

DISORDERED EATING IN NON-ELITE MARATHON
RUNNERS

By

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Abstract:

Purpose: The primary purpose of this study was to evaluate prevalence of disordered eating in non-elite marathon runners. Another purpose for this study was to analyze the difference in disordered eating prevalence between males and females, as well as, to evaluate the relationship of BMI categories and education levels with disordered eating.

Methods: The participants for this study were recruited through running club directors throughout the states of Oklahoma, Arkansas, and Texas via email. Running club directors sent an email containing the information sheet on the study procedures and a hyperlink to the Qualtrics survey. The participants were required to fill out a two-part survey that included anthropometrics, demographics, marathon information, and the EAT-26 questionnaire.

Results: A total of 98 non-elite marathon runners participated in this study. There were 49 males and 49 females. Disordered eating risk was exhibited by 23 (23.5%) of the participants ($EAT-26 \geq 20$). There was no significant difference in disordered eating risk ($EAT-26 \geq 20$) between genders ($p = .057$) There was also no significant difference found in the EAT-26 subscales Dieting (D) ($p = .221$), Food Preoccupation (FP) ($p = .133$), and Oral Control (OC) ($p = .062$) between males and females. There was no significant difference found in EAT-26 total scores between the BMI categories, normal and overweight ($p = .858$). There was a significant relationship between the BMI categories and the subscale OC ($p = .038$). There was a significant negative correlation between BMI and subscale OC ($r = -.228$, $p = .024$). There was no significant difference found in EAT-26 total scores or subscales between the education levels (total $p = .620$; D $p = .842$, FP $p = .227$, and OC $p = .600$).

Conclusion: Non-elite marathon runners are a population that could benefit from dietary education, specifically education on binge eating. Further research should explore BMI and the subscale Oral Control.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.....	1
Research Questions.....	3
II. REVIEW OF LITERATURE.....	4
Disordered Eating.....	4
Eating Disorders.....	7
Consequences of Eating Disorders and Disordered Eating.....	8
Eating Disorders in Males vs. Females.....	11
Evaluation of Disordered Eating.....	14
Eating Disorder Inventory.....	14
Eating Attitudes Test.....	15
Disordered Eating and Eating Disorder Predictors.....	18
Summary.....	21
III. METHODOLOGY.....	23
Subject Selection.....	23
Methods.....	23
Statistical Analysis.....	24

Chapter	Page
IV. FINDINGS.....	26
Prevalence of Disordered Eating	27
EAT-26 and Behavior Questions	28
Gender and Disordered Eating.....	29
BMI and Disordered Eating.....	30
Education and Disordered Eating	31
V. DISCUSSION.....	34
Discussion.....	34
Limitation and Further Research	41
Conclusion	43
REFERENCES	46
APPENDICES	57

LIST OF TABLES

Table	Page
1: Participants Anthropometrics	27
2: BMI Categories (Normal and Overweight) and Gender.....	27
3: Gender and Disordered Eating.....	29
4: Gender Differences in EAT-26 Total Scores and Subscales	30
5: BMI Categories Differences in EAT-26 Total Scores and Subscales	31
6: Education Level and Disordered Eating Prevalence.....	32
7: Education Level Differences in EAT-26 Total Scores and Subscales.....	33

LIST OF FIGURES

Figure	Page
1. EAT-26 Subscale Questions	16
2. EAT-26 Behavior Questions.....	28

CHAPTER I

INTRODUCTION

Vince Lombardi Jr. famously stated, “Winning isn’t everything, but wanting to win is” (Overman, 1999). This is the common mindset for many athletes; however, what if the drive to win leads to the gradual destruction of one’s health? The dietary patterns of athletes have recently become a topic of interest. There has been an increase in knowledge of the consequences related to improper eating habits. Athletes are considered a higher risk population to develop a disordered eating pattern due to their increased drive for a competitive edge. Disordered eating is a term that encompasses a variety of habits associated with eating. Some of these habits are restrictive eating, bingeing, purging, and excessive exercise (Mountjoy et al., 2014). Eating disorders differ from disordered eating in the fact that they are clinically diagnosed. Eating disorders include anorexia nervosa, bulimia nervosa, and eating disorder not otherwise specified (EDNOS). This study will focus on disordered eating, however it is important to recognize that without proper attention, a disordered eating pattern can develop into a clinically diagnosed eating disorder (Mountjoy et al., 2014).

Disordered eating has been shown to be more prevalent in sports that focus on leanness (aesthetic) as an advantage such as running, gymnastics, wrestling, dancing, and swimming (Joy, Kussman, & Nattiv, 2016). Disordered eating, from restrictive dieting to

binging episodes, can be a result of an athlete going to extremes to gain a competitive edge. The medical consequences of a disordered eating pattern for athletes can be detrimental. Musculoskeletal injuries are considered one of the most feared consequences of a disordered eating pattern in athletes. This is due to improper fueling for the skeletal system and the athlete's muscles along with rigorous activity associated with his or her sport causing an increased risk of injury development. Other medical issues can include: fatigue, hair loss, decreased endurance, cognitive lapses, and in females, the manifestation of the female athlete triad. The female athlete triad is multifactor diagnosis for females that includes disordered eating, amenorrhea, and osteoporosis (El Ghoch, Soave, Calugi, & Dalle Grave, 2013; Thein-Nissenbaum, 2013; Treasure, Claudino, & Zucker, 2010).

Disordered eating is also associated with harmful comorbidities such as depression, anxiety, substance abuse, and bipolar disorder (Joy et al., 2016). Shanmugam (2014) conducted a study with British athletes to find associations between depressive symptoms and eating psychopathology over a six-month period. The researchers expected to see depression play a role in the increased onset of a disordered eating, however, it was found that disordered eating plays a role in the development of depressive symptoms (Shanmugam, Jowett, & Meyer, 2014). Studies like this show that there are not only physical consequences associated with disordered eating, but also psychological consequences.

It is important to recognize risk factors of disordered eating. The recognition of risk factors will help decrease the overall prevalence of disordered eating as well as the long-term consequences. This study explores the prevalence of disordered eating in non-

elite marathon runners and examines the relationships between BMI and education with disordered eating risk.

Research Questions

Research Question #1: What is the prevalence of disordered eating in non-elite marathon runners?

Research Question #2: Are there differences in the prevalence of disordered eating (EAT-26, ≥ 20) between male and female non-elite marathon runners?

Research Question #3: Do male or female non-elite marathon runners generally score lower or higher on the EAT-26?

Research Question #4: Do non-elite marathon runners in different BMI categories, normal and overweight, differ in EAT-26 scores?

Research Question #5: Does education have an influence on EAT-26 scores in non-elite marathon runners?

