



SHORT COMMUNICATION

Pilot study: Mindful Eating and Living (MEAL): Weight, eating behavior, and psychological outcomes associated with a mindfulness-based intervention for people with obesity

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KEYWORDS

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Summary

Objectives: The purpose of this study was to pilot a brief (6-week) group curriculum for providing mindfulness training to obese individuals, called Mindful Eating and Living (MEAL).

Setting and design: Participants were recruited through a local Young Men's Christian Association (YMCA) in spring 2006. Data was collected at three time points: baseline, completion of intervention (6 weeks), and 3-month follow-up (12 weeks).

Intervention: Six weekly two-hour group classes (with two monthly follow-up classes). Content included training in mindfulness meditation, mindful eating, and group discussion, with emphasis on awareness of body sensations, emotions, and triggers to overeat.

Main outcome measures: Key variables assessed included changes in weight, body-mass index (BMI), eating behavior, and psychological distress. In addition, physiological markers of cardiovascular risk were evaluated including C-reactive protein (hsCRP), adiponectin, low-density lipoprotein (LDL), and plasminogen activator inhibitor-1 (PAI-1).

Results: Ten obese patients enrolled with a mean BMI of 36.9 kg/m² [SD ± 6.2]. The mean weight was 101 kg/m² and the mean age was 44 years (SD = 8.7; range = 31–62). Compared to baseline data, participants showed statistically significant increases in measures of mindfulness and cognitive restraint around eating, and statistically significant decreases in weight, eating disinhibition, binge eating, depression, perceived stress, physical symptoms, negative affect, and C-reactive protein.

Conclusions: This study provides preliminary evidence that a eating focused mindfulness-based intervention can result in significant changes in weight, eating behavior, and psychological distress in obese individuals.

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Psychological distress has been shown to play a role in binge-type eating behaviors,¹ which are generally characterized by the repeated, uncontrolled consumption of large amounts of food in short periods of time.² Research suggests that people who engage in binge eating are also at increased risk for obesity,³ which increases a person's risk for developing several serious obesity-related health conditions such as cardiovascular disease and diabetes.^{4,5}

Mindfulness-Based Stress Reduction (MBSR) is a well-established, systematic patient centered educational approach that uses training in mindfulness meditation to increase awareness and the ability to respond skillfully to experiences that contribute to emotional distress and maladaptive behavior.⁶ Mindfulness meditation is not a relaxation or mood management technique. Rather, it is a highly refined, systematic attentional strategy to "reduce cognitive vulnerability to reactive modes of mind that might otherwise heighten stress and emotional distress" (Bishop, 2004, p. 231).⁷ Mindfulness approaches have been extensively shown to be an effective intervention for treatment of both psychological and physiological symptoms, including depression, anxiety, and cardiovascular improvements.^{8,9} In addition, recent preliminary evidence suggests that modified mindfulness-based interventions can reduce binge-type eating in obese people, though weight loss was not documented.^{10–12}

The purpose of this study was to replicate preliminary findings by piloting a brief (6-week) group curriculum for providing mindfulness training to obese individuals, called Mindful Eating and Living (MEAL).¹⁰ MEAL is designed to specifically teach skills which lead to increased awareness of eating, emotions, and negative self-judgment. The goal is to help participants cultivate awareness of their behaviors and reduce automatic eating, ideally resulting in less binge-type eating behavior and improved psychological functioning. We hypothesized that MEAL would be associated with an improvement in mood, eating behavior, and metabolic markers, and a decrease in weight and inflammation at both 6-week and 12-week follow-up.

Methods

Participants and procedure

The participants were 10 adults (7 women) recruited in March 2006, through a local YMCA; the site of where the intervention was held. This study was reviewed and approved by the University of New Mexico's Human Research and Review Committee. All participants started and finished the course at the same time. Inclusion criteria included a BMI of at least 30 kg/m², and a willingness to commit to the course and the research study. Exclusion criteria were severe acute mood disorder, psychosis, and current known substance abuse. Research questionnaires were completed at a separate location with research assistants who were not involved in teaching the course.

