

Research Article

Mindful Eating and Weight Loss, Results from a Randomized Trial

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Abstract

More than one-third of the US adult population is obese. Mindful eating is a possible strategy for weight management. The purpose of the current study was to examine the effectiveness of Eat Smart, Move More, Weigh Less (ESMMWL) in increasing mindful eating as measured by the Mindful Eating Questionnaire (MEQ). The secondary objective was to investigate the relationship between mindful eating and weight loss. Participants were part of a randomized controlled trial that evaluated the effectiveness of ESMMWL, a real-time online, 15-week weight management program. A total of 80 state employees and teachers in North Carolina (intervention group = 42, wait-list control group = 38) participated in the study. The primary outcome was mindful eating as measured by the MEQ, a 28-item questionnaire that assesses five domains of mindful eating. All analyses were performed using SPSS software. Independent samples t-tests and X2 tests were used to compare baseline measures for intervention and waitlist control groups. Analyses of covariance with baseline measure as covariates were conducted to compare change in mindfulness scores between the two groups. Mean mindfulness scores were analyzed using repeated measures ANOVA with Greenhouse-Geisser correction for violations of sphericity. The relationship between weight loss and mindfulness was analyzed with Pearson correlations. Results indicated that ESMMWL participants lost more weight than participants in the waitlist control group. For all subscales and the summary score, participants who completed ESMMWL had a significantly larger increase in their mindfulness scores than those in the waitlist control group. Study results suggest that there is a beneficial association between mindful eating and weight loss. This study contributes to the mindfulness literature as few studies have employed rigorous methodology to examine the effectiveness of an intervention on mindful eating.

INTRODUCTION

In the United States, obesity affects more than one-third of the adult population [1]. Being categorized as overweight or obese increases the risk of chronic disease including hypertension, type 2 diabetes, and cardiovascular disease [2,3]. Evidence suggests that weight loss in individuals who are overweight or obese may prevent or reduce many of the risk factors for chronic illness [4-10].

There are a number of weight loss strategies that may be employed including caloric restriction, physical activity, pharmacotherapy, or weight loss surgery. Public health guidelines recommend a combination of reducing caloric intake, increasing physical activity, and behavior modification therapy for successful weight management [11]. Specifically, various public health organizations support the small changes approach [12], which emphasizes the combination of diet and physical activity and suggest incremental reductions in energy intake and increases in energy expenditure to prevent gradual weight gain and/or promote gradual weight reduction [13]. In recent years, mindful eating, including increasing one's awareness and focus on eating, paying attention to hunger and satiety cues, planning meals and snacks, and eating as a singular activity, has been introduced as a possible strategy for weight management.

Within the past decade, there has been an increase in the literature associating mindfulness with reduction in obesity as well as mindfulness as a component of eating disorder treatment [14]. The practice of mindfulness has also been applied to the reduction of food cravings [15,16], portion control [17], and reduction in BMI [18-22] and weight [18,19,21,22]. Mindfulness refers to the learned ability to be open, accepting, and attentive to the moment and, in relation to eating, it refers to an individual maintaining a "non-judgmental awareness of [one's] physical and emotional sensations while eating or in a food-related environment" [23]. An increase in mindful eating is stated to increase sensitivity to the physiological signs of hunger, satiety cues, pace of eating, the food environment, and food characteristics [17,23,24]. Furthermore, when examining the change in mindfulness, studies found that participants who scored high in mindfulness also had lower problematic eating behaviors [15] and reported fewer serving sizes of energy dense foods [17]. The evidence suggests that mindfulness-based weight loss interventions had an impact on reducing weight and BMI [18-22] but there is a need for additional research. Specifically, there is a need for more published studies that examine the relationship between a validated measure of mindfulness and weight change [25].

The purpose of the present study was to examine the effectiveness of Eat Smart, Move More, Weigh Less Online (ESMMWL) in increasing mindful eating as measured by the Mindful Eating Questionnaire (MEQ) [23] after individuals participate in a 15-week weight management program that incorporates mindful eating techniques. The secondary objective was to investigate the relationship between mindful eating, as indicated by the MEQ, and weight loss.