CHAPTER II

LITERATURE REVIEW

Strong athletic performance can be a result of various factors. The factors can be a combination of natural ability, effort, skills needed for a particular sport, and body composition. Other aspects include psychological and socio-cultural factors. Strong athletic performance takes work ethic and an unrivaled longing to win. In sports today, athletes often face many pressures. These pressures can stem from a desire to be better than the competition as well a desire to look a certain way. These pressures can come from a variety of places including coaches, friends, family, or media. Some of these pressures lead to negative consequences. One of these consequences may be the development of disordered eating pattern (Joy et al., 2016).

Disordered Eating

Disordered eating can be viewed on a continuum of dietary patterns. This continuum begins with an appropriate diet supplemented with extreme exercise. It then continues to develop into a disrupted eating pattern. The continuum ends at a clinically defined eating disorder (Mountjoy et al., 2014).

Disordered eating can also be best described through the understanding of behaviors related to impulsivity and negative urgency. Negative urgency is a response to

distress that can lead to impulsive behaviors (Anestis, Smith, Fink, & Joiner, 2009). To further understand negative urgency, it is important to understand the term urgency. In the case of negative urgency, the word urgency is used to denote “lack of premeditation”. Anestis et al. (2009) found that there was a significant relationship between acting rashly and with lack of premeditation associated with dysregulated eating. Therefore, negative urgency could be considered a character trait of those who have disordered eating patterns (Anestis et al., 2009).

Researchers conducted a recent study on university students in Norway and found that depression increased patterns of binge eating as well as restrained eating patterns within women. The study showed that women used food as a form of “emotion regulation”, meaning that they were more likely to engage in disordered eating patterns to help cope with emotional distress (Brechan & Kvalem, 2015).

Weight dissatisfaction also plays a role in disordered eating (Forrester-Knauss & Zemp Stutz, 2012; Johnson & Wardle, 2005; Vartanian, Smyth, Zawadzki, Heron, & Coleman, 2014). Weight dissatisfaction is the overall discontentment with one’s outer appearance and current weight status (Forrester-Knauss & Zemp Stutz, 2012). In a Swiss study, researchers looked at the predictors of disordered eating in 6,308 men and 8,085 women with the mean age of 50.7 years. The researchers found that weight dissatisfaction was a predictor of disordered eating (Forrester-Knauss & Zemp Stutz, 2012). Another study done on 1,177 adolescent girls, found that body dissatisfaction, much like weight dissatisfaction, played a key role in bulimic symptoms, emotional eating, psychological distress and weight control among the participants (Johnson & Wardle, 2005)

Along with emotional regulation and psychological behaviors, sports participation is also a topic of interest when discussing disordered eating. There is conflicting data when it comes to how sports participation can affect dietary patterns. Most research supports that athletes have a higher prevalence of disordered eating patterns compared to their non-athlete counterparts (Joy et al., 2016). However, researchers have found that some athletes have a lower chance of developing a disordered eating pattern depending on what sport they participate in (Joy et al., 2016). Therefore, it is important to look at the body goals associated with each sport.

Disordered eating is more common in sports that require a lower body weight or an emphasis on leanness (also known as aesthetic sports) (Joy et al., 2016). A recent study conducted on 83 Division I female college athletes used an ATHLETE survey to assess the internal and external psychological predictors of disordered eating. The ATHLETE survey was developed to help understand the specific psychological characteristics seen in athletes that predict the development of a disordered eating pattern. The survey was divided into six categories, “Drive for Thinness and Performance, Social Pressure on Eating, Performance Perfection, Social Pressure on Body Shape, Athlete Identity, and Team Trust” (Wells, Chin, Tacke, & Bunn, 2015). The data from this study showed that the women who participated in lean sports (cheer, cross country, swimming, and volleyball) scored highest in the ‘Drive’ subscale of the survey compared to the non-lean athletes (Wells et al., 2015). “Drive” is measured by the time dedicated to the sport outside of the mandatory practices or competitions. Drive seems like a positive character trait of an athlete, however, they also found that because their drive to perform was so high, they also scored highest on “Dieting” and “Limit Food Intake” subscale. This could

be caused by an athlete's dedication to succeed regardless of the means to obtain success. Of the athletes, 35.1% of the lean athletes were trying to lose weight by dieting compared to 19.6% of the non-lean athletes (Wells et al., 2015). Researchers conducted another study on 320 elite and non-elite female Australian athletes, ages seventeen to thirty. They found significant differences in dietary habits between those in sports that focused on leanness compared to those in non-lean focused sports. Seventy-four of the women in this study scored above a twenty on an EAT-26 survey and of those women, 82.4% of the women participated in sports focused on leanness. These sports included: gymnastics, cheerleading, cycling/endurance sports, long distance running, lightweight boxing, and lightweight rowing (Kong & Harris, 2015).

Eating Disorders

The Diagnostic and Statistical Manual of Mental Disorders Fifth edition (APA, 2013) has created three broad categories for eating disorders including; anorexia nervosa, bulimia nervosa, and eating disorder not otherwise specified (APA, 2013). The International Classification of Diseases tenth revision also has three categories; anorexia nervosa, bulimia nervosa, and atypical eating disorder (Treasure et al., 2010) Studies show that within the United States ten million women and one million men suffer from clinically significant eating disorders (Joy et al., 2016). However, due to the denial that most experience with disordered eating the number is estimated to be much larger. These disorders can be difficult to diagnose due to the numerous possible symptoms such as restrictive behavior, binge eating, purging, excessive exercise, body checking, body

avoidance, and body image disturbance. This is a short list of the many subjective diagnosing symptoms. The other diagnosing symptoms include; weight loss, reduced libido, loss of menstrual cycle, loss of beard growth, sensitivity to cold, weakness and fatigue. Most of these symptoms are self-reported which can cause a discrepancy in an accurate diagnosis (Treasure et al.).

Eating disorders have been shown to be more prevalent among athletes as opposed to their non-athlete counterparts. A Norwegian study showed that 13% of the athlete participants had the presence of a clinical or subclinical eating disorder in comparison to the 4.6% of non-athlete control group (Sundgot-Borgen & Torstveit, 2004). A more recent study conducted on 611 first year high school athletes and 355 non-athlete first year high school students showed that 50.7% of athletes were at risk of disordered eating compared to 25.0% of the non-athlete group. The same study showed that among the total athlete population, 7.0% of the athletes that had an eating disorder compared to 2.3% of non-athlete counterparts (Martinsen & Sundgot-Borgen, 2013). The major difference between a disordered eating pattern and an eating disorder is that eating disorders are clinically diagnosed.

