EVALUATING MINDFUL EATING MOBILE APPLICATION
IN COLLEGE STUDENTS

by
Christy Loui-Tang

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As members of the DNP Project Committee, we certify that we have read the DNP project
prepared by Christy Loui-Tang, titled Evaluating Mindful Eating Mobile Application in College
Students and recommend that it be accepted as fulfilling the DNP project requirement for the
Degree of Doctor of Nursing Practice.

Patricia Daly, PhD, FNP-BC, ENP-BC, FAANP
Date: November 16, 2018

Angela Brown, DNP, MSN, RN, ANP-BC, FNP-BC, CDE
Date: November 16, 2018

Christy Pacheco, DNP, FNP-BC
Date: November 16, 2018

Final approval and acceptance of this DNP project is contingent upon the candidate’s submission
of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend
that it be accepted as fulfilling the DNP project requirement.

Patricia Daly
Date: November 16, 2018

DNP Project Director: Patricia Daly, PhD, FNP-BC, ENP-BC
ACKNOWLEDGMENTS

I would like to thank Dr. Patricia Daly, my project chair and my advisor for all the guidance and knowledge she provided to assist me in finishing this project. It would not have been made possible without her. I would also like to thank my husband, family, and friends who have supported me throughout this journey.
DEDICATION

This project is dedicated to my mother, sister, grandmother, and my husband, whom were my pillars of support in my pursuit for my doctorate degree and dreams of becoming a nurse practitioner.
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ABSTRACT

**Purpose:** The purpose of this DNP project is to determine the efficacy of a mindful eating mobile application in decreasing unhealthy eating and binge eating habits, promoting healthy eating behaviors and increasing mindfulness during eating in college adult graduate students in the College of Nursing.

**Background:** The collegiate population is known for developing unhealthy eating habits consisting of skipping meals, binge eating, and stress eating that can cause a negative impact in students’ health. Nurses have been identified at high risk for poor self-care, thus nursing students are an extremely vulnerable population. Mindful eating is an emerging practice that is effective in combatting eating disorders, binge eating symptoms, and weight loss. With the emergence of mobile health apps, and over 99% of college students utilizing health apps, a mindful eating mobile application intervention may be a solution in aiding students develop healthier eating habits.

**Methods:** Following a review of mindful eating computer applications the Am I Hungry? mindful eating computer was chosen for its compatibility with mindful eating principles and ease of use. A baseline survey including demographics, mindful eating questionnaire (MEQ) and binge eating scale (BES) were given to participants prior to the introduction of the intervention. Participants utilized a mindful eating mobile application, Am I Hungry? for six weeks. Post-surveys were emailed at the end of six-week period assessing the MEQ and BES scores as well as questions evaluating frequency of use and perceived usefulness of the mobile app.

**Outcomes achieved:** Some 38 students participated in the pre-survey and 24 students were retained completing the six-week intervention and responded to the post-survey. Surprisingly,
100% of all student participants BES scores >17 consistent with moderate binge eating behaviors and 54% student participants BES scores >27 consistent with severe binge eating behaviors. As anticipated there was inverse relationship between binge eating and mindful eating demonstrated by strong a negative correlation between BES and MEQ with \( R=-0.4519; R^2=0.2042 \). Overall, participants’ mean MEQ scores increased from 2.75 to 2.84, while mean BES scores decreased from 28.21 to 25.54 following the six-week intervention. De-identified results were shared with participants and faculty to increase awareness of student risk for binge eating and the potential of employing mindful eating computer application to promote healthy eating.

**Conclusion:** The mindful eating mobile application decreased binge eating habits in the students over a six-week period, and provided a small increase in overall mindful eating. Further investigations should include comparing outcomes to in-person mindful eating classes, studying differing health care student populations, longer term follow-up and identifying binge eating risk factors. Specifically, methods have been shared with a junior nurse practitioner project investigator planning to replicate this study. Emphasizing the importance of self-care to nursing students has the potential to improve their self-care while exposing them to the potential of employing a mobile application to promote health.
INTRODUCTION

The college adult population is at high risk for disturbed eating behaviors and weight gain due to the increase level of stress from managing multiple responsibilities in their lives. Young adults face many challenges in ‘emerging adulthood’ as they learn to adapt to changes in work, education, and home life and experience identity-exploration (Quick & Byrd-Bredbenner, 2013). Graduate students also experience increased school work load, while many still work and may have family and children at home to provide for. These factors contribute to increased overall stress preventing individuals from caring for themselves, or eating healthily. In addition, unhealthy eating behaviors also develop. Disturbed eating behaviors may be portrayed by binge eating, self-induced vomiting, over-exercising, and misuse of medications (Quick & Byrd-Bredbenner, 2013). Binge eating in particular, poses as a serious concern as it may often lead to weight gain and obesity (Kelly-Weeder et al., 2014). Due to time and monetary constraints, college adults are attracted to easily accessible fast foods, and are at risk for mindless eating, and other unhealthy eating habits and making poor food choices (Bahl et al., 2013).

In the past decade, research has shown the efficacy of “mindfulness” in the form of “mindful eating” as an effective intervention in combating binge eating, unhealthy eating habits, weight-gain and obesity (Bahl et al., 2013; Daly et al., 2016). Mindfulness focuses on the concept of being in the present and truly living in the present experience which can be applied to various aspects of human life including eating. When mindfulness is practiced habitually, individuals may experience various benefits that include the mind, body, emotional, and spiritual state of being. The practice of “mindful eating” allows the individual to be present with their food, allowing them to enjoy food without guilt. Mindfully eating allows individuals to be aware
of their internal cues of hunger and satiety, as well as the quality and consistency of the food which overall prevents mindless eating and binge eating (Bahl et al., 2014).

With the continuous emergence of technology and mobile usage in everyday life, recent studies have also shown significant behavioral changes when utilizing mobile phone apps for health promotion (Zhao, Freeman, & Li, 2016). However, no research has been done to show the efficacy of a mindful eating intervention delivered by a mobile application. A mindful eating mobile application may provide an easily accessible intervention for college adults to modify their behaviors and eat more healthily.

**Background Knowledge**

College adults are susceptible to unhealthy eating behaviors such as binge eating that can be caused by stress, boredom, and peer-influences. Binge eating is defined as eating due to an emotional trigger with low self-awareness. It is eating without dietary restraints, usually with large volumes of food in duration of time (Heatherton & Baumeister, 1991). Mindless eating is defined as eating that is caused by external cues that are unrelated to physical hunger such as “colors, smells, labels, friends and family, and distractions” (Bahl et al., 2013). Due to the numerous distractions and influences in the collegiate environment, students are more susceptible to mindless eating. Emotional eating drives individuals to eat even when the person does not physically feel hunger as a coping mechanism that covers the underlying problem. Researchers have proven that ineffective coping mechanisms cause individuals to adapt mental disorders as well as unhealthy eating behaviors. In a study in Bethesda, Maryland, one in seven college females reported binge eating, and one-third of those students reported using compensatory mechanisms such as self-induced vomiting or use of laxatives after their binge
eating sessions (Quick & Byrd-Bredbenner, 2013). In a study performed in Ontario University, it was shown that gender, BMI, and difficulties regulating emotions are correlated with disordered eating behaviors (Lafrance Robinson et al., 2014). Disordered eating was detected in both male and female subjects, but it is shown that women were more likely than men to admit to struggling with emotional difficulties. Women were also more likely to have bulimia than men (Lafrance Robinson et al., 2014). Disordered eating is a common issue that affects young adults in the college environment across the world.

Current literature has also reported significant weight gain during college in young adults. In a systematic review and meta-analysis including over 49 peer-reviewed studies, participants have shown an average weight increase of 1.55kg (95% CI=1.3, 1.8kg) and 1.17% increase in %FAT (95% CI=0.7, 1.6%). The change in body weight was greater over the course of the four years rather than just the first year (Fedewa et al., 2014). Another study by Lipson and Sonneville (2017) focused on evaluating eating disorder symptoms in undergraduate and graduate students across 12 universities in the United States. Covariates included age, degree (undergraduate and graduate), sexual orientation, and race. The results revealed that binge eating was more prevalent in females than in males (49% vs 30%). Individuals that were overweight were also more likely to binge eat and use compensatory behaviors. Compensatory mechanisms were equal in males and females. The transition to college life is a critical time to educate students on weight management and nutritional intake. Nurse practitioners can take the opportunity to intervene to promote healthier eating habits. Recent research on mindful-eating is shown to be effective in combating obesity and binge eating. Bahl et al.’s (2014) study focuses on utilizing mindfulness to combat mindless eating and reducing stress in college students.
Significant results showed an inverse relationship between mindfulness to overeating and skipping meals (Bahl et al., 2014).