METHODS

Sample

A total of 80 (69 female, 11 male) state employees and teachers with benefits through the North Carolina State Health Plan for Teachers and State Employees were recruited to participate in the randomized trial, which has been previously described [26]. Sample size was calculated based on estimated weight loss and completion rates as estimated by previous data from this program. For 80% power, $\alpha=0.05$, two-sided t-test, a sample size of 46 participants (23 per group) was needed. Participants were recruited via email and phone from the registration lists of an online weight management program offered between January and February 2013. In order to participate, individuals were required to: be over 18 years of age, have a BMI ≥ 25 , have weekly access to a computer with high-speed internet, have English language proficiency, and be willing to accept a random group assignment. Exclusion criteria included: current enrollment in another weight management program, pregnancy, weight loss of ≥ 4.5 kg in the past year, taking medication known to affect body weight, having a friend or relative that lives in the same household already enrolled in the study, previous participation in the online weight management program being evaluated, surgery in the past 3 months or surgery scheduled within the next 8 months, or limited mobility that would make physical activity difficult.

Design

Participants were recruited as a part of a randomized controlled trial evaluating the effectiveness of an online weight management program. Individuals who met the eligibility criteria were invited to meet with the project coordinator to learn more about the study. Following the first meeting, study participants were randomized, using a computerized random number generator, to the intervention ($n = 42$) or wait-list control group ($n=38$). Class instructors were not part of the research staff and were blind to whether participants in their class were enrolled in the study. Additional details of the study design have been previously published [26]. Participants met with research staff in-person at three time points (pre-participation, post-participation, and six-month follow-up) in which mindful eating and weight were assessed. Participants assigned to the wait-list control group were not offered the ESMMWL program during the first 15 weeks following recruitment when the intervention group participated in the program. Once the intervention group completed the program, the wait-list control group also participated in the same program. Data were collected between December 2012 and April 2014. All study procedures were approved by the Institutional Review Board of NC State University and participants provided written informed consent during the initial study assessment.

Intervention

The ESMMWL program discussed 'living mindfully' as part of the equation to achieve and maintain a healthy weight (*Planning + Tracking + Living Mindfully = Achieving and Maintaining a Healthy Weight*). Living mindfully encompasses all aspects of our lives; however, the ESMMWL program focused on mindfulness as it relates to healthy eating and physical activity. The concepts of mindful eating, in particular, were woven throughout the ESMMWL 15-week curriculum. At the beginning of each weekly lesson, the instructor encouraged participants to reflect on how mindful they were over the last seven days about incorporating different healthy eating strategies such as using a smaller plate or taking time to assess their hunger level. Throughout the program, participants were also reminded and encouraged to track the foods and beverages they consumed on a daily basis, including how they felt before and after eating. Several times during each lesson, mindfulness related to the week's topic was discussed. Participants were provided with concrete ways to eat more mindfully. Examples of how mindful eating concepts were presented within the 15 weekly lessons are presented in Table 1.

Measures

The primary outcome was mindful eating as measured using the MEQ [23] administered via Survey Monkey®. Survey Monkey is a secure method of collecting data. All data were stored on computers protected by a secure network. The 28-item self-report questionnaire assesses five domains of mindful eating: disinhibition (the inability to stop eating even when full), external cues (eating in response to environmental cues), emotional response (eating in response to negative emotional states), awareness (being aware of and appreciating the effects of food on the senses, being aware of how food affects internal states), and distraction (focus on other activities while eating). Using a 4-point Likert scale (ranging from 1 = "never/rarely" to 4 = "usually/always"), subscale scores were calculated as the mean of items within that scale and the summary score was calculated as the average of the five subscale scores. Higher scores indicated greater mindful eating skills after the appropriate items were reverse coded. For this study, Cronbach's alpha for the five subscales at pretest ranged from 0.54 to 0.79 and the Cronbach's alpha for the overall scale was 0.45.

Weight was measured without shoes in lightweight street clothing using a portable scale (Cardinal Detecto model DR150/400; Cardinal, Webb City, MO).

Analysis

All analyses were performed using SPSS software (version 21; IBM Corp, Armonk, NY). Data from ESMMWL completers ($n=28$) and waitlist controls ($n=36$) were included in the analyses. Across the intervention and wait list control groups, 16 participants were removed from the final analysis due to: loss to follow-up, discontinuation of the intervention, or not completing 10 of 15 class sessions of the ESMMWL program. Means and frequency distributions were used to describe participant characteristics. Independent samples t-tests and X^2 tests were used to compare baseline measures for intervention and waitlist control groups. Analyses of covariance with baseline measure as covariates were

Table 1: Inclusion of Mindful Eating Concepts in Eat Smart, Move More, Weigh Less Curriculum.

