15.7) T2: 129.5(17.7) T3: 125.4 (15.8) p=0.006	T0: 127.6 (13.2) T1: 122.1 (14.7) T2: 121.5(4.5) T3: 124.6 (23.9) p=0.828	p=0.9245
Diastolic Blood Pressure (mmHg)	T0: 78.7 (8.6) T1: 76.0 (9.5) T2: 80.6 (8.2) T3: 79.4 (12.2) p=0.010	T0: 79.1 (7.2) T1: 74.1 (7.3) T2: 79.3(7.1) T3: 77.6 (5.3) p=0.183	p=0.7313

T0: Baseline; T1: Three months; T2: six months; T3: nine months

Table 12b: Comparison of Overall Survey Changes Between Groups

	<u>Mindfulness Group</u> T0: n=36; T1: n=33; T2: n=28; T3: n=25	<u>Standard Group</u> T0: n=17; T1: n=7; T2: n=6; T3: n=5	Difference Between Groups:
Mindful Eating Scale	T0: 72.4 (10.9) T1: 82.6(8.5) T2: 83.42 (11.0) T3: 77.9 (10.9) p=<0.001	T0: 69.6 (10.8) T1: 74.3 (10.2) T2: 81.6 (6.5) T3: 82.5 (8.5) p=0.137	p=0.3349
Five Facet Mindfulness	T0: 57.5 (7.6) T1: 61.4(8.0) T2: 61.75 (9.0) T3: 60.1 (8.9) p=0.014	T0: 55.6 (8.9) T1: 56.0 (6.0) T2: 57.4 (6.6) T3: 58.3 (6.3) p=0.949	p=0.2223
Perceived Stress Scale	T0: 18.3 (7.0) T1: 14.7(7.7) T2: 14.89 (7.0) T3: 15.3 (8.1) p=0.037	T0: 19.0 (3.5) T1: 16.9 (5.2) T2: 16.6 (4.1) T3: 12.5 (5.9) p=0.070	p=0.8122
IPAQ (MET- minutes)	T0: 2017.1 (2468.2) T1: 2697.1 (2184.5) T2: 2359.7 (2137.4) T3: 2076.3 (2909.9) p=0.513	T0: 1019.9 (1661.8) T1: 3458.0 (2553.7) T2: 3247.0 (1717.2) T3: 2323.1 (2386.5) p=0.102	p=0.8684
Sitting time (minutes)	T0: 482.9 (194.9) T1: 350.7 (188.7) T2: 383.1 (202.2) T3: 366.3 (162.4) p=<0.001	T0: 410.0 (152.6) T1: 402.0 (115.4) T2: 408.0 (149.4) T3: 525.0 (90.0) p=0.311	p=0.8731

T0: Baseline; T1: Three months; T2: six months; T3: nine months

Table 12c: Comparison of Overall Dietary Changes Between Groups

	<u>Mindfulness Group</u> T0: n=36; T1: n=33; T2: n=28; T3: n=25	<u>Standard Group</u> T0: n=17; T1: n=7; T2: n=6; T3: n=5	Difference Between Groups
Daily Intake of Fruit, Vegetables, Legumes (cups)	T0: 2.1 (0.83) T1: 2.2(0.8) T2: 2.3 (0.62) T3: 2.2 (0.4) p=0.469	T0: 2.29 (0.81) T1: 2.01 (0.70) T2: 2.36 (0.39) T3: 2.4 (0.8) p=0.190	p=0.8396
Daily Intake of Dairy (cups)	T0: 1.44 (0.92) T1: 1.3(1.1) T2: 1.40 (0.38) T3: 1.4 (0.4) p=0.877	T0: 1.01 (0.34) T1: 0.85 (0.21) T2: 1.39 (0.44) T3: 1.2 (0.2) p=0.291	p=0.1176
Daily Intake of Added Sugars (teaspoons)	T0: 12.0 (6.4) T1: 7.3 (3.4) T2: 13.9 (3.6) T3: 16.0 (5.6) p=<0.001	T0: 11.6(5.2) T1: 8.07 (3.8) T2: 14.9 (2.1) T3: 12.7 (2.8) p=0.027	p=0.5516
Daily intake of Sugar from Sugar- Sweetened Beverages (teaspoons)	T0: 4.1 (5.9) T1: 1.5 (2.0) T2: 4.9 (1.6) T3: 6.0 (4.5) p=<0.001	T0: 3.8 (2.6) T1: 3.0 (2.9) T2: 4.9 (1.2) T3: 4.2 (0.6) p=0.419	p=0.8542
Daily Whole Grain Intake (ounces)	T0: 0.49 (0.55) T1: 0.52 (0.6) T2: 0.59 (0.22) T3: 0.73 (0.18) p=0.567	T0: 0.48 (0.58) T1: 0.23 (0.14) T2: 0.67 (0.22) T3: 0.70 (0.18) p=0.213	p=0.4399
Daily Fiber Intake (grams)	T0: 12.8 (3.9) T1: 12.4 (3.2) T2: 15.3 (2.7) T3: 15.8 (2.8) p<0.001	T0: 13.2 (5.4) T1: 9.7 (1.0) T2: 14.9 (1.3) T3: 15.8 (2.8) p=0.038	p=0.2404