Consequences of Eating Disorders and Disordered Eating

Eating disorders cause numerous health complications but the stakes are raised when dealing with athletes. The low energy intake and low body weight can lead to injuries and fatigue which can be detrimental to athletic performance. The risks associated with disordered eating in females can be even higher. A combination of

menstrual dysfunction, low energy availability, and low bone mineral density are all clinical manifestations of the Female Athlete Triad (El Ghoch et al., 2013). The Female Athlete Triad can manifest itself in many different ways. One way is musculoskeletal injuries which can be characterized as stress fractures mainly due to low bone mass. Researchers conducted a study on female athletes, primarily cross-country runners, and found that those with unhealthy eating habits had a higher rate of stress fractures (Rauh, Nichols, & Barrack, 2010). Another study showed that the pursuit of athletic excellence was directly correlated with disordered eating patterns (Pettersen, Hernæs, & Skårderud, 2016). This study was conducted with Norwegian cross-country skiers and biathletes examining disordered eating in sports that favor a leaner build. They found that athletes seeking a leaner body mass were typically driven by the pursuit of athletic excellence. Athletes will try to achieve a leaner body in hopes that it will improve their overall athletic performance (Pettersen et al., 2016).

Although, a leaner physique can be perceived as an advantage by the athlete, extreme dietary measures can hinder athletic performance (El Ghoch et al., 2013). One way of measuring athletic performance and strength is through a EuroFit Physical Fitness Test Battery (EPFTB). This physical fitness tests evaluates six different aspects of fitness: cardiovascular endurance, strength, muscular endurance, flexibility, speed and balance (Council of Europe & Committee for the Development of Sport, 1993) . A recent study conducted by Alberti and colleagues used the EPFTB to evaluate the performance of 37 anorexia patients. Their research showed that the anorexia nervosa participants had significantly lower scores than the healthy age-matched control group (Alberti et al., 2013; El Ghoch et al., 2013). This could be due to an impaired energy dependent cellular

membrane pumping or reductive adaption within the muscle cells which leads to a quicker fatigue in muscle endurance (Saunders & Smith, 2010).

Disordered eating not only affects the athlete physically, but can also impair the psychological stability of the athlete. Sports, whether competitive or not, require a certain level of focus and mental alertness in order to achieve optimal performance. Disordered eating can lead to a negative interpretation of how one's body is meant to look. This leads to an unhealthy focus in one's eating habits and in extreme cases can begin to affect personal and professional relationships. Along with increasing injury risk, long-term or unrecognized disordered eating can lead to eating disorders (El Ghoch et al., 2013). In severe cases of clinical eating disorders, cognition and learning capabilities are severely impaired. A recent study showed that 20% of those with clinically severe eating disorders lose the ability to live independently 10-20 years after onset of the illness (El Ghoch et al., 2013). A recent study showed that girls who struggled with disordered eating have a higher prevalence of separation anxiety, major depression, generalized anxiety, and dysthymia compared to those without disordered eating patterns (Touchette et al., 2011).

Research has been done on binge eating specifically and its similarity to a drug addiction due to its mirroring cues and orbitofrontal cortex response. Binge eating can be very dangerous because it is often accompanied by a comorbidity of depression, anxiety, bipolar disorders, and to a lesser extent, substance abuse (Williams, 2016). Therefore, it is thought that athletes who experience disordered eating will not only be affected in their performance physically but their mental capacity will also suffer from the lack of nutrition.

Eating Disorders in Males vs. Females

When reviewing literature, it is apparent that disordered eating and eating disorders are more closely studied in female populations than male populations. However, it is important to note the research that has been done shows that males struggle with disordered eating and eating disorders as well as females. In a recent study done with young Finnish males, researchers determined that 6.9% of the 2,906 males who participated presented with disordered eating behaviors. Of those men, the main motivation behind their eating patterns was overall body acceptance and less about performance or health. Body acceptance included enhancing their appearance and sex appeal (Nurkkala et al., 2016). When one thinks of eating disorders, one tends to recognize restrictive eating patterns that characterize anorexia nervosa or bulimia nervosa, however, to include a male population it is important to include research that deals with muscle dysmorphia, an eating disorder more commonly seen in males than in females.

The first look into muscle dysmorphia conceptualized it as “reverse anorexia nervosa”(Murray, Rieger, Touyz, & De la Garza García, 2010). It was deemed “reverse” because those who suffered from muscle dysmorphia presented symptoms and behaviors that mirrored the psychological characteristics of those with anorexia nervosa, yet, the disordered eating patterns were typically the opposite of those patterns seen in anorexia nervosa. Muscle dysmorphia has since been viewed in the eating disorder spectrum (Murray et al., 2012). Muscle dysmorphia can be better defined as obsessive belief that one’s body does not have enough muscle mass. In a recent study, researchers found that the prevalence of muscle dysmorphia in the male population resembles the total eating

disorder prevalence percentage in women (Compte, Sepulveda, & Torrente, 2015). Many scales that measure the prevalence of eating disorders focus on female symptomatology such as the Eating Disorder Inventory (EDI) which focuses on the drive for thinness. Men who present issues with muscle dysmorphia are not trying to achieve thinness, but a physique that is dense with muscle mass (Murray et al., 2010). One could assume that eating disorders within the male population are underreported due to the way that disordered eating questions are presented. For many of the evaluations used in determining eating disorder risk factors the questions are geared toward female symptomatology (Nurkkala et al., 2016).

Lack of research about male athletes with eating disorders could be due to the underreported theme of eating disorders in males or it could be that there is a much higher prevalence of eating disorders in female athletes than male athletes. An intriguing study conducted on collegiate male athletes aimed to test prevalence of eating disorders through the same four psychological characteristics used to test eating disorders in females. These characteristics include; perfectionism, self-esteem, reasons for exercising, and appearance orientation. These scales are found within the EDI. The EDI also highlights areas of the body such as hips and buttocks which are typically not areas of body image concern for the male population (Murray et al., 2010). They found that their test failed to be valid in male athletes meaning that the same psychological characteristics seen in female athletes who present eating disorders cannot be used accurately for males.

The mechanisms behind males developing an eating disorder appear to vary from those of females (Galli, Petrie, Greenleaf, Reel, & Carter, 2014). The researchers evaluated scores from the Questionnaire for Eating Disorder Diagnoses (Q-EDD) for two

hundred and three collegiate male athletes. The results showed that the Q-EDD correctly identified the asymptomatic males but zero percent of the males who were symptomatic were classified correctly. This differs greatly from the finding that the Q-EDD correctly classified fifty percent of the symptomatic females correctly. The researchers of this study suggested using different characteristics that include; identity foreclosure or self identity discovery, fear of stigmatization, low social support, and need for social approval as well as evaluating other predictors: drive for muscularity, drive for leanness, and anabolic steroid use (Brown, Glastetter-Fender, & Shelton, 2000; Galli et al., 2014).