| Lesson Number and Title | Inclusion of Mindful Eating Concepts |
|--|--|
| Lesson # 1 Introduction | <ul style="list-style-type: none"> • The program was introduced as one that will help participants learn how living mindfully can help achieve and maintain a healthy weight. The program employed the concept of “living mindfully” as part of the following equation: <i>Planning + Tracking + Living Mindfully = Achieving and Maintaining a Healthy Weight.</i> • The importance of tracking was introduced in this lesson in order to help increase mindful eating. Participants were asked to track the foods and beverages they consumed, the amount, the calories and how they felt before and after eating. • Mindful eating was defined in the program as “eating with awareness, awareness of what is on your plate and also of the entire eating experience. It is being present in the moment and enjoying every aspect of the meal you are eating.” • Simple strategies to help increase mindful eating were introduced: <ul style="list-style-type: none"> ○ Eat without distractions. ○ Eat while sitting down. ○ Eat slowly and enjoy every bite. ○ Make each meal last at least 20 minutes. • The weekly homework assignment assigned to all participants was to be more mindful of eating habits by tracking all of the foods and beverages they consume during the week. |
| Lesson # 2 Make Your Commitment | <ul style="list-style-type: none"> • At the beginning of the lesson, participants were asked to reflect and share answers to the following questions: <ul style="list-style-type: none"> ○ What did you do to be more mindful about what you ate and drank? ○ Did you find that tracking your food and beverage intake helped to improve mindful eating? • Participants were encouraged to develop and record their SMART goal in the Personal Record in order to be more mindful about improving eating habits during the program. • Participants were asked to respond to questions about their home eating environment in order to be more aware about which mindful eating strategies they should address in the program. |
| Lesson # 3 Re-think Your Drink | <ul style="list-style-type: none"> • Participants were asked to guess the amount of sugar in popular beverages to help them be more mindful about the large amount of calories consumed in drinks. • Participants were asked to think about how many sugar-sweetened beverages they consume per day to improve mindful eating and drinking. |
| Lesson # 4 Eat Fewer Calories | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how mindful they were about making changes in their sugar-sweetened beverage consumption (<i>previous week's lesson topic</i>) during the past week. • Participants were taught the serving size for a serving of meat - <i>a three-ounce portion of chicken, beef, pork or fish is about the size of your palm or a deck of cards</i> - in order to improve mindful eating by controlling portion sizes. |
| Lesson # 5 Move More | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how mindful they were about eating fewer calories (<i>previous week's lesson topic</i>) during the past week. |
| Lesson # 6 Check the Facts | <ul style="list-style-type: none"> • The lesson was introduced by describing that one of the best ways to improve mindful eating is to “become a label reader.” |
| Lesson # 7 Enjoy More Fruits and Vegetables | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they used nutrition labels (<i>previous week's lesson topic</i>) to improve mindful eating about the foods they consumed during the past week. • An illustration was provided comparing how many more fruits and vegetables one can consume for the same amount of calories and much more fiber compared to other processed, snack foods (<i>e.g., 35 grape tomatoes have the same amount of calories as 10 potato chips or three peanut butter crackers and twelve times the fiber</i>) in order to improve mindful eating. • Participants were asked to think about how many servings of fruits and vegetables they consume per day compared to how many are recommended in order to improve mindful eating. |
| Lesson # 8 Right-Size Your Portions | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they incorporated more fruits and vegetables into their day (<i>previous week's lesson topic</i>) to improve mindful eating. • Strategies were introduced to help participants decrease portion sizes in order to improve mindful eating such as: <ul style="list-style-type: none"> ○ Measure your portions. ○ Do not serve family style. ○ Do not eat directly from containers or bags. ○ Use smaller plates, bowls or glasses. ○ Do not eat while doing other things like watching TV or driving. • The Hunger Scale was presented to help participants improve mindful eating by eating when hungry instead of out of habit. |

