MINDFULNESS AND NUTRITION AND EXERCISE BEHAVIORS IN COLLEGE STUDENTS: THE MODERATING ROLE OF SLEEP QUALITY

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MINDFULNESS AND NUTRITION AND EXERCISE BEHAVIORS

IN COLLEGE STUDENTS: THE MODERATING ROLE OF SLEEP QUALITY

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ABSTRACT

Inadequate nutrition, physical inactivity, and poor sleep quality have become increasingly common in college student populations, placing students at greater risk of being overweight or obese in adulthood. Researchers have adopted the construct of mindfulness to better understand and potentially modify health behavior. The purpose of the present investigation was to examine the relationships between mindfulness and health behaviors (i.e., nutrition and exercise) in undergraduate college students. Sleep quality was tested as a moderator of these relationships. The current study also explored the unique influence of each of the five facets of mindfulness (i.e., observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) on college students' nutrition and exercise behavior. The sample consisted of 357 undergraduates from colleges throughout the United States who completed online surveys. Hierarchical multiple regression analyses demonstrated that sleep quality moderated the relationship between mindfulness and nutrition behavior with an enhancing effect. However, moderating effects for the mindfulness-exercise behavior relationship did not hold. Hierarchical multiple regression analyses also revealed the Observe facet of mindfulness to be most predictive of nutrition behavior, whereas the Observe and Describe facets were most predictive of exercise behavior. The present

findings highlight that enhancing mindfulness and improving sleep hygiene may be particularly beneficial in elevating health-promoting behavior in undergraduate college students. Limitations, future directions, and implications are discussed.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Education, have examined a dissertation titled “Mindfulness and Nutrition and Exercise Behaviors in College Students: The Moderating Role of Sleep Quality,” presented by Taryn Acosta Lentz, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION

Obesity has been recognized as the public health challenge of our time. According to the American College Health Association (ACHA, 2008), 36.7% of college students are either overweight (body mass index [BMI] 25.0 – 29.9 kg/m^2) or obese (BMI $\geq$ 30.0 kg/m^2). Excess weight is considered a key source of premature mortality and morbidity, and has been found to be associated to a variety of health complications, including cardiovascular diseases, type 2 diabetes, hypertension, dyslipidemia, and stroke (Brancati, Kao, Folsom, Watson, & Szklo, 2000; Flegal, Carroll, Ogden, & Johnson, 2002; Mokdad, Bowman, Ford, Vinicor, Marks, & Koplan, 2000). Given that weight problems in late adolescence are highly predicative of overweight and obesity in adulthood (Guo, Wu, Chumela, & Roche, 2002), unhealthy dietary behavior and physical inactivity have been identified as two of the top six health risk behaviors in college students (e.g., Douglas, Collins, Warren, Kann, Gold, & Clayton et al., 1997; Lowry, Galuska, Fulton, Wechsler, Kann, & Collins, 2000). Further, a growing body of evidence has identified sleep deprivation as another important risk factor for overweight and obesity (Patel & Hu, 2008; Van Cauter & Knutson, 2008).

The transition from high school to college is marked by drastic environmental changes, which likely influence health related behaviors (Crombie, Dutton, Panton, & Abood, 2009; Lenz, 2001). Much empirical attention has been devoted to documenting unhealthy behaviors in college students, specifically inadequate nutrition, physical inactivity, and sleep deprivation (e.g., Anding, Suminski, & Boss, 2001; Haberman & Luffey, 1998). For example, research has found that the majority of college students

typically consume a diet that is low in fruits and vegetables, while high in sugar, sodium, and fat (Anding et al., 2001; Hendricks, Herbold, & Fung, 2004; Lowry et al., 2000; Schutte, Song, & Hoerr, 1996). Other problematic dietary behaviors identified in college student populations include: frequent meal skipping (Debate, Topping, & Sargent, 2001; Sax, 1997), limited food variety (Shutte et al., 1996), frequent snacking on energy-dense foods, and high levels of fast food consumption (Task Force on National Health Objectives for Higher Education, 1991). Empirical data demonstrate that physical activity levels decline dramatically from junior high school to college graduation (Anding et al., 2001), and several researchers have reported that college students tend to lead relatively sedentary lifestyles (e.g., Anding et al., 2001; Kelley & Kelley, 1994; Pinto & Marcus, 1995). According to the National College Health Assessment (NCHA; 2012), roughly 50% of undergraduates fail to meet the current federal guidelines for aerobic and muscle strengthening physical activity (ACHA, 2012). Furthermore, empirical research has shown that only 11% of undergraduate college students reported good sleep hygiene (Buboltz, Brown, & Soper, 2001). In fact, Forquer, Camden, Gabriau, and Johnson (2008) found that over one-third of college students reported taking longer than 30 minutes to fall asleep, waking up more than once per night, and feeling fatigued during the day. Despite the established risks, it is evident that inadequate nutrition, physical inactivity, and sleep deprivation have become increasingly common in college student populations.

Recently, researchers have adopted the construct of "mindfulness" to better understand and potentially modify health behavior. Mindfulness is an Eastern concept originating in the Buddhist spiritual tradition, which has only recently come into

prominence within contemporary Western society. Simply defined, mindfulness refers to the "nonelaborative awareness to current experience" with an attitude of "curiosity, experiential openness, and acceptance" (Bishop, Lau, Shapiro, Carlson, Anderson, & Carmody et al., 2004, p. 234). Although mindfulness may be cultivated with the regular practice of meditation, Kabat-Zinn (2003) highlighted that mindfulness is an inherent human capacity, as everyone is mindful from moment to moment to one degree or another. Thus, in addition to being a state of consciousness, researchers have proposed that mindfulness may also be considered a trait, in that some individuals are typically more mindful than others (Brown & Ryan, 2003; Thompson & Waltz, 2007).

While some researchers argue that dispositional mindfulness has a single factor structure (e.g., Brown & Ryan, 2003), others conceptualize dispositional mindfulness as a multidimensional construct. For example, Baer, Smith, Hopkins, Krietemeyer, and Toney (2006) utilized factor analysis to identify five facets of mindfulness: observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience. The *Observing* factor includes noticing internal and external experiences (e.g., sensations, thoughts, emotions, sights, and sounds). The *Describing* factor involves using language to label and prescribe meaning to internal experiences. The *Acting with awareness* factor is the tendency to focus attention on present moment activities, as opposed to behaving mechanically (i.e., being on automatic pilot). The *Nonreacting to inner experience* factor refers to allowing thoughts and feelings to come and go, without elaboration. The *Nonjudging of inner experience* factor involves adopting a nonevaluative orientation toward thoughts and feelings. For the purposes of the present investigation, mindfulness was assessed as a multidimensional construct.

Over the past few decades, the psychological and physical health benefits of mindfulness have generated considerable interest. In the context of dietary behavior, the findings have been promising and indicate an inverse relationship between mindfulness and disordered eating behavior. More specifically, mindfulness-based interventions have been found to diminish food cravings (Alberts, Mulkens, Smeets, & Thwissen, 2010), decrease binge eating (Kristeller & Hallet, 1999), and reduce BMI in overweight individuals (Tapper, Shaw, Ilsley, Hill, Bond, & Moore, 2009). Although the health behavior literature is dominated by studies that explore the relationship between mindfulness and disordered eating, recent findings suggest a positive association between mindfulness and nutrition behavior (e.g., fruit and vegetable intake; Gilbert & Waltz, 2010; Grinnell, Greene, Melanson, Blissmer, & Lofgren, 2011). In regards to exercise behavior, some investigations have detected increases in physical activity following mindfulness-based interventions, even when physical activity was not the target of the intervention (e.g., Carlson, Speca, Patel, & Goodey, 2004). However, correlational studies examining the relationship between mindfulness and exercise behavior have yielded mixed findings and warrant further investigation (e.g., Murphy, Mermelstein, Edwards, & Gidycz, 2012; Roberts & Danoff-Burg, 2010). In the context of sleep hygiene, empirical research has shown that mindfulness practice may help reduce sleep disturbances that are related to stress (Carlson & Garland, 2005), and improve overall sleep quality in novice meditators (Brand, Holsboer-Trachsler, Naranjo, & Schmidt, 2012). Descriptive studies have found that college students with greater levels of dispositional mindfulness tend to report better sleep quality (Murphy et al., 2012; Roberts & Danoff-Burg, 2010).

College students' sleep habits and consequent sleep quality can have profound physiological and behavioral consequences (Buboltz et al., 2001; National Sleep Foundation, 2008). Previous literature reviews and meta-analyses have found significant associations between sleep duration and obesity, however researchers are only beginning to understand the mechanisms involved. Across studies, findings indicate an inverse relationship between sleep quality and appetite. Experimental evidence suggests that sleep deprivation may alter the secretory patterns of two appetite-regulating hormones, ghrelin and leptin (Banks & Dinges, 2007; Spiegel, Tasali, Penev, & Van Cauter, 2004). In studies of young healthy men, sleep curtailment was associated with elevated ghrelin and suppressed leptin secretion, and corresponded to increased hunger and appetite (Brondel, Romer, Nouges, Touyarou, & Davenne, 2010; Spiegel et al., 2004). Sleep deprivation may also affect nutritional choices, as sleep restriction is strongly correlated with increased caloric consumption of snacks prior to bedtime (Nedeltcheva, Kilkus, Imperial, Kasza, Schoeller, & Penev, 2009). In a rural Midwestern sample, Stamatakis and Brownson (2007) found that individuals who slept less than 7 hours consumed more fast food and high-fat food than those who slept 7-8 hours per night. Spiegel and colleagues (2004) observed a 33-45% increase in craving for carbohydrate-rich foods as a result of sleep restriction. Low sleep duration has also been associated with fatigue (Caldwell, 2002; Forquer et al., 2008) and reduced physical activity (Patel, Malhotra, White, Gottlieb, White, & Hu, 2006). Schmid, Hallschmid, Lassen, Mahnke, Schultes, and Schiöth et al. (2009) confirmed that sleep loss led to decreased physical activity levels among young healthy men. In a recent study, Bromley, Booth, Kilkus, Imperial, and Penev (2012) found that sleep restriction resulted in reduced amount and intensity of

physical activity in adults at risk for type 2 diabetes. Given the identified health consequences of insufficient sleep, the present study examined the influence of sleep quality in the relationship between mindfulness and health behavior (i.e., nutrition and exercise).

Purpose

Despite the established risks of being overweight or obese, college students continue to engage in adverse health related behaviors at relatively high rates. That is, college students' lives are plagued by inadequate nutrition (Lowry et al., 2000), physical inactivity (Anding et al., 2001), and poor sleep quality (Buboltz et al., 2001). Although there is a growing body of evidence linking mindfulness and sleep quality, no study has examined the role of sleep quality in the relationships between mindfulness and nutrition, and mindfulness and exercise behavior. Given the physiological consequences of sleep deprivation, one may speculate whether even a mindful person can successfully implement good nutrition and exercise habits when they suffer from poor sleep hygiene. Thus, the present study was designed to explore the relationships between mindfulness and health behaviors in college students; in particular, nutrition, exercise, and sleep. More specifically, the present study explored the potential moderating role of sleep quality in the relationships between mindfulness and nutrition, and mindfulness and exercise behavior. Further, the current investigation examined the influence of each of the five facets of mindfulness (observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) on undergraduate college students' nutrition and exercise behavior.

CHAPTER 2

REVIEW OF THE LITERATURE

Health Risk Behaviors in College Students

Nutrition and exercise behavior are key determinants of health status, and are associated with 4 of the 10 leading causes of death in the United States (US Department of Health and Human Services [HHS], 2000). Sleep is also imperative for overall health, as complex neurological, physiological, and hormonal processes occur during sleep (Dement, 2000). Research has shown that a healthy diet, regular physical activity, and good sleep hygiene are independently associated with a reduced risk for obesity, coronary heart disease, stroke, hypertension, and type 2 diabetes (Ayas, White, Manson, Stampfer, Speizer, & Malhotra et al., 2003; Beihl, Liese, & Haffner, 2009; Gangwisch, Heymsfield, Boden-Albala, Buijs, Kreier, & Pickering et al., 2006; Hasler, Buysse, Klaghofer, Gamma, Ajdacic, & Eich et al., 2004). However, the majority of college students fail to meet the nutrition and exercise guidelines necessary for health benefits (ACHA, 2012), typically consuming diets high in fat, sodium, and sugar while leading relatively sedentary lifestyles (Anding et al., 2001; Pinto & Marcus, 1995). In addition, sleep deprivation and poor sleep quality are highly prevalent on college campuses, as research has shown that college students report at least twice as many sleep problems as the general population (Brown, Soper, & Buboltz; 2001). To better our understanding of the health risk behaviors in college students, the following review of the literature will examine the nutrition, exercise, and sleep habits of undergraduates.

Nutrition and Exercise

Evidence shows that as young adults transition from high school to college,

negative changes can occur in health behaviors, particularly nutrition and exercise (Douglas et al., 1997; Lowry et al., 2000). In 2001, Anding and colleges examined the dietary and exercise behaviors of 60 female college students in the context of the *Dietary Guidelines for Americans* (HHS, 1995). The dietary guidelines outlined the following 7 recommendations: (a) eat a variety of foods; (b) balance the food you eat with physical activity; (c) choose a diet with plenty of fruits, vegetables, and grain products; (d) choose a diet low in fat, saturated fat, and cholesterol, (e) choose a diet moderate in sugars; (f) choose a diet moderate in salt and sodium; and (g) drink alcoholic beverages in moderation. Participants completed an assessment of their physical activity engagement over the past month, and were asked to record their food consumption for 3 days. Mean BMI levels were indicative of healthy weights, however, 25% of the sample was classified as overweight. Although participants met the daily recommended servings for meat, the majority failed to consume enough fruits, vegetables, grains, or dairy products. In fact, only 15% of participants reported consuming 5 or more servings of fruits and vegetables daily. Further, most participants exceeded suggested levels of saturated fat, sugar, and sodium. In regards to physical activity, approximately 25% of participants surveyed reported that they exercised regularly. Although most participants followed at least one of the dietary guidelines, no participant adhered to all seven recommendations. The findings of this study are consistent with those of previous investigations in that a large majority of the sample did not consume the recommended servings of food groups nor did they engage in regular physical activity (Dinger & Waigandt, 1997; Haberman & Luffey, 1998; Schutte et al., 1996).