Smartphone usage has been made a norm for people across the life span. Statistically, 91% of Americans over the age of 18 in the United States uses a smartphone. Specifically, in the collegiate population, 98% of all students utilize a smartphone (Melton et al., 2014). Studies have shown that college students utilize at least one health app on their smartphone (Gowin, 2015). The top reasons for mobile health application usage is for fitness and health purposes (Cho et al., 2014). These statistics show how easily assessable mobile applications are for students, as well as motivation for students to utilize a health app to develop healthier eating habits. A mindful eating mobile application would a feasible intervention in coaching students into eat healthier, overall decreasing binge eating habits and other unhealthy behaviors.

**Local Problem**

The University of Arizona contains a large population of college adults that accurately represents the national adult population that is effected by binge eating and other unhealthy eating behaviors. Graduate students have multifactorial stresses including work, school, family, and social stresses that makes them susceptible to adapting unhealthy eating habits. Mindful eating can be beneficial in improving the eating habits and overall health of the graduate students at the University of Arizona. Currently there are 44,831 students enrolled in the University of Arizona. Of those, 35,123 are undergraduate students and 9709 are graduate students. Nursing graduate students help represent a portion of the graduate students at the University of Arizona (The University of Arizona, 2017). They also contain a large ratio of females that reflect on the populations in the binge eating studies. The Master’s Entry to the Profession of Nursing (MEPN)
program contain approximately 90 students per cohort. Many of these students have nursing experience already and are also more prone to being health conscious. Promoting self-care in nurses and nursing students may help decrease stress and create health benefits during school and work. Utilization of a mobile application promoting mindful eating may offer a feasible solution to healthier eating in nursing graduate students at the University of Arizona.

Purpose

The purpose of this DNP project is to determine the efficacy of a mindful eating mobile application in decreasing unhealthy and binge eating habits, promoting healthy eating behaviors and increasing mindfulness during eating in college adult graduate students in the College of Nursing. Mindful eating habits and attitudes will be investigated pre and post intervention using the Mindful Eating Questionnaire.

Study Question

It has been established that the college young adult populations are at risk for disturbed eating behaviors as well as unintentional weight gain due to various stresses that exist within the collegiate environment. Literature has also supported the effectiveness of mindful eating as an intervention to decrease stress eating, controlling weight and promote positive eating habits and relationship with food. Mobile applications in health promotion have also shown positive results. There have not been any studies performed on utilizing a mindful eating app in promoting healthy eating behaviors. The PICO question is: In college adults, ages 18 and over (P), will the use of a mindful eating mobile application (I), promote mindful eating, decrease unhealthy eating behaviors, and prevent weight gain (O), in comparison to no intervention (C)?
FRAMEWORK AND SYNTHESIS OF EVIDENCE

Theoretical Framework

The Health Belief Model (HBM) applies to this DNP project providing an excellent framework for promoting the utilization of a mindful eating app in college young adults. The HBM was first used in the 1950s to explain health-related behaviors and became a popular and effective framework for guiding health behavior interventions (Strecher & Rosenstock, 1997). At that time, the US Public Health Service utilized this model in attempt to understand the lack of participation in disease detection and prevention programs. Concurrently, cognitive theorists emerged with the concept of an individual’s subjective value of and subjective probability, expectation, of the intervention outcome that ultimately motivates behavioral changes (Strecher & Rosenstock, 1997). Examples of early HBM application to health behaviors included Breast cancer screening and AIDS-prevention behavioral studies. The purpose of my DNP is to promote the use of a mindful eating app as a health behavior intervention in modifying the unhealthy eating behaviors of my study population. The prior usage of this model is similar in purpose to my project and appears to be a promising framework.

There are several key constructs of the HBM: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Perceived susceptibility can be defined as the individual’s beliefs in the likelihood for contracting a disease or condition (Strecher & Rosenstock, 1997). This applies to the project study population, as their individual beliefs regarding the impact of their eating on their health resulting in conditions such as an unhealthy weight, obesity, negative body image or diabetes type II in later adulthood. Perceived severity is defined as how serious the condition or disease is viewed by the individual.
The severity of the condition is influenced by what difficulties, consequences, and resources it may cost the individual (Rosenstock, 1974). In relation to the project’s population group, this could be defined as their emotional outlook on how obesity, overweight, and negative self-image may affect them in their lives. Perceived benefits can be defined as an individual’s perception on how the intervention may benefit them in reducing the risk or severity of the condition in their lives. Positive effects must be clarified for this particular construct in the model and action must be defined by: how, when, and where (Strecher & Rosenstock, 1997). In relation to this DNP project, clear benefits will be emphasized including: research supporting the benefits of mindful eating in reducing weight, reducing binge eating habits, and helping an individual establish a healthy relationship with food. Instructions on how to utilize the mindful eating mobile application will be clarified. The application should be used whenever the individual feels hunger including food choices, and attending to their satiety during meals. The application itself shall guide the individual to practice mindfulness during their eating experience.

The acceptance of the possibility of the impact on eating upon disease conditions and the perception of its seriousness serves a driving force for the individual to take action. However, there are barriers that may potentially prevent an individual from taking action (Rosenstock, 1974). Perceived barriers are defined as the individual’s perception regarding the negative costs of taking action in tangible and psychological regards (Strecher & Rosenstock, 1997). The cost of utilizing this application will be the $2.99 fee of obtaining the application, which will be reimbursed, and the time it will take the individual to learn to use the application and utilizing the app every time they decide to eat. However, the application is easily accessible, as smartphones are commonly used by the college adult population as previously discussed. The
less barriers there are to a health intervention, the more likely the individual will partake in the intervention (Rosenstock, 1974). Cues to action can be defined as triggers driving the individual to take action (Strecher & Rosenstock, 1997). A reminder system may be set on the individual’s phone during meals and at the beginning of the day to bolster utilization of the mindful eating mobile application. The application icon can also be set on the front screen of the phone so that the individual as a visual cue as they log on to their phone. Lastly, self-efficacy is the last construct of the HBM. This is defined as the individual’s confidence and conviction to adhere to the proposed intervention (Strecher & Rosenstock, 1997). This can be maximized by providing sufficient guidance, training, positive reinforcement, and goal setting. For this DNP project, guidance and training will be provided at the beginning of the study providing necessary instructions for the participants. A questionnaire will be given to test prior knowledge. Individual goals can also be set for the duration of the study, so that they can focus on their desired outcome. The mindful eating app provides constant coaching, and positive reinforcement as the individual uses the application. The HBM provides a perfect framework for the purpose of this DNP project in promoting individuals to utilize the mindful eating mobile application in reducing unhealthy eating behaviors and promoting healthy eating habits that will help them obtain their health goals.
Theories and Concepts

The escape theory can be applied to explain the phenomena of mindless eating and other binge eating behaviors. The escape theory was conceptualized by Heatherton and Baumeister (1991) explaining how binge eating is a motivated attempt to escape self-awareness that is often due to a burdensome underlying issue. Binge eating offers an immediate stimulus to redirect their focus and attention to, rather than facing their true problems. This is also an explanation of cognitive narrowing (Blackburn et al., 2006). This concept can be applied to the college young adult population, as individuals of this age group are often susceptible to various stressors, adapting to their adult life in school, work, social and home life. Binge eating is often used as an escape from other underlying issues in their lives.

Mindfulness is an ancient concept derived through Buddhist philosophy that may even be traced back to ancient Hindu scriptures. The concept of mindfulness refers to the individual’s
awareness of their present state and experience, aiming to conceptualize the present moment blocking out impurities that may distract from the present moment (Bahl et al., 2013). There are five dimensions of mindfulness that illustrates the nature mindfulness: acting with awareness, nonreactivity to inner experience, nonjudgment of experience, describing, and observing (Bahl et al., 2013). The concept of mindfulness and mindful practice would be the perfect solution to combating mindless eating and binge eating behaviors as it places the individual in the present, allowing them to recognize and face emotions that may cause them to mindlessly eat.

The Technology Acceptance Model (TAM) can be applied to the utilization of a mobile phone application in promoting mindful eating in the participants. TAM addresses two main factors that influences people’s behavioral intentions to adapt to the use of a technology known as “perceived usefulness” (PU) and “perceived ease of use” (PEOU) (Cho et al., 2014). PU is defined as how useful the individual believes the technology will be in improving his/her life or performance. PEOU is defined by how convenient and effortless it is for the user to utilize the technology in their lives (Cho et al., 2014). A mobile application is easily accessible and simple to use for college students on a day to day basis.

