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## The Effects of a Mindfulness Intervention on Ameliorating Premenstrual Hedonic Eating Patterns in College-Aged Females

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Department: Dietetics, Health and Sport Science

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## Abstract

**Background:** Young women in college are susceptible to weight gain from a myriad of factors to include environmental and hormonal influences. **Objective:** The aim of this study was to determine the impact of a mindfulness intervention on food craving behaviors in women in the luteal and follicular phases of the menstrual cycle. **Methods:** This was a quasi-experimental study using repeated samples one-way ANOVA and qualitative data to examine pre-intervention and post-intervention changes in cravings and mindfulness. **Results:** 23 participants completed the intervention and study-related requirements pre-intervention and post-intervention. There was a trend of mean decrease in FCQ-T scores ( $124.83 \pm 3.76$  to  $117.44 \pm 3.67$ ,  $p=0.204$ ) and mean increase in MEQ scores ( $69.74 \pm 5.63$  to  $72.57 \pm 6.45$ ,  $p=0.127$ ). Menstruating women reported remorse, anger, and loss of control when cravings occur. After the mindfulness intervention, acknowledging physical sensations, emotions, hunger/fullness cues, contemplation of outcomes if the craving was or was not indulged, and engaging in mindfulness exercises resulted in a shift in how the food craving was managed. **Conclusion:** Mindfulness interventions may be supportive in ameliorating food cravings in college-aged menstruating females.



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Dayton

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## 1. Introduction

Young women, between the ages of 18 and 35, are more susceptible to experiencing weight gain partly due to the stage of life women are often in at this age, such as living alone or cohabitating in college and marriage.<sup>1</sup> For women in college, the infamous “Freshman Fifteen” alludes to first year college students experiencing a weight gain of fifteen pounds, as a result of increased alcohol consumption, increased energy intake and increased sedentary behavior due to sitting in class and time spent studying.<sup>1</sup> For college-aged women, the availability and access to energy dense foods in the dining halls coupled with greater independence in food choice contribute to the overconsumption of energy. These environmental factors are involved in increased energy intake, as are hormones, such as those of the gastrointestinal tract, nervous system, and in the menstrual cycle.

While the environment plays a role in initiating food seeking behaviors, several hormones and systems regulate hunger and satiety. Cortisol mobilizes stored glucose in the body and has an orexigenic effect.<sup>2</sup> Dopamine is related to the neurocircuitry involving reward and motivation.<sup>3</sup> Leptin and ghrelin are impacted by emotions, suppressing satiety and stimulating hunger.<sup>4</sup> Menstrual hormones influence energy intake depending on what phase in her cycle a woman is currently experiencing.<sup>5</sup> These hormones drive food-seeking behaviors, especially in pleasurable foods, defined as hedonic eating.<sup>3</sup> Mindfulness has been proven as an effective strategy to cope with the craving of foods, typically those high in sugar, fat, salt, and refined carbohydrates.<sup>6</sup>

The decision to eat is driven by hunger, appetite, or cravings. Hunger is the physiological need for food, a predictor of the willingness to eat and how much to be eaten, and a signal to maintain the body’s homeostatic mechanisms.<sup>7</sup> A stomach growl is one indication of hunger, creating a physical sensation to increase food intake as soon as possible. Appetite describes the psychological drive to seek out food, caused by the sight, smell, or thought of food. Hedonic hunger, or cravings, is the desire to eat food for pleasure in the absence of hunger.<sup>3</sup> Hedonic eating is defined as the consumption of foods originating from hyperpalatable diets and manifesting in maladaptive eating behaviors.<sup>3</sup> It is the flavor, temperature, texture, and consistency felt in the mouth that contributes to pleasure and increased intake.<sup>8</sup> As for what kinds of foods are preferred in these craving

experiences, foods rich in refined carbohydrates, sweets, and chocolate are more favored, especially in women.<sup>9</sup> Foods high in salt and fat are also preferred.<sup>10</sup> The taste of these foods translates to physiological mechanisms in a consumer, such as stimulating pancreatic secretions.<sup>11</sup> These foods also promote positive emotions in times of irritability and stress.<sup>10</sup> Behaviors such as stress-eating or eating as a coping strategy to compensate for something else puts an individual at risk for the development of obesity.<sup>3</sup> Having a weight in the overweight or obese categories increase the risk of cardiovascular disease, diabetes, cancer, and other comorbidities.<sup>1</sup>

Hedonic eating implies that the behavior can become compulsive, meaning an uncontrollable urge to have an excess intake of food. Hedonic eating is mediated via the endocannabinoid system, which is expressed in both homeostatic and hedonic feeding.<sup>12</sup> This system is made up of lipid neuromodulators involved in reward and motivational pathways, managing pain, and emotions.<sup>12</sup> Endocannabinoids promote overeating through linking homeostatic and hedonic circuits as it relates to energy balance regulation.<sup>12</sup> This means what is eaten and processed metabolically is simultaneously signaled to the body if that food elicited a positive emotion, which then proceeds to be stored in memory as a reward signal.<sup>12</sup>

Stress is a prevalent experience of college students and has been shown to influence food seeking behaviors.<sup>1</sup> Seeking pleasure from food is promoted by negative emotional states, as it was found that women experiencing high amounts of stress sought palatable, or gratifying, feeding to lessen stress.<sup>3</sup> A study by Rezitis et al. evaluating individuals with weights in the obese category found this cycle can be interrupted with behavior modification from learning strategies to respond to negative stimuli other than turning to palatable food in order to lessen hedonic eating.<sup>3</sup> It has also been shown that mindfulness strategies help attenuate food cravings.<sup>6</sup>

Regulation partially relies on reward and motivation neurocircuitry to modify food seeking behaviors.<sup>13</sup> The hypothalamus is responsible for regulating food intake through neurons from the hypothalamic arcuate nucleus, taking part in the processes of hunger and satiety.<sup>13</sup> These chemical messengers include dopamine, serotonin, and the corticotropin-releasing hormone. Following a meal of hypercaloric, palatable foods in large quantities, an individual's control circuits are weakened, resulting in conditioned

learning and a resetting of reward thresholds to increase.<sup>13</sup> Dopamine, a neurotransmitter elicited from the hypothalamus, is released when this threshold is met or even when stimuli associated with the food reward are presented, anticipatory of the behavior and therefore becomes a conditioned response.<sup>13</sup> This memory of the stimulus, the highly palatable food, raises the reward threshold, causing one to overeat. The hippocampus remembers these cues, expressing high levels of insulin, ghrelin, and other regulators and promoters related to increased food intake. This predictive and responsive nature of dopamine release was seen in high-fat and high-sugar foods.<sup>3</sup> These reactions lengthen the meal experience, as it is a part of pleasurable eating, thus delaying satiety.

