Orthorexia nervosa among college students: Associations with restrictive eating, excessive exercise, and psychological distress

Abstract
Orthorexia Nervosa (ON) is defined as a "fixation" or an unhealthy obsession with eating healthy food (Bratman, 2000). ON is not considered an official eating disorder in the DSM-5; however, ON consists of an intense diet regimen (Mcinerney-Ernst, 2011). Individuals who suffer from ON have found to be considerably invested in the foods they consume and how meals are prepared. ON can be a cause for a concern because some individuals would rather starve than eat foods which they consider to be "impure" (Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). Individuals with ON have been found to be more interested in the quality over the quantity of the foods they consume (Arby & Koven, 2015). This study used an online survey method via www.SurveyMonkey.com. The primary focus of this study was to investigate the correlations between ON and other forms of disordered eating, excessive exercise, and psychological factors among the college student population. Results indicate that ON, anxiety, and obsessive-compulsive features are related, but ON and depression are not. It was hypothesized those with orthorexic tendencies would be more inclined to excessively exercise due to extreme guilt; ON and exercise were related, but this was not mediated by fear of food, guilt, or obsessive-compulsive features.

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Orthorexia Nervosa Among College Students:
Associations with restrictive eating, excessive exercise, and psychological distress

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A Senior Thesis Submitted to the
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Orthorexia Nervosa (ON) is defined as a “fixation” or an unhealthy obsession with eating healthy food (Bratman, 2000). ON is not considered an official eating disorder in the DSM-5; however, ON consists of an intense diet regimen (McInerney-Ernst, 2011). Individuals who suffer from ON have found to be considerably invested in the foods they consume and how meals are prepared. ON can be a cause for a concern because some individuals would rather starve than eat foods which they consider to be “impure” (Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). Individuals with ON have been found to be more interested in the quality over the quantity of the foods they consume (Arby & Koven, 2015). This study used an online survey method via www.Surveymonkey.com. The primary focus of this study was to investigate the correlations between ON and other forms of disordered eating, excessive exercise, and psychological factors among the college student population. Results indicate that ON, anxiety, and obsessive-compulsive features are related, but ON and depression are not. It was hypothesized those with orthorexic tendencies would be more inclined to excessively exercise due to extreme guilt; ON and exercise were related, but this was not mediated by fear of food, guilt, or obsessive-compulsive features.
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Background
In 1997, an American physician Steven Bratman, proposed an eating disorder called orthorexia nervosa (ON). Before Bratman (1997) was a physician, he worked as a staff cook in New York. Bratman was tasked to satisfy numerous dietary restraints, which he noted as an extremely time-consuming process. The meals Bratman would prepare were always vegetarian. Bratman eventually became a vegetarian and quickly became very careful about the foods he would consume. He notes that he would chew his food at least fifty times before swallowing, isolate himself whenever he ate, and always leave his stomach partially empty by the end of each meal. He often found that he would criticize his friends and family on their eating habits. Bratman lived this way for multiple years before he had a realization that something was not right because all he could think about was food (Borgida, 201; Bratman, 1997).

Orthorexia nervosa is defined as a “fixation” or an unhealthy obsession with eating healthy food (Bratman, 2000). At this time, Bratman’s definition of ON serves for generality since ON is not officially recognized in the DSM-5 as an eating disorder (McInerney-Ernst, 2011). Orthorexia comes from the Greek word “ortho” meaning straight or accurate and “orexia” meaning appetite or hunger. ON is commonly referred to as a starting point to improve one’s diet, eating habits or general health (Bratman, 2000). The prominent fears associated with ON involve worries of eating, health, and the quality of meals one consumes (Furth et al., 2014). In extreme cases, individuals with ON may choose to starve themselves rather than eat foods which, under their own criteria, they consider “impure” or harmful to their health (Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). Because of this, it can be inferred that nutritional and mineral deficiencies may occur over time, which has the long-term potential to actually be harmful towards one’s overall health (Bosi et al., 2007; Bratman, 2000; McInerney-Ernst, 2011).
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As previously stated, ON does tend to start as a desire to change one's diet and eat healthier; however, this can transform itself into an unhealthy obsession. The time spent planning, purchasing, preparing, and eating meals affects other aspects of people's lives (Hughes, Oberle, Samaghahadi, 2016). Individuals with ON have also been found to have certain rituals in regards to how their food is prepared, including methods of preparation (a specific way of preparing certain foods) and materials (certain utensils) (Brytek-Matera, 2012). Some describe ON as a severe phobia about eating only "pure" food. Individuals with ON do not only have an obsession with healthy food, they have also been found to have specific attitudes toward food and a specific avoidance towards certain foods. Healthy eating in itself is not considered to be an eating disorder, but it may be when the healthy eating crosses over into preoccupation and causes distress to the individual that it becomes a problem. In most cases of ON, the quality of foods consumed may be more important than values, relationships, or personal life goals (Brytek-Matera, 2012; Donini et al., 2004). In general, the literature does not indicate that ON is intended to serve a weight management function; however, the intense diet regimen can lead to severe weight loss (Borgida, 2011).

Symptoms of ON

Individuals with ON are typically concerned with the quality, as opposed to the quantity, of food they consume. These individuals may often go to great lengths to determine the source, processing, and packaging of their foods before they allow themselves to even consider consuming it (Arby & Koven, 2015). Some symptoms of ON include guilt, a strong desire to eat when feeling nervous, self-isolating from outside activities, and having an excessive/obsession worry over one's diet and health (Donini et al., 2004). Individuals with ON can have strong feelings towards food and endorse a spiritual obligation to withhold from eating certain foods.
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Individuals with ON may experience extreme guilt if they stray from their diet regimen (Borgida, 2011).

Bratman (2000) developed *Bratman's Orthorexia Test* (BOT) as a screening tool, which has been widely used as an early diagnostic questionnaire to test for the disorder (Brytek-Matera, 2012). This diagnostic test for orthorexia consists of ten questions including

1. Do you spend more than 3 hours a day thinking about your diet?
2. Has the quality of your life decreased as the quality of your diet has increased?
3. Do you plan your meals several days ahead?
4. Is the nutritional value of your meal more important than the pleasure of eating it?
5. Have you become stricter with yourself lately?
6. Does your self-esteem get a boost from eating healthily?
7. Have you given up foods you used to enjoy in order to eat the ‘right’ foods
8. Does your diet make it difficult for you to eat out, distancing you from family and friends?
9. Do you feel at peace with yourself and in total control when you eat healthily?
10. Do you feel guilty when you stray from your diet?

Generally speaking, if the individual answers “yes” to 4 or 5 questions, Bratman suggests it may be beneficial for one to “relax regarding his/her diet.” However, if the individual answers “yes” to all questions, then she/he has an important obsession with healthy eating and should evaluate one’s eating habits with trained professionals (Borgida, 2011; Brytek-Matera, 2012).

Based on the Bratman’s test, Donini et al., (2004) were able to create a diagnostic test for orthorexia called Orthorexia Nervosa-15 (ORTO-15). Some of the original questions from Braman’s test remained and some newly developed questions were added. The ORTO-15 is a
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self-report measure consisting of fifteen multiple choice questions to eating attitudes, obsessive tendies, and the relationship between orthorexia and eating attitude. Each item is listed 4-point Likert scale with 0 indicating little agreement and 4 indicating a strong agreement (Borgida, 2011; Brytek-Matera, 2012). The 15 questions included in the ORTO-15 are:

1. When eating, do you pay attention to the calories of the food?
2. When you go in a food shop, do you feel confused?
3. In the last 3 months, did the thought of food worry you?
4. Are your eating choices conditioned by your worry about your health status?
5. Is taste of food more important than the quality when you evaluate food?
6. Are you willing to spend more money to have healthier food?
7. Does the thought about food worry you for more than three hours a day?
8. Do you allow yourself any eating transgressions?
9. Do you think your mood affects your eating behavior?
10. Do you think that the conviction to eat only healthy food increases self-esteem?
11. Do you think that eating healthy food changes your lifestyle (frequency of eating out, friends)?
12. Do you think that consuming healthy food may improve your appearance?
13. Do you feel guilty when transgressing?
14. Do you think that on the market there is also unhealthy food?
15. At present, are you alone when having meals?

