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Mindful Eating and Its Relationship to Body Mass Index and Physical Activity Among University Students

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Abstract Mindful eating is conceptualized as being aware in the present moment when one is eating, paying close attention to the senses, including physical and emotional sensations. There are little published data exploring mindful eating in samples of the general population, and no work evaluating the concept in a university setting; thus, the purpose of this study was to examine the relationships of mindful eating to BMI and physical activity levels among students at a 4-year university and to assess the potential usefulness of mindful eating interventions in this campus setting. Ninety participants completed the 28-item Mindful Eating Questionnaire, consisting of five subscales (Disinhibition, Awareness, External Cues, Emotional Response, and Distraction) and questions about height, weight, and physical activity. Lower BMI was associated significantly with overall mindful eating. Level of physical activity was not related significantly to overall mindful eating scores; however, students who were more physically active were *more* likely to lack awareness of their food and to eat in response to negative emotions. These results suggest that mindful eating may be a useful concept to explore further, because the relationships among mindful eating, BMI, and physical activity are not straightforward. A better understanding of these complexities might lead to more effective intervention strategies for addressing overweight and obesity risk in university populations.

Keywords Mindful eating · Obesity

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Introduction

Overweight and obesity is an increasing problem among US college students. The 2006 American College Health Association's National College Health Assessment found that over 30 % of college students surveyed were overweight or obese (Nelson 2008). In addition, the National Longitudinal Study of Adolescent Health reported a 5-year obesity incidence of almost 13 % when tracking 13- to 20-year olds for 5 years, from 1996 to 2001 (Nelson et al. 2008). Obesity is related to multiple diseases, including, among others, hypertension, high cholesterol, dyslipidemia, type 2 diabetes, cardiovascular disease, and many cancers (Must et al. 1999). Therefore, it is important to develop a better understanding of determinants of overweight and obesity in college students and to develop health promotion interventions that can be delivered on college campuses.

The college years are a time of decline in diet quality, which may play a central role in weight gain (Racette et al. 2005). Young adults eat frequently at fast-food restaurants and consume large numbers of soft drinks (Nelson et al. 2008). Poor diet quality is accompanied by a decline in physical activity for many college students, with sedentary hours spent studying, in the classroom, watching television, and sitting at a computer (Keating et al. 2005). Despite the need demonstrated by these and other studies, there has been little research to inform evidence-based intervention development for weight management on college campuses (Nelson et al. 2008).

Eating Decisions

Given that an increase in caloric intake is central to weight gain and obesity trends in the USA, an understanding of overweight and obesity rests heavily on understanding the

factors that affect eating decisions (Swinburn et al. 2009). Beyond hunger, many environmental cues initiate eating, including seeing that food is available, eating with others, emotional eating, stress eating, boredom, and providing something to do while watching TV, reading, or working on the computer. Cues that stop eating include: completion of the meal by others, running out of food, and the TV show ending (Wansink 2004). Often, people monitor how much is eaten and when to stop eating by external cues such as an empty bowl or plate rather than the physical sensation of satiation (Schacter and Gross 1968). Distractions such as reading, watching TV, being at the computer, or talking to others can increase food consumption by serving as cues to initiate eating, obscuring fullness and satiety, and extending eating. These distractions often prevent monitoring of the amount of food eaten (Wansink 2004).

Other factors that affect eating involve the packaging or presentation of the food itself. Factors such as package size, plate shape, lighting, and variety of foods served influence consumption volume by preventing recognition of how much food is being consumed, or by serving as a heuristic of portion size that is misleading (Chandon and Wansink 2003). When package sizes double, for example, the amount of food eaten increases 18 to 25 % for meals and 30 to 45 % for snack foods (Wansink 1996). Food and beverage marketing also can influence consumption. College-aged students, especially males, are frequently targets of marketing campaigns for fast food and soda (Nelson et al. 2008).