Nutrition behavior has received greater attention than exercise, as studies have

shown reduced energy intake to be more effective for weight loss as compared to physical activity (Votruba, Horvitz, & Schoeller, 2000). In a study of 630 male and female college students, Debate and colleagues (2001) explored students' current weight status, dietary practices, and dietary patterns. Participants completed a questionnaire that assessed dietary and weight-control behaviors, and were asked to report their food consumption over the past 24 hours by using the groups identified by the Food Guide Pyramid (United States Department of Agriculture [USDA], 1992). Of the sample, 64% of the students had healthy BMI levels. Similar to Anding et al. (2001), results indicate that the majority of college students did not meet the daily recommended food servings as described by the Food Guide Pyramid. More specifically, only 18% of participants consumed 5 servings of fruit and vegetables per day, 7% consumed 6 or more servings of grain, and 53% consumed 2 or more servings of dairy. These findings are comparable to the results of the National College Health Risk Behavior Survey, which found that 75% of participants failed to consume a total of 5 fruits and vegetables per day (CDC, 1997). Consistent with other studies on college meal skipping (e.g., Huang, Song, Schemmel, & Hoerr, 1994; Hertzler & Frary, 1989), breakfast was never/rarely consumed by 44% of participants. In addition, approximately 32% of students reported eating fast food always/often. These findings support Sneed and Holdt (1991) who indicated that college women and men consume approximately 2 fast food meals per week.

In 2003, Huang, Harris, Lee, Nazir, Born, and Kaur surveyed 736 college students to assess weight, diet, and physical activity. Participants responded to questionnaire items regarding their dietary and exercise habits. According to participants' BMI levels, roughly 21% were overweight and 4% were obese. Of note, men were more likely than

women to be overweight, but not obese. In regards to nutrition, 69% of participants consumed fewer than 5 servings of fruit and vegetables per day, and 67% consumed less than 20g of fiber. Women consumed significantly less fiber than their male counterparts. Exercise levels were also low, as physical activity guidelines recommend that adults do at least 30 minutes of aerobic exercise each day (United States Department of Health and Human Services [HHS], 2008). Men were more likely to engage in aerobic exercise, and reported exercising more days per week than women. Overall, participants reported engaging in aerobic exercise an average of only 2.8 days per week, and doing strength training exercises 2.2 days per week. In addition, 16% of students reported engaging in no physical activity. Another study involving undergraduate students revealed that 59% of participants exercised 3 or more times per week, and 30% did not engage in exercise at all (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Collectively, these findings are consistent with those of Pinto and Marcus (1995), who concluded that a substantial portion of college students lead rather sedentary lifestyles.

In a longitudinal study, Butler, Black, Blue, and Gretebeck (2004) sought to address the dietary, physical activity, and body weight parameter changes associated with relocation from home to college. Of the 54 first-year college women sampled, approximately 15% were overweight and 5% were obese. Similar to previous investigations, the data revealed that roughly 80% of the participants did not meet the minimum recommendations for fruits, vegetables, grains, or dairy (Haberman & Luffey, 1998). Interestingly, the researchers found a significant caloric decrease over the course of 5 months, but observed a significant increase in body weight parameters during the same period. Butler and colleagues (2004) attributed body weight changes to a

significant decline in physical activity. Not to mention, fat mass increased, which indicate a reduction in physical fitness that is likely associated with a lack of exercise. In contrast to previous assumptions (Votruba et al., 2000), the findings suggest that physical activity patterns may be a stronger indicator of weight gain than dietary intake.

Although many people have embarked on ambitious exercise programs at one time or another, most struggle to maintain a regular exercise regimen. In fact, empirical research has estimated that 50% of individuals who begin an exercise program drop out within the first 6 months, or fail to maintain physical activity at the intended level (e.g., Dishman, 1988; Marcus, Bock, & Pinto, 1997). In a sample of 392 Canadian university students, Irwin (2007) conducted a longitudinal investigation to identify the extent to which college students maintain physical activity at a level necessary for health promotion over a 1-month period. Participants responded to items regarding the frequency and intensity of their physical activity experiences, and were asked to keep a physical activity log. Of the respondents, only 35% of students maintained physical activity for 1 month at the level necessary to gain health benefits. No gender differences were found. This prevalence rate is similar to the findings of a cross-sectional study by Sarkin, Nichols, Sallis, and Calfas (1998), who identified that roughly 37% of college students were sufficiently physically active for health benefits.

In a recent longitudinal investigation, Wengreen and Moncur (2009) examined changes in weight, dietary intake, and physical activity in 159 first-year college students. Participants completed surveys regarding their dietary intake and physical activity over the past six months of high school and during their first semester at college. At the start of the investigation, 14% of participants were overweight and 6% were obese. Over the

course of the study, weight and BMI levels increased. Specifically, 23% of participants gained ≥ 5% of their body weight, yet no participants lost ≥ 5% of their body weight during the same period. Among those who gained ≥ 5% of their body weight, the average amount of weight gained was 4.5 kg (9.9 lbs.). There was no significant difference in the amount of weight gained by men and women. Findings indicate that college students who gained ≥ 5% of their body weight were more likely to eat breakfast, and participated in less physical activity. The association between breakfast consumption and weight gain is surprising, as previous research has provided evidence that breakfast skipping is positively correlated with body weight (e.g., Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). The authors suggested that the observed findings regarding breakfast consumption may be attributed to eating in all-you-can-eat dining facilities. In fact, those participants who gained ≥ 5% of their body weight consumed an average of 2.1 more meals per week in campus dining facilities than participants who did not gain a significant amount of weight. Similarly, other researchers have found college weight gain to be highly correlated with eating breakfast and lunch in all-you-can-eat dining halls (Levitsky, Halbmaier, & Mrdjenovic, 2004). Levitsky et al. (2004) hypothesized that campus dining facilities offer a great abundance and variety of food, which may promote excess energy intake. In regards to physical activity, the results are consistent with the findings of Butler et al. (2004) and Jung, Bray, and Martin Ginis (2008) who also found a significant association between weight gain and decreases in physical activity, despite overall reductions in energy intake. Given that 79% of students who gained ≥ 5% of their body weight lived on campus, the findings are interesting to compare to those of Bray, Millen, and Kwan (2004) who found that students who move

away from their parents' home to an on-campus residence showed decreased levels of physical activity during their first year of college, whereas students who lived at home showed no such decline.

In sum, numerous researchers have reported that college students display poor nutrition and exercise behavior. The typical diet of college students is often low in fruits and vegetables and high in fat, sugar, and sodium (Anding et al., 2001; CDC, 1995; Debate et al., 2001), which may be characterized as a diet deficient in essential vitamins and minerals (Hendricks et al., 1998; Zive, Nicklas, Busch, Myers, & Berenson, 1996). Although all-you-can-eat dining halls offer a vast array of foods, college students fail to eat a great enough variety of foods to meet the minimum recommendations outlined by the Food Guide Pyramid (Anding et al., 2001; Debate et al., 2001). College students also engage in frequent meal skipping (Debate et al., 2001; Huang et al., 1994; Hertzler & Frary, 1989) and have high levels of fast food consumption (Debate et al., 2001; Sneed & Holdt, 1991). In regards to exercise, the majority of college students are not sufficiently physically active for health benefits (Irwin, 2007; Sarkin et al., 1998). Evidence indicates that as students transition from high school to college, physical activity levels decline (Butler et al., 2004; Jung et al., 2008; Bray et al., 2004; Wengreen & Moncur, 2009), resulting in a considerable body of students leading inactive lifestyles (Pinto & Marcus, 1995).

Sleep

The quantity and quality of sleep among college students have changed dramatically over the past several decades. Hicks, Fernandez, and Pellegrini (2001a) conducted a longitudinal investigation, sampling 3 large cohorts of college students over

three consecutive decades. In the late 1970s, a sample of 1,839 students slept an average of 7.3 hours, whereas a similar sample of college students surveyed a decade later reported that they slept an average of 6.87 hours per night (Hicks, Mistry, Lucero, Marcial, & Pellegrini, 1990). Between 1970 and 2001, the median sleep duration of college students dropped 1 hour, from 7.75 to 6.65 hours per night (Hicks et al., 2001a), which is far below the recommended 8.5 to 9.25 hours for their age group (National Sleep Foundation, 2008). However, subsequent reports regarding average sleep duration in college students have been inconsistent. Hoesk, Phelps, and Jensen (2004) sampled 996 students and found a mean sleep duration of 7.69 hours per night. In a sample of 313 college students, Forquer et al. (2008) reported a mean sleep duration of 7.2 on weekdays and 8.6 hours on weekends. Interestingly, researchers have observed that college students often deprive themselves of sleep during the week and attempt to "catch up" on sleep during the weekends (Brown et al., 2001; Jensen, 2003). College students also frequently shift their bedtime and wake time (Tsia & Li, 2004), despite evidence that optimal healthy sleep is best achieved by maintaining a consistent sleep/wake schedule. It appears that as students transition to college, their sleep habits tend to change and usually not for the better (Pilchner, Ginter, & Sadowsky, 1997).

More recently, Liguori, Schuna, and Mozumdar (2011) conducted a longitudinal study that assessed changes in sleep duration over the course of the semester in a sample of 820 male and female undergraduates. Participants completed surveys inquiring about their sleep habits, perceptions, and disturbances. Sleep duration ranged from 7.30 to 7.58 hours per night, with first-year students sleeping 20 minutes longer than upper division students. Mean sleep duration in this study was longer than values reported in previous

investigations (Hicks et al., 2001a; Forquer et al., 2008, Hoesk et al., 2004), and even increased over the course of the semester. Interestingly, female students had a significant increase of about 30 minutes in mean sleep duration throughout the semester, which occurred mostly during the winter months. Although sleep quantity was adequate, participants reported a mean of only 3.39 days per week where they awoke feeling rested. Comparably, data from the NCHA (2012) indicated that only 10% of college students report getting enough sleep to feel rested 6 out of 7 days of the week (ACHA, 2012).

In addition to sleep duration, college students' sleep quality has received increased and warranted empirical attention. Evidence demonstrates that poor sleep quality can have physiological and behavioral consequences that can negatively effect students' health and well-being (Banks & Dinges, 2007). In 2001, Buboltz and colleagues examined sleeping patterns in a sample of 191 male and female undergraduates. Participants completed measures that assessed their subjective sleep quality and sleep habits. Of the sample, only 11% of participants reported good sleep quality. Further, the results revealed that more than 73% of participants indicated occasional sleep difficulties, with women reporting more problems than men. These findings are consistent with previous research that found that approximately 68% of college students report experiencing sleep problems (Hicks, Johnson, & Pellegrini, 1992). Sleep difficulties endorsed by the majority of the sample included: taking more than 30 minutes to fall asleep, difficulties falling asleep more than 3 times per week, waking up too early, and morning tiredness. In fact, 54% of students surveyed reported feeling tired the next day. In another study of college students, Caldwell (2002) found that sleeping just one hour less than the recommended 8 hours per night, coupled with irregular sleep

schedules, resulted in 75% of a college student research sample reporting of feelings of fatigue. The researchers concluded that, "college students suffer a decreased level of sleep quality compared to the 'normal' adult population" (Buboltz et al., 2001, p. 133).

In an expanded study, Buboltz, Soper, Jenkins, Woller, Johnson, and Faes (2009) assessed sleep quality and sleep habits in a sample of 742 undergraduates. Of the sample, poor sleep quality was reported by 22% of participants, whereas 66% indicated that they experienced occasional sleep problems. Similar to the results of Buboltz et al. (2001), only 11% of participants indicated good sleep quality and 54% reported feeling "mostly tired" in the mornings. In contrast to the Buboltz et al. (2001), a higher percentage of students took more than 30 minutes to fall asleep (24% vs. 20%), experienced sleep disturbances (20% vs. 15%), experienced nocturnal awakenings (20% vs. 14%), woke up too early (18% vs. 14%), and used sleep medications (3% vs. 1%). In a sample of 313 undergraduate and graduate college students, Forquer et al. (2008) reported even higher prevalence of sleep difficulties. Of the participants, 30% reported taking longer than 30 minutes to fall asleep, 43% woke up more than once per night, and 58% reported feeling fatigued the next day. Of note, no gender differences in time to fall asleep, hours of nightly sleep, or number of awakenings were found.

In sum, empirical research suggests that college students suffer from poor sleep quality. According to Hicks, Fernandez, and Pellegrini (2001b), college students' sleep dissatisfaction rose from 24% to 71% between 1978 and 2001. Additionally, sleep difficulties are highly prevalent among college students, particularly taking more than 30 minutes to fall asleep, difficulties falling asleep, waking up too early, and morning tiredness (Buboltz et al., 2001, 2009). Across investigations, more than half of college

students report feeling fatigued during the day (Buboltz et al., 2001, 2009; Caldwell, 2002; Forquer et al., 2008). Although findings regarding college students' average sleep duration are mixed (Hicks et al., 2001a; Forquer et al., 2008, Hoesk et al., 2004; Liguori et al., 2011), researchers agree that college students are at high risk for sleep deprivation and poor sleep quality (Buboltz et al., 2001, 2009).

Sleep, Nutrition, and Exercise. Poor sleep quality can have significant physiological and behavioral consequences (Buboltz et al., 2001; National Sleep Foundation, 2008). Evidence has revealed cross-sectional associations between sleep deprivation and obesity. A review of the literature suggests that sleep deprivation and poor sleep quality may be related to an increased risk for obesity by de-regulating appetite, which in turn corresponds to increased energy consumption. Observational studies have detected changes in the secretory patterns of two appetite-regulating hormones, ghrelin and leptin, as a result of insufficient sleep (e.g., Spiegel et al., 2004). Ghrelin stimulates appetite, whereas leptin decreases appetite. Together, these two opposing hormones work to control appetite and ensure that optimal energy intake and homeostasis is obtained (Valassi, Scacchi, & Cavagnini, 2008).

In 2004, Spiegel et al. examined both ghrelin and leptin levels before, during, and after induced sleep curtailment. Participants were 12 young men with healthy BMI levels who typically slept an average of 7 to 9 hours per night. The researchers obtained blood samples at 20-minute intervals after sleep was restricted to 4 hours for two consecutive nights, and after sleep was extended to 10 hours for two consecutive nights. Half of the sample received the 4 hours before the 10 hours condition, while the other half got the reverse. Participants also completed visual analogue scales for hunger and appetite. The

results revealed that leptin levels were 18% lower and ghrelin levels were 28% higher when sleep was restricted to 4 hours per night. In addition, the reciprocal changes in ghrelin and leptin in response to sleep restriction resulted in a 24% increase in hunger and a 23% increase in appetite. The greatest increase in appetite tended to be for carbohydrate-rich foods, including sweets, salty foods, and snacks, which rose from 33-45%. In another study of 11 healthy men and women, Nedeltcheva et al. (2009) found that recurrent sleep restriction was accompanied by increased consumption of excess calories from carbohydrate-rich snacks before bedtime. Collectively, the findings suggest that sleep deprivation may have the capacity to influence nutritional choices.

