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Specific Yoga Practices and Mindful Eating Habits among New and Experienced Yoga Practitioners

Shauna E. Keeler
Syracuse University

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Abstract

Current research suggests that yoga practitioners are more mindful eaters, consume more fruits and vegetables and gain less weight over time when compared to individuals who do not practice yoga. This study aimed to determine the relationship between mindful eating habits and yoga practice in terms of how they are related to dietary quality. To determine the relationship between these factors, a 51-item survey was developed and distributed to a yoga studio in Syracuse, New York. The survey asked for information on typical yoga practices, mindful eating habits and dietary habits using a brief food frequency questionnaire. The responses from 88 individuals were included in data analysis.

Individuals with 10 or more years of yoga practice exhibited more mindful eating habits than individuals with a less established practice suggesting that yoga is an effective method for improving mindful eating habits. Mindful eating and length of yoga practice both seemed to be associated with higher dietary quality and a healthier BMI. Higher mindful eating scores were associated with higher consumption of fruit and vegetables. Similarly, individuals with more yoga experience consumed a greater amount of whole grains, fruits and a wider variety of vegetables, while consumption of processed food was lower, indicating a higher quality diet. Results suggest that yoga practice may be useful in improving mindful eating habits and dietary quality.

Specific Yoga Practices and Mindful Eating Habits among New and Experienced Yoga Practitioners

By

**Shauna Elizabeth Keeler
Union College, 2009**

Thesis

Submitted in partial fulfillment of the requirements for the Degree of Master of Science in Nutrition Science.

Syracuse University

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Introduction

Obesity in the United States

According to the National Center for Health Statistics, Centers of Disease Control and Prevention (CDC), nearly 35% of American adults are obese (BMI greater or equal to 30) making obesity and its associated diseases America's most pressing health concern (Ogden et al., 2014). Despite the recent drop in obesity prevalence among children 2-5 years old, nearly 17% of our nation's children and teens (ages 2-19) are also considered obese (Ogden et al., 2014). Obesity and overweight dramatically increase an individual's risk of non-communicable diseases, including Type 2 Diabetes, stroke, high blood pressure, coronary heart disease, sleep apnea, cancer, impaired fertility, and metabolic syndrome (National Heart, Lung and Blood Institute, 2013). As a result of obesity-related medical costs, approximately \$147 billion was spent in 2008 towards treating the condition's various associated health issues (Finkelstein et al., 2009). The nation's weight issue is further exacerbated by sedentary lifestyles, busy schedules, fast food and a tendency towards mindless eating, oftentimes on the go. Individuals suffering from over-weight and obesity are encouraged by health professionals to try everything to drop excess weight from workouts, to calorie counting, to medications and, in more severe cases, invasive surgeries (National Institutes of Health, (NIH) 2000). Even if people are able to lose excess weight, maintaining a healthy weight can be a lifelong struggle, because behavior patterns may not change, resulting in imminent weight gain. In fact, only about 30% of overweight Americans are able to achieve long-term weight loss maintenance of $\geq 10\%$ of original body weight suggesting that our current weight loss methods are ineffective and unsustainable (Kraschnewski et al., 2010).

Diet Quality in the United States

Paradoxically, even though more calories are being consumed than ever before, the obesity epidemic has coincided with a reduction in diet quality in the United States. Whole foods, or those that are minimally processed, are associated with higher dietary quality due to the fact that they contain more bioactive substances, therefore, offering more nutritive value (Shahidi, 2009). In contrast, processed foods are often high in calories and offer less beneficial compounds when compared to whole foods, but they are more widely available than ever thus contributing to overweight and obesity (Shahidi, 2009, Monteiro et al., 2013). Not surprisingly, as consumption of ultra-processed food increases, calorie consumption has also increased. For example, compared to average daily caloric intake in 1970, Americans consumed approximately 500 more calories a day in 2010 and approximately 760 more calories per day when compared to typical intakes from the 1950s (Economic Research Service, 2013, Grotto et al., 2010). To help put this in perspective, the CDC estimated that in 2007 men consumed an estimated 2,504 kcals daily and women consumed approximately 1,771 kcals (Wright and Wang, 2010). In 2011, the typical American's intake of grains and meats exceeded recommendations, while diets were lacking in vegetables, dairy and fruit (Economic Research Service, 2013). In fact, typical American eating habits have been given the unfortunate (but earned) nickname of "SAD," an acronym for Standard American Diet, which is associated with multiple non-communicable diseases and is notoriously low in fresh fruits, vegetables and whole grains while being high in calories, saturated fats and processed foods (Grotto et al., 2010). As a result of low fruit, vegetable and whole grain intakes; average fiber intake among adults is less than 16 grams per day; Americans are eating roughly half of the recommended fiber intake of 25-38 grams/day, which may also play a role in weight gain (King et al., 2012). Lastly, empty calories from added

sugars are providing a significant amount of energy in the average American's diet contributing roughly 335 calories and 239 calories daily for men and women, respectively, potentially displacing healthier foods and providing extraneous calories (Ervin et al., 2013).

Dietary Quality Outside of the U.S.

The issue of obesity and its associated diseases is no longer unique to the United States. Adult obesity prevalence is rising on a global scale. In fact, according to the World Health Organization, its occurrence has roughly doubled over the last 30 years (World Health Organization, 2013). Even more shocking, perhaps, is that nearly 70% of the global population live in countries with higher death rates from overweight and obesity and their complications than from deaths caused by underweight (World Health Organization, 2013). A major contributor to this shift is the globalization of the food market, which has created an abundance of inexpensive, often high-calorie foods. Consumption of these foods is increasing, often displacing more traditional diets, which tend to favor whole, nutrient-rich foods (Montiero et al., 2010). The consumption of these "ultra-processed" foods, as termed by Montiero et al, is increasing all over the world, with significant consumption shifts in middle income countries, thereby contributing to global obesity trends (Montiero et al., 2013). In parallel with obesity, type 2 diabetes is also becoming more prevalent throughout the world. Currently, type 2 diabetes is estimated to affect 382 million individuals worldwide with particular increases realized in Europe, South-East Asia and countries in the Western Pacific (International Diabetes Federation, 2013).

Addressing Obesity through Mind and Body Practices that Increase Mindfulness

The increasing magnitude of the obesity epidemic has inspired the exploration of new

approaches for healing people's relationship with food. According to the National Institutes of Health's (NIH) National Center for Complementary and Alternative Medicine (NCCAM), complementary weight loss practices may include dietary supplements, mind-body meditation, yoga, and acupuncture (NCCAM, 2013). Many alternative medical systems incorporate mindfulness, or heightened consciousness, into their practices. Ayurveda (ancient Indian medicine), for example, often referred to as the "science of life," emphasizes balance through mindfulness. To achieve this, yoga practice may be prescribed (along with herbal mixtures or other lifestyle changes).

As a mind/body practice, yoga shows promise in helping to normalize eating habits through increased mindfulness. Unlike the other mind and body practices, however, which require little movement, the physical movement encouraging strength and flexibility during yoga may provide an added benefit of energy expenditure to help individuals maintain or lose weight. Much of the success yoga has had at helping people become more mindful eaters, lies in the fact that it encourages a mind/body connection that may help participants feel more in control of their eating habits presumably making them less susceptible to frequent binging (McIver et al., 2009). A stronger mind/body connection may also help individuals be more mindful of their hunger state and help them avoid over-eating once their hunger has been satisfied. Rather than encouraging a strict diet regime, a common weight loss strategy today, the mindfulness learned through yoga may allow practitioners to make healthier food choices based on their individual needs allowing for a more flexible and, therefore, potentially more sustainable change. In other words, yoga practice increases mindfulness, which, in turn, allows mindful eating habits to develop naturally over time as individuals become empowered to make their own food choices based on their bodies' needs. Although this is a difficult undertaking, it may become easier as the

mind/body connection strengthens. While yoga is not the only way to promote mindfulness that could have beneficial effects on one's dietary habits, its recent popularity as a mind/body practice begs more research on its effects. If a strong connection between specific yoga practices and high dietary quality (a diet high in fruits, vegetables, whole grains and low in processed foods and sugar sweetened beverages) can be determined, its utilization as a complementary form of nutrition therapy may be a creative way to help address America's weight issue and potentially save a significant amount of money on healthcare costs while improving the health and well-being of many (Ross et al., 2012).

Introduction to Yoga

Yoga is considered, "the science of the mind." This ancient practice made its way to the western world in the 1960s and has since become a popular form of exercise with an estimated 15 million practitioners (Smith et al., 2011). Yoga is unique as a form of exercise in that it traditionally is a multi-dimensional practice incorporating physical movement, spirituality and mindfulness into a cohesive unit, rather than simply emphasizing aerobic activity or calorie expenditure. As its popularity grows, yoga continues to gain attention in the medical arena. Studies have demonstrated the usefulness of yoga practice in reducing stress, increasing mindfulness and fostering body awareness, among other benefits, but have failed to provide an in-depth analysis of the potential relationship between yoga practice and diet quality (Brisbon et al., 2011, Hewett et al., 2011, Shelov et al., 2009, Impett et al., 2006). As mentioned previously, The National Institutes of Health (NIH), the premiere leader of medical research in the United States, recognizes yoga practice as a "mind-body" complementary health modality through its division, the National Center for Complementary and Alternative Medicine (NCCAM). The 2007 National Health Interview Survey (NHIS) found yoga to be a growing complementary

healthcare practice being utilized by approximately 6.1% of U.S. adults. Deep breathing exercises, known in yoga as “pranayama,” and meditation, another aspect often incorporated into yoga practice, were also popular complementary health practices among adults with 12.7% and 9.4%, respectively, of the population practicing (Barnes et al., 2008).

Yoga is an approximately 4,000-year-old spiritual practice originating from India based on concepts of mindfulness and compassion. The word yoga is translated as “union,” or sometimes to “yoke,” meaning to unite, or yoke, together the mind and body encouraging a stronger connection between the two. According to Desikachar, founder of a specific yoga style called, Viniyoga, yoga may also be interpreted as “to tie the strands of the mind together” or “to attain what was previously unattainable,” (Desikachar, 1999). Yoga practice encourages students to develop their capacity to live mindfully through practices such as meditation, pranayama and asana, which are discussed in detail later. Mindfulness, according to Jon Kabat-Zinn, creator of Mindfulness-Based Stress Reduction therapy, a popular mindfulness-based intervention, is a “moment to moment, nonjudgmental awareness” adding that it “is cultivated attention in a particular way, namely, on purpose in the present moment,” (Gazella, 2005). Yoga practice, as a vehicle for promoting mindfulness, may also be beneficial for improving eating habits, which for many, may mean promoting weight loss or at least weight management and consumption of a more nutrient dense diet, or one of higher dietary quality, high in whole foods and limited in processed foods (Monteiro et al., 2013). As interest in yoga continues to grow and the issues of obesity and overweight continue to be of major concern, the potential connection between the practice of yoga and a healthy diet should be explored.

The Eight Limbs of Yoga

Traditional Ashtanga yoga practice involves the Eight Limbs. The Eight Limbs were

described by the ancient sage, Pantanjali, in the Yoga Sutras (Satchidananda, 1979), estimated to have been written over 4,000 years ago. The concepts included in the Eight Limbs encourage mindfulness on a variety of levels through thoughts, actions and words and provide the backbone of yoga philosophy. The practices and foundation of yoga philosophy potentially provide students with the skills necessary to navigate through difficult situations successfully over time. It is worth mentioning Sutra 2 of Patanjali's Yoga Sutras (an ancient foundational text on yoga), which states, "The restraint of the modifications of the mind-stuff is Yoga," (Satchidananda, 1978). This short phrase describes the ultimate goal of yoga practice, which is to learn how to remove distractions from your thoughts and remain non-reactive. It trains one to cultivate uninterrupted mindfulness that can translate to all aspects of one's life, one of which is through the food one eats.

The Eight Limbs of Yoga

1. Yamas

Translated as "restraints" or "abstinences," the yamas refer to including nonviolence "ahimsa," truthfulness "satya," non-stealing "asteya," continence "brahmacharya," and non-greed "aparigraha." The yamas encourage peacefulness and temperance.

2. Niyamas

Translated as "observances," the niyamas refer to purity "saucha," contentment "samtosha," accepting pain and not causing pain "tapah," study of spiritual books "svadhyaya" and self-surrender "Isvrapranidhanani."

3. Asana

Asana refers to physical postures or "seats." Asana practice seems to be the most popular of the 8 limbs in the United States, with many classes emphasizing only physical postures.

Traditionally, the postures are practiced to develop flexibility, strength and concentration. Asana practice is emphasized because it allows the body to become supple having the capacity to find comfort in nearly any position so that the individual can focus their thoughts on meditation, rather than uncomfortable feelings that may arise in different postures. It is also thought that frequent deliberate movement, that involves twisting, back bending and forward folding allow for the release of toxins from the body.

4. Pranayama

Pranayama is frequently translated as “breath control” and refers to various techniques that are used to inhale and exhale. “Prana” is often referred to as one’s “life-force.” In the Yoga Sutras, a technique of pranayama is described as “the modifications of the life-breath that are either external, internal or stationary. They are regulated by space, time and number and are either long or short,” (Satchidananda, 1978).

5. Pratyahara

Pratyahara is translated as “abstraction” and refers to control over the senses, which allows for improved concentration. As the Sutras states, “When the senses withdraw themselves from the objects and imitate, as it were, the nature of the mind-stuff, this is pratyahara,” (Satchidananda, 1978). This practice encourages individuals to move beyond momentary pleasures of the senses and remain unaffected by various temptations through learning how to master these desires rather than giving in to them.

6. Dharana

Dharana is translated as, “concentration” and is considered a first step towards meditation. It is described by Pantanjali as the “binding of the mind to one place, object or idea,” and by Satchidananda as “training your mind to meditate” (Satchidananda, 1978).

7. Dhyana

While it may be common for distractions to arise in the thoughts while practicing dharana, in dhyana, the mind is unaffected by distractions or outside thoughts. Rather than “training” yourself to meditate, you are simply meditating. As the Sutras say, “Dhyana is the continuous flow of cognition toward that object,” (Satchidananda, 1978). “Object,” refers to the object of meditation.

8. Samadhi

In the eighth and final limb of yoga, the individual experiences a form of “oneness” with the object of meditation. As Satchidanada describes, “the culmination of meditation is samadhi,” (Satchidananda, 1978). This is a continuous form of meditation in which the meditator is unconscious of the act of meditating, rather, it simply occurs.

Yoga in the U.S.

Yoga practice has become somewhat of a phenomenon in the United States with classes seemingly offered in nearly every gym, health club and community center in the country. In many ways, yoga has become a trendy form of exercise, with devoted celebrity followers including, Madonna, Sting and Lady Gaga, among others, who have helped to move its practice into the mainstream. In fact, some people are even arguing for yoga classes to be included in public school curriculum and research has shown it may be a beneficial addition (Conboy et al., 2013). In 2012, it was estimated that practitioners spent approximately \$2.5 billion on yoga instruction and an additional \$4.5 billion was also spent on yoga equipment and yoga clothing (Yoga Journal, 2012). With this wide scale growth and acceptance into society, yoga has transformed into a “westernized” version of itself that often places a higher emphasis on the physical practices of yoga rather than the spiritual. That is not to say that spiritual practices are

avoided, but the extent to which the spiritual aspects of yoga are practiced can vary from studio to studio. Some practitioners may avoid it all together opting for “Power Yoga” classes that emphasize strength-building while others may frequent studios that offer classes or workshops in “Kirtan” (devotional chanting). Regardless of the endless amount of variation that can exist between classes, yoga studios provide a safe and supportive community for people to begin connecting with their bodies, exploring their spirituality and fostering their well-being.