Even though people can recognize that environmental factors influence others, they often believe they are not affected by these environmental influences. On average, people make 200 more daily decisions about food than they think they are making, which suggests many of these decisions are made automatically, without conscious recognition. Individuals may overeat and gain weight because they are unaware of many of the food decisions they make each day (Wansink and Sobal 2007). In other words, if people were to direct more conscious attention to eating, or to eat *mindfully*, they may be less prone to overeating. Framson et al. (2009) developed the Mindful Eating Questionnaire to aid in the exploration of mindful eating as a predictor of health outcomes. The Questionnaire was developed using validated instruments measuring eating behavior (the Three Factor Eating Questionnaire, the Dutch Eating Behavior Questionnaire, and the Emotional Eating Scale) and mindfulness (the Mindful Attention Awareness Scale, the Freiburg Mindfulness Inventory, the Kentucky Inventory of Mindfulness Skills, the Cognitive and Affective Mindfulness Scale, the Mindfulness Questionnaire, and a published factor analysis of items from these five scales (Framson et al. 2009). The purpose of the current paper is to understand how to examine the relationships of mindful eating as measured by the Mindful Eating Questionnaire to BMI and physical activity levels among university students and to assess the potential usefulness of mindful eating interventions in this campus setting.

Mindfulness

When individuals are practicing mindfulness, they focus their attention on the activity at hand, and pay careful attention to it. Focusing on the activity at hand also includes noticing thoughts, feelings, and memories that arise and observing when the mind has wandered in order to refocus attention on the activity. As part of mindful exercises, individuals are encouraged to cultivate curiosity, interest, acceptance of the experiences, and freedom from self-criticism and judgment (Baer and Krietemeyer 2006).

Mindfulness is contrasted with states of mind where attention is focused elsewhere, on memories, plans, daydreams, worries, which leads to automatic behaviors, mindless habits, unhealthy behavior patterns, and a general unawareness of one's actions (Brown and Ryan 2003).

The concept of mindfulness has its roots in Buddhist and Eastern contemplative spiritual traditions involving meditation practice (Kabat-Zinn 1982). In these traditions, mindfulness meditation was used as a method to reduce suffering and encourage the development of positive characteristics including awareness, insight, wisdom, compassion, and self-control (Goldstein 2002). Recently, the potential health benefits of mindfulness have been explored by Western health professionals and researchers. This was accomplished by designing mindfulness techniques that are independent of spiritual beliefs and Buddhist practices but are conceptualized based on traditional mindful meditation practices (Baer and Krietemeyer 2006). Mindfulness-based interventions have included treatments for stress reduction, cognitive therapy, dialectical behavior therapy, acceptance and commitment therapy, depression, anxiety, eating disorders, chronic pain, interventions for cancer patients, relationship enhancement, and personality disorders (Brown and Ryan 2003; Kabat-Zinn 2003).

Methods of teaching mindfulness can include formal meditation practices that direct attention toward some target object or sensation. Sitting meditation, for example, involves focusing one's attention on one target, such as the sensation of breathing, a candle flame, or a word or phrase, and returning one's attention to this target each time it wanders. The purpose of sitting meditation is to cultivate greater mindfulness in daily life (Goldstein 2002).

More informal exercises can target mindfulness in daily life through awareness of walking, bathing, cleaning the house, eating, shopping, and driving (Baer and Krietemeyer 2006). Mindful awareness of daily activities is thought to

increase self-awareness, the ability to make decisions, and enjoyment of pleasant moments.

In recent studies mindfulness meditation was found to influence eating behaviors and weight loss through stress relief, providing an increased sense of control, heightening the ability to detect satiety cues, and repairing eating habits (Davis et al. 2008; Rott et al. 2008). In light of these findings, nutrition researchers and practitioners have recently applied the concept of mindfulness to eating, in order to fully understand eating behaviors and initiate dietary behavior changes.

Mindful Eating

Mindful eating is conceptualized as being aware in the present moment when one is eating; paying close attention to the senses, including physical and emotional sensations (Albers 2008). Mindfulness when eating focuses on the process of eating, not the types of foods eaten. It is not a diet approach that involves rules to follow. Albers (2008) identified three basic steps that are important to mindful eating. The first step involves noticing all of the senses, tastes, smells, and textures to the food eaten. The second is recognizing repetitive habits such as eating while multitasking and eating on autopilot without being aware consciously. The third is being aware of what triggers the initiation and cessation of eating.

