MINDFULNESS AND BINGE EATING SYMPTOMS IN UNDERGRADUATE COLLEGE FEMALES

by

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ABSTRACT

Mindfulness is a multi-faceted construct. Its five constituent facets include: observing, describing, acting with awareness, nonjudgment of inner experience and nonreactivity to inner experience. Mindfulness is a skill that is now being studied due to its relationship to lower levels of negative psychological conditions. Binge eating symptoms, which are associated with negative psychological states such as anxiety and depression, are especially prominent among college females. Currently, no study has investigated the relationship between all five of the facets and binge eating symptoms in undergraduate college females. The purpose of this study is to investigate the relationship between mindfulness as a whole, and all five facets of mindfulness and binge eating symptoms in undergraduate college females.

Fifty-two female college students (18-26 years old) at the University of Delaware completed self-administered questionnaires assessing demographic characteristics, mindfulness and binge eating symptoms as part of a randomized controlled trial. Anthropometric measurements were also taken. There was a significant, moderate, negative correlation between mindfulness and binge eating symptoms ($r_s(50)=-0.48$ $p<0.01$), indicating that as mindfulness increased, binge eating symptoms decreased. Three of the five facets were significantly negatively related to binge eating symptoms: acting with awareness ($r_s(50)=-0.36$, $p=0.08$), nonjudgment of inner experience ($r_s(50)=-0.49$, $p<0.01$) and nonreactivity to inner experience ($r_s(50)=-0.49$, $p<0.01$). Observing and describing were not significantly associated with binge eating symptoms ($p’s > 0.05$). The relationship between
mindfulness and binge eating symptoms did not differ between individuals with a Body Mass Index (BMI) indicating overweight (BMI ≥25.0) or normal weight (BMI <24.9). Results from this study can be used to inform future interventions that develop prevention strategies and mindfulness-based intervention programs for binge eating symptoms in college females. Based on the results described here, a focus on the facets acting with awareness, nonjudgment, and nonreactivity may be beneficial for these programs. The temporal relationship between the facets of mindfulness and binge eating symptoms is an avenue for future research.
Chapter 1

INTRODUCTION

Mindfulness is broadly defined as “a state of consciousness, which involves consciously attending to one’s moment-to-moment experience”. Mindfulness is a multifaceted construct, composed of five facets including: observing, describing, acting with awareness, nonjudgement of inner experience, and nonreactivity to inner experience. Overall mindfulness and these facets can be measured using the five facet of mindfulness questionnaire (FFMQ). Mindfulness is a skill that is now being used as a method to alter negative psychological conditions such as stress, anxiety and distress. One specific psychological condition that mindfulness may be applied to is eating disorders, specifically binge eating disorder (BED).

BED affects people of all ages, with 2.8% of the U.S adult population having BED at some point in their lifetime. Although the prevalence of BED may seem low, subthreshold levels of eating disorder behaviors (e.g. binge eating symptoms) are more common. Binge eating symptoms are defined as “eating unusually large quantities of food, accompanied by a loss of control over one’s eating”. Binge-eating episodes are not followed by purging, resulting in excess caloric intake relative to needs, so individuals who experience binge eating symptoms may be at higher risk of having overweight or obesity. Furthermore, BED is associated with experiencing guilt, shame and/or distress about the behavior, which could lead to more binge eating.
Binge eating symptoms are especially prominent among college females. A couple of studies have assessed the prevalence of binge eating in college females. One study (n=852) found that among college-aged females, 25% reported binge eating symptoms. Another study of 450 college-aged females found that 33% of these females reported binge eating symptoms during their first year of college. The average age onset of binge eating symptoms is 22 years old and the average onset of full threshold BED is 25 years old. Taking preventative action during the college years could prevent binge eating symptoms from escalating to BED. One preventative action that could be been considered is mindfulness.

Recently, the relationship between mindfulness and binge eating symptoms in undergraduate college females has been of interest. A handful of cross-sectional studies have used the FFMQ and eating behavior surveys to assess the relationship between these two variables in both male and female undergraduate college students. Many of these studies examined the relationship between some, but not all, of the individual facets of mindfulness and eating behaviors, and did not use a tool to directly measure binge eating symptoms. Instead, instruments that measure disinhibited eating behaviors were used. Given that disinhibited eating represents a necessary state for binge eating to occur, studies that measured disinhibited eating and mindfulness were included here for review. The previous literature suggests that mindfulness as a whole and the facets describing, acting with awareness, nonjudgment of inner experience and nonreactivity of inner experience are negatively associated with binge eating symptoms in undergraduate college females.
Currently, no study has investigated the relationship between all five of the facets and binge eating symptoms in undergraduate college females. The purpose of this study was to investigate the relationship between mindfulness as a whole, and all five facets of mindfulness and binge eating symptoms in undergraduate college females. Exploring whether specific facets of mindfulness have negative correlations with binge eating symptoms, while others may not, could contribute to the development of targeted prevention strategies and mindfulness-based interventions for binge eating symptoms in college students.
Chapter 2

REVIEW OF THE LITERATURE

2.1 Mindfulness

The concept of mindfulness originates from Eastern spiritual traditions, most commonly in the form of mindfulness meditation. In this culture, meditation is used as a method to develop the skill of mindfulness, defined as “a state of consciousness, which involves consciously attending to one’s moment-to-moment experience.” However, mindfulness is not only used in the form of meditation. Based on a variety of definitions, mindfulness has been broadly described as “a process of bringing certain quality of attention to a moment-by-moment experience” and “being aware within the present moment without judging.” In a state of mindfulness, one observes thoughts and feelings occurring in the mind and body, but they do not react to these occurrences. This creates a space between one’s perception and response. Though there are many interpretations of mindfulness, no standard definition exists.