T0: Baseline; T1: Three months; T2: six months; T3: nine months

Chapter 5: Discussion

The intent of this study was to assess the effectiveness of a mindfulness-enriched weight management program on weight loss maintenance over time. This was accomplished by comparing the mindfulness-enriched program to a standard behavioral weight loss program over twelve weeks of intervention and six additional months of follow-up. It was hypothesized that those in the mindful eating intervention would lose more weight than those who received the standard intervention, and that the mindful eating group would maintain their weight loss significantly better than the standard group at six- and nine-month follow-up evaluations. It was also hypothesized that the mindful eating group will demonstrate significantly better improvements than the standard group in secondary outcome measures such as mindful eating scale scores, physical activity, perceived stress, and general mindfulness between baseline and post intervention assessments.

Both groups produced significant weight loss. However, the two groups were not significantly different at the end of the three-month program, or after the additional six months of follow-up. The impact of change in mindful eating on weight was evident in the mindful group, but this effect did not significantly increase weight loss when compared to the standard weight loss group.

The difference in rates of attrition between the two groups was significant, with the majority of people who were placed into the standard group dropping out. This could be due to the fact that some of those participants were disappointed that they were not placed in the mindfulness group, and did not wish to complete the standard program. This high dropout rate resulted in the standard group being all female by the end of the study,

which limits generalizability to the obese male population. Different recruitment approaches could have reduced this phenomenon, perhaps instead advertising for a generic weight loss program, and shielding participants from the intervention principles. This may eliminate or reduce expectations and group allocation preference.

Initial Impact of Program

Numerous health benefits were produced in the three-month program, for both groups. Both groups lost a significant amount of weight; the mindfulness group lost on average 8.75(7.8) pounds during the three-month program, while the standard group lost an average of 6.35(6.8) pounds. These amounts represent a mean percent body weight loss of 4.1% for the mindfulness group and 3.1% for the standard group.

Although weight loss of greater than 5 – 10% of initial body weight has been shown to yield the most benefits, the AHA/ACC/TOS Guidelines for the Management of Overweight and Obesity do point out that sustained weight loss of even 3 – 5% can result in clinically meaningful reductions in chronic disease risk factors (Jensen et al., 2013). Additionally, ideal intervention lengths for weight loss programs are longer than twelve weeks, with current guidelines recommending at least 14 visits over a time period of least six months, or monthly for 12 months (Jensen et al., 2013). Some studies have conducted three-month interventions, and found similar weight loss results as the current study (Yamauchi et al., 2014).

Improvements in physical activity from baseline to three months were found in both groups as well. The standard group saw greater improvements than the mindfulness group in time spent being active, increasing their activity time by 2438 MET-minutes per

week ($p=0.067$). The mindfulness group increased their activity time on average by 617.6 MET-minutes per week ($p=0.113$). It is important to note, however, that average time spent being physically active was already above current recommendations at baseline for both groups. The Academy of Nutrition and Dietetics' position paper on interventions for the treatment of overweight and obesity in adults recommends a weekly goal of 150 – 420 minutes of moderate to vigorous activity to encourage weight loss and long term weight loss maintenance (AND, 2016). The mindfulness group reported an average of 2017.1(2468.2) MET-minutes of physical activity per week at baseline, while the standard group reported an average of 1019.9(1661.8) MET-minutes. This translates into approximately 500 active minutes per week for the mindfulness group, and 254 active minutes per week for the standard group. In the mindfulness group, increases in physical activity were significantly correlated with reduction in weight and body fat percent. On the other hand, time spent being inactive, as measured by minutes spent sitting, went down significantly in the mindful group ($p<0.001$) but not the standard group ($p=.883$).