These theories and concepts explain the underlying aspects of this DNP project addressing the causation of mindless eating. Mindfulness philosophy provides a solution to combating mindless eating, and the TAM helps to guide individuals in using mobile technology as an intervention. Overall, the HBM serves as an overarching framework that ties the different components of the mindless eating phenomenon and its solution together. A mobile application promoting mindfulness while eating provides a practical intervention in combatting mindless eating, binge eating and promote healthier relationships with food.
Synthesis of Evidence

A literature search was conducted on PubMed, Medline, CINAHL, Cochrane, and Google Scholar with the identifying search terms: “mindfulness,” “mindful eating,” “binge eating,” “mobile application,” and “health promotion.” The inclusion and exclusion criteria are as follows: limiting results to the past five years, human subjects only, English language, abstract available, full text available, clinical trials, and reviews. For the purpose of this DNP project, 20 of the most relative, and highest graded level of evidence that pertained to the research questions were selected review. The initial search was not able to yield all 20 prevalent articles for my project and I had to expand my search criteria to last 10 years for the remainder of the articles. Two articles were found within the last 10 years. Many of the results focused on mindful eating and its effects on weight loss and obesity. However, the focus of this project is mindful eating and its effects on binge eating, unhealthy eating behaviors, and increase in overall mindfulness. Secondary outcomes that included mindfulness and its effects on obesity and weight loss are included in many of the chosen articles to reflect on the additional effects and benefits of mindful eating.

One exploratory study was identified that specifically focused on mindfulness as a long term solution for binge eating in college students by Bahl, Milne, Ross, and Chan (2014). The exploratory study utilized interviews and analysis of the responses and the Mindful Attention Awareness Scale (MAAS) to identify relationships in mindfulness and eating habits in college students. The study clearly identified students who practiced mindfulness had an inverse relationship with over eating or skipping meals (Daly, 2016). In a randomized control trial (RCT) conducted on adolescent Latinas (age 14-17) with obesity, a mindful eating intervention was
conducted weekly over the course of six weeks to evaluate the feasibility and efficacy of the intervention on weight loss and mindfulness. The results showed a significant decrease in BMI of 1.1kg/m² (t=3.03, p=0.019) in the MEI group in contrast to the comparison group that ended up with an increase in BMI of 0.72kg/m² (t=2.98, p=0.021). Participants overall reported feelings of being more in control and were able to identify factors to control eating (Daly, Pace, Berg, Menon & Szalacha, 2016).

In a binge eating RCT by Kristeller, Wolever, and Sheets (2013), a Mindfulness-Based Eating Awareness Training (MBEAT) program was compared to a psychoeducational/cognitive-behavioral (PECB) intervention on eating. The results revealed that 95% of the MBEAT intervention group no longer had binge eating disorder in comparison to only 76% in the PECB intervention group (Kristeller et al., 2013). The mindfulness based intervention clearly had more significant results than the cognitive behavioral intervention. Another RCT by Alberts, Theweissen, and Raes (2012), also showed similar results evaluating a mindfulness based intervention on binge eating, food cravings, and also body image. The intervention group showed significant effects in reduction of emotional eating, t(11) = 1.08, p = .03, d = .53 and less concerns of body image, t(11) = 3.93, p < .01, d = .68 (Albert et al., 2012).

In a systematic review by Godfrey, Gallo, and Afari (2014), 19 studies were reviewed which included a total of eight RCTs with the majority using the Binge Eating Scale (BES). The review strongly supported that mindfulness based interventions significantly reduced binge eating behaviors to large effect size. In Katterman, Kleinman, Hood, Nackers, and Corsica’s (2014) systematic review, 14 studies were investigated utilizing mindfulness meditation to decrease emotional and binge eating behaviors. The outcome measures included binge eating,
emotional eating, and psychological stress. In three studies, stress was significantly reduced in the intervention groups. Binge eating was measured in seven studies using the BES, and indicated a significant reduction in binge eating behaviors with medium to large effect sizes (Cohen’s D= 0.43 to 2.08) (2014). Hendrickson and Rasussen’s (2014) experimental study also revealed significant reduction in impulsive eating and food choices in the mindful-eating group. A study by Marchiori and Papie (2014) examined how a mindfulness-based intervention can help reduce over eating and portion sizes. The results supported decrease in unhealthy overeating as well, as well as overall reduction in feelings of hunger.

A recent study (Mason, Jhaveri, & Cohn, 2018), was the first of its kind to evaluate a mobile mindful eating intervention in reducing craving-related eating. The intervention utilizes a 28-day program that provides daily mobile lessons on mindful eating. The six-month dietary intervention showed a significant 40.21% (p<0.001) reductions in food cravings. Now significant differences were noted for weight and BMI as secondary measures (Mason, Jhaveri, & Cohn, 2018).

In summary, the first search produced strong evidence supporting the efficacy of a mindful eating intervention in reducing binge eating behaviors. Evidence supporting mindful eating effectively causing weight loss were stronger in weight loss based mindful eating studies but remains inconclusive in other studies where weight loss is a secondary measure (Katterman et al., 2014). Most of the literature discussed that attrition was a common limitation in their study with high turnover rates (Daly et al., 2016).

Most of the literature on health mobile applications that were found, focused on evaluating mobile applications that promoted diet and exercise, and weight loss assistance. A
correlational study was conducted in South Korea with 422 participants that examined the
cognitive and contingent factors that influenced college young adults to use smartphone health
applications. The study revealed that the two strongest factors that influenced participants into
using an application were “to become fit by exercising” and “to lose weight” (Cho, Quinlan,
Park, & Noh, 2014). Another qualitative study conducted in the southwest United States,
explored how and why college students used health and fitness mobile apps to change their
health behaviors. The results showed that most participants used at least one fitness app.
Interview responses also revealed that the two main reasons for the utilization of a health app
was to assist in an established behavior or to assist in starting a new health behavior (Gowin et
al., 2015).

A randomized control trial evaluating the efficacy of a smartphone app in promoting
physical activity in the primary care setting showed significant increase in physical activity over
the eight-week trial (Glynn et al., 2014). The study used a pedometer to measure the number of
steps taken daily, and revealed an average of 1029 steps between week 1 to week 8 (Confidence
interval: 95%) (Glynn et al., 2014). Another randomized control trial was found that evaluated
the use of a mobile application with three intervention components in promoting healthy eating
over the course of four months. The results showed that image-based dietician support was well
perceived by users, but user engagement decreased over time with the meal recording
intervention component (Kato-Lin, Padma, Downs, & Abhishek, 2015). A systematic review
which evaluated 24 studies supported ambiguous evidence on the efficacy of mobile app usage
for health behavior interventions. Many of the current studies contained small to medium sample
size. Large sample size studies are needed to solidify evidence (Payne, Lister, West, &
Bernhardt, 2015). Zhao, Freeman, and Li’s (2016) systematic review also supported significant health behavior changes in 17 out of 23 studies.

Overall, small to medium sample studies have been performed that supports the efficacy of mobile applications on promoting health behaviors. Larger studies are still needed. The current research also doesn’t provide long-term follow-up that evaluated the continued app usage on the participants. Mobile applications have a significant influence on health behaviors on the short term, but none have been evaluated long term.

The two literature searches conclude that a mindful eating mobile application can be feasible and effective in promoting mindful eating, and decreasing unhealthy eating habits. The intervention must be adjusted accordingly to the strengths and weaknesses as identified and discussed in this literature review. Please see Table 1 and Table 2 for the evidence appraisal.
TABLE 1. *Synthesis of evidence related to mindful eating intervention.*

Project Question: In college young adults, does the utilization of a mindful eating mobile application intervention decrease binge eating and other unhealthy eating behaviors?