Though the practices of yoga are varied, a typical western yoga class lasts for 60-90 minutes and begins with centering, or a period of time when students are encouraged to focus on their breath becoming aware of each inhalation and exhalation while clearing their minds of distractions or outside thoughts before settling into their practice. Focused breathing and consciously separating distractions from the thoughts allow the student to focus on the present moment and promote mindfulness. Following this, there is typically a warm-up consisting of “surya namaskara” or sun salutations (a short series of poses designed to build heat in the body and increase flexibility) followed by a progressive sequence that often prepares the student for a peak pose, a deep expression of a posture. Throughout class, students are encouraged to remain “present” or “mindful” by deliberately releasing distractions from their thoughts and turning their attention inward to connect with their bodies and their breath. Oftentimes, poses require steady concentration, which helps to keep practitioners in the present moment, a difficult task that improves over time. Finally, students are invited to come to the final relaxation posture, “savasana.” Also known as “corpse pose,” savasana is arguably the most important pose of the class. During this time, practitioners experience a form of silent meditation for about 5-10 minutes, sometimes longer. Traditionally, the postures leading up to savasana are designed to physically tire the body thoroughly enough so one is able to sit still in uninterrupted meditation,

or mindfulness, for an extended period of time following asana practice. Although classes in the United States tend to be rather “asana”-focused, other forms of yoga practice, which may include meditation breath work (known in Sanskrit as “pranayama”), or even study of philosophy, including the ancient yoga texts, like the Yoga Sutras (Satchidananda, 1979) or Bhagavad Gita (Mitchell, 2000) may also be included. Although yoga practice may look different today than it did in ancient India, its core concepts of compassion and mindfulness remain.

Specific Aims

Yoga practice is associated with a variety of desirable health outcomes, one of which is a higher display of mindful eating habits. However, the practices of yoga are wide ranging and current research does not sufficiently account for its variety. Current research also does not include detailed dietary analyses of individuals who regularly practice yoga, which makes it difficult to determine how dietary quality compares both among new and experienced practitioners and the general American public. This study will attempt to distinguish how yoga practice relates to mindful eating and whether mindful eating is associated with improved diet quality as years of yoga practice increase. The potential correlation between yoga practice and dietary quality will be also assessed to determine if yoga practice is related to a diet high in fruits, vegetables, whole grains and low in processed foods. Ultimately, this finding could demonstrate yoga’s potential usefulness in not only improving mindful eating habits, but also in improving dietary quality, both of which may be useful for individuals looking to maintain or lose weight. It is hypothesized that individuals who have more experience with yoga will score higher on the Mindful Eating Questionnaire (MEQ) (Framson et al., 2009) than individuals with less experience and will also consume a diet higher in fruits, vegetables and whole grains, thus indicating higher dietary quality among more experienced yoga practitioners.

Literature Review

Cultivating Mindfulness through Asana-based Yoga Practice

Mindfulness may be a key to a healthy diet and weight and yoga is a proven method of promoting mindfulness (Framson et al., 2009, Shelov et al., 2009). As yoga practice develops, mindfulness seems to improve over time (Shelov et al., 2009, Brisbon et al., 2011). Using an 8-week intervention in which individuals were randomly assigned to a yoga group or a control group, Shelov et al., (2009) showed drastic improvements in overall mindfulness as well as in all four measured sub-scales of mindfulness using the Freiburg Mindfulness Inventory scale (Buchheld et al., 2001). Among the included sub scales were, 1. Dis-identifying attentional processes of mindfulness 2. Accepting and open attitude toward experience 3. Process-oriented understanding and 4. Paying attention without distraction. In this particular study, participants attended a weekly Hatha yoga class that lasted 60 minutes and included breathing exercises, a standard yoga sequence and savasana. The sub-scale that demonstrated the greatest change following the 8 week intervention was, “dis-identifying attentional processes of mindfulness” or “the ability to pay attention to the present moment without distraction,” (Shelov et al., 2009). For individuals looking to improve mindfulness, this study suggests 60 minutes a week may be enough to make significant changes.

Still, length of time spent practicing yoga seems to be associated with higher degrees of mindfulness. Brisbon et al., (2011) demonstrated that advanced practitioners (~14.53 years of experience) scored significantly higher on the Mindful Attention Awareness Scale (MAAS) (Brown et al., 2003) when compared with beginning practitioners (~3.33 years of experience). Using the MAAS, mindfulness was defined in the study as “an enhanced attention to and

awareness of current experience or present reality,” (Brown et al., 2003). In addition to increased mindfulness (measured by the MAAS), experienced practitioners demonstrated decreased stress by scoring significantly lower than beginning students on the Perceived Stress Scale (Cohen et al., 1983) and a moderate negative correlation between mindfulness and stress was demonstrated. The Perceived Stress Scale is a 10-item questionnaire that measures the frequency of the respondent’s emotions related to stress including nervousness, ability to cope, anger and level of confidence to determine stress levels (Cohen et al., 1983). Since stress is associated with inflammation, risk of cardiovascular disease and multiple disease-like states, the implications of the negative correlation between mindfulness and stress are vast when considering one’s health and well-being (Black et al., 2002). This study did not include a non-yoga group, so it is difficult to say how the “beginning” students would have compared to individuals who have never practiced before. Similarly, Hewett et al., (2011) were able to measure an increase in mindfulness and decrease in perceived stress among individuals studying Bikram yoga (a specific style of heated yoga that utilizes the same 26 asanas, or postures, in a particular sequence each class) during an 8-week intervention. In this particular study, mindfulness was measured through the 39-item, Five-Facet Mindfulness Questionnaire (Baer et al., 2008), which assesses mindfulness through alternative sub-scales including, “observe,” “describe,” “awareness,” “nonreactive” and “non-judging.” Improvements were made within each of the sub-scales, but the largest shift was under the “non-judging” category. Participants also were asked to complete the Perceived Stress Scale (Cohen et al., 1983). Once again, mindfulness was negatively correlated with perceived stress. Interestingly, improvement in mindfulness was also correlated with a reduced resting heart rate (Hewett et al., 2011).

Mindful Eating Habits and Yoga Practice

The mindfulness learned through yoga practice may be useful for reducing frequency of mindless eating, which may be a major contributing factor to declining health in the United States. Mindful or mindless eating refers to how attentive an individual may (or may not) be towards how, what, when and where they are eating. According to the U.S. Department of Health and Human Services, approximately 35% of American adults are obese (BMI \geq 30) (Ogden et al., 2014). Mindless eating may be a factor contributing to the increased number of calories Americans are eating which, in turn, is likely contributing to the current obesity epidemic (Wansink, 2006). Mindless eating “occurs when the act of eating is not consciously attended to; the cessation of eating is based on salient external environmental food cues (e.g., the bottom of a food bowl or the end of a television program) rather than internal cues that signal satiety,” (Hendrickson and Rasmussen, 2013). The food environment in the United States seems to encourage mindless eating with expanding portion sizes, larger plate sizes, overexposure to food advertisements and busy schedules that call for eating on the run. External cues, such as these, seem to determine how much we are eating rather than internal regulation signals like hunger or fullness (Wansink, 2010). People are likely to let their serving size determine how much they eat and will only know to finish eating when the food is no longer there, rather than listening to other fullness cues relayed by the body. Often, people are doing another task when they are eating, for example checking emails or driving, making it nearly impossible for them to eat mindfully. Food also seems to surround us constantly at social gatherings, meetings, around the office, at convenience stores and so on. There seem to be endless opportunities to eat. In fact, it is estimated that we make 200 food decisions a day that we are not even aware of (Wansik et al., 2007). Successfully navigating this complicated and unrelenting food environment requires a

great deal of mindfulness. Although yoga is not the only route to improve mindfulness, it has the added benefit of improving the mind body connection, which is discussed later.

Once cultivated through yoga, mindfulness has been shown to translate to one's diet through "mindful eating" habits. In their paper, "Development and Validation of the Mindful Eating Questionnaire," Framson et al., (2009), determined that as minutes of yoga practice per week and years of experience increased, so did mindful eating habits. Mindful eating, as defined by Framson and others is "a non-judgmental awareness of the physical and emotional sensations while eating or in a food-related environment." Among the domains chosen for measuring mindful eating habits were "*disinhibition*,"—"the inability to stop eating even when full"; "*awareness*,"—"being aware of and appreciating the effects of food on the senses"; "*external cues*,"—"eating in response to external cues"; "*emotional response*"—"eating in response to negative emotional states"; and "*distraction*,"—"focus on other activities while eating" (Framson et al., 2009). Mindful eating encourages individuals to notice how, why, when and where they are eating, while being aware of how meals make them feel. It also encourages people to savor their foods and take the time to enjoy them, ideally, in a pleasant setting. Mindful eating also involves thoughtful food preparation, paying attention to food purchases and food sources. According to the Center for Mindful Eating, an individual who eats mindfully "becomes aware of the interconnection of earth, living beings, and cultural practices and the impact of their food choices on those systems" (Center for Mindful Eating, 2013). Presumably, a mindful eater acknowledges these considerations and tends to choose foods that are less costly to the environment and more beneficial to the community by, for instance, purchasing local food. However, the Mindful Eating Questionnaire (MEQ) was not designed to measure this facet of mindful eating.

Individuals who practice mindful eating are also able to monitor their food intake based on their hunger-level and have the ability to end a meal or snack based on their bodies' internal cues or satisfaction level, rather than letting external cues or emotions determine intakes. Because of this, mindful eating may be considered a useful technique in weight maintenance. In fact, the researchers found that the higher an individual's BMI, the worse the individual tended to score on the Mindful Eating Questionnaire, suggesting that mindful eaters weigh less than mindless eaters (Framson et al., 2009). Perhaps eating mindfully protects individuals from potential weight gain over time. The researchers also looked at other physical activities such as walking and "moderate/strenuous exercise" and were not able to make a similar connection with mindful eating, suggesting that physical activity that includes a mindful component, like yoga practice, is more beneficial than physical activity alone in improving one's diet. The mindfulness subscale that showed the most significant difference was for "emotional response" among different BMI categories with higher BMIs seeming to also be associated with higher degrees of emotional response to food. Emotional response was also higher among women than men, suggesting men are less susceptible to being influenced by emotions when eating (Framson et al., 2009). To differentiate dieting tendencies from mindful eating habits, the researchers also included a subscale to measure "cognitive restraint," which they found was independent of mindful eating habits suggesting that mindful eating is a concept distinct from typical dieting methods, like restricting calories or frequently monitoring weight fluctuations. In other words, mindful eaters are not depriving themselves of foods; they seem to naturally make better food choices. Since many people may use eating as a coping strategy for dealing with emotions, a reduced "emotional response" towards food may help individuals limit their intake of excessive calories and potentially avoid weight gain during particularly difficult periods.

As mentioned previously, mindful eating means to purposely approach meal or snack times with focused attention and non-judgmental awareness, allowing yourself to fully experience the food being consumed. Within this concept, there are no “right” or “wrong” foods; there simply is food. The adoption of this idea, presumably, helps individuals to reduce their preoccupation with food, which may be causing them to overeat when given the opportunity. Before mindful eating is applied, however, preoccupation with food can become a source of guilt for dieters or people trying to lose weight. As a result, food thoughts are often suppressed in an attempt to minimize overeating. Research has shown, however, that this strategy is not only ineffective in terms of reducing consumption, it may even lead individuals to eat more than they normally would have if they were not suppressing their food thoughts. For example, Barnes and Tantleff-Dunn (2010), explored the relationship between food thought suppression and weight-related outcomes and found that individuals who suppressed their thoughts of food were more likely to fall victim to episodic binge eating and experience more cravings for food. They also found that women were more likely than men to try to suppress thoughts of food and so were individuals who were dieting when compared to those who were not (Barnes et al., 2010). This evidence suggests dieting, in the traditional sense, might not work. In fact, the authors write, “the less individuals attempted to avoid their thoughts, the less likely they were to experience unwanted thoughts and experiences (e.g. binge eating).” Dieters might be more likely to binge on and crave foods they are trying to “suppress.” Rather than approaching food with an accepting, open and almost indifferent attitude, like a mindful eater might, dieters’ attempts to suppress thoughts of particular foods may actually cause them to become preoccupied by those foods and become more prone to over-eating or binge eating. In yoga practice, students are encouraged to not only remain mindful, and observant to thoughts that present themselves but also be

nonreactive, which may be another reason their ability to mindfully eat seems more developed than individuals who do not practice yoga. Yoga practitioners may be less likely to eat impulsively than individuals who do not have a regular practice by not necessarily giving validation to each craving they experience and using internal cues, such as hunger levels, as a guide for intake patterns.

In another study, Alberts, Mulkens, Smeets and Thewissen (2010) looked at how mindfulness based training would affect existing food cravings. Both the control and experimental groups received a weekly dietary consultation with a dietitian and were required to participate in regular physical activity. In contrast to the control group, the experimental group also received a manual designed to increase acceptance levels in an attempt to manage food cravings. The acceptance portion of the intervention included instruction on body scanning (a technique often used in yoga), mindfulness meditation and craving acceptance with techniques included to help participants avoid reacting to cravings. Results showed that the experimental group significantly decreased cravings, whereas the control group saw no significant change (Alberts et al., 2010). In the end, the experimental group also reported experiencing less feelings of preoccupation with food, suggesting that not only would they be less likely to act on cravings, but they also may be less likely to experience cravings in the first place. The results of this study provide further evidence that equipping individuals with skills like body awareness, acceptance and mindfulness, all concepts inherent in the philosophy of yoga, help them to navigate the difficult food environments they encounter and reduce inner struggles with food choices they may face (Alberts et al., 2010).

Kristeller, Baer and Quillian-Wolever designed the Mindfulness-Based Eating Awareness Training (MB-EAT) intervention aimed at treating binge eating disorders (BED) (2006). The

intervention involves what it deems “heartful qualities of mindfulness,” which include being non-judgmental, compassionate and self-accepting, once again, all qualities inherent in the philosophy of yoga. MB-EAT utilizes mindfulness meditation, mindful eating exercises, gentle chair yoga, body scan practices and training on cultivating both emotional balance and self-acceptance. In a separate paper, Kristeller writes,

“the MB-EAT program is designed to help individuals cultivate awareness of both internal and external triggers to eating, interrupt dysfunctional cycles of bingeing, self-recrimination and over-restraint, and re-engage the natural physiological processes of eating regulation.”

(Kristeller et al., 2011)

The program has demonstrated success in reducing bingeing episodes with weekly bingeing dropping from 4 to 1.5 binges per week (Kristeller and Hallett, 1999) and the amount of food consumed during the episodes also reportedly dropped. Depression symptoms have also been shown to lessen among program participants (Kristeller et al., 1999, Kristeller et al., 2011). A recent study of the program also found weight loss to occur as a result of the intervention (Kristeller et al., 2011). Since depression may lead individuals to overeat, weight loss might have been related to decreased depression symptoms. Mindfulness, self-acceptance and the ability to remain nonjudgmental in this program seem to allow individuals to regularize their eating habits and avoid making impulsive food decisions by re-wiring how they relate to themselves, which in turn, allows for transformation of their existing attitudes and habits related to food, making room for new habits to form. Since yoga is rooted in these same traits (mindfulness, self-acceptance and nonjudgmental attitudes), it is possible that yoga practice would offer similar results to this program.