Improvements in blood pressure were seen in both groups, but not to a degree to be considered statistically significant. This is likely due to baseline averages being normal. Perhaps if the mean blood pressure levels were high enough to be considered hypertensive, more substantial improvements would have been seen.

In the mindful group, mindful eating and general mindfulness scores went up significantly, while the standard group also saw a significant improvement in mindful eating scores ($p=0.043$), but no significant changes in general mindfulness scores ($p=.923$). Improvements in mindful eating scores were correlated with weight loss in the mindfulness group. Similarly-designed studies comparing a mindful eating program with

a standard diabetes self-management intervention among adults with type 2 diabetes have also found significant improvements in mindfulness measures (Miller et al., 2014).

Reductions in perceived stress scores are also noteworthy. In the mindful group, perceived stress scores went down significantly ($p=0.002$), but not in the standard group ($p=0.260$). This supports the efficacy of using mindfulness in stress management that has been documented numerous times in the research literature (Khoury, Sharma, Rush, & Fournier, 2015). Additionally, weight loss has been found to relieve stress (O'Reilly et al., 2014). Indeed, reduction of perceived stress was correlated with a reduction in weight, body fat percent, and waist circumference in the mindfulness group.

One theory related to the mechanism behind this relationship is effect of emotional eating (Levoy et al., 2017). Under emotional stress, some people may experience disinhibition related to eating, and as a result overeat, which can lead to weight gain over time. Because mindfulness training promotes non-judgmental awareness of the present moment, stress and related emotional eating may be reduced. Related research has produced findings that support this phenomenon. Levoy, Lazaridou, Brewer, and Fulwiler (2017) examined the effect of an eight-week mindfulness-based stress reduction program and found that emotional eating measures were reduced. However, their study did not measure changes in weight during or after the intervention.

In the mindfulness group, changes for all eating behaviors measured by the DSQ were significant except for daily intake of whole grains. None of the changes seen in the standard group, were substantial enough to be statistically significant. Some of these significant changes, however, were not desirable. For instance, daily intake of dairy in the mindfulness group went from 1.44(0.92) cups per day at baseline to 1.3(1.1) cups per day

at three months, while the recommendation is 3 cups per day (US HHS & USDA, 2015). The standard group reduced their dairy intake as well, starting at 1.0 (0.34) cups per day, and ending at 0.85 (0.21) cups per day.

The same phenomenon occurred with fiber intake, where average daily intake for the mindfulness group was reduced from 12.8(3.9) grams per day to 12.4(3.2) grams per day, and from 13.2 (5.4) grams to 9.7 (1.0) grams for the standard group. The 2020 Dietary Guidelines for Americans (DGAs) (US HHS & USDA, 2015) recommend at least 14 grams per 1,000 calories of dietary fiber.

Although daily intake of fruits, vegetables, and legumes did increase significantly in the mindfulness group, this only represents an average increase of 0.2 cups per day, and they were still not meeting the recommendations set by the DGAs of 4.5 cups per day (US HHS & USDA, 2015). On the other hand, improvements in fruit and vegetable intake were significantly correlated with weight loss in the mindfulness group. In the standard group, daily intake of fruits, vegetables, and legumes decreased from 2.29 (0.81) to 2.01 (0.7) cups per day.

Daily intake of added sugars from all sources and sugar-sweetened beverages were reduced significantly in the mindfulness group, to the extent that the average intake was very close to the DGAs. The Guidelines recommend that added sugars be limited to less than 10% of calories per day. For a 1200-calorie diet, which most participants were following during the twelve-week intervention, this would translate to 30 grams, or 7 teaspoons. The mindfulness group began the program taking in an average of 12.0 (6.4) teaspoons per day, and ended the program taking in an average of 7.3 (3.4) teaspoons. The standard group, however, began the program taking in an average of 11.6 (5.2)

teaspoons per day, and ended the program taking in an average of 8.1 (3.8) teaspoons. This reduction was not found to be significant, and was higher than the DGA recommendation.

Within the mindfulness group, some interesting differences were seen between sexes. Women (n=29) saw greater improvements in mindful eating scores than males (n=4), at a significance of $p=0.082$. Additional analysis revealed that weight loss was correlated with improvements in mindful eating ($R=-.541$, $p=0.003$) and perceived stress ($R=0.622$, $p=0.001$) in females, but not males ($R=0.833$, $p=0.167$; and $R=-0.795$, $p=0.205$). This suggests that the mindfulness component of the weight loss program was more impactful in females than it was in males, and this may be due to differences in driving forces between the sexes that lead to overeating.