<table>
<thead>
<tr>
<th>Author/Article</th>
<th>Qual: Concepts or Phenomena</th>
<th>Theoretical Framework</th>
<th>Design</th>
<th>Sample (N)</th>
<th>Data Collection (Instruments/Tools)</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberts, H. J., Thewissen, R., &amp; Raes, L. (2012). Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. <em>Appetite, 58</em>(3), 847-851.</td>
<td>What are the effects of a mindfulness-based intervention on eating behavior, food cravings, body image, and dichotomous thinking?</td>
<td>(none)</td>
<td>Randomized Control Trial</td>
<td>N= 26 women (mean age = 48.5 years, SD = 7.90) Mean weight= 94.6kg (SD = 16.41; range 68.0–123.0) Mean BMI= (BMI) was 32.7 (SD = 6.1; range 23.5–45.8) Sample retained: 100%</td>
<td>Weight and BMI Kentucky Inventory Mindfulness Skills Extended (KIMS-E) Dutch Eating Behaviour Questionnaire (DEB-Q) Body Shape Questionnaire (BSQ) The Dichotomous Thinking Scale (DTS) General Food Craving Questionnaire Trait (G-FCQ-T)</td>
<td>Participants in intervention group reported significant increase in mindfulness t(12) = 3.31, p &lt; .01, d = 1.15. Both control and intervention group showed restrained eating (no significance between groups) Intervention group reported significant reduction in emotional eating t(11) = 1.08, p = .03, d = .53 Intervention group showed significantly less concerns of body image t(11) = 3.93, p &lt; .01, d = .68</td>
</tr>
<tr>
<td>Author/Article</td>
<td>Qual: Concepts or Phenomena</td>
<td>Quan: Key Variables</td>
<td>Hypothesis Research Question</td>
<td>Theoretical Framework</td>
<td>Design</td>
<td>Sample (N)</td>
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<tr>
<td>Bahl, S., Milne, G.R., Ross, S. M., &amp; Chan, K. (2013). Mindfulness: A long-term solution for mindless eating by college students. <em>Journal of Public Policy &amp; Marketing</em>, 32(2), 173-184.</td>
<td>The purpose of this study is to evaluate the relationship between mindfulness and unhealthy eating behaviors in college students.</td>
<td>Self-control strength model</td>
<td>Exploratory study</td>
<td>353 Responses</td>
<td>57.2% males</td>
<td>Mindful Attention Awareness Scale Poisson Regression Models</td>
</tr>
<tr>
<td>Corsica, J., Hood, M. M., Katterman, S., Kleinman, B., &amp; Ivan, I. (2014). Development of a novel mindfulness and cognitive behavioral intervention for stress-eating: A comparative pilot study. <em>Eat Behav</em>, 15(4), 694-699. doi:10.1016/j.eatbeh.2014.08.002</td>
<td>The purpose of this study is to compare three interventions on its effects for decreasing stress-eating. The interventions include: modified mindfulness-based stress reduction (MBSR) intervention, cognitive behavioral stress-eating intervention (SEI), and a combined intervention with MBSR and SEI.</td>
<td>(None)</td>
<td>Comparative Pilot Study</td>
<td>N=53</td>
<td>MBSR (N= 9) SEI (N=20) MBSR+SEI (N=14) 98% female M(age)=45.4 years, SD = 10.4 41% Caucasian 37% African American 16% Hispanic 6% other</td>
<td>The Perceived Stress Scale The Eating and Appraisal Due to Emotions and Stress Questionnaire</td>
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<td>Author/Article</td>
<td>Qual: Concepts or Phenomena</td>
<td>Theoretical Framework</td>
<td>Design</td>
<td>Sample (N)</td>
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<td>Daly, P., Pace, T., Berg, J., Menon, U., &amp; Szalacha, L. A. (2016). A mindful eating intervention: A theory-guided randomized anti-obesity feasibility study with adolescent Latino females. <em>Complement Therapy Medicine, 28</em>, 22-28. doi:10.1016/j.ctim.2016.07.006</td>
<td>In a 6-week pilot study on obese adolescent (age 14-17) Latinas, what is the feasibility and efficacy of a mindful eating intervention on BMI and mindful awareness?</td>
<td>Information-Motivation-Behavioral Skills Theory (IMB)</td>
<td>Randomized Control Trial utilizing repeated measures at Pre, Post and 4 week follow-up.</td>
<td>Randomized 1:2 (n=37) MEI Group: n=8 Comparison Group: n=15</td>
<td>Structured interviews with MEI group to evaluate feasibility of intervention. Mindful Attention Awareness Scale (MAAS) Adolescent Motivation Questionnaire BMI</td>
<td>23 participants total finished Feasibility evaluation: Participants felt they were able to gain control and identified factors to help control eating BMI: MEI group declined by 1.1kg/m² (t=3.03, p=0.019) CG BMI increased by 0.72kg/m² (t=2.98, p=0.021) MEI efficacy: No significant changes</td>
</tr>
<tr>
<td>Godfrey, K. M., Gallo, L. C., &amp; Afari, N. (2015). Mindfulness-based interventions for binge eating: A systematic review and meta-analysis. <em>J Behav Med, 38</em>(2), 348-362. doi:10.1007/s10865-014-9610-5</td>
<td>The purpose of this article is to analyze the literature on mindfulness-based interventions and its effects on binge eating behaviors. (none)</td>
<td>Systematic Review</td>
<td>19 studies included in review after identification and screening Consists of 8 RCTs Nine studies used mindfulness-based interventions</td>
<td>Eating disorder examination Binge Eating Scale</td>
<td>Majority had large effect size Overall, mindfulness-based interventions were effective on binge eating in large to medium-large magnitude MBI is less effective on participants without initial binge-eating habits</td>
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<td>Hendrickson, K. L., &amp; Rasmussen, E. B. (2017). Mindful eating reduces impulsive food choice in adolescents and adults. <em>Health Psychol</em>, 36(3), 226-235. doi:10.1037/hea0000440</td>
<td>The purpose of this study is to determine if a brief mindful eating intervention can reduce impulsive food choices in the adult and adolescent population.</td>
<td>(none)</td>
<td>Experimental Study</td>
<td>348 participants 172 adolescents (n=88 females; M(age)=13.13) 176 adults (n=126 females; M(age)=23.33) 77.8% Caucasian Body fat % = Range (6.40 to 53.70) 93% adherence to study</td>
<td>Health Measures: height, weight, body fat percentage, blood glucose, and waist circumference Food Choice Questionnaire (FCQ) Monetary Choice Questionnaire (MCQ) IBM SPSS 22.0 Last Observation Carried Forward (LOCF) ANCOVA</td>
<td>Participants with high PBF were more impulsive for food than low PBF participants. Participants in the mindful-eating group exhibited more self-control when choosing food. No changes were seen between the groups for monetary choices.</td>
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<td>Katterman, S. N., Kleinman, B. M., Hood, M. M., Nackers, L. M., &amp; Corsica, J. A. (2014). Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: a systematic review. <em>Eat Behav, 15</em>(2), 197-204. doi:10.1016/j.eatbeh.2014.01.005</td>
<td>The purpose of this article is to investigate if mindfulness meditation used as a primary intervention is effective in decreasing binge eating, emotional eating, and aid in weight loss.</td>
<td>(none)</td>
<td>Systematic Review</td>
<td>14 studies included after identification, screening and meeting review criteria</td>
<td>Binge Eating Scale (BES) Dutch Eating Behavior Questionnaire, Emotional Eating Scale, Three-Factor Eating Questionnaire</td>
<td>All 7 studies addressing binge eating used BES and found significant reduction in binge eating with medium to large effect size (Cohen’s $d = 0.43$-$2.08$) 5 studies showed significant reduction in emotional eating ($-0.01$-$0.94$) Overall decrease in weight is non-conclusive; studies with significant decrease in weight loss had primary interventions focusing on weight loss.</td>
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<tr>
<td>Author/Article</td>
<td>Qual: Concepts or Phenomena</td>
<td>Hypothesis Research Question</td>
<td>Theoretical Framework</td>
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<td>Kristeller, J., Wolever, R. Q., &amp; Sheets, V. (2013). Mindfulness-based eating awareness training (MB-EAT) for binge eating: A randomized clinical trial. <em>Mindfulness, 5</em>(3), 282-297.</td>
<td>To evaluate the efficacy of a 12-session Mindfulness-Based Eating Awareness Training (MBEAT) program in comparison to a psychoeducational/cognitive-behavioral (PECB) intervention</td>
<td>MBEAT</td>
<td>Randomized Control Trial</td>
<td>Total: N=92  MBEAT Group: N=39  PECB Group: N=27  Wait list control: N=26</td>
<td>Binge Eating Scale (BES)  Three-Factor Eating Questionnaire  Power of Food Scale (PFS)  BMI</td>
<td>Four months post-intervention 95% of MBEAT group no longer qualified binge eating disorder status compared to 76% in the PECB group.  MBEAT showed significance in decrease of depression  29% of MBEAT and 28% of PECB group showed 5lb decrease in weight during course of intervention. Weight-loss continued to decrease post-intervention</td>
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<td>Author/Article</td>
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<td>Marchiori, D., &amp; Papiés, E. K. (2014). A brief mindfulness intervention reduces unhealthy eating when hungry, but not the portion size effect. <em>Appetite, 75</em>, 40-45.</td>
<td>- The purpose of this study is to examine the effects of a mindfulness-based intervention on promoting healthy eating, reducing overeating, and reducing portion sizes.</td>
<td>(none)</td>
<td>2X2 between subjects design</td>
<td>N= 110 students (M(age) = 20.9 ± 2.3; M(BMI) = 22.3 ± 2.5)</td>
<td>Main Outcome Measure: caloric intake of chocolate chip cookies Weight- and Body-Related Shame and Guilt scale Five Facet Mindfulness Questionnaire Restraint Scale Perceived self-regulatory success in dieting</td>
<td>Effect size of 0.25 No effects on difference of caloric intake. Mindfulness decreased unhealthy overeating and reduced overall effects of hunger.</td>
</tr>
<tr>
<td>Mason, A. E., Jhaveri, K., Cohn, M., &amp; Brewer, J. A. (2018). Testing a mobile mindful eating intervention targeting craving-related eating: feasibility and proof of concept. <em>Journal of Behavioral Medicine, 41</em>(2), 160-173.</td>
<td>- The purpose of this study is to determine if a 28-day mobile mindful eating intervention can decrease craving-related eating in overweight adults or obese women.</td>
<td>Obesity-Related Behavioral Intervention Trials (ORBIT) framework</td>
<td>Single-arm Clinical Trial</td>
<td>N=104 M(age)=46.2+/-.14.1 years BMI=31.5+/-.4.5 75% participants completed intervention within 7 months</td>
<td>Ecological Monetary Assessment (EMA) Body Mass Index (BMI) Self-Report Questionnaire Food Craving Questionnaire-Trait-Reduced (FCQTR) Reward-based Eating Drive Scale (RED) Palatable Eating Motive Scale (PEMS)</td>
<td>Participants who completed the intervention reported significant reductions in cravings (40.21% reduction; p&lt;0.001)</td>
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TABLE 2. Synthesis of evidence related to evaluation and utilization of mobile application on health promotion.