Sleep deprivation leads to daytime sleepiness (Aeschbach, Postolache, Sher, Matthews, & Wehr, 2001), which may discourage participation in activities that require added physical effort or energy, such as exercise, and the preparation of nutritious meals, as opposed to purchasing food items (e.g., fast food). Thus, it is conceivable that insufficient sleep may be a barrier to good nutrition and exercise, which can result in weight gain. Given the paucity of research in this area, Stamatakis and Brownson (2007) sought to examine the effects of sleep on nutrition and exercise behavior. The researchers collected cross-sectional data from rural communities in Midwestern United States, obtained from a telephone-administered questionnaire that assessed common weight related behaviors, including fruit and vegetable consumption, fat intake, frequency of eating fast food, and physical activity. Based on habitual sleep duration values, participants were grouped into three categories: short sleep duration (< 7 hours), long sleep duration (≥ 9 hours), and a reference group (7-9 hours). The results revealed that short sleep duration was associated with higher levels of fast food and high-fat food

consumption along with lower levels of fruit and vegetable intake and physical activity. A subsequent experimental study by Schmid and colleagues (2009) confirmed that acute sleep loss decreases physical activity engagement in young healthy men. The researchers also observed that not only was the frequency of physical activity decreased, but the intensity of exercise was reduced to lower levels as well.

In a recent study, Bromley et al. (2012) sought to test the hypothesis that sleep curtailment would result in reduced amount and intensity of physical activity in adults at risk for type 2 diabetes. A sample of 18 young healthy men and women with a parental history for type 2 diabetes were subjected to two 7-day inpatient sessions where sleep was restricted to 5.5 or 8.5 hours. Participants who exercised regularly (39%) were allowed to follow their typical exercise regimen during both sessions. To simulate occupational activities, participants performed office-like tasks for 6 hours a day, including working on computer, making phone calls, entering data, researching, reading, and writing. Participants spent the remainder of their waking hours engaged in leisure activities, such as watching TV, playing video games, reading, surfing the internet, or making phone calls. Continuous wrist actigraphy and waist accelerometry were used to monitor participants' sleep and physical activity. It was found that sleep restriction was associated with 31% lower daily movement, a 24% reduction in moderate to vigorous physical activity, and more sedentary behavior. In fact, decreases in daily activity were most prominent in participants who exercised regularly (-39% vs. -4% in exercisers vs. non-exercisers, respectively). The results are consistent with the findings of Schmid et al., (2009) and St-Onge, Roberts, Chen, Kelleman, O'Keeffe, and RoyChoundry (2011) who observed a similar decrease in physical activity intensity in response to experimental

sleep curtailment. Given the established behavioral health consequences of insufficient sleep, the present study examined the influence of sleep quality in the relationships among mindfulness and nutrition and exercise behavior.

Mindfulness

Definition of Mindfulness

The term "mindfulness" is complex and multifaceted, as it has been used to describe a mode of processing information, a state of awareness, a meditative practice, and a psychological trait (Brown et al., 2007). In contemporary Western psychology, researchers have attempted to develop an operational definition of mindfulness, and identify the core dimensions of the construct. One of the most commonly cited definitions of mindfulness is the awareness that arises through "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). In a later article, Kabat-Zinn (2003) added that mindfulness includes "an affectionate, compassionate quality with the attending, a sense of openhearted, friendly presence and interest" (p. 145). Definitions and descriptions of mindfulness provided by other researchers have been similar. For example, Brown and Ryan (2003) defined mindfulness as "the state of being attentive to and aware off what is taking place in the present" (p. 822). Baer (2003) elaborated that mindfulness involves "the nonjudgmental observation of the ongoing stream of internal and external stimuli as they arise" (p. 125). Similarly, Bishop et al. (2004) defined mindfulness as the "non-elaborative awareness to current experience" with an orientation of "curiosity, experiential openness, and acceptance" (p. 234). Although the definitions vary in regards to what facets of mindfulness they include, all seem to capture the basic elements that mindfulness

teachers have deemed important (Baer, 2011).

Brown and Ryan (2003) suggested that individuals differ in their propensity to be aware and sustain attention to the present moment. Thus, in addition to being a state of consciousness, research has demonstrated that mindfulness is a characterological trait (Brown & Ryan, 2003; Thompson & Waltz, 2007). For the purpose of the current investigation, mindfulness was treated as a "dispositional or trait-like variable that is roughly consistent over time and across situations" (Baer, 2011; p. 246). However, it is important to clarify that the inherent tendency to respond mindfully to daily activities can be enhanced with training (Baer, 2011; Brown & Ryan, 2003; Carmody & Baer, 2008). In fact, mindfulness-based treatment interventions have been shown to improve mean scores on measures of dispositional mindfulness, therefore demonstrating that mindfulness is amenable to change with practice (Carmody & Baer, 2008; Carmody, Reed, Kristeller, & Merriam, 2008; Chambers, Lo, & Allen, 2008).

Theory of Mindfulness

While some researchers focus solely on the attentional facets of mindfulness, most have adopted Bishop and colleagues (2004) two-component model of mindfulness. The first component involves the self-regulation of attention and awareness, and the second includes the adoption of a curious, open, and accepting attitude (Bishop et al., 2004). Bishop and colleagues' (2004) model identifies these components in terms of "specific behaviors, experiential manifestations, and implicated psychological processes" (p. 230).

Attention and awareness. According to Brown and Ryan (2004), awareness is the "subjective experience of internal and external phenomena," whereas attention is the

"focusing of awareness to highlight selected aspects of that reality" (p. 242-243). For example, when eating, one can be highly attentive to the taste experience, while sensitively aware of the enhanced feeling of fullness in one's stomach (Brown & Ryan, 2003). As Bishop et al. (2004) emphasized, mindfulness specifically concerns the self-regulation of attention to the conscious awareness of one's immediate experiences (e.g., physical sensations, perceptions, thoughts, feelings, and imagery). Further, this "self-regulation" not only involves the ability to attend to a given entity for an extended period of time, but the capacity to intentionally shift attention between objects and simultaneously inhibit elaborative processing (Bishop et al., 2004). Thus, present moment awareness (i.e., mindfulness) enhances the direct experience of events, as opposed to the meaning prescribed to events (Shapiro, Carlson, Astin, & Freedman, 2006).

Acceptance. The second component of Bishop et al.'s (2004) model of mindfulness is acceptance. In the context of mindfulness, however, it is important to clarify that acceptance does not imply passivity or resignation (Cardaciotto, Herbert, Froman, Moitra, & Farrow, 2008), but involves the adoption of a nonjudgmental attitude that allows one to experience more fully, without distortion or bias. For example, when having a food craving, acceptance requires a nonevaluative orientation toward the craving and requires a willingness to withstand the uncomfortable, and potentially negative feelings that accompany the craving (Alberts et al., 2010). Therefore, mindfulness encourages an open and receptive attitude, and discards "one's agenda to have a different experience" (p. 233, Bishop et al., 2004).

Mindfulness, Nutrition, and Exercise

To date, the majority of mindfulness research has focused on the effectiveness of mindfulness-based interventions, whereas the examination of mindfulness as a dispositional variable has been addressed by only a handful of studies in the health behavior literature. In a sample of 553 male and female college students, Roberts and Danoff-Burg (2010) investigated the relationships between mindfulness and health behaviors, in addition to the role of stress in mediating these effects. Participants completed assessments of mindfulness, perceived health, health behaviors (i.e., sleep, smoking, binge eating, physical exercise, and risky sexual activity), health-related activity restriction (e.g., missing work or school), and stress. The results revealed that participants who were more mindful engaged in less binge eating, were more physically active, and reported better sleep quality. Furthermore, stress was shown to partially mediate these relations, suggesting that greater mindfulness is related to decreased stress levels, which in turn promotes positive health behavior. Baer et al. (2006) highlighted that relaxation, defined as the reduction of tension, is one of the primary mechanisms underlying mindfulness. Stress has also been found to be significantly associated with diet (Cartwright, Wardle, Steggles, Simon, & Croker, 2003; Grunberg & Straub, 1992), physical exercise (Salmon, 2001), and sleep quality (Akerstedt, 2006; Akerstedt, Kecklund, & Axelsson, 2007). Given the aforementioned established relationships and the high prevalence of stress on college campuses (Misra & Castillo, 2004), stress was considered as a covariate in the current investigation.

In a similar investigation, Grinnell et al. (2011) sought to determine whether mindfulness is associated with anthropometric and self-report measures of diet and physical activity among 75 first-year college students. Although mindful and less

mindful participants were similar in regards to anthropometric assessments (e.g., weight, height, BMI, waist circumference, and blood pressure), differences emerged on the behavioral measures. More specifically, college students who were more mindful had a lower susceptibility to emotional eating, eating in response to external rather than internal cues, and reported less barriers to physical activity. These findings support the utility of dispositional mindfulness in promoting positive health behavior in college students.

To date, only one study has examined the unique influence of each of the five facets of dispositional mindfulness (observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) on college students' nutrition and exercise behavior. In a sample of 269 male and female undergraduates, Gilbert and Waltz (2010) examined the degree to which mindfulness predicts diet, physical activity, and self-efficacy. The results revealed that college students who were more mindful reported higher levels fruit and vegetable intake, lower levels of fat intake (men only), higher levels of moderate- and vigorous-intensity physical activity, and greater self-efficacy. Interesting gender differences emerged, as the ability to observe sensation, perceptions, thoughts, and feelings predicted healthier behaviors for males, whereas the capacity to describe and apply meaning to experiences predicted healthier behaviors for females. In regards to physical activity, the observe subscale alone predicted men's moderate and vigorous physical activity. For females, the describe subscale was predictive of moderate physical activity and the act with awareness subscale was predictive of vigorous physical activity. Concerning dietary behavior, the observe and act with awareness subscales were predictive of men's fruit and vegetable intake. The nonreact subscale alone predicted men's fat intake. For females, the observe

subscale alone was predictive of fruit and vegetable intake. Of note, mindfulness was not significantly associated with fat intake for women. Overall, the findings suggest that the various facets of mindfulness may be related to specific health behaviors.

In a recent longitudinal investigation, Murphy et al. (2012) examined the extent to which mindfulness predicted health behaviors (i.e., sleep, eating, and exercise) and physical health among a sample of 441 college women. Participants responded to questionnaires that assessed mindfulness, healthy eating habits, exercise frequency, sleep quality, and physical health. Consistent with Roberts and Danoff-Burg's (2010) findings, higher levels of mindfulness were found to be significantly related to healthy eating habits and better sleep quality. However, frequency of exercise was not significantly related to mindfulness, which the researchers attributed to methodological limitations of the scale. Given the inconsistent findings, the relationship between mindfulness and exercise behavior in college students warrants further investigation.

The examination of mindfulness and health behaviors among college students seems particularly relevant to counseling psychologists who work with college students, as the present study provides useful information for enhancing understanding of how mindfulness influences weight-related behaviors in this population. In accordance with the goal of the American Psychological Association's Strategic Plan (APA, 2011) to expand psychology's role in advancing health, psychologists must work to increase support, research, training, education, and interventions that improve and reduce the obesity epidemic. As experts in understanding and changing behavior, psychologists have the capacity to address some of the behavioral and environmental causes of obesity. Accordingly, the current investigation can assist in the development of mindfulness-

based interventions that may help to reduce the barriers that college students face in their effort to embrace a healthier lifestyle. Perhaps, mindfulness may be a unique and cost-effective tool for improving physical health.

Rationale and Purpose

Obesity is a complex disorder that originates from both genetic and environmental factors and may put individuals at risk for premature mortality and morbidity (Brancati et al., 2000; Mokdad et al., 2001). The epidemic proportions of overweight and obesity in the United States demonstrate that many Americans are in calorie imbalance – that is, they consume more calories than they expend. Given that people cannot control the calories they expend via metabolic processes, it is important that they decrease the amount of calories they consume from food and beverage intake, and increase caloric expenditure through exercise. Despite the established risks, nutrition and exercise represent behaviors that are often neglected by college students. Given that students begin to adopt their own health behavior patterns, college life may set the stage for establishing long-term health behavior (Dinger & Waigandt, 1997). Thus, it is imperative that mindfulness be examined as a potentially critical factor in increasing our understanding of health behaviors among undergraduate college students.

To date, only a relatively small number of studies have addressed the utility of mindfulness in the domain of nutrition and exercise behavior among college students. Furthermore, only one study has examined the unique associations among the five facets of mindfulness and college student health behavior (Gilbert & Waltz, 2010). However, the results are promising and indicate a positive association among mindfulness and nutrition behavior (Gilbert & Waltz, 2010; Murphy et al., 2012; Roberts & Danoff-Burg,

2010). In regards to exercise behavior, the findings have been mixed (Murphy et al., 2012), but the majority of studies indicate that higher levels of mindfulness correspond to greater physical activity engagement (Gilbert & Waltz, 2010; Grinnell et al., 2011; Roberts & Danoff-Burg, 2010). Given the high prevalence of sleep deprivation and poor sleep quality among college students (Buboltz et al., 2001; Forquer et al., 2008; Hicks et al., 2001a), one may speculate whether insufficient sleep may serve as a barrier to healthy nutrition and exercise. That is, feeling fatigued may hinder one's participation in activities that require added physical effort, such as exercise, and healthy meal preparation. Accordingly, experimental evidence has found sleep deprivation to be associated with increased hunger and appetite for carbohydrate-rich foods (Nedeltcheva et al., 2009; Spiegel et al., 2004), and decreases in amount and intensity of physical activity (Bromley et al., 2012; Schmid et al., 2009).

In an attempt to expand on both the study of mindfulness and that of health behavior, the aim of the present study was four-fold: (a) examine the influence of sleep quality on the relationship between mindfulness and nutrition behavior; and (b) examine the influence of sleep quality on the relationship between mindfulness and exercise behavior; (c) determine which facets of mindfulness (observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) are most predictive of college students' nutrition; and (d) determine which facets of mindfulness are most predictive of college students' exercise behaviors.

Hypotheses and Research Questions

The following hypotheses and research questions were offered to address the study's purpose:

Hypotheses

1. Sleep quality will moderate the relationship between mindfulness (total score) and nutrition behavior in undergraduate college students, such that the interaction of mindfulness and sleep quality will explain the variance in nutrition behavior above and beyond what is explained by mindfulness and sleep quality.
2. Sleep quality will moderate the relationship between mindfulness (total score) and exercise behavior in undergraduate college students, such that the interaction of mindfulness and sleep quality will explain the variance in exercise behavior above and beyond what is explained by mindfulness and sleep quality.

Research Questions

1. Which facets of mindfulness are most predictive of undergraduate college students' nutrition behavior?
2. Which facets of mindfulness are most predictive of undergraduate college students' exercise behavior?

Models of the hypotheses and research questions are presented in Figures 1 through 4.