Mindful Eating and Living (MEAL) intervention

MEAL is a mindfulness-based training program which is designed specifically for overweight/obese individuals. The

format is a 6-week curriculum, taught in weekly sessions of 2-h each. Specific exercises include mindfulness meditation, group eating exercises, and group discussion. Participants use written materials and compact discs at home on a daily basis. The MEAL curriculum has elements of other mindful eating curricula,^{11,12} but in a briefer format with minimal didactic information. It emphasizes brief daily meditation, and pairing meditation with eating. This enables participants to individually examine hunger and satiety cues, the qualities of foods they crave, and emotional and cognitive states associated with eating. Each MEAL class includes an eating exercise, with a variety of foods and in several common meal situations (hungry, full, alone, social).

Instruction was provided by the author of the MEAL curriculum (author BMS). During the classes, participants were exposed to sitting meditation, eating meditations, light yoga, walking meditation, and group discussion. General information on diet, exercise, calories, and nutrition was also provided, but emphasis was repeatedly placed on direct experiences during the meditation rather than fund of knowledge. At home, participants were required to listen to a recorded 10-min mindfulness meditation each day, and encouraged to engage in as much mindful eating as possible. Exercise was not part of the curriculum, but basic yoga and walking meditations were performed during some classes, and participants were encouraged to increase their general physical activity by 5–10% each week.

Psychological and eating measures

Outcome measures were administered at three time points: baseline (week preceding intervention), intervention completion (6 weeks), and 3-month follow-up (12 weeks). The questionnaires assessed demographics, eating behavior, and psychological functioning. Eating behavior was assessed by the 50-item *Three-Factor Eating Questionnaire (TFEQ)*¹³ and the 16-item *Binge Eating Scale (BES)*.² Depression and anxiety were assessed by the 21-item *Beck Depression Inventory (BDI)*¹⁴ and the 21-item *Beck Anxiety Inventory (BAI)*.¹⁵ Perceived stress was assessed by the *Perceived Stress Scale (PSS)*¹⁶ and physical symptoms were assessed by asking participants to rate the extent to which they had experienced 12 physical symptoms over the last month including "indigestion", "headaches", and "feeling weak all over". The 20-item *Positive and Negative Affect Schedule (PANAS)* was used to assess affect.¹⁷

Mindfulness was assessed by the 39-item *Kentucky Inventory of Mindfulness Skills (KIMS)* which includes four subscales: observe, accept, awareness, and describe.¹⁸ All selected instruments have been used in adult obesity and mindfulness studies and have demonstrated adequate external validity, internal consistency, and test–retest reliability.

Weight and inflammation markers. In addition to collecting height, weight and waist/hip measurements, participants also completed an oral glucose tolerance test and blood draws to measure C-reactive protein (hsCRP), adiponectin, low-density lipoprotein (LDL), and plasminogen activator inhibitor-1 (PAI-1)

Data analysis

SPSS version 14.0 was used for all data analyses. Paired *t*-tests (2-tailed, $\alpha=0.05$) were used to compare baseline, post-intervention, and follow-up means on dependent variables. Trends ($p<0.10$) are noted because of the small sample size. Tests for multiple comparisons were not used because this was a pilot study and an exploratory analysis. Cohen's *d* was used to estimate the magnitude of treatment effect sizes at post-intervention and follow-up relative to baseline status.¹⁹ For Cohen's *d*, an effect size of 0.2–0.3 is considered a "small" effect, around 0.5 a "moderate" effect and 0.8–1.0 a "large" effect.²⁰ Missing data was handled by carrying over the data from the last time point collected.

Results

Ten obese patients enrolled with a mean body-mass index (BMI) of 36.9 kg/m² [SD ± 6.2]. The mean weight was 101 kg/m² and mean age was 44 years (SD = 8.7; range = 31–62). Six subjects were Caucasian; two were Hispanic, and two were Native American. Five subjects were married, four subjects were single, and one subject was divorced. The mean annual income range was US\$50,000–75,000. One participant had completed high school, and the other nine participants completing at least some college. All subjects completed the intervention and attended each session except one subject who missed one session due to a planned absence. No subjects were dropped from the program. One subject did not complete questionnaires at the 3-month follow-up point (12 weeks) and so data collected at post-intervention (6 weeks) was carried over and used for that missing time point.