| | |
|---|--|
| Lesson # 9 Plan, Shop, Fix and Eat | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about portion control (<i>previous week's lesson topic</i>) to improve mindful eating. • Participants were asked to think about how many times per week they consume a meal or a snack away from home in order to improve mindful eating. Increasing awareness of how often they eat out is important to help participants adopt strategies to plan, shop, fix and eat more meals at home. • The concept was introduced that being mindful of <i>what</i> we eat, <i>where</i> we eat and <i>when</i> we eat can help us eat healthy and improve mindful eating. • The Family Spotlight in this lesson presented the concept that mindful eating can be improved by teaching children that meals should be slow and enjoyable times for sharing. |
| Lesson #10 Eat Out Less | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about planning meals and snacks in order to increase the amount of meals and snacks eaten at home (<i>previous week's lesson topic</i>) to improve mindful eating. • Illustrations were presented comparing the calorie difference between a meal eaten at home vs. a meal eaten from a fast-food restaurant and showing how portion sizes served in restaurants have greatly increased over the years. • The strategy to “prepare before you go” was presented to encourage participants to look at the menu options and nutrition information before dining out to improve mindfulness about making a healthy choice when eating at a restaurant. • The strategy to “think before you order” was presented to encourage participants to assess hunger levels before ordering in order to practice portion control and mindful eating when dining out. |
| Lesson # 11 Move Strong | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about reducing calories consumed while dining out or eating out less (<i>previous week's lesson topic</i>) to improve mindful eating. |
| Lesson # 12 Start Smart | <ul style="list-style-type: none"> • Participants were encouraged to think about how often they eat breakfast in order to improve mindful eating. • Participants were asked to guess how many calories are in some common fast-food breakfast foods in order to increase awareness about the large amount of calories in these items and improve mindful eating. |
| Lesson # 13 Reduce Screen Time | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about eating a healthy breakfast (<i>previous week's lesson topic</i>) to improve mindful eating. • The concept of ‘mindless eating’ was presented as a concept closely associated with screen time in that eating in front of the TV or computer prevents us from paying attention to how much we are eating and how full we are, resulting in additional calories consumed per hour. • Participants were encouraged to improve mindful eating by being more aware of the way that food and drink ads make them feel; e.g., does hunger increase as a result of the food shown on TV or commercials? |
| Lesson # 14 Pack Smart Lunches | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about not eating in front of a screen and reducing screen time overall (<i>previous week's lesson topic</i>) to improve mindful eating. • Participants were encouraged to think about how often they bring lunch from home/eat lunch at home in order to increase awareness about their eating habits and improve mindful eating. • Participants were asked what they do when they don't take a break for lunch in order to increase awareness about their eating habits and improve mindful eating. • Participants were asked to think about what they typically eat for lunch/snacks in order to increase awareness about their eating habits and improve mindful eating. |
| Lesson # 15 Keep Your Commitment | <ul style="list-style-type: none"> • Participants were encouraged to reflect and share with the group how they were more mindful about packing and eating a healthy lunch (<i>previous week's lesson topic</i>) to improve mindful eating. • Participants were reminded that the goal of Eat Smart, Move More, Weigh Less is to plan, track and live mindfully (including <i>mindful eating</i>) to achieve a healthy weight. • Participants were encouraged to keep their commitment to live mindfully and were reminded that <i>mindfulness</i> means paying attention to the events, activities and thoughts that make up their daily life and continuing to live mindfully will help them keep their commitment to eat smart [and move more]. • Participants were reminded of simple strategies to improve mindful eating covered in the program earlier. |

conducted to compare change in mindfulness scores between intervention and control groups. Data from completers in the intervention and waitlist control (n=48) groups were combined to examine increases in mindfulness scores. Mean mindfulness scores from pre-participation, post-participation, and six-month follow-up were analyzed using repeated measures ANOVA with Greenhouse-Geisser correction for violations of sphericity. The relationship between weight loss and mindfulness was analyzed with Pearson correlations.

RESULTS AND DISCUSSION

The demographic characteristics of the participants are in Table 2. Most participants were female and Caucasian. Over three quarters completed at least a bachelor's degree and nearly three quarters had incomes greater than \$50,000. There were no significant differences between intervention and control participants for baseline weight (Table 2) and mindfulness scores (Table 3), with the exception of the emotional subscale of the MEQ (control = 2.9, intervention = 2.4, p=.003).

Table 2: Baseline Characteristics of Eat Smart, Move More, Weigh Less (ESMMWL) and Control Group Participants.