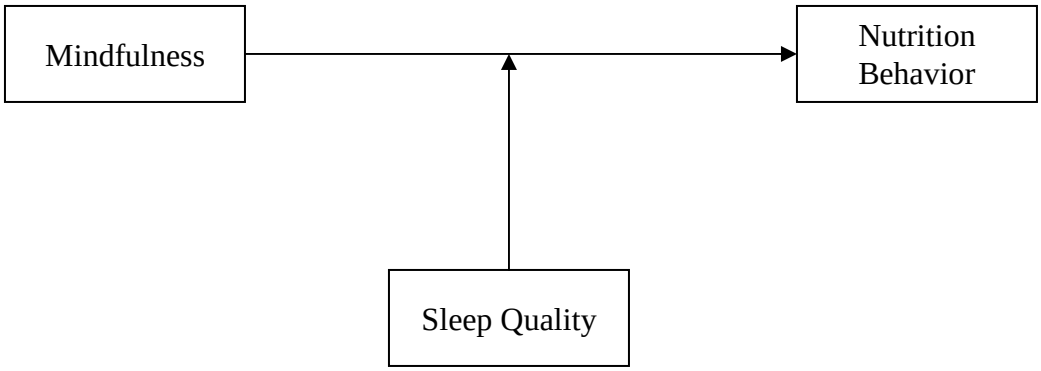

Figure 1. Model of Hypothesis 1.

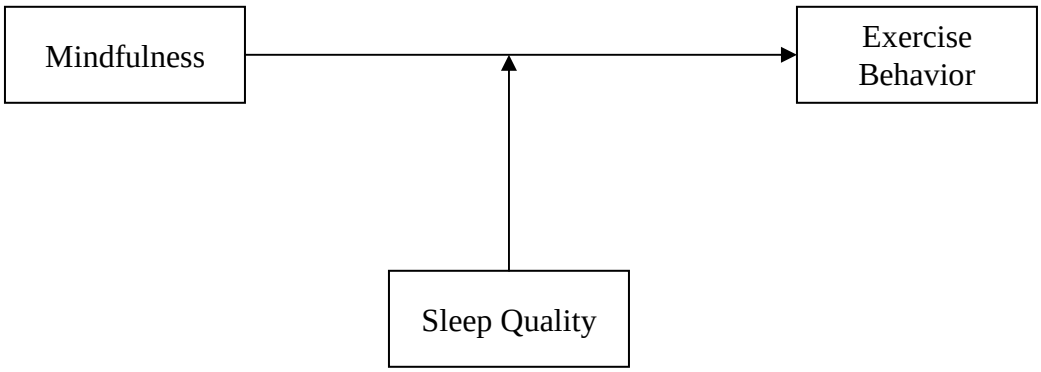

Figure 2. Model of Hypothesis 2.

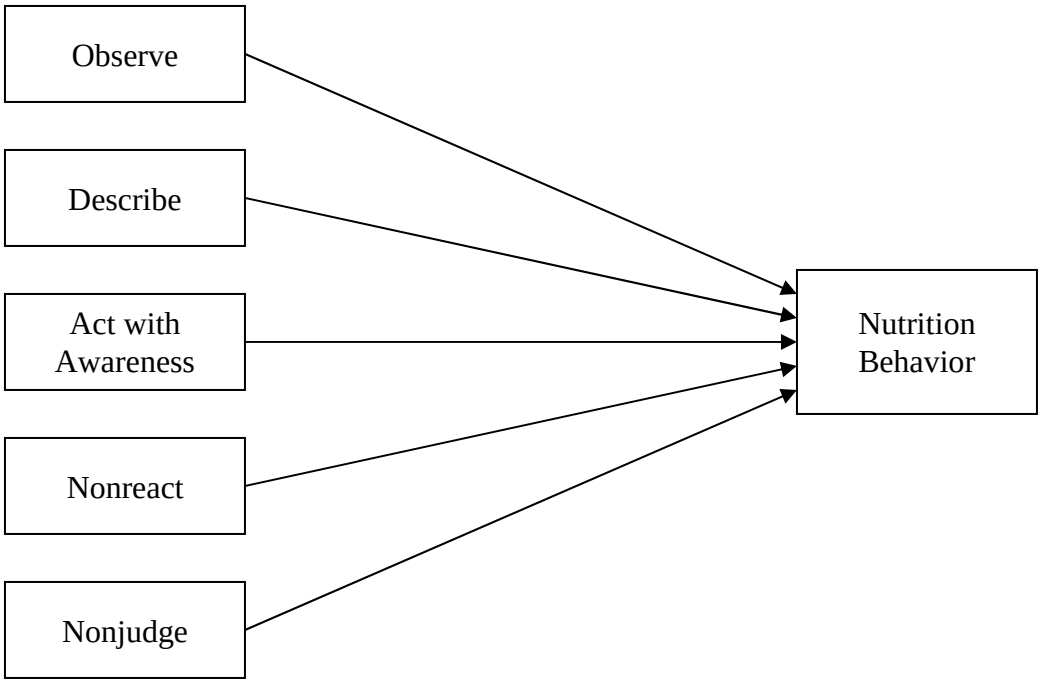

Figure 3. Model of Research Question 1.

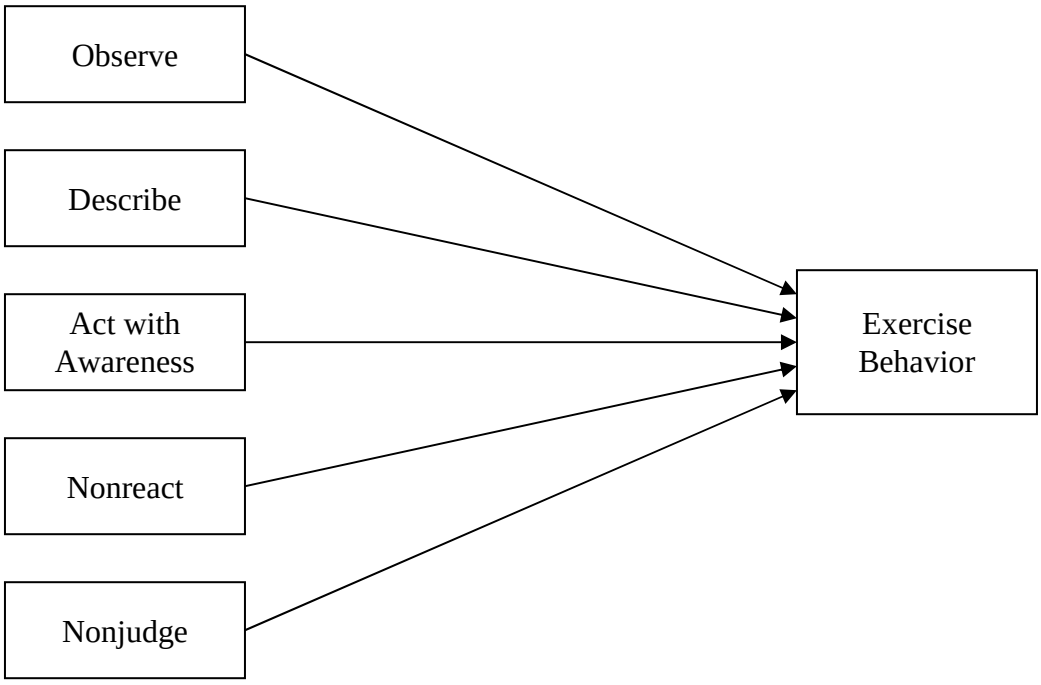

Figure 4. Model of Research Question 2.

CHAPTER 3

METHODOLOGY

Participants

Non-probability sampling (i.e., convenience sampling) was employed in the present study. Participants included undergraduate students who were enrolled in colleges throughout the United States. Undergraduate college students were solicited for participation for the present investigation because: (a) statistics show that being overweight and obese are highly prevalent in college student populations, and (b) research evidence demonstrates that a substantial portion of college students suffer from inadequate nutrition, physical inactivity, and poor sleep quality. When initially determining a target sample size for this study, the recommendation by Tabachnick and Fidell (2001) was considered. These authors suggested that a sample of 8m + 50 is needed for regression analysis, where *m* is the number of predictors, in order to detect a medium effect size. Given that there are seven predictors in the current study, and two variables that needed to be controlled for, the target sample size for this study was, at minimum, 122 participants. However, according to Faul, Erdfelder, Buchner, and Lang (2009), a sample of up to 395 students may be needed to detect a small effect size, and achieve desired alpha level ($\alpha = .05$) and power ($1 - \beta = .80$). Therefore, the present study sought a participant sample of 395 male and female undergraduates.

A total of 438 participants were recruited for this study. Sixty participants, however, were dropped form the study because although they agreed to participate, they did not respond to any survey items. Listwise deletion was used to remove an additional 2 participants from the study who completed less than half of the survey items before

discontinuing their participation. This sample was further reduced to 357 male and female undergraduates due to non-undergraduate academic status (i.e., graduate students or dual enrollment high school students, n = 10), gender identity other than male or female (i.e., transgender, n = 4), unmet age requirement (i.e., under age 18, n = 4), and a univariate outlier (n =1). The remaining sample included 164 male (45.9%) and 193 female (54.1%) undergraduates whose ages ranged from 18 to 35 years (M = 20.99, SD = 3.11). Racial/ethnic composition was as follows: 35.3% Caucasian, 30.8% Latino/Hispanic, 18.5% Black/African American, 7.8% Asian/Asian American, 6.4% Bicultural/Multicultural, 0.6% Native American, 0.6% identified their racial/ethnic background as "other." In regards to sexual orientation, 89.1% of participants identified heterosexual, 2.3% as gay, 1.4% as lesbian, 3.9% as bisexual, 1.1% identified their sexual orientation as "other," and 2.2% of participants did not respond to this item. Of the participants, 24.9% were first year college students, 18.5% were sophomores, 21.3% were juniors, 27.2% were seniors, and 8.1% were fifth year seniors.

In regards to body metrics, participants' height ranged from 58 to 77 inches (M = 67.33, SD = 4.18), with men (M = 70.36, SD = 3.07) reporting greater height than women (M = 64.76, SD = 3.15). Participants weight ranged from 95 to 320 pounds (M = 155.72, SD = 36.46), with men (M = 171.91, SD = 33.31) weighing significantly more than women (M = 141.96, SD = 33.30). Self-reported height and weight were used to calculate participants' BMI (BMI = weight in kilograms divided by height in meters squared), which ranged from 14.23 to 41.00 kg/m^2 (M = 24.04, SD = 4.71). No gender differences were observed. Adult BMI criteria were applied to describe participants as not overweight (BMI < 25.0 kg/m^2), overweight (BMI = 25.0 – 29.9 kg/m^2), or obese

(BMI ≥ 30.0 kg/m^2). Accordingly, 70.3% of the total sample was classified as not overweight (n = 251), 19.0% as overweight (n = 68), and 10.7% as obese (n = 38). With respect to sleeping habits, participants reported sleeping an average of 3 to 12 hours per night (M = 6.78, SD = 1.23). No gender differences in habitual sleep duration were observed. Demographic information is provided in Table 1.

Table 1

Summary of Demographic Characteristics for the Total Sample

Characteristics	N (%)	Min	Max	*M*	*SD*
Age	357	18	35	20.99	3.11
Height (in)	357	58	77	67.33	4.18
Weight (lbs)	357	95	320	155.72	3.15
BMI (kg/m^2)	357	14.23	41.00	24.04	4.71
Not Overweight	251 (70.3%)				
Overweight	68 (19.0%)				
Obese	38 (10.7%)				
Habitual sleep (hours)	357	3	12	6.78	1.23
Gender					
Male	164 (45.9%)				
Female	193 (54.1%)				
Race/Ethnicity					
Caucasian	126 (35.3%)				
Latino/Hispanic	110 (30.8%)				
Black/African American	66 (18.5%)				
Asian/Asian American	28 (7.8%)				
Bicultural/Multicultural	23 (6.4%)				
Native American	2 (0.6%)				
Other	2 (0.6%)				
Sexual Orientation					
Heterosexual	318 (89.1%)				
Gay	8 (2.3%)				
Lesbian	5 (1.4%)				
Bisexual	14 (3.9%)				
Other	4 (1.1%)				
Missing	8 (2.2%)				

(table continues)

Characteristics	N (%)	Min	Max	*M*
Year in School				
First Year	89 (24.9%)			
Sophomore	66 (18.5%)			
Junior	76 (21.3%)			
Senior	97 (27.2%)			
Fifth Year Senior	29 (8.1%)			
Mother's Education Level				
Some School	36 (10.1%)			
High School Graduate/GED	102 (28.6%)			
Vocational/Technical School	17 (4.8%)			
2 Year College	53 (14.8%)			
4 Year College	76 (21.3%)			
Graduate/Professional Degree	70 (19.6%)			
Missing	3 (0.8%)			
Parental/Household Income				
$25,000 or less	58 (16.3%)			
$25,000 to $50,000	86 (24.1%)			
$50,000 to $75,000	72 (20.2%)			
$75,000 to $100,000	63 (17.6%)			
$100,000 or more	73 (20.4%)			
Missing	5 (1.4%)			

Measures

Measurements that were used to assess mindfulness, nutrition behavior, exercise behavior, sleep quality, perceived stress, as well as a demographic questionnaire, are described in this section (also see Appendices A through F).

Mindfulness

Mindfulness was measured using the Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), a 39-item self-report inventory that assesses five facets related to mindfulness: (1) *observing* or attending to sensations, perceptions, thoughts, and feelings; (2) *describing* or labeling experiences with words; (3) *acting with awareness* as

opposed to on "automatic pilot"; (4) *nonreactivity* or allowing thoughts and feelings to come and go, without elaboration; and (5) *nonjudging* or adopting a nonevaluative orientation toward inner experiences(See Appendix A). This instrument was derived from a factor analysis of questionnaires measuring the general tendency to be mindful in daily activities. The FFMQ can be scored wholly or divided into five facets: observe (8 items; e.g., "I notice the smells and aromas of things."), describe (8 items; e.g., "I'm good at finding words to describe my feelings."), act with awareness (8 items; e.g., "When I do things, my mind wanders off and I'm easily distracted."), nonreact (7 items; e.g., "In difficult situations, I can pause without immediately reacting."), and nonjudge (8 items; "I disapprove of myself when I have irrational ideas."). For the purposes of the present investigation, all five facets were used. Participants rated their agreement with each item on a 5-point Likert-type scale, ranging from 1 (*never or very rarely true*) to 5 (*very often or always true*). Total scores range from 39 to 195, with higher scores indicating greater levels of dispositional mindfulness.