Long Term Impact of Program

The standard group continued to lose weight after the intervention concluded. The sample size was much smaller than the mindfulness group (n=5), and therefore the impact of each participant's outcome changes was more influential on the group's average.

Despite the average weight loss increasing in the standard group and decreasing in the mindfulness group, the rates of weight maintenance were not different between the groups. Those who regained more than 3% of their baseline body weight at the six-month assessment made up 17.9% in the mindfulness group and 16.7% in the standard group. A Chi square test revealed a p-value of 0.945. At the nine-month assessment, those who had regained more than 3% of their baseline body weight made up 36% of the mindfulness group and 20% in the standard group. A Chi square test revealed a p-value of 0.488.

The six and nine-month assessments showed that many of the significant changes in variables seen within the first three months endured. In the mindfulness group, changes in weight, body fat percent, waist circumference, blood pressure, mindfulness, perceived stress, inactivity, intake of fiber, total added sugars, and sugar-sweetened beverages all remained significantly improved. Changes in physical activity, intake of dairy, fruits, vegetables, and legumes were previously significant at three months, but these improvements did not sustain over time. Changes in whole grain consumption were not significant at any of the follow-up assessments.

In the standard group, changes in weight over time, surprisingly, were found to be statistically insignificant ($p=0.083$). One might argue, however, that clinical significance cannot be denied, as average weight over time continued to decrease over time. Changes in waist circumference remained significantly improved, while changes in intake of total added sugars and fiber improved substantially to be considered significant, even though they were not significant at three-months. Changes for the remainder of outcome measures remained insignificant.

Despite apparent differences in outcomes between the two groups, an additional repeated measures analysis that accounted for time, attrition, and difference in sample size revealed that there were no significant differences in the groups' long term outcomes, even those measures related to mindfulness. While the differences over time within each group were mostly significant over the entire nine-month study, the between-group changes were not.

Strengths & Limitations

A strength of this study was the use of evidence-based information for both intervention groups provided by an experienced Registered Dietitian. An additional strength of the study was the use of valid and reliable scales to assess mindfulness, stress, physical activity, and diet. A final strength of this study is the evaluation of participants three and six months after the conclusion of the three-month weight loss program. Conducting follow-up assessments can help assess the likelihood of long term weight maintenance.

The main limitations of this study were the small sample size of participants, and the high, uneven rate of attrition. A larger sample size would have provided a more adequate representation of the population. In addition, participants were mostly highly educated white females, with a high income. Out of the 53 participants who initiated the study, 13 discontinued. Out of those 13, 10 were in the group that received the standard weight loss program. This means that 58.8% (n=10) of participants in the standard group did not complete the study, while only 8.3% (n=3) of participants in the mindful group did not complete the study. Attrition is usually less than 15% in most weight loss studies (Rehackova et al, 2016). Due to participant drop outs, the standard group concluded the study with no males in the sample. Those who discontinued the study tended to be of a lower weight, and had a mean annual income that was higher. A final limitation was that the study sample was not randomly selected; participants were recruited through print newspaper, radio, and online advertising methods.

Conclusion

Both intervention groups were pilot programs, although created from evidence-based information and a well-established federal program. Refinement and repetition of these programs may build on and validate the findings of the current study. Use of a larger, more diverse sample size would help improve generalizability. Administration of the program to minorities and people of lower socioeconomic status is needed, since these populations tend to be disproportionately affected by the burden of obesity.

Best practices for weight loss and weight loss maintenance continue to be an important topic of future research, as the rates of obesity worldwide remain a threat to public health. This study demonstrated that current best practices are indeed effective at achieving weight loss and weight loss maintenance, but that there are additional, less obvious interactions that impact long-term outcomes. Future studies on the topic may add to the growing body of evidence that supports mindfulness practice as an important part of health.

UNIVERSITY OF KENTUCKY RESEARCH



Need help losing weight?

Want to learn more about mindful eating?

Researchers at the University of Kentucky are conducting a study to compare traditional weight loss strategies with a mindful eating-focused weight loss program.

You may be eligible to participate if you:

- Are 25-65 years old;
- Are at least 20 pounds overweight;
- Are relatively healthy; and
- Have not lost more than 10 pounds in the last 6 months.



Please note: there are other eligibility requirements for which participants will be screened.