| | ESMMWL (n = 28) | Control Group(n=36) | P value |
|------------------------------------|-----------------|---------------------|---------|
| Age, years, mean (SD) | 47.6 (11.9) | 48.2 (8.7) | 0.81 |
| Sex | | | |
| Female, n (%) | 22 (78.6) | 32 (88.9) | 0.31 |
| Race, n (%) | | | |
| African American | 6 (21.4) | 11 (30.5) | 0.28 |
| Caucasian | 22 (78.6) | 23 (63.9) | |
| Other | 0 (0.0) | 2 (5.6) | |
| Education, n (%) | | | |
| High school graduate | 1 (3.6) | 1 (2.8) | 0.91 |
| Some college or Associate's degree | 6 (21.4) | 6 (16.7) | |
| Bachelor's degree | 8 (28.6) | 9 (25.0) | |
| Graduate or professional degree | 13 (46.4) | 20 (55.5) | |
| Annual household income, n (%) | | | |
| \$0 - \$50,000 | 6 (25.0) | 9 (29) | 0.77 |
| \$50,001 or more | 18 (75) | 22 (71) | |
| Preferred not to answer | 4 | 5 | |
| Body weight and BMI (mean, SD) | | | |
| Weight (kg) | 102.1 (33.1) | 93.4 (17.1) | 0.21 |
| BMI (kg/m ²) | 37.6 (10.6) | 33.7 (4.8) | 0.08 |

Table 3: Baseline Mindfulness Scores for Eat Smart, Move More, Weigh Less (ESMMWL) and Control Group Participants.

| | ESMMWL (n = 28) | Control Group (n=36) | P value |
|------------------------|-----------------|----------------------|---------|
| Mindfulness (mean, SD) | | | |
| Awareness | 2.5 (0.5) | 2.6 (0.7) | 0.70 |
| Distraction | 2.7 (0.7) | 2.8 (0.8) | 0.64 |
| Disinhibition | 2.6 (0.6) | 2.7 (0.7) | 0.54 |
| Emotional | 2.4 (0.8) | 2.9 (0.8) | 0.003 |
| External | 2.8 (0.5) | 2.6 (0.6) | 0.11 |
| Summary | 2.6 (0.3) | 2.7 (0.5) | 0.40 |

Table 4 shows change in weight and mindfulness scores for the intervention and control groups. ESMMWL participants lost more weight than participants in the waitlist control group (1.9 kg vs. 0.3 kg, $p=.02$). For all subscales and the summary score, participants who completed ESMMWL had a significantly larger increase in their mindfulness scores than those in the waitlist control group.

Among the combined group of intervention and waitlist control participants, there was an overall significant difference between the means at the three time points (before participation, after participation, and at six-month follow-up) for the mindfulness summary score and for scores for all subscales except for distraction (Table 5). Pair wise comparisons using Bonferroni correction showed a significant increase in scores for these subscales from pre-participation to post-participation and maintenance of scores at six months (i.e., there were no significant differences from post-participation to six months).

Finally, among the combined intervention and waitlist control groups, there was a significant positive correlation between weight change and the change in two mindfulness subscales [disinhibition ($r=.37$, $p<.01$) and emotional ($r=.30$, $p<.05$)] as well as with the summary score ($r=.32$, $p<.05$). Greater weight loss was associated with increased mindfulness for the two individual subscales and the MEQ summary score.

The primary goal of this study was to examine whether those who participated in the ESMMWL program had an increase in mindful eating compared to the control group. The second aim

was to observe the relationship between mindful eating, as measured by the MEQ, and weight loss. The results of the study show that those participating in ESMMWL had a significantly larger increase in mindful eating and in all subscales compared to the waitlist control group. Upon combining all ESMMWL completers from the intervention and waitlist control groups at six-month follow-up, there was a significant increase from before participation to after participation in overall mindful eating and in the awareness, disinhibition, emotional, and external subscales. Lastly, improvements in overall mindful eating, disinhibition (the inability to stop eating even when full), and emotional eating (eating in response to negative emotional states) were associated with increased weight change among participants who completed ESMMWL.

The results from the current study suggest that there is a beneficial association between mindfulness and weight loss; very few studies have rigorously examined this relationship. Olson and Emery conducted a systematic review of the literature evaluating the effects of mindfulness-based interventions on weight change and whether increased mindfulness relates to weight loss [25]. Out of the 19 studies that met the inclusion criteria, 13 showed evidence of significant weight loss among the participants in the mindfulness interventions. These studies suggest that a favorable relationship exists between the two constructs but key methodological limitations were identified. Of the 19 studies, 12 were published in peer-reviewed journals and only seven included a measure of mindfulness. Furthermore, only one study (out of the 19) that included a validated measure of mindfulness

Table 4: Change from Baseline to 15 Weeks (Post-program) for Eat Smart, Move More, Weigh Less (ESMMWL) and Control Group Participants.