Prevalence

Through the creation of the ORTO-15, Donini et al. (2004) conducted the first known prevalence rate evaluation of ON. Out of the 404 subjects they tested, 168 were male and 236
were female. Of these participants, 28 were found to suffer from orthorexia, yielding a prevalence rate of 6.9% in comparison to other eating disorders. A total of 64 participants (15.8%) were found to have normal eating patterns but altered personality scores (i.e., the Minnesota Multiphasic Personality Inventory, MMPI) scores such as OCD characteristics; 69 participants (17.1%) had somewhat healthy eating patterns and had normal MMPI scores, and the remaining participants had average eating patterns and average MMPI scores (Donini et al., 2004; Shah 2012). The orthorexic subjects tested showcased a “strong or uncontrollable desire to eat when feeling nervous, excited, happy or guilty” (Donini et al., 2004).

One Turkish study analyzed orthorexic tendencies within 318 medical residents (169 males and 149 females). Results revealed that 45.5% participants scored below 40 in the ORTO-15 test, which they report as having “highly sensitive behavior” regarding their eating habits (Bosi, Camur, & Gule, 2007; Shah 2012). Another study conducted in Turkey of 878 medical students found a 43.6% prevalence rate for orthorexic tendencies. In addition, this study found a positive correlation between body mass index and orthorexic tendencies; however, previous findings have stated that orthorexic tendencies have not been found to serve a weight control function (Fiden, Ertekin, Isikay, & Kirpinar, 2010; Brytek-Matera, 2015; Shah, 2012). The last Turkish study tested orthorexic tendencies in a group of performers. The study consisted 94 participants (39 men and 55 women). The study consisted of three types of performers: ballet dancers (29.9%), opera singers (46.8%), and symphony orchestra musicians (23.4%). The study showcased the prevalence rate for orthorexic tendencies at 81.8% for opera singers, 32.1% for ballet dancers, and 36.4% for symphony orchestra musicians (Aksoydan & Camci, 2009; Shah, 2012).
A study conducted in Austria assessed the prevalence of orthorexia in female dietitians. There were 238 participants, with a 12.8% prevalence rate observed for ON. It was also noted that 52.3% displayed no symptoms of orthorexia and 34.9% displayed at least a few symptoms of orthorexia. It was proposed that a higher prevalence rate of ON may exist among individuals who work in dietary fields; however, this study was limited by its inclusion of only women dietitians and a lack of a control group (Kinzl, Hauer, Traweger, Kiefer, 2006; Shah, 2012).

A Hungarian study of 810 (89.4% female) university students observed a prevalence rate of over 70% displaying orthorexic tendencies. There seemed to be no statistical difference between male and female prevalence rates. There was a significant negative correlation between orthorexic tendencies and body mass index suggesting that if orthorexic tendencies are present, there is a higher likelihood of eating and body image disturbance (Varga, Thege, Dukay-Szabó, Túry, & van Furth, 2014; Brytek-Matera, 2015).

An Italian study conducted by Segura-Garcia and colleagues (2015) assessed the prevalence of orthorexic tendencies in patients who had undergone treatment for a previous eating disorder. It was hypothesized that orthorexia nervosa and anorexia nervosa (AN) as well as bulimia nervosa (BN) would share similar qualities, and that patients who have suffered from either AN or BN would be more likely to show signs of ON after being treated for a previous eating disorder. Thirty-two patients with either AN or BN were evaluated by the ORTO-15, as well as the Yale-Brown-Cornell Eating Disorder Scale (YBC-EDS) and the Eating Attitudes Test (EAT-26). A control group consisted of 32 females who had never been diagnosed or treated with any form of eating disorder. Among the eating disorder group, 28% of participants showed orthorexic tendencies before being treated for an eating disorder, and 58% showed orthorexic tendencies three years after being treated for an eating disorder. This contrasts with only 6% of
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the control group showing such tendencies. The results of this study indicate that there is a high rate of orthorexic tendencies among patients who have been diagnosed with AN and BN, and these tendencies tend to increase after undergoing treatment (Segura-Garcia et al., 2015).

Another Italian study conducted by Segura-Garcia and colleagues (2012) examined the relationship of ON to other eating disorders among athletes. This study used the ORTO-15, Eating Attitude Test 26 (EAT-26), Body Uneasiness Test (BUT) and Yale-Brown-Cornell Eating Disorder Scale (YBC-EDS) in 577 athletes and 217 non-athlete control participants. There was a high correlation between ORTO-15 and the EAT-26 scores among the athletes. Findings of this study suggest that, at least among athletes, symptoms of orthorexia are associated with other forms of disordered eating (Segura-Garcia et al., 2012; Shah, 2012).

There have been two American studies that have assessed the prevalence of orthorexic tendencies. The first was conducted by McInerney-Ernst (2011), who tested the prevalence of orthorexia nervosa in an American college student sample, exploring the legitimacy of orthorexia nervosa as an eating disorder. There were 163 participants included in this study: 128 females (78.5%) and 25 males (21.5%). Most of the participants (89.1%) had college majors that focused on the arts, science, or a health field. Based on the ORTO-15, most of the participants (82.5%) met the criteria for having orthorexia nervosa. An alternate ORTO-15 was suggested with a cut-off score below 35, which would have resulted in only 30% of participants meeting the criteria for having orthorexia nervosa. The different cut-off scores of testing ON raises the question of reliability in the ORTO-15 measure. The results of this study did not indicate any significant associations between ON and age, gender, BMI, education, ethnicity, weight loss attempts, smoking, or alcohol consumption. There was also no significant relationship between marital status, number of children, or employment status. This study also did not find a significant
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relationship between anxiety symptoms, OCD symptoms, and ON symptoms. However, this study did find a positive correlation between ON and the characteristics it shares with other established eating disorders, with an example being a concern for the food being consumed (McInerney-Ernst, 2011).

The second study conducted by Shah (2012) examined the prevalence of ON, anxiety, OCD, eating disorders, and satisfaction with life among an American college sample. This study hypothesized that there would be a positive correlation between orthorexia and anxiety and OCD, that ON would have a higher prevalence rate in men, and there would be a positive correlation between higher quality of life and low body-mass index. There were 171 college undergraduates in the study with the majority being female (59.72%). Using the cut-off of the ORTO-15 at 40, a majority of the participants (69%) met the criteria for orthorexia nervosa, which is higher than most studies and not consistent with any of the previous studies except for the other American study conducted by McInerney-Ernst (2011). Again, the reliability of the ORTO-15 is called into question with the present results having a cut-off score of 40. If the study was to use the amended cut-off score of 35, only 21% of participants would have met the criteria for ON. Shah (2012) suggests this is because the ORTO-15 has poor internal reliability when being used in the United States as the data are not consistent with any previous study except the other American study (McInerney-Ernst, 2011). The results of this study found no significant relationship between anxiety, OCD, and orthorexia; however, there was a positive relationship between disordered eating and orthorexic tendencies. There was also a positive correlation between higher quality of life and low BMI, which is relevant because individuals with ON typically will view themselves as having a higher quality of life when their BMI is lower. In
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contrast to the other studies reported, Shah (2012) observed no significant difference for the prevalence rates of orthorexia for males and females.