For more information, please contact:
Teresa Lee, RD, LD
859-619-3640
teresalee@uky.edu



www.UKclinicalresearch.com

Appendix B: Telephone Screening Form

Script: “Thank you for your interest in taking part in our study, which is being conducted by myself, Teresa Lee, a graduate student in the Department of Dietetics and Human Nutrition at the University of Kentucky. By doing this study, we hope to learn which of two approaches works better for weight loss and weight loss maintenance over time. There are certain requirements we are looking for in study participants, so we need to conduct this screening phone call. This should take about 5 minutes. I need to ask some personal questions which might make you feel uncomfortable. You will not gain any benefit from completing this screening phone call. Passing this screening phone call and attending the informational session does not guarantee inclusion in the study. Your height and weight must be verified when for you to enter the study. The information you give will only be seen by me, and I will make every effort to keep confidential all research records that identify you. We may be required to show information that identifies you to people at the University of Kentucky to verify that we are conducting this research in an ethical manner. You will not be able to participate in the study without first undergoing this screening process. You are free to hang up now if you do not want to proceed. You are also free to stop this conversation at any time during the screening process. If you would like, I can give you the contact information for the university’s office of research integrity if you have any questions about your rights as a volunteer in this study.

Are you interested in proceeding? ___ YES ___ NO

I need to ask you a series of questions to determine your eligibility for our study. I will read through all of them and if you can answer “yes” to any of them, please let me know, because unfortunately you cannot take part in this study. You do not have to tell me which one you answer “yes” to.

Are you currently pregnant or breastfeeding? Do you currently have a child under the age of 9 months?

Are you planning on becoming pregnant in the next 12 months?

Have you ever been diagnosed with HIV, cancer, anorexia or bulimia, schizophrenia or bipolar disorder?

Have you ever been hospitalized for a psychiatric disorder or are you taking any anti-psychotic medications?

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

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

In the past month, have you had chest pain when you were not doing PA?

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

Do you have a bone or joint problem (for example, back, knee, or hip) that could be made worse by a change in your physical activity?

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

Height: _____ # Weight: _____ in. BMI: _____ (28-45 eligible)

Have you gained or lost weight in the last six months? Gained—Stayed the Same—Lost

If lost weight, how much (in last 6 months)? _____ (> 10 lbs: **ineligible**)

Do you have a smart phone that you use applications on? YES – NO

Are there any foods that you avoid for any reason? If yes: _____

Name: _____ Date: _____

Best phone: _____ Email: _____

What is your preferred method of contact? Phone / email / text

Date of Birth/age: _____ (**25-65 years eligible**)

When are you available to attend meetings?

Weekday evenings – Weekday mornings – Weekday afternoons – weekend mornings – weekend afternoons

Eligible: **Yes** **No**

Orientation Session Time and Date: _____

Comments:

Appendix C: Questionnaires with Coding

Basic Demographics

Gender:

- Female = 1
- Male = 2

Race/Ethnicity:

- African American/African/Black/Caribbean = 1
- Asian/Pacific Islander = 2
- Caucasian/White = 3
- Hispanic/Latino = 4
- Native American = 5
- Other = 6

Education Level:

- Less than high school = 1
- High school diploma/GED = 2
- Some college = 3
- College graduate = 4
- Some graduate school = 5
- Completed graduate school = 6

Annual Household Income:

- Less than \$25,000 = 1
- \$25,000 – \$49,999 = 2
- \$50,000 – \$99,999 = 3
- \$100,000 or greater = 4

Are you a UK Employee?