Mindfulness is often composed of five facets, which include: observing, describing, acting with awareness, nonjudgement of inner experience, and nonreactivity to inner experience. These facets and overall mindfulness can be measured using the Five Facet of Mindfulness Questionnaire (FFMQ). Each of the 39 items are rated on a 5-point scale ranging from: 1 (“never or very rarely true”) to 5 (“very often or always true”). Each of the five facets of mindfulness are described below in detail.
Observing includes noticing internal and external experiences. These sensory experiences could include smells, sights and emotions (e.g. “When I’m walking, I deliberately notice the sensations of my body moving”).

Describing refers to using words to characterize internal experiences (e.g. “I’m good at finding words to describe my feelings”).

Acting with awareness includes being present in the moment without behaving on autopilot (e.g. attending to present moment experiences). All the items in this subscale are reverse scored.

Nonjudgment of inner experience refers to not evaluating ones’ thoughts or feeling (e.g. “Not criticizing oneself for having irrational or inappropriate emotions”). All the items in this subscale are reverse scored.

Nonreactivity to inner experience is experiencing thoughts and feelings as they come and go without getting caught up in them (e.g. “When I have distressing thoughts or images, I just notice them and let them go”).

Mindfulness is a skill that is now being used in the form of meditation or as a skill-based intervention to help individuals with negative psychological conditions such as stress, anxiety and distress. Research has shown that mindfulness can be beneficial with decreasing these psychological conditions. Recently, research on mindfulness has gained increased attention in the nutrition field. Nutrition researchers are now using mindfulness and its five facets to better understand and modify dietary behavior. When the practice of mindfulness is applied to everyday tasks such as eating, this is otherwise known as mindful eating.
2.2 Mindfulness and Eating

Mindful eating involves being fully aware of the physical and emotional sensations associated with eating (e.g. the sensory properties of one’s food). Steps to eating more mindfully may include: decreasing the pace of eating (e.g., taking breaks between bites, chewing more slowly), not eating in front of distractions such as a computer or television, being aware of the body’s hunger and fullness cues, and observing/acknowledging responses to food (e.g. likes, dislikes, neutral) without judgement. An individual can be mindful while eating a meal by being attuned to the moment-to-moment taste experience (e.g. being aware of the sights, smells and textures of one’s food), while also being aware of their fullness cues. Intuitive eating is a term often used interchangeably with mindful eating. Intuitive eating involves “the body intrinsically knowing the quantity and types of food to eat to maintain both nutritional health and an appropriate weight.”

In summary, mindful eating can help an individual recognize and respond to satiety and hunger cues. Due to the established benefits of mindfulness in other realms and the prevalence of eating pathology, it is important to consider what mindful eating is not: eating behaviors that can be categorized as disinhibited. Disinhibited eating is “the tendency to overeat in response to different stimuli, and can occur in a variety of circumstances such as when an individual is presented with an array of palatable foods or under emotional stress.” Disinhibited eating is also referred to as uncontrolled eating. If someone is eating in response to external or emotional cues these uncontrolled eating episodes may occur because of a motivated
attempt to escape from self-awareness.\textsuperscript{27} These individuals are also likely not attuned to the present moment, which suggests a lack of mindfulness. It is important to consider disinhibition because this is a necessary state for binge eating.\textsuperscript{28}

\section*{2.3 Binge Eating Symptoms}

Binge eating symptoms are the hallmark of binge eating disorder (BED). BED is an identified eating disorder in the \textit{Diagnostic and Statistical Manual of Mental Disorders 4\textsuperscript{th} edition}.\textsuperscript{29} Binge eating symptoms are defined as “eating unusually large quantities of food, accompanied by a loss of control over one’s eating.”\textsuperscript{10} Binge eating symptoms are associated with: eating more rapidly than normal, eating until uncomfortably full, a sense of being out of control, eating large amounts of food when not feeling physically hungry, eating alone due to embarrassment about how much one is eating, feeling disgusted, depressed or guilty following overeating.\textsuperscript{30} All of these characteristics suggest that one’s eating is disinhibited.

Binge eating symptoms are especially prominent among college females.\textsuperscript{11,13} The average onset of subthreshold binge eating disorder is 22 years old,\textsuperscript{8} which is why learning ways to prevent full threshold binge eating disorders in college females is relevant. In previous studies with first year college-aged women, 25-33\% of the sample reported binge eating symptoms.\textsuperscript{12,13} Research has shown that the development of disordered eating in females may represent a psychological accommodation to transitional challenges.\textsuperscript{31,32} One transitional challenge could include starting college. Starting college, moving away from home, and having to be independent in ways one
previously did not have to be represent a transition. In fact, there is a widespread belief that the risk of developing an eating disorder is increased by the college experience. 13 In one study, 15% of the female sample (n=450) reported that they started binge eating over the course of their first year in college. 13 In addition, a study done by Pyle and colleagues, found that 7% of freshman females (n=852) reported binge eating more than once a week. 12 The transition from home life to dorm life, as well as the increased academic rigor can contribute to unprecedented levels of stress in freshman females to the point where they need a coping mechanism, such as binge eating. 13 In a sample of 450 female freshman, 51% reported eating due to stress. 12 Another study’s results suggested that higher perceived stress was associated with the exacerbation of disordered eating symptoms during freshman year. 13 The college environment can be competitive in not only the academic setting, but also in regards of feeling the need to achieve a socially-accepted body. 33 In a study that looked at body dissatisfaction at the beginning of the first year of college, results showed that females with increased body dissatisfaction were about three times more likely to report binge eating symptoms. 34 A study also examined whether the college experience promoted the development of binge eating behaviors and results indicated that females who reported binge eating at the start of the year were significantly more likely to report binge eating by the end of the school year (X²(1) =4.21, p<0.05). 13 Binge eating has been associated with feelings of failure, guilt and loss of control 33 as well as linked to long-term weight gain and obesity, which is why it is an important, but preventable problem. 23, 35
Mindfulness is one strategy that may lessen binge eating symptoms and may also mitigate other negative states, like stress, that precede disinhibited or binge eating.