In an interesting case study of a 30 year old, obese individual named Neal, mindful eating

was shown to be an effective and maintainable strategy for weight loss (Singh et al., 2008). At the intervention's initiation, Neal was considered Class III obese (BMI of 44) and remembers having difficulty controlling his weight as early as elementary school. Previous attempts at weight loss had mostly failed and this individual was looking to make long-lasting lifestyle changes rather than adhering to a diet. The intervention included several components such as increased physical activity, in this case, regular walking, and mindfulness exercises including Dr. Shapiro's Picture Perfect Weight Loss: The Visual Program for Weight Loss (Shapiro, 2002) to retrain current attitudes towards food, "visualizing and labeling hunger," and meditation. Lastly, "mindful eating" techniques were included in the intervention to encourage Neal to make several small changes, including to "place his utensils on his plate following every mouthful of food taken," "increase chewing each mouthful of food up to 30 times per mouthful," "try to isolate the seven tastes of food—sour, sweet, bitter, spicy, salty, alkaline, and astringent," "focus fully on the act of eating," (Singh et al., 2008). The intervention lasted a total of four years and 49 weeks. Throughout the duration of the study, Neal's weight loss was consistent and maintained. His starting weight of 311 lbs., dropped to about 182 lbs., in the last year of the study. Researchers kept in touch with Neal during the fifth year and learned that his weight dropped to about 168 lbs., reducing his BMI to 24.5, an astonishing difference from his initial weight. Neal had previously tried adding physical activity to his regimen in an attempt to lose weight, but was unable to maintain his reduced weight and quickly gained it back. However, it seems that adding a mindfulness component to his weight loss methods provided an effective and long-lasting alternative for weight reduction and he was able to make sustainable changes to keep him on the right track. Among the changes made were slower-paced, mindfully-based eating, noticing subtle taste differences in food consumed, labeling hunger, frequent meditation and selecting more

healthy foods.

Yoga practitioners tend to gain less weight over time and to have lower BMIs than non-practitioners. In a United States study, an analysis of 15,500 adults between the ages of 53 and 56, found that individuals who regularly practiced yoga gained less weight over a 10 year period than individuals participating in other physical activities, such as, walking or lifting weights (Kristal et al., 2005). In normal weight practitioners, this translated to approximately 3.1 less pounds and among overweight practitioners, this translated to a surprising 18.5 pounds over 10 years (Kristal et al., 2005). Yoga practitioners were more likely to maintain weight or lose weight rather than gain weight over time (Kristal et al., 2005). Moliver et al., (2011) also were able to show that yoga practitioners tend to have lower BMIs than non-practitioners and demonstrate a significant inverse correlation between yoga practice and BMI measures. In fact, practitioners were more likely to fall in the normal BMI range while non-practitioners fell closer to the obese classification of BMI. The researchers also found that yoga practitioners were less likely to be on medication (Moliver et al., 2011). Ross, Friedmann, Bevans and Thomas (2012) found home practice was highly correlated to lower BMIs with a 0.17 decrease in BMI for every day home practice occurred during the week. Interestingly, this study also found that individuals who studied yoga philosophy with more frequency tended to have lower BMIs, as well (Ross et al., 2012). When asked about how yoga had affected their weight, 56% of respondents felt that yoga helped “attain or maintain a healthier weight,” (Ross et al., 2013). Lower BMIs among yoga practitioners have been attributed to mindfulness (learned through yoga practice) that extended to dietary habits, which ultimately allows the individual to make mindful eating a natural part of life.

Body Awareness and Mindful Eating

Yoga practitioners seem to develop a higher degree of body awareness than non-practitioners (Impett, 2006), which may help them to better judge their hunger and fullness and avoid eating due to external cues. Throughout class, students are guided through sequences involving multiple postures or “asanas,” that are frequently held for several breaths; these movements may seem awkward to the beginner and are uncommon outside of yoga practice. It is possible the varieties of these deliberate movements, necessitating a combination of strength, flexibility, concentration and calmness are able to increase awareness of one’s body. In fact, it is not uncommon for new students to find their first class slightly confronting and emotionally or physically uncomfortable as they begin to connect with their bodies through movement and breath. The increased familiarity of one’s body, physical abilities and focused attention on the present moment through yoga may facilitate a newfound awareness that strengthens practitioners’ mind/body connection, ultimately leading to a more mindful lifestyle, which includes the diet. Consistent practice of yoga has been shown to contribute significantly with increased body awareness and increased body responsiveness when compared to individuals engaging solely in aerobic activity (Daubenmier, 2005). The increased body responsiveness and body awareness likely result from the combination of physical and *mindful* aspects of yoga versus an activity that is merely physical and does not include a mental component.

A higher degree of body awareness, or body mindfulness, may help individuals notice how their food choices make them feel and help them avoid foods that are processed and contain high amounts of sugar, salt and fat. As Kristal et al., (2005) report, practitioners demonstrated a more positive body experience and, because of this, tended to avoid “junk foods” and “overeating” to practice respect for their bodies. This concept is revolutionary in many ways, but

primarily because the practitioners are not depriving themselves of “junk foods,” they are simply choosing the foods that make them feel well and avoiding those that do not, possibly because they have a greater ability to tune into this phenomenon than non-practitioners. Yoga practitioners, it seems, are not dieting. From a nutrition standpoint, many individuals on diets are more likely to experience bingeing, perhaps resulting from a sense of deprivation. This results in a vicious cycle of calorie restriction, bingeing episodes and guilt, which leads to further calorie restriction. Teaching individuals to tune into their bodies’ cues and notice for themselves which foods promote their health and which foods do not, is a difficult task, but the payoffs have tremendous potential. For many, it means breaking the vicious cycle of dieting and finally beginning to heal their relationship with food.

In a recent study (Martin, R et al., 2013), body awareness was shown to mediate the relationship between exercise type and mindful eating habits. For example, individuals who practiced yoga demonstrated both higher levels of body awareness, as measured by the body awareness scale determined by Daubenmier (2005), and mindful eating habits as measured by the Mindful Eating Questionnaire (Framson et al, 2009). Yoga practitioners also exhibited less disordered eating tendencies whereas individuals participating in the moderate intensity, cardio-based activity group were more likely to display disordered eating habits. In fact, a positive correlation between cardio-based exercise and disordered eating was established. Cardio exercisers were less likely to display adequate levels of body awareness to protect them from disordered eating habits, unlike the yoga group. A negative correlation between cardio exercise and Trait Mindfulness, as measured by the Mindful Awareness Attention Scale (Brown and Ryan, 2003) was also established. Since body awareness and mindfulness are both associated with mindful eating habits, cardio exercisers may not receive this benefit, potentially putting

them at a higher risk for disordered eating habits.

In a separate study, Dittmann and Freedman (2009) also found that the women who practiced yoga demonstrated greater body awareness, body responsiveness, spiritual readiness and higher intuitive eating scores. Evelyn Tribole, coauthor of *Intuitive Eating* considers intuitive eating to be similar to mindful eating, but broader in scope, including body acceptance and physical activity (Tribole and Resch, 2012). Still, like mindful eating, intuitive eating requires a strong ability to tune into the body's natural urges in terms of food intake. Daubenmier (2005) also found that yoga practice was associated with higher levels of body awareness and body responsiveness. When compared to aerobic exercisers, yoga students demonstrated lower BMIs, higher body awareness, higher body responsiveness, higher body satisfaction and lower self-objectification, meaning their internal experience was based more on how they felt versus how they felt they looked, and disordered eating tendencies (Daubenmier, 2005). Strelan et al. (2003) also found that women may actually experience higher self-objectification through aerobic activity. Dittmann and others (2005) shows that women's attitudes towards their bodies seemed to change significantly and participants were quoted as saying, "My ability to read the physical signals of my body [has changed]" and "I trust my body to tell me what it needs," (Dittman et al., 2009). The women felt more connected to their bodies and seemed to respect their bodies more following yoga practice. Yoga seems to facilitate embodiment among practitioners allowing them to better connect their bodies to their minds and develop a deeper understanding of their bodies' needs, limits, strengths, weaknesses, tendencies and desires in a manner that is unifying rather than objectifying and accepting rather than negating or judgmental.

Body awareness may be stronger among yoga practitioners due to the accepting nature of the practice. Yoga practices provide a non-competitive, nurturing environment where students

are encouraged to explore movement and listen to their bodies' cues and are frequently reminded that the practice is an individual journey, constantly ebbing and flowing. As Desikachar says, "Yoga serves the individual, and does so through inviting transformation rather than by giving information," (Desikachar, 1999). In yoga, the journey is emphasized rather than a destination, which is in contrast to more cardio-based exercise programs, which might consider reaching a "target weight" as the motivation for working out. Typically, yoga studios are void of mirrors, which allow students to rely on their bodies' feelings rather than on their outward appearances. This helps students develop body awareness by allowing them to rely on their internal experience of the postures, thereby creating a strong connection to the body, rather than objectifying and judging the postures through use of a mirror which provides an external experience.

Yoga Practice and Diet Quality

Current studies have shown that yoga practitioners eat more fruits and vegetables when compared to the general public, suggesting practitioners make healthier diet choices. As mentioned previously, in a major study, Kristal, Littman, Benitez and White (2005) found that yoga practitioners tended to gain less weight over a 10-year period than those who did not practice. All data were collected using a food frequency questionnaire and physical assessment with information on length of yoga practice and years spent practicing yoga. The food frequency questionnaire determined that yoga practitioners had more fruits and vegetables in their diets than non-practitioners and experienced practitioners had still more of these foods than less experienced practitioners. Individuals who practiced yoga for four or more years tended to eat 45% more fruits and vegetables than those who did not practice (Kristal et al., 2005). In addition, these practitioners consumed markedly less fat (11%) than those who didn't practice, as well (Kristal et al., 2005). Framson et al., (2009) also found yoga practitioners were more likely to

consume sufficient amounts of fruits and vegetables than survey participants who did not practice yoga. Benefits increased as years of practice increased, which the authors attributed to an increase in mindfulness that translated to the diet. Ross, Friedmann, Bevens and Thomas (2012) also found that yoga practitioners are more likely to consume adequate amounts of fruits and vegetables and receive higher scores in “mindfulness” and “subjective well-being” categories. In a separate study, by the same author, median intakes of fruits and vegetables were 5.5 and 6.1 servings per day for women and men respectively, showing that yoga practitioners may be more likely to reach daily recommendations for fruit and vegetable intake when compared to the general public (Ross et al., 2013). Adequate intake of fruits and vegetables is shown to reduce risk of chronic disease (Hung et al., 2004). This research suggests, that as mindfulness increases, fruit and vegetable intake also increases, which overtime may have protective effects against disease, but did not include a direct correlation between mindfulness and fruit and vegetable intake. In a separate study, yoga practitioners also demonstrated being more likely to eat fruits and vegetables compared to individuals who practiced cardio-related exercises and less likely to eat “take-away” foods which were considered less healthy options (Martin, R. et al., 2013). Regardless, increased mindfulness could help improve awareness of which foods are being consumed and how much is being consumed potentially inspiring a deliberate attempt of the practitioner to “eat healthier.”

Not only are yoga practitioners more likely to eat fruits and vegetables, but when compared with the general public, practitioners are more likely to be vegetarians and avoid sources of meat, poultry and fish (Penman et al., 2012). This may be due to the practice of “ahimsa” or nonviolence, which is part of the first Limb of yoga (yamas) and may inspire serious practitioners to avoid meat or animal products. Another potential explanation of a typical yoga

diet comes from Satchidananda...

“People trying to sit quietly found they couldn’t. They encountered pain, stiffness, bile, gas, etc., and thought, ‘what is the reason for these things and how can we get rid of them?’ They realized it was due to toxins from eating the wrong foods, at the wrong times and in the wrong quantities. These people pondered, ‘What is good food that won’t leave toxins? What should the limit be? When is the proper time to eat?’ They formed the Yogic diet, free of meat, fish, eggs, stimulants and excessive use of spices.” (Satchidananda, 1978)

Regardless of the reasons practitioners may have to begin a vegetarian diet, a plant-based diet helps to reduce, among other things, hypertension, hyperlipidemia, risk of heart disease, type 2 diabetes, obesity (Campbell et al., 2012). Penman et al (2012) determined many practitioners were more likely to become vegetarians or vegans as yoga experience deepened with increasing length of time practiced and were more likely to prefer organic foods than those with a less established practice. Purchasing more organic products may be another example of how the mindfulness of yoga practice is able to translate to one’s eating habits, as organic products tend to be more environmentally friendly (Underwood et al., 2011).

Perceived Stress and Diet Quality

As previously mentioned, yoga seems to be effective in helping reduce perceived stress levels (Brisbon et al., 2009, Hewett et al., 2011), which may reduce the practitioner’s risk of succumbing to stress-related diseases, but reduced stress could also play a major role in the practitioner’s diet as well. For example, in a study unrelated to yoga practice, Oliver and Wardle (1999) found that stress might cause an individual to under eat or overeat. When compared to men, over-eating was the more common outcome during stressful periods for women (~45%). Whether or not more or less calories were being consumed, diet quality suffered among both

men and women with 73% of participants eating more “snack” foods than usual. Among the snack-type foods being consumed, 70% of participants ate “sweets and chocolate” during stressful times and 60% ate “cakes and biscuits.” Fruits and vegetables were the least likely foods to be consumed (19%), suggesting that during times of stress, diet quality may suffer tremendously with higher intakes of energy dense foods and lower intakes of nutrient dense foods (Oliver et al., 1999).

In a more recent study (Groesz et al., 2011), perceived stress was demonstrated to strongly influence the “drive to eat” among participants, which included 457 women from Northern California. The researchers measured restraint, disinhibition and hunger through the Eating Inventory (Stunkard et al., 1985) and binge eating tendencies through the Binge Eating Scale (Gormally et al., 1982). Stress was measured through the Perceived Stress Scale (Cohen et al., 1988). A food frequency questionnaire was also included to measure frequency with which “palatable non-nutritious foods” and nutritious foods are typically consumed. The results showed that the more perceived stress a woman experienced, the more likely she was to eat palatable non-nutritious foods (e.g. “junk foods”) and display a higher “drive to eat,” which would increase the likelihood that bingeing or overeating would occur and less desirable food choices would be made.

As mentioned earlier, current research on yoga shows that individuals who practice regularly tend to perceive less stress (Brisbon et al., 2009, Hewett et al., 2011). Since research has also shown that individuals practicing yoga tend to have lower BMIs than non-practitioners, perceived stress could potentially play a major role in how much and what individuals practicing yoga are eating.

Benefits of Pranayama Practice

Pranayama, or breath control, is the 4th of the Eight Limbs of yoga and is typically practiced in a comfortable, seated position in which the spine is kept upright. Often, prana is defined as the “life-force” and, in the yogic tradition, it is believed that through controlling the life-force, or prana, longevity is increased. Conscious breathing also seems to help people to stay in the present moment. As Swami Satchidananda says in his translations of the Yoga Sutras, “By regulating the *prana*, we regulate our minds, because the two always go together. If one is controlled, the other is automatically controlled as well,” (Satchidananda ,1978). Typically, the yogic breath during asana practice is through the nostrils, but other techniques may include breathing through the mouth, practicing breath retention, engaging the abdominals or even making use of sound. As BKS Iyengar, known as the “Father of Modern Yoga,” states, “evenness of breathing leads to healthy nerves and so to evenness of mind and temper,” also adding “its practice leads to longevity,” (Iyengar, 1979). In *Light on Yoga*, known as a modern-day foundational text on yoga, Iyengar suggests particular techniques of breath control for improving health. For example, he suggests that “Surya Bhedana Pranayama,” referred to as alternate nostril breathing, may help to “increase digestive power [and] soothe and invigorate the nerves” (Iyengar, 1979), while practicing “Bhastrika” or “Kapalabhati” may “activate and invigorate the liver, spleen, pancreas and abdominal muscles,” (Iyengar, 1979). Kapalabhati breathing (a technique that encourages the practitioner to contract the abdominal muscles during each exhale), may in fact be useful for improving symptoms of gastrointestinal diseases, Gastroesophageal Reflux Disease, in particular, by strengthening the diaphragm (Kaswala et al.,2013). These practices are a fundamental aspect of traditional yoga practice and may be frequently employed by serious yoga practitioners.