Statement of the Problem

The available research data correlations are vastly divergent based on the literature review; therefore, more research is needed to resolve these discrepancies. There is minimal background literature on ON as an eating disorder and because of this, the topics discussed are based on the previous literature. In patients with ON, restrictive eating habits will typically appear because of the intense diet regimen that these individuals feel they must follow. To our knowledge, no studies have evaluated the correlation between restrictive eating habits and ON. Because of this, we hypothesize that the restrictive eating habits of other eating disorders (such as anorexia nervosa) would be common in ON, since ON and anorexia nervosa both have limitations of what they eat (or do not eat). With that being said, the literature regarding restrictive eating habits will be primarily through anorexic tendencies, but it can be inferred that it would be similar within ON individuals.

Another factor that may affect individuals of ON are the social factors associated with the intense diet regimen. Because individuals with ON are less likely to trust the preparation of food by anyone other than themselves, these individuals are going to be less likely to go to social outings and gatherings, which would directly affect their social experiences with others. This can cause an issue when an individual with ON is isolating themselves from others and experiences causing psychological distress (Hughes et al., 2016). For example, research has shown that depression and eating disorders co-occur (Godart et al., 2007). While ON has not been officially recognized as an eating disorder in the DSM-5, many of the qualities of ON are similar to other forms of eating disorders and restrictive eating habits; as such, it may be that depression and
other psychological effects common to other EDs would occur within these individuals. Lastly, the research on excessive exercise as it directly relates to ON is scarce. Because of this, excessive exercise research within other types of restrictive eating such as AN individual's will be used. Excessive exercise may play an important role in ON because of the guilt associated with eating foods that they consider to be impure. It proved difficult to find an accurate measure which tested guilt relevant to the present study, but it may be the case that some of the guilt experienced by individuals with ON may stem from a deep-rooted perfectionism issue. With this in mind, a measure investigating perfectionism will be used in addition to the available measure to assess guilt more broadly.

**Restrictive Eating**

As mentioned above, according to the literature regarding restrictive eating habits in individuals with AN, it can be inferred that the same might hold for individuals with ON. Disordered eating is different from the standard conceptualization of an eating disorder. The term "eating disorder" suggests a disease that can be clinically diagnosed, whereas the term "disordered eating" refers to specific patterns of eating that can develop into an eating disorder (Bryla, 2003) or have other adverse consequences, e.g., weight gain or weight cycling. There are many subcategories of disordered eating, but this section will only focus on those relevant to ON. A few signs of disordered eating include skipping meals, avoiding certain foods or certain food categories, feeling guilty after eating, and an obsession with food and weight (Bryla, 2003). It has already been stated that weight does not appear to play a significant role in the development of ON; however, all of the other disordered eating signs stated can be associated with signs of ON. It is already known that individuals with ON will avoid certain foods and food categories; they will skip meals in which they consider unhealthy; they have a tendency to feel
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guilty after eating; and there is a strong obsession with food. Disordered eating has been shown to have consequences such as psychological symptoms, worse eating habits with poor nutritional intake, and difficulties maintaining weight due to weight cycling (Neumark-Sztainer, 1995; Bryla, 2003).

While research regarding ON has not found any significant correlation between the disorder and weight loss, it can be inferred that before ON develops, an individual may be trying to eat healthier in order to maintain or lose weight. A study conducted by Eisenberg and colleagues (2012) researched associations between hurtful comments about one’s weight from significant figures in one’s life with disordered eating behaviors. Previous research has found a correlation between weight-teasing and disordered eating habits among the adolescent population. This study suggested that it is likely that environmental and social factors have an important contribution to unhealthy weight control behaviors. The results of this study indicate a significant correlation between developing disordered eating habits and receiving negative weight-based comments from family and significant others (Eisenberg et al., 2012).

In another study, Muehlhauser (2017) set out to test whether there is a relationship between perceived criticism and disordered eating patterns, as well as whether the relationship has any correlation with self-criticism. One hundred and five undergraduate college students participated in an online self-report survey that assessed self-criticism, perceived criticism from others, and disordered eating behaviors. The results of this study indicate levels of perceived criticism were not related to disordered eating behaviors; however, an individual's level of self-criticism was found to be related to disordered habits and behaviors (Muehlhauser, 2017).

An Australian study conducted by Grigg and colleagues (1996) determined that 10-20% of females experiment in unhealthy weight loss methods involving restricted energy and nutrient
intake. Some of the practices used were to cut meats, dairy, and starchy foods entirely from their diet. There is evidence to suggest that adolescents may tend to associate the idea of dieting with an increase in healthy food behaviors such as eating large amounts of fruits. Many individuals associate dieting with skipping meals and a means of starvation (Bryla, 2003). Disordered eating can increase the likelihood of binge eating episodes. It has been found that when food intake is severely restricted, an individual is more likely to give into temptations for unhealthy foods, which in turn, may result in binge eating. In contrast, those who do not diet show a lesser likelihood to binge eat, and they often maintain more consistent eating patterns (Neumark-Sztainer, 1995; Bryla, 2003).

Social Factors

The quality of life of an individual with ON may deteriorate as they forego both intimate and larger social gatherings that involve food, socially isolating themselves and experiences (Hughes et al., 2016). Suffering from ON can cause individuals to be very wary over the way their food is prepared. This can cause the individual's social life to diminish since they do not trust anyone to prepare their food for them, thereby resulting in individuals cutting themselves off from outside social interactions where food may be involved. Little is known about the negative social effects experienced by individuals with orthorexia nervosa. There have only been two studies conducted on these social outcomes. In one study conducted by Nevin and Vartanian (2017), attitudes and beliefs towards those with orthorexic tendencies as well as anorexic tendencies were evaluated. Results indicated that a woman was viewed more negatively if she was following a clean diet as opposed to an “average” diet. They also found that individuals suffering from orthorexia nervosa were perceived just as negatively as those described as suffering from anorexia nervosa (Nevin & Vartanian, 2017).
Apart from the study mentioned above, there is only one other study that investigated negative social outcomes of orthorexia. Simpson and Mazzeo (2017) found that the stigma towards someone described as having orthorexia nervosa was similar negative stigma as other individuals with other types of eating disorders. However, it is important to note that this study did not include a control group; therefore, further research is needed to determine the exact relationship stigma between orthorexia and other disordered eating (Nevin & Vartanian, 2017).

Psychological Distress

Since ON is a relatively new concept, there is a dearth of information regarding psychological effects of ON directly. However, in this section, psychological effects will be analyzed through inferences drawn from those experienced by individuals with other forms of disordered eating. As previously mentioned, research has been shown that depression and eating disorders co-occur (Godart et al., 2007). There are individuals who do not meet the DSM criteria who still present symptoms of an eating disorder. For both diagnosed and subthreshold cases, impairment has been observed, including prior psychiatric treatment, elevated reports of suicide attempts, high reports of emotional distress, and other psychiatric disorders (Salk, 2016).

In a study conducted by Nereen (2007), it was hypothesized that negative life events would be associated with disordered eating, depression, and anxiety symptoms among participants. This study consisted of 215 college freshmen who completed self-report measures of anxiety, depression, recent negative life events, disordered eating, and perceived exposure to disordered eating. This study observed significant correlations between negative life events and disordered eating, anxiety, and depression (Nereen, 2007).

Another study researched the incidence of disordered eating and its relationship with depression and body satisfaction among Hispanic females, examining the extent to which
depression and body satisfaction could predict disordered eating habits. It was thought that depression would predict body dissatisfaction and body dissatisfaction would predict disordered eating (Santiago, 2001). The results of this study showed a significant relationship among depression, body dissatisfaction, and disordered eating. Both depression and body dissatisfaction were shown to be significant predictors of disordered eating. Lastly, as hypothesized, the relationship between disordered eating and depression was mediated by body dissatisfaction (Santiago, 2001).