<table>
<thead>
<tr>
<th>Author / Article</th>
<th>Qual: Concepts or phenomena</th>
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<tbody>
<tr>
<td>Cho, J., Quinlan, M. M., Park, D., &amp; Noh, G. Y. (2014). Determinants of adoption of smartphone health apps among college students. <em>Am J Health Behav, 38</em>(6), 860-870. doi:10.5993/ajhb.38.6.8</td>
<td>The purpose of this study is to exam the cognitive and contingent factors that cause college students to utilize smartphone health applications.</td>
<td>Technology Acceptance Model (TAM)</td>
<td>Correlational Study</td>
<td>N=422 participants 59.7% female Average Age = 22.1 years</td>
<td>Survey Monkey 5-point Likert Scale</td>
<td>The two biggest motivations to utilize a health app were 1) to become fit by exercising and 2) to lose weight.</td>
</tr>
<tr>
<td>DiFilippo, K. N., Huang, W. H., Andrade, J. E., &amp; Chapman-Novakofski, K. M. (2015). The use of mobile apps to improve nutrition outcomes: A systematic literature review. <em>Journal of Telemedicine and Telecare, 21</em>(5), 243-253.</td>
<td>The purpose of this systematic review is to determine if the use of nutritional mobile apps can produce improved outcomes in knowledge and behavior in healthy adults.</td>
<td>(none)</td>
<td>Systematic Review</td>
<td>Only four articles met all search criteria and was analyzed for this review. All four studies evaluated weight loss.</td>
<td>A literature search was conducted using various databases including: PubMed, CINAHL, and Web of Science</td>
<td>All studies revealed adherence to diet monitoring (p&lt;0.001) and decreased effort in continuing using the app (p&lt;0.024) However, most of the apps focused on weight loss with inconsistent outcomes.</td>
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<td>Author / Article</td>
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<td>Godino, J. G., Merchant, G., Norman, G. J., Donohue, M. C., Marshall, S. J., Fowler, J. H., ... Patrick, K. (2016). Using social and mobile tools for weight loss in overweight and obese young adults (Project SMART): A 2 year, parallel-group, randomised, controlled trial. <em>Lancet Diabetes Endocrinol</em>, 4(9), 747-755. doi:10.1016/s2213-8587(16)30105-x</td>
<td>The purpose of this study is to assess the efficacy of a 2-year weight loss program using social and mobile tools (SMART program) on weight loss.</td>
<td>Intention to Treat framework</td>
<td>Parallel Group, Randomized Control Trial</td>
<td>N=404</td>
<td>Primary Outcome: weight (kg)</td>
<td>Adjusted weight was significantly less in SMART group at 6 months (−1.33 kg [95% CI −2.36 to −0.30], p=0.011) and 12 months (−1.33 kg [−2.30 to −0.35], p=0.008) but not at 18 months. Participation in SMART group declined over time. 78% of SMART group would recommend to others.</td>
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TABLE 2.  — Continued

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<tr>
<th>Author / Article</th>
<th>Qual: Concepts or phenomena Quan: Key Variables Hypothesis Research Question</th>
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<th>Data Collection (Instruments/Tools)</th>
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<tr>
<td>Gowin, M., Cheney, M., Gwin, S., &amp; Franklin Wann, T. (2015). Health and fitness app use in college students: A qualitative study. American Journal of Health Education, 46(4), 223-230.</td>
<td>The purpose of this study is to explore how college students in the southwest United States utilize health and fitness apps to change their health behaviors.</td>
<td>Grounded Theory</td>
<td>Qualitative Study</td>
<td>Total participants: N=27 Ages (18-30) Male=6 Female=21 Caucasian=92%</td>
<td>Interviews with open-ended questions (15-50 minutes long)</td>
<td>Most participants had more than one fitness apps. Participants downloaded apps with an intent to meet a goal. Two groups of app users discovered: Users who downloaded app to help support an established behavior; and users who downloaded app to start new behavior. Participants liked using apps that are free and easy to use.</td>
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<tr>
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<td>Glynn, L. G., Hayes, P. S., Casey, M., Glynn, F., Alvarez-Iglesias, A., Newell, J., ... Murphy, A. W. (2014). Effectiveness of a smartphone application to promote physical activity in primary care: the SMART MOVE randomised controlled trial. Br J Gen Pract, 64(624), e384-391. doi:10.3399/bjgp14X680461</td>
<td>The purpose of this study is to evaluate the efficacy of a smartphone app in promoting physical activity in a primary care setting</td>
<td>(none)</td>
<td>Randomized Control Trial</td>
<td>Total participants: N=90</td>
<td>Accupedo-Pro Pedometer app</td>
<td>Smartphone app significantly increased physical activity over 8-week trial. Difference from week 1 to week 8 was 1029 steps (95% confidence interval)</td>
</tr>
<tr>
<td>Kato-Lin, Y. C., Padman, R., Downs, J., &amp; Abhishek, V. (2015). Evaluating Consumer m-Health Services for Promoting Healthy Eating: A Randomized Field Experiment. AMIA Annu Symp Proc, 2015, 1947-1956.</td>
<td>The purpose of this study is to evaluate utilizing a mobile app addressing 3 intervention components to promote healthy eating over the course of 4 months.</td>
<td>Social Cognitive Theory</td>
<td>Randomized Control Trial</td>
<td>Total participants: N=239</td>
<td>One-Way Anova SAS 9.4</td>
<td>Strong evidence for efficacy of image-based dietician support (p&lt;0.01) User engagement on meal recording significantly decreased over time.</td>
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TABLE 2. – Continued

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<tr>
<td>Payne, H. E., Lister, C., West, J. H., &amp; Bernhardt, J. M. (2015). Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. <em>JMIR mHealth and uHealth</em>, 3(1).</td>
<td>The purpose of this systematic review is to describe the current literature on mobile app usage for health behavior interventions. (none)</td>
<td>Systematic Review</td>
<td>24 studies were qualified for this review.</td>
<td>Literature search performed on Pubmed, Medline, CINAHL, PsychArticles, PsychINFO, etc…</td>
<td>There is a lack of large sample size studies using large mobile application. Mobile applications may be feasible and an acceptable means of delivering health interventions.</td>
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<td>Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N. A., Williams, S. L., Duncan, M. J., &amp; Vandelanotte, C. (2016). Efficacy of interventions that use apps to improve diet, exercise, and sedentary behaviour: a systematic review. <em>Int J Behav Nutr Phys Act, 13</em>(1), 127. doi:10.1186/s12966-016-0454-y</td>
<td>The purpose of this systematic review is to assess the efficacy of current health apps to improve diet, exercise, and sedentary behaviors in the adult and pediatric population.</td>
<td>(none)</td>
<td>Systematic Review</td>
<td>27 studies were included. 19 were randomized control trials. 23 studies targeted adults 4 studies targeted children.</td>
<td>Literature search performed using 5 databases including: Scopus, CINAHL, SportDiscuss, PsycINFO and Web of Science Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines</td>
<td>17 studies on adult population showed significant health improvements. 2 studies on pediatric showed significant health improvement.</td>
</tr>
<tr>
<td>Zhao, J., Freeman, B., &amp; Li, M. (2016). Can Mobile Phone Apps Influence People's Health Behavior Change? An Evidence Review. <em>J Med Internet Res, 18</em>(11), e287. doi:10.2196/jmir.5692</td>
<td>The purpose of this evidence review is to evaluate the effectiveness of mobile apps in attaining health-behavior changes and to assess the quality of the evidence.</td>
<td>(none)</td>
<td>Systematic Review</td>
<td>23 studies were included and categorized in to 11 themes to influence behavior changes.</td>
<td>Literature search was conducted on Medline, PreMedline, PsycINFO, Embase, Health Technology Assessment, Education Resource Information Center (ERIC), and CINAHL.</td>
<td>17 studies revealed significant health behavior changes. 19 of the studies showed 65% retention rate or higher. Self-Monitoring was the most common behavior change which showed in 12 studies.</td>
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METHODS

Project Design

The design for this DNP project is a quasi-experimental, one group approach utilizing a pre-test and post-test design to assess mindful eating habits, binge eating habits, and overall relationship with food before and after the utilization of the mindful eating mobile application. This quasi-experimental design is suitable for the intervention, as the study is controlled without randomization. Participants received guidance and information on the mindful eating mobile application during the in person initial intake recruitment. Demographics, weight, and height were collected the prior to the intervention. The collection of height and weight allows the project investigator to calculate participants’ BMI. The one group pre-test/post-test were conducted six weeks apart. Most mindful eating studies allow for at least six to eight weeks for the intervention to take place. The six-week time period allows for participants to utilize the application and possibly employ mindful eating practices.

