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The Effects of Mindful Eating Education on Increasing Satiety Signals

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Abstract:

Background: Mindful eating is a practice that incorporates focusing on thoughts, emotions and sensations within the body when consuming food. Satiety is defined as a state of fullness where there is no longer an intake of food. Mindful eating techniques could help college students identify their hunger and satiety signals and respond to those cues over environmental or psychosocial cues that could lead to over-eating. Giving mindful eating education has the possibility to help people recognize their satiety signals and stop eating sooner.

Objective: To examine the effects of mindful eating education on increasing satiety signals.

Design: Randomized cross-over study

Participants: The study consisted of 25 participants (Ages 18-30, 19 females, 6 males).

Main outcomes: Satiety and meal completion time pre- (Visit 1) and post- (Visit 2) mindful eating education and increased awareness of satiety signals.

Secondary outcomes: Frequencies of pre-mindful eating education responses within sample populations, follow-up survey responses within sample populations, and characteristics within sample populations

Statistics: Normality of quantitative variables was assessed using Shapiro-Wilk test and box plots, pre- and post-variables in both groups was compared using Wilcoxon signed – rank test. The association between the categorical variables were examined by the chi-square test and Fisher Exact test.

Results: No significant difference was found comparing satiety time during visit 1 and visit 2 (P-value = 0.459). Similarly, no significant difference was found when comparing the meal completion time during visit 1 and visit 2 (P-value = 0.737). However, there was a significant difference when satiety time was deducted from meal completion time and compared between visit 1 and visit 2 (P-value = 0.008).

Conclusion: Mindful eating can potentially be used as an intervention to increase recognition of satiety signals. Further research within this topic is warranted with a larger sample size and duration to observe other possible significant outcomes, and to better standardize the mindful eating education given.

The Effects of Mindful Eating Education on Increasing Satiety Signals

Introduction

Over the last four decades, the prevalence of obesity has significantly increased. Currently, according to the CDC, one-third of adults in the United States are obese.[1] This comes with a heavy price tag, costing the country more than $147 billion annually in medical costs.[1] With this increase in the obese population, we see similar trends in the college student population.[2] At this particular point in life, many lifestyle habits are formed including diet, physical activity, stress management and more. Oftentimes when unhealthful habits are formed during college years, risk factors of cardiovascular disease, Type II Diabetes, hypertension, and others are significantly increased. It has been shown by the National Longitudinal Study of Adolescent Health that those who are obese during their adolescent years have a high likelihood of remaining obese throughout their young adult years.[2] It is important to focus on creating healthful habits early on in life and especially throughout the college years. Mindful eating education has the potential to help promote generally recommended eating habits and recognition of satiety cues. The earlier in life people can recognize and act upon satiety signals, the likelihood of becoming obese is reduced.

Satiety, Satiety Signals, and Obesity

When discussing healthful habits, often times hunger and satiety are some of the major topics discussed. Before examining these topics, it's important to distinguish between satiety and satiation. When consuming a meal, the reduction of hunger accompanied by the feeling of fullness, and eventually the termination of a meal, is known as satiation.[3] Satiation is further defined by various factors such as the volume, weight, or caloric content of the food consumed.[3] Satiety, on the other hand, is defined as a state of fullness where there is no longer an intake of

food.[3] As the state of satiety diminishes, hunger develops.[3] Forde's study on expected satiety found that it is strongly correlated with eating behaviors and post meal satiation, implying that cognitive expectation during portion selection has an impact on caloric intake.[4] This is further supported by a study on energy density on satiety, which found that the majority of participants viewed foods with the same portion size as having the same expected satiety.[5] Overall, these studies have vast implications on the impact of learned associations on food and expected satiety and satiation levels.[5]