Hedonic eating behavior is influenced by the hormone cortisol and the desire to seek out comfort with foods.<sup>2</sup> This hormone is released via the hypothalamus-pituitary-adrenal (HPA) axis, during times of stress to elicit the availability of glucose through the mobilization of energy stores.<sup>2</sup> The release of cortisol has been shown to affect food intake, especially of highly palatable foods, such as ones high in sugar, fats, and other calorically dense foods.<sup>2</sup>

The hormone leptin, secreted from adipocytes, influences hedonic eating by enhancing the reward response and stimulating anorexigenic neurons, leading to satiety and the end of a meal.<sup>4</sup> With excess adiposity or eating palatable foods, a slight leptin resistance is developed, with appetite increasing and the threshold for reward heightening, increasing intake through hedonic eating.<sup>4</sup> In opposition to leptin, ghrelin stimulates hunger by activating orexigenic neurons, as plasma ghrelin concentrations increase when the body is in a negative energy balance.<sup>14</sup> In times of stress, ghrelin increases with cortisol, to modulate the stress and elicit a feeling of reward through consumption.<sup>4</sup> A false illusion of hunger is present in those that stress-eat, partly due to ghrelin staying elevated in those eating for emotional compensation and experiencing a relief of tension and stress.<sup>15</sup>

Hormones associated with the menstrual cycle, such as progesterone, influence hedonic eating behaviors and energy intake in various ways based on which phase of the menstrual cycle a woman is in.<sup>5,9</sup> Menstruation is the monthly process when the lining of the uterus, the endometrium, is shed, during a woman's reproductive years. In a typical cycle of 28 days, days 1-7 are known as menstruation, where the endometrium, or the

lining of the uterus, sheds if there is no pregnancy.<sup>9</sup> GnRH, or the gonadotropin-releasing hormone, is released from the hypothalamus and produces the follicle-stimulating hormone and luteinizing hormone. Days 1-14 characterizes the follicular phase, where the endometrium thickens, and some follicles grow from the follicle-stimulating hormone (FSH) that is released from the pituitary gland.<sup>9</sup> FSH is elevated in anticipation of menstruation and during menstruation, as well as at ovulation.<sup>5</sup> Days 15-19 is when ovulation can take place, which is when the ovum is released from the largest follicle and waits in the fallopian tube for fertilization.<sup>9</sup> The luteinizing hormone (LH) is at the highest around ovulation, released from the pituitary gland to form the corpus luteum.<sup>5</sup> Days 15-28 characterizes the luteal phase, which produces a high amount of progesterone in preparation to receive a fertilized ovum.<sup>9</sup> Progesterone is highest in the mid-luteal phase.<sup>5</sup> The late luteal phase characterizes the “premenstrual” phase. If the ovum is not fertilized, menstruation occurs. Estrogen is highest in the mid-follicular phase and rises to a lesser extent in the mid-luteal phase.<sup>5</sup>

At the time of ovulation, appetite is at its lowest, and is at its highest in the luteal phase.<sup>5</sup> In relation to sex hormones progesterone and estrogen rising in the luteal phase, it can be concluded these hormones play a role in appetite stimulation. Progesterone can be indicative of this, but estrogen also rises in the late-follicular phase where appetite is the lowest, so estrogen does not increase food intake.<sup>16</sup> As for progesterone, it remains unclear in the literature as to the reason why the hormone acts as a promoter for increased food intake. There is specifically increased resting energy expenditure in the luteal phase.<sup>17</sup> Additionally, it is known that progesterone promotes fat storage, resulting in an increased desire for fat-rich foods when progesterone is secreted.<sup>5</sup> The consumption of calorically dense foods participates in increased energy intake in the late-luteal phase, where progesterone is high.<sup>16</sup> Overall energy intake from saturated and monounsaturated fats, and sweet-tasting foods are notably increased in the mid-luteal phase, where progesterone dominates.<sup>17</sup> In this phase, upon menstruation, there is a significant pattern of chocolate cravings in the U.S., coming from media marketing and social norms that are permissive of indulgences like these and encouraging them.<sup>18</sup>

This triad of diet, hormones, and the menstrual cycle are deeply intertwined, and all affect one another. Overall, it appears that food cravings are not cycle phase-



dependent, but that the intensity, frequency, and duration of food cravings and hedonic eating patterns are reliant on where a woman is in her menstrual cycle.<sup>5</sup> Tapper et al. studied the effectiveness of various mindfulness strategies, including present moment awareness, acceptance, and decentering. These strategies were compared and evaluated on craving frequency, strength, and duration, all of which were proven to be improved with mindfulness.<sup>6</sup> Studies to date have also focused on the mere association of food cravings and the menstrual cycle, especially with the luteal phase. There is a gap in the literature evaluating interventions with mindfulness to manage hedonic eating behaviors in the menstrual cycle. The purpose of this study is to determine the effect of a mindfulness intervention on food cravings (hedonic eating patterns) and on mindful eating behaviors, associated with the menstrual cycle.

## **2. Methodology**

### ***2.1 Design***

This was a quasi-experimental study design to assess the impact of a mindfulness intervention on food craving behaviors in college-aged menstruating females. The study was approved by UD IRB. Eligible candidates were invited to participate in this study.

### ***2.2 Inclusion criteria***

Individuals were included if they were college-aged females (18- 24 years) attending the University of Dayton, experiencing a 28-day menstrual cycle, and able to track the menstrual cycle. Those that were excluded were males, non-menstruating females, females over the age of 25 years, and females not enrolled at the University of Dayton.

### ***2.3 Recruitment and procedures***

Non-randomized convenience sampling was used to identify individuals within the inclusion criteria. An email was sent to eligible participants via University of Dayton clubs and advisors. Eligible candidates were provided with the Informed Consent via email. Eligible and interested participants provided an electronic signature on the informed consent.