Setting

This project was conducted in the College of Nursing at the University of Arizona located in Tucson in the southern region of Arizona. The College of Nursing was selected for the purpose of recruiting participants that meet age and education criteria as well as familiarity with health focused computer applications and access to smart phone technology. This project offers information and guidance for students that are interested in mindful eating practices.

Participants

Participants include college adults, ages 18 and up, that attend the University of Arizona College of Nursing that are enrolled in the Master’s Entry to the Profession of Nursing (MEPN)
program. MEPN students were assumed to have more health motivated due to previous work experience and education. The goal of 100 participants was set to be recruited, with a goal of retaining 15-20 students that complete the intervention.

**Data Collection**

The mobile application, *Am I Hungry?* will be utilized for the purpose of this study after examination of the app and the past reviews from other consumers. Consent from the owner and the company of the app have been obtained, and support and reimbursement of the app for a portion of participants were offered for this study. The company has also provided a limited number of free downloads in support of the project.

With the assistance of the College of Nursing faculty, emails and flyers were distributed throughout the college of nursing to notify students about the mindful eating study. Information was provided in person to the MEPN students and MEPN student organization (MSO) regarding the purpose of the study and potential benefits it may provide students. Coordinating with faculty, a 10-minute introduction was provided for students during their organization meeting discussing the purpose of the study, as well as orientation to the phone app. With the assistance of faculty, emails were sent out consisting of the study information. If the students were interested, a short survey to qualify the students for study criteria will be provided before the students are provided with further instructions and information. The following was provided via email coordinating with the program faculty members. Demographic data were collected according to age, gender, years in college, activity level, as well as work and familial factors. The mindful eating questionnaire (MEQ) and the binge eating scale (BES) were provided in survey format for participants to fill out pre-intervention and post-intervention. The MEQ is an
effective tool used to assess mindfulness when eating as well as the participant’s relationship with food (Framson et al., 2009). The BES has been used to assess binge eating habits and will be utilized to assess overeating, emotional eating, and mindless eating.

The pre-test consisted of demographic data survey as well as the MEQ and BES surveys to help gather data on the sample population and assess baseline knowledge and habits on mindful eating and binge eating. The post-test consisted of the MEQ and BES surveys that will be done electronically via email and the internet which will allow flexibility and convenience for participants and hopefully help retain participation of the final survey. Compliance and adherence to the application was also included in the final survey. Final surveys were conducted via Qualtrics with a pin created by the students to analyze pre- and post-test scores.

**Plans for Data Analysis**

Microsoft Excel and statistical software were used to analyze data. Descriptive statistics were used to analyze demographic data. Survey answers will be converted to a Likert-type scale where answers can be converted into a measurable response using ordinal data. Data analysis will focus on evaluating the efficacy of the mindful eating mobile application. Comparison of the MEQ and BES scores from pre-test and post-test were analyzed. Demographics were included in analysis highlighting any significant differences.

**Ethical Considerations**

The sample population consists of healthy adults that are not considered a vulnerable population. However, ethical considerations must still be considered prior and during the conduction of the study. Consent was indicated by the individuals by their volunteering to participate in the study. No identifiable information was collected. All data were encrypted and
password protected. All eligible students were invited to participate. Students were allowed to withdraw from the study at any time.

**Beneficence**

There were no negative outcomes of participating in the study. Potential health benefits may be provided by participating in this study including developing healthier eating habits, reducing overeating, and increase in overall enjoyment of food.

**Respect for Human Dignity**

Participation was voluntary, and personal information remained anonymous. The study was conducted in a safe and nonjudgmental manner. Safety, and privacy concerns were also addressed.

**Justice**

Participation was voluntary. Recruitment was impartial as long as they meet the criteria. IRB approval was received before the implementation of this project.

**RESULTS**

**Demographics**

A total of 42 students were qualified and volunteered to participate in this project. Four students did not meet the eating disorder inclusion criteria by scoring either a low BMI, or indication of previous eating disorders. A total of 24 students completed the intervention and the post-survey evaluations. The student population consisted of 84% female and 16% males and was predominantly Caucasian (73.7%). The population age ranged from 21 years old to 49 years, with majority being under 30 (71.0%). BMI was also calculated for each participant according to their age, sex, height, and weight. Some 21% of the participants were overweight with a BMI of
25-30, and 13% were considered obese with a BMI greater than 30. Exactly 50% of the students were content with their current eating habits, while the other 50% were not. The majority of the participants (30 out of 38) stated they are employed during the program, while eight of the participants were either employed part-time or full time. A small number (6 out of the 38) of the participants had children. Stress levels were identified prior to the start of the MEPN program and at present from a scale of 1-5. And 94.7% of students indicated a stress level of ‘3’ and above during their program. An average increase stress of 1.92 was revealed in the demographics survey from before the program to present enrollment in the program. Participants were asked to identify current stressors in their life. School was a unanimous answer from each participant. Other common stressors included time management, finances, work, and social life.

TABLE 3. Demographics – gender and age.

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<thead>
<tr>
<th>Gender</th>
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<tbody>
<tr>
<td>Male</td>
<td>6</td>
<td>15.79%</td>
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<tr>
<td>Female</td>
<td>32</td>
<td>84.21%</td>
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<tr>
<td>Total</td>
<td>38</td>
<td>100.00%</td>
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<tr>
<th>Sample Age</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>27</td>
<td>71.00%</td>
</tr>
<tr>
<td>30-39</td>
<td>9</td>
<td>23.70%</td>
</tr>
<tr>
<td>40+</td>
<td>2</td>
<td>5.30%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100%</td>
</tr>
</tbody>
</table>

TABLE 4. Demographics – ethnicity and eating habits.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>28</td>
<td>73.68%</td>
</tr>
<tr>
<td>Hispanic / Latino</td>
<td>7</td>
<td>18.42%</td>
</tr>
<tr>
<td>Native American</td>
<td>1</td>
<td>2.63%</td>
</tr>
<tr>
<td>Asian / Pacific Islander</td>
<td>1</td>
<td>2.63%</td>
</tr>
<tr>
<td>African American</td>
<td>1</td>
<td>2.63%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content Eating</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>19</td>
<td>50.00%</td>
</tr>
<tr>
<td>No</td>
<td>19</td>
<td>50.00%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
**FIGURE 2.** Participant BMI range.

**FIGURE 3.** Participant stress level (1-5 scale).
Pre-Survey Analysis

In addition to the demographics survey, well-established previously validated instruments baseline Mindful Eating Questionnaire (MEQ) and Binge Eating Scale (BES) questionnaire administered to the 38 participants, revealed all of the student participants scored in the moderate to high binge eating range yet had above average mindful eating scores. The surveys were evaluated and scored manually twice for accuracy. The MEQ is scored from ‘1’ to ‘4’ per question depending on the answer: ‘1’ is the lowest measure of mindfulness during eating while ‘4’ is the highest possible score measuring mindfulness. The mean MEQ score was 2.75 at baseline. Participants scored lowest on distraction (2.67) and highest on emotional (2.86) cues on the MEQ survey. The mean BES score was 28.21. A BES of 18 to 26 indicates moderate binge eating habits, and a BES over 27 indicates severe binge eating habits. All of the participants scored over a BES of 17 which indicates that all the participants demonstrated binge eating behaviors. 46% of the participants scored between 18-26 indicating moderate binge eating, and 54% scored above 27 indicating severe binge eating.

A Pearson’s correlation analyzed relationships between BMI, MEQ and BES scores. As anticipated since mindfulness and binge eating are considered paradoxical behaviors, a moderately strong, negative correlation was identified between MEQ vs BES scores, with R=-0.4519; R²=0.2042. Surprisingly only a weak positive correlation was identified between BMI and BES scores, with R=0.2584; R²=0.0668. Similarly, a weak negative correlation was also identified between BMI and MEQ scores, with R=-0.231; R²=0.0534.
TABLE 5. Baseline MEQ mean scores.