Research indicates that mindful eating may be an effective approach to reduce overeating. Mindful eating was found to be negatively associated with BMI among participants at a fitness facility, preparatory school, software company, and non-profit company (Framson et al. 2009). In addition, mindfulness-based eating awareness training, including meditation practice and mindful eating skills, reduced compulsive eating in obese individuals and also attenuated depression and raised self-regard (Kristeller 2003).

It has also been demonstrated that mindful eating practices can be beneficial in treating eating disorders, including binge eating disorder (Kristeller and Hallett 1999), bulimia nervosa (Proulx 2008), and Prader–Willi syndrome (Singh et al. 2008). Several studies provided support for mindfulness-based treatments of binge eating disorder and bulimia nervosa by reducing or completely stopping the frequency and magnitude of binges, improving control over eating, increasing awareness of hunger and satiety, increasing levels of mindfulness, and reducing depression, anxiety, and emotional distress (Baer et al. 2005; Corstorphine 2006; Kristeller et al. 2006; Proulx 2008; Smith et al. 2006).

In addition to these studies, large-scale mindful eating studies are currently being conducted by The Medical College of Cornell University (US Department of Health And Human Services, National Institutes of Health (NIH) 2009), the University of California, San Francisco (US Department of Health And Human Services, National Institutes of Health (NIH) 2010b), and Drexel University (US Department of Health And Human Services, National Institutes of Health (NIH) 2010a). However, there is little published data exploring mindful eating in samples of the general population, and no work evaluating the concept in a university setting. The purpose of this study was to examine the relationships of mindful eating to BMI and physical activity levels among students at a 4-year university and to assess the potential usefulness of mindful eating interventions in this campus setting.

Method

Participants

The participants were students at a medium-sized southeastern university. They were randomly solicited to participate in the study using university identification numbers. Because all students at the university are assigned an identification number when they are admitted, the ID number served as a method of randomly soliciting students for participation. A random number generator available online at http://stattrek.com/Tables/Random.aspx was used to select the last four digits of student identification numbers. Next, the university's student directory was used to search for students by identification number. Students chosen to participate were contacted through their university e-mail addresses. A sample size of 200 students was sought. In order to achieve this sample, 2,755 students were invited to participate. Of the 2,755 questionnaires e-mailed to study participants, 100 (3.6 %) were returned.

Responses from ten participants (10 %) were excluded from analysis due to not meeting inclusion criteria or because of missing data. This yielded a total sample of 90 participants.

The age of participants ranged from 18 to 58 years old with a mean age of 25.86±9.67 years. Participants' academic levels ranged from freshmen through graduate student, with 14.0 % (n=8) freshmen, 19.3 % (n=11) sophomores, 15.8 % (n=9) juniors, 19.3 % (n=11) seniors, and 31.6 % (n=18) graduate students. Females comprised 56.6 % (n=47) of the participants and males 43.4 % (n=36). In terms of ethnicity, 84.5 % (n=71) of participants reported their race as white/Caucasian, 10.7 % (n=9) as African American/black, 3.6 % (n=3) as Asian, 1.1 % as American Indian (n=1). (Note that some of the participants declined to answer personal descriptor questions, leading to descriptor category totals that add up to less than 90).

Materials

The Mindful Eating Questionnaire (Framson et al. 2009) was used to measure mindful eating. It consists of 28 items, with Likert scale questions anchored by never/rarely, sometimes, often, and usually/always. Each of the five subscales is measured with three to eight items, with the overall summary score calculated as the mean of the five subscales. Framson et al. (2009) demonstrated that the questionnaire was a valid measure with adequate construct validity and reliability (Cronbach's alpha value= 0.64). Subscale scores also had good internal consistency reliability: disinhibition (0.83), awareness (0.74), external cues (0.70), emotional response (0.71), and distraction (0.64).

The subscales are defined as follows:

Disinhibition measures the ability to stop eating when full. An example of a question from the disinhibition subscale is, "If there are leftovers I like, I take a second helping even though I am full."

Awareness is noticing the effects of food on the senses and how food affects internal states. One question from this subscale reads, "Before I eat, I take a moment to appreciate the colors and smells of my food."