## ***2.4 Protocol***

Once consent was confirmed, participants were invited to attend one of three offered sessions for a presentation. Before delivering the intervention, participants were instructed to complete a pre-intervention survey, made up of a 39-item Food Cravings Questionnaire-Trait (Appendix 1) and a 28-item Mindful Eating Questionnaire (Appendix 2) via Qualtrics by scanning a QR code with their Smartphone device. Following the completion of the pre-intervention survey, the participants engaged in a 1-hour mindfulness education session. The curriculum for the mindfulness education session was created using existing education formats and information from the literature review, reviewed by a registered dietitian with practice in this area and implemented by the PI. Standard mindfulness strategies were utilized for mindful breathing, a body scan, and mindful eating. During this session, the PI provided the participants with knowledge and strategies related to mindfulness habits to address hedonic food seeking behaviors and information on the role of hormones and the menstrual cycle in the eating experience (Appendix 3). A workbook was provided in relation to the presentation's information and participants were instructed to complete it throughout the session. Within a month, before the follow-up meeting, participants were tasked with engaging in mindful eating and journaling about it in the workbook. Participants attended a second session one month later to turn in their workbooks and complete the post-intervention survey, consisting of the same questionnaires. Participants received \$20 compensation after completing all study-related activities. Participant identity was protected by assigning a participant ID number, which was marked on the surveys instead of submitting their name.

## ***2.5 Survey Instruments***

The Food Cravings Questionnaire-Trait (FCQ-T) and the Mindful Eating Questionnaire (MEQ) was utilized to evaluate hedonic eating behaviors and mindful eating skills prior to the intervention and after the intervention.<sup>19,20</sup>

### ***2.5.1 Demographic Survey***

Six multiple choice or fill-in the blank questions were used to report demographics (age, sex, ethnicity, day of menstrual cycle, first day of last period (mm/dd/yyyy), and hormone related medication use).

### 2.5.2 Food Craving Questionnaire-Trait

The Food Cravings Questionnaire-Trait (FCQ-T) is a validated tool to measure the frequency and intensity of food craving experiences in general.<sup>19</sup> It consists of 39 items and response categories ranging from 1 (never) to 6 (always). There are no inverted items. Responses are summed for total score, where the higher scores represent more frequent and intense food cravings. The total possible score is 234. The FCQ-T has internal reliability that scales as excellent ( $\alpha > .90$ ), with a retest-reliability over a few weeks as good for the FCQ-T total score ( $r > .80$ ). It was acknowledged that this scale is sensitive to change during interventions, like in obesity or eating disorder treatment. This tool also has construct validity, especially supported by studies that examine food cue reactivity (behavioral, cognitive-affective, or neural responses to food). The 39 items represent nine categories of cravings and are as follows:

- Items 5, 18, 23: having intentions and plans to consume food
- Items 9, 10, 15, 24, 38: anticipation of positive reinforcement that may result from eating
- Items 16, 19, 21: anticipation of relief from negative states and feelings as a result of eating
- Items 2, 3, 22, 25, 26, 29: lack of control over eating
- Items 6, 8, 27, 28, 31, 32, 33: thoughts and preoccupation with food
- Items 11, 12, 13, 14: craving as a physiological state
- Items 20, 30, 34, 39: emotions that may be experienced before or during food cravings or eating
- Items 1, 35, 36, 37: cues that may trigger food cravings
- Items 4, 7, 17: guilt from cravings and/or for giving into them

### 2.5.3 Mindful Eating Questionnaire

The Mindful Eating Questionnaire (MEQ) is a validated tool to measure the nature of mindful eating.<sup>20</sup> The MEQ has a score of good internal consistency and reliability. It consists of 28 items and response categories ranging from 1 (never/rarely) to 4 (usually/always), where higher scores signify more mindfulness. The possible total for the Mindful Eating Questionnaire was 112. Responses are calculated as the mean of items separately for each factor. Then, the summary score is the mean of the five factors, where a higher score indicates more mindful eating. The 28 items represent five factors that are as follows:

- Factor 1 (items 1-8): disinhibition
- Factor 2 (items 9-15): awareness

- Factor 3 (items 16-21): external cues
- Factor 4 (items 22-25): emotional response
- Factor 5 (items 26-28): distraction

## **2.6 Analysis**

Due to the sample size of 23, descriptive analysis was performed on all questionnaires at first. At baseline, mean FCQ-T and MEQ values were compared using an independent t-test analysis. To determine the effect of the mindfulness education session on FCQ-T and MEQ values, a repeated samples one-way ANOVA was performed. All quantitative analyses were performed using SPSS Version 29. Qualitative analysis was used to assess workbook responses and journal prompt responses to determine preconceptions, prevalence and engagement in mindfulness practice.

## **3. Results**

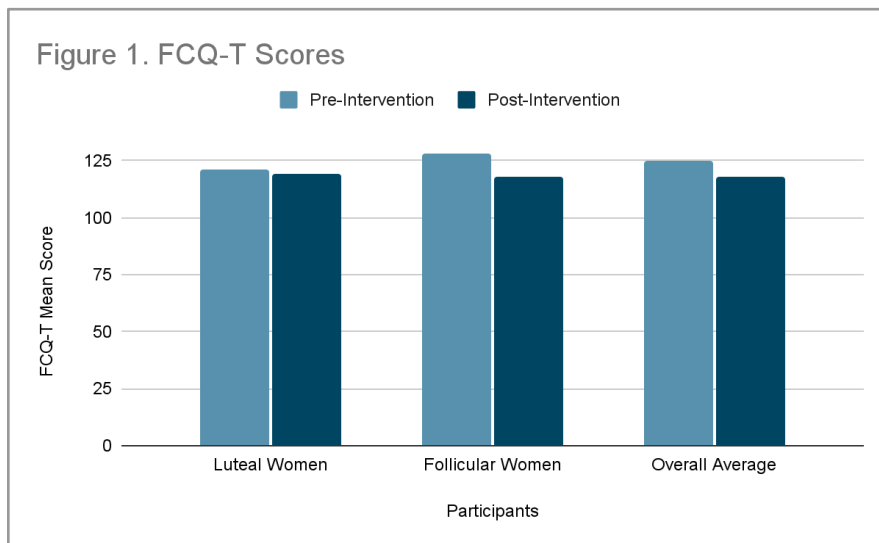
### **3.1 Participants**

There were 23 women who participated in the mindfulness education sessions. Participants were students at the University of Dayton, between the ages of 18-24 years, who experienced a menstrual cycle and were able to track it. At the time of the education session, of the 23 women, 11 were in the luteal phase and 12 were in the follicular phase. A month later for the post-survey, 11 were in the luteal phase and 12 were in the follicular phase as well.