- YES = 1
- NO = 2

International Physical Activity Questionnaire

Question Part 1

_____ days per week = 1 – 7

_____ No vigorous job-related physical activity = 0

Question part 2

_____ hours per day = put everything in minutes

_____ minutes per day

_____ don't know/not sure = leave blank

Mindful Eating Scale

	Never	Some- times	Often	Usually
I become very short tempered if I need to eat. <u>REVERSE</u>	1	2	3	4
I snack without being aware that I'm eating. <u>REVERSE</u>	1	2	3	4
I multitask while eating. <u>REVERSE</u>	1	2	3	4
I don't pay attention to what I'm eating because I'm daydreaming, worrying, or distracted. <u>REVERSE</u>	1	2	3	4
I need to eat like clockwork. <u>REVERSE</u>	1	2	3	4
I can tolerate being hungry for a while.	1	2	3	4
I tell myself I shouldn't be hungry. <u>REVERSE</u>	1	2	3	4
I criticize myself for the way I eat. <u>REVERSE</u>	1	2	3	4
When I get hungry, I can't think about anything else. <u>REVERSE</u>	1	2	3	4
I have a routine for what I eat. <u>REVERSE</u>	1	2	3	4
I tend to evaluate whether my eating is right or wrong. <u>REVERSE</u>	1	2	3	4
I eat the same thing for lunch every day. <u>REVERSE</u>	1	2	3	4
I notice how my food looks.	1	2	3	4
I eat something without really being aware of it. <u>REVERSE</u>	1	2	3	4
I stay aware of my food while I'm eating.	1	2	3	4
I wish I could control my hunger. <u>REVERSE</u>	1	2	3	4
It's easy for me to concentrate on what I'm eating.	1	2	3	4
I notice the smells and aromas of food.	1	2	3	4
I eat the same thing on the same day of each week. <u>REVERSE</u>	1	2	3	4
I eat between meals	1	2	3	4
Once I've decided to eat, I have to eat straight away. <u>REVERSE</u>	1	2	3	4
I have a routine for when I eat. <u>REVERSE</u>	1	2	3	4
I wish I could control my eating more easily. <u>REVERSE</u>	1	2	3	4
I snack on food when I'm bored. <u>REVERSE</u>	1	2	3	4
I eat automatically without being aware of what I'm eating. <u>REVERSE</u>	1	2	3	4
I notice flavors and textures when I'm eating my food.	1	2	3	4
I eat at my desk or computer. <u>REVERSE</u>	1	2	3	4
I tell myself I shouldn't be eating what I'm eating. <u>REVERSE</u>	1	2	3	4

Five Facet Mindfulness Questionnaire

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

1	2	3	4	5
Never or very rarely true	Rarely true	Sometimes true	Often true	Very often or always true

_____ 1. I'm good at finding words to describe my feelings.

_____ 2. I can easily put my beliefs, opinions, and expectations into words.

_____ 3. I watch my feelings without getting lost in them.

REVERSE 4. I tell myself I shouldn't be feeling the way I'm feeling.

REVERSE 5. It's hard for me to find the words to describe what I'm feeling.

_____ 6. I pay attention to sensations, such as the wind in my hair or the sun on my face.

REVERSE 7. I make judgements about whether my thoughts are good or bad.

REVERSE 8. I find it difficult to stay focused on what's happening in the present.

_____ 9. When I have distressing thoughts, I 'step back' and am aware of the thought without getting taken over by it.

REVERSE 10. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.

REVERSE 11. It seems I am running on automatic without much awareness of what I'm doing.

_____ 12. When I have distressing thoughts, I can feel calm soon after.

REVERSE 13. I tell myself I shouldn't be feeling the way that I'm feeling.

_____ 14. I notice the smells and aromas of things.

_____ 15. Even when I'm feeling upset, I can find a way to put it into words.

REVERSE 16. I rush through activities without really being attentive to them.

_____ 17. When I have distressing thoughts I am able to just notice them without reacting.

DIETARY SCREENER QUESTIONNAIRE

These questions are about foods you ate or drank during the past month, that is, the past 30 days. When answering, please include meals and snacks at home, at work or school, in restaurants, and anyplace else.

Mark an to indicate your answer. To change your answer, completely fill the box for the incorrectly marked answer (). Then mark an X in the correct one. Your answers are important.

● How old are you (in years)?

--	--	--

years

● Are you male or female?

- Male
 Female

● During the past month, how often did you eat **hot or cold cereals**? *Mark one .*

- Never → **Go to question 4.**
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2 or more times per day

● During the past month, what kind of cereal did you usually eat? – *Print cereal.*

● If there was another kind of cereal that you usually ate during the past month, what kind was it? – *Print cereal, if none leave blank.*

● During the past month, how often did you have any **milk** (either to drink or on cereal)? Include regular milks, chocolate or other flavored milks, lactose-free milk, buttermilk. Please do **not** include soy milk or small amounts of milk in coffee or tea. *Mark one .*

- Never → **Go to question 8.**
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2-3 times per day
 4-5 times per day
 6 or more times per day

● During the past month, what kind of milk did you usually drink? *Mark one .*

- Whole or regular milk
 2% fat or reduced-fat milk
 1%, ½%, or low-fat milk
 Fat-free, skim or nonfat milk
 Soy milk
 Other kind of milk – *Print milk.*

● During the past month, how often did you drink **regular soda or pop** that contains sugar? Do **not** include diet soda. *Mark one .*

- Never
- 1 time last month
 2-3 times last month
- 1 time per week
 2 times per week
 3-4 times per week
 5-6 times per week
- 1 time per day
 2-3 times per day
 4-5 times per day
 6 or more times per day



9 During the past month, how often did you drink **100% pure fruit juices** such as orange, mango, apple, grape and pineapple juices? Do **not** include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. *Mark one* .