Another study conducted by O'Brien and colleagues (2016) set out to investigate whether the association between disordered eating habits and weight stigma experiences could be attributed to internalized weight bias and psychological distress. This study consisted of 634 college undergraduates, assessed via online survey methodology on weight stigma, disordered eating, psychological distress, and internalized weight bias. The data showed a significant association between weight stigma and all measures of disordered eating. The internalization of weight bias showed a significant association with psychological distress. The authors concluded that internalized weight bias and psychological distress are important factors when considering the relationship between disordered eating and weight stigma (O'Brien et al., 2016).

**Excessive Exercise**

The obsession with appearance based benefits of exercise has led to the creation of ‘excessive exercise’ within clinical concern (Scott, 2011). Exercise is given the term ‘excessive’ once it has the ability to impact an individual’s daily life and functioning. There is a cyclical quality to excessive exercise: the more that an excessive exerciser engages in this behavior, the stronger the urge to exercise. These individuals are found to continuously increase length, frequency, and intensity of their workouts. Because of this, those who excessively exercise are
more prone to experience psychological and physiological distress whenever they are unable to partake in their workouts (De Coverley Veale, 1987; Scott, 2011).

To our knowledge, the data regarding excessive exercise and ON is scarce. Only one study was found that tested the prevalence of ON in participants who exercised regularly. Eriksson and colleagues (2008) conducted a Swedish study testing if the impact of high anxiety about appearance could impact BOT scores within fitness participants. This study included 251 participants (166 females and 85 men). Of those tested, 66% of the men and 54% of the females exercised regularly, at least 3-4 times a week. The results indicated that when women exercised at a higher frequency than the average for this fitness center, they were more likely to indicate symptoms of orthorexia. There was no statistically significant effect for men. Nonetheless, this study provides some support for an association between excessive exercise and orthorexic tendencies, at least among women (Eriksson, Baigi, Marklund, & Lindgren, 2008).

Since the previous study did find a correlation between ON and excessive exercise, it would be reasonable to hypothesize that orthorexic tendencies can result in excessive exercise behaviors. Since it has already been established that ON shares similar qualities to anorexia nervosa, it would also be reasonable to conclude that the excessive exercise literature regarding individuals diagnosed with anorexia would also hold within individuals who display characteristics of ON.

One study set out to predict the relevance of excessive exercise among patients diagnosed with AN. This study consisted of 153 inpatient participants who were previously diagnosed with AN. This study defined excessive exercise as an obligatory workout for a minimum of one hour, with the goal of maintaining weight and shape, for 6 days a week. The results of this study found that 34% of AN patients met criteria for excessive exercise. The study also found that high levels
of depression, self-esteem, and dietary restraint were all significantly associated with excessive exercise. However, one limitation of this study included the fact that all patients who completed the questionnaire were inpatients; therefore, they were not actively exercising during their self-report. There is a chance that impacted the participant's responses, thereby possibly impacting the findings of the study (Bowell-Weiss & Cater, 2010).

Another study conducted by Calogero and Mond (2009) set out to evaluate the nature of excessive exercise among those with a diagnosed eating disorder. The excessive eating habits were compared between eating disorder treatment patients and healthy controls. The study included 102 patients with an eating disorder and 184 healthy women. Self-report measures were used to assess motivation for exercise, obligation for exercise, and the intensity of the exercise. Findings revealed clear differences between participants with an eating disorder and the healthy participants, with elevations for ED patients on extreme guilt when an exercise is missed, exercising primarily due to shape, physical attraction, and weight related reasons (Calogero & Mond, 2009).

Research Questions

Hypothesis One.

Based on the literature for disordered eating more broadly defined, it was hypothesized that there would be significant associations between orthorexic tendencies and psychological variables such as depression, anxiety, obsessive compulsive features, and health-related quality of life.

Hypothesis Two.

It was hypothesized that individuals prone to restrictive eating habits and those who score high on the Fear of Food Measure would be more likely to have orthorexic tendencies.
Hypothesis Three.

It was hypothesized that guilt would mediate the relationship between orthorexic tendencies and excessive exercise.

Method

Participants

Participants were recruited from Eastern Michigan University using an online survey method. Validity checks were done through multiple pauses throughout the study to ask the participant if "they were still with us" by selecting a given open. For example, we may have asked the participant to select the option of "B" to check that they were still actively engaged in the survey. Any participants that failed this validity check was removed from the overall results of this study. A total of 325 participants started the survey; however, based on the multiple validity checks, only 290 were valid cases. Of these 290 participants, 34.5% were male, 63.1% were female, and less than 1% reported other gender identification. The mean age of participants was 22 years old, with a range of 18 to 60. With respect to race/ethnicity, 66% identified as Caucasian, whereas 13.9% reported identifying as African American, 4.2% reported identifying as Hispanic, 4.5% reported identifying as Asian, less than 1% identified as either Middle Eastern or American Indian, and 10.8% reported as identifying as having a multi-racial identity.

Design

The aim of this study was to investigate how ON in undergraduate college students correlates with restricted eating habits, excessive exercise, and psychological effects. Cross-sectional survey research methodology was used.

Procedures

Participants were recruited from the undergraduate psychology courses at Eastern Michigan University through the SONA research system. The survey was designed through an
online survey method using SurveyMonkey (www.SurveyMonkey.com), a commonly used platform for online survey deployment. Participants were able to complete the survey in one session. All participants received the same set of questionnaires. Participants were first asked to fill out a demographic questionnaire. This was then followed by the Bratman’s Orthorexia Test (BOT), Orthorexia Nervosa-15 (ORTO-15), Yale-Brown Excessive Compulsive Scale (Y-BOCS), Center for Epidemiological Studies Depression (CES-D), Exercise and Eating Disorders Questionnaire (EED), Quality of Life Questionnaire (SF-36), the Fear of Food Measure (FOFM), the Big Three Perfectionism Scale (BTS), and the Personal Feelings Questionnaire (PFQ).

Measures

Demographic questionnaire. Participants were asked to provide basic demographic information consisting of age, gender identity, sexual orientation, weight, height, race/ethnicity, employment status, marital status, and socioeconomic status.

Bratman’s Orthorexia Test (BOT). Orthorexic tendencies were assessed using Bratman’s Orthorexia Test (Appendix A; Bratman, 2000). This scale consists of ten items measuring different individual orthorexic qualities such as, “Do you spend more than 3 hours a day thinking about your diet?” and “Do you feel at peace with yourself and in total control when you eat healthily?” Bratman (2000) suggests that answering “yes” to more than three of the questions could suggest orthorexic tendencies. The BOT is based primarily on clinical experience, and the validity has not been tested by Bratman or others.

Orthorexia Nervosa-15 (ORTO-15). Orthorexic tendencies were also assessed using the Orthorexia Nervosa-15 test (Appendix B; Donini et al., 2004). The ORTO-15 consists of fifteen items which measure various eating attitudes, obsessive tendencies, and the relationship between orthorexia and eating attitudes such as, “When eating, do you pay attention to the calories of the
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food?" and Are you willing to spend more money to have healthier food?" Each item is listed 4-point Likert scale with 0 indicating little agreement and 4 indicating a strong agreement. Donini (2004) suggested that scores below 40 points represent highly sensitive orthorexic tendencies, and eating behavior reaches more normal standards as the score increases (Brytek-Matera, 2012; Donini et al., 2004).

The ORTO-15 was designed after Bratman's Orthorexia Test. The items address the preparation, consumption, selection, the effect of, and attitude towards an individual's presumption towards healthy foods. Donini et al. (2004) tested for three underlying factors, which consisted of the cognitive-rational (items 1, 5, 6, 11, 12, 14), the clinical (items 3, 7, 8, 9, 15) and the emotional (items 2, 4, 10, 13) components of ON (Donini et al., 2004; Varga et al., 2014). Answers which suggest orthorexic tendencies were rated with a score of 1, while the healthier answers were given a score of 4. Item scores are summed to yield a total score. A score of 40 or lower is suggested to indicate high orthorexic features and was tested as most appropriate for distinguishing between individuals with ON and without (Varga et al., 2014). A limit to the scale is that it does not test for obsessive-compulsive features, which Donini et al., 2004 believed should be added in a future version of the ORTO-15 and should be tested separately.