| | ESMMWL (N=28) | Control group (N=36) | |
|------------------------------------|------------------|-------------------------|---------|
| Characteristic | Mean (sd) | Mean (sd) | p-value |
| Weight, kg | -1.9 (3.0) | -0.3 (2.3) | 0.02 |
| Body mass index, kg/m ² | -0.7 (1.2) | -0.1 (0.9) | 0.01 |
| Mindfulness | | | |
| Awareness | 0.40 (0.6) | 0.03 (0.4) | .002 |
| Distraction | 0.26 (0.7) | -0.31 (0.7) | <0.001 |
| Disinhibition | 0.59 (0.6) | 0.05 (0.4) | <0.001 |
| Emotional | 0.47 (0.7) | -0.10 (0.5) | <0.001 |
| External | 0.17 (0.5) | -0.01 (0.6) | .009 |
| Summary | 0.38 (0.4) | -0.07 (0.3) | <0.001 |

Table 5: Mean Mindfulness Subscale and Summary Scores Before Participation, After Participation, and at Six-month Follow-up in Eat Smart, Move More, Weigh Less.

| | Before participation (n=48) | After participation (n=48) | Six-month follow-up (n=48) | |
|----------------------|--------------------------------|-------------------------------|-------------------------------|---------|
| Mindfulness subscale | Mean (sd) | Mean (sd) | Mean (sd) | p-value |
| Awareness | 2.56 (0.58) | 2.86 (0.53) | 2.87 (0.60) | .005 |
| Distraction | 2.57 (0.76) | 2.66 (0.78) | 2.86 (0.61) | .066 |
| Disinhibition | 2.74 (0.56) | 3.18 (0.45) | 3.21 (0.48) | <0.001 |
| Emotional | 2.58 (0.80) | 2.94 (0.63) | 2.95 (0.68) | .007 |
| External | 2.63 (0.53) | 2.86 (0.55) | 2.81 (0.59) | .029 |
| Summary Score | 2.61 (0.36) | 2.93 (0.34) | 2.94 (0.38) | <0.001 |

evaluated the relationship between change in weight and change in mindfulness. None of the studies showed a relationship between change in mindfulness and weight loss. Olson and Emery concluded that there were too many methodological concerns to provide solid evidence that mindfulness-based interventions have an effect on weight loss and there is a need for more rigorous studies that examine the association.

There are very few studies that employ rigorous methodology to assess mindful eating and how it relates to weight management. Forman et al., conducted an observational study with a sample of 29 women to assess the feasibility and effectiveness of a 12-week acceptance-based behavioral intervention [27]. The behavioral intervention was modified to leave out cognitive strategies (e.g., suppressing and controlling cravings) and instead incorporated other components aimed to increase weight loss such as mindful awareness of eating behaviors and goals. They found that there was a significant increase in weight loss among completers from baseline to post-intervention and at the six-month follow-up. Furthermore, there was an increase in mindfulness from baseline to post-intervention. On the other hand, the results indicated that change in mindfulness from baseline to post-intervention was not associated with percent weight loss at post-intervention but it was associated with percent weight loss at the six-month follow-up. One major limitation of the Forman et al. study was the attrition rate. While the original sample included 29 women, only 19 completed the post-test assessment and only 14 completed the six-month follow-up. The small sample size limits the generalizability and power of the study, therefore, firm conclusions about the relationship between mindfulness and weight change cannot be drawn. One of the current study's strengths is the methodology that employed an intervention and control group to examine the effectiveness of a mindfulness intervention on mindful eating. Furthermore, as the systematic

review highlights, there are even fewer studies that evaluate the association between the change in weight and the change in mindfulness, as measured by a validated scale in present study. Finally, there is evidence to support the positive relationship between weight change, specifically greater weight loss in the current study, and mindful eating.

There were a few limitations in the current study to highlight. First, the sample was predominantly Caucasian women, which limits the generalizability of the results to other groups. The original study was powered for weight loss and did not base the sample size on expected difference in change in mindfulness between intervention and control groups.

CONCLUSION

The main purpose of this study was to examine the effectiveness of ESMMWL in increasing mindful eating as measured by the MEQ and investigate the relation between mindful eating and weight loss. Overall, results from this study provide evidence to support that greater weight loss is associated with increased mindfulness, as measured by a validated scale and that mindful eating is a promising strategy in weight management. Future studies might examine whether increased mindfulness predicts weight loss, specifically, investigating the degree to which mindful eating within the ESMMWL program is associated with weight loss. There is a need for more studies that employ rigorous methodology to continue the exploration of the role mindful eating can play in weight management.

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