Empirical studies have used the FFMQ total scores to assess dispositional mindfulness as an overarching mindfulness construct (e.g., Caldwell, Emery, Harrison, & Greeson, 2011), while subscale scores have been used to better understand the specific skills that are enhanced through the practice of mindfulness (e.g., Carmody, Baer, Lykins, & Olendzki, 2009). Intercorrelations of the facets range from .32 to .56, implying that the facets represent related, yet distinct constructs (Baer, Smith, Lykins, Button, Krietemeyer, & Sauer et al., 2008). Baer and colleagues (2008) conducted a confirmatory factor analysis that supported a hierarchical model in which the five factors are indicators of an overarching mindfulness construct. Therefore, FFMQ total scores

and subscale scores were used in the main analyses.

Baer and colleagues (2006) established construct validity by examining the relationships between the mindfulness facets and other constructs. The observe facet was highly correlated to openness (.42). The describe facet was positively associated with emotional intelligence (.60) and negatively related to alexithymia (-.68). The act with awareness facet was strongly correlated with absent-mindedness (-.61) and dissociation (-.62). The nonreact facet was positively related with self-compassion (.53). The nonjudge facet was negatively related with thought suppression (-.56), neuroticism (-.55), difficulties in emotional regulation (-.52), psychological symptoms (-.50), and experiential avoidance (-.49). Further, empirical studies have observed increases in FFMQ scores with the participation of the Mindfulness-based Stress Reduction group intervention (Carmody & Baer, 2008). Baer and colleagues (2006) reported adequate to good internal consistency reliability for each of the five facets of the FFMQ, with alpha values ranging from .75 (nonreact) to .91 (describe). The FFMQ demonstrated good internal consistency reliability in the current sample for the entire scale (α = .87), and adequate to good internal consistency reliability for the observe (α = .75), describe (α = .86), act with awareness (α = .83), nonreact (α = .87), and nonjudge (α = .77) subscales.

Nutrition and Exercise Behavior

The Health-Promoting Lifestyles Profile-II (HPLP-II; Walker, Sechrist, & Pender 1995) is a 52-item questionnaire that can be scored wholly or divided into six subscales: health responsibility, interpersonal relations, nutrition, physical activity, spiritual growth, and stress management. Nutrition behavior was measured using the 9-item nutrition subscale of the HPLP-II, which assesses participants' selection and consumption of

nutritious foods as outlined by the Food Guide Pyramid (Ardell, 1986; USDA, 1992; See Appendix B). An example item from the nutrition subscale includes, "Limit use of sugars and food containing sugar (sweets)." Similar to the methodology used by Jones and Nies (1996), the 8-item physical activity subscale was used as a measure of exercise behavior (See Appendix C). The physical activity subscale measures participants' involvement in light, moderate, and/or vigorous activity (Bouchard, Shepard, Stephens, Sutton, & McPherson, 1990; Dishman, 1988, HHS, 1991). An example item from the physical activity subscale includes, "Exercise vigorously for 20 or more minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber)." Participants rated their agreement to each item on a 4-point Likert-type scale, ranging from 1 (*never*) to 4 (*routinely*). Scores on the nutrition subscale range from 9 to 36, with higher scores indicating better nutrition. Scores on the physical activity subscale range from 8 to 32, with higher scores indicating greater physical activity. The nutrition and physical activity subscales have shown good internal consistency reliability, with coefficient alphas of .85 and .89, respectively. In a sample of undergraduate college students, the HPLP-II demonstrated good test-retest reliability ($\alpha = .89$) after a 3-week interval. Walker et al. (1995) established construct validity through factor analysis and convergence with the Personal Lifestyle Questionnaire ($r = .68$). The HPLP-II has been used in numerous studies as a measure of health promoting behaviors in college students (e.g., Stark & Brinkley, 2001). In the present sample, the nutrition and physical activity subscales of the HPLP-II demonstrated adequate to good internal consistency reliability, with coefficient alphas of .72 and .80, respectively.

Sleep Quality

The Sleep Quality Index (SQI; Urponen, Partinen, Vuori, & Hasan, 1991) is an 8-item self-report measure that assesses general sleep difficulties over the past 3 months (See Appendix D). Each item has three possible responses. All responses are weighed as a 0, 1, or 2, with 2 representing the most common or most severe symptom. For items regarding difficulties falling asleep, sleep disturbances, waking up during the night, waking up too early in the morning, and insomnia, response categories include: *no, < 3 days per week, and 3-7 days per week.* An example item includes, "Disturbed night sleep during the past 3 months." Time to fall asleep is reported with the responses: *≤ 10 min, 11-30 min, and > 30 min*. Frequency of hypnotics use is assessed using the response categories: *no, occasionally, and at least once per week.* Morning tiredness is reported with the responses: *rather or very alert, don't know, and rather or very tired.* The items are summed to derive a total score of sleep quality, which range from 0 to 16 with higher scores indicating poorer sleep quality. Total scores of 0 to 1 indicate good sleep quality, scores from 2 to 8 represent occasional sleep difficulties, and scores ranging from 9 to 16 indicate poor sleep quality. For the purposes of the present study, total scores were reverse scored so that higher scores reflect greater sleep quality. Accordingly, total scores of 0 to 7 indicate poor sleep quality, scores from 8 to 14 represent occasional sleep difficulties, and scores ranging from 15 to 16 indicate good sleep quality. Urponen et al. (1991) reported adequate internal consistency reliability for the SQI ($\alpha = .74$), and provided validity evidence by demonstrating a significant relationship between quality of sleep and subjective health. Similarly, the SQI demonstrated adequate internal consistency reliability in the present sample ($\alpha = .79$).

Perceived Stress

The Perceived Stress Scale, 10-item version (PSS-10; Cohen, Kamarck, & Mermelstein, 1983), is a self-report instrument that measures perceptual stress (See Appendix E). An example item from the scale includes, "In the past month, how often have you been upset because of something that happened unexpectedly?" Participants rated their agreement with each item on a 5-point Likert-type scale, ranging from 0 (*almost never*) to 4 (*very often*). Total scores were obtained by reversing the scores (e.g., 0=4, 1=3, 2=2) on the four positive items (i.e., item numbers 4, 5, 7, 8), and then calculating the sum of the 10 items. Total scores range from 0 to 40, with higher scores indicating greater levels of perceived stress. Cohen and Williamson (1988) reported good internal consistency reliability for the PSS, with Cronbach's alpha coefficients ranging from .84 to .86. Current findings demonstrate that the PSS-10 is a reliable and valid instrument for the assessment of perceived stress in college students (Roberti, Harrington, & Storch, 2006). More specifically, Roberti and colleagues (2006) reported good internal consistency reliability for the PSS-10 total score ($\alpha = .89$) and provided convergent validity evidence by demonstrating a significant relationship between perceived stress and anxiety. Accordingly, the PSS demonstrated good internal consistency reliability in the present sample ($\alpha = .85$).

Demographic Questionnaire

Participants completed a 10-item demographic questionnaire that requested their age, gender, ethnicity, sexual orientation, year in school, mother's level of education, and parental/household income. In order to further describe the sample, participants were asked to report their height, weight, and average sleep duration, as undergraduate college

students have been identified as an at-risk population for obesity and sleep deprivation. Self-reported height and weight were converted to metric measurements to calculate participants' BMI (BMI = weight (kg)/height^2). Adult BMI criteria were applied to describe participants as not overweight (BMI < 25.0 kg/m^2), overweight (BMI = 25.0 – 29.9 kg/m^2), or obese (BMI ≥ 30.0 kg/m^2). Lastly, to assess habitual sleep duration, participants were asked, "How many hours of sleep do you usually get a night?"

Responses to these demographic items were used for two purposes. The first purpose was to describe the sample of participants. The second purpose was to conduct exploratory analysis in which Pearson correlations between the demographic variables and outcome/moderator variables were examined. Correlational analysis was done to ensure that associations were not significant, as previous studies have shown certain demographic variables (e.g., gender) to be related to mindfulness and health behaviors (See Appendix F).

Procedure

This study commenced upon IRB approval (see Appendix G). Once approval was acquired, an email describing the study was sent to student affairs coordinators at colleges throughout the United States (See Appendix H). The email asked coordinators to include a research participation request in any listserv, electronic newsletter, or networking site that their students utilize (See Appendix I). Interested participants could click on the link provided in the participation request to be taken directly to the study. All surveys were conducted online through SurveyMonkey. Before beginning the study, participants were given information regarding the study's purpose, risks, and benefits, in addition to the researcher's contact information in case any questions or concerns should

arise following their participation (See Appendix J). Those who agreed to participate provided implied consent by completing the survey, which included the FFMQ, the nutrition and physical activity subscales of the HPLP-II, the SQI, the PSS, and a demographic questionnaire. Total completion time was approximately 8-10 minutes. Participation was completely voluntary and could be discontinued at any time. Although no identifying information was requested and all responses remain confidential, participants were offered the chance to provide their email address, kept separate from the survey responses, to enter a raffle to win one of three $25 Amazon gift cards (See Appendix K).

CHAPTER 4

RESULTS

The statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) Software.

Data Examination

Data were screened to ensure that assumptions of univariate and multivariate analysis had not been violated based on standards indicated by Tabachnick and Fidell (2007). First, descriptives and frequencies were run to test regression assumptions on all variables, including missing values and outliers. Surveys with missing data (i.e., no responses on over half of the survey items and/or surveys that had no responses at all) were eliminated (n = 62) because there was limited or no data that could be used in the analyses. To check for normality of distributions, histograms were created for each variable, and skewness and kurtosis statistics were deemed acceptable. Upon examination of histograms and standardized scores for each variable, one univariate outlier was detected because its z-score surpassed a cutoff of 3.3. According to Warner (2008), a reasonable approach to handling outliers is to use a standard rule of exclusion of extreme scores (i.e., z-score > 3.3) during the preliminary data screening stages rather than the later stages in the analyses. Therefore, the univariate outlier was deleted. Descriptive statistics of study measures and a priori variables including means, standard deviations, reliability, skewness, and kurtosis statistics are provided in Table 2. Mahalanobis distance and Leverage values did not indicate any multivariate outliers. As evidence of homoscedascity, scatterplots of prediction and residual values for the dependent variables demonstrated that data fell equally above and below the line of best

fit. Durbin-Watson statistics indicated values around the desired level of 2.00, suggesting independence of observations. Pearson correlations and scatterplots demonstrated linear relationships among study variables. Intercorrelations for control, predictor, and criterion variables are presented in Table 3. There was no evidence of multicollinearity, as Tolerance values were well above .2 and VIF statistics were well below 5. Collinearity statistics are provided in Table 4 and 5.

Table 2

Means, Standard Deviations, Reliability, Ranges, Skewness, and Kurtosis Statistics of Study Measures and A Priori Variables (*N = 357*)

Variable	*M*	*SD*	α	Range	Skewness	Kurtosis
PSS	19.11	7.17	.85	0-39	.03	-.29
FFMQ Total	128.36	17.85	.87	81-183	.00	.27
FFMQ Observe	26.76	5.77	.75	11-40	-.02	-.39
FFMQ Describe	27.45	6.19	.86	8-40	-.06	-.40
FFMQ Act	26.53	5.84	.83	9-40	-.27	-.13
FFMQ Nonreact	21.43	4.84	.87	7-35	.15	.10
FFMQ Nonjudge	26.36	6.87	.77	8-40	-.12	-.36
SQI	11.11	3.60	.79	1-16	-.78	-.17
HSD	6.78	1.23	-	3-12	-.25	.73
HPLP-II N	22.68	4.83	.72	9-36	-.02	.00
HPLP-II PA	19.21	5.22	.80	8-32	.17	-.50

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. SQI = Sleep Quality Index. HSD = Habitual Sleep Duration. HPLP-II = Health Promoting Lifestyles Profile-II Nutrition and Physical Activity Subscales.

Table 3

Intercorrelations among Control, Predictor, and Criterion Variables (N = 357)

Variable	1	2	3	4	5	6	7	8	9	10	11
1. PSS	-	-.48**	.01	.19**	-.43**	-.32**	-.45**	-.39**	-.17**	-.11*	-.16**
2. FFMQ Total		-	.45**	.70**	.63**	.55**	.63**	.25**	.07	.25**	.25**
3. FFMQ Observe			-	.28**	-.08	.37**	-.14**	-.06	.03	.22**	.19**
4. FFMQ Describe				-	.28**	.29**	.22**	.12*	.00	.17**	.25**
5. FFMQ Act					-	.05	.53**	.27**	.06	.07	.10
6. FFMQ Nonreact						-	.09	.12*	.09	.21**	.18**
7. FFMQ Nonjudge							-	.26**	.03	.09	.05
8. SQI								-	.22**	.02	.01
9. HSD									-	.14**	.02
10. HPLP-II N										-	.41**
11. HPLP-II PA											-

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. SQI = Sleep Quality Index. HSD = Habitual Sleep Duration. HPLP-II = Health Promoting Lifestyles Profile-II Nutrition and Physical Activity Subscales.
* $p < .05$. ** $p < .01$.

Table 4

Collinearity Statistics for Predictors of Nutrition Behavior (N = 357)

Predictor	*Partial*	*Part*	Tolerance	VIF
PSS	-.02	-.00	.69	1.51
FFMQ Total	.22	.22	.77	1.30
FFMQ Observe	.15	.15	.78	1.28
FFMQ Describe	.07	.06	.79	1.27
FFMQ Act	.01	.01	.64	1.57
FFMQ Nonreact	.99	.09	.73	1.37
FFMQ Nonjudge	.06	.05	.64	1.57
SQI	-.02	-.02	.81	1.24
SQI x FFMQ Total	.12	.12	.96	1.04
HSD	-.00	-.00	.94	1.06
HSD x FFMQ Total	-.03	-.03	.95	1.05

Note. PSS = Perceived Stress Scale. FFMQ-Total = Five Facet Mindfulness Questionnaire – Total Score. SQI = Sleep Quality Index. HSD = Habitual Sleep Duration.

Table 5

Collinearity Statistics for Predictors of Exercise Behavior (N = 357)

Predictor	*Partial*	*Part*	Tolerance	VIF
PSS	-.07	-.06	.69	1.51
FFMQ Total	.21	.20	.77	1.29
FFMQ Observe	.11	.10	.78	1.28
FFMQ Describe	.17	.16	.79	1.27
FFMQ Act	.03	.03	.64	1.57
FFMQ Nonreact	.04	.04	.73	1.37
FFMQ Nonjudge	-.05	-.05	.64	1.57
SQI	-.07	-.06	.81	1.89
SQI x FFMQ Total	.04	.04	.96	1.04
HSD	.13	.13	.94	1.06
HSD x FFMQ Total	.03	.03	.95	1.05

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. SQI = Sleep Quality Index. HSD = Habitual Sleep Duration.