In a recent meta-analysis, researchers found that males who participated in aesthetic sports and endurance sports were not at a significantly higher risk of developing an eating disorder compared to their non-athlete counterparts. These sports include bodybuilding, swimming, and triathlons. However, they did find that wrestlers presented a higher prevalence of eating disorders due to the desire for high muscle mass and low body fat mass. The desire for thinness is a more feminine term that many male athletes do not associate with, therefore, the lack of unisex or masculine terminology could be a cause of the underreported disordered eating patterns in the male population (Chapman & Woodman, 2016).

The highest rate of eating disorders in female athletes was seen in sports that have an emphasis on lean body mass giving a competitive edge (Joy et al., 2016). These sports include gymnastics, diving, figure skating, and dance. In one study, researchers focused on these specific sports and within these sports, the females who qualified as having an eating disorder or were at high risk for developing an eating disorder or, self reported that they reached menarche early. The researchers found that very few of these women were

actually early developers; however, once they hit puberty the women felt as though the weight gain and body change impaired performance, and caused judges to focus less on performance excellence and more on the body of the athlete (Sundgot-Borgen, 1994b).

Another common predictor to developing an eating disorder in female athletes is following an excessive exercise regimen. Excessive exercise has been shown to be present in up to 55% of females with an eating disorder (Taranis, Touyz, & Meyer, 2011). It is also considered the last symptom to subside as well as increase the risk of relapse. Excessive exercise patterns have commonly been viewed as a reason for the women to maintain a shape and weight; however, in recent years, researchers have started looking closer into how compulsive exercise is a result of negative urgency that was mentioned earlier. (Taranis et al., 2011). Excessive exercise is a way for some of the female athletes to compulsively “correct” a behavior that they deem as detrimental to either their weight or performance (Brechan & Kvalem, 2015).

Evaluation of Disordered Eating

Eating Disorder Inventory

There are several surveys used to better understand patterns of disordered eating and one of them is called the Eating Disorder Inventory (EDI). This is a sixty-four item, self reported, assessment of the psychological and behavioral traits commonly seen in those with anorexia nervosa (Garner, Olmsted, & Polivy., 1983). This survey focuses on eight subscales; drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, and maturity fears. The first three subscales are aimed to provide information on the participants eating and body

views while the last five focus on specific psychological traits seen in clinically diagnosed cases of anorexia nervosa. The EDI is a reliable and valid scale for those presenting risks for anorexia nervosa, however, because it focuses on anorexia, it does not properly assess risk factors of non-specified eating disorders or disordered eating patterns (Garner et al., 1983).

Eating Attitudes Test

Another survey used to better understand the patterns of disordered eating is the EAT-26. It is a widely used evaluation method for assessing risk factors for disordered eating. Garner and Garfinkel developed the Eating Attitudes Test in 1979. The EAT-26 is a twenty-six question test that evaluates the psychological aspects that correlate with anorexia nervosa (Garner, Olmsted, Bohr., & Garfinkel, 1982a). This test focuses on objective behaviors. The participant rates their behavior from “never” to “always”. The beginning of the test asks the participant questions based on their anthropometrics such as weight, height, etc. The main evaluation is a twenty-six question survey. The questions are split up into three subscales. These subscales are not mentioned on the actual evaluation; however, researchers developed the subscales to better understand the different risks that the participant is presenting. The first subscale is “dieting”. This subscale section presents questions that are geared towards the participant’s avoidance of certain foods. The second subscale is “bulimia and food preoccupation”. This subscale asks questions related to the participant’s thoughts on food in general as well as bulimic thoughts and behaviors. The third subscale is called “oral control”. This subscale explores

the participant’s self-control and the peer pressure they might feel in regards to weight gain (Garner et al., 1982a). The subscales and their corresponding questions are presented in Figure 1.

Subscales	EAT-26 Questions
Dieting	Am terrified about being overweight.
	Aware of the calorie content of foods that I eat.
	Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)
	Feel extremely guilty after eating.
	Am preoccupied with the desire to be thinner.
	Think about calories when I exercise.
	Am preoccupied with the thought of having fat on my body.
	Avoid foods with sugar in them.
	Eat diet foods.
	Feel uncomfortable after eating
	Engage in dieting behavior.
	Like my stomach to be empty.
	Have the impulse to vomit after meals.
Food Preoccupation	Find myself preoccupied with food.
	Have gone on eating binges where I feel that I may not be able to stop.
	Vomit after I have eaten.
	Feel that food controls my life.
	Give too much time and thought to food.
	Enjoy trying rich foods.
Oral Control	Avoid eating when I am hungry.
	Cut my food into small pieces.
	Feel that others would prefer if I ate more.
	Other people think I am too thin.
	Take longer to eat my meals.
	Display self-control around food.
	Feel that others pressure me to eat.
Figure 1: EAT-26 Subscale Questions	

The scoring ranges from zero to three for the first twenty-five questions, (0, sometimes, rarely, or never; 1, Often; 2, Usually; 3, Always). Zero (never) represents the lowest risk score and three (always) with the highest risk score. However, the twenty-sixth question is reverse scored where “always” is scored the lowest. When one scores at a twenty or above, they are considered to be at a high risk for disordered eating patterns (Garner & Garfinkel, 1979). The last four questions of the EAT-26 are called the “Behavioral Questions” and are unique because if they are answered yes, the participant is automatically considered at risk. Estimates of internal consistency reliability ($\alpha = .90$) (Garner et al., 1982a). The EAT-26 was the best for this study due to its versatility throughout all of the types of disordered eating. It does not just focus on one type of disordered eating pattern but includes risks for the whole spectrum of dietary patterns.

The EDI is used to assess disordered eating with a tendency to favor risks associated with anorexia nervosa, while the EAT-26 is more broadly assessing risk factors for the whole compass of disordered eating patterns. One of the major concerns for using the EDI for a mixed gender athlete study is that it focuses on female symptomatology as mentioned earlier. The “Body Dissatisfaction” section asks questions related to “thighs, buttocks, hips, and stomach” (Garner et al., 1983). These are not common areas of body dissatisfaction in male athletes who are typically more concerned about muscle development in the upper body region (Murray et al., 2012). Therefore, because this study included a mixed gender athlete population, the EAT-26 was used for its more gender-neutral symptomatology.

Disordered Eating and Eating Disorders Predictors

There are several predictors or comorbidities related to disordered eating and eating disorders. One of the first predictors is gender. There is a higher prevalence of disordered eating and eating disorders among the female population (Joy et al., 2016). Another predictor of developing a disordered eating pattern is being an athlete. There are higher rates of athletes with disordered eating patterns compared to their non-athlete counterparts (Sundgot-Borgen & Torstveit, 2004). There are also psychological comorbidities related to disordered eating and eating disorders. Those who struggle with substance abuse or have a psychiatric comorbidity such as depression, anxiety, or a personality disorder increase their chances of developing a disordered eating pattern or eating disorder (Becker & Grilo, 2015; Dunkley, Masheb, & Grilo, 2010). Along with depressive symptoms, those who have experienced childhood trauma or some type of physical, sexual, or mental abuse are also more likely to develop an eating disorder later in life (Dunkley et al., 2010).