Currently, there is little research regarding the effects of pranayama, but interest in breath control is growing. One study, in particular, measured the amount of test anxiety experienced by school-age children following pranayama. Children who were in the experimental group experienced half as much anxiety than the control group and their test scores were actually better, demonstrating an inverse correlation between anxiety and test scores (Nemati et al., 2013). In another study, men practicing pranayama techniques demonstrated a reduction of anticipatory responses to external stimuli, which the authors felt may be due to a reduced susceptibility to impulsivity following the practice (Telles et al., 2013). Pranayama techniques may also be useful in improving fine motor skills as evidenced by a significant improvement in finger dexterity and visual discrimination among individuals seeking treatment for stress management following yogic breath work (Telles et al., 2012). Each of these outcomes connects back to improved mindfulness that resulted from the breath work. None of the above studies assessed potential changes that could have occurred in diet, but reduced anxiety and reduced habitual responses to external stimuli may both be beneficial in how they affect dietary choices.

Benefits of Meditation Practice

Meditation is another foundational practice of yoga being the seventh limb of the traditional Ashtanga Practice known as “Dhyana” typically translated as “meditation” or “contemplation.” In the Yoga Sutras, Dhyana is explained as “sustained concentration, whereby the attention continues to hold or repeat the same object or place,” (Satchidananda, 1978). Although many studios may not include lengthy meditations in their asana classes, various forms of meditation may be weaved into typical classes. It is not uncommon for studios to offer regular classes in meditation or a special workshop to help students develop their practices. In fact, some consider “asana” or the physical postures in yoga to be a form of moving meditation. There are

countless techniques that can be utilized in meditation, the most common of which is probably “mantra” meditation, or the silent repetition of a word or phrase that may or may not be coordinated with the breath.

When practicing meditation, individuals are usually encouraged to choose a comfortable seat and close their eyes, allowing thoughts to settle and becoming aware of the breath. Meditations lasting about 20 minutes are common, but experienced meditators and devoted yoga practitioners may reserve several hours of their day to meditation practice. As the individual meditates, distracting thoughts may arise, which he/she is encouraged to notice, but not necessarily follow, returning focus instead back to his/her meditation. Traditional meditation practice encourages complete stillness during the meditation’s duration. Through this stillness, uncomfortable sensations may occur, for example, an itch or a limb “falling asleep,” and rather than attending to these sensations, meditators allow themselves to experience them while continuing to focus their attention on the meditation rather than the sensation. Aside from physical discomforts, when one sits in silence and removes the possibility for external distractions, emotional discomforts may also come up, which again, are noticed but not fixated on, rather, meditators are encouraged to simply let them go and return their attention inward. Overtime, physical or emotional distractions are expected to occur less frequently during meditation practice. Perhaps by allowing themselves to experience these forms of discomfort, meditators are less likely to spend time avoiding uncomfortable thoughts or experiences and may be better equipped to deal with them “head—on” by recognizing the temporality of the experience or their own ability to separate themselves from the discomfort by not identifying with it. As Kristeller et al. write,

“While meditation is recognized to have powerful impact as a ‘relaxation’ tool, it is more

appropriately viewed as a way to cultivate a particular quality of attention and awareness, which then mediates self-regulation across multiple domains of functioning, including physical, emotional, behavioral, and relationship to self and others.” (Kristeller and Wolever, 2011)

In other words, meditation’s benefits translate across the multiple dimensions of our existence: mind, body and soul. In their book, *Jivamukti Yoga*, renowned yoga practitioners and instructors, Shannon Gannon and David Life, write on of their experience on meditation...

“After a period of not engaging with the thoughts, they begin to quiet down. Space between the thoughts becomes apparent. The silence out of which thoughts originate is continuous... Your state of consciousness begins to shift, from a condition of fragmentation to one of concentration. This shift in consciousness is typified by a peaceful feeling, which affects body and mind. This peacefulness is the result of identifying with the infinite rather the finite, which we experience as thoughts.” (Gannon, 2002)

Research has confirmed meditation’s usefulness in helping to improve levels of mindfulness. Moore and Milinowske (2009), for example, studied the effects of meditation on cognitive flexibility and self-reported mindfulness comparing a group of Buddhist meditators with a group of non-meditators. Results showed that the meditators demonstrated significantly higher degrees of both self-reported mindfulness [determined by the Kentucky Inventory of Mindfulness Skills (KIMS)] and attentional performance (Baer et al., 2004). Higher levels of total mindfulness (determined by the KIMS) were correlated with higher displays of mindfulness within each of the measured sub scales, including, “observe,” “describe,” “aware,” and “accept,” (Moore et al., 2009). Meditators also outscored non-meditators in their abilities to de-automate their responses and concentrate in an environment of distraction measured by the Stroop task (Macleod et al.,

1991, Stroop 1935). The d2—Concentration and Endurance test (Brickenkamp et al., 1962) was also administered to both groups to measure attention and concentration performance. On both tests, non-meditators had more errors than meditators, who were faster and more accurate when completing their tasks. Cognitive flexibility may help meditators to avoid falling back into old patterns, allowing them instead, to create new habits.

Monk-Turner (2003) studied the effects of a 14-week meditation practice on a group of students attending a university in Virginia. Students in the experimental group practiced meditation for at least 10 minutes at a time, biweekly over the course of the 14-week intervention. When compared to the control group of non-meditating students, the meditators exhibited less negative reactions to receiving criticism with 64% of meditators indicating they *rarely* were “upset over criticism,” compared with 33% at the pre-test that measured the frequency of various ailments and emotions. Meditators also seemed to reduce the frequency with which they experienced feelings of “upset” (Monk-Turner 2003). Following the interventions, meditators were also less likely to self-medicate with drugs, such as “street drugs” or “tranquilizers” and experience joint and muscle pain compared with non-meditators.

Meditation’s effects on well-being were also demonstrated by Li-Chuan Chu (2010) in a study exploring how its practice relates to emotional intelligence (assessed using the Emotional Intelligence Scale (EIS) (Schutte et al., 1998), perceived stress (Cohen et al., 1983) and other mental health parameters (measured through the general health questionnaire—GHQ) (Goldberg and Hillier, 1979). The Emotional Intelligence Scale (EIS) consists of 33 items that are designed to determine the “appraisal and expression” and “regulation and utilization” of emotions. As the author hypothesized, meditation practitioners exhibited more developed emotional intelligence as measured by the four factors of the EIS, including how individuals utilize emotion, regulate their

moods, appraise their emotion and practice social skills. Higher EI scores correlated with lower scores on the Perceived Stress Scale (Cohen et al., 1983) and lower incidence of negative mental health. This suggests that individuals who meditate for at least twenty minutes daily experience less stress, have an improved ability to recognize and utilize emotions appropriately and are less susceptible to aspects of negative mental health such as depression, anxiety and insomnia among other mental health parameters. The ability to manage emotions skillfully may reduce the amount of “emotional eating” that an individual participates in. Similarly, Schreiner and Malcolm (2008) explored the benefits of meditation, mindfulness meditation, in particular, against stress, depression and anxiety. Meditations occurred weekly for two hours over the course of 10 weeks and included what the authors referred to as five core components that included “present-centered awareness,” “attention training,” “objective, nonreactive observation,” “open receptiveness,” and “impersonal awareness.” Individuals were also encouraged to practice meditation techniques at home. Following the interventions, individuals who exhibited severe depression at the onset of the meditation program experienced significant decreases in their depression symptoms. Anxiety and levels dropped significantly among individuals with both moderate and severe symptoms following the meditation program.

Yoga Practice and Health

In addition to the positive effects yoga has on one’s mental well-being, Yoga practice may also be associated with greater physical well-being, of which, diet plays a major role. Research has shown that yoga practice may be beneficial for managing metabolic syndrome symptoms (Khatri and Gahlot, 2007), improving lipid profiles (Shantakumari et al., 2013), managing Type 2 Diabetes Mellitus (Singh et al., 2008), reducing symptoms of irritable bowel syndrome (Cousins et al., 2011), and alleviating lower back pain (Sherman, 2012). Anxiety (Sherman,

2009) and depression symptoms decrease (Cramer et al., 2013) and sleep quality (Vera et al., 2009) seems to improve with the adoption of a yoga practice.

Implications

The increasing magnitude of the obesity epidemic has inspired the exploration of new approaches for healing people's relationship with food. Yoga shows promise in helping to normalize eating habits through increased mindfulness. Practices of pranayama, meditation and the study of yogic philosophy also are beneficial in improving mindfulness that may have desirable outcomes when considering the diet. Yoga practice may also assist in creating lasting and healthy dietary habits through increasing body awareness and allowing practitioners to better tune into their hunger and fullness levels rather than eating as a result of external factors. Increased body awareness may also help to encourage practitioners to make healthier dietary choices. Reduced levels of stress that seem to occur with frequent and consistent yoga practice may lessen the frequency with which individuals engage in "stress eating." Overall, yoga practice may be a useful strategy for maintaining or losing weight and improving diet quality.

Methods

The purpose of this study was to establish how dietary habits are related to yoga practice. To explore the relationships between specific yoga practices, mindful eating habits and dietary quality, a 51-item survey was developed (Appendix 1). The survey consisted of four parts: demographic information, yoga practice, mindful eating habits, and lastly, a food frequency questionnaire. Prior to distributing the survey, IRB approval was obtained through Syracuse University's Office of Research Integrity and Protection.

The survey was designed using Qualtrics Survey Software and was distributed to a local yoga studio that offers a variety of classes and different styles of yoga. Classes typically last for 75 minutes and range in intensity. The studio usually offers four different classes a day, with classes offered seven days a week. All instructors at this particular studio have completed at least 200 hours of yoga teacher training. Participants were reached by email through the yoga studio's listserv. The survey was open for two weeks with a reminder email sent after the first week to allow email recipients ample time to participate. The survey was sent to approximately 2,200 individuals who belonged to the studio's listserv. Overall, the response rate was 4%; upon closing the survey, ninety-three participants responded, but only 88 completed responses were included in the analysis.

Survey Design

Demographic Information

In this section of the survey, indices examined included sex, age, race, education level, height and weight. BMI was calculated to classify individuals according to their BMI (weight in pounds x 703/ inches²). BMI under 18.5 kg/m² was considered underweight, 18.5-24.9 kg/m²

was considered normal, 25-29.9 kg/m² was considered overweight and a BMI over 30 kg/m² was considered obese (CDC, 2014).

Yoga Practice

This section consisted of 13-items that listed particular styles of yoga practice, location of practice, e.g., at home or in a studio, frequency of practice of pranayama, meditation, asana and study of yoga philosophy, frequency of yoga practice per week, time in minutes of typical practice and years of experience practicing yoga. Questions were also included on whether yoga was practiced for weight loss and the number of minutes per week respondents typically engaged in physical activity other than yoga practice. For each participant, *minutes of typical yoga practice was multiplied by number of practices per week* to determine the number of minutes yoga is typically practiced per week. This was further broken down into five categories (20-60 minutes, 61-120 minutes, 121-200 minutes, 201-300 minutes, and 301 or more minutes). Weekly yoga practice was broken down into four categories, namely once a week, 2-3 times a week, 4-5 times a week and 6-7 times a week for analysis. Years of yoga experience was categorized for analysis as follows: 0.5-2 years, 3-5 years, 6-9 years and 10 or more years.

Mindful Eating Habits

This section consisted of The Mindful Eating Questionnaire developed by Framson et al., (2009). The 28-item survey included five subscales to determine mindful eating habits, “*disinhibition*,”—“the inability to stop eating even when full”; “*awareness*,”—“being aware of and appreciating the effects of food on the senses”; “*external cues*,”—“eating in response to external cues”; “*emotional response*”—“eating in response to negative emotional states”; and “*distraction*,”—“focus on other activities while eating” (Framson et al., 2009). Questions measured frequency with which an individual is mindful during certain eating activities or within

particular food environments, including dining out at a restaurant and going to the movie theater and ordering popcorn. Respondents were able to choose “never/rarely,” “sometimes,” “often,” and “usually” based on their typical habits. This section was scored according to specifications determined by Framson et al., (2009). Answers were coded on a scale with “never/rarely” indicating a value of 1 and “usually” indicating a value of 4, except for several items that were reversed scored. Each subscale was scored separately and these were averaged together to determine the total score for mindful eating. Higher scores indicated more mindful eating habits.

Dietary Intake

This section consisted of the NHANES Dietary Screener Questionnaire (DSQ) (National Cancer Institute 2014). A variety of foods were included to measure usual intake of foods such as fruits, vegetables, meat, whole grains and added sugars, including green leafy vegetables, sugar-sweetened beverages, fruit, beans, processed meat, red meat, cheese and chocolate. All responses were coded to determine daily food frequency using the values provided by NHANES (included below).

Never = 0 times a day

Once last month = 0.033 times a day

Two to three times last month = 0.083 times a day

Once per week = 0.143 times a day

Twice per week = 0.286 times a day

3-4 times per week = 0.5 times a day

5-6 times per week = 0.786 times a day

Once per day = 1 time a day

Two times per day = 2 times a day

Two or more times per day = 2.5 times a day

Values from the daily food frequencies above were then multiplied by seven to determine estimated servings per week of each food included in the dietary screener.

Using the algorithms developed by NHANES, data collected from the dietary screener along with information on the participants' sex and age were used to determine estimated daily cup equivalents for fruit and vegetable and dairy intake, teaspoons of added sugars (tsp), milligrams of calcium (mg), grams of fiber (g), and ounce equivalents for whole grains. For example, predicted daily cup equivalents of fruits and vegetables was calculated using the algorithm below (N_{FGK} = times consumed per day, P_k = portion size and K = food type) (NHANES, 2014).

$$E ([Fruits and Veg]^{1/2}) = b_0 + b_1([N_{FG1}P_1 + N_{FG2}P_2 + \dots + N_{FG10}P_{10}]^{1/2})$$

A SAS program made available from NHANES was used to score the dietary screener using the determined algorithms (NHANES, 2014). Calculated values were used to assess overall dietary quality, but specific foods were also considered in the analysis to

determine intake trends for foods of interest (meat, milk, sweets, fruits and vegetables, etc.).

Predicted daily values (including fruit/vegetables, calcium, added sugar, fiber and whole grains) were analyzed to create a comprehensive picture of dietary quality. Foods used to calculate predicted daily intakes are listed below (NHANES, 2014). If an individual missed or skipped a question about a particular food, predicted intakes could not be calculated for any of the values that required the food in the analysis.