External cues measures eating in response to environmental triggers. A question from this subscale is, "I notice when just going into a movie theater makes me want to eat candy and popcorn."

Emotional response is defined as eating in response to negative emotions. An example from the emotional response subscale is, "When I am sad, I eat to feel better."

Distraction is focusing on other activities while eating. An example of a question from this subscale reads "I think about things I need to do while I am eating."

In addition, three questions adapted from the National Health and Nutrition Examination Survey were included to measure physical activity. Questions asked the number of days a week respondents were physically active, the average time spent doing physical activity, and the number of times in the last 30 days respondents had exercised strenuously. Participants were also asked to report their height, weight, and demographic information including gender, age, race, and academic class level. The questionnaire contained a total of 38 questions, and it was expected participants would take approximately 20 min to complete it.

Procedure

Data were collected using a self administered questionnaire. SurveyMonkey was used as a tool to deliver the questionnaires and to assure the anonymity of students' responses. The surveys were delivered to participating students through university e-mail accounts. In order to have a high response rate for the e-mailed survey, a three-phase administration process was followed. Students in the sample were first e-mailed a short notice that they had been selected to participate in the study. They were e-mailed the questionnaires 1 week after the notice was sent. Finally, a notice was sent to remind students to turn in their surveys 1 week after the questionnaires were sent. Prior to completing the survey, participants gave electronic informed consent online. Participants were offered an incentive of being entered into a drawing to receive a $25 iTunes gift card for taking part in the study. To qualify, the participants completed the survey questions and provided their e-mail address at the end of the survey. E-mail addresses used in the drawing were compiled separately from the surveys to maintain survey confidentiality.

Results

Pearson correlation tests were conducted to compare the relationships among variables. BMI was calculated using the participants' self-reported weight and height as weight (in kilograms)/height (in meters)^2. The total minutes of physical activity per week was calculated by multiplying the number of reported days per week of physical activity with the average number of minutes spent engaging in physical activity.

After inverting 12 questions, an overall mindful eating score was calculated by computing the mean score, with higher scores indicating higher mindfulness. Subscale scores for disinhibition, awareness, external cues, emotional response, and distraction were calculated in similar fashion. There were four questions with a response choice of "not applicable," and when this response was chosen, no score was entered for that question.

The mindful eating section of the questionnaire showed good internal reliability, with a Cronbach's alpha value of 0.72. Subscale scores also had good internal consistency reliability: disinhibition (0.78), awareness (0.60), external cues (0.56), emotional response (0.61), and distraction (0.55). The BMI of participants ranged from 16.7 to 39.4 with a mean of 25.2±4.3. Participants' BMI classifications were 2.4 % (n=2) underweight, 55.4 % (n=46) normal weight, 30.1 % (n=25) overweight, and 12.0 % (n=10) obese; 18.9 % (n=17) of participants were physically active less than 60 min/week, 50.0 % (n=45) were physically active 60 to 300 min/week, and 31.1 % (n=28) were physically active more than 300 min/week. Minutes of physical activity per week ranged from 0 to 1,260 with a mean of 222.1±213.5 and median of 180.0. There was a significant negative correlation between BMI and minutes of physical activity per week (r=−0.19; p=0.045).

The mean mindful eating summary score was 2.89±.32 (based on a four-point scale). The means for subscale scores were: disinhibition (2.99±0.56), awareness (2.59±0.47), external cues (2.65±0.55), emotional response (3.17± 0.67), and distraction (3.04±0.58).

There was a significant negative correlation between BMI and overall mindful eating score (r=−0.28; p= 0.005). This means that as BMI increased, overall mindful eating scores decreased. In turn, participants who had higher mindful eating scores had lower BMI values. Significant negative correlations were found between BMI and the disinhibition subscale score (r=−0.31; p=0.002) and BMI and the emotional subscale score (r=−0.30; p=0.003). Similarly to the overall mindful eating summary score, as BMI increased, disinhibition and emotional subscale scores decreased.

There were significant negative correlations between minutes of physical activity per week and the awareness subscale score (r=0.19; p=0.04) as well as the emotional subscale score (r=0.20; p=0.03). This means that as the amount of physical activity increased, the mindful eating awareness and emotional subscale scores decreased. Results also showed a trend between physical activity and overall mindful eating, however results were marginally unsignificant (r=0.17; p=0.05).