Gastrointestinal neuropeptide signaling plays a vital role in communicating hunger and satiety to the brain. The neuropeptides (NPY) ghrelin and motilin signal hunger while glucagon-like peptide (GLP-1) and peptide tyrosine tyrosine (PYY) signal satiety.[6,7] Secretion of the NPY leptin also acts on the hypothalamus to decrease food intake.[6] The alteration of the satiety signaling from the GI tract has been linked to the development of obesity.[6,7] A randomized, double blind study conducted on both lean subjects and obese subjects found that a high dose of ghrelin infusion was associated with an increase in food intake in both obese subjects as well as lean subjects.[8] A study conducted by Yang et al., found that "Living High-Training low" altitude training technique is associated with an increase in GLP-1 and weight loss in adolescents with obesity.[9]

Mindful Eating and Weight Management

Mindful eating is a practice that incorporates focusing on thoughts, emotions and sensations within the body.[10] Meta-analysis by Pannowitz et al found mindfulness during meals has shown promise in honing into natural satiety signals meant to deter over-eating.[10] Within this body of research, it is believed that by exercising mindfulness, advances may be made in weight

loss, binge eating, satiety responses, and overall improved healthy eating and awareness of external eating cues.[10]

Meta-analysis conducted by Caldwell et al suggests that 80% of participants who lost weight during a standard behavioral weight loss program did not maintain the weight loss over time.[11] An explanation for this common weight loss regression is that caloric restriction diets cause the dieter to learn to ignore hunger cues.[11] In actuality, accurate reflection upon these internal cues, as well as the appropriate responses to them, are necessary for regulating healthy eating behaviors.[11] With this in mind, an alternative to the widely used caloric deficit dieting method is the intuitive or mindful eating approach.[11]

There are several studies that show positive results in weight management due to implementing mindful eating education. For example, a questionnaire-based study conducted by Ouwens et al using the Dutch Eating Behavior Questionnaire, the Freiburg Mindfulness Inventory and the Hospital Anxiety and Depression Scale studied 335 mainly female morbidly obese patients who were candidates for bariatric surgery.[10] At the end of the study, mindfulness positively correlated with restrained eating behaviors while it was negatively associated with detrimental emotional and external eating behaviors.[10] An additional study of interest by Grinnell et al was a questionnaire and anthropometric study of 75 first-year college students.[12] The categorized non-mindful participants reported more emotional eating in response to external cues.[12] At the end of the study, correlations were observed between mindfulness and weight-related behaviors such as binge eating and alertness to external eating cues which translated to increased waist circumference within the non-mindful group.[12] If these behavioral differences between the mindful and non-mindful group were sustained, then differences in anthropometric and clinical measures such as weight, BMI, and blood pressure are likely to arise as well.[12] This

is especially important in college students that are perhaps first learning to make their own food choices that will inherently influence their health later in life.[12] Therefore, mindful eating techniques could help college students identify their hunger and satiety signals and respond to those cues instead of detrimental environmental or psychosocial cues that could lead to over-eating.[12]

Mindful eating and disease management

Current projections conclude that the number of people with diabetes in the United States will more than double from 2005 to 2050.[13] Mindfulness-based interventions have been shown to benefit the treatment and management of chronic disease like diabetes.[14] Effective diabetes self-care requires self-management skills as many individuals with diabetes struggle with regulating food intake and have a history of dieting and weight cycling.[13] The Miller et al MB-EAT for Diabetes (MB-EAT-D) intervention including training in mindful meditation, eating, and practice of physical activity and body awareness was used to study subjects with diabetes.[13] This 8-week pilot study concluded with a mean reduction in HbA1c of 0.48% 1 month after the intervention.[13] Furthermore, the reduction in HbA1c of 0.67% to 0.83% seen at the 3-month follow-up, if sustained, could result in significant reduction in microvascular and cardiovascular risk within the population.[13]