Social norms of the individual's surroundings also play a role in the development of disordered eating. One study showed that college women who scored above a twenty on the EAT-26 have a higher body dissatisfaction level based on the norms of the women in their environment. Therefore, if they are immersed in a community of peers that favor a drive for thinness or a desire to maintain a lower body weight, that woman is more likely to partake in a disordered eating dietary pattern (Forney & Ward, 2013). Overall, environment and the values held by peers play a role in predicting a disordered eating behavior.

Another aspect that plays a role in eating disorder development within these sports is the influence of the athlete's coach. Many of these activities require athletes to start at a young age in order to be competitive. Athletes report that they had increased pressure from their coaches starting at a young age. In the same study, participants who started dieting for a sport at a young age were more likely to develop an eating disorder later in life (Sundgot-Borgen, 1994b). Those who started sports at a young age were typically aiming to become an elite athlete. Elite athletes have been shown to have a higher risk for developing an eating disorder compared to their recreational sporting counterparts (Kong & Harris, 2015). This suggests that an athlete's level of competition might also play a role in the development of an eating disorder (Kong & Harris, 2015). One researcher suggested that athletes differentiate between a "sporting" body and a "social" body. This idea encompasses how athletes feel content with their body outside of sports, in regular daily activities, however, they might feel unsatisfied with the way their bodies look or perform within their sporting activity (Kong & Harris, 2015)

Education level has long been a topic of discussion when it comes to eating patterns. A common area of research lies in the correlation of lower education levels and prevalence of obesity (Hiza, Casavale, Guenther, & Davis, 2013). However, education level is a largely ignored area of research when it comes to restrictive forms of disordered eating patterns. In a recent study, researchers found that a higher education level might be linked to an increased nutritional knowledge which is shown to correlate with better dietary practices (Hiza, Casavale, Guenther, & Davis, 2013). There are a variety of physiological triggers that lead to the prevalence of disordered eating, however, can it be inferred that those with higher education would be more aware of the consequences of

disordered eating and therefore less likely to have disordered eating practices? A study done in 2011 showed that women with eating disorders were less educated than those in the control group (Maxwell et al., 2011). There is a lack of research on disordered eating and how it relates to education level.

Body Mass Index (BMI) is one of the most commonly used measurements to assess body composition. Body Mass Index (BMI) has been thought to be a predictor for many different diseases and medical issues, however, recently research has begun to view it in light of the development of disordered eating patterns. The World Health Organization and the National Heart, Lung, and Blood Institute created the calculation for BMI which is weight in kilograms divided by height in meters squared. They denoted that a BMI under 18.5 kg/m^2 is considered underweight, $18.5 - 24.9 \text{ kg/m}^2$ is considered normal weight, and above 24.9 kg/m^2 is considered overweight (Flegal, Kit, & Graubard, 2014). BMI is normally not used to assess athletes because fat free mass is not taken into account. However, BMI might be a helpful tool for better understanding the characteristics of those at risk for disordered eating. This would be beneficial because BMI is an easy calculation and when looked at with other known risk factors it may be a quick field method for assessing degree of risk for disordered eating (Nevill et al., 2010).

A recent study was done on 210 physical education college students from Iran in order to gain more knowledge on how EAT-26 scores correlate with BMI. The gender of the participants was 105 females and 105 males. They found that 15.2% of the males scored 20 or higher compared to the 4.8% of females (Rouzitalab et al., 2015). They also found that overall, the males scored higher on the EAT-26. They found that BMI and waist-to-hip ratio were significantly and positively correlated with higher EAT-26 scores

in males. They also found that weight significantly and positively correlated with a higher EAT-26 score in the female participants. The male participants who presented with a disordered eating risk did not have a different body composition or weight difference than the males who were not at risk, however, the females who were at risk had a higher body weight, BMI, waist circumference, and waist to hip ratio compared to the healthy females in the study (Rouzitalab et al., 2015). This suggests that there could be a positive correlation between BMI and EAT-26 scores.

Another study using the EAT-26 in adolescents 12-18 years of age showed that a higher BMI was positively correlated with an increased probability of developing an eating disorder. It was also found that if the participant was overweight or obese, he or she was more likely to be at risk for developing an eating disorder (Babio, Canals, Pietrobelli, Pérez, & Arija, 2009).

Hidayah and Bariah (2011) explored the relationship of EAT-26 scores and BMI in dancers. The participants who scored a 20 or above on the EAT-26 had an overall higher BMI than those who scored below a 20. The researchers argued that this could be due to the participants restricting food and then developing higher cravings to the food. Then when the subjects would splurge, it would create a guilty feeling about overeating which correlates with a higher EAT-26 score. These were their assumptions to explain the correlation between BMI and EAT-26 scores (Hidayah & Bariah, 2011).

Summary

Understanding the characteristics of disordered eating will equip coaches, athletes, researchers, and medical professionals with knowledge on how to decrease this

prevalence. Previous literature has suggested that females are at a higher risk for developing disordered eating compared to their male counterparts (Joy et al., 2016; Martinsen & Sundgot-Borgen, 2013; Sundgot-Borgen, 1994a; Sundgot-Borgen & Torstveit, 2004). In recent studies, researchers have used BMI as a tool to try and detect disordered eating (Nevill et al., 2010) Researchers have found that participants with a BMI in the normal to overweight categories are at a higher risk for disordered eating (Rouzitalab et al., 2015). This could be due to those with a higher BMI participating in more drastic weight loss practices (Babio et al., 2009; Bariah, 2011; Rouzitalab et al., 2015). Education and disordered eating is a rare topic among previous research. There is very little research on this specific topic especially in the athlete population. There has been previous literature that suggests a lower socioeconomic status including lower levels of education can contribute to the prevalence of overweight and obesity (Ogden & National Center for Health, 2010a, 2010b; Paeratakul, Lovejoy, Ryan, & Bray, 2002). The current study will be one of the only studies to explore the relationship between education and disordered eating. This study will also provide important findings in the specific population of non-elite marathon runners ages 18-65.

This study looks at the prevalence of disordered eating in non-elite marathon runners. To better understand the difference between male and female runners, EAT-26 scores between the genders were explored. Next, the participant's BMI was compared to their EAT-26 scores. Lastly, education level and the prevalence of disordered eating in the non-elite marathon runners was explored.

CHAPTER III

METHODS

Subject Selection

The participants for this study were recruited through running club directors throughout the states of Oklahoma, Arkansas, and Texas via email. The participants were required to be between eighteen and sixty-five years of age. The participants were required to have finished a marathon within the previous year or training to complete a marathon within the next six months. This study was reviewed and approved by the university's Institutional Review Board prior to any subject recruitment and data collection.