Main Analyses

Hypotheses Testing

Hierarchical multiple regression analyses were conducted to examine hypotheses 1 and 2**,** which suggested that sleep quality would moderate the relationship between mindfulness and health behavior (i.e., nutrition and exercise) in undergraduate college students. The predictor and moderator variables were mean-centered prior to entry into the regression equation, and these centered values were used to create the interaction term in order to avoid problems with multicollinearity (Aiken & West, 1991). In addition, perceived stress served as a covariate and was entered in the first step of the regression analyses. Mindfulness (total score) was entered in the second step, sleep quality was entered in the third step, and the interaction term (mindfulness x sleep quality) was entered in the fourth step. Nutrition and exercise behavior served as the criterion variables. The results for the hierarchical regression analyses are summarized in Tables 6 through 9, with an alpha level of $p < .05$ used to determine the statistical significance of the results.

As presented in Table 6, results for the first analysis indicated that Hypothesis 1 was supported. The overall model was significant, with approximately 8% of the variance in nutrition behavior scores explained $R^2 = .08$, $F(4, 352) = 7.33$, $p < .001$. In step 1, perceived stress accounted for a significant 2% of the variance in nutrition behavior scores, $R^2 = .02$, $\Delta F(1, 355) = 4.53$, $p = .033$, which is a small effect size, although only perceived stress was observed to be a significant predictor of nutrition behavior, $\beta = -.11$, $t(355) = -2.14$, $p = .033$. After controlling for perceived stress, model fit improved significantly in step 2 with the addition of mindfulness, explaining

approximately 5% more of the variance in nutrition behavior scores, $\Delta R^2 = .05$, $\Delta F(1, 354) = 18.15$, $p < .001$, a small to medium effect size. Further, mindfulness emerged as a significant predictor, $\beta = .25$, $t(353) = 4.26$, $p < .001$. In step 3, sleep quality explained less than 1% more of the variance in nutrition behavior scores, $\Delta R^2 = .00$, $\Delta F(1, 353) = 0.74$, $p = .390$. In step 4 of the regression model, after controlling for perceived stress and the main effects of mindfulness and sleep quality, the inclusion of the interaction term (mindfulness x sleep quality) explained a significant 1% of the variance in nutrition behavior, $\Delta R^2 = .01$, $\Delta F(1, 352) = 4.50$, $p = .026$, a small effect size. Moreover, the interaction term was found to be a significant predictor of nutrition behavior, above and beyond the individual main effects, $\beta = .01$, $t(351) = 2.24$, $p = .026$. Based on these results, Hypothesis 1 was supported, indicating that the relationship between mindfulness and participants' nutrition behavior differed by sleep quality.

To clarify the interpretation of this significant interaction, participants were examined at high, moderate, and low levels of sleep quality, based on Urponen et al.'s (1991) classification for good (score of 15 to 16, $n = 58$, $R^2 = .17$), moderate (score of 8 to 14, $n = 236$, $R^2 = .06$) and poor (score of 0 to 7, $n = 61$, $R^2 = .01$) sleep quality. The plotted interaction is presented in Figure 5.

In order to further explore the interaction between mindfulness and sleep quality as a predictor of nutrition behavior, the hierarchical regression analysis was repeated with self-reported habitual sleep duration (i.e., in hours) as the moderator variable. This analysis revealed significant main effects of mindfulness, $\beta = .25$, $t(354) = 4.22$, $p < .001$, and habitual sleep duration, $\beta = .13$, $t(353) = 2.47$, $p = .014$, however, the interaction term (mindfulness x habitual sleep duration), $\beta = .03$, $t(352) = .56$, $p = .578$, was not

significant (See Table 7). Moreover, the relationship between mindfulness and nutrition behavior did not vary as a function of habitual sleep duration.

Table 6

Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Nutrition Behavior (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.01	.01*
PSS	-.08	.04	-.11*		
Model 2				.06	.05***
PSS	.00	.04	.01		
FFMQ Total	.07	.02	.25***		
Model 3				.06	.00
PSS	-.01	.04	-.01		
FFMQ Total	.07	.02	.25***		
SQI	-.07	.08	-.05		
Model 4				.08	.01*
PSS	-.00	.04	-.00		
FFMQ Total	.07	.02	.25***		
SQI	-.03	.08	-.02		
SQI x FFMQ Total	.01	.00	.12*		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. SQI = Sleep Quality Index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

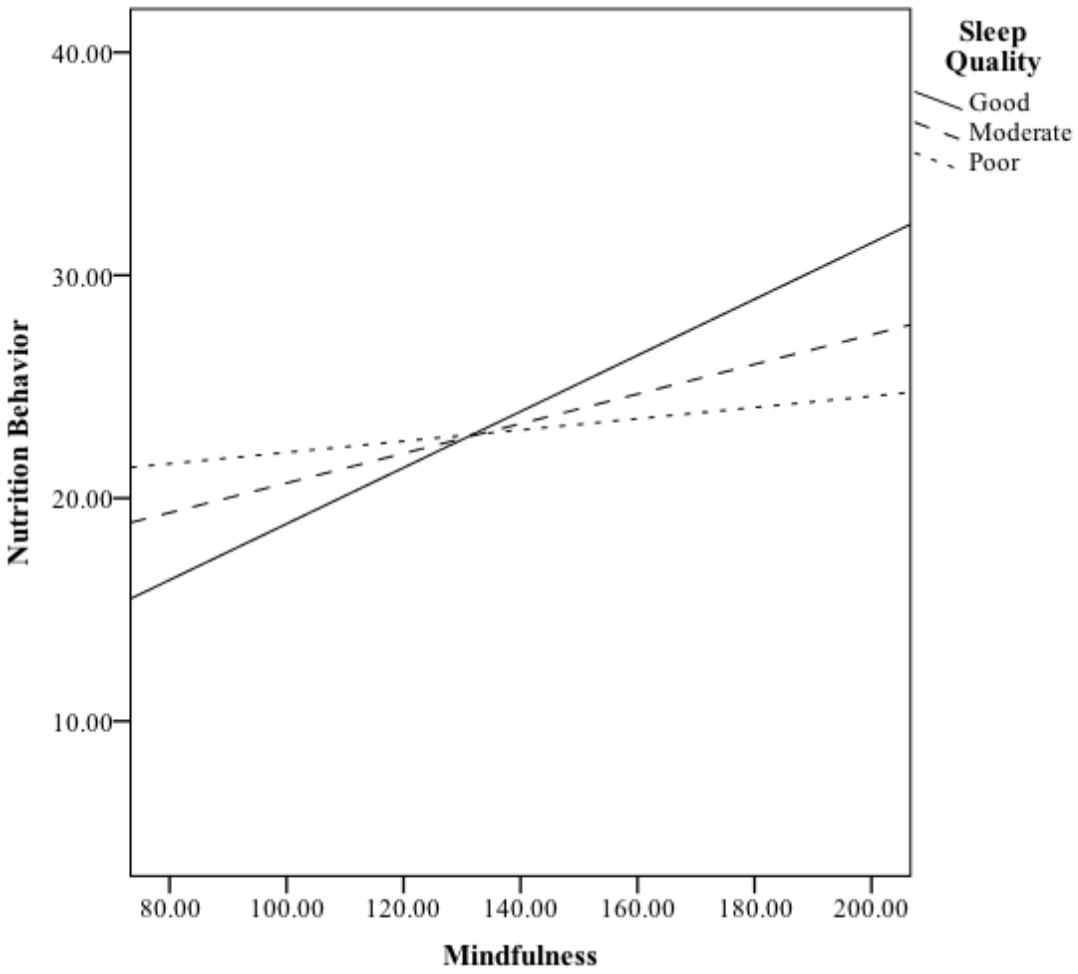

Figure 5. The Relationship Between Mindfulness (Total Score) and Nutrition Behavior as a Function of Sleep Quality.

Table 7

Summary of Exploratory Hierarchical Multiple Regression Analysis for Variables Predicting Nutrition Behavior (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.01	.01*
PSS	-.08	.04	-.11*		
Model 2				.06	.05***
PSS	-.01	.04	-.01		
FFMQ Total	.07	.02	.25***		
Model 3				.08	.02**
PSS	.01	.04	.01		
FFMQ Total	.07	.02	.25***		
HSD	.50	.20	.13**		
Model 4				.08	.00
PSS	.02	.04	.03		
FFMQ Total	.07	.02	.25***		
HSD	.54	.21	.13**		
HSD x FFMQ Total	.01	.01	.03		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. HSD = Habitual Sleep Duration.
* $p < .05$. ** $p < .01$. *** $p < .001$.

To investigate Hypothesis 2, the hierarchical regression analysis was repeated for exercise behavior. Results indicated that Hypothesis 2 was not supported, as the main effect of sleep quality, $\beta = -.08$, $t(353) = -.1.39$, $p = .165$, and the interaction term (mindfulness x sleep quality), $\beta = .04$, $t(352) = .69$, $p = .489$, were non-significant. Of note, this analysis revealed a significant main effect for perceived stress, $\beta = -.16$, $t(355) = -3.00$, $p = .003$. Further, mindfulness emerged as a significant predictor of exercise behavior, $\beta = .22$, $t(353) = 3.84$, $p < .001$, explaining approximately 6% more of the variance in exercise behavior scores beyond perceived stress, $\Delta R^2 = .06$, $\Delta F(1, 354) = 14.75$, $p < .001$, which is a small effect size (See Table 8). In sum, the interaction

between mindfulness and sleep quality did not significantly predict exercise behavior, above and beyond the individual main effect of mindfulness.

In order to further explore the interaction between mindfulness and sleep quality as a predictor of exercise behavior, the hierarchical regression analysis was repeated with self-reported habitual sleep duration (i.e., in hours) as the moderator variable. This analysis revealed significant main effects for perceived stress, β = -.16, $t(355)$ = -3.00, p = .003, and mindfulness, β = .22, $t(354)$ = 3.84, $p < .001$, however, neither a main effect of habitual sleep duration, β = .00, $t(353)$ = .02, p = .984, nor the interaction term (mindfulness x habitual sleep duration), β = -.03, $t(352)$ = -.51, p = .611, were significant (See Table 9). Therefore, the relationship between mindfulness and participants' exercise behavior did not differ by habitual sleep duration.

Table 8

Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Exercise Behavior (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.03	.03**
PSS	-.12	.04	-.16**		
Model 2				.07	.04***
PSS	-.04	.04	-.05		
FFMQ Total	.07	.02	.22***		
Model 3				.07	.01
PSS	-.06	.04	-.08		
FFMQ Total	.07	.02	.23***		
SQI	-.11	.08	-.08		
Model 4				.07	.00
PSS	-.06	.05	-.08		
FFMQ Total	.07	.02	.23***		
SQI	-.10	.08	-.07		
SQI x FFMQ Total	.00	.00	.04		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. SQI = Sleep Quality Index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 9

Summary of Exploratory Hierarchical Multiple Regression Analysis for Variables Predicting Exercise Behavior (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.03	.03**
PSS	-.12	.04	-.16**		
Model 2				.06	.04***
PSS	-.04	.04	-.05		
FFMQ Total	.07	.02	.22***		
Model 3				.06	.00
PSS	-.04	.04	-.05		
FFMQ Total	.07	.02	.22***		
HSD	.00	.22	.02		
Model 4				.06	.00
PSS	-.04	.04	-.05		
FFMQ Total	.07	.02	.22***		
HSD	-.02	.23	-.00		
HSD x FFMQ Total	-.01	.01	-.03		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire. HSD = Habitual Sleep Duration.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Research Questions

Hierarchical multiple regression analyses were conducted to address research questions 1 and 2, which explored which facets of mindfulness were most predictive of college students' nutrition and exercise behaviors. Perceived stress served as a covariate and was entered in the first step of the regression analyses. The five facets of mindfulness (observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) were entered into the second step of the regression equation simultaneously. Nutrition and exercise behavior served as the criterion variables.

Together, the five facets of mindfulness were significantly predictive of nutrition behavior scores, $R^2 = .08$, $\Delta F(5, 351) = 5.24$, $p < .001$, and exercise behavior scores, $R^2 = .09$, $\Delta F(5, 350) = 5.34$, $p < .001$, with small to medium effect sizes. Examination of the standardized beta weights revealed that the observe facet, $\beta = .17$, $t(350) = 2.88$, $p = .004$, was the strongest predictor of nutrition behavior, whereas the observe, $\beta = .11$, $t(350) = 1.98$, $p = .049$, and describe facets, $\beta = .18$, $t(350) = 3.15$, $p = .002$, emerged as the strongest predictors of exercise behavior. The results for the hierarchical multiple regression analyses are summarized in Tables 10 and 11, with an alpha level of $p < .05$ used to determine the statistical significance of the results.

Table 10

Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Nutrition Behavior from the Five Facets of Mindfulness (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.01	.01*
PSS	-.08	.04	-.11*		
Model 2				.08	.07***
PSS	-.02	.04	-.03		
Observe	.14	.05	.17*		
Describe	.06	.05	.07		
Act	.00	.05	.01		
Nonreact	.11	.06	.11		
Nonjudge	.05	.05	.07		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 11

Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Exercise Behavior from the Five Facets of Mindfulness (N = 357)

Predictor	B	SE B	β	R^2	ΔR^2
Model 1				.03	.03*
PSS	-.12	.04	-.16**		
Model 2				.09	.07***
PSS	-.09	.05	-.12		
Observe	.10	.05	.11*		
Describe	.15	.05	.18**		
Act	.04	.06	.04		
Nonreact	.05	.06	.05		
Nonjudge	-.04	.05	-.06		

Note. PSS = Perceived Stress Scale. FFMQ = Five Facet Mindfulness Questionnaire.
* $p < .05$. ** $p < .01$. *** $p < .001$.

CHAPTER 5

DISCUSSION

Much empirical attention has been devoted to documenting unhealthy behaviors in college students, particularly inadequate nutrition (Lowry et al., 2000), physical inactivity (Anding et al., 2001), and poor sleep quality (Buboltz et al., 2001). However, relatively few studies have addressed the utility of mindfulness in the context of health behavior among college students. The current study was the first to examine how mindfulness and sleep quality may interact to enhance nutrition and exercise behaviors in undergraduate college students (n = 357). Further, the present study explored which of the five facets of mindfulness (observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of inner experience) are most predictive of college students' nutrition and exercise behavior.

Hypothesis 1

Hypothesis 1 stated that sleep quality would moderate the relationship between mindfulness and nutrition behavior in undergraduate college students. Consistent with predictions, the results of the hierarchical multiple regression analysis supported the moderation model. More specifically, the relationship between mindfulness and participants' nutrition behavior differed by sleep quality.