Another chronic disease associated with obesity - cardiovascular disease (CVD) - is the primary cause of mortality worldwide.[15] Historically, CVD incidence increased with industrialization which created easier access to appealing, calorie-dense foods. Furthermore, sedentary yet fast-pace lifestyles that include electronics distract from meal consumption.[15] Research by Loucks et al suggests the practice of mindfulness may help curb several CVD risk behaviors.[15] This research showed high vs. low Mindful Attention Awareness Scale (MAAS)

scores demonstrated cross- sectional evidence that mindfulness is positively associated with cardiovascular health. This association is driven by improvements in smoking, body mass index, fasting glucose, and physical activity CVD risk factors.[15]

Currently, there is insufficient research examining the impact of mindful eating education on satiety signals. Therefore, the purpose of this graduate student research study was to examine the effects of mindful eating education on increasing satiety signals.

Methods

Subjects: A total of 25 subjects, both male and female subjects from the age of 18-30 were recruited for this study. Recruitment methods included word of mouth, flyers. Subjects were involved in both the intervention and control group. All methods and procedures were approved by Loma Linda University Institutional Review Board. All subjects signed an Informed Consent Document (ICD).

Risk: Breach of confidentiality

Benefits: This research adds to the body of knowledge on the science of mindful eating.

Inclusion criteria: Subjects were: enrolled at Loma Linda University, packed or purchased their own lunch on a regular basis (willingness bring/buy the same lunch the following week), and had a 1 hour or less lunch period.

Exclusion criteria: Subjects who skipped breakfast, exercised within 2 hours of their lunch time, smoked nicotine or marijuana, had the condition of T1 or T2 diabetes, and/or had newly prescribed medications 2 weeks prior to testing.

Instruments:

1. Satiety questionnaire: During the control and intervention trials, each subject was given a 10 minute, yes/no, written satiety questionnaire at the completion of their meal. This

survey was based on 2017 Clementi et al Mindful Eating Questionnaire and includes questions such as: do you taste every bite you eat? (Appendix Part A)

2. Follow-up survey: each subject was given a written follow-up survey post trial.
3. Mindful eating education material: mindful eating handout by move.va.gov.

Procedures

Day 1: Control Trial

Subjects were asked to meet the investigator at the Loma Linda Student Pavilion and sign an ICD. Subjects signed and provided an email address and phone number. Subjects were then asked to eat their meal with an investigator present. During the trial, the subject was asked to verbally inform the investigator when they feel full. The investigator used a stopwatch to record when the subject had reached satiety. After the subject had decided to end their meal, they were asked to fill out a questionnaire. Subjects were also reminded to bring the same meal the following week.

Day 8: Intervention Trial

Subjects were asked to meet the investigator at the Loma Linda Student Pavilion with the same meal as the previous week. The investigator briefly gave mindful eating education to the subject for 5 minutes, based on a script and give a Mindful Eating Handout to the subject. Subjects were then asked to eat their meal with an investigator present. During the trial, the subjects were asked to verbally inform the investigator when they felt full. After deciding to end his/her meal, each subject was asked to fill out a questionnaire.

Day 15: Follow-up

Subjects were asked to meet the investigator at the Loma Linda Student Pavilion and received a follow-up survey on behavioral change experienced after mindful eating education.

Results

No significant difference was found comparing satiety time during visit 1 (pre-mindful eating education) and visit 2 (P-value = 0.459) (Table 2). Similarly, no significant difference was found when comparing the meal completion time during visit 1 and visit 2 (P-value = 0.737) (Table 2). However, there was a significant difference when satiety time was deducted from meal completion time and compared between visit 1 and visit 2 (P-value = 0.008) (Table 2). A significant association was also found between gender and response to: Do you prepare your own food? (P-value = 0.031) (Table 3).