Research Design and Data Collection

The participants were all contacted by their running club directors with an email containing the information sheet on the study procedures and a hyperlink to the Qualtrics survey. The participants who consented to take the survey were then prompted to follow the hyperlink to complete the 2-part survey. The two sections of this survey are included in Appendix A and Appendix B (EAT-26). Appendix A contains thirty-eight questions that gathered information on participant age, gender, height, weight, and education level along with information about their marathon background. Appendix B contains the EAT-

26. The EAT-26 is a validated screening tool used to assess disordered eating risk with a Cronbach alpha of .90 (Garner et al., 1982a). The scoring ranges from zero to three for the first twenty-five questions, (0, sometimes, rarely, or never; 1, Often; 2, Usually; 3, Always). Zero (never) indicates the lowest risk score and three (always) indicates the highest risk score. The twenty-sixth question is reverse scored in which “always” is scored the lowest. The last four questions of the EAT-26 are called the “Behavioral Questions” and are unique because if answered yes, the participant is automatically considered at risk. A score of 20 or above on the EAT-26 indicates disordered eating (Garner & Garfinkel, 1979). The subscales of the EAT-26 include; dieting, food preoccupation, and oral control. The dieting subscale focuses on avoiding fattening foods to achieve thinness. Food preoccupation looks at obsessive thoughts about food and the oral control subscale looks at self-control as well as peer pressures to lose or gain weight (Garfinkel & Newman, 2001; Garner et al., 1982a).

To be included in this study, the participants had to complete all sixty-nine questions which included both Appendix A and Appendix B. The participants in the survey were not identified directly and no information linked the participant to the survey answers. All participant information was anonymous.

Statistical Analysis

The statistical analysis in this study was performed using Statistical Package for Social Science (SPSS for PC 20.0). The level of significance was set at $p < 0.05$.

Descriptive statistics, including means and standard deviations, frequencies and ranges

were used to describe the demographic and anthropometric characteristics. A chi-square was used to compare disordered eating prevalence between male and female participants. An independent t-test was then used to evaluate the significant differences between genders for total EAT-26 scores and EAT-26 subscales Dieting (D), Food Preoccupation (FP), and Oral Control (OC). An independent t-test was also used to analyze the difference in EAT-26 total scores and EAT-26 subscales (D, FP, and OC) between the BMI categories (Normal and Overweight). Then Pearson's correlation coefficients analyzed relationships between BMI and the EAT-26 total scores and the EAT-26 subscales Relationships between education and disordered eating prevalence were analyzed using a chi-square test. Lastly, differences between education levels in EAT-26 subscales, as well as EAT-26 total scores were explored using ANOVA.

CHAPTER IV

RESULTS

This study included 151 participants between the ages of 18 and 65. There were 151 surveys distributed. Fifty-three participants failed to respond to the pertinent items on the survey so their data was excluded from the analysis. This left 98 (64.9%) of the original participants, 49 of them were male (50%), and 49 were female (50%). The mean age of the participants in years was 37 ± 12 . The mean BMI of the participants was $23.01\text{kg}/\text{m}^2 \pm 3.1$. Table 1 shows the total population anthropometrics as well as the anthropometrics split into male and female. To continue with anthropometrics, Table 2 shows gender and the BMI categories, normal and overweight. BMI was condensed into two categories to prevent statistical groups having less than five. It is important to have more than five in each group to reduce the possibility of incorrectly increasing the cell expected value and creating false significance (Helsel, 1990).

Table 1. Descriptive information for the total sample and for males and females separately.			
Anthropometrics			
	Mean	Minimum	Maximum
Age (years)	37 ± 12	20	65
M	37 ± 12	20	65
F	36 ± 11	21	63
Height (in)	68.2 ± 4.5	60.00	77.50
M	71.3 ± 2.9	65.00	77.50
F	65.2 ± 2.7	60.00	70.00
Weight (lbs)	153.9 ± 26.8	101.00	225.00
M	171.2 ± 20.6	137.00	225.00
F	136.6 ± 20.4	101.00	190.00
BMI	23.1 ± 2.9	18.01	31.09
M	23.7 ± 2.5	19.79	29.29
F	22.6 ± 3.1	18.01	31.09

Note: M = male, F = female

Table 2. Additional descriptive information for the total sample and for males and females separately.		
BMI Anthropometrics		
	Normal BMI (≤ 24.99 kg/m ²)	Overweight BMI (≥ 25 kg/m ²)
M	35 (71.4%)	14 (28.6%)
F	38 (77.6%)	11 (22.4%)
Total	73 (74.5%)	25 (25.5%)

Disordered Eating Risk

The total scores of the EAT-26 ranged from 0 to 42 with a mean of 8.6 ± 7.9 in all participants combined. The internal consistency for this study was ($\alpha = .80$). An at risk score on the EAT-26 is a score ≥ 20 or if the participant answered yes on one of the four

behavior questions (Garner et al., 1982a). Twenty-three of the participants (23.5%) were at risk for disordered eating.

EAT-26 Scores and Behavior Questions

Fourteen of the 23 (60.9%) participants that were considered at risk for disordered eating, qualified strictly on answering yes on a behavior question. These participants scored below a 20 on the EAT-26 yet, qualified as at risk for disordered eating due to answering “Yes” to one or more of the behavior questions. Seven of the nine remaining participants, answered yes to a behavior question as well as scored ≥ 20 on the EAT-26. Behavior questions are stated below in Figure 2. Question A had 19 yes answers, both questions B and C received four yes answers and question D received one.

Behavioral Questions:		
In the past 6 months have you:	Yes	No
A. Gone on eating binges where you feel that you may not be able to stop? (Eating much more than most people would eat under the same circumstances) If you answered yes, how often during the worst week: _____		
B. Ever made yourself sick (vomited) to control your weight or shape? If you answered yes, how often during the worst week: _____		
C. Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape? If you answered yes, how often during the worst week? _____		
D. Ever been treated for an eating disorder? When: _____		

EAT-26 From: Garner et al. 1982, *Psychological Medicine*, 12, 871-878); adapted by D. Garner with permission.

Figure 2: EAT-26 Behavior Questions.

Gender and Disordered Eating

There were 23 runners of the 98 (23.5%) that presented with disordered eating risk (Table 3). Out of the 23 participants with a disordered eating risk, 12 were male and 11 were female. A chi-square revealed that there was no significant difference in disordered eating prevalence (EAT-26 score ≥ 20) between the genders of the non-elite marathon runners ($p = .057$).