It is important to elucidate the potential mechanisms by which sleep quality may increase mindfulness effects for nutrition behavior. One possibility is that deep, restorative sleep may heighten a mindful person's alertness and ability to observe and respond to the internal and external sensations involved in food intake (e.g., observing hunger and satiety cues) and food selection (e.g., nonreacting to impulses to eat unhealthy

foods). More explicitly, good sleep quality may yield more accurate assessments of hunger and greater energy to resist palatable, energy-dense foods. Not to mention that being fully rested may help a person to discriminate the feeling of fatigue from physical hunger. Notably, when participants' self-reported habitual sleep duration served as the moderator, the moderating effects did not hold. Habitual sleep duration, however, was significantly and positively predictive of nutrition behavior. That is, students who reported sleeping more hours per night were more likely to report healthier nutrition practices. Collectively, these findings highlight the importance of sleep in the context of nutrition behavior among undergraduate college students. More specifically, sleeping more hours per night may promote healthy eating, but when one cannot achieve sufficient hours of sleep, it is imperative that the quality of sleep is good in order to encourage mindful food consumption.

Interestingly, mindfulness also had a significant unique influence on nutrition behavior, such that regardless of sleep quality, participants with higher levels of mindfulness reported greater nutrition behavior. This finding is consistent with previous literature that found that higher levels of trait mindfulness are associated with greater awareness of healthy dietary practices and lower tendency to consume food in response to adverse emotional experiences (Grinnell et al., 2011). Empirical evidence suggests that mindfulness cultivates self-acceptance and compassion, qualities that may disrupt the cycle of distress eating (Gongora, Derksen, & van Der Staak, 2004). In combination, the results of the first analysis suggest that mindfulness and sleep may help individuals to cope with food cravings and make positive nutritional choices.

Hypothesis 2

Hypothesis 2 stated that sleep quality would moderate the relationship between mindfulness and exercise behavior in undergraduate college students. This hypothesis was not supported, as results of the hierarchical multiple regression analyses indicate that neither sleep quality nor habitual sleep duration influence the relationship between mindfulness and exercise to a significant degree. Perhaps the absence of a moderating effect for sleep quality could be attributed to previous evidence that suggests that mindful individuals report fewer barriers to physical activity (Grinnell et al., 2011), and are more likely to successfully act on their exercise intentions compared to less mindful individuals (Shapiro, Oman, Thoresen, Plante, & Finders, 2008). For example, if a person has greater awareness of their body's daily need for movement and can notice the positive changes in how they feel physically (e.g., increased energy) after exercise, he or she may be more likely to engage in physical activity regardless of the quality of their sleep the night before. In fact, given the growing consensus that regular exercise promotes better sleep (Youngstedt & Kline, 2006; Youngstedt, O'Connor, & Dishman, 1997), mindful individuals may commit to regular exercise engagement, irrespective of current sleep habits, in an effort to improve sleep quality. The nature and direction of the relationship between sleep quality and exercise among mindful individuals warrants further investigation.

While correlational studies examining the relationship between mindfulness and exercise behavior have yielded mixed findings (e.g., Murphy, Mermelstein, Edwards, & Gidycz, 2012; Roberts & Danoff-Burg, 2010), the present study found that mindfulness (total score) was significantly and positively predictive of exercise behavior. That is,

individuals who reported increased awareness of body, emotions, and mind, were more likely to engage in regular physical activity. Ulmer, Stetson, and Salmon (2010) speculated that mindfulness intervenes between the cognitive and affective determinants of physical activity and overt behavior in a way that supports exercise engagement. With regard to the five facets of mindfulness, perhaps if individuals are more in tune with their bodily sensations during (e.g., muscle burn) and after exercise (e.g., increased energy), labels and prescribes meaning to their exercise experience in an adaptive way (e.g., When I workout, my mood improves.), and maintains a nonreactive, nonjudgmental attitude throughout their workout (e.g., I am uncomfortable, but I can do this.), they are more likely to act with awareness and follow through with their exercise intentions (e.g., I want to run for thirty minutes), rather than terminating exercise at the first signs of discomfort (e.g., shortness of breath, fatigue, etc.). More succinctly, greater levels of mindfulness may help a person to navigate exercise-related challenges by counteracting automatic responses with curious and compassionate awareness (Gilbert & Waltz, 2010; Ulmer et al., 2010). However, further research is needed to determine whether mindfulness promotes physical activity or the reverse –caring for one's body encourages a more present-moment orientation toward one's experiences.

Research Question 1

Research Question 1 sought to determine which facets of mindfulness were most predictive of college students' nutrition behavior. Investigation of the individual facets of mindfulness revealed that the Observe facet demonstrated a unique predictive relationship with nutrition behavior. Comparably, Gilbert and Waltz (2010) found the Observe factor to be significantly predictive of men's fruit and vegetable intake.

However, current findings were not limited to men as no significant gender differences were observed.

The current data suggest that higher scores on the Observe facet of mindfulness were associated with greater nutrition behavior. This finding implies that individuals who have the ability to notice and attend to their internal experiences (observing) are more likely to make better nutritional choices. As supported by previous research, the mindful observation of internal sensations encourages attitudinal preferences for healthier foods (Jordan, Wang, Donatoni, & Meier, 2014), and mindful individuals report less consumption of calorie-dense food (Beshara, Hutchinson, & Wilson, 2013). Further, mindfulness has been found to help individuals consume appropriate food portions based on hunger and satiety cues (Mathieu, 2009; Tylka, 2006) and accept their cravings more fully without attempting to control, change, or avoid them (Hayes, Strosahl, & Wilson, 1999).

In an effort to better illuminate the potential mechanisms by which the Observe facet influences nutrition behavior, it is important to acknowledge the parallels that have been made between mindfulness (i.e., self-awareness) and behavioral modification. As proposed by Gilbert and Waltz (2010), perhaps greater self-awareness assists individuals in the monitoring and regulation of food intake. For example, if individuals are more mindful of physiological sensations, they may note subtle changes in the way they feel (e.g., energy level) after consuming a nutritious meal as opposed to fast food. Mindful observation may, in turn, encourage greater self-control to resist the consumption of unhealthy foods. Further, careful observation of the thoughts and feelings associated with eating may increase a person's capacity to refrain from engaging in automatic

behaviors (e.g., distress eating) that have become linked to negative emotional reactions, distorted thinking processes, and the misattribution of physical sensations (Alberts, Thewissen, & Raes, 2012; Wolever & Best, 2009).

Research Question 2

Research Question 2 sought to determine which facets of mindfulness were most predictive of college students' exercise behavior. Examination of the individual facets of mindfulness revealed that the Observe and Describe facets demonstrated unique predictive relationships with exercise behavior. Although previous research has demonstrated a similar relationship between the Describe facet and moderate physical activity in women (Gilbert & Waltz, 2010), this finding was not limited to female participants in the current study. In fact, no significant gender differences were observed.

The results imply that higher scores on the Observe and Describe facets of mindfulness were associated with greater exercise behavior. That is, college students who have the ability to notice and attend to their internal experiences (observing), as well as label their experiences with words (describing), may be more likely to engage in physical activity. Although the data did not indicate the way in which college students describe their experiences, it is possible that students are labeling internal and external phenomena in a proactive and adaptive way. For example, Gilbert and Waltz (2010) proposed that the describe skill heightens one's ability to identify health-related contingencies (e.g., When I work out, I feel better.) and categorize behaviors as healthy (e.g., engaging in exercise) and unhealthy (e.g., avoiding exercise). While the observe skill may help individuals to be more in tune with their bodily sensations during (e.g., muscle burn) and after exercise (e.g., improved mood), one may speculate whether the

describe facet helps individuals balance stressful, and even unpleasant, exercise observations (e.g., shortness of breath) against the potential benefits of becoming and staying active (e.g., increased energy). Further, the describe facet taps into the role of intention in the context of health behaviors, making it possible to align daily behaviors (i.e., exercise) with personal values and a long-term vision for health.

Limitations and Future Directions

There are several limitations of the current study and potential future directions for research that warrant further consideration. First, although the present findings indicate that sleep is an important moderator in the mindfulness-nutrition relationship, the correlational design does not allow for inferences of causal pathways. Whereas prior studies have supported that mindfulness promotes sleep quality (e.g., Roberts & Danoff-Burg, 2010), it is feasible that good sleep quality precedes mindfulness or that healthy dietary habits have positive effects on sleeping patterns. Further, one may speculate whether greater awareness (i.e., mindfulness) leads to a desire to care for one's body (i.e., via exercise and healthy eating) or the reverse – health-promoting behaviors encourage a more present-moment orientation toward one's experiences. Therefore, longitudinal and experimental studies are needed to establish causality among the relationships between mindfulness, sleep, nutrition, and exercise.

Second, the online recruitment method utilized in the current study may pose limitations, as evidenced by 14% of participants discontinuing their participation prematurely. Without contact, it is difficult to discern the reason participants failed to complete the study in its entirety. However, Hoerger (2010) argued that an average of 10% of participants dropout after providing consent on online surveys within university

populations, with a 2% increase per 100 survey items, which is relatively consistent with the present investigation.

Third, the current analyses did not control for potential confounds beyond perceived stress, such as on- versus off-campus residence or access to university dining facilities (i.e., meal plan), which may account for some of the variance in college students nutrition and exercise behavior. In fact, empirical evidence has demonstrated that students who move away from their parents' home to an on-campus residence report decreased levels of physical activity (e.g., Bray et al., 2004), whereas students who live at home show no such decline. Further, Levitsky and colleagues (2004) argued that all-you-can-eat campus dining facilities offer a great abundance and variety of food, which may promote excess dietary intake in college students. Thus, future investigations should consider controlling for student residence and meal plan status.

Fourth, due to the high percentage of racial/ethnic minorities in the present sample, generalizability to the typical U.S. college population is limited (U.S. Department of Education, 2009). Based on the statistics for college enrollment, it appears that Hispanic/Latino participants were overrepresented in this study by about 18%, as approximately 13% of students enrolled in undergraduate study identify as Hispanic/Latino (US Department of Education, 2008).

Lastly, while the results of the hierarchical multiple regression analysis supported the moderation model, only 8% of the total variance in nutrition behavior was explained, which is a small effect size. Further, the interaction (mindfulness x sleep quality) itself explained only1% more variance above and beyond that explained by the individual main effects of mindfulness, sleep quality, and perceived stress, which represents a trivial

effect size. Given the large sample size, relationships found to be statistical significant in the current study may have limited practical significance. Therefore, university psychologists should take caution when considering the findings of the present study when designing interventions aimed at increasing college students' health-promoting behaviors. Despite the small effect sizes, however, the values yielded in the current investigation were comparable to those observed for other individual-level variables in mindfulness and health behavior literature (e.g., Gilbert & Waltz, 2010; Murphy et al., 2012). Therefore, practical implications of the current study are worthy of consideration.

In regards to future directions, the absence of a significant finding regarding the potential moderating effect for sleep quality in the mindfulness-exercise relationship highlights an avenue for future research to examine how college students follow through with exercise intentions despite poor sleep hygiene. Also, given the significance of mindfulness as a predictor of students' nutrition and exercise behavior in the current investigation, the relationships among these constructs should be explored further. Based on the present findings, the specific facets of mindfulness that are most predictive of college students' nutrition (i.e., Observe) and exercise (i.e., Observe and Describe) behavior have been identified. However, qualitative studies could offer a richer understanding of the internal and external experiences associated with food intake that students' are observing, as well as, illuminate how students are observing and prescribing meaning to their exercise experiences. As evidenced by the results of the hierarchical regression analysis for variables predicting nutrition behavior, future research is warranted to explore the possible mediating role of mindfulness in the relationship between perceived stress and nutrition behavior. Perhaps, mindfulness may help a person

under stress refrain from engaging in unhealthy nutrition behaviors (e.g., distress eating).

One of the major reasons for investigating mindfulness as it relates to college student health behavior is its amenability. That is, mindfulness-based treatment interventions have been shown to improve mean scores on measures of dispositional mindfulness, demonstrating that mindfulness can increase with practice (Carmody & Baer, 2008; Carmody, Reed, Kristeller, & Merriam, 2008; Chambers, Lo, & Allen, 2008). Given that traditional mindfulness-based interventions can be time consuming, investigations on how to modify mindfulness interventions to be conducive to college students' demanding schedules may be another advantageous area of future research.

Implications

Despite the aforementioned limitations, the present study contributes to our understanding of the relationships between mindfulness and health behaviors in college students. By demonstrating sleep quality to be an important moderator in the mindfulness-nutrition relationship and habitual sleep duration to be a significant predictor of nutrition behavior, results support the need for university counseling psychologists to focus on the quality as well as the quantity of sleep when promoting healthy dietary practices among college students. As students transition to college, their sleep habits tend to change for the worse (Pilchner, Ginter, & Sadowsky, 1997), as they become increasingly vulnerable to factors that increase stress-related sleeping difficulties (e.g., erratic schedules, Lund, Reider, Whiting, & Prichard, 2010). College students who are consistently getting poor sleep quality are at greater risk for problems far more severe than feeling fatigued during the day (e.g., overweight and obesity, Patel & Hu, 2008; Van Cauter & Knutson, 2008). Given college students' demanding schedules, brief

mindfulness interventions that involve both in-person outreach programs and supplemental online resources may be the best way to reach undergraduates. Interventions could articulate the nutritional health benefits of sufficient, restorative sleep, including enhanced awareness of hunger and fullness cues, increased capacity to resist the urge to eat junk food, and greater energy for healthy meal preparation. Alternatively, interventions may also consider providing education about the health risks associated with insufficient sleep (e.g., obesity, type 2 diabetes, etc.). Most importantly, interventions should coach specific mindfulness techniques (e.g., mindful breathing, body scan, progressive muscle relaxation, etc.) that promote relaxation in an effort to improve sleep quality.