Predicted fruits and vegetables (cup equivalents):

<i>Fruit</i>	<i>Dried beans</i>
<i>100% fruit juice</i>	<i>Other vegetables</i>
<i>Salad</i>	<i>Tomato sauce</i>
<i>Fried potatoes</i>	<i>Salsa</i>
<i>Other potatoes</i>	<i>Pizza</i>

Predicted dairy (cup equivalents):

<i>Cheese</i>	<i>Milk</i>
<i>Pizza</i>	<i>Frozen desserts</i>

Predicted added dietary sugar (teaspoons):

<i>Hot cereals</i>	<i>Sports drinks</i>
<i>Cold cereals,</i>	<i>Frozen desserts</i>
<i>Soda</i>	<i>Cookies/cake/pie/brownies</i>
<i>Sugar/honey in coffee/tea</i>	<i>Doughnuts</i>

Predicted added dietary sugar from sugar-sweetened beverages (teaspoons):

<i>Soda</i>	<i>Sugar/honey in coffee and tea</i>
-------------	--------------------------------------

Sports drinks

Predicted whole grains (grams)

Hot cereals

Whole grain bread

Cold cereals

Popcorn

Brown rice

Predicted fiber and predicted calcium (grams)

Hot cereals

Cheese

Tomato sauce

Cold cereals

Pizza

Salsa

Soda

Milk

Fruitades/Sports

Sugar/honey in

Fruit

drinks

coffee/tea

100% fruit juice

Brown rice

Candy

Salad

Whole grain

Doughnuts

Fried potatoes

bread

Cookies, cake,

Other potatoes

Popcorn

pie, brownies

Dried beans

Frozen desserts

Other vegetables

Two questions were added on to the dietary section of the survey to determine whether the participant was currently following a vegetarian or vegan diet and to measure how important it was to the participant to purchase foods that were organic, local or seasonal. Diets high in daily consumption of fruits, vegetables, whole grains and low in foods/beverages with added sugars were considered to be of higher dietary quality than those that were not.

Analysis

All compiled data were analyzed using SPSS Statistics Software Version 22. Six participants were excluded from data analysis. For example, one participant was excluded after indicating that yoga practice had not yet begun. One participant was also excluded after indicating that she was pregnant. Three participants were also excluded for starting, but failing to complete the survey. One participant was excluded after indicating that yoga practice is undertaken once a week for 5 minutes which was not considered enough to make a noticeable difference in either dietary quality or mindful eating habits.

To determine how yoga practice relates to mindful eating habits and dietary quality, dietary habits measured by the food frequency questionnaire were compared with the following factors: years of yoga practice, days per week of yoga practice, minutes of yoga practice per week and mindful eating score. To facilitate analysis, participants were categorized into four categories based on years of yoga experience, including 0.5-2 years (n = 26), 3-5 years (n = 26), 6-9 years (n = 17) and 10 or more years (n = 19). The chosen categories are different from those assigned by Framson et al., (2009) who used 3 categories (<2 years, 2-4 years and 5 or more years), but allowed for improved distribution of the sample. Four categories were also used to classify participants based on days of yoga practice per week, including once per week (n = 21), 2-3 times per week (n = 35), 4-5 times per week (n = 23) and 6-7 times per week (n = 9). Lastly, participants were classified according to minutes of yoga practice per week, which included five categories, namely 20-60 minutes per week (n = 5), 61-120 minutes per week (n = 17), 121-200 minutes per week (n = 20), 201-300 minutes per week (n = 25) and 301 or more

minutes per week ($n = 19$). Categories were chosen to capture differences in dietary quality and mindful eating practice among individuals at different stages of their yoga practice.

One-Way ANOVA tests with Bonferroni post-hoc analysis ($p < 0.05$) were used to analyze differences between the means for available data. Distribution did not follow a normal pattern.

Results

Table 1: Summary of Sample Demographic Characteristics (n=88)

	Category	Frequency (n)	%
Sex	Male	13	14.8
	Female	75	85.2
Race	White	85	96.6
	Asian	1	1.1
	Other	2	2.3
Education Level	High School	5	5.7
	Bachelor	42	47.7
	Master's	26	29.5
	Doctorate	15	17.0
BMI (kg/m²)	<18.5 (Underweight)	3	3.4
	18.5-24.9 (Normal)	60	69.0
	25.0-29.9 (Overweight)	21	24.1
	>30.0 (Obese)	3	3.4
	Total	88	100.0

Table 1: BMI = pounds x 703/ in². Mean +/- standard deviation for BMI = 23.35 +/- 3.05.

Eighty five percent of respondents were female and about 15% were male (Table 1). Nearly 97% of respondents identified themselves as white, 1.1% as Asian and 2.3% identified as “other” (Table 1). African American and Native Hawaiian populations were not represented. About 6% held a high school degree, 47.7% a bachelor’s degree, 29.5% a master’s degree and 17% a doctoral degree (Table 1). BMI ranged from 17.48-31.36kg/m², with a mean value of 23.23 kg/m² (Table 1). Mean age was approximately 37 years with a range from 20-60. The majority of participants found shopping locally, seasonally and organically somewhat important to very important and 26% of the population reported practicing a vegetarian or vegan diet (Appendix 2).

Yoga Practice

Table 2: Description of Sample Population's Typical Yoga Habits (n=88)

Practice	Response	%
Home Practice	Yes	51.1 n=45
	No	48.9 n=43
Studio Practice	Yes	90.3 n=84
	No	4.3 n=4
Study Philosophy	Yes	34.5 n=30
	No	65.5 n=57
Minutes Studying Yoga Philosophy Per Week	0-10	73.3 n=63
	11-20	3.5 n=3
	21-30	10.5 n=9
	31-40	2.3 n=2
	41-50	0 n=0
	51-60	7.0 n=6
Minutes Meditation Per Practice	0-10	83.5 n=71
	11-20	10.6 n=9
	21-30	3.5 n=3
	31-40	0 n=0
	41-50	1.2 n=1

	51-60	1.2 n=1	The population had a mean of approximately 6 years of yoga practice (standard deviation = 5.81) and practiced approximately 3 days a week (standard deviation = 1.73). Forty-five percent of respondents reported having a home practice and 90.3% reported practicing in a studio (Table 2), although these were not mutually exclusive and, in fact, 42% percent practiced both at home and at a
Minutes of Pranayama Per Practice	0-10	59.3 n=51	
	11-20	19.8 n=17	
	21-30	8.1 n=7	
	31-40	0 n=0	
	41-50	1.2 n=1	
	51-60	3.5 n=3	
	61-90	8.1 n=7	
Minutes of Asana Per Practice	0-10	4.5 n=4	
	11-20	6.8 n=6	
	21-30	5.7 n=5	
	31-40	1.1 n=1	
	41-50	13.6 n=12	
	51-60	19.3 n=17	
	61-90	46.6 n=41	
	Over 90	2.3 n=2	

studio. Approximately 35% of respondents included self-study of yogic texts or philosophy in their practice, but 85% spent 10 or less minutes studying yoga philosophy (Table 2). Nearly 60% of respondents spent 10 or less minutes practicing pranayama or breath work and about 84% spent 10 or less minutes in meditation during each practice

(Table 2). However, nearly half of respondents spent between 61-90 minutes practicing yoga during each session (Table 2).

Yoga Practice and Mindful Eating Score

As previously mentioned, the Mindful Eating Questionnaire (MEQ) (Framson et al., 2009) includes 5 subscales to measure mindful eating habits including “*disinhibition*,”—“the inability to stop eating even when full”; “*awareness*,”—“being aware of and appreciating the effects of food on the senses”; “*external cues*,”—“eating in response to external cues”; “*emotional response*”—“eating in response to negative emotional states”; and “*distraction*,”—“focus on other activities while eating” (Framson et al., 2009). Scores from the subscales are averaged together to determine the mean MEQ score. The overall mean scores for the Mindful Eating Questionnaire (MEQ) did not demonstrate significant differences between group variation within categories for years of yoga practice, minutes of practice per week or days of practice per week, but individuals with the most years of yoga experience seemed to score higher on the MEQ than individuals with less years of experience (Table 3).

Table 3: Mindful Eating Scores and Yoga Practice (n = 88)

Mindful Eating Score	1.00-2.50 (n= 9)	2.51-3.00 (n=30)	3.01-3.50 (n=45)	3.51-4.00 (n=4)
Mean Years of Yoga Practice	5.44 (3.92)	5.37 (5.04)	6.59 (6.49)	8.50 (7.51)
Mean Days of Yoga Practice Per Week	3.61 (2.12)	3.13 (1.68)	3.26 (1.75)	3.13 (1.44)
Mean Minutes of Yoga Practice Per Week	249.56 (146.19)	225.08 (126.42)	235.73 (154.17)	168.75 (67.50)

Table 3: Mindful Eating Scores are scaled from 1.00-4.00 with 4.00 indicating a higher level of mindful eating habits (Framson et al., 2009). Standard deviation is reported in parenthesis.

Sub-scores for *external* and *awareness* were also highest among individuals with 10 or more years of yoga experience (Table 4).

Table 4: Years of Yoga Practice and Mean Sub-scores of the Mindful Eating Questionnaire (n=88)

Mean Mindful Eating Sub-scores	½-2 Years (n=26)	3-5 Years (n=26)	6-9 Years (n=17)	10 or more Years (n=19)	Population Mean
Disinhibition	3.22 (0.44)	3.04 (0.64)	3.18 (0.44)	3.17 (0.47)	3.15 (0.51)
External	2.61 (0.53)	2.74 (0.52)	2.58 (0.45)	2.86 (0.39)	2.70 (0.49)
Distraction	2.92 (0.47)	2.94 (0.61)	2.94 (0.63)	2.88 (0.51)	2.92 (0.55)
Awareness	2.87 (0.66)	2.97 (0.74)	2.97 (0.54)	3.04 (0.60)	2.96 (0.64)
Emotional	3.37 (0.48)	2.96 (0.65)	3.19 (0.70)	3.28 (0.66)	3.19 (0.63)

Table 4: The MEQ (Framson et al. 2009) is scored out of 4.00 points, with higher scores indicating more mindful habits. The scores for the subscales, disinhibition, external, distraction, awareness and emotional response are averaged together to determine mean mindful eating score. Standard deviation is reported in parenthesis.

Years of Yoga Practice and Dietary Quality

Table 5: Mean Predicted Daily Intake and Years of Yoga Practice

Mean Predicted Intake	½-2 Years	3-5 Years	6-9 Years	10 or more Years	Population Mean
Fiber (g) (n=79*)	14.72 (4.04)	16.63 (5.57)	14.71 (4.26)	17.39 (4.31)	15.90 (4.72)
Calcium (mg) (n=79*)	645.69 (165.55)	778.62 (501.43)	607.22 (156.20)	680.00 (213.46)	687.84 (320.74)
Added Sugar (tsp) (n=81*)	8.24 (4.82)	9.04 (3.88)	7.23 (3.59)	9.80 (4.74)	8.62 (4.31)
Whole Grains (oz) (n=83*)	1.15 (0.77)	1.39 (1.38)	1.15 (1.11)	1.57 (1.61)	1.31 (1.23)
Dairy (Cup) (n=82*)	1.04 (0.57)	1.17 (0.99)	0.85 (0.48)	0.98 (0.61)	1.03 (0.71)
Fruit/Vegetables/Legumes (Cup) (n=82*)	2.73 (1.07)	2.99 (0.94)	2.60 (0.74)	3.28 (0.85)	2.91 (0.94)
Added Sugar from SSBs (tsp) (n=85*)	2.22 (2.76)	2.24 (2.66)	1.02 (1.63)	2.33 (3.24)	2.03 (2.67)

Table 5: Predicted daily intake for the above was determined through algorithms specific to the DSQ (Dietary Screener Questionnaire) determined by NHANES to account for age and gender in its calculation. Standard deviation is reported in parenthesis. *Predicted values could not be calculated for certain categories if the respondent failed to answer a question on the DSQ for a food needed to perform the algorithm, which affected the size of the sample.

Daily whole grain intake (ounce equivalents) (1.57, mean = 1.31) and daily fiber intake (17.39 g, mean = 15.9) was highest among individuals with 10 or more years of experience (Table 5). Predicted daily fruit/vegetable/legumes (in cups) was highest for individuals with 10 or more years of experience (3.28 cups, mean = 2.91 cups) (Table 5). Consumption of added sugar (1.02 tsp, mean = 2.03 tsp) and dairy (0.85 cups, mean = 1.03 cups) was lowest among individuals who had 6-9 years of experience, but was otherwise fairly steady (Table 5). Daily dairy intake (1.17 cups, mean = 1.03) and subsequently, calcium intake (mg) was highest among individuals with 3-5 years of experience (778.62 mg, mean = 687.84) (Table 5).

Nineteen percent of individuals who have been practicing yoga for 0.5-2 years indicated following vegetarian/vegan diets compared with 42% of individuals who have been practicing for 10 or more years (Appendix 3). Although not statistically significant, vegetarian/vegan diets seemed to steadily be more common among individuals with more years of experience.

Days of Yoga Practice Per Week and Dietary Quality

Table 6: Mean Predicted Daily Intake and Days of Yoga Practice Per Week

Mean Predicted Intake	Once Per Week	2-3 Times Per Week	4-5 Times Per Week	6-7 Times Per Week	Population Mean
Fiber (g) (n=78*)	18.75 (3.66)	15.00 (5.02)	14.96 (3.97)	16.79 (5.74)	15.92 (4.75)
Calcium (mg) (n=78*)	671.78 (168.08)	708.34 (455.19)	654.69 (150.21)	740.64 (282.61)	687.84 (322.29)
Added Sugar (tsp) (n=80*)	9.23 (4.54)	8.99 (4.90)	7.69 (3.21)	8.64 (4.52)	8.64 (4.33)
Whole Grains (oz) (n=82*)	1.68 (1.03)	1.10 (1.03)	1.30 (1.56)	1.21 (1.36)	1.29 (1.23)
Dairy (Cup) (n=81*)	0.96 (0.57)	1.02 (0.89)	1.04 (0.51)	1.22 (0.75)	1.03 (0.72)
Fruit/Vegetables/Legumes (Cup) (n=81*)	3.22 (0.91)	2.76 (0.92)	2.80 (0.94)	3.16 (1.11)	2.92 (0.95)
Added Sugar from SSBs (tsp) (n=84*)	1.93 (3.01)	2.15 (2.89)	1.99 (2.35)	2.07 (2.22)	2.05 (2.68)

Table 6: Predicted daily intake for the above was determined through algorithms specific to the DSQ (Dietary Screener Questionnaire) determined by NHANES to account for age and gender in its calculation. Standard deviation is reported in parenthesis. *Predicted values could not be calculated for certain categories if the respondent failed to answer a question on the DSQ for a food needed to perform the algorithm, which affected the size of the sample.

Predicted consumption of dairy was highest among individuals who practiced 6-7 times per week, but this group also had the smallest sample size (Table 6). Added sugar was highest among individuals who practiced once per week (Table 6). Although it was not significant, predicted fruit/vegetable/legume intake was highest among individuals who practiced once per week (Table 6). Once again, this may have been due to the

sample size.