<table>
<thead>
<tr>
<th>MEQ Mean Scores (Baseline)</th>
<th>Awareness</th>
<th>Distraction</th>
<th>Disinhibition</th>
<th>Emotional</th>
<th>External</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.73</td>
<td>2.67</td>
<td>2.75</td>
<td>2.86</td>
<td>2.77</td>
<td>2.75</td>
</tr>
</tbody>
</table>

TABLE 6. Baseline BES mean score.

<table>
<thead>
<tr>
<th>BES Mean Score (Baseline)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28.21</td>
</tr>
</tbody>
</table>

FIGURE 4. Baseline (BES).
**FIGURE 5.** MEQ versus BES. 
\( R=0.4519; \ R^2=0.2042 \)

**FIGURE 6.** BMI versus BES. 
\( R=0.2584; \ R^2=0.0668 \)
Post-Survey Analysis

Post-intervention surveys were collected between weeks 4-6 via email through the Qualtrics application. Only 24 out of the 38 student participants were retained and completed the intervention and participated in filling the post-intervention surveys. Although instructed to choose and remember their individualized four-digit pin numbers for identification and interpretation of the data, only eight students were able to recall their initial PIN and therefore individual scores could not be correlated. The final survey included the MEQ and BES questionnaires as well as two questions assessing the students’ amount of app usage per week, and overall perceived usefulness of the mobile application. The MEQ score increased from 2.75 (baseline) to 2.84 (post-intervention). Participants scored lowest on external cues (2.61) and highest on emotional cues (3.12) to eating. Students scored highest on emotional cues during the
baseline surveys as well and demonstrated an increase from 2.86 to 3.12 mean.

BES decreased from 28.21 (baseline) to 25.54 (post-intervention). The percentage of severe binge eaters decreased from 54% to 42%. Although, none of the participants scored under a 17 demonstrating non-binge eating behavior. Overall the BES did decrease in mean over the course of the intervention.

TABLE 7. Post-intervention MEQ mean scores.

<table>
<thead>
<tr>
<th>MEQ Mean Scores (Post-Intervention)</th>
<th>Awareness</th>
<th>Distraction</th>
<th>Disinhibition</th>
<th>Emotional</th>
<th>External</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.69</td>
<td>2.79</td>
<td>2.97</td>
<td>3.12</td>
<td>2.61</td>
<td>2.84</td>
</tr>
</tbody>
</table>

TABLE 8. Post-intervention BES mean score.

| BES Mean Score (Post-Intervention) | 25.54 |

**FIGURE 8.** Post-intervention (BES).
Usage frequency ranged greatly between the participants. Some 33% of the students utilized the mobile app 1-2 times per week, 21% rarely used the app, 21% used it 2-3 times per week, 13% used the app almost every day, and 13% of the students used it daily or with every meal. The majority of the students (50%) found the app to be moderately useful, while 25% found the app not useful at all. A small amount (13%) found the app very useful, 8% somewhat useful, and 4% extremely useful.

**FIGURE 9.** Usage frequency.
DISCUSSION

Results Versus Expectations

The results of this project supports previous mindful eating intervention findings in the literature. Similar to reported studies, our post mindful eating intervention application surveys revealed decrease in binge eating and increase mindfullness. BMI was not followed in this short six-week study. Additionally, the literature supports the efficacy of mobile health apps in general, though to our knowledge this is the only examination of a mindful eating application. The difference in mean BES score decreased from 28.21 to 25.54. The MEQ mean surprisingly only increased from 2.75 to 2.84. As mindful eating increases, binge eating behaviors decrease. The data reflects a strong inverse relationship between mindfulness and binge eating. The data also depicts the inverse relationship between BMI and binge eating scores, as well as the positive relationship of BMI and MEQ although these correlations are weak. Because stress is a major
component experienced by the population, it should be noted that the emotional component of
the MEQ was scored the highest in the pre and post surveys, which is contrary to expectations
prior to the conduction of this project. Another unexpected finding would be the number of
students that exhibited binge eating behaviors. All (100%) of the participants exhibited some sort
of binge eating behavior. The lowest score was 19, which was scored by only one participant in
the pre-survey, and three participants in the post-survey. The amount of binge eating behaviors in
the collegiate population, even amongst students entering the healthcare field is alarmingly large.
However, it is also important to note that the amount of severe binge eaters decreased from 54%
to 42% by the end of the intervention phase. Additionally, only one-third of the students are
classified overweight or obese compared to the US population in which over two-thirds of the
population. Future study considerations might examine this finding in master’s entry nursing
programs.

The initial medium sample size that the project, was also larger than expected. Because
studies, have shown that attrition rates are often an obstacle with mobile application
interventions and healthy eating interventions, it was not surprising that only 24 out of the 38
students completed the intervention and the final survey. It is expected that all five participants
that stated they never/rarely utilized the phone app found the app to not be useful. Participants
that at least used the app 1-2 times or more per week found the app to be moderately useful or
more. The perceived usefulness also reflects upon the attrition rate of the participants. Some
63.2% of the participants were retained. And 75% of the retained participants found the app to be
somewhat to very useful. These statistics are supported by the TAM discussed previously. Those
who did not find the app to be useful rarely used the app. Those who found the app to be useful,
used the app more often. The HBM discusses how perceived benefits is a key construct to motivate change in a health behavior. Half (50%) of the of the initial participants were content with their current eating behaviors. Due to lack of motivation and internal cues, some of the participants may not have felt the need to utilize the mobile application. Participant’s motivation for change is also reflected upon the attrition rate as well as frequency of use and perceived usefulness.

**Challenges and Limitations**

The greatest challenge would be the recruitment and retention of the participants. There was 40% attrition rate despite multiple efforts to increase participation and retain participants. A gift card incentive was provided after completion of the final survey. Weekly emails were also sent to remind participants to utilize the app and ask if they had any questions. It is difficult to decipher the causes of attrition. Further complicating analysis was of the 24 retained participants only eight recalled their pin number so individual pre and post data responses could not be correlated. Sets assigned pin number, or employing a specific pneumonic (i.e., asking participants to use the last four digits of their phone number) would be an alternative in the future to prevent this complication. Attrition is consistently an obstacle with mobile application interventions. In-person mindful eating intervention programs have had more retention success.

**Future Implications**

The MEPN student population presents a portion of graduate students with the desire to enter the health care field. This study could be replicated utilizing other student populations, both undergraduate and graduate. Binge eating behaviors are caused by a multitude of life variables and may change with each population assessed. It is interesting that 100% of these graduate
nursing students demonstrated binge eating behaviors. Future investigation should further explore binge eating behaviors in graduate students. As students with many stressors in their lives entering the health care profession, consideration should be given to binge eating habits of professional nurses. Self-care deficit has been identified as an issue in healthcare professionals, potentially placing them at higher risk for binge eating behaviors. Future studies may also examine a combination in-person plus mobile application mindful eating intervention that could maximize results in students.

**Conclusion**

Mindful eating has been used effectively in improving healthy eating behaviors, decreasing impulsive and binge eating behaviors, as well as combatting obesity and help with weight loss. Health mobile applications are being made daily to help users develop healthier lifestyles which makes mobile applications highly assessable for students. With students’ busy lifestyles, a mobile application intervention is seemingly a good fitting aid to promote healthy eating behaviors. This mindful eating intervention has shown to provide benefits and improve eating behaviors in graduate nursing students. Further investigations should include further exploration of binge eating in nursing graduate students, as well as maximizing the benefits of mindful eating for student.
APPENDIX A:

DEMOGRAPHIC QUESTIONNAIRE
Demographic Questionnaire

The purpose of the demographic questionnaire is to help better understand the results of study. All information will be kept confidential and are strictly used for the purpose of this study. There are no right or wrong answers. Please answer to the best of your abilities. Thank you for your participation.

1. What is your gender?
   _____ 1. Male  _____ 2. Female

2. What is your age? __________

3. What is your height? __________

4. What is your weight? __________

5. What race are you?
   _____ Caucasian
   _____ Hispanic/Latino
   _____ Asian/Pacific Islander
   _____ African American
   _____ Native American
   _____ Other

6. How many years of work experience have you had? _______

7. Are you currently working? If so, part time or full time?
   _____ 1. Not working
   _____ 2. Full-time
   _____ 3. Part-time

8. Do you have children? If so, how many?
   _____ 1. None
9. Are you currently content with your eating habits?
   _____ Yes   _____ No

10. Have you ever been diagnosed with an eating disorder? If so what was the diagnosis?
    _____ No   _____ Anorexia   _____ Bulimia   _____ Other

11. On a scale of 0-5, how would you rate your stress level prior to entering the MEPN program (0= no stress, 5= most stressful you have ever experienced)?
    ___ 1   ___ 2   ___ 3   ___ 4   ___ 5

12. On a scale of 0-5, how would you rate your stress level currently (0= no stress, 5= most stressful you have ever experienced)?
    ___ 1   ___ 2   ___ 3   ___ 4   ___ 5

13. Identify current stressors in your life.
APPENDIX B:

MINDFUL EATING QUESTIONNAIRE
Mindful Eating Questionnaire

1. I eat so quickly that I don’t taste what I’m eating.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always

2. When I eat at “all you can eat” buffets, I tend to overeat.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always
   ___N/A – I never eat a buffet

3. At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always

4. I recognize when food advertisements make me want to eat.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always
   ___N/A – Food ads never make me want to eat

5. When a restaurant portion is too large, I stop eating when I’m full.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always

6. My thoughts tend to wander while I am eating.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always

7. When I’m eating one of my favorite foods, I don’t recognize when I’ve had enough.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always

8. I notice when just going into a movie theater makes me want to eat candy or popcorn.
   ___Never/Rarely   ___Sometimes   ___Often   ___Usually/Always
   ___N/A – I never eat candy or popcorn
9. If it doesn’t cost much more, I get the larger size food or drink regardless of how hungry I feel.
   