### 2.4 Mindfulness and Binge Eating Symptoms

In the literature, cross-sectional studies have investigated the relationship between mindfulness and eating behaviors. Previous studies have used the FFMQ as a measure of mindfulness as well as a variety of questionnaires such as the Binge Eating Scale (BES), the Three-Factor Eating Questionnaire (TFEQ), and the Dutch Eating Behavioral Questionnaire (DEBQ) to measure disinhibited eating behaviors in both undergraduate females and males. Only one study used the BES, specifically measuring binge eating symptoms, but the other questionnaires mentioned measure disinhibited eating behaviors and since binge eating symptoms fall under this umbrella, those measures are included.

Originally, the TFEQ was comprised of three subscales, one of which was disinhibition. A revised version of the TFEQ further divided disinhibition into two facets: uncontrolled eating and emotional eating. The DEBQ is a measure of eating behavior that is also comprised of three subscales, two of which envelop disinhibited eating: emotional eating and external eating.

The relationship between mindfulness as a whole and binge eating symptoms or disinhibited eating has been examined in undergraduates. Roberts and colleagues studied both undergraduate males and females and found that mindfulness was significantly negatively correlated with binge eating symptoms measured as by the
This same negative relationship was found between mindfulness and disinhibited eating when using the TFEQ-uncontrolled eating ($r= -0.27$, $p=0.05$), TFEQ-emotional eating ($r= -0.30$, $p=0.05$), the DEBQ-external eating ($r= -0.202$, $p<0.05$) and the DEBQ-emotional eating ($r= -0.23$, $p<0.01$) in undergraduate college females.

Since mindfulness as a whole has been deconstructed into five facets, it is important to investigate which facets specifically relate binge eating symptoms. When considering the individual facets of mindfulness and their relationship to binge eating symptoms, however, the relationship becomes more nuanced.

The facet observing and the correlation with binge eating symptoms has mixed findings in the literature. In a study done by Sala and colleagues using the BES to measure binge eating symptoms, no significant relationship was found between observing and binge eating score. There was also no significant relationship between the facet observing and TFEQ-uncontrolled eating, TFEQ-emotional eating, the DEBQ-external eating or DEBQ-emotional eating. The past literature suggests that there may not be a significant relationship between the facet observing and binge eating symptoms.

The facet describing is not one of the five facets that is always included in studies using the FFMQ. For example, one of the previous studies using college students and the BES did not assess or report the relationship between the facet describing and binge eating symptoms. No previous studies have measured the correlation between this facet and binge eating symptoms using the BES. Other studies
have measured the correlation between describing and disinhibited eating behaviors in undergraduate college females, but only one study, which used the TFEQ-emotional eating subscale, found a significant negative correlation (r= -0.15, p=0.05). There was no significant correlation when using the TFEQ-uncontrolled eating, the DEBQ-external eating or the DEBQ-emotional eating.

In previous studies, the facet acting with awareness, was found to be significantly negatively correlated with binge eating symptoms. The study done by Sala and colleagues was the only study to report the relationship between acting with awareness and binge eating symptoms using the BES. This study found that acting with awareness was significantly negatively correlated with binge eating symptoms (r= -0.37, p<0.001). There was a significant negative correlation between acting with awareness and disinhibited eating when using the TFEQ-uncontrolled eating (r= -0.31, p<0.01), the TFEQ-emotional eating (r= -0.31, p<0.01) and the DEBQ-external eating (r= -0.19, p<0.05).

Nonjudgment of inner experience has been found to be significantly negatively correlated with binge eating symptoms and disinhibited eating behaviors. One of the previous studies using undergraduate college students did not report on the relationship between nonjudgment of inner experience and binge eating symptoms, assessed by the BES. No previous studies have assessed (or reported) the relationship between nonjudgment of inner experience and binge eating symptoms using the BES; however, some studies have measured the relationship between nonjudgment of inner experience and disinhibited eating behaviors. There was a
significant negative correlation between nonjudgment of inner experience and disinhibited eating when using the TFEQ-uncontrolled eating ($r= -0.26$, $p<0.01$), the TFEQ-emotional eating ($r= -0.34$, $p<0.01$) and the DEBQ-external eating ($r= -0.16$, $p<0.05$) in undergraduate college females.

Similarly, to the other facets, *nonreactivity to inner experience* has been found to be significantly negatively correlated with binge eating and eating behaviors. Sala and colleagues found that when using the BES, nonreactivity was significantly negatively correlated with binge eating symptoms in undergraduate college females ($r= -0.31$, $p<0.001$). A relationship in the same direction was found when using the TFEQ-uncontrolled eating subscale ($r= -0.18$, $p=0.05$), the TFEQ-emotional eating subscale ($r= -0.19$, $p=0.05$), the DEBQ-external eating subscale ($r= -0.18$, $p<0.05$) and DEBQ-emotional eating subscale ($r= -0.31$, $p<0.01$) in undergraduate college females.

### 2.5 Mindfulness, Binge Eating Symptoms and Weight Outcomes

Mindful eating skills involve being aware of hunger cues and eating intuitively, which should help individuals recognize and respond to these hunger cues and not overeat. Thus, being mindfulness should correlate with weight. It is also known that individuals who participate in binge eating behaviors are at a greater risk for long-term weight gain and obesity. Some published studies have examined the association of mindfulness and body mass index (BMI). Studies that have used the Mindful Eating Questionnaire (MEQ) to examine the relationship between
mindfulness and BMI in female and male adults found that there was a significant negative correlation.\textsuperscript{40,19} As the BMI of participants increased, the overall mindful eating score decreased. The MEQ has five subscales and in the study conducted by Moor and colleagues, there was a significant negative correlation between the disinhibition subscale score and BMI ($r=-0.30$, $p=0.003$).\textsuperscript{40} Additionally, when using the Intuitive Eating Scale (IES), studies have found that IES scores were negatively related to BMI.\textsuperscript{41,42} Intuitive eating was found to be more common in individuals who were within the normal weight or underweight category.\textsuperscript{42} Based off what is in the literature, we would expect for the relationship between binge eating symptoms and mindfulness to be stronger at higher BMIs because there is more binge eating present.