Table 3. Risk of disordered eating in total sample and males and females separately		
Gender and Disordered Eating		
Gender	Risk of DE (EAT-26 score ≥ 20)	No Risk of DE (EAT-26 score ≤ 20)
M	12 (24.5%)	37 (75.5%)
F	11 (22%)	38 (77.5%)
Total	23 (23.5%)	75 (76.5%)
Sig. (p) = .057		

An independent t-test was also used to analyze the significant difference between males and females for total EAT-26 scores. There was no significant difference between males and females in total EAT-26 scores ($p = .563$). An independent t-test was used to evaluate the significant difference between males and females in EAT-26 subscales Dieting (D), Food Preoccupation (FP), and Oral Control (OC). There was no significant difference between males and females in the subscales D ($p = .221$), FP ($p = .133$), OC ($p = .062$) as seen in Table 4.

Table 4. Differences between males and females and the total scores of the EAT-26 and the EAT-26 subscales.

Gender differences in EAT-26 total scores and subscales			
Subscales	Mean		Sig. (p)
	Males	Females	
Total EAT-26 scores	8.31 ± 6.87	8.84 ± 8.91	.563
Dieting	4.55 ± 5.00	5.50 ± 6.10	.221
Food Preoccupation	1.57 ± 1.73	1.70 ± 2.67	.133
Oral Control	2.18 ± 2.32	1.64 ± 1.83	.062

BMI and Disordered Eating

In order to prevent statistical errors due to low expected frequencies, the BMI categories were condensed into normal ($\leq 24.99 \text{ kg/m}^2$) and overweight ($\geq 25 \text{ kg/m}^2$). An independent t-test was used to evaluate BMI categories for EAT-26 total scores. There were no significant differences found in BMI categories for EAT-26 total scores ($p = .858$). An independent t-test was also used to evaluate BMI categories for EAT-26 subscales. There were no significant differences between BMI categories in the subscales D ($p = .877$), and FP ($p = .857$). There was a significant difference between BMI categories in the subscale OC ($p = .038$) as shown in Table 5.

Table 5. Differences between the BMI categories, normal and overweight, and the total EAT-26 scores and the EAT-26 subscales.

BMI category differences in EAT-26 total scores and subscales			
Subscales	Mean		Sig. (p)
	Normal BMI	Overweight BMI	
Total EAT-26 scores	8.95 ± 8.12	7.80 ± 7.46	.858
Dieting	5.11 ± 5.53	5.00 ± 5.85	.877
Food Preoccupation	1.64 ± 2.31	1.64 ± 2.14	.857
Oral Control	2.19 ± 2.22	1.16 ± 1.46	.038

Pearson’s correlation coefficients were run on BMI and the subscales as well as the total EAT-26 scores. There was no significant correlation between BMI and total EAT-26 scores ($p = .734$) or the subscales D ($p = .581$) and FP ($p = .624$). There was a significant negative correlation between BMI and the subscale OC ($r = -.228$, $n = 98$, $p = .024$).

Education and Disordered Eating

A chi-square was used to analyze relationships between education level and EAT-26 scores. Education was divided into three categories; high school diploma and Associate’s Degree, Bachelor’s Degree, and Post Graduate Degree (MS, MA, or PhD). Fifteen of the 98 (15.3%) participants had a high school (HS) diploma and/or Associate’s degree, 3 of these 15 (20%) participants presented with a disordered eating risk (EAT-26

≥ 20). There were 40 of the 98 participants that had a Bachelor’s Degree and of those participants, 9 (22.5%) presented with a disordered eating risk (EAT-26 ≥ 20). The remaining 43 participants had a Post Graduate Degree and of those 43, 11 (25.6%) presented with a disordered eating risk. The chi-square revealed no significant relationship between education level and disordered eating risk (p = .892) (Table 6).

Table 6. Risk of disordered eating separated by education levels.

Education Level and Disordered Eating Prevalence		
Education level	Risk of DE	No Risk of DE
High school Diploma/ Associates Degree	3 (20%)	12 (80%)
Bachelor’s Degree	9 (22.0%)	31 (77.5%)
Post Graduate Degree	11 (25.6%)	32 (74.4%)
Sig. (p) = .892		

An ANOVA was used to evaluate the significant differences among education levels for the total EAT-26 scores as well as each subscale (D, FP, and OC). There was no significant difference between education levels in total EAT-26 scores (p = .690). There were also no significant differences found between the different levels of education in the subscales D (p = .875), FP (p = .308), or OC (p = .474) (Table 7).

Table 7. Differences between the education levels, and the total EAT-26 scores and the EAT-26 subscales.

Education Level Differences in EAT-26 total scores and subscales

Subscales	Education Level Sig. (p)
Total EAT-26 Scores	.690
Dieting	.875
Food Preoccupation	.308
Oral Control	.474

Note: Education Levels = High School Diploma/Associates Degree, Bachelor's Degree, and Post Graduate Degree.

CHAPTER V

DISCUSSION

Disordered eating prevalence can be higher in those who participate in sports where physical leanness is seen to add a competitive edge. These sports are sometimes referred to as aesthetics sports and include cross country, running, diving, gymnastics, ballet, cheer, wrestling, bodybuilding and cycling (Chapman & Woodman, 2016; Joy et al., 2016; Kong & Harris, 2015; Wells et al., 2015). In one cross-sectional study, researchers looked at female athletes and non-athletes to better understand the differences in disordered eating. There were 46 aesthetic/lean athletes, 62 ball game sport athletes, and 108 age-matched non-athletes. It was found that 17% of the aesthetic/lean athletes were at risk for disordered eating compared to 3% of the ball game athletes, and 2% of the non-athletes (Thiemann et al., 2015). Distance runners are under increased pressure to be lean because speed can be affected by body composition (Clemente-Suarez & Nikolaidis, 2017). In one study, researchers found a positive relationship between body fat mass and race time in mountain marathon runners. They believed that the fat mass might cause an extra load for the runners causing slower race times (Clemente-Suarez & Nikolaidis, 2017). Running focuses on aerodynamics as an advantage because it can increase speed and race times (Sundgot-Borgen & Torstveit, 2010).

In the current study, 23.5% of the non-elite marathon runners were at risk of disordered eating (EAT-26 \geq 20) compared to the 76.5% of those not at risk (EAT-26 < 20). The percentage of those at risk for disordered eating could be expected to be higher than sedentary or a non-athlete populations (Joy et al., 2016). In previous studies researchers have found that runners and athletes who compete in sports that focus on leanness have a higher risk of disordered eating compared to their non-athlete counterpart (Joy et al., 2016; Kong & Harris, 2015; Sundgot-Borgen & Torstveit, 2010; Wells et al., 2015). A higher risk of disordered eating for runners could be a result of a psychological drive for performance excellence, and pressure among peers, seen in marathon runners compared to their non-athlete counterparts (Forney & Ward, 2013; Loucks, 2007; Wells et al., 2015).