The correlations between BMI and the awareness subscale score (r=−0.10; p=0.19), distraction subscale score (r=0.07; p=0.28), and external subscale score (r=−0.11; p=0.16) were not significant. Results also found no significant correlation between minutes of physical activity per week and overall mindful eating score (r=0.17; p=0.05), the distraction subscale score (r=0.031; p=0.39), disinhibition subscale score (r=0.084; p=0.22), and external subscale score (r=−0.023; p=0.41).

Discussion

In this sample of university students, overall mindful eating was negatively correlated with BMI, suggesting that students with lower BMI are more mindful eaters. These findings are consistent with those of Framson et al. (2009) who developed and tested the MEQ using a sample composed mainly of middle-aged, white women at fitness and yoga facilities. Framson found inverse relationships between BMI and all five subscales. In this sample of university students, significant inverse relationships were present with three subscales; for the awareness and distraction subscales correlations were not significant but were inverse or close to zero.

Among university students, level of physical activity and overall mindful eating scores were not associated significantly. This is also consistent with Framson et al.'s (2009) results. From these findings, it appears that mindful eating is not simply an attribute of those with additional positive health behaviors, as those who exercise more are not more likely to be mindful eaters. To the contrary, two subscales showed a significant negative correlation with physical activity, suggesting that university students who exercise more may be less aware of the foods they eat and more likely to be emotional eaters. Why this is so, is unclear. Perhaps students who exercise more are busier individuals, or individuals who use exercise are compensating for emotional eating. This is speculative at this point. Framson et al. did not test this relationship at the subscale level. However, they found walking more than 200 min a day to be associated with lower mindful eating scores, which they attributed to chance. The findings reported here suggest otherwise, and there is a need to explore the issue in more depth.

Other research has investigated the relationship between BMI and eating behaviors measured by subscales in the mindful eating measure used in this study. Research using the Three Factor Eating Questionnnaire found that disinhibition had a significant positive correlation to BMI (Bond et al. 2001). These findings concur with the negative correlation between BMI and the disinhibition subscale score seen here.

The negative correlation found between BMI and the emotional subscale score are similar to research using the Emotional Appetite Questionnaire. This research found that as BMI increased negative emotional eating increased as well, and as BMI decreased positive emotional eating increased (Nolan et al. 2010). This is consistent with findings that higher emotional subscale scores (equating to higher mindful eating and lower negative emotional eating) corresponded to lower BMIs.

Similar to the Mindful Eating Questionnaire, an Intuitive Eating Scale (IES) has been developed to measure reliance on internal hunger and satiety cues, eating for physical rather than emotional cues, and unlimitied eating behaviors (Tylka 2006). Intuitive eating is very similar to mindful eating and is characterized by following internal hunger and satiety cues to determine eating. Results found that IES scores were negatively related to BMI, indicating higher intuitive eating was associated with lower BMI values. This is congruent with findings that higher overall mindful eating scores corresponded to lower BMIs.

There are several limitations to this study. Findings demonstrated significant correlations between BMI and mindful eating; larger studies are needed to determine causal links and to assess the salience of the concept in other types of college settings. Second, the response rate of completed questionnaires was quite low. This may be due to the questionnaires being administered during the summer term when many students were not enrolled in classes. The respondents included a large proportion

(31.6 %) of postgraduate students, which may impact generalizability of findings to colleges without postgraduates. Lastly, data from the survey questionnaire was self reported. Participants may not have been truthful in their responses, especially when reporting their weights and heights.

In this sample of university students, lower BMI was associated significantly with eating more mindfully. Lower BMI was associated also with the ability to stop eating when full and to avoid eating in response to negative emotions. Level of physical activity was not related significantly to mindful eating scores. However, students who were more physically active were *more* likely to lack sensory awareness of their food and to eat in response to negative emotions. These results suggest that mindful eating may be a useful concept to explore further, because the relationships among mindful eating, BMI, and physical activity are not straightforward. A better understanding of these complexities might lead to more effective intervention strategies for addressing overweight and obesity risk in college populations.

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