Yale-Brown Obsessive Compulsive Scale (Y-BOCS). Obsessive Compulsive tendencies were tested using the Yale-Brown Obsessive Compulsive Scale (Appendix C; Goodman, 1985). This scale is used to test severity of OCD within individuals. This scale consists of 10 items which measure obsessive thoughts and compulsive behaviors such as "How much distress do your obsessive thoughts cause you?" and "How much time do you spend performing compulsive behaviors?" Y-BOCS scores range from 0 to 40. Scores closer to 40 indicate higher severity of obsessive compulsion. Obsession and compulsion scores are shown
on subscales that range from 0 to 20, but only the total Y-BOCS score is included in the 
interpretation. Based on the severity of symptoms interpreted, the total scores can be split into 
five different categories. Scores within 24-31 are likely to have severe cases of obsessive 
compulsive tendencies and scores ranging from 32-40 are shown to have an extreme case of 
OCD. While research is contradictory on whether obsession and compulsion correlate with ON, 
we believe that it may be correlated. We used the Y-BOCS to test for this correlation.

Goodman et al. (1989) tested the validity of this scale and was able to find that the Y-
BOCS had a significant correlation with two independent measures of OCD. This same study 
also showed evidence that the Y-BOCS is sensitive to changes in OCD symptoms. The Y-BOCS 
was also shown to have high internal consistency and high interrater reliability (Goodman et al., 
using a multi-method approach. The Y-BOCS was able to demonstrate strong convergent 
validity with measures associated with OCD, but divergent validity in relation to depression.

**Center for Epidemiological Studies Depression (CES-D).** Severity of depressive 
symptoms was assessed using Center for Epidemiological Studies Depression (Appendix D; 
Radloff, 1977). This scale consists of twenty items measuring various symptoms of depression, 
such as "I did not feel like eating; my appetite was poor" and "I had trouble keeping my mind on 
what I was doing." Items query how many times an individual experienced each symptom over 
the last week ranging from rarely or none of the time (less than 1 day = score of 0) and most or all 
of the time (5-7 days = score of 3). The scores range from 0-60, and depression is considered 
when a score reaches 16 points or more. Questions 4, 8, 12, and 16 are reverse scored. The CES-
D will be used to find correlations between individuals displaying symptoms of ON and 
individuals displaying symptoms of psychological effects such as depression.
Yang and colleagues (2015) tested the reliability and validity of the CES-D by testing 409 participants who had attempted suicide and 409 controls who had not. The results found that the Cronbach’s alpha values of the CES-D were 0.940 and 0.895 within suicide attempters and comparison residents. The authors found that CES-D scores were significantly correlated with scores on the Beck Hopelessness Scale (BHS) and the Trait Anxiety Inventory (TAI) in their participants who had attempted suicide and those who had not. A 3-factor structure which consisted of interpersonal problems, positive affect, and depressive mood and somatic symptoms combined was displayed in 14 of the scale items using a confirmatory factor analyses. This was shown to work best with the two populations tested within this study. The conclusion of this study showed that CES-D scale is satisfactory in reliability and validity when used to assess depression in previous suicide attempters and those who did not attempt suicide (Yang et al., 2015).

**Exercise and Eating Disorders Questionnaire (EED).** The Exercise and Eating Disorders Questionnaire (Appendix E; Danielsen et al., 2012) is an eighteen item self-report scale used to assess compulsive exercise, which includes items such as “It feels wrong if I can’t be physically active every day” and “I enjoy being physically active.” Participants indicate their frequency of eating and exercise behaviors on a Linkert 6-point scale ranging from 0 (Never) and 5 (Always). These items are reverse-scored for statements with a positive meaning. It is scored by taking the total of each of the eighteen items from the subscales and a total global scale score. Higher scores on the EED suggest higher exercise rates with scores ranging from 0 to 90. We will use the EED to test for correlations in individuals who excessively exercise and individuals displaying orthorexic tendencies.
The EED was the first clinically derived self-report measure which assessed compulsive exercise within individuals with an eating disorder (Danielsen et al., 2012). The properties of the EED were validated with a four-factor solution subscale, which consisted of: compulsive exercise, positive and healthy exercise, awareness of bodily signals, and weight and shape exercise. There was a statistically significant difference between eating disorder patients and healthy controls (p < .001) on the global score, subscales, and individual items. The global score test-retest reliability was satisfactory. (r = 0.86) (Danielson et al., 2015).

Quality of Life Questionnaire (SF-36). The Quality of Life Questionnaire (Appendix F) consists of thirty-six questions assessing an individual’s quality of life. The self-report measure assesses general health ranging from poor to excellent. This scale also assesses limitations of activities ranging from not limited to limited a lot. Physical and emotional health problems are assessed on a yes or no scale. Social activities are evaluated with items ranging from not at all to severely. Energy and emotions are assessed with items ranging from none of the time to all of the time scale. Lastly, general health is assessed with items ranging from definitely false to definitely true. The SF-36 consists of eight scaled scores: (vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning, and mental health). Each scale is on a 0-100 scale with the assumption that each holds equal weight. The lower an individual sum score, the higher the disability in that subsection. We used the SF-36 to test the relationships between facets of quality of life and orthorexic tendencies.

Ruta and colleagues (1994) conducted a study to test the reliability and validity of the SF-36 within two patient populations. The study consisted of 1,787 patients with one of four conditions consisting of lower back pain, varicose veins, menorrhagia, and suspected peptic
ulcer. This was assessed using internal consistency reliability with Cronbach's alpha coefficient. The retest of reliability was done using the Pearson correlation coefficient and confidence interval analysis. The authors found that both measures of reliability found similar results when looking at most of the SF-36 scales. When conducting a controlled trial, the authors found a statistically significant difference of 20 points that can be detected on all eight SF-36 scales. The conclusion was found that all eight SF-36 scales show high reliability when used for monitoring health within an inpatient sample. At least four of the scales displayed high reliability when used for managing individual patients.

**Fear of Food Measure (FOFM).** The Fear of Food Measure (Appendix G; Byrne & Levinson, 2014) is a 23-item questionnaire to assess trait anxiety over eating, food avoidance behaviors, and concerns or fear over food. This questionnaire consists of questions such as “I feel anxious when I eat” and “There are certain foods I avoid because they make me anxious.” All items are reported ranked on a 7-point Likert scale from 1 (Not at all) to 7 (Very much so).

Byrne and Levinson (2015) developed the FOFM to assess trait anxiety about eating, food avoidance behaviors, and feared concerns in relation to eating. In a general sample of 399 participants and a female sample of 203 participants, the FOFM displayed a three-factor structure with convergent and divergent validity. The three subscales were found to be moderately to strongly correlated (rs= 0.57 to 0.76). Test-retest reliability was strong and held up among original results. All three subscales were shown to be elevated among participants diagnosed with an eating disorder relative to healthy controls.

**Personal Feelings Questionnaire (PFQ).** The Personal Feelings Questionnaire is a 10-item questionnaire designed to assess shame and guilt. The scale was initially used to provide
information about characteristic emotional tendencies. This questionnaire ranges from 0-4 reflecting how common the feeling is for the participant. “0” means you never experienced that feeling, “1” means the feeling is experienced rarely, “2” means you experience that feeling some of the time, “3” means you experience that feeling frequently but not in a consistent way, and “4” means you experience the feeling almost continuously or continuously. An example of two of the feelings this questionnaire consists of is the feeling of “embarrassment” and “intense guilt.”