We hypothesized that MEAL would be associated with a decrease in weight and inflammation and an improve-

ment in metabolic markers. All participants significantly lost weight. Average weight among all participants went from 101 kg to 97 kg over 12 weeks, for a mean weight loss of 4 kg ($p<0.01$). Average BMI among all participants went from 37 kg to 35.7 kg over 12 weeks, for a mean BMI loss of 1.3 kg ($p<0.01$). There was also a reduction in C-reactive protein (hsCRP) from 0.30 to 0.24 mg/dl over 12 weeks ($p<0.04$). There were no significant changes observed in other markers of cardiovascular risk, such as glucose, adiponectin, low-density lipoprotein (LDL), or plasminogen activator inhibitor-1 (PAI-1).

Table 1 displays the mean scores for eating behaviors and each of the psychological outcome measures for the three time points; baseline, completion of intervention (6 weeks), and 3-month follow-up (12 weeks). We hypothesized that there would be an increase in mindfulness, and cognitive restraint around eating and a decrease in eating disinhibition, hunger, and binge eating scores post-intervention and at 3-month follow-up. As shown in Table 1, compared to baseline, moderate to large increases were observed in subscales related to mindfulness at both 6 weeks and 12 weeks including the observe ($p=0.003$; $p=0.03$, respectively), accept ($p=0.07$; $p=0.02$, respectively), awareness ($p=0.04$; $p=0.02$, respectively), and describe ($p=0.01$; $p=0.002$, respectively) subscales. Increases in cognitive restraint were seen at both 6 weeks ($p=0.02$) and 12 weeks ($p=0.05$) compared to baseline. In addition, large decreases in disinhibition or loss of control over eating and binge eating were observed at both 6 weeks ($p=0.05$; $p=0.003$, respectively) and 12 weeks ($p=0.02$; $p=0.001$, respectively). A large decrease in hunger was observed at 6 weeks ($p=0.02$) but was only significant at a trend level by 12 weeks ($p=0.09$).

Lastly, we hypothesized that there would be a decrease in psychological distress post-intervention and at 3-month follow-up. Moderate to large decreases were observed at both 6 weeks and 12 weeks for depression ($p=0.002$; $p=0.05$, respectively), physical symptoms

Table 1 Treatment-related changes from baseline in eating and psychological variables.

Outcome variable	Baseline (week 0)	Post-intervention (week 6)			Follow-up (week 12)		
	Mean	Mean	<i>p</i>	<i>d</i> '	Mean	<i>p</i>	<i>d</i> '
Mindfulness							
Observe	37.7 (7.7)	44.5 (7.7)	0.003	0.8	42.3 (7.9)	0.03	0.6
Accept	29.3 (6.1)	32 (5.4)	0.07	0.5	34.5 (2.1)	0.02	1.1
Awareness	28.6 (5.5)	31.9 (5.8)	0.04	0.6	33.0 (3.4)	0.02	0.6
Describe	26.1 (5.7)	30.0 (5.7)	0.008	0.7	32.4 (4.4)	0.002	1.2
Eating behaviors							
Cognitive restraint	8.8 (6.1)	14.1 (5.4)	0.02	0.9	13.8 (6.2)	0.03	0.8
Disinhibition	9.5 (4.6)	6.4 (2.8)	0.05	0.8	4.5 (2.5)	0.02	1.4
Hunger	7.6 (3.9)	4.6 (3.5)	0.02	0.8	4.6 (3.5)	0.09	Trend
Binge eating	16.2 (5.4)	9.2 (5.1)	0.003	1.3	7.2 (2.3)	0.001	2.2
Depression	12.5 (9.6)	9.3 (9.4)	0.002	1.3	7.8 (5.5)	0.05	2.2
Anxiety	13.4 (12.1)	8.7 (9.0)	0.01	0.8	10.0 (10.7)	0.07	Trend
Perceived stress	18.0 (7.6)	15.8 (8.9)	0.22	NS	13.9 (7.8)	0.02	0.5
Physical symptoms	15.0 (6.3)	11.9 (8.8)	0.05	0.4	9.3 (8.7)	0.01	0.8
Negative affect	23.9 (8.9)	16.8 (8.8)	0.001	0.8	17.8 (8.7)	0.03	0.7
Positive affect	32.8 (6.1)	35.5 (6.5)	0.21	NS	35.7 (6.5)	0.21	NS