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you drink coffee or tea that had **sugar** or **honey** added to it? Include coffee and tea you sweetened yourself and presweetened tea and coffee drinks such as Arizona Iced Tea and Frappuccino. Do **not** include artificially sweetened coffee or diet tea.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you drink **sweetened** fruit drinks, sports or energy drinks, such as Kool-Aid, lemonade, Hi-C, cranberry drink, Gatorade, Red Bull or Vitamin Water? Include fruit juices you made at home and added sugar to. Do **not** include diet drinks or artificially sweetened drinks.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

During the past month, how often did you eat **fruit**? Include fresh, frozen or canned fruit. Do **not** include juices.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat a green leafy or lettuce **salad**, with or without other vegetables?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



14 During the past month, how often did you eat any kind of **fried potatoes**, including french fries, home fries, or hash brown potatoes?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any **other kind of potatoes**, such as baked, boiled, mashed potatoes, sweet potatoes, or potato salad?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat refried beans, baked beans, beans in soup, pork and beans or any other type of cooked dried beans? Do **not** include green beans.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **brown rice** or other cooked whole grains, such as bulgur, cracked wheat, or millet? Do **not** include white rice.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, not including what you just told me about (green salads, potatoes, cooked dried beans), how often did you eat **other vegetables**?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you have Mexican-type **salsa** made with tomato?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



20 During the past month, how often did you eat **pizza**? Include frozen pizza, fast food pizza, and homemade pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you have **tomato sauces** such as with spaghetti or noodles or mixed into foods such as lasagna? Do not include tomato sauce on pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any kind of **cheese**? Include cheese as a snack, cheese on burgers, sandwiches, and cheese in foods such as lasagna, quesadillas, or casseroles. Do **not** include cheese on pizza.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **red meat**, such as beef, pork, ham, or sausage? Do **not** include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures. Red meats may also include veal, lamb, and any lunch meats made with these meats.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat any **processed meat**, such as bacon, lunch meats, or hot dogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures.

Processed meats are those preserved by smoking, curing, or salting, or by the addition of preservatives. Examples are: ham, bacon, pastrami, salami, sausages, bratwursts, frankfurters, hot dogs, and spam.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



25 During the past month, how often did you eat **whole grain bread** including toast, rolls and in sandwiches? Whole grain breads include whole wheat, rye, oatmeal and pumpernickel. Do **not** include white bread.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

26 During the past month, how often did you eat **chocolate** or any other types of candy? Do **not** include sugar-free candy.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **doughnuts**, sweet rolls, Danish, muffins, pan dulce, or pop-tarts? Do **not** include sugar-free items.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **cookies, cake, pie or brownies**? Do **not** include sugar-free kinds.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **ice cream or other frozen desserts**? Do **not** include sugar-free kinds.

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

During the past month, how often did you eat **popcorn**?

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



Perceived Stress Scale

The following questions ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0 = Never	1 = Almost Never	2 = Sometimes	3 = Fairly Often	4 = Very Often
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1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and 'stressed'?	0	1	2	3	4
<u>4. In the last month, how often have you felt confident about your ability to handle your personal problems? REVERSE</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>5. In the last month, how often have you felt that things were going your way? REVERSE</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
<u>7. In the last month, how often have you been able to control irritations in your life? REVERSE</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>8. In the last month, how often have you felt that you were on top of things? REVERSE</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Appendix D: Weight Loss Program Weekly Topics

	Standard Program Topic	Mindfulness-Enriched Program Additional Topic
Week 1	Introduction, self-monitoring	Cultivating attention and intention
Week 2	Healthy eating, meal planning	Body scan, layers of the mind
Week 3	Increasing activity	Cultivating loving-kindness
Week 4	Managing stress	Mindful stress management
Week 5	Metabolism	Automatic eating
Week 6	Portion control	Understanding hunger
Week 7	Overcoming setbacks	A cure for emotional eating
Week 8	On the go tips	Mind over menu
Week 9	Cooking at home	Mindful food preparation
Week 10	Benefits of weight loss	Changing thought patterns
Week 11	Love your body	Building mindful self-compassion
Week 12	Summary & Conclusion	Lifelong mindfulness