Harder and Lewis (1987) conducted a study to test the validity and reliability of the PFQ. The study consisted of 120 participants and all of them received the shame and guilt measures while 60 of them were administered some of the construct validity instruments. The results for the PFQ scales appeared to be the most valid out of the four guilt measures that was tested in the study. PFQ guilt exhibited “significant relationships with PFQ shame, self-derogation, low self-esteem, lack of self-image stability, MAACL anxiety, MAACL depression, MAACL hostility, Beck depression, and regression defense” (Harder & Lewis, 1987).

Data Analyses

Data analyses used Chi-Square and t-test analyses as appropriate to evaluate differences in orthorexic tendencies across demographic variables. To test the main hypotheses, a correlational matrix of all the variables was evaluated. The correlation matrix was inspected for items that are related one on one to be put into a regression equation to identify which hold up as the strongest predictors to account for the most variance in orthorexic tendencies. To test mediation, Preacher and Hayes’ SPSS macro was used with the predictor variable being orthorexic tendencies, and the outcome being excessive exercise and the mediator being guilt.
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Other psychological mediators (i.e., fear of food, obsessive-compulsive tendencies) were also assessed.

Results

This study had 326 volunteers who started the survey; however, based on the multiple validity checks, only 290 of them were valid cases. Participants self-reported demographic data is available in Table 1. Of these 290 participants, the 34.5% were male, 63.1% were female, and less than 1% reported other gender identification. The participants' ages ranged from 18 to 60 (M = 21.7, SD = 5.97).

Table 1

<table>
<thead>
<tr>
<th>Participant Demographics</th>
</tr>
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<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Age in years</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
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<tr>
<td>Other</td>
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<tr>
<td>Trans FTM</td>
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<tr>
<td>Race</td>
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<tr>
<td>White/Caucasian</td>
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<tr>
<td>Black/African American</td>
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<tr>
<td>Hispanic/Latino</td>
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<tr>
<td>Asian</td>
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<tr>
<td>American Indian or Alaska Native</td>
</tr>
<tr>
<td>Middle Eastern</td>
</tr>
<tr>
<td>Biracial/Other</td>
</tr>
</tbody>
</table>
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The results of this study found the ORTO-15 and the BOT to be highly inversely correlated (-.43). This raises the question about the reliability and validity of the ORTO-15 and is consistent with the other American study findings (McInerney-Ernst, 2011 & Shah, 2012). Because of this, the BOT measure was used to measure correlations between existing variables instead of the ORTO-15. Bratman suggests that an individual who answers “yes” to 4 or more questions on the BOT are displaying orthorexic tendencies. By this cut-off, 67% of the sample in the present study met this cut-off. Because this cut-off number was so high, the cut-off was amended to answering “yes” to 6 or more questions on the BOT. This amended cut-off did not seem to change anything on the t-tests; therefore, expanding the cut-off to 6 does not produce any new information with the results of the BOT.

Hypothesis One.

It was hypothesized that there would be significant associations between orthorexic tendencies and psychological variables such as depression, anxiety, obsessive compulsive features, and health-related quality of life. A correlation matrix was produced to state the results of orthorexic tendencies and related variables. A full breakdown of these relationships is available in Table 2. As hypothesized, orthorexic tendencies were significantly correlated with anxiety, guilt, shame, obsessive compulsive features, excessive exercise, and health related quality of life (see Table 2). These results suggest that the BOT scale is associated with shame (.152), guilt (.186), YBOCS (.224), FOFM (.410), and the EED Total Score (.404). In other words, results indicate that ON, anxiety, and obsessive-compulsive features are related, but ON and depression were not. The hypothesis predicted orthorexic tendencies to be associated with health-related quality of life; however, the only health-related quality of life subscale that had statistical significance with the BOT is physical role functioning (-.206).
## Table 2

*Correlation Matrix of Bratman’s Orthorexia Test and related variables (N = 290)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BOT Total Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ORTO-15</td>
<td>-.43**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. PFQ Shame</td>
<td>.15*</td>
<td>-.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. PFQ Guilt</td>
<td>.19**</td>
<td>-.13*</td>
<td>.71**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. YBOCS</td>
<td>.22*</td>
<td>-.05</td>
<td>.47**</td>
<td>.44**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. CESD</td>
<td>.09</td>
<td>-.06</td>
<td>.66**</td>
<td>.66**</td>
<td>.59**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. FOFM</td>
<td>.41**</td>
<td>-.32**</td>
<td>.50**</td>
<td>.49**</td>
<td>.47**</td>
<td>.472**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. EED Total Score</td>
<td>.40**</td>
<td>-.31**</td>
<td>-.08</td>
<td>.03</td>
<td>.02</td>
<td>-.04</td>
<td>.19**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. SF-36 RL PHYS</td>
<td>-.21**</td>
<td>.09</td>
<td>-.19**</td>
<td>-.26**</td>
<td>-.31**</td>
<td>-.29**</td>
<td>-.33**</td>
<td>.16</td>
<td></td>
</tr>
</tbody>
</table>

*Note. *p < .05, **p < .01, ***p < .001*
**Hypothesis Two.**

It was hypothesized that individuals prone to restrictive eating habits and those who score high on the Fear of Food Measure would be more likely to have orthorexic tendencies. This relationship can be examined through Table 2. As hypothesized, the FOFM was significantly correlated with the BOT ($r = .41$). In other words, these results suggest that participants who scored high on the FOFM were more likely to have orthorexic tendencies. The overall model was significant ($F (4) = 12.95, p < .001$), but the only significant variable from the combined regression model was the FOFM ($t = 5.9, p < .001$).

**Hypothesis Three.**

It was hypothesized that guilt would mediate the relationship between orthorexic tendencies and excessive exercise. To measure this, a mediation analysis of the BOT, PFQ Guilt, and the EED was used. The full results of this mediation analysis are displayed in Figure 3. These results suggest that the BOT and PFQ Guilt are related, and the BOT and the EED are related, but these relationships were not mediated by guilt. In other words, those who have orthorexic tendencies may experience guilt, and those who have orthorexic tendencies may experience excessive exercise, but those with orthorexic tendencies are not excessively exercising because of guilt.

*Figure 3*

*Path analysis of the relationship between BOT Measure, PFQ Guilt total score, and EED total score.*
Because the original hypothesis was not supported by the findings, a mediation analysis of the BOT, the FOFM, and the EED was also ran. This analysis is shown in Figure 4. In support of the original findings, the BOT was associated with the FOFM, the BOT was still associated with the EED, but these were not mediated by the FOFM. In other words, individuals with orthorexic tendencies are likely to experience fear of food, individuals with orthorexic tendencies are still likely to excessively exercise, but individuals with orthorexic tendencies are not excessively exercising due to the fear of food.

Figure 4

Path analysis of the relationship between BOT Measure, FOFM, and EED total score

Since the FOFM relationship was not found to be the mediator, the Y-BOCS was also analyzed. This analysis is shown in Figure 5. Again, the BOT was associated with the Y-BOCS, the BOT was still associated with EED, but these were not mediated by the Y-BOCS. In other words, individuals with orthorexic tendencies are likely to have obsessive compulsive features, individuals with orthorexic tendencies are still likely to excessively exercise, but individuals with orthorexic tendencies are not excessively exercising due to obsessive-compulsive features.
Lastly, we wanted to understand what was most significant predictor of orthorexic tendencies. A regression analysis of the Y-BOCS, PFQ Guilt, PFQ Shame, The FOFM and the EED was conducted. The regression analysis excluded the FOFM and the EED since they are similar measures already correlated with the BOT. When removing FOFM and the EED from the regression analysis, the Y-BOCS held up as being the strongest predictor of orthorexic tendencies. In other words, obsessive-compulsive features are a strong predictor of ON.