Note: Data are reported as mean, standard deviation in parentheses.

* Interpretative ranges: 0.2 = small, 0.5 = medium, and 0.8 = large.

($p=0.05$; $p=0.01$, respectively), and negative affect ($p=0.001$; $p=0.03$, respectively). Differences in perceived stress were not found at 6 weeks but a moderate decrease was found by 12 weeks ($p=0.02$). A significant decrease in anxiety was observed at 6 weeks ($p=0.01$) but was only significant at a trend level by 12 weeks ($p=0.07$). No differences were seen in regard to positive affect.

Discussion

The purpose of this study was to pilot a brief curriculum for providing mindfulness training to obese individuals, called Mindful Eating and Living (MEAL). All participants lost weight and a reduction in C-reactive protein was observed. In addition, moderate to large effect sizes were seen for all eating and psychological variables examined, except for positive affect. This parallels similar studies which have shown correlations between mindfulness, changes in eating behavior, and psychological distress.^{10–12}

The dysregulation model of obesity forms the foundation of the mindful eating approach to obesity. This model posits that many obese individuals have lost the ability to recognize or respond to internal cues of hunger, taste, satiety, and fullness.^{21–23} In addition, avoidance of unpleasant emotions, and reduced coping skills may play a role in eating behaviors.²⁴ When exposed to negative emotions, some people tend to use avoidant or impulsive styles of coping and often overeat in response to stress, consuming excess calories in an automatic and dissociative fashion.^{11,25–27} Many popular diets focus on restricting calories without providing a means to restore the body's natural ability to regulate eating behavior.

By promoting awareness of emotional states and physiological signals, mindfulness meditation may increase the ability to recognize and respond to normal satiety cues. Mindfulness training involves purposeful and sustained attention to internal dialogues and bodily cues which could facilitate assessment and potential re-patterning of automatic behaviors. This could be a particularly salient feature in changing conditioned patterns of eating, which typically have developed over years. In contrast to a focus on cutting calories, mindfulness help people reduce weight and improve health by restoring the individual's ability to detect, and respond to, natural cues of hunger and satiety.

There are several limitations to this study. First, the findings cannot be generalized to normal weight and overweight individuals because the sample was small and limited to people with obesity. Second, there was no control group, making it difficult to know if the results were due to regression to the mean or placebo effects. Third, the follow-up period was relatively short making it impossible to know if the changes would be maintained over a longer period of time. Fourth, data on compliance with home meditation practice was not collected which would have helped determine whether the changes were due to meditation itself, rather than group participation. Future research with a larger sample, a more rigorous design and broader demographics could address these gaps. In addition, examination of outcomes needs to be expanded to include actual dietary intake as most mindful eating studies have only focused on eating behaviors such as binge-type eating.

In conclusion, MEAL appears to be a promising approach to mindful eating, weight loss, and possibly for initiating a host of positive changes in health and functioning. MEAL was not only associated with weight loss but also improvements in eating behaviors, reductions in psychological distress, and improvements in some important physiological indices. To confirm these preliminary findings, a randomized controlled investigation of MEAL and a comparison group is under way.

Conflict of interest statement

The authors have no conflicts of interest that could impact the conduct or presentation of this study.