<b>Frequencies of Participants</b>					
<b>Gender</b>	<b>Age</b>	<b>Race/Ethnicity</b>	<b>Experience a menstrual cycle</b>	<b>Phase of menstrual cycle</b>	<b>Medications that influence hormones</b>
100% Female	100% 18-24 years	100% White	100% Yes	48% luteal 52% follicular	35% oral contraceptive 4% IUD 61% N/A

### 3.2 FCQ-T

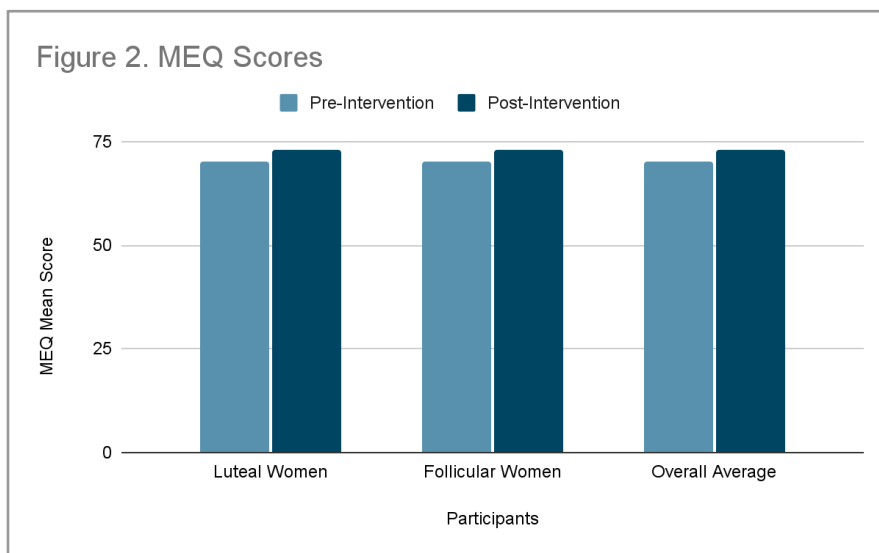
The possible total of the Food Craving Questionnaire-Trait was 234. The overall mean of all participants for the pre-intervention Food Craving Questionnaire-Trait was a score of  $124.83 \pm 18.05$  (See Figure 1). This demonstrates a high frequency and intensity of their food cravings. The luteal women scored an average of  $120.45 \pm 21.12$  and the follicular women scored an average of  $128.83 \pm 14.48$ , evident of high frequency and intensity of food cravings as well. When looking at the follicular women compared to the luteal women, there was no statistical difference in pre-intervention FCQ-T scores. The post-intervention results had an overall average score of  $117.43 \pm 17.61$ , with the luteal women scoring an average of  $116.00 \pm 14.09$  and the follicular women scoring an average of  $118.75 \pm 20.87$ . Of the 23 participants, 61% (14) had lower FCQ-T scores for the frequency and intensity of their food cravings. A repeated measures one-way ANOVA analysis found FCQ-T scores trending towards a decrease from pre-intervention to post-intervention ( $124.83 \pm 3.76$  to  $117.44 \pm 3.67$ ), but this finding was not statistically significant ( $p=0.204$ ).



### 3.3 MEQ

The possible total for the Mindful Eating Questionnaire was 112. Results of the pre-intervention for the Mindful Eating Questionnaire had an overall average score of  $69.74 \pm 5.63$ , with the luteal women scoring an average of  $70.45 \pm 1.77$  and follicular women

scoring an average of  $69.08 \pm 1.61$ , indicating the acquisition of some mindful eating skills with room to grow in (See Figure 2). The post-intervention results had an overall mean score of  $72.57 \pm 6.45$ , with the luteal women scoring a mean of  $72.09 \pm 6.46$  and follicular women scoring an average of  $73.00 \pm 6.70$ . Of the 23 participants, 70% (16) had increased mindful eating skills over the course of a month since engaging in the mindfulness education session. A repeated measures one-way ANOVA analysis found MEQ scores trending towards an increase from pre-intervention to post-intervention ( $69.74 \pm 5.63$  to  $72.57 \pm 6.45$ ), but this finding was not statistically significant ( $p=0.127$ ).



### ***3.4 Qualitative Data - Workbook Responses***

The mindfulness education session was developed using a similar framework from Mason et al.'s study.<sup>21</sup> A workbook consisting of open ended questions was provided to all participants. These findings are outlined in Table 1. After listening to an introduction of the topic, participants were instructed to reflect on if they engaged with mindful eating before and the prevalence of food cravings in their lives (See Table 1). Prior to the intervention some noted they were aware of mindful eating but did not actively engage in it. Some reported they were intentional with eating and identified as health-conscious. A third group that emerged were those that had never practiced mindful eating and admittedly are often distracted and mindless when eating.

### Types of Foods Craved

Cravings were associated with foods that were sweet, savory, high fat and sugar, high fat with protein, and carbohydrate-rich. Environmental factors such as accessibility, boredom, stress, and the week before their menstrual phase began were identified as promoters to cravings.

### Attitudes Towards Food Cravings

One-third of all participants reported guilt, along with sentiments of shame, regret, and self-consciousness associated with indulging in cravings. Some reported frustration and annoyance at themselves for giving into their food craving. A few described restricting intake or engaging in exercise after a craving in order to compensate. A few reported a non-judgmental attitude towards themselves recognizing it is acceptable to give into cravings.

**Table 1. Pre-Intervention Workbook Responses**

Topic	Themes	Quotes
Practicing mindfulness	<ol style="list-style-type: none"> <li>1. Unconscious eater: never engaged with mindfulness, distracted eating</li> <li>2. Intentional eater: slow down, health-conscious, listens to hunger and fullness cues</li> <li>3. Aware of what it is but does not practice: feels silly, in a rush</li> </ol>	<ol style="list-style-type: none"> <li>1. “I do a lot of mindless eating. I often give into my cravings and don’t think about how often I eat or what I’m eating. Eating is not often conscious for me” (ID #17)</li> <li>2. “I feel a lot better when I practice it - like enjoying every bite and eating without distractions” (ID #20), “I am aware when I am hungry and eat what will sustain and fuel my body instead of instant satisfaction” (ID #14)</li> <li>3. “I feel silly doing it sometimes. Usually I am in too much of a rush that I just scarf down my food without tasting it” (ID #18)</li> </ol>