Minutes of Yoga Practice Per Week and Dietary Quality

Table 7: Predicted Daily Intake and Minutes of Yoga Practice Per Week

Mean Predicted Intake	20-60 Minutes	61-120 Minutes	121-200 Minutes	201-300 Minutes	>300 Minutes	Population Mean
Fiber (g) (n=77*)	18.79 (4.38)	16.98 (3.49)	14.74 (5.66)	16.06 (4.33)	14.85 (4.71)	15.75 (4.66)
Calcium (mg) (n=77*)	637.24 (190.65)	643.92 (165.80)	651.08 (172.79)	764.47 (519.99)	642.28 (172.80)	680.85 (317.53)
Added Sugar (tsp) (n=79*)	8.07 (5.02)	8.59 (2.86)	8.60 (5.39)	9.91 (4.66)	7.03 (3.41)	8.57 (4.35)
Whole Grains (oz) (n=81*)	2.33 (1.33)	1.38 (0.87)	1.00 (1.13)	1.52 (1.51)	1.01 (1.12)	1.31 (1.24)
Dairy (Cup) (n=80*)	0.82 (0.46)	0.92 (0.62)	0.96 (0.51)	1.17 (0.10)	1.02 (0.59)	1.02 (0.71)
Fruit/Vegetables/ Legumes (Cup) (n=80*)	3.03 (0.70)	3.12 (0.96)	2.69 (0.92)	2.91 (0.94)	2.85 (1.01)	2.89 (0.94)
Added Sugar from SSBs (tsp) (n=83*)	2.40 (4.12)	1.13 (1.49)	2.34 (3.18)	2.71 (3.11)	1.41 (1.80)	2.00 (2.70)

Table 7: Predicted daily intake for the above was determined through algorithms specific to the DSQ (Dietary Screener Questionnaire) determined by NHANES to account for age and gender in its calculation. Standard deviation is reported in parenthesis. *Predicted values could not be calculated for certain categories if the respondent failed to answer a question on the DSQ for a food needed to perform the algorithm, which affected the size of the sample.

Minutes of yoga practice per week did not seem to be positively associated with predicted daily intakes for fiber, calcium, added sugar, whole grains, dairy, fruit/vegetables/legumes or added sugar from sugar sweetened beverages (SSBs) (Table 7). Individuals who practiced for the most minutes during the week consumed the least amount of added sugar in their diets. Interestingly, individuals who practiced between 20-60 minutes each week consumed the most fiber and individuals who practiced between 61-120 minutes per week consumed the most fruit, vegetables and legumes.

Minutes of Other Physical Activity Per Week

In terms of physical activity other than yoga practice, there were no significant differences in dietary habits among individuals who participated in “other” physical activity. Relationships between physical activity and dietary quality did not demonstrate much consistency among individuals who spent more time engaging in physical activity.

Mindful Eating Score

Mindful Eating and Dietary Quality

Table 8: Mean Predicted Daily Intake and Mindful Eating Score

Mean Predicted Intake	1.00-2.50	2.51-3.00	3.01-3.50	3.51-4.00	Population Mean
Fiber (g) (n=79*)	18.02 (6.54)	15.96 (4.89)	15.50 (4.47)	15.71 (1.27)	15.90 (4.72)
Calcium (mg) (n=79*)	689.56 (281.08)	764.72 (468.96)	636.78 (182.01)	664.02 (80.11)	687.84 (320.74)
Added Sugar (tsp) (n=81*)	8.84 (3.32)	8.26 (4.72)	8.98 (4.36)	6.26 (1.44)	8.62 (4.31)
Whole Grains (oz) (n=83*)	1.71 (1.54)	1.32 (1.11)	1.21 (1.28)	1.55 (1.16)	1.31 (1.23)
Dairy (Cup) (n=82*)	1.03 (0.66)	1.23 (0.93)	0.89 (0.55)	1.20 (0.17)	1.03 (0.71)
Fruit/Vegetables/ Legumes (Cup) (n=82*)	3.20 (0.83)	2.80 (0.91)	2.95 (0.10)	2.58 (1.06)	2.91 (0.94)
Added Sugar from SSBs (tsp) (n=85*)	1.89 (1.90)	2.03 (2.67)	2.16 (2.93)	0.83 (0.86)	2.03 (2.67)

Table 8: Predicted daily intake for the above was determined through algorithms specific to the DSQ (Dietary Screener Questionnaire) determined by NHANES to account for age and gender in its calculation. Standard deviation is reported in parenthesis. *Predicted values could not be calculated for certain categories if the respondent failed to answer a question on the DSQ for a food needed to perform the algorithm, which affected the size of the sample.

Although weekly consumption of foods seemed to improve as MEQ score increased, mindful eating did not make a significant difference in terms of predicted daily intake of fiber, calcium, added sugar, whole grains, dairy, fruit/vegetables/legumes, but

individuals who scored in the highest bracket for the MEQ consumed less added sugar in their diets (Table 8).

Mindful Eating Score and BMI

Figure 1: BMI and Mean Mindful Eating Score

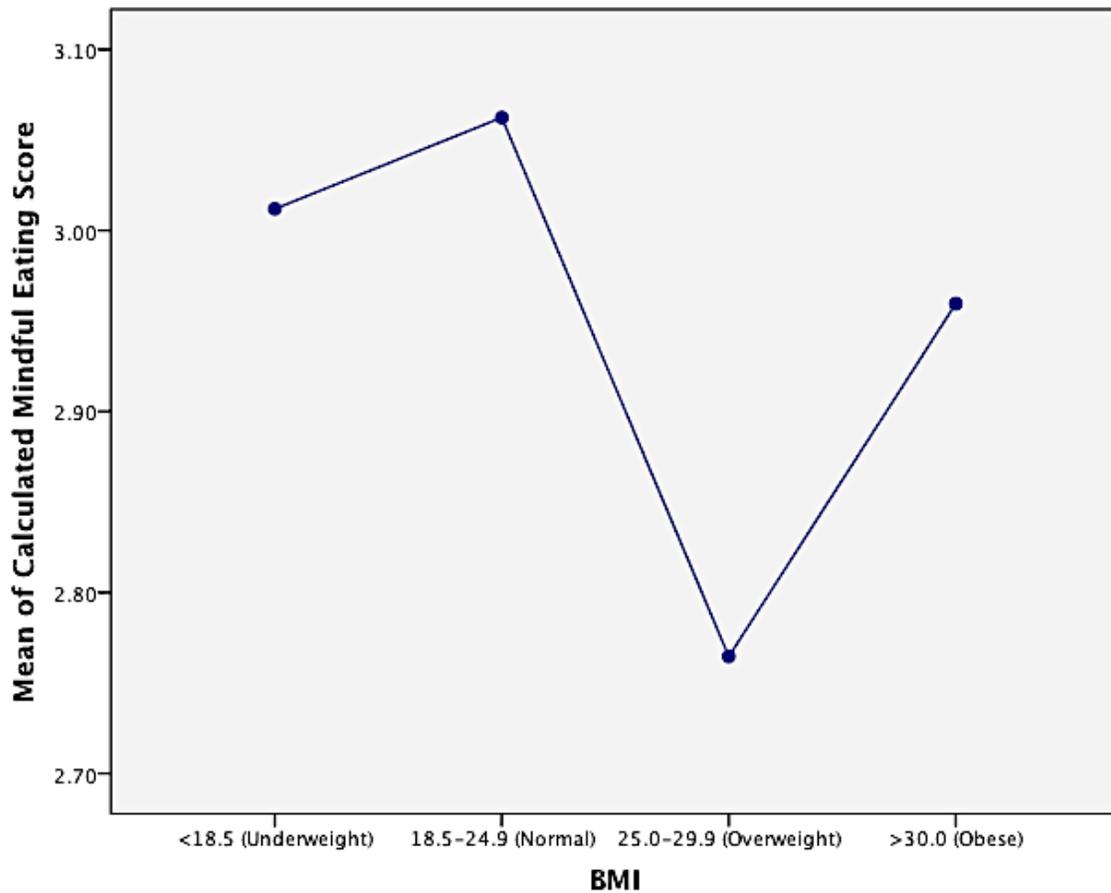


Figure 1: Mindful eating score is based on a scale of 1.00-4.00 with 4.00 indicating the highest level of mindful eating (Framson et al., 2009).

As Figure 1 demonstrates, mindful eating score was high among individuals with a BMI considered normal. Individuals who had a normal BMI scored higher than 3.06 on the MEQ compared to a score of 2.76 for those who had an overweight BMI (Appendix 4). Individuals with a normal BMI scored significantly higher than individuals with an

overweight BMI ($p = 0.009$) (Appendix 5). Individuals with an overweight BMI tended to score lower on all subscales of the MEQ in addition to a lower total mindful eating score. The sub-score for emotional response, in particular, was lowest among individuals with an overweight BMI (Appendix 4). In general, obese individuals had less years of yoga experience and spent less time practicing each week compared with members of other BMI groups.

Dietary Quality and BMI

Table 9: Mean Predicted Daily Intake and BMI

Mean Predicted Intake	<18.5 (Under-weight)	18.5-24.9 (Normal)	25.0-29.9 (Over-weight)	>30 (Obese)	Population Mean
Fiber (g) (n=79*)	16.17 (1.93)	15.19 (4.24)	18.20 (5.92)	13.77 (2.16)	15.90 (4.72)
Calcium (mg) (n=79*)	838.01 (124.94)	640.76 (164.63)	803.66 (575.42)	651.51 (274.17)	687.84 (320.74)
Added Sugar (tsp.) (n=81*)	16.23 (3.52)	7.96 (3.80)	9.11 (4.62)	9.80 (6.01)	8.62 (4.31)
Whole Grains (oz.) (n=83*)	0.59 (0.15)	1.19 (1.22)	1.83 (1.32)	0.96 (0.49)	1.31 (1.23)
Dairy (Cup) (n=82*)	1.48 (0.57)	0.94 (0.48)	1.22 (1.12)	0.90 (0.80)	1.03 (0.71)
Fruit/Vegetables/Legumes (Cup) (n=82*)	3.25 (1.30)	2.82 (0.92)	3.14 (0.99)	2.58 (0.84)	2.91 (0.94)
Added Sugar from SSBs (tsp.) (n=85*)	6.69 (2.14)	1.75 (2.23)	1.93 (2.47)	3.34 (5.35)	2.03 (2.67)

Table 9: Predicted daily intake for the above was determined through algorithms specific to the DSQ (Dietary Screener Questionnaire) determined by NHANES to account for age and gender in its calculation. Standard deviation is reported in parenthesis. *Predicted values could not be calculated for certain categories if the respondent failed to answer a question on the DSQ for a food needed to perform the algorithm, which affected the size of the sample.

Interestingly, predicted intakes from Table 9 showed individuals with a BMI <18.5 (underweight) had higher predicted SSBs consumption compared to people with either normal or overweight BMIs ($p = 0.009$ and $p = 0.002$), although this category

contained few participants and may not be reflective of typical patterns. Still, individuals with an underweight BMI consumed about 6.69 tsp. of added sugar daily from sugar-sweetened beverages, compared to normal BMI (1.75 tsp.), overweight BMI (1.93 tsp.) and obese BMI (3.34 tsp.) (Table 9). In fact, overall, underweight individuals consumed more added sugar than normal ($p = 0.006$) and overweight ($p = 0.036$) individuals.

(Appendix 6) No significant *between group differences* were observed in different BMI categories in terms of following a vegan or vegetarian diet, but individuals with a BMI >25 seemed less likely to follow such a diet (Table 9).

Discussion

Demographic Information

Although there were 93 responses, only 88 complete responses were used for data analysis. This study's participants were students from a small yoga studio in Syracuse, New York and the survey was distributed through email. The studio's instructors are all 200-hour certified or registered and a variety of classes are offered daily. Although the studio offers class packages, which are slightly less expensive, drop-in classes cost \$15.00 each, which excludes participants who may not have expendable income to regularly participate in yoga classes. The study population was not very diverse; the majority was well educated (94% had at least a bachelor's degree), 97% were white and 85% were women. Few men responded to the survey, which may have contributed to some degree of bias. Recent research on yoga has encountered a similar demographic (Penman et al., 2012, Ross et al., 2013). In general, women with a higher education level (undergraduate and beyond) may be more likely to participate in physical activity for leisure and health maintenance, which may have also influenced the results (Grzywacz and Marks, 2001).

Yoga Practice and Mindful Eating Habits

Yoga practice is useful for increasing mindfulness (Shelov et al., 2009, Brisbon et al., 2011, Hewett et al., 2011) and this study found that mindful eating scores were highest among individuals with a developed yoga practice. Yoga interventions have had success as a therapy method for multiple forms of eating disorders, including anorexia nervosa, bulimia, and binge eating (Carei, 2011, McIver, 2009). Each of these illnesses has different symptoms and effects on people, but yoga seems to help heal patients'

relationship to food, regardless, and has demonstrated successful outcomes with each, perhaps, in part, due to an increase in mindfulness. Neurobiology research using functional magnetic resonance imaging has identified physiological changes underlying mindfulness. These studies report amygdala deactivation suggesting a down regulation of negative emotions (Robins et al., 2013). Long-term yoga practice is believed to enhance emotional stability, attention and sensory capabilities primarily by enhancing awareness in the present moment and acceptance of different emotional states. This study found that individuals with more years of yoga experience and those who practiced more frequently during the week scored higher on the Mindful Eating Questionnaire. Ultimately, the purpose of mindfulness is not only to make one more aware of the present moment but also to increase focused attention without distraction. Frequent yoga practice together with long-term yoga experience facilitates acquisition of skills that are not limited just to the practice session; skills acquired can be extended outside of yoga practice to daily life experiences such as food and dietary patterns. Eating mindfully may lead to more conscious appreciation of food and its benefits and allow individuals to be more conscious of the nuances of the eating process in general such as preparation method, portion size, source of food and other emotions associated with food. The current study found that individuals with 10 or more years of experience scored higher on the MEQ although the relationship between yoga practice and mindful eating habits was not considered significant. Mindfulness is a skill that has to be developed over time with practice coupled with gradual increases in the duration and intensity of practice.

Higher mindful eating scores among individuals with more years of yoga experience seem potentially related to an increase in awareness scores. The awareness

subscale was configured to measure an individual's ability to be "aware of and appreciate the effects of food on the senses" suggesting that yoga helps individuals to better appreciate their food and how it makes them feel which may mean they are more involved in the sensual experience of eating. Individuals with 10 or more years of experience also demonstrated the highest scores on the external cue portion of the survey that measured how an individual's eating habits may be influenced by external cues or environmental factors rather than eating in response to hunger and fullness levels. Perhaps this is due not only to the increased levels of body awareness that yoga practice fosters, but also to other important effects on mental processes such as improved emotional regulation, non-attachment, heightened observation skills and better adaptation to stressors. As one continues to practice yoga, these skills may allow experienced yoga practitioners to be less affected by external cues and instead use internal cues to determine intakes (Impett, 2006).

Framson et al. (2009) determined that MEQ scores were positively associated with minutes of yoga practice per week. This study, however, was unable to find the same relationship between minutes of yoga practice and mindful eating scores. This may be due to a difference in chosen categorical values for data analysis that may have limited this differentiation. Framson et al. used 3 categories of minutes of yoga practice (<60, 61-120, >120), whereas this study included 5 categories for data analysis (<60, 61-120, 121-200, 201-300, >301). The present study found that minutes of yoga practice per week seemed to be associated with higher dietary quality, but it did not seem related to mindful eating scores. It is possible that those individuals who practiced for over 60 minutes were

new to the yoga practice and may have been overzealously practicing yoga as a physical activity without yet having achieved or developed the needed skills for mindful eating.

Other physical activity

Mindful eating scores were not associated with minutes of physical activity per week other than yoga practice. This is consistent with the findings of Framson et al., 2009. Unlike yoga practice, however, minutes spent in other physical activity did not demonstrate any noticeable differences in dietary quality or typical intake patterns. Current research even suggests that individuals who spend more time engaging in cardio exercise may exhibit more disordered eating patterns, whereas disordered eating is less likely among individuals who practice yoga (Martin et al., 2013, Daubenmier 2005).