References

- Colles SL, Dixon JB, O'Brien PE. Loss of control is central to psychological disturbance associated with binge eating disorder. *Obesity (Silver Spring)* 2008;**16**(March (3)):608–14.
- Gormally J, Black S, Daston S, Rardin D. The assessment of binge eating severity among obese persons. *Addict Behav* 1982;**7**(1):47–55.
- Wilfley DE, Wilson GT, Agras WS. The clinical significance of binge eating disorder. *Int J Eat Disord* 2003;**34**(Suppl.):S96–S106.
- Mokdad A. Actual causes of death in the United States. *JAMA* 2000;**291**:1238–45.
- National Institutes of Health, National Institute of Diabetes DaKD. *Statistics related to overweight and obesity: the economic costs*; 2004.
- Ludwig DS, Kabat-Zinn J. Mindfulness in medicine. *JAMA* 2008;**300**(September (11)):1350–2.
- Bishop S, Lau M, Shapiro S, Carlson LE, Anderson N, Carmody J, et al. Mindfulness: a proposed operational definition. *Clin Psychol Sci Pract* 2004;**11**(3):230–41.
- Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits. A meta-analysis. *J Psychosom Res* 2004;**57**(July (1)):35–43.
- Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol* 2003;**84**(April (4)):822–48.
- Smith BW, Shelley BM, Leahigh L, Vanleit B. A preliminary study of the effects of a modified mindfulness intervention on binge eating. *Complement Health Pract Rev* 2006;**11**(3):133–43.
- Kristeller JL, Hallett B. Effects of a meditation-based intervention in the treatment of binge eating. *J Health Psychol* 1999;**4**:357–63.
- Kristeller JL, Baer RA, Quillian-Wolever R. Mindfulness-based approaches to eating disorders. In: Baer RA, editor. *Mindfulness-based treatment approaches*. Oxford: Academic Press; 2006.
- Stunkard AJ, Wadden TA. Restrained eating and human obesity. *Nutr Rev* 1990;**48**(February (2)):78–86.
- Beck AT, Ward Ch, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961;**4**(June):561–71.
- Piotrowski C. The status of the Beck Anxiety Inventory in contemporary research. *Psychol Rep* 1999;**85**(August (1)):261–2.
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;**24**(December (4)):385–96.
- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol* 1988;**54**(June (6)):1063–70.

18. Baer RA, Smith GT, Allen KB. Assessment of mindfulness by self-report: the Kentucky inventory of mindfulness skills. *Assessment* 2004;**11**(September (3)):191–206.
19. Cohen J. A power primer. *Psychol Bull* 1992;**112**:155–9.
20. Cohen J. *Statistical power analysis for the behavioral sciences*. 2nd ed. Lawrence Erlbaum Associates; 1988.
21. Craighead LW, Allen HN. Appetite awareness training: a cognitive behavioral intervention for binge eating. *Cogn Behav Pract* 1995;**2**:249–70.
22. Lowe MR. The effects of dieting on eating behavior: a three-factor model. *Psychol Bull* 1993;**114**(July (1)):100–21.
23. Kristeller JL. Mindfulness, wisdom and eating: applying a multi-domain model of meditation effects. *J Constructivism Human Sci* 2003;**8**(2):107–18.
24. Murata GH, Shah JH, Duckworth WC, Wendel CS, Mohler MJ, Hoffman RM. Food frequency questionnaire results correlate with metabolic control in insulin-treated veterans with type 2 diabetes: the Diabetes Outcomes in Veterans Study. *J Am Diet Assoc* 2004;**104**(December (12)):1816–26.
25. Byrne S, Cooper Z, Fairburn C. Weight maintenance and relapse in obesity: a qualitative study. *Int J Obes Relat Metab Disord* 2003;**27**(August (8)):955–62.
26. Ganley RM. Emotion and eating in obesity: a review of the literature. *Int J Eat Disord* 1989;**8**:343–61.
27. Kristeller JL, Hallett B. An exploratory study of a meditation-based intervention for binge eating disorder. *J Health Psychol* 1999;**4**(3):357–63.