Cravings	<ol style="list-style-type: none"> <li>1. Types of food craved <ol style="list-style-type: none"> <li>1. Sweet</li> <li>2. Savory</li> <li>3. High fat, high sugar</li> <li>4. High fat with protein</li> <li>5. Carbohydrate-rich</li> </ol> </li> <li>2. Frequency of cravings <ol style="list-style-type: none"> <li>1. Daily</li> <li>2. Most intensely during the menstrual phase and the week before</li> <li>3. Depends on boredom /procrastination level</li> </ol> </li> <li>3. Accessibility to cravings <ol style="list-style-type: none"> <li>1. Readily accessible</li> <li>2. Intentionally does not buy craved foods</li> </ol> </li> <li>4. Environmentally <ol style="list-style-type: none"> <li>1. Distracted: watching television, on the phone, school work</li> <li>2. At home</li> <li>3. Nighttime</li> <li>4. After a meal</li> <li>5. With alcohol</li> <li>6. Mentally: stressed, bored, homesick</li> <li>7. Socially: unsettled in social settings, with roommates, friends, families, celebrations</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Half of participants stated sweet <ol style="list-style-type: none"> <li>1. Sweet like chocolate</li> <li>2. Savory/salty, like chips, fries</li> <li>3. High fat and sugar like ice cream, cookies, cookie dough</li> <li>4. High fat with protein like cheese, peanut butter</li> <li>5. Carbohydrates like pizza, pasta, bread</li> </ol> </li> <li>2. Half of participants said daily</li> <li>3. Half of participants said readily accessible</li> <li>4. Half of participants said when stressed, when bored <ol style="list-style-type: none"> <li>1. “While doing school work or while watching a show” (ID #1)</li> <li>2. “If I am hanging around my house for longer periods of time the cravings are more likely to come up” (ID #10)</li> <li>3. “After dinner, I crave sweets” (ID #21)</li> <li>4. “I experience cravings more when drinking” (ID #7)</li> <li>5. “I tend to crave homemade meals when I am away from home” (ID #3)</li> <li>6. “My sweet food cravings are always with friends and family after a get-together, hang-out, or event” (ID# 4)</li> </ol> </li> </ol>
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<p>Attitudes and emotions after eating craved food</p>	<ol style="list-style-type: none"> <li>1. Remorse <ol style="list-style-type: none"> <li>1. Guilt, shame, self-conscious, uncomfortable, regret</li> </ol> </li> <li>2. Anger <ol style="list-style-type: none"> <li>1. Frustration, annoyance, judgment</li> </ol> </li> <li>3. Restriction <ol style="list-style-type: none"> <li>1. Compensates with restriction after, used to reverse the lack of control and discipline sentiment</li> </ol> </li> <li>4. Without worry <ol style="list-style-type: none"> <li>1. Acknowledges it is normal, provides grace to self</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. One third participants said guilt <ol style="list-style-type: none"> <li>1. “Before consuming the craved food I think that it will make me feel satisfied but really I only get satisfaction when I am eating the food and afterwards I feel bad about it” (ID #2)</li> <li>2. “Guilt, shame, trapped” (ID #15)</li> </ol> </li> <li>2. “They frustrate me about my lack of control and discipline when I experience a craving” (ID #23) <ol style="list-style-type: none"> <li>1. “They often make me feel unhealthy or judgmental towards myself” (ID #20)</li> </ol> </li> <li>3. “My solution seems to be that I need to go exercise rather than not eat it” (ID #23)</li> <li>4. “I think it is important to acknowledge these cravings. The mentality I was taught growing up was to satisfy the itch in a small quantity in the present to avoid overindulging later” (ID #14) <ol style="list-style-type: none"> <li>1. “I usually don’t mind too much and don’t really worry about it” (ID #11)</li> <li>2. “Sometimes I regret eating as much as I did or what I ate. Other times I have grace for myself and realize it’s a balancing act” (ID #6)</li> </ol> </li> </ol>
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At the end of the intervention, participants were instructed to practice mindfulness with a food craving that came up within the month between the two sessions. They completed the prompts to provide insight into feeling and processing the food craving and why that might be (See Table 2).

### **Acknowledging the Craving Through Physical and Emotional Sensations**

Participants recognized their cravings as a physical sensation, describing it as “mouth watering.” Emotionally, these cravings proved to be pulling their focus away from whatever they were doing, leading numerous participants to report their stressed out, antsy feelings. Some reported feeling disheartened and wanting the craved food to serve as comfort. Others reported feeling angry with their craving and shameful.

### **Contemplation of Fulfilling the Craving**

Nearly all participants reported feeling full when experiencing their hunger and fullness levels. When answering prompts that probed a participant to work through their craving, some reported anticipatory pride if they did not give into their craving, while others reported feeling unsatisfied. On the other hand, when participants were asked what they would feel if they did eat their craved food, the theme of guilt and shame appeared, as it had in the first set of prompts prior to the mindfulness intervention. The last element of working through the craving section asked participants to identify their current mental state, with nearly all participants reporting that they felt stressed, overwhelmed, and burdened with school.

### **Applying Mindfulness Strategies**

The prompts go on to have the participants practice a body scan and breathwork. When asked if the craving had shifted at all after slowing down, many participants reported no longer needing to fulfill the craving, due to reasons such as the body scan making them feel grateful for their body or that their stress had decreased, reducing their impulsivity for the craving as well. There were other participants that reported giving into the craving, but not to the same extent as before, such as by adjusting portion sizes. There was a space at the end of the journal prompts for free-writing, where a few participants summarized their experience with this study. These responses included reflections that this experience helped them learn about themselves, recognize that mindful eating is

challenging but equally beneficial to their health, and that they feel better when they practice the mindfulness strategies they learned.