Table 1. Frequency (%) of Demographic Characteristics within Sample Population (N=25)

Demographic Characteristics	Frequency (%)
Age	
18-25	16 (64)
26-30	9 (36)
Gender	
Male	6 (24)
Female	19 (76)
Special Diet Followed	
Yes	5 (20)
No	20 (80)

Table 2. Mean (SD) of Satiety and Meal Completion (min) Pre and Post Mindful Education (N=25)

	Mean (SD)	P-value
Satiety:		
Satiety time visit 1	14.1 (6.4)	0.459
Satiety time visit 2	14.5 (6.6)	
Meal Completion:		
Meal completion time visit 1	16.1 (6.8)	0.737
Meal completion time visit 2	14.9 (6.8)	
Meal Completion Time Minus Satiety Time:		
Meal completion visit 1 - Satiety time visit 1	2.0 (3.1)	**0.008**
Meal completion visit 2 - Satiety time visit 2	0.3 (0.8)	

P-values were calculated based on Wilcoxon signed – rank test; SD- standard deviation

Table 3. Significance of Pre-Questionnaire Responses by Gender

	Gender P-value
Do you prepare your own food?	**0.031**^

^p- values calculated based on Fisher Exact Test.

Of the participants, 68% stated they have not changed the rate at which they eat after participating in this study at time of follow-up. However, 92% stated they are more aware of satiety and hunger cues after participating in this study. This response corresponds to no significant differences found comparing satiety time and meal completion times during visit 1 and visit 2, yet a significant increase in the cessation of food consumption at the point of satiety after mindful eating education.

Discussion

In this research study, we investigated the effects of mindful eating education on increasing satiety signals. We found there was no significant difference when comparing satiety time during visit 1 and visit 2. We believe this is influenced by participants consuming the same exact meal each visit, as they are likely to reach satiety at roughly the same time during each visit. There also was also no significant difference found when comparing the meal completion time during visit 1 and visit 2 possibly due to the same reasoning. Importantly, we did find significance between the first and second visit when satiety time was deducted from meal completion time. This significant decrease in time between satiety and meal completion times after mindful eating education suggests faster cessation of food consumption at the point of satiety, which bodes well for efforts to decrease compulsive overeating. Therefore, the tips given during the mindful eating education on how to better understand and react to satiety signals may have been put into practice during the second visit when participants ate their lunch.

Additionally, a significant association was found between gender and response to: “Do you prepare your own food?”. Female participants were found to more likely prepare their own food (95%) over male participants (50%).

Of the participants, 68% stated that they have not changed the rate which they eat after participating in the study. However, 92% stated that they are more aware of satiety and hunger cues after participating in the study. We believe that changing the rate at which you eat takes considerable practice, since it is a habit developed over time. Unfortunately, our participants only had a week in between their mindful eating education and follow-up survey regarding dietary changes. This was most likely not enough time to develop a permanent habit change. Most participants did, though, seem to become more aware of their satiety and hunger cue after participating in the study.

Overall, our findings reflected a meta-analysis by Pannowitz et al in finding mindfulness during meals has shown promise in honing into natural satiety signals meant to deter over-eating.[10] Our findings also support the study conducted by Ouwens et al that found mindfulness positively correlated with restrained eating behaviors while it was negatively associated with detrimental emotional and external eating behaviors.10

This study was conducted with participants that were students from Loma Linda University. Therefore, some limitations include the target population used, the small sample size, limited number of interactions with participants (3 visits) and the short duration of the study (3 weeks).

Conclusion

Overall, the results presented here illustrated that mindful eating can potentially be used as an intervention to increase satiety signals. After receiving mindful eating education,

participants displayed an increased awareness to satiety cues shown by a significantly shorter period between time to satiety and meal completion time after receiving mindful eating education during visit 2 compared to before receiving education. Therefore, mindful eating may help individuals increase their recognition of satiety cues and hunger cues and stop eating prior to overconsumption. Further research within this topic is warranted with a larger sample size and longer duration to observe other possible significant outcomes, and to better standardize and solidify the mindful eating education given. Research of the effects of mindful eating education within various populations such as obese or pediatric, as well as individuals with chronic diseases is also needed.