### 2.6 Literature Review Summary

Overall, the literature suggests that mindfulness as a whole and the facets describing, acting with awareness, nonjudgment of inner experience and nonreactivity to inner experience are negatively associated with binge eating symptoms and disinhibited eating particularly in undergraduate college females. To date, no published study has examined the association between binge eating symptoms, specifically using the BES, and mindfulness as a whole and broken down by individual facet in undergraduate college females. Although the studies conducted by Roberts\textsuperscript{38} and Sala\textsuperscript{14} used the FFMQ and the BES, Roberts and colleagues used both females and males in their sample and Sala did not explore the relationship of all five facets. The present study will address this gap by thoroughly assessing the relationship
between mindfulness as a whole, and its five constituent facets with binge eating symptoms and provide valuable knowledge about the relationship between mindfulness and binge eating symptoms in undergraduate college females, a population at risk for both eating disorders and obesity.
Chapter 3

AIMS

The primary aim of this research is to determine the relationship between mindfulness and binge eating symptoms in an undergraduate college female sample. This was achieved by using self-administered questionnaires from baseline data of an intervention study.

3.1 Specific Aims

Aim One: To explore the relationship between mindfulness and binge eating symptoms in an undergraduate college female sample.

H1: Mindfulness (as a whole) will have a negative relationship with binge eating symptoms.

Aim Two: To explore the relationship between the individual facets of mindfulness and binge eating symptoms.

H1: The mindfulness facets describing, acting with awareness, nonjudgment of inner experience and nonreactivity to inner experience will have a negative relationship with binge eating symptoms.

H2: The mindfulness facet observing will not be related to binge eating symptoms.
3.2 Exploratory Aim

To determine if body mass index (BMI) category is a moderator of the relationship between mindfulness and binge eating symptoms.

**H1**: Participants with a higher BMI ($\geq 25.0 \text{ kg/m}^2$) as compared with a lower BMI ($< 24.9.0 \text{ kg/m}^2$) will exhibit a stronger relationship between mindfulness and binge eating symptoms.
Chapter 4

METHODS

4.1 Study Design

This research project uses baseline data from a randomized controlled trial studying the effects of a regular yoga practice on body image in a female college sample. This is a cross-sectional study using data from baseline of both the control and intervention participants. After being screened, participants attended baseline assessment. At this assessment, after consenting to participate in the trial, a self-administered questionnaire was provided and anthropometric data were collected. The questionnaire asked participants about mindfulness and eating habits. The Five Facet Mindfulness Questionnaire (FFMQ) was used to assess mindfulness and the Binge Eating Scale (BES) was used to assess binge eating symptoms. The primary objective for this study was to assess the relationship between mindfulness and binge eating symptoms.

4.2 Participants

This study involved fifty-two female college students (18-26 years old) at the University of Delaware. Eligibility criteria included: females who were a freshman, sophomore, or junior at the University of Delaware; between the age of 18-26 years-old; available during the scheduled intervention time on Mondays, Wednesdays and Fridays for the full 10-week intervention; and physically able to participate in yoga.
This study excluded seniors at the University of Delaware due to compensation being a fitness class pass to the schools’ gym for the subsequent fall semester.

Participants were recruited through recruitment flyers that were placed around campus, handed out at student centers, and distributed through email announcements. The email announcements were directed toward clubs and sororities on campus. Study information was also sent to instructors of large undergraduate classes, such as psychology and engineering. Participants who were interested contacted the research team by email to receive more information about the study and were screened over email for initial eligibility. Eligible participants were scheduled to attend the baseline assessment.

4.3 Procedures

At the baseline assessment, all study procedures were explained and participants read and signed an informed consent approved by the University of Delaware’s Institutional Review Board. The participants then completed a questionnaire that included surveys regarding mindfulness and binge eating. Lastly, anthropometric measurements, weight and height, were collected by trained research assistants.
4.4 Measures

Demographics. Demographic data including race/ethnicity, age, education level, academic major and previous yoga experiences were self-reported and collected via survey.

Anthropometrics. Participant height and weight were measured by trained personnel using standard anthropometric techniques. A stadiometer (Seca 213, California) and a research-grade body weight scale (Tanita BWB-800S, Illinois) were used. Weight was taken twice in light clothing, with shoes removed, and rounded to the nearest 0.1 kg. If there was a greater than 0.1 kg difference the measurement was repeated a third time. The two measurements with the smallest difference were averaged. Height was taken twice and rounded to the nearest 0.5 cm. If there was a greater than 0.5 cm difference between the first two measurements, the measurement was repeated a third time. The two measurements with the smallest difference were averaged. Body Mass Index (BMI) (kg/m²) was calculated from height and weight measures.

Five Facet of Mindfulness Questionnaire (FFMQ). The FFMQ is a 39-item self-report questionnaire that was developed by Baer et al, to assess the tendency to be mindful during daily life. This tool was developed by integrating items from the Mindful Attention Awareness Scale (MAAS), Freiburg Mindfulness Inventory (FMI), Kentucky Inventory of Mindfulness Skills (KIMS), Cognitive and Affective Mindfulness Scale (CAMS) and the Southampton Mindfulness Questionnaire (SMQ). In a past study to determine the facets of mindfulness, an exploratory factor
Analysis was conducted using four samples of participants that included regular mediators, demographically similar nonmediators, a general community sample, and an undergraduate student sample. The samples of participants completed all the mindfulness questionnaires that are previously listed. The analysis allowed for items from different instruments to combine to form factors. These findings suggested a five-factor solution: observing, describing, acting with awareness, nonjudgment of inner experience, and nonreactivity to inner experience. Items are rated on a 5-point scale ranging from: 1 (“never or very rarely true”) to 5 (“very often or always true”). Certain items are reversed scored. Scores on the FFMQ have been found to have good psychometric properties within samples of undergraduates (Cronbach’s alpha= 0.75-0.91).