**Table 2. Post-Intervention Journal Prompts Responses**

Theme	Subtheme	Quotes
Acknowledging the craving	<ul style="list-style-type: none"> <li>a. Types of food craved               <ul style="list-style-type: none"> <li>i. Sweet</li> <li>ii. Savory</li> <li>iii. High fat, high sugar</li> <li>iv. High fat with protein</li> <li>v. Carbohydrate-rich</li> </ul> </li> <li>b. Physically experienced               <ul style="list-style-type: none"> <li>i. Mouth watered</li> <li>ii. Leg bounced</li> <li>iii. Stomach clenched</li> <li>iv. Imagining texture</li> </ul> </li> <li>c. Emotionally experienced               <ul style="list-style-type: none"> <li>i. Distracted: anxious, antsy, stressed, conflicted</li> <li>ii. Subdued: sad, bored, wants comfort and to feel better</li> <li>iii. Intense: anger, shame, overwhelm</li> </ul> </li> <li>d. Hunger/fullness cues               <ul style="list-style-type: none"> <li>i. Nearly all were full</li> <li>ii. Some moderately hungry</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. Over half of participants said chocolate/sweet               <ul style="list-style-type: none"> <li>i. Ice cream</li> <li>ii. Potato chips, french fries, doritos</li> <li>iii. Peanut butter m&amp;m's</li> <li>iv. Sausage spinach farfalle</li> <li>v. Popcorn, chips</li> </ul> </li> <li>b. Half of participants described mouth watering and/or stomach clenching               <ul style="list-style-type: none"> <li>i. "My mouth was salivating...I wanted the rich taste and smooth texture of chocolate" (ID #22)</li> <li>ii. "I'm salivating and my leg is bouncing" (ID #15)</li> </ul> </li> <li>c. One third reported they would feel better if they have their craved food               <ul style="list-style-type: none"> <li>i. "Emotionally and mentally, I feel distracted from what I was working on...I won't be able to focus on anything else" (ID #12)</li> <li>ii. "I was bored while watching a movie" (ID #19)</li> <li>iii. "It's all I can think about. It's making me feel anxious and ashamed" (ID #15)</li> </ul> </li> <li>d. Nearly all reported full</li> </ul>
Working through the craving	<ul style="list-style-type: none"> <li>a. If craving is not eaten               <ul style="list-style-type: none"> <li>i. Proud</li> <li>ii. Unsatisfied</li> </ul> </li> <li>b. If craving is eaten               <ul style="list-style-type: none"> <li>i. Remorse: guilt</li> <li>ii. Temporary satisfaction: comfort, pleasure, nostalgia, fleeting happiness</li> </ul> </li> <li>c. Current mental state               <ul style="list-style-type: none"> <li>i. Overwhelmed:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. Almost half reported unsatisfied/unfulfilled/unsatiated               <ul style="list-style-type: none"> <li>i. "If I don't have chocolate I believe I will continue to think about it...proud of myself for resisting the temptation" (ID #6)</li> </ul> </li> <li>b. "I think I'll feel a little better short term, but not long term...self soothing" (ID #19)               <ul style="list-style-type: none"> <li>i. "I think if I have the food, I will feel like eating is over and</li> </ul> </li> </ul>

	<p>stressed, overworked with school, academic burden</p> <ul style="list-style-type: none"> <li>ii. Down: sad, lonely, homesick</li> <li>iii. Exhausted: drained</li> </ul>	<p>I can move onto my next task” (ID #18)</p> <ul style="list-style-type: none"> <li>c. Nearly all stated overwhelmed or overworked with school, or stressed <ul style="list-style-type: none"> <li>i. “I am definitely tired...on my period feeling sad...a little off” (ID #10)</li> </ul> </li> </ul>
Post-body scan, breathwork, slowing down	<ul style="list-style-type: none"> <li>a. No longer needed to fulfill craving <ul style="list-style-type: none"> <li>i. Relaxed: stress decreased, did not feel as urgent, craving had weakened</li> <li>ii. Grateful for body</li> <li>iii. Did something else</li> </ul> </li> <li>b. Gave into the craving <ul style="list-style-type: none"> <li>i. Not to the same extent as before though</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. “The craving did weaken when I slowed down to focus on my breathing” (ID #22) <ul style="list-style-type: none"> <li>i. “The desire has shifted a little bit because I am more aware of how full my stomach feels. The scan also made me feel thankful for my body and wanting to nourish it” (ID #6)</li> <li>ii. “I feel more at peace/relaxed enough to not make an impulsive decision” (ID #8)</li> <li>iii. “I feel a bit less like having a cookie and a bit more like I should do something relaxing for a while like coloring” (ID #10)</li> </ul> </li> <li>b. “The body scan was so nice and I decided to have half a cookie” (ID #7)</li> </ul>
Final thoughts about the experience	<ul style="list-style-type: none"> <li>a. More conscious of cravings <ul style="list-style-type: none"> <li>i. Learning about self</li> </ul> </li> <li>b. Mindful eating is challenging <ul style="list-style-type: none"> <li>i. Busy college life</li> <li>ii. Struggle to remind self</li> </ul> </li> <li>c. Engages with mindful eating consistently <ul style="list-style-type: none"> <li>i. Enjoys food more</li> <li>ii. Part of healthier lifestyle</li> <li>iii. Feels better</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. “I have been practicing a lot of mindful eating habits this past month. My favorite has been practicing a full sensory experience while I eat. This has helped me really enjoy my food more...I get so busy so this helped me slow down and listen to my hunger cues. In terms of cravings, I have been taking more time to consider them. While I still often give in, this tactic has helped me know how much of it I should eat so I don’t stuff myself. I plan on continuing to use these tactics to live a healthier lifestyle” (ID#17)</li> <li>b. “Since the first workshop, I have become more conscious of my cravings. I feel less bad after giving into a craving because I have acknowledged and accepted it. I have</li> </ul>

		<p>also noticed that I truly appreciate and enjoy food more when 1.) I am not in a rush to eat and 2.) When there are no distractions such as TV or TikTok...During this experience I was able to recognize my fullness and take leftovers home instead of continuing to eat off my plate” (ID #6)</p> <p>c. “Taken more time to slow down and be mindful of what I’m eating. I haven’t always done this, but I feel better when I eat now” (ID #3)</p> <p>d. “I realize cravings kick in when I don’t eat every couple of hours. The longer I wait to eat an actual snack/meal, the stronger the craving is” (ID #19)</p> <p>e. “I try and remember to mindfully eat but I struggle to remind myself” (ID #18)</p> <p>f. “I notice I tend to crave things at the end of the day too, like my defenses break down at that point and I give into the cravings” (ID #23)</p> <p>g. “I made sure to sit and eat without distractions as much as possible. Definitely a challenge being a busy college student but a good one at that!” (ID #14)</p>
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## 4. Discussion

Studies to date have shown a mere association of food cravings and the menstrual cycle, noting an increased presence in relation with increased progesterone.<sup>5,9,10</sup> Progesterone and energy expenditure increase the most during the luteal phase of a woman’s menstrual cycle.<sup>5</sup> Studies to date have also focused on mindfulness mitigating the frequency, intensity, and duration of food cravings.<sup>6</sup> This study aimed to bridge the gap by evaluating the effects of a mindfulness intervention on managing hedonic eating patterns, or food cravings, associated with the menstrual cycle and on mindful eating behaviors.

### **Food Craving Behaviors**

Considering the participants were college-aged females, the pre-intervention survey results were consistent with the literature in regard to the prevalence of food cravings and the relevance to the participants' stage of life and environment of college.<sup>1</sup> The workbook responses prior to delivering the intervention were accurate with what was seen in the literature for what kind of foods were craved: sweet, savory, high fat and sugar, high fat with protein, and carbohydrate-rich.<sup>6</sup> Workbook responses revealed food cravings occurring daily for half of the participants, with their craved foods being readily accessible to them. The literature discussed increased energy intake in these college-aged females due to stress, accessibility, and busy schedules.<sup>1</sup> Stress was reported to be a factor influencing cravings across most participants. Stress further increases ghrelin secretion, or the hunger signal, in accordance with eating for emotional compensation to relieve the stressed feelings.<sup>14</sup> The FCQ-T affirmed what the workbook responses had shown for the frequency and intensity of food cravings that participants had experienced, which was strongly apparent overall as a group and not limited to one group of women in a certain phase of their menstrual cycle.