Mindful Eating and Dietary Quality

In addition to having a healthier BMI, mindful eaters also appeared to consume a diet of higher quality compared to individuals who did not demonstrate mindful eating tendencies. This study found that as mindful eating score increased, consumption of fruit, whole grains and vegetables increased. Surprisingly, consumption of red meat was higher among individuals who scored higher on the MEQ, which was not found when other factors, like years or days of yoga practice were examined. Mindful eating scores did not correlate with likelihood of following a vegetarian/vegan diet either. This suggests that mindful eaters may have different values than yoga practitioners, but this component was not included in the present study. It is also possible that mindful eaters pay more attention to factors that affect health. For example, they may have been sensitized to the negative health effects of certain vegetarian patterns or recognize a need for iron, for instance, from animal food sources through red meat consumption. It is also possible that they

viewed yoga practice as a form of physical activity and consequently they may have not been interested in pursuing some of the more philosophical-based traditions of yoga such as avoiding meat. Regardless, this demonstrates that mindful eating may be a useful strategy to improve dietary quality and long term health status by encouraging higher consumption of plant foods like fruits, vegetables and whole grains and lower consumption of processed foods. Such dietary patterns have been recognized widely as helping to reduce risk of chronic disease (Martin et al., 2013).

Approximately 93% of respondents in this study considered purchasing organic food to be “very important” or “somewhat important” while 7% did not consider it to be important. These findings closely align with those of Penman and others (2012) who found that approximately 50% of mindful participants preferred organic food. Such a choice demonstrates that mindfulness can be applied to other aspects of food consumption such as paying attention to the sources of food. An alternative explanation is that those who preferred organic foods did so because of their familiarity as well as concerns with the environmental and health benefits of such foods in addition to perhaps having easy access to such foods.

Mindful Eating and BMI

Mindfulness, is an experiential “moment to moment, nonjudgmental awareness,” that gives an individual the opportunity to objectively notice their habits without being judgmental about them (Gazella, 2005). Mindfulness seems to promote good health by increasing acceptance, attention and awareness. Research has shown that increased mindfulness leads to decreased perceived stress, improved sleep quality, reduced anxiety and fewer symptoms of depression (Brown et al., 2003, Roberts et al., 2010, Grossman et

al., 2004). When applied to the realm of diet, mindfulness may help to normalize eating habits and promote a healthy weight. Previous research has shown that being mindful of food consumption facilitates regularization of dietary habits and mindfulness interventions designed to correct forms of disordered eating and encourage weight loss among the obese are gaining in popularity (O'Reilly et al., 2014, Kristeller and Wolever, 2011). Some of the success mindfulness has had in these interventions may lie in the fact that it simply encourages awareness of dietary choices rather than imposing dietary restrictions which may make people more resistant to change. Since mindless eating may be contributing to the obesity epidemic, reducing such behavior may decrease an individual's risk of becoming overweight and obese, subsequently reducing risk of chronic diseases like type 2 diabetes (Wansink, 2010, Wang, 2005).

In this study, only 3 individuals had a BMI < 18.5 and an equal number had a BMI >30, which limited further analysis for these two categories. However, trends between normal (n = 60) and overweight (n = 21) individuals were consistent with Framson et al.'s (2009) findings. This study found that practicing mindfulness in the diet, through mindful eating, has a beneficial impact on dietary quality and BMI. In fact, individuals who had a BMI <25 kg/m² were most likely to score well on the Mindful Eating Questionnaire, both in terms of total score and within the sub-scores of disinhibition (the ability to stop eating when full), distraction (focusing on other activities while eating) and awareness (noticing the food being consumed and its effects on the body), showing that these individuals approach eating with a perceptive attitude, taking the time to recognize what they eat and savor the experience allowing them to finish a meal based on when they feel full. Individuals with an overweight BMI (25-29.9 kg/m²),

on the other hand, did not fare well on the total mindful eating score and all its subscales demonstrating that mindfulness may play an important role in maintaining a healthy weight. Although scores for all sub-categories of the MEQ decreased as BMI went from normal to overweight, the largest shift occurred in the emotional response sub-score that is eating in response to negative emotions. Individuals with a normal BMI had a mean emotional response score of 3.29 whereas individuals with an overweight BMI had a mean score of 2.88. This was consistent with Framson et al.'s (2009) findings for emotional response (emotional sub-score of BMI <25 = 3.21 and emotional sub-score of BMI 25-29.9 = 2.83) suggesting that overweight individuals may have a more difficult time controlling their emotional response to food compared to individuals with a normal BMI. This means individuals with a BMI <25 may be less likely to overeat due to their emotional state, and subsequently, less likely to gain weight. Eating in response to emotions may be a large contributor to obesity (Levitan and Davis, 2010). In addition, to preventing emotional eating by fostering acceptance of the emotional state (Robins et al, 2013) mindfulness may help individuals improve their focused attention on the matter on hand, in this case eating. This can result in increased vigilance regarding portion sizes, which may further facilitate weight control thereby preventing weight gain before it even occurs (Bashara et al., 2013, Jacobs et al., 2013).

Dietary Quality and Yoga Practice

In the present study, 26.4% of respondents reported practicing a vegan or vegetarian diet, which was similar to the study of Penman et al., (2012) which found 22.6% of respondents practiced vegetarian diets. Intakes of red meat and processed meat were lowest among individuals with 10 or more years of yoga experience. As years of

yoga practice increased, the likelihood of adopting a vegetarian diet (0.5-2.0 years = 19%, 3-5 years = 20%, 6-9 years = 29%, 10 or more = 42%) also increased. These findings are important because they provide support for two of the tenets of the Ashtanga Yoga, namely “Ahimsa” or non-violence and “Saucha” or purity. The former espouses the sentiment of love for all creation and the belief that destroying a living thing is an insult to its Creator. Saucha supports the need for pure food in the yogic tradition to attain focused attention and spiritual evolution. Simple, nourishing, vegetarian food is therefore encouraged to promote health, strength, energy and life. These expectations are established in yoga philosophy and tradition; it is possible that participants who had familiarized themselves with yoga philosophy were the ones practicing these sentiments. Findings in the present study supported these expectations. Scientific literature also supports the fact that well planned vegan and/or vegetarian diets in general, are known for their benefits such as a lowered risk of chronic disease (AND, 2009). Yoga practitioners in this study may be making this choice of following a vegetarian diet with the objective of achieving improved well being and quality of life (Campbell et al., 2012, Marsh et al., 2011). Intakes of red meat and processed meat were lowest among individuals with 10 or more years of yoga experience. This study also found that consumption patterns changed as years of yoga practice increased. Daily predicted whole grain intake, fiber and daily predicted intake of fruits, vegetables and legumes increased, which suggests that as years of yoga practice increased, overall dietary quality, aside from simply increased fruits and vegetables (Kristal et al., 2005, Ross et al., 2012), also increased.

Individuals who practiced yoga 6-7 times per week also appeared to consume a diet of higher quality. They were also more likely to have established mindful eating habits compared to those who practiced less. These individuals consumed the most calcium and dairy compared to individuals who practiced fewer times during the week. Their consumption of processed meat was also low. Overall, consumption of whole foods seemed higher, while processed foods that are more likely to be high in calories, fat and sugar seemed lower, indicating that the length of yoga practice was associated with a diet of higher quality. In fact, individuals who practiced four or more times during the week consumed the least amount of added sugar in their diets. Practicing for more days during the week had a major impact on dietary quality indicating that more frequent practices, even if they are brief, may be useful for improving dietary quality.

Individuals who spent more minutes per week practicing yoga consumed the least amount of added sugar. More minutes spent in practice per week also seemed to be associated with decreased consumption of red and processed meat. Interestingly, individuals who practiced for 20-60 minutes consumed more predicted fruits, vegetables and legumes compared with individuals who practiced for more minutes per week. Although some parameters of dietary quality improved as minutes of yoga practice per week increased, over 60 minutes of yoga practice did not indicate any positive effects.

Conclusion

This study was designed to explore how mindful eating is related to yoga practice and, in turn, how both yoga practice and mindful eating habits affect dietary quality. Findings suggest that yoga practice and mindful eating may help to improve dietary quality. Although significant relationships between mindful eating habits, as measured by the Mindful Eating Questionnaire, and yoga practice were not seen in the present study, MEQ scores did seem to be higher among individuals with more years of yoga practice. This suggests that mindful eating habits may improve as years of yoga practice increase which is consistent with previous research. Spending quality time in yoga practice may be an effective method for helping to achieve or maintain a normal BMI while also improving dietary quality and mindful eating habits. This can lead to improved health, particularly as years of yoga practice increase. Individuals with more yoga experience seemed to consume a wider variety of whole foods, including fruit, vegetables and legumes.

Individuals with a normal BMI scored the highest on the MEQ suggesting that mindfulness is an important factor in regulating weight control. Also tied in was the fact that dietary quality seemed to also improve as MEQ score increased. Increased time spent in yoga practice seemed to affect more dietary parameters, such as fiber, fruits and vegetables, and promote higher dietary quality than practicing mindful eating alone. While yoga practice is a means for promoting mindful eating habits, there are perhaps other factors that influence dietary quality among yoga practitioners; however, these were not explored. There were some similarities in terms of quality of dietary intake with both increased mindful eating score and increased practice of yoga, e.g. increased

consumption of fruit and other vegetables. However, consumption of red meat was completely opposite among individuals with the highest levels of yoga experience and individuals with the highest scores on the MEQ, which may indicate that although yoga practice may promote mindful eating habits, consumption decisions regarding individual foods may be mediated by individual perceptions, health beliefs and other factors not explored here.

Limitations

This study has several limitations, the most crucial of which was the sample size (n = 88). Further, a convenience sample was utilized to explore the habits of individuals from only one studio without including a control group of individuals who do not practice yoga, which further limits the strength of the present study. The yoga studio chosen for distribution of the survey tends to attract a fairly young and athletic audience, which may have also led to a sample bias. Although analysis of data showed positive trends in healthy dietary habits among individuals who had more experience with yoga practice, many results did not reach statistical significance, which is likely attributable to the small sample size. Since significance was not often reached, it is difficult to determine if yoga practice is, in fact, the catalyst for increased dietary quality through higher consumption of whole foods and decreased consumption of refined foods and added sugars when compared to individuals who do not practice. Practicing yoga at a studio can also be expensive, which should be considered in light of the results. Often, costs are between \$15-20 per class, which means participants likely are of a socio-economic standing that would allow them to pursue such a practice, but may also make purchasing healthier foods more accessible as well. However, this study did not question participants about their socio-economic status. Future studies may wish to examine how individuals of a

lower socio-economic status respond to yoga practice. Of course, the practice must first be made available to these individuals, either through free or discounted classes. Another major limitation in this study and many other studies exploring yoga practice is the lack of diversity; well-educated, white women are overrepresented while data on men and individuals belonging to other ethnicities within the yoga sphere is lacking, which was consistent with the sample included in the present study. This warrants correction in future research, ideally exploring potential changes in dietary habits over time with a diverse set of participants as yoga experience deepens.

If a participant failed to answer a question from the Dietary Screener (NHANES 2009), analysis of predicted daily intakes of food and its components like fiber, added sugar, fruits and vegetables, etc. would have been compromised, as SAS software would have been unable to calculate a predicted value to be used in analysis. This is a limitation because it further reduced the sample size for dietary quality analysis. Regardless, predicted fruit and vegetable consumption revealed trends indicating that individuals who had more years of experience consumed more fruits and vegetables, which is consistent with Framson et al., (2009), but a larger sample size may have demonstrated a stronger correlation. Unlike Framson et al., however, different categories were chosen to represent years of yoga practice; this was decided to create a slightly more equal distribution of participants within each category, but may make comparison with Framson et al.'s study less relevant. Also important to note, mindfulness according to yogic philosophy includes concepts of nonviolence and non-harming, which may lead individuals who practice yoga to be more concerned with where their food is sourced from and how it is produced, which was not measured by the Mindful Eating Questionnaire (MEQ). Presumably,

however, this may be a major influencing factor on an individual's dietary habits, which is evidenced by the fact that vegetarianism was most prevalent among the participants who had been practicing yoga the longest. Lastly, the Dietary Screener also did not address portion sizes and can only provide a rough estimate of actual intakes. Asking for typical portion sizes from participants would have allowed for a more accurate picture of predicted daily consumption.

Although significance was not reached for mean difference in consumption of all foods, dietary quality and mindful eating habits appeared to be higher among individuals who had a more developed yoga practice. Overall, individuals who spent more time in yoga practice were observed to consume more fruits, a wider variety of vegetables and less meat. High intake of fruits and vegetables is associated with improved health and reduced risk of chronic diseases (Campbell et al., 2012). Since yoga practice seems to be associated with increased consumption of these foods, yoga may potentially provide additional protection against chronic diseases.

Despite its limitations, this study provided a more detailed dietary analysis and expanded on the findings of much of the existing yoga literature which is mainly limited to consumption of fruits and vegetables, by also exploring predicted daily intakes of fiber, added sugar, calcium, dairy and sugar sweetened beverages. Answers from the Dietary Screener also revealed that intakes of both red meat and processed meat were lower among individuals who had a more developed yoga practice. Although many studies determined that yoga practitioners were more likely to practice vegetarianism than the general public, meat intake had not been previously analyzed. At the time of this writing, this study also provided a first analysis of how dietary quality relates to mindful

eating habits. However, future research should concentrate on determining a stronger correlation between yoga practice and dietary quality and mindful eating by measuring changes in dietary habits that occur overtime among a diverse population.

Implications

The obesity problem is no longer unique to the United States and is spreading throughout the globe leading to an epidemic of non-communicable diseases (NCDs) and taking a major toll on both global health and the global economy. Yoga practice, as a complementary health practice, may be a creative way to potentially help alleviate the high prevalence of overweight and obesity through improving mindfulness. Ultimately, the mindfulness learned through yoga practice may translate to an increased awareness of dietary choices, including mindfulness of portion sizes and the source of food.

Eventually, the ability to tune in to hunger and fullness levels may improve and eating for reasons other than hunger, like stress or depression, which may be a major contributor to the overconsumption of calories. This can be expected to allow individuals to better manage their intake thus facilitating healthy weight management. In conclusion, nutrition professionals may wish to explore the potential correlation between yoga practice and mindful eating habits and dietary quality with clients who have difficulty managing their weight or are looking for alternative or complementary ways to improve their dietary quality.

Appendix

1. Survey

Greetings yogis and yoginis!

My name is Shauna Keeler and I teach HotCore Rock on Tuesday nights at O. I'm also a graduate student at Syracuse University seeking my Master's in Nutrition Science. I am interested in learning more about how yoga practice affects mindful eating habits and diet quality.

You will be asked to fill out a survey about your current yoga and eating habits. This will take approximately 15 minutes of your time. I am inviting you to participate in a research study. Involvement in the study is voluntary. This means you can choose whether to participate and that you may withdraw from the study at any time without penalty. Whenever one works with email or the internet; there is always the risk of compromising privacy, confidentiality, and/or anonymity. Your confidentiality will be maintained to the degree permitted by the technology being used. It is important for you to understand that no guarantees can be made regarding the interception of data sent via the internet by third parties.

If you have any questions, concerns or complaints about the research, please contact Dr. Sudha Raj by email at sraj@syr.edu.

You must be 18 years old to participate. By continuing, I agree to participate in this research study and that I am over 18 years of age.

Thank you for your time.

Namaste!

Shauna Keeler

Syracuse University

Nutrition Science and Dietetics

426 Ostrom Avenue, Room 117

Syracuse, NY 13244

Q1 Age (in years):

Q2 Sex:

Male (1)

Female (2)

Q3 Race:

White (1)

Black/African American (2)

Asian (3)

Native Hawaiian/Other Pacific Islander (4)

Other (5)

Q4 Current Weight (in lbs):

Q5 Current Height (in inches)

Q6 Please select your highest degree earned.