**Binge Eating Scale (BES).** The BES is a 16-item instrument to measure the severity of binge eating behavior and the uncontrolled consumption of a large amount of food. Eight of the items describe the behavioral manifestations of binge eating symptoms and eight describe feelings and cognitions associated with binge eating symptoms. Each item consists of three or four statements that reflect a range of severity and participants choose the statement that best describes their perceptions and feelings of their eating behaviors. The response options are coded from zero to four. Each item is tallied, and scores are summed to create a global binge eating score. A score of 17 or lower indicates no binge eating symptoms, 18-26 indicates moderate binge eating symptoms, and 27 and higher indicates severe binge eating symptoms. The BES was
created before binge eating disorder was recognized as a psychiatric diagnosis, so it is intended to be used as a screening tool. A modified version of the BES was used in this study.

4.5 Data Analysis

Variables of interest in this analysis included participant characteristics (age, race, academic standing, and major), anthropometrics (weight, height and BMI), mindfulness (as measured by the FFMQ) and binge eating symptoms (as measured by the BES). Data were assessed for skewness, kurtosis, and extreme outliers defined as greater than three standard deviations from the mean. Descriptive statistics were used to examine participant characteristics (race, academic standing, and major) and are described as frequencies. Means and standard deviations were computed for continuous variables such as age, total mindfulness, each of the five facets of mindfulness, and a binge eating symptoms score. An alpha level of \( p < 0.05 \) was used to denote statistical significance for all tests. Statistical analysis was performed using SPSS version 24.0.

Due to non-normally distributed data, a nonparametric test will be used to analyze primary aim one and two. A multiple linear regression model was fit to examine if BMI category moderated the relationship between mindfulness and binge eating symptoms. The independent variable (mindfulness) and dependent variable (binge eating symptoms) were measured on continuous scales and the moderator variable (BMI category – overweight or normal weight) was treated as a dichotomous
variable. As defined by the World Health Organization BMI cutoffs, a BMI greater than or equal to 25.0 kg/m² represented an overweight BMI category as compared with a normal weight BMI category of 24.9 kg/m² or under. The following regression equation was used: \( y=b_1 \times x_1 + b_2 \times x_2 + b_3 \times x_1 \times x_2 + c; \) where \( Y= \) estimated dependent variable (binge eating symptoms), \( b= \) regression coefficients, \( x_1= \) mindfulness, \( x_2= \) BMI category, \( x_3= \) the interaction between BMI category and mindfulness and \( c= \) constant.
Chapter 5

RESULTS

5.1 Normality and Distributions of Variables

The outcome variables for these analyses, including total mindfulness, the five facets of mindfulness, and binge eating symptoms, were tested for normality using the Shapiro-Wilk test. Total mindfulness and the five facets of mindfulness were normally distributed. The BES was not normally distributed (p<0.05); as such, a nonparametric test was used for primary aims one and two. One participants’ BMI was an outlier (greater than three standard deviations from the mean). The outlier was not removed because it was a true value and was included in the analysis.

5.2 Characteristics of Participants

Participant demographics and characteristics are summarized in Table A.1. Fifty-two undergraduate college females were included in the analysis. On average for the sample, participants were 19.62 ± 0.95 years old. The majority of the participants were White (84.6%) and three of the participants identified as Hispanic/Latino (5.8%). Twenty-five participants were freshman (48.1%), seventeen participants were sophomores (32.7%) and ten participants were juniors (19.2%). Based on participant measured height and weight, average BMI was 23.62 ±.63 kg/m². The majority of participants were students in the College of Arts and Sciences (33.3%) and the College of Health Sciences (21.6%). Means and standard deviations for outcomes of interest (mindfulness and binge eating symptoms) are displayed in Table A.2.
5.3 Relationship between mindfulness and binge eating symptoms

To investigate aim one, a Spearman Rank-Order Correlation was used to assess the relationship between mindfulness (FFMQ) and binge eating symptoms (BES) (Table A.3). There was a significant moderate, negative correlation between the two variables ($r_s(50) = -0.48$, $p<0.01$) (Table A.3). This indicates that as mindfulness increased, binge eating symptoms decreased.

5.4 Relationship between five facets of mindfulness and binge eating symptoms

To investigate aim two, a Spearman Rank-Order Correlation was used to assess the relationship between each individual facet of mindfulness (five FFMQ subscales) and binge eating symptoms (BES) (Table A.3). The facets observing ($r_s(50) = 0.01$, $p=.949$) and describing ($r_s(50) = -0.22$, $p=.110$) were not significantly associated with binge eating symptoms. The facets acting with awareness ($r_s(50) = -0.36$, $p<0.01$), nonjudgment of inner experience ($r_s(50) = -0.49$, $p<0.01$), and nonreactivity to inner experience ($r_s(50) = -0.49$, $p<0.01$) were all significantly, negatively correlated with binge eating symptoms, indicating that as the facet scores increased, binge eating symptoms decreased.

5.5 BMI category as a moderator between mindfulness and binge eating symptoms

To assess the exploratory aim, a multiple linear regression was used to determine if BMI category moderated the relationship between mindfulness and binge
eating symptoms (Table A.4). An outlier for BMI was detected so the regression model was compared with the outlier removed and included to determine the impact of the outlier. The outlier did not impact the results, and was a true value based on observation and measurement of participants, so it was included in the analysis.

FFMQ and BMI category explained 21.2% of the variance in binge eating symptoms. The overall model was statistically significant (F (2, 49) = 6.61; p= 0.003), but the interaction between FFMQ and BMI category was not significant (R^2 change= 0.00, F change (1,48) = 0.01; p= 0.915). This indicates that the strength of the relationship between mindfulness and binge eating symptoms did not differ between the two BMI categories.
Chapter 6

DISCUSSION

The overall aim of this study was to explore the relationship between mindfulness and binge eating symptoms in an undergraduate college female sample. The average total score for mindfulness, measured by the FFMQ (M=119.86, SD=19.24) was similar to values reported in the validation study conducted by Baer, which reported an average total score of 124.34 (SD=26.34). The average score is also comparable to results obtained from a study using undergraduate students (M=127.11, SD=16.80).