Findings of the present study also support the utility of mindfulness in promoting nutrition and exercise behavior among undergraduate college students. Given that mindfulness can be enhanced with training, university counseling psychologists may consider utilizing mindfulness-based interventions as a way to improve dietary habits and increase physical activity in college students. The results suggest that mindfulness-based outreach programs targeting nutrition should focus on coaching students how to notice and attend to internal cues of hunger and satiety (observing) in order to withstand food cravings without reacting to them. To support students' efforts to more mindful with regard to food consumption, university psychologists should consider facilitating evidenced-based mindful eating exercises (e.g., Mindfulness-Based Eating Awareness Training, Kristeller & Hallett, 1999) and incorporating smartphone applications, such as the Mindful Eating Tracker, to monitor food-related thoughts, assess hunger and satiety cues, and log meals. Mindfulness-based interventions aimed at increasing physical

activity engagement should teach students how to both notice (observing) and label their exercise experiences (describing) in a proactive and adaptive way (e.g., When I work out, I feel better.). Interventions targeting exercise may consider incorporating mindful physical activity engagement (e.g., yoga) and progressive muscle relaxation exercises to heighten students' awareness of the impact of muscle tension on the body. Empirical evidence suggests that as students transition from high school to college, they begin to adopt their own health behavior patterns that may influence their physical health status later in life (Dinger & Waigandt, 1997). By utilizing mindfulness as a tool to facilitate healthy eating and regular physical activity, university counseling psychologists can reduce the risk for obesity, coronary heart disease, stroke, hypertension, and type 2 diabetes (Ayas, White, Manson, Stampfer, Speizer, & Malhotra et al., 2003; Beihl, Liese, & Haffner, 2009; Gangwisch, Heymsfield, Boden-Albala, Buijs, Kreier, & Pickering et al., 2006; Hasler, Buysse, Klaghofer, Gamma, Ajdacic, & Eich et al., 2004). Taken together, the present findings highlight that enhancing mindfulness and improving sleep hygiene may be particularly beneficial in elevating health-promoting behaviors in undergraduate college students in a sustainable way, which supports the goal of the APA's Strategic Plan (2011) to expand psychology's role in advancing health and wellness.

APPENDIX A

FIVE FACET MINDFULNESS QUESTIONNAIRE

Five Facet Mindfulness Questionnaire

Please rate each of the following statements using the scale provided. Select the response that best describes your own opinion of what is generally true for you.

1	2	3	4	5
never or very rarely true	rarely true	sometimes true	often true	very often or always true

1. When I'm walking, I deliberately notice the sensations of my body moving.
2. I'm good at finding words to describe my feelings.
3. I criticize myself for having irrational or inappropriate emotions.
4. I perceive my feelings and emotions without having to react to them.
5. When I do things, my mind wanders off and I'm easily distracted.
6. When I take a shower or bath, I stay alert to the sensations of water on my body.
7. I can easily put my beliefs, opinions, and expectations into words.
8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
9. I watch my feelings without getting lost in them.
10. I tell myself I shouldn't be feeling the way I'm feeling.
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
12. It's hard for me to find the words to describe what I'm thinking.
13. I am easily distracted.
14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
15. I pay attention to sensations, such as the wind in my hair or sun on my face.
16. I have trouble thinking of the right words to express how I feel about things
17. I make judgments about whether my thoughts are good or bad.
18. I find it difficult to stay focused on what's happening in the present.
19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
21. In difficult situations, I can pause without immediately reacting.
22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.
23. It seems I am "running on automatic" without much awareness of what I'm doing.

24. When I have distressing thoughts or images, I feel calm soon after.
25. I tell myself that I shouldn't be thinking the way I'm thinking.
26. I notice the smells and aromas of things.
27. Even when I'm feeling terribly upset, I can find a way to put it into words.
28. I rush through activities without being really attentive to them.
29. When I have distressing thoughts or images I am able just to notice them without reacting.
30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.
32. My natural tendency is to put my experiences into words.
33. When I have distressing thoughts or images, I just notice them and let them go.
34. I do jobs or tasks automatically without being aware of what I'm doing.
35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.
36. I pay attention to how my emotions affect my thoughts and behavior.
37. I can usually describe how I feel at the moment in considerable detail.
38. I find myself doing things without paying attention.
39. I disapprove of myself when I have irrational ideas.

APPENDIX B

HEALTH-PROMOTING LIFESTYLE PROFILE-II

NUTRITION SUBSCALE

Health-Promoting Lifestyle Profile-II – Nutrition Subscale

This questionnaire contains statements about your present way of life or personal habits. Please respond to each item as accurately as possible, and try not to skip any item. Indicate the frequency with which you engage in each behavior.

1	2	3	4
never	Sometimes	often	routinely

1. Choose a diet low in fat, saturated fat, and cholesterol.
2. Limit use of sugars and food containing sugar (sweets).
3. Eat 6-11 servings of bread, cereal, rice and pasta each day.
4. Eat 2-4 servings of fruit each day.
5. Eat 3-5 servings of vegetables each day.
6. Eat 2-3 servings of milk, yogurt or cheese each day.
7. Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts group each day.
8. Read labels to identify nutrients, fats, and sodium content in packaged food.
9. Eat breakfast.

APPENDIX C

HEALTH-PROMOTING LIFESTYLE PROFILE-II

PHYSICAL ACTIVITY SUBSCALE

Health-Promoting Lifestyle Profile-II – Physical Activity Subscale

This questionnaire contains statements about your present way of life or personal habits. Please respond to each item as accurately as possible, and try not to skip any item. Indicate the frequency with which you engage in each behavior.

1	2	3	4
never	Sometimes	often	routinely

1. Follow a planned exercise program.
2. Exercise vigorously for 20 or more minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber).
3. Take part in light to moderate physical activity (such as sustained walking 30-40 minutes 5 or more times a week).
4. Take part in leisure-time (recreational) physical activities (such as swimming, dancing, bicycling).
5. Do stretching exercises at least 3 times per week.
6. Get exercise during usual daily activities (such as walking during lunch, using stairs instead of elevators, parking car away from destination and walking).
7. Check my pulse rate when exercising.
8. Reach my target heart rate when exercising.

APPENDIX D

SLEEP QUALITY INDEX

Sleep Quality Index

Please indicate which of the following response options best refer to your experience.

1. Time to fall asleep *(≤ 10 min, 11-30 min, > 30 min)*
2. Suffered from insomnia during the past 3 months *(no, < 3 days/week, 3-7 days/week)*
3. Difficulties falling asleep during the past 3 months *(no, < 3 days/week, 3-7 days/week)*
4. Disturbed night sleep during the past 3 months *(no, < 3 days/week, 3-7 days/week)*
5. Nocturnal awakenings during the past 3 months *(no, < 3 days/week, 3-7 days/week)*
6. Tiredness in the morning *(rather or very alert, don't know, rather or very tired)*
7. Wake up too early in the morning during the past three months *(no, < 3 days/week, 3-7 days/week)*
8. Use of hypnotics during the past 3 months *(no, occasionally, at least once per week)*

APPENDIX E

PERCIEVED STRESS SCALE

Perceived Stress Scale

The following questions will ask you about your feelings and thoughts during the past month. Please indicate how often you felt or thought a certain way.

0	1	2	3	4
never	almost never	sometimes	fairly often	very often

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and "stressed"?
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
7. In the last month, how often have you been able to control irritations in your life?
8. In the last month, how often have you felt that you were on top of things?
9. In the last month, how often have you been angered because of things that were outside of your control?
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

APPENDIX F

DEMOGRAPHIC QUESTIONNAIRE

Demographic Questionnaire

1. Age: _____

2. Gender:
   1 [ ] Male
   2 [ ] Female
   3 [ ] Transgender
   4 [ ] If not listed, please specify: _____

3. Ethnicity (Check one):
   1[ ] Caucasian
   2[ ] Black/African American
   3[ ] Hispanic/Latino(a)
   4[ ] Asian/Asian American
   5[ ] Native American
   6[ ] Bicultural/Multiracial
   7[ ] If not listed, please specify: _____

4. Sexual Orientation:
   1 [ ] Heterosexual
   2 [ ] Gay
   3 [ ] Lesbian
   4 [ ] Bisexual
   5 [ ] If not listed, please specify: _____

5. Year in School:
   1 [ ] First Year
   2 [ ] Sophomore
   3 [ ] Junior
   4 [ ] Senior
   5 [ ] 5th Year Senior
   6 [ ] If not listed, please specify: _____

6. Mother's Level of Education:
   1 [ ] Some School
   2 [ ] High School Graduate/GED
   3 [ ] Vocational/Technical School
   4 [ ] 2 Year College
   5 [ ] 4 Year College
   6 [ ] Graduate/Professional Degree

7. Parental/Household Income Level:
   1 [ ] $0 - $25,000
   2 [ ] $25,000 - $50,000
   3 [ ] $50,000 - $75,000

4 [ ] $75,000 - $100,000
5 [ ] $100,000 +

8. Please indicate your current height:
_____ (feet) _____ (inches)

9. Please indicate your current weight:
_____ (pounds)

10. How many hours of sleep do you usually get a night?
_____ (Please round to the nearest half hour, Ex. 8.5 hours)

APPENDIX G

IRB APPROVAL LETTER

NOTICE OF EXEMPT DETERMINATION

Principal Investigator: Chris Brown
215 School of Education
Kansas City, MO 64110

Protocol Number: 13-576
Protocol Title: MINDFULNESS AND NUTRITION AND EXERCISE BEHAVIORS IN COLLEGE STUDENTS: THE MODERATING ROLE OF SLEEP QUALITY
Type of Review: Administrative Review

Date of Determination: 05/10/2013

Dear Dr. Brown,

The above referenced study was reviewed and determined to be exempt from IRB review and approval in accordance with the Federal Regulations 45 CFR Part 46.101(b).

This approval includes the following documents:
Attachments
Solicitation_Email_Participants
Cover_Letter_Accompanying_Online_Survey
Solicitation_Email_Student_Affairs_Coordinators
Instruments

You are required to submit an amendment request for all changes to the study, to prevent withdrawal of the exempt determination for your study. When the study is complete, you are required to submit a Final Report.

Please contact the Research Compliance Office (email: umkcirb@umkc.edu; phone: (816)235-5927) if you have questions or require further information.

Thank you,
Mary Oconnor
SSIRB

APPENDIX H

SOLICITATION EMAIL FOR STUDENT AFFAIRS COORDINATORS

Solicitation Email for Student Affairs Coordinators

Dear (Enter Student Affairs Coordinator Name),

Hello, may name is Taryn Acosta and I am a doctoral candidate in division of Counseling and Educational Psychology at the University of Missouri – Kansas City. I am conducting a brief online survey about undergraduate college students' nutrition, exercise, and sleep habits for my dissertation, a study approved by UMKC's Social Sciences Institutional Review Board (Protocol Number #13-567).

I respectfully request your assistance to gather data for my dissertation. Specifically, I am asking if you would be willing to include the research participation request below in any listserv, electronic newsletter, or networking site that your students utilize.

The survey will take approximately 8-10 minutes to complete, and those students who complete the survey will be given the opportunity to enter a raffle for one of three $25 Amazon gift cards. Students' participation in the completion of this survey is completely voluntary and their responses will remain confidential. Students may decide to withdraw from the study at anytime without penalty.

I appreciate your cooperation and consideration of my request. If you have any additional questions about this study, please contact me at tjanq5@mail.umkc.edu or my faculty advisor, Dr. Chris Brown, at brownchr@umkc.edu.

Respectfully,

Taryn J. Acosta
Counseling Psychology Doctoral Candidate
University of Missouri- Kansas City

APPENDIX I

SOLICITATION EMAIL FOR PARTICIPANTS

Solicitation Email for Participants

Greetings,

You are invited to participate in a research study on college students' nutrition, exercise, and sleep behavior. To be eligible, you must be an undergraduate college student of 18 years of age or older. If you elect to participate, you will be asked to click on the link below. You will be routed to a short online survey packet. Total completion time is approximately 8-10 minutes.

Your participation in the completion of this survey is completely voluntary and your responses will remain confidential and used as aggregate data. You may decide to withdraw from the study at anytime without penalty. By completing this survey, you provide your informed consent to participate.

There are no direct benefits to you for participating in this study. Your participation in this study may enhance the understanding of health risk behaviors in college students. Those who complete the survey will be given the opportunity to enter a raffle for one of three $25 Amazon gift cards. After the survey you will enter the raffle by providing your email address. Email addresses are in no way connected to survey responses, as you will click a link to be redirected to a separate page where you may enter your email address. There are no known or anticipated risks associated with participation in this study.

If you have any questions about this study, please contact Taryn Acosta, primary investigator at tjanq5@mail.umkc.edu or Dr. Chris Brown, faculty advisor, at brownchr@umkc.edu.

Click here: https://www.surveymonkey.com/s/collegehealthstudy

Respectfully,

Taryn J. Acosta
Counseling Psychology Doctoral Candidate
University of Missouri- Kansas City

APPENDIX J

COVER LETTER ACCOMPANYING ONLINE SURVEY

Cover Letter Accompanying Online Survey

Greetings,

Thank you for considering participating in our research study. On the following pages, you will find some very general demographic questions and items about nutrition, exercise, and sleep behavior. At the end of the survey, we invite you to click on the link to be redirected to a separate page where you may provide your email address to enter a raffle to win one of three $25 Amazon gift cards.

While every effort will be made to keep confidential all of the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions.

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about the study that you are participating in you are encouraged to call Taryn Acosta (612.819.2043), the primary investigator, or Chris Brown (816.235.2491)**,** the faculty advisor of this research.

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been harmed as a result of participating in this study, please call the IRB Administrator of UMKC's Social Sciences Institutional Review Board at 816-235-5927.

If you would like to participate in this study then select the "I agree to participate" option below and click continue. If you would like to decline to participate in this study then simply close your browser window. Remember that you may withdraw from the study anytime by closing your browser window. Thank you for you participation.

Sincerely,

Taryn Acosta and Chris Brown

APPENDIX K

ONLINE INCENTIVE FORM

Online Incentive Form

After participants complete the survey, they will be routed to this online incentive form:

Thank you so much for completing this survey!

You are now eligible to be entered into a drawing for one of three $25 Amazon gift certificates. Please click on the link below and enter your email address. Please note that this contact information cannot be linked to your survey responses in any way and will be destroyed at the conclusion of this study.

When data collection is complete, the drawings will be conducted. If your email address is chosen, you will receive an email with the subject heading "Research Study Participant". In the email you will be asked to provide your preferred mailing address to receive the gift card. Feel free to contact me if you have any questions about this reimbursement process.

Sincerely,

Taryn J. Acosta
Counseling Psychology Doctoral Candidate
University of Missouri- Kansas City
(612) 819-2043
tjanq5@mail.umkc.edu

Click here: http://www.surveymonkey.com/(enter link name)

College Student Health Behavior Study Raffle Information

In the space below, please provide your email address to participate in the raffle. This information cannot be linked to your survey responses in order to protect your confidentiality.

Email address: _____

Thanks again for your participation!

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VITA

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After graduating from Cornell University, Mrs. Acosta Lentz worked as a personal trainer and nutritional advisor in Minneapolis, Minnesota, while completing a minor in psychology at the University of Minnesota. She was accepted into the doctoral program in Counseling Psychology at the University of Missouri-Kansas City in 2008, an APA-accredited training program, and received the Helen Lee Stevens Scholarship. She was awarded a Masters of Arts in Counseling and Guidance in 2011. In 2014, Mrs. Acosta Lentz completed her doctoral internship at Florida International University's Counseling and Psychological Services, an APA-accredited internship site. She currently serves as the Psychologist – Multicultural Specialist at University of Kansas Medical Center's Counseling and Educational Support Services.