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Vita
Teresa Margaret Lee, RD, LD

EDUCATION

University of Kentucky - Lexington, Kentucky

Master of Science in Nutrition and Food Systems, Pending Completion

- Anticipated graduation May 2017

Bachelor of Science in Dietetics, August 2011

- University Honors – Cum Laude

Coordinated Program Dietetic Internship, January – July 2011

- Community Nutrition Rotation: University of Kentucky Cooperative Extension Service
- Medical Nutrition Therapy Rotation: Saint Joseph Hospital, Lexington, Kentucky
- Food Service Systems Management Rotation: Saint Joseph Hospital, Lexington, Kentucky

EMPLOYMENT

University of Kentucky Department of Dietetics & Human Nutrition

Dates: August 2015 - present

Position: Teaching Assistant – Full time, 20 hours per week

Flaget Memorial Hospital – Bardstown, Kentucky

Dates: August 2011 – August 2015

Positions: Registered Dietitian — Part Time (24 hours weekly)

University of Kentucky Health & Wellness Program – Lexington, Kentucky

Dates: August 2014 – January 2016

Position: Wellness Guide, Health & Wellness Program – Part Time (16 – 24 hours weekly)

Central Baptist Hospital – Lexington, Kentucky

Dates: May 2012 – May 2013

Position: Outpatient Oncology Dietitian—Part Time (16 hours weekly)

Good Foods Co-op—Lexington, Kentucky

Dates: March 2005 – present

Positions: Customer Service Associate, Cashier, Scanning Clerk; Part Time (weekly hours vary)

PROFESSIONAL CREDENTIALING & OTHER CERTIFICATIONS

- **Registered Dietitian** Academy of Nutrition and Dietetics' Commission on Dietetic Registration; ID# 1036846
- **Licensed Dietitian** Kentucky Board of Licensure and Certification for Dietitians and Nutritionists; License #2424
- Advanced Cardiovascular Life Support Certified
- National Provider Identifier # 1790036168

PROFESSIONAL MEMBERSHIPS

- Academy of Nutrition & Dietetics* 2007 – present
- Weight Management Dietetic Practice Group
 - Mentor Program Volunteer, Coaching Subunit Volunteer
 - Oncology Nutrition Dietetic Practice Group
- Kentucky Academy of Nutrition & Dietetics* 2007 – present
- Bluegrass Academy of Nutrition & Dietetics* 2008 – present
- Board Positions: Membership Committee Chair & Job Coordinator, June 2014 – present
- University of Kentucky Student Dietetic Association* 2007 – 2011
- Board Position: Hunger Chair, 2009 - 2010

AWARDS

- Bluegrass Academy of Nutrition and Dietetics Emerging Dietetic Leader Award, February 2017
- University of Kentucky School of Human Environmental Sciences Alice P. Killpatrick Fellowship, Spring 2017 & Fall 2016
- Bluegrass Academy of Nutrition and Dietetics Special Contribution Award, February 2016
- Bluegrass Academy of Nutrition and Dietetics Scholarship Award, February 2016
- University of Kentucky Dean’s List, Fall 2008, Fall 2009, Spring 2010, Fall 2010

SPEECHES & PRESENTATIONS

- “Mindfulness and Weight” Bluegrass Academy of Nutrition and Dietetics Seminar, February 18, 2017
- “Comparing Mindfulness-Based Weight Management to Current Standard Practices,” HES Research Luncheon Presentation, November 4, 2016.
- “Trim Down, Bardstown!” Community Weight Loss Program facilitator, January – April 2014. Created curriculum and led each class throughout the 12-week program.
- “Nutrition for Breast Cancer Prevention” Flaget Mother-Daughter Luncheon, Bardstown, Kentucky, February 12, 2012
- “Nutrition and Autoimmune Disease” National MS Society Healthy Steps Lunch Bunch, Lexington, Kentucky, July 21, 2011
- “Engaging Nutrition Students in Fighting World Hunger—An Undergraduate Student Reflection” Kentucky Dietetic Association Food and Nutrition Conference and Exhibition, Louisville, Kentucky, April 14, 2011
- HES Research Luncheon Presentation, The Kentucky Academy School Feeding Program, February 2011.

PUBLICATIONS

JT Mullins, T Stephenson, **T Cox**. “Engaging Dietetic and Nutrition Students in Fighting Hunger” *Journal of the American Dietetic Association*, Volume 111, Issue 9, Supplement, Page A99, September 2011.