The present studies results show that total mindfulness, as measured by FFMQ score, was negatively correlated with binge eating symptoms, as measured by the BES. Considering that binge eating symptoms are conceptually related to disinhibited eating (e.g. uncontrolled, emotional, or external eating), this finding is consistent with published results. Significant negative associations were found when comparing the FFMQ and TFEQ-uncontrolled eating, TFEQ-emotional eating, DEBQ-external eating, and the DEBQ-emotional eating in undergraduate college females. Since binge eating symptoms, by definition, are disinhibited it makes sense that the relationship between mindfulness and disinhibited eating and mindfulness and binge eating would be in the same direction. The negative correlation between the FFMQ and the BES (r,(50)= -0.48, p<0.01) in the present study is stronger than the correlation between the FFMQ and binge eating symptoms and disinhibition found in these other studies (r ranged from -0.20 to -0.30). This may be due to the fact that
disinhibition can be conceptualized as being a necessary but not sufficient state for binge eating symptoms to occur.

Secondly, we sought to explore the relationship between each of the five individual facets of mindfulness and binge eating symptoms. The average scores for the individual facets in the present sample were consistent with values reported in previous studies using similar samples.\textsuperscript{14,16} The scores were also consistent with values reported in the validation study conducted by Baer.\textsuperscript{21} Consistent with our hypotheses, the facet observing was not related with binge eating symptoms and the facets acting with awareness, nonjudgment of inner experience, and nonreactivity to inner experience were significantly negatively correlated with binge eating symptoms. In contrast to hypotheses, however, the facet describing was not significantly correlated with binge eating symptoms. These results are not surprising considering findings in the literature.\textsuperscript{14-16} Currently, only one study has explored the correlation between the FFMQ and the BES, but did not utilize all five facets in the questionnaire.\textsuperscript{14} Since no studies to date have examined the relationship of the five facets of mindfulness and binge eating symptoms, our results were compared to studies that explored the relationship between the five facets and disinhibited eating behaviors. These studies found results similar to those of this study.

\textit{Observing}. It was thought that observing was a central feature of mindfulness and that this facet should lead to an increased ability to notice hunger cues leading to eating in response to internal cues\textsuperscript{44}. In regards to binge eating symptoms, this means that one who can notice their hunger cues and respond to them would be able to stop
eating when full, therefore, they would not be engaging in binge eating behaviors.
Consistent with our results though, previous studies found no significant correlation between observing and binge eating symptoms or disinhibited eating behaviors.\textsuperscript{14-16} We made the hypothesis that observing would not be related to binge eating symptoms based on the extant literature. A potential reason for this facet not being correlated with binge eating symptoms is due to the subscales items in the FFMQ being more tailored towards external experiences (e.g. paying attention to sensations, such as the wind in my hair or sun in my face)\textsuperscript{44} versus internal experiences that one would experience during a binge.

\textit{Describing}. One study found a significant, negative correlation between describing and disinhibited eating using the TFEQ-emotional eating questionnaire ($r=\text{-}0.15$; $p=0.05$).\textsuperscript{15} However, another study did not find a significant relationship between describing and disinhibited eating, which encompasses emotional eating.\textsuperscript{16} The study that used the BES did not report or include the describing subscale in their study.\textsuperscript{14} There are currently no studies that have examined the relationship between describing and binge eating symptoms in the literature. We hypothesized that describing would be negatively correlated with binge eating symptoms because if someone is good at finding words to describe their feelings or emotions they would be less inclined to engage in binge eating when experiencing unpleasant emotions. The items in the describing subscale may not capture the ability to describe feelings or emotions during eating or in a food-related environment. Additionally, being able to describe feelings or emotions is only one part of inhibiting response. This may be why
we did not find a significant relationship between describing and mindfulness in this study.

*Acting with awareness.* In previous studies, acting with awareness was found to be significantly, negatively correlated with binge eating symptoms and disinhibited eating (rs ranged from -0.19 to -0.37).\textsuperscript{14-16} The negative correlation found in this study was within this range (rs(50)= -0.36, p<0.01). When acting with awareness, one is not running on automatic pilot, instead one is attending to present moment experiences. Having increased awareness in general, should lead to increased awareness of the processes involved in food choice.\textsuperscript{50}

*Nonjudgement of inner experience.* Nonjudgment of inner experience refers to taking a nonevaluative stance toward thoughts and feelings.\textsuperscript{21} Someone who is nonjudgmental of their inner experience will not evaluate emotions they are experiencing as bad and feel that they should not feel them.\textsuperscript{21} It has been established that individuals engaging in binge eating behaviors feel guilt, shame, and/or depressive symptoms. These feelings indicate a judgement of the self (especially shame, which involves judging oneself as less than desirable or worthy). It follows that individuals judging the self would have further evaluative feelings about their self-judgment (e.g. “I’m not supposed to be thinking this way” or “I deserve to feel like this”). In previous studies, nonjudgement of inner experience was found to be significantly, negatively correlated with disinhibited eating.\textsuperscript{15,16} The correlation found in this study (rs(50)= -0.49, p<0.01), was stronger than in previous findings (r ranged from -0.16 to -0.34), but other studies assessed disinhibited eating and not binge eating
symptoms. The other study that used the BES did not use the nonjudgement subscale
(or report findings) in their manuscript. There are no studies that explore the
relationship between the facet nonjudgment and binge eating symptoms, so the present
study adds that there was a significant, negative correlation found between
nonjudgment and binge eating symptoms in this sample of college females.