Contradictory to current literature, luteal women were not more affected by the intensity and frequency of food cravings, as follicular women scored higher. The literature had intensity and frequency of food cravings being the highest in the luteal phase because that is where progesterone dominates, associated with increased energy expenditure, increased energy intake, and increased fat storage.<sup>5,10</sup> Although the difference between women in the follicular phase and the luteal phase was not statistically different, indicating this difference could be random and thus negligible.

Attitudes after the craved food was eaten was not congruent with the literature, as the literature discussed hormones such as dopamine being part of pleasurable eating, delaying satiety and lengthening the meal experience.<sup>13</sup> Engaging in hedonic eating behaviors, in the literature, referred to a relief of negative feelings, hence becoming a conditioned response when a food craving became associated with a negative feeling.<sup>13</sup> However, one third of participants reported guilt, shame, and regret as emotions felt after eating their craved food. This was novel in a sense that this mindfulness intervention

would not only address food cravings throughout a woman's menstrual cycle for the sake of her physical health, but also for her mental health.

Once the mindfulness education session was implemented and a month passed, a trend towards decreased hedonic eating patterns was observed in the FCQ-T post-intervention scores, although not statistically significant. However, nearly all participants described the meaning and benefit of the mindfulness practice in improving their food cravings. It is consistent with the literature that mindfulness strategies, such as present moment awareness, acceptance, and decentering, benefitted participants by decreasing their hedonic eating patterns.<sup>6</sup>

### **Mindful Eating Behaviors**

The workbook responses demonstrated that most participants revealed they were familiar with mindful eating from social media and peers, but had not routinely and purposefully engaged with it. The MEQ pre-intervention score for the entire group affirmed this, displaying a moderate amount of mindful eating skills. After learning about mindfulness strategies and experiencing first-hand through the journal prompts how their food cravings felt less urgent after applying the techniques, the post-intervention MEQ scores for the entire group increased accordingly, although not statistically significant.

What was different from the literature in the set of journal prompts about acknowledging their chosen food craving was that one third of participants thought they would emotionally feel better if they ate the craved food, but when contemplating if the craving was actually eaten, many reported guilt and remorse. This is novel because the craving is so overwhelmingly distracting they feel they must eat it now to feel better, but recognize it is a temporary, fleeting satisfaction that will manifest into disappointment in oneself and guilt. As the prompts encouraged working through their craving mindfully, these types of emotions were recognized. The literature focused mostly on stress, which is present with these journal prompt responses as academically burdened college students.<sup>2</sup> However, what also emerged from these responses that was unique was sadness, loneliness, and exhaustion as to what they felt when their food craving came up. Once the journal prompts instructed them to practice the body scan and breathwork, they were able to relax and have their stress decrease. Applying mindfulness techniques revealed that

their food cravings were associated with the stress and overwhelm from schoolwork, while also allowing them to check in with themselves for other emotions they were experiencing.

The post-intervention journal prompt responses affirmed the literature about how mindfulness strategies are successful in managing food cravings, as the body scan, breathwork, and slowing down the eating experience responses demonstrated.<sup>6</sup> The mindfulness strategies did decenter and create awareness as the literature had shown, but also gratitude for their body and mind, a deeper connection to their inner self that moved away from the food on its own, but more about checking in with how they were feeling in that present moment.<sup>6</sup>

It is consistent with the literature that the increase from pre-intervention to post-intervention MEQ scores was small, as it is important to note the length of time in between surveys was one month and only one 60-minute mindfulness education session was implemented.<sup>21</sup> It has been shown that with more mindfulness education sessions, the MEQ scores would improve drastically.<sup>6</sup> Although the quantitative data showed inconclusive results for the intervention decreasing food craving behaviors, the qualitative responses revealed that mindfulness is within one's control to practice, to ameliorate these food cravings and aid in stress-management for the sake of their mental health, too.

### ***Strengths and Limitations of the Study***

Limitations of this study include having a small sample size, as recruiting individuals and scheduling individuals was challenging. Taking this into consideration, the statistical analysis used this small sample size of 23, which was less than what was determined as statistically powerful, which was 30. Another limitation was not specifying late luteal phase compared to early luteal phase for women to be categorized in, as the hedonic eating behaviors are shown in the literature to be present in those most in mid-luteal and the late luteal phase, also known as the premenstrual phase. Strengths of this study included having participants write free responses during the mindfulness education session and within the month in between the surveys to engage with their cravings mindfully. These responses provided more individualized details to a person's prior



experience with mindful eating, if any, and with how they felt from the mindfulness education session when applying its tools to their food cravings. This was beneficial to read and analyze in addition to the surveys, rather than relying on the surveys alone for results. Lastly, strengths of this study include having a nearly equal proportion of participants in the luteal phase as were in the follicular phase.

### ***Implications and Future Research***

There are many areas of future research from this study. For one, the mindful education session could be developed to expand over the course of 8 weeks, with an aim to build mindful eating habits with participants over a longer time frame. This could result in stronger mindful eating skills and decreased prevalence of food cravings.

Additionally, it would be interesting to have a similar intervention with postmenopausal women, educating these women at the hormones involved in this stage of life and how this affects the eating experience. In this case, it would be beneficial to see if food cravings are as prevalent and if mindfulness is a helpful strategy for this population.

Lastly, a component of this study that could be added is nutrition counseling with the participants to make changes for healthier alternatives that are tailored to their personalized preferences for the foods they crave in the premenstrual phase.

## **5. Conclusion**

All in all, the quantitative data showed inconclusive results in the mindfulness education session helping to decrease food craving behaviors and mindful eating behaviors.

However, the qualitative data demonstrated that everyone benefited from the mindfulness education session and grew in their mindful eating skills, regardless of what menstrual cycle phase they were in. This is beneficial in order to help them ameliorate premenstrual hedonic eating behaviors, as well as when they are not in the late luteal phase. Moreover, mindfulness helps grow consciousness about their physical and mental states to alleviate negative sentiments around hedonic eating, decrease stress, and reconnect with themselves.