High School (1)

Bachelor's (2)

Master's (3)

Doctorate (4)

Q7 Frequency of Yoga Practice How many years have you been practicing yoga?

Q8 How many times a week do you practice yoga?

Q9 When you practice, how long (in minutes) do you practice?

Q10 When you practice, which styles do you typically practice? Choose ALL that apply.

- Anusara (1)
- Ashtanga (2)
- Baptiste (3)
- Bikram (4)
- Hatha (5)
- Hot Yoga (6)
- Iyengar (7)
- Jivamukti (8)
- Kripalu (9)
- Kundalini (10)
- Modern Yoga Classes (e.g. HipHop Yoga, HotCore Rock, etc.) (11)
- Prana Flow (12)
- Power Yoga (13)
- Restorative (14)
- Vinyasa (15)
- Yin (16)
- Other/not sure. Please describe (17) _____

Q11 Do you have a home practice?

- Yes (1)
- No (2)

Q12 Please indicate how often you practice the following at home.

	Never (1)	1-3 Times a Month (2)	Once a Week (3)	2-3 Times per Week (4)	4-6 Times a Week (5)	Daily (6)
Asana (physical postures) (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pranayama or Breath Control (ex. alternate nostril breathing, lion's breath, etc.) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meditation (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Do you practice at a studio?

- Yes (1)
- No (2)

Q14 Please indicate how often you practice the following at a studio.

	Never (1)	1-3 Times a Month (2)	Once a Week (3)	2-3 Times a Week (4)	4-6 Time a Week (5)	Daily (6)
Asana (physical postures) (1)	<input type="radio"/>					
Pranayama or Breath Control (ex. alternate nostril breathing, lion's breath, etc.) (2)	<input type="radio"/>					
Meditation (3)	<input type="radio"/>					

Q15 Do you include self-study of yogic texts/yoga philosophy (ex. The Yoga Sutras, Light on Yoga, etc.) in your practice?

- Yes (1)
- No (2)

Q16 How many minutes per week do you spend studying yoga philosophy?

- 0-10 (1)
- 11-20 (2)
- 21-30 (3)
- 31-40 (4)
- 41-50 (5)
- 51-60 (6)
- Over an hour (7)

Q17 On days you practice, how much time do you typically spend doing the following?

	0-10 minute s (1)	11-20 minute s (2)	21-30 minute s (3)	31-40 minute s (4)	41-50 minute s (5)	51-60 minute s (6)	61-90 minute s (7)	Over 90 minute s (8)
Meditation (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pranayama (Breath Work) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studying Yoga Philosophy (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Asana (Postures) (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 Do you practice yoga for weight loss?

- Yes (1)
- No (2)

Q19 Do you participate in other forms of physical activity (other than yoga)?

- Yes (1)
- No (2)

Q20 How many minutes a week do you typically spend doing other forms of physical activity?

Q21 Please select the appropriate choice that best describes your behavior with regard to the following statements.

	Never/Rarely (1)	Sometimes (2)	Often (3)	Usually (4)
I eat so quickly that I don't taste what I'm eating. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I eat at "all you can eat" buffets, I tend to overeat. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a party where there is a lot of good food, I notice when it makes me want to eat more food than I should. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I recognize when food advertisements make me want to eat. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When a restaurant portion is too large, I stop eating when I'm full. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My thoughts tend to wander while I am eating. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm eating one of my favorite foods, I don't recognize when I've had enough. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I notice when just going into a movie theater	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

When I'm feeling stressed at work, I'll go find something to eat. (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If there's good food at a party, I'll continue eating even after I'm full. (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm sad, I eat to feel better. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I notice when foods and drinks are too sweet. (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Before I eat, I take a moment to appreciate the colors and smells of my food. (21)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I taste every bite of food that I eat. (22)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I recognize when I'm eating and not hungry. (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I notice when I'm eating from a dish of candy just because it's there. (24)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have trouble not eating ice cream, cookies, or chips if they're around the house. (25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think about things I need to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

do while I'm eating. (26)				
When I'm at a restaurant, I can tell when the portion I've been served is too big for me. (27)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I notice when the food I eat affects my emotional state. (28)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22 Dietary Habits During the past month, how often did you eat hot or cold cereals? Mark one.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q23 During the past month, what kind of cereal did you usually eat? Print cereal.

Q24 If there was another kind of cereal that you usually ate during the past month, what kind was it? Print cereal. If none, leave blank.

Q25 During the past month, how often did you have any milk (either to drink or on cereal)? Include regular milks, chocolate or other flavored milks, lactose-free milk, buttermilk. Please do not include soy milk or small amounts of milk in coffee or tea. Mark one.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2-3 times per day (9)
- 4-5 times per day (10)
- 6 or more times per day (11)

Q26 During the past month, what kind of milk did you usually drink? Mark one.

- Whole or regular milk (1)
- 2% fat or reduced-fat milk (2)
- 1%, 1/2%, or low-fat milk (3)
- Fat free, skim or nonfat milk (4)
- Soy milk (5)
- Other kind of milk. Print milk. (6) _____

Q27 During the past month, how often did you drink regular soda or pop that contains sugar? Do not include diet soda. Mark one.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2-3 times per day (9)
- 4-5 times per day (10)
- 6 or more times per day (11)

Q28 During the past month, how often did you drink 100% pure fruit juices such as orange, mango, apple, grape and pineapple juices? Do not include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. Mark one.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2-3 times per day (9)
- 4-5 times per day (10)
- 6 or more times per day (11)

Q29 During the past month, how often did you drink coffee or tea that had sugar or honey added to it? Include coffee and tea you sweetened yourself and pre-sweetened iced tea and coffee drinks such as Arizona Iced Tea and Frappuccino. Do not include artificially sweetened coffee or diet tea.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2-3 times per day (9)
- 4-5 times per day (10)
- 6 or more times per day (11)

Q30 During the past month, how often did you drink sweetened fruit drinks, sports or energy drinks, such as Kool-Aid, lemonade, Hi-C, cranberry drink, Gatorade, Red Bull or Vitamin Water? Include fruit juices you made at home and added sugar to. Do not include diet drinks or artificially sweetened drinks.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2-3 times per day (9)
- 4-5 times per day (10)
- 6 or more times per day (11)

Q31 During the past month, how often did you eat fruit? Include fresh, frozen or canned fruit. Do not include juices.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q37 During the past month, how often did you eat a green leafy or lettuce salad, with or without other vegetables?

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q32 During the past month, how often did you eat any kind of fried potatoes, including French fries, home fries, or hash brown potatoes?

- Never (1)
- 1 time last month (3)
- 2-3 times last month (4)
- 1 time per week (5)
- 2 times per week (6)
- 3-4 times per week (7)
- 5-6 times per week (8)
- 1 time per day (9)
- 2 or more times per day (10)

Q33 During the past month, how often did you eat any other kind of potatoes, such as baked, boiled, mashed potatoes, sweet potatoes or potato salad?

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q34 During the past month, how often did you eat re-fried beans, baked beans, beans in soup, pork and beans or any other type of cooked dried beans. Do not include green beans.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q35 During the past month, how often did you eat brown rice or other cooked whole grains, such as bulgar, cracked wheat or millet? Do not include white rice.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q36 During the past month, not including what you listed about green salads, potatoes, cooked dried beans, how often did you eat other vegetables?

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q38 During the past month, how often did you have Mexican-type salsa made with tomato?

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q39 During the past month, how often did you eat pizza? Include frozen pizza, fast food pizza and homemade pizza.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 3-4 times per week (5)
- 5-6 times per week (6)
- 1 time per day (7)
- 2 or more times per day (8)
- 2 times per week (9)

Q40 During the past month, how often did you have tomato sauces such as with spaghetti or noodles or mixed into foods such as lasagna? Do not include tomato sauce on pizza.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q42 During the past month, how often did you eat any kind of cheese? Include cheese as a snack, cheese on burgers, sandwiches, and cheese in foods such as lasagna, quesadillas, or in casseroles. Do not include cheese on pizza.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q43 During the past month, how often did you eat red meat, such as beef, pork, ham or sausage? Do not include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew and other mixtures. Red meats may also include veal, lamb and any lunch meat made with meats.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q41 During the past month, how often did you eat any processed meat, such as bacon, lunch meats, or hotdogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures. Processed meats are those preserved by smoking, curing

or salting or by the addition of preservatives. Examples are: ham, bacon, pastrami, salami, sausages, bratwursts, frankfurters, hot dogs and spam.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q44 During the past month, how often did you eat whole grain bread including toast, rolls and in sandwiches? Whole grain breads include whole wheat, rye, oatmeal and pumpernickel. Do not include white bread.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q45 During the past month, how often did you eat chocolate or any other types of candy? Do not include sugar-free candy.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q46 During the past month, how often did you eat doughnuts, sweet rolls, Danish, muffins, pan dulce, or pop-tarts. Do not include sugar-free items.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q47 During the past month, how often did you eat cookies, cake pie or brownies? Do not include sugar-free items.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q48 During the past month, how often did you eat ice cream or other frozen desserts? Do not include sugar-free kinds.

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q49 During the past month, how often did you eat popcorn?

- Never (1)
- 1 time last month (2)
- 2-3 times last month (3)
- 1 time per week (4)
- 2 times per week (5)
- 3-4 times per week (6)
- 5-6 times per week (7)
- 1 time per day (8)
- 2 or more times per day (9)

Q50 Are you currently following a vegetarian or vegan diet?

- Yes (1)
- No (2)

Q51 Please choose the answer that best describes your preferences. How important is it for you that your food is...

	Not Important	Somewhat Important	Very Important
Organic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seasonal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Food Preferences

Food Preferences		Frequency (n=88)	%
Purchasing Organic Food	Not Important	6	6.8
	Somewhat Important	50	56.8
	Very Important	32	35.4
Purchasing Local Food	Not Important	5	5.7
	Somewhat Important	51	58.0
	Very Important	32	36.4
Purchasing Seasonal Food	Not Important	8	9.1
	Somewhat Important	52	59.1
	Very Important	28	31.8
Vegetarian/Vegan	Yes	23	26.4
	No	64	73.6

3. Years of Yoga Practice and Vegetarian/Vegan Diets (n=87)

Dietary Preferences	½-2 Years	3-5 Years	6-9 Years	10 or more Years
	% w/in category	% w/in category	% w/in category	% w/in category
Vegetarian/Vegan	19.2	20.0	29.4	42.1
Non-Vegetarian/Vegan	80.8	80.0	70.6	57.9

4. BMI and Mean Mindful Eating Scores

Table 4: Standard Deviation is indicated by parenthesis.

BMI		Total Mindful Eating Score	Disinhibition	External	Distraction	Awareness	Emotional
<18.5 (Underweight)	Mean	3.01 (0.03)	3.48 (0.22)	1.94 (0.25)	3.11 (0.38)	3.11 (0.51)	3.42 (0.29)
	N	3	3	3	3	3	3
18.5-24.9 (Normal)	Mean	3.06 (0.36)	3.21 (0.49)	2.76 (0.50)	2.97 (0.55)	3.08 (0.61)	3.29 (0.60)
	N	60	60	60	60	60	60
25.0-29.9 (Overweight)	Mean	2.76 (0.37)	2.92 (0.57)	2.60 (0.43)	2.82 (0.54)	2.60 (0.67)	2.88 (0.68)
	N	21	21	21	21	21	21
>30.0 (Obese)	Mean	2.96 (0.10)	3.05 (0.22)	2.83 (0.17)	2.89 (0.51)	2.61 (0.35)	3.42 (0.29)
	N	3	3	3	3	3	3
Total	Mean	2.99 (0.37)	3.14 (0.51)	2.69 (0.49)	2.94 (0.54)	2.95 (0.65)	3.20 (0.63)
	N	87	87	87	87	87	87

5. BMI and Mean Mindful Eating Scores 2

Table 5: Standard error is indicated by parenthesis.

(I) BMI	(J) BMI	Mean Difference (I-J)	Sig.
<18.5 (Underweight)	18.5-24.9 (Normal)	-.05 (0.21)	1.000
	25.0-29.9 (Overweight)	.25 (0.22)	1.000
	>30.0 (Obese)	.05 (0.29)	1.000
18.5-24.9 (Normal)	<18.5 (Underweight)	.05 (0.21)	1.000
	25.0-29.9 (Overweight)	.30* (0.09)	.009
	>30.0 (Obese)	.10 (0.21)	1.000
25.0-29.9 (Overweight)	<18.5 (Underweight)	-.25 (0.22)	1.000
	18.5-24.9 (Normal)	-.30* (0.09)	.009
	>30.0 (Obese)	-.19 (0.22)	1.000
>30.0 (Obese)	<18.5 (Underweight)	-.05 (0.29)	1.000
	18.5-24.9 (Normal)	-.10 (0.21)	1.000
	25.0-29.9 (Overweight)	.19 (0.22)	1.000

6. BMI and Predicted Intake of Added Sugar and Predicted Intake of Added Sugar from Sugar Sweetened Beverages

Table 6: Standard error is indicated by parenthesis.

Dependent Variable	(I) BMI	(J) BMI	Mean Difference (I-J)	Sig.
Predicted daily added sugar intake (tsp.)	<18.5 (Underweight)	18.5-24.9 (Normal)	8.28* (2.42)	.006
		25.0-29.9 (Overweight)	7.12* (2.52)	.036
		>30.0 (Obese)	6.43 (3.33)	.342
	18.5-24.9 (Normal)	<18.5 (Underweight)	-8.28* (2.42)	.006
		25.0-29.9 (Overweight)	-1.15 (1.07)	1.000
		>30.0 (Obese)	-1.85 (2.42)	1.000
	25.0-29.9 (Overweight)	<18.5 (Underweight)	-7.12* (2.52)	.036
		18.5-24.9 (Normal)	1.15 (1.07)	1.000
		>30.0 (Obese)	-.69 (2.52)	1.000
	>30.0 (Obese)	<18.5 (Underweight)	-6.43 (3.33)	.342
		18.5-24.9 (Normal)	1.85 (2.42)	1.000
		25.0-29.9 (Overweight)	.69 (2.52)	1.000
Predicted daily intake of added sugar (tsp.) from sugar sweetened beverages	<18.5 (Underweight)	18.5-24.9 (Normal)	4.94* (1.51)	.009
		25.0-29.9 (Overweight)	4.76* (1.57)	.020
		>30.0 (Obese)	3.35 (2.01)	.663
	18.5-24.9 (Normal)	<18.5 (Underweight)	-4.94* (1.51)	.009

		25.0-29.9 (Overweight)	-0.18 (0.65)	1.000
		>30.0 (Obese)	-1.59 (1.50)	1.000
	25.0-29.9 (Overweight)	<18.5 (Underweight)	-4.76* (1.57)	.020
		18.5-24.9 (Normal)	.18 (0.65)	1.000
		>30.0 (Obese)	-1.41 (1.57)	1.000
	>30.0 (Obese)	<18.5 (Underweight)	-3.35 (2.08)	.663
		18.5-24.9 (Normal)	1.59 (1.51)	1.000
		25.0-29.9 (Overweight)	1.41 (1.57)	1.000

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Vita

Name of Author: Shauna Elizabeth Keeler

Place of Birth: Utica, New York

Undergraduate School Attended: Union College

Degrees Awarded: Bachelor of Arts, Union College 2009