Nonreactivity to inner experience. In previous studies, nonreactivity to inner
experience was found to be significantly negatively correlated with binge eating
symptoms and disinhibited eating.\textsuperscript{14-16} The study that used the BES found a correlation
that was weaker ($r= -0.31$) than the correlation found in the present study ($r_s(50)= -
0.49$, $p<0.01$). The studies that measured nonreactivity and disinhibited eating found
correlations from $r = -0.18$ to $r = -0.31$\textsuperscript{15,16}. Being nonreactive may help an individual
detach from emotional experiences, thus decreasing maladaptive emotional regulation
strategies such as binge eating.\textsuperscript{14}

Overall, the present study found stronger correlations between the five facets
of mindfulness and binge eating symptoms than studies that explored the relationship
between the facets and disinhibited eating. This may be because disinhibited eating
behaviors reflect a tendency towards overeating that may be ‘milder’ than binge
eating, but may eventually take the form of binge eating.\textsuperscript{28} Individuals with increased
mindfulness are less likely to engage in binge eating behaviors because of their
increased self-awareness, reduced reactivity to emotions and improved ability to
utilize appropriate coping skills to overcome stressful circumstances,\textsuperscript{52} which matches
the results that were found in this study.
Lastly, we sought to determine whether BMI category was a moderator of the relationship between mindfulness and binge eating symptoms. We hypothesized that participants with a higher BMI (≥25.0 kg/m²) as compared to those with a lower BMI (<24.9 kg/m²) would exhibit a stronger relationship between mindfulness and binge eating symptoms. If mindfulness is thought of as a trait that can be applied to eating skills, it would follow that those who eat mindfully would be more aware of hunger and satiety, which should help individuals recognize and respond to these cues and eat in accordance with their physiological needs. Thus, we would expect for the relationship between binge eating symptoms and mindfulness to be stronger at higher BMIs because there is more binge eating present. It is also known that individuals who participate in binge eating behaviors are at a greater risk for long-term weight gain and obesity. In the literature, studies that utilized the FFMQ and the BES did not include anthropometric measurements so these results cannot be compared to studies that used the same questionnaires or a similar sample. Previous literature that examined the relationship between mindfulness and BMI (self-reported) found that as BMI increased, mindfulness decreased. However, these studies were examining the correlation between BMI and mindfulness and in the present study, we sought to see if the relationship between mindfulness and binge eating symptoms is different based on BMI category. We found that the strength of the relationship between mindfulness and binge eating symptoms did not differ between BMI category. This result may not coincide with previous findings because we assessed BMI as a moderator and did not examine the correlation between BMI and mindfulness because
there was no correlation between BMI and mindfulness in our sample. There are also discrepancies in the literature with regards to how BMI was categorized. Some studies used BMI as a continuous variable\textsuperscript{40} and others trichotomized BMI (<25.0, 25.0-29.9, \geq 30.0 \text{ kg/m}^2).\textsuperscript{41,42} Another reason why our results may not coincide with previous findings is because of the differences in questionnaires used. Published studies used the Mindful Eating Questionnaire (MEQ) and the Intuitive Eating Scale (IES)\textsuperscript{40-42} to measure mindfulness. The MEQ was developed to measure the construct of mindful eating.\textsuperscript{40} The questionnaire was established using similar mindfulness questionnaires that were used to develop the FFMQ such as the Mindful Attention Awareness Scale (MAAS),\textsuperscript{7} Freiburg Mindfulness Inventory (FMI),\textsuperscript{43} Kentucky Inventory of Mindfulness Skills (KIMS),\textsuperscript{44} Cognitive and Affective Mindfulness Scale (CAMS)\textsuperscript{26} In addition to these mindfulness questionnaires, questionnaires related to diet were also used to develop the MEQ items, which is the main difference between the FFMQ and the MEQ. The IES was developed to measure one’s reliance on internal hunger and satiety cues, and eating in response to physical rather than emotional cues.\textsuperscript{41} The subscales of the IES include unconditional permission to eat, eating for physical rather than emotional reasons, and reliance on internal hunger and satiety cues.\textsuperscript{41} The FFMQ, the MEQ and IES all encompass similar items, but the findings in past studies suggest that BMI is related to mindful eating but not overall mindfulness since those studies used mindfulness questionnaires specific to eating.

Strengths of the present study include use of overall mindfulness, but also each of the five facets. Future research can further investigate the facets specifically related
to binge eating symptoms when developing interventions. Another strength of this study was that there was no missing data for the main outcome variables.

The study’s cross-sectional design is limiting in that we are unable to make causal inferences; an experimental study would need to be conducted to determine causal pathways. Future studies may also want to control for covariates such as BMI, academic year or major. These are factors that may influence the correlation between mindfulness and binge eating symptoms.

Results from this study can be used to inform future interventions. When developing prevention strategies and mindfulness-based intervention programs for binge eating symptoms in college females, based on the results described here, there could be a focus on acting with awareness, nonjudgment, and nonreactivity. Future experimental research might seek to understand the causal mechanisms between the relationship of the facets of mindfulness and binge eating symptoms in hopes of decreasing binge eating symptoms in college students.
Mindfulness is a multifaceted construct that is broadly defined as “a state of consciousness, which involves consciously attending to one’s moment-to-moment experience.” \(^1\) Mindfulness is a skill that is being used alter negative psychological conditions such as binge eating disorder (BED).\(^6\)\(^,\)\(^7\) Binge eating symptoms, aspect of BED, are especially prominent among college females. Taking preventative action during the college years could help to prevent BED. Mindfulness can be a skill to help decrease binge eating symptoms, therefore, mindfulness might be a useful tool to include when developing preventative interventions. Thus, it is of interest to investigate specifically which facets are contributing to this relationship so that intervention efforts can be focused around those facets.