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Appendix

Part A:

Demographic Survey Questions:

1. What is your age: _____

2. What gender do you most identify with? Male Female Other _____

3. Do you follow a specific diet? Yes No

- If Yes what type of diet?

Vegan Vegetarian Lacto-Ovo Vegetarian Pescetarian Other _____

Survey Questions:

4. How stressed are you feeling today. (Circle a number)

Not stressed 1 2 3 4 5 Very Stressed

5. Do you prepare your own food? Yes No

- If not, who prepares your meals? Mother Father Spouse Other _____

- If not, do you purchase your meals? Yes No

6. Are you primarily in charge of purchasing groceries at your household? Yes No

7. Do you typically eat snacks between breakfast and lunch? Yes No

- If so, did you eat a snack today? Yes No
- How long ago did you eat your snack? _____

8. When you are typically eating a meal, do you notice when you feel full? Yes No

- If so, do you stop eating? Yes No

9. Do you typically read nutrition labels of the foods you eat? Yes No

10. When you're at a restaurant, do you typically finish your meal whether you feel full or not?

Yes No

11. Do you taste every bite you eat? Yes No

12. When eating your favorite food, do you notice when you're full? Yes No

- If so, do you stop eating? Yes No

13 . Do you snack while studying? Yes No

- If so, do you notice when you're full? Yes No
- Do you stop eating when you're full? Yes No

14. At what pace did you just eat your meal? Slow Moderate Fast

Follow-up Survey:

1. Have you changed the rate at which you eat after participating in this study? Yes No
    - If so, did the rate at which you eat increase or decrease? _____

**Statistically significant by diet type

2. Have you changed any of your usual portion sizes after participating in this study? Yes No
    - If so, did your portion sizes increase or decrease? _____

3. Are you more aware of satiety and hunger cues after participating in this study? Yes No

** statistically significant by diet type

4. Do you eat the same size meals as you previously did? Yes No

5. What is the most important thing you learned from this mindful eating study?

** statistically significant in age

Younger = eating slower

Part B

Mindful Eating Education Handout

B11

MOVE!®

Mindful Eating

What is Mindfulness?

Mindfulness means being fully aware of what is going on within and around you at each moment. Mindfulness can be applied to many aspects of life. Being mindful of your eating may help with weight management. Being mindful involves being aware of yourself and your surroundings physically, emotionally, and mentally. It means paying attention to each changing moment.

What is Mindful Eating?

Mindful eating takes the concept of mindfulness and applies it to why, when, where, what, and how you eat. This means being aware of both the physical and emotional feelings connected to eating.

- **Observe your body.** Notice hunger and fullness signals that guide you to start and stop eating.
- **Do not judge yourself** or your reaction to food.
- **Notice your reaction to food.** What do you like, what don't you like?
- **Savor your food.** While eating, notice all of the colors, smells, flavors, and textures of the food.

Mindfulness may help you to avoid overeating. First bites may be the most satisfying, and additional bites may not be as pleasurable. This can help with portion control.

Be aware. Ask yourself, "Am I…"

- Physically hungry? (on a scale from "1" to "10")
- Eating quickly or slowly?
- Dining in-the-moment–Am I mindlessly munching or noticing each bite?
- Multi-tasking, or truly focused on this meal or snack?
- Feeling my stomach rumbling?
- Bored, stressed, tired, anxious, angry, sad, etc.?

Here are some tips:

- Take a breath and ask yourself, "Am I truly hungry?," before you reach for food.
- Begin practicing mindfulness. Start by eating one meal a day in a slower, more aware manner.
- Focus on eating. Avoid doing other activities while you eat (working, talking on the phone, watching TV, driving, reading, etc.).
- Set a timer for 20 minutes and take the whole time to eat the meal.
- Eat silently for 5 minutes (think about what it took to produce that meal, from the sun and water, to the farmer, to the grocer, to the cook).
- Slow down. Eat with your non-dominant hand or try using chopsticks.

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