Discussion

The main purpose of this study was to fill the gaps in the literature surrounding ON as an eating disorder. This study attempted to use Donini’s (2004) ORTO-15 as our variable predicting orthorexic tendencies. However, the BOT and ORTO-15 were negatively correlated, which does not make a lot of sense since they are supposed to be testing for the same thing. All of the studies in the literature review with the exception of two were done outside of the United States. All of the studies in the literature review used the ORTO-15 to test for ON, but given that the current study found the BOT and ORTO-15 to be negatively correlated, it raises concern for how reliable the ORTO-15 really is. Extensive review and inspection of the scoring syntax verified that we were, in fact, scoring the measure in the direction indicated by its developers. However,
McInerney-Ernst (2011) and Shah (2012) were the only two American studies to use the ORTO-15 within their study and both questioned the internal validity and reliability of the measure. This leaves us to wonder if there was something lost in translation with the scoring of the ORTO-15 since it was developed in Italy and mostly tested in other countries outside of the United States.

It was hypothesized that there would be significant associations between orthorexic tendencies (now, using the BOT) and psychological variables such as depression, anxiety, obsessive compulsive features, and health-related quality of life. As mentioned above, the results showed a significant correlation between orthorexic tendencies and psychological variables such as anxiety, obsessive compulsive features, but did not yield any significant correlations with depression or health-related quality of life. Previous studies found no significant relationship between anxiety, OCD, and orthorexia, but they did find a positive relationship between ON and other disordered eating (Shah, 2012; McInerney-Ernst, 2011).

Secondly, it was hypothesized that individuals prone to restrictive eating habits and those who scored high on the FOFM will be more likely to have orthorexic tendencies. To our knowledge, the FOFM has never been used in previous studies of ON. The results indicate a significant correlation between orthorexic tendencies and fear of food. This could indicate that the FOFM is a good measure to use when screening for orthorexic tendencies since they were so highly related.

Lastly, it was hypothesized that guilt would mediate the relationship between orthorexic tendencies and excessive exercise, and those with orthorexic tendencies would be more inclined to excessively exercise if they were also high on a measure of guilt. The results showed that ON and exercise were related, but this was not mediated by fear of food, guilt, or obsessive-compulsive features. Aksoydan & Camci, (2009) conducted a study looking at exercise habits
within individuals who may have orthorexic tendencies, but they did not state any proposed mediations with the relationship between ON and excessive exercise. There is a phenomenon deemed as Activity Anorexia, which found that in animals, excessive exercise is not caused by any psychological variables, but rather by starvation itself making activity more reinforcing, which could be one of the reasons that we did not see this response in the present study (Pierce & Epling, 1994).

As mentioned above, 67% of sample is above the cut-off of the BOT (4 or more of questions). We believe that the cut-off may be too low to show a real statistical significance, so we tested a different cut-off of 6 items and above. We made the interpretation that the more extreme orthorexic tendencies were, the more negative quality of life one would have. However, shame, guilt, Y-BOCS, and FOFM all remained near the same level significance. In addition, the SF-36 physical role limitations being lower for individuals with a more extreme case of ON still reported the same. Therefore, changing the cut-off of the BOT from 4 and above to 6 and above did not change any of the correlated results between any measures and did not give us any new information.

ON is significantly correlated with many variables, and after reviewing the results, we were interested in which individuals may be most at risk for developing ON. The highest level of significance with ON was the FOFM, but that does not tell us a lot of information since these two variables are conceptually highly overlapping. Therefore, if we take out the FOFM, the next closest significant correlation would be individuals who scored high on the Y-BOCS. According to the results, these individuals who have obsessive compulsive features are at a higher risk for developing ON. This is an interesting finding because previous research had consistently not found a correlation between ON and obsessive-compulsive features (Varga, Thege, Dukay-
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Szabó, Túry, & van Furth, 2014; Brytek-Matera, 2015; Shah, 2012; McInerney-Ernst, 2011).

One reason this study may have found different results than others could be because most (if not all) previous research has relied solely on the ORTO-15 as the measure for ON, whereas the BOT was the measured used in this study. It would make sense that individuals with high obsessive-compulsive features would be more at risk for an eating disorder, which relies heavily on the obsessive component of healthy eating habits. This could suggest that the BOT is a more reliable test for assessing individuals with ON than the ORTO-15.

Limitations and Future Research

The present study was the first to primarily use the BOT as the predictor for orthorexic tendencies. This could be a limitation because the BOT is only a 10-item measure with “yes” or “no” responses. While it is possible that using the BOT as our ON variable measure was a good thing because we saw correlations that other studies did not when using the ORTO-15, this could also be a limitation to the study because the BOT has never been tested for internal validity and reliability. This poses the question of the validity and reliability of the results this study received. Future researchers may want to look into the validity and reliability of the BOT as a measure for ON. Future research should also look into the ORTO-15 as a reliable test for ON since the only validity and reliability test for it was done by Donini himself (Donini, 2005).

Additionally, all data was gathered via self-report measures, which is a limiting factor. It is possible that participants could have under-reported on severe symptoms in the measures. Social desirability bias could have occurred since participants may have been unwilling to report accurately to be seen in a more favorable light by the researcher despite the participants knowing that the study was anonymous. Another limitation to the study falls within the majority of our
sample being of a Caucasian race (66%). This opens gaps within our findings because we did not have a very racially diverse sample of participants.

Despite the limitations to the current study, ON should be further investigated to further delve into its classification as an ‘eating disorder.’ Future studies should have a more varied sample that has individuals of varied ages, ethnicities, and perhaps geographical locations. In addition, future studies should measure ON with Bratman’s test to see if the results are similar to the results received in the present study. The development of a valid orthorexia measure is necessary. The BOT and the ORTO-15 stand as the only two orthorexia measures that have been developed and neither of them have strong validity and reliability as measures to test ON. Shah (2012) and McInereny-Ernst (2011) were the first studies to question the internal validity and reliability of the ORTO-15. Many previous studies show inadequacies within the validity of the ORTO-15, but many have continued to use the measure without questioning any of the psychometric properties and have accepted the odd results (Shah, 2012).

This study failed to find what could be mediating the relationship between ON and excessive exercise. As shown above, it was not guilt, fear of food, or obsessive-compulsive features. We know that orthorexic tendencies and excessive exercise are related, and we know that individuals with orthorexic tendencies are more likely to excessively exercise, but we still do not know why. Future research could delve deeper into the underlying reasons behind why individuals with ON may be more inclined to excessively exercise. Additional research on the possibility of activity anorexia should be considered, as noted above.

The purpose of this study was to learn more information about ON so that eventually, we can learn how to better recognize signs, symptoms, and possible treatment with individuals who may have this disorder. To our knowledge, the current study is only the third American study
that has been conducted within an American college population. The current study found ON to be associated with guilt, shame, anxiety, obsessive-compulsive features, fear of food, and excessive exercise. The results of this study also show that the FOFM can be used in relation to orthorexic tendencies because the two are highly correctly. Lastly, this study showed that guilt, fear of food, and obsessive-compulsive features does not mediate the relationship between orthorexic tendencies and excessive exercise. Future research should continue to expand on the underlying reasons behind those findings. Study limitations such as sample, the use of self-report measure's, and the internal validity and reliability of Bratman's Orthorexia Test should be considered when interpreting the results of this study. Lastly, the ORTO-15 scale should not be used in future research on ON because a new scale should be developed. It is clear through the results of this study that the ORTO-15 cannot be reliably used as an appropriate measure to test ON when it is so negatively correlated with the BOT, which is designed to test for the same thing. There is still a lot that is unknown about ON as an eating disorder (or if it can even be classified as an eating disorder). Future research should expand on the present findings to further establish whether ON is truly an eating disorder, a variant of obsessive-compulsive disorder, or simply an extreme version of health behavior.
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Appendix A