The present study explored the relationship between total mindfulness and each of the five facets of mindfulness and binge eating symptoms in undergraduate college females. This is the first study to examine relationship between all five of the facets of mindfulness and binge eating symptoms in this population. The results of this study suggest that total mindfulness and the facets acting with awareness, nonjudgement of inner experience and nonreactivity to inner experience are significantly negatively related to binge eating symptoms in undergraduate college females. Counter to a priori hypotheses, the relationship between total mindfulness and binge eating symptoms was not moderated by BMI category. Results from this study can be used to inform future interventions that target prevention strategies and
mindfulness-based intervention programs for binge eating symptoms in college females.
REFERENCES


34. Barker ET, Galambos NL. Body dissatisfaction, living away from parents, and poor social adjustment predict binge eating symptoms in young women making the transition to university. *J Youth Adolescence*. 2007;36(7):904-911. https://link-


### Table A.1 Demographic and Anthropometric Characteristics of Sample (n=52)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (M±SD)</td>
<td>19.62±.95 18.29-22.34</td>
</tr>
<tr>
<td>BMI (M±SD)</td>
<td>23.62±4.53 16.72-43.90</td>
</tr>
<tr>
<td><strong>Race (n, %)</strong></td>
<td></td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>Asian</td>
<td>5 (9.6%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>2 (3.8%)</td>
</tr>
<tr>
<td>Native Hawaiian or other Pacific Islander</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>White</td>
<td>44 (84.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Ethnicity (n, %)</strong></td>
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<tr>
<td>Not Hispanic or Latino</td>
<td>49 (94.2%)</td>
</tr>
<tr>
<td><strong>Academic Standing (n, %)</strong></td>
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</tr>
<tr>
<td>Freshman</td>
<td>25 (48.1%)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>17 (32.7%)</td>
</tr>
<tr>
<td>Junior</td>
<td>10 (19.2%)</td>
</tr>
<tr>
<td><strong>College within UD (n, %)</strong></td>
<td></td>
</tr>
<tr>
<td>College of Arts &amp; Sciences</td>
<td>18 (33.3%)</td>
</tr>
<tr>
<td>College of Education &amp; Human Resources</td>
<td>3 (5.9%)</td>
</tr>
<tr>
<td>College of Agriculture &amp; Natural Resources</td>
<td>4 (7.8%)</td>
</tr>
<tr>
<td>College of Health Sciences</td>
<td>11 (21.6%)</td>
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<tr>
<td>College of Earth, Ocean &amp; Environment</td>
<td>4 (7.8%)</td>
</tr>
<tr>
<td>College of Engineering</td>
<td>3 (5.9%)</td>
</tr>
<tr>
<td>Alfred College of Business &amp; Economics</td>
<td>7 (13.7%)</td>
</tr>
<tr>
<td>Undeclared</td>
<td>2 (3.9%)</td>
</tr>
</tbody>
</table>

M±SD= mean ± standard deviation; BMI= Body Mass Index (kg/m²); n= frequency; UD=University of Delaware
Table A.2 Means, Standard Deviations of Participant Responses

<table>
<thead>
<tr>
<th>Measure</th>
<th>M (SD)</th>
<th>Sample Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFMQ Total</td>
<td>119.86 (19.24)</td>
<td>77.0-169.0</td>
</tr>
<tr>
<td>Observing</td>
<td>26.40 (4.83)</td>
<td>18.0-37.0</td>
</tr>
<tr>
<td>Describing</td>
<td>25.33 (6.76)</td>
<td>10.0-38.0</td>
</tr>
<tr>
<td>Acting with Awareness</td>
<td>25.31 (5.86)</td>
<td>13.0-37.0</td>
</tr>
<tr>
<td>Nonjudgement of inner experience</td>
<td>24.29 (7.03)</td>
<td>9.0-38.0</td>
</tr>
<tr>
<td>Nonreactivity to inner experience</td>
<td>18.54 (4.68)</td>
<td>7.0-27.0</td>
</tr>
<tr>
<td>Binge Eating Scale</td>
<td>11.37 (8.65)</td>
<td>0.0-33.0</td>
</tr>
</tbody>
</table>

FFMQ=Five Facet of Mindfulness Question, M=mean, SD=standard deviation
Survey ranges= FFMQ total: 39.0-195.0; Observing: 8.0-40.0; Describing: 8.0-40.0; Acting with Awareness: 8.0-40.0; Nonjudgement: 8.0-40.0; Nonreactivity: 7.0-35.0;
Binge Eating Scale: 0.0-46.0
Table A.3 Spearman’s Rank-Order Correlations coefficients between mindfulness (FFMQ) and binge eating symptoms (BES)

<table>
<thead>
<tr>
<th></th>
<th>FFMQ Total</th>
<th>Observing</th>
<th>Describing</th>
<th>Acting with Awareness</th>
<th>Nonjudgment of inner experience</th>
<th>Nonreactivity to inner experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES</td>
<td>-0.48**</td>
<td>0.01</td>
<td>-0.22</td>
<td>-0.36**</td>
<td>-0.49**</td>
<td>-0.49**</td>
</tr>
</tbody>
</table>

Note: p<0.01**
Table A.4 BMI category as a moderator of the relationship between mindfulness (FFMQ) and binge eating symptoms (BES)

<table>
<thead>
<tr>
<th>Step</th>
<th>Standardized Coefficients</th>
<th>P values</th>
<th>t</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F Change</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>&lt;0.001**</td>
<td>4.178</td>
<td>0.21</td>
<td>0.21</td>
<td>6.611</td>
</tr>
<tr>
<td></td>
<td>FFMQ</td>
<td>0.001**</td>
<td>-3.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>0.15</td>
<td>1.46</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>0.18</td>
<td>1.35</td>
<td>0.21</td>
<td>0.00</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>FFMQ</td>
<td>0.30</td>
<td>-1.04</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>BMI</td>
<td>0.74</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FFMQ*BMI</td>
<td>0.92</td>
<td>-0.11</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: p<0.001**
Appendix B

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER
DATE: December 5, 2016

TO: Carly Pacanowski, PhD RD
FROM: University of Delaware IRB

STUDY TITLE: [953669-1] Can yoga reduce body image concerns in females, thereby reducing risk of obesity and eating disorders?

SUBMISSION TYPE: New Project

ACTION: APPROVED

APPROVAL DATE: December 5, 2016

EXPIRATION DATE: December 4, 2017

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # (4)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.
Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.