   ___Never/Rarely ___Sometimes ___Often ___Usually/Always

10. I notice when there are subtle flavors in the foods I eat.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

11. If there are leftovers that I like, I take a second helping even though I’m full.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

12. When eating a pleasant meal, I notice if it makes me feel relaxed.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

13. I snack without noticing that I am eating.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

14. When I eat a big meal, I notice if it makes me feel heavy or sluggish.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

15. I stop eating when I’m full, even when eating something I love.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

16. I appreciate the way my food looks on my plate.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always

17. When I’m feeling stressed at work, I’ll go find something to eat.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always
    ___N/A – I don’t work

18. If there’s good food at a party, I’ll continue eating even after I’m full.
    
    ___Never/Rarely ___Sometimes ___Often ___Usually/Always
19. When I’m sad, I eat to feel better.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

20. I notice when foods and drinks are too sweet.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

21. Before I eat, I take a moment to appreciate the colors and smells of my food.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

22. I taste every bite of food that I eat.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

23. I recognize when I’m eating and not hungry.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

___N/A – I never eat when I’m not hungry.

24. I notice when I’m eating from a dish of candy just because it’s there.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

25. When I’m at a restaurant, I can tell when the portion I’ve been served is too large for me.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

26. I notice when the food I eat affects my emotional state.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

27. I have trouble not eating ice cream, cookies, or chips if they’re around the house.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

28. I think about things I need to do while I am eating.
___Never/Rarely  ___Sometimes  ___Often  ___Usually/Always

APPENDIX C:

BINGE EATING SCALE
### Binge Eating Scale

Below are groups of statements about behavior, thoughts, and emotional states. Please indicate which statement in each group best describes how you feel.

<p>| | |</p>
<table>
<thead>
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</table>
| **1.** | I don’t feel self-conscious about my weight or body size when I’m with others.  
  - I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.  
  - I do get self-conscious about my appearance and weight which makes me feel disappointed in myself.  
  - I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness. |
| **2.** | I don’t have any difficulty eating slowly in the proper manner.  
  - Although I seem to “gobble down” foods, I don’t end up feeling stuffed because of eating too much.  
  - At times, I tend to eat quickly and then, I feel uncomfortably full afterwards.  
  - I have the habit of bolting down my food, without really chewing it. When this happens I usually feel uncomfortably stuffed because I’ve eaten too much. |
| **3.** | I feel capable to control my eating urges when I want to.  
  - I feel like I have failed to control my eating more than the average person.  
  - I feel utterly helpless when it comes to feeling in control of my eating urges.  
  - Because I feel so helpless about controlling my eating I have become very desperate about trying to get in control. |
| **4.** | I don’t have the habit of eating when I’m bored.  
  - I sometimes eat when I’m bored, but often I’m able to “get busy” and get my mind off food.  
  - I have a regular habit of eating when I’m bored, but occasionally, I can use some other activity to get my mind off eating.  
  - I have a strong habit of eating when I’m bored. Nothing seems to help me break the habit. |
| **5.** | I’m usually physically hungry when I eat something.  
  - Occasionally, I eat something on impulse even though I really am not hungry.  
  - I have the regular habit of eating foods, that I might not really enjoy, to satisfy a hungry feeling even though physically, I don’t need the food.  
  - Even though I’m not physically hungry, I get a hungry feeling in my mouth that only seems to be satisfied when I eat a food, like a sandwich, that fills my mouth. Sometimes, when I eat the food to satisfy my mouth hunger, I then spit the food out so I won’t gain weight. |
6.  
   o I don’t feel any guilt or self-hate after I overeat.  
   o After I overeat, occasionally I feel guilt or self-hate.  
   o Almost all the time I experience strong guilt or self-hate after I overeat.

7.  
   o I don’t lose total control of my eating when dieting even after periods when I overeat.  
   o Sometimes when I eat a “forbidden food” on a diet, I feel like I “blew it” and eat even more.  
   o Frequently, I have the habit of saying to myself, “I’ve blown it now, why not go all the way” when I overeat on a diet. When that happens I eat even more.  
   o I have a regular habit of starting strict diets for myself, but I break the diets by going on an eating binge. My life seems to be either a “feast” or “famine.”

8.  
   o I rarely eat so much food that I feel uncomfortably stuffed afterwards.  
   o Usually about once a month, I eat such a quantity of food, I end up feeling very stuffed.  
   o I have regular periods during the month when I eat large amounts of food, either at mealtime or at snacks.  
   o I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseous.

9.  
   o My level of calorie intake does not go up very high or go down very low on a regular basis.  
   o Sometimes after I overeat, I will try to reduce my caloric intake to almost nothing to compensate for the excess calories I’ve eaten.  
   o I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning but overeat in the evening.  
   o In my adult years, I have had week-long periods where I practically starve myself. This follows periods when I overeat. It seems I live a life of either “feast or famine.”

10.  
   o I usually am able to stop eating when I want to. I know when “enough is enough.”  
   o Every so often, I experience a compulsion to eat which I can’t seem to control.  
   o Frequently, I experience strong urges to eat which I seem unable to control, but at other times I can control my eating urges.  
   o I feel incapable of controlling urges to eat. I have a fear of not being able to stop eating voluntarily.

11.  
   o I don’t have any problem stopping eating when I feel full.  
   o I usually can stop eating when I feel full but occasionally overeat leaving me feeling uncomfortably stuffed.  
   o I have a problem stopping eating once I start and usually I feel uncomfortably stuffed after I eat a meal.  
   o Because I have a problem not being able to stop eating when I want, I sometimes have to induce vomiting to relieve my stuffed feeling.
12.  
- I seem to eat just as much when I’m with others (family, social gatherings) as when I’m by myself.  
- Sometimes, when I’m with other persons, I don’t eat as much as I want to eat because I’m self-conscious about my eating.  
- Frequently, I eat only a small amount of food when others are present, because I’m very embarrassed about my eating.  
- I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a “closet eater.”

13.  
- I eat three meals a day with only an occasional between meal snack.  
- I eat 3 meals a day, but I also normally snack between meals.  
- When I am snacking heavily, I get in the habit of skipping regular meals.  
- There are regular periods when I seem to be continually eating, with no planned meals.

14.  
- I don’t think much about trying to control unwanted eating urges.  
- At least some of the time, I feel my thoughts are pre-occupied with trying to control my eating urges.  
- I feel that frequently I spend much time thinking about how much I ate or about trying not to eat anymore.  
- It seems to me that most of my waking hours are pre-occupied by thoughts about eating or not eating. I feel like I’m constantly struggling not to eat.

15.  
- I don’t think about food a great deal.  
- I have strong cravings for food but they last only for brief periods of time.  
- I have days when I can’t seem to think about anything else but food.  
- Most of my days seem to be pre-occupied with thoughts about food. I feel like I live to eat.

16.  
- I usually know whether or not I’m physically hungry. I take the right portion of food to satisfy me.  
- Occasionally, I feel uncertain about knowing whether or not I’m physically hungry. At these times it’s hard to know how much food I should take to satisfy me.  
- Even though I might know how many calories I should eat, I don’t have any idea what is a “normal” amount of food for me.

APPENDIX D:

DISCLOSURE FORM
Evaluating Mindful Eating Mobile Application in College Students
Christy Tang

The purpose of this project is to determine the impact of a mindful eating mobile application on binge eating habits, healthy eating behaviors and mindfulness while eating.

If you choose to take part in this project, you will be asked to utilize a mindful eating application for the duration of 6 weeks. It will take approximately 10 minutes to complete the surveys. There are no foreseeable risks associated with participating in this project and you will receive no immediate benefit from your participation. Survey responses are anonymous.

If you choose to participate in the project, participation is voluntary, refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw at any time from the project. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant in this project.

For questions, concerns, or complaints about the project, you may email Dr. Daly, at pdaly@email.arizona.edu
REFERENCES