Bratman’s Self-Test for Orthorexia Nervosa

1. Do you spend more than 3 hours a day thinking about your diet?

2. Do you plan your meals several days ahead?

3. Is the nutritional value of your meal more important than the pleasure of eating it?

4. Has the quality of your life decreased as the quality of your diet has increased?

5. Have you become stricter with yourself lately?

6. Does your self-esteem get a boost from eating healthily?

7. Have you given up foods you used to enjoy in order to eat the ‘right’ foods

8. Does your diet make it difficult for you to eat out, distancing you from family and friends?

9. Do you feel guilty when you stray from your diet?

10. Do you feel at peace with yourself and in total control when you eat healthily?
Appendix B
Donini's ORTO-15

1. When eating, do you pay attention to the calories of the food?
2. When you go in a food shop do you feel confused?
3. In the last 3 months, did the thought of food worry you?
4. Are your eating choices conditioned by your worry about your health status?
5. Is the taste of food more important than the quality when you evaluate food?
6. Are you willing to spend more money to have healthier food?
7. Does the thought about food worry you for more than three hours a day?
8. Do you allow yourself any eating transgressions?
9. Do you think your mood affects your eating behavior?
10. Do you think that the conviction to eat only healthy food increases self-esteem?
11. Do you think that eating healthy food changes your life-style (frequency of eating out, friends, ...)?
12. Do you think that consuming healthy food may improve your appearance?
13. Do you feel guilty when transgressing?
14. Do you think that on the market there is also unhealthy food?
15. At present, are you alone when having meals?
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Appendix C
Goodman’s Y-BOCS

1. How much of your time is occupied by obsessive thoughts?
2. How much do your obsessive thoughts interfere with your social or work functioning?
3. How much distress do your obsessive thoughts cause you?
4. How much of an effort do you make to resist the obsessive thoughts?
5. How much control do you have over your obsessive thoughts?
6. How much time do you spend performing compulsive behaviors?
7. How much do your compulsive behaviors interfere with your social or work functioning?
8. How would you feel if prevented from performing your compulsion(s)? How anxious would you become?
9. How much of an effort do you make to resist the compulsions?
10. How strong is the drive to perform the compulsive behavior?
Appendix D

Radloff’s CES-D

1. I was bothered by things that usually don’t bother me.

2. I did not feel like eating; my appetite was poor.

3. I felt that I could not shake off the blues even with help from my family or friends.

4. I felt I was just as good as other people.

5. I had trouble keeping my mind on what I was doing.

6. I felt depressed

7. I felt that everything I did was effort

8. I felt hopeful about the future.

9. I thought my life had been a failure.

10. I felt fearful.

11. My sleep was restless.

12. I was happy.

13. I talked less than usual.


15. People were unfriendly.

16. I enjoyed life.

17. I had crying spells.

18. I felt sad.

19. I felt that people dislike me.

20. I could not get “going.”
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Appendix E

Danielsen’s EED

1. I am physically active to avoid dealing with negative emotions.

2. It feels wrong if I can’t be physically active every day.

3. If I haven’t been physically active I don’t eat.

4. If I haven’t been physically active, I can’t relax.

5. If I haven’t been physically active, I get a bad conscience.

6. If I haven’t been physically active, my body feels big.

7. If I haven’t been physically active, my body feels disgusting.

8. I listen to my body.

9. I enjoy being physically active.

10. I like to exercise with other people.

11. I am physically active to be healthy.

12. I notice when I get tired.

13. I notice when I get thirsty.


15. I notice when I feel fit/in shape.

16. I am physically active to become thin.

17. I am physically active to burn calories I have eaten.

18. I am physically active for appearance reasons.
Appendix F
Quality of Life Questionnaire (SF-36)

In general, would you say your health is:

1 - Excellent
2 - Very good
3 - Good
4 - Fair
5 - Poor

 Compared to one year ago, how would you rate your health in general now?

• Much better now than one year ago
• Somewhat better now than one year ago
• About the same
• Somewhat worse now than one year ago
• Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

• Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports
• Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
• Lifting or carrying groceries
• Climbing several flights of stairs
• Climbing one flight of stairs
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- Bending, kneeling, or stooping
- Walking more than a mile
- Walking several blocks
- Walking one block
- Bathing or dressing yourself

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

Cut down the amount of time you spent on work or other activities?

- Yes
- No

Accomplished less than you would like?

- Yes
- No

Were limited in the kind of work or other activities?

- Yes
- No

Had difficulty performing the work or other activities (for example, it took extra effort)

- Yes
- No
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During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

Cut down the amount of time you spent on work or other activities?
- Yes
- No

Accomplished less than you would like?
- Yes
- No

Didn’t do work or other activities as carefully as usual?
- Yes
- No

During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?
- Not at all
- Slightly
- Moderately
- Quite a bit
- Extremely
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How much bodily pain have you had during the past 4 weeks?

- None
- Very Mild
- Mild
- Moderate
- Severe
- Very severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- Not at all
- A little bit
- Moderately
- Quite a bit
- Extremely

How much of the time during the past 4 weeks…

- Did you feel full of pep?
- Have you been a very nervous person?
- Have you felt so down in the dumps that nothing could cheer you up?
- Have you felt calm and peaceful?
- Did you have a lot of energy?
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- Have you felt downhearted and blue?
- Did you feel worn out?
- Have you been a happy person?
- Did you feel tired?

During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- All of the time
- Most of the time
- Some of the time
- A little of the time
- None of the time

How TRUE or FALSE is each of the following statements for you.

- I seem to get sick a little easier than other people
- I am as healthy as anybody I know
- I expect my health to get worse
- My health is excellent
Appendix G

Fear of Food Measure (FOFM)

Please read the below statements and indicate how characteristic they are of you from 1 (not at all) to 7 (very much so).

1 2 3 4 5 6 7

Not at all  Very much so

AE

1. I feel anxious when I eat.  1 2 3 4 5 6 7
2. If I have to eat a meal, it makes me uncomfortable.  1 2 3 4 5 6 7
3. Eating makes me uncomfortable.  1 2 3 4 5 6 7
4. I feel tense when I am around food.  1 2 3 4 5 6 7
5. Food makes me anxious.  1 2 3 4 5 6 7
6. I worry about eating.  1 2 3 4 5 6 7
7. It is hard for me to eat because it makes me nervous.  1 2 3 4 5 6 7
8. I don’t like it when there is food near me.  1 2 3 4 5 6 7

FAB
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1. There are certain foods I avoid because they make me anxious.

2. I have specific patterns and behaviors that I engage in when I eat.

3. I have to eat my food in a certain order.

4. There are foods that I will not touch because I don't like how they feel.

5. I try and avoid eating when I can.

6. I have rules about what I eat.

FC

1. Eating makes me anxious because I am afraid I might get fat.

2. Eating makes me anxious because I worry I might get sick.

3. I don’t like eating because of the way my stomach feels after I eat.

4. I worry that eating will make me dissatisfied with my body.
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5. I feel anxious when eating around other people.  1 2 3 4 5 6 7

6. I don't like to eat around other people because they might judge me.  1 2 3 4 5 6 7

7. I don't like to eat in social situations.  1 2 3 4 5 6 7

8. If I don't eat much because I am worried about my weight.  1 2 3 4 5 6 7

9. I don't like the physical sensations I feel when eating.  1 2 3 4 5 6 7
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Appendix H

PFQ

Please indicate how often you have experienced each feeling within the last 2 weeks:

Embarrassment
Feeling ridiculous
Self-consciousness
Feeling humiliated
Feeling "stupid"
Feeling helpless
Paralyzed
Feelings of blushing
Feeling laughable
Feeling disgusting to others
Mild guilt
Regret
Intense guilt
Remorse
Feeling you deserve criticism for what you did
Worry about hurting or injuring someone