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## Appendix 1

### Food Craving Questionnaire-Trait

ITEMS	RESPONSE CATEGORIES					
	Never/N/A	Rarely	Sometimes	Often	Usually	Always
1. Being with someone who is eating often makes me hungry.	1	2	3	4	5	6
2. When I crave something, I know I will not be able to stop eating once I start.	1	2	3	4	5	6
3. If I eat what I am craving, I often lose control and eat too much.	1	2	3	4	5	6
4. I hate it when I give in to cravings.	1	2	3	4	5	6
5. Food cravings invariably make me think of ways to get what I want to eat.	1	2	3	4	5	6
6. I feel like I have food on my mind all the time.	1	2	3	4	5	6
7. I often feel guilty for craving certain food.	1	2	3	4	5	6
8. I find myself preoccupied with food.	1	2	3	4	5	6
9. I eat to feel better.	1	2	3	4	5	6
10. Sometimes, eating makes things seem just perfect.	1	2	3	4	5	6
11. Thinking about my favorite foods makes my mouth water.	1	2	3	4	5	6
12. I crave foods when my stomach is empty.	1	2	3	4	5	6
13. I feel as if my body asks me for certain foods.	1	2	3	4	5	6
14. I get so hungry that my stomach seems like a bottomless pit.	1	2	3	4	5	6
15. Eating what I crave makes me feel better.	1	2	3	4	5	6

16. When I satisfy a craving I feel less depressed.	1	2	3	4	5	6
17. When I eat what I am craving I feel less depressed.	1	2	3	4	5	6
18. Whenever I have cravings, I find myself making plans to eat.	1	2	3	4	5	6
19. Eating calms me down.	1	2	3	4	5	6
20. I crave foods when I feel bored, angry, or sad.	1	2	3	4	5	6
21. I feel less anxious after I eat.	1	2	3	4	5	6
22. If I get what I am craving I cannot stop myself from eating it.	1	2	3	4	5	6
23. When I crave certain foods, I usually try to eat them as soon as I can.	1	2	3	4	5	6
24. When I eat what I crave I feel great.	1	2	3	4	5	6
25. I have no willpower to resist my food crave.	1	2	3	4	5	6
26. Once I start eating, I have trouble stopping.	1	2	3	4	5	6
27. I cannot stop thinking about eating no matter how hard I try.	1	2	3	4	5	6
28. I spend a lot of time thinking about whatever it is I will eat next.	1	2	3	4	5	6
29. If I give in to a food craving, all control is lost.	1	2	3	4	5	6
30. When I'm stressed out, I crave food.	1	2	3	4	5	6
31. I daydream about food.	1	2	3	4	5	6
32. Whenever I have a food craving, I keep on thinking about eating until I actually eat the food.	1	2	3	4	5	6
33. If I am craving something, thoughts of eating it consumes me.	1	2	3	4	5	6

<b>34. My emotions often make me want to eat.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>35. Whenever I go to a buffet I end up eating more than what I needed.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>36. It is hard for me to resist the temptation to eat appetizing foods that are in my reach.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>37. When I am with someone who is overeating, I usually overeat too.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>38. When I eat food, I feel comforted</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>39. I crave foods when I'm upset.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>

## Appendix 2

### Mindful Eating Questionnaire

ITEMS	RESPONSE CATEGORIES			
	Never/Rarely	Sometimes	Often	Usually/Always
1. I stop eating when I'm full even when eating something I love.	1	2	3	4
2. When a restaurant portion is too large, I stop eating when I'm full.	1	2	3	4
3. When I eat at "all you can eat" buffets, I tend to overeat.	1	2	3	4
4. If there are leftovers that I like, I take a second helping even though I'm full.	1	2	3	4
5. If there's good food at a party, I'll continue eating even after I'm full.	1	2	3	4
6. When I'm eating one of my favorite foods, I don't recognize when I've had enough.	1	2	3	4
7. When I'm at a restaurant, I can tell when the portion I've been served is too large for me.	1	2	3	4
8. If it doesn't cost much more, I get the larger size food or drink regardless of how hungry I feel.	1	2	3	4
9. I notice when there are subtle flavors in the foods I eat.	1	2	3	4
10. Before I eat I take a moment to appreciate the colors and smells of my food.	1	2	3	4
11. I appreciate the way my food looks on my plate.	1	2	3	4
12. When eating a pleasant meal, I notice if it makes me feel relaxed.	1	2	3	4
13. I taste every bite of food that I eat.	1	2	3	4
14. I notice when the food I eat affects my emotional state.	1	2	3	4



15. I notice when foods and drinks are too sweet.	1	2	3	4
16. I recognize when food advertisements make me want to eat.	1	2	3	4
17. I notice when I'm eating from a dish of candy just because it's there.	1	2	3	4
18. I recognize when I'm eating and not hungry.	1	2	3	4
19. I notice when just going into a movie theater makes me want to eat candy or popcorn.	1	2	3	4
20. When I eat a big meal, I notice if it makes me feel heavy or sluggish.	1	2	3	4
21. At a party when there is a lot of good food, I notice when it makes me want to eat more food than I should.	1	2	3	4
22. When I'm sad I eat to feel better.	1	2	3	4
23. When I'm feeling stressed at work I'll go find something to eat.	1	2	3	4
24. I have trouble not eating ice cream, cookies, or chips if they're around the house.	1	2	3	4
25. I snack without noticing that I am eating.	1	2	3	4
26. My thoughts tend to wander when I am eating.	1	2	3	4
27. I think about things I need to do while I am eating.	1	2	3	4
28. I eat so quickly that I don't taste what I'm eating.	1	2	3	4

## Appendix 3

### Mindfulness Education Session Outline

#### Introduction

1. Why this session
2. Differences between food cravings, appetite, and hunger
3. Food seeking behaviors and how environmental factors and hormones influence these
4. An overview of the menstrual cycle and connecting it to energy intake and food cravings

#### Pillar #1 Defining Mindful Eating

1. Defining mindful eating and mindless eating
2. Defining hedonic eating patterns
  - a. Positive reinforcement
  - b. Negative reinforcement
  - c. Connecting with your cycle
3. Look inward to reflect on *your* relationship with mindful eating and with cravings

#### Pillar #2 Mental Awareness

1. Existing with the craving: RAIN exercise (Recognize, Accept, Investigate, Note)
  - a. Be non-judgmental with yourself about them
2. Be kind and give grace to yourself, practice positive inner self-talk
3. Meditation practice (Veterans Health Administration)

#### Pillar #3 Physical Sensations

1. Hunger and satiety cues
2. Body scan (Greater Good Science Center)
3. Slowing down the eating experience (Veterans Health Administration)

#### Pillar #4 Next Steps

1. Recalibration in the moment: slow down in the moment, get curious, be present
1. If you do give into cravings - that's ok! Do not play the shame game
2. Engage with your cravings - journal prompts
  - a. Can reveal patterns, reasonings, etc. to gain more awareness