In the current study, 23 (23.5%) of the 98 athletes were at risk for disordered eating. These individuals are at a higher risk of experiencing injury and an onset of psychological comorbidities than those not at risk of disordered eating (Rauh et al., 2010; Touchette et al., 2011). Disordered eating can manifest into a clinically diagnosed eating disorder causing extended physical and psychological damage such as musculoskeletal injuries, Female Athlete Triad, anxiety disorders and depression (El Ghoch et al., 2013; Mountjoy et al., 2014; Rauh et al., 2010) Although there were more participants not at risk for disordered eating in the current study, the number of participants at risk for disordered eating cannot be ignored due the consequences they may experience with disordered eating.

In previous studies on disordered eating, the focus has been predominately on female athletes, however, in the current study, the participants were compared based on

gender. Gender is thought to be a predictor of disordered eating (Joy et al., 2016). Previous literature suggests that females have a higher risk for disordered eating than males (Joy et al., 2016; Sundgot-Borgen, 1994a; Sundgot-Borgen & Torstveit, 2004). Social and psychological differences between males and females play a large role in disordered eating risk. In one study, researchers found that women partook in dieting and had a higher prevalence of disordered eating than males due to thinness being perceived as part of their feminine identity (Mussap, 2007). Another explanation for a higher prevalence of disordered eating in the female population, is the terminology used in the research scales that measure risk (Nurkkala et al., 2016). The EDI focuses on drive for thinness as well as body dissatisfaction in areas such as hips and buttocks. Drive for thinness is considered feminine terminology because males cannot typically relate to the drive to be “thin”. Their body aspirations would lie more in increased leanness or increased muscle mass (Murray et al., 2012). The areas of body dissatisfaction including hips and buttocks will also decrease the number of reported disordered eating cases in males because these are areas that are not typically points of dissatisfaction in males (Murray et al., 2010). The male population could be underreported due to the disordered eating surveys including more feminine symptomology and terminology (Joy et al., 2016; Murray et al., 2010).

In the current study, no significant difference in prevalence of disordered eating risk between males and females was found. This could be primarily due to the type of sport that was studied. In the current study the athletes all participated in distance running which is a sport that is considered an “aesthetic/lean” sport (Joy et al., 2016). Although males and females differ in many aspects of competing, runners of both genders will have

similarities in training and preparation for their races. Male endurance athletes, such as runners, will exhibit many similar habits to that of female endurance athletes due to the benefits associated with leanness (Atkinson, 2011). In runners, regardless of the gender, there is a level of discipline and body ideology perceived as more competitive (Atkinson, 2011; Gapin & Petruzzello, 2011).

Although prevalence of disordered eating risk in the non-elite marathon runners did not differ between male and females in this study; it is important to look further into how the EAT-26 scores differed between genders. A recent study was conducted on Pakistani pharmacy students to better understand how males and females differ on EAT-26 scores (Khalid et al., 2017). They found that there was no significant difference in the mean EAT-26 scores between the males and females. The EAT-26 scores for the males (16.89 ± 11.56) vs. the EAT-26 scores for females (17.05 ± 11.02) showed that neither males nor females scored higher or lower on the EAT-26 ($p = 0.854$). They attributed this to the “slenderness” movement seen in social media that not only favors women to have a slender physique, but also men (Khalid et al., 2017). In another study, researchers suggested that nutritional knowledge appears to have a greater effect on EAT-26 scores than gender alone. They conducted a study including both male and female students and professional ballet dancers (Wyon, Hutchings, Wells, & Nevill, 2014). They found no significant differences in EAT-26 scores between the male and female groups. They found that the males and the professional ballet dancers had lower mean scores on the EAT-26 compared to the females and the student level ballet dancers; however, these findings were not significant (Wyon et al., 2014). This suggests that total EAT-26 scores might not be affected by gender (Khalid et al., 2017). These findings support the current

study's findings. In the current study, there was no significant difference found between males and females and the total EAT-26 scores.

Although in the current study gender did not play a significant role in differences in total EAT-26 scores, the EAT-26 subscales were further analyzed to see if there was a difference in subscales scores between males and females. The EAT-26 is split into three subscales, dieting, food preoccupation, and oral control. The dieting subscale focuses on food avoidance. This includes avoiding foods that are perceived as fattening or foods that might interfere with body thinness. The food preoccupation subscale includes questions relating to thoughts that are obsessive towards food as well as bulimic thoughts and behaviors. The oral control subscale focuses on self-control around food as well as peer pressure regarding weight status (Garfinkel & Newman, 2001). Previous research suggests that males and females have psychological differences as well as differences in coping mechanisms (Jones, Mendenhall, & Myers, 2016). This might suggest a difference in how males and females answer the EAT-26. In one study, researchers looked at both male and female athletes and non-athletes. The study included 580 male and female athletes along with 362 male and female non-athletes ages 10-19 years old. They found that females in both athlete and non-athlete group scored higher in the dieting subscale and oral control (Fortes, Kakeshita, Almeida, Gomes, & Ferreira, 2014). They found that the female athletes scored higher than female non-athletes and males in the food preoccupation subscale. These findings suggest that there are differences in how males and females answer the specific subscales of the EAT-26 (Fortes et al., 2014). This study was conducted on younger athletes than the athletes looked at in the current study;

however, it is one of the only studies that compare males and females and EAT-26 subscale scores.

In contrast, the current study found no significant differences in how the male and female participants answered the different subscales of the EAT-26. One possible explanation for this is that the current study looked at athletes in the same sport. Not only were the participants in this study in the same sport, but they were all non-elite marathon runners which is a sport that focuses on leanness (Joy et al., 2016). For the study previously mentioned, the authors did not differentiate between sports for the males and females (Fortes et al., 2014). This could suggest that the sport in which the population participates, might have a greater effect on disordered eating risk compared to gender.

Another characteristic to consider when evaluating disordered eating risk, is the participant's body composition. Body mass index (BMI) is a commonly used measurement for body composition (Blackwell, 2002; Rouzitalab et al., 2015; Stommel & Schoenborn, 2010). BMI is utilized in both clinical and community settings for not only a quick and easy assessment of body composition but it is also evaluated along with other risk factors that help assess a patient for the risk of certain medical conditions such as obesity, heart disease, cancer, type 2 diabetes and other metabolic abnormalities (Stommel & Schoenborn, 2010). In previous literature, researchers have found that BMI was positively correlated with EAT-26 scores (Babio et al., 2009; Bariah, 2011; Rouzitalab et al., 2015). The researchers theorized that this positive correlation could be due to those with an overweight BMI taking more extreme dietary measures in order to lose weight. They also suggested that the participants were restricting food for certain

periods and then binging, causing their BMI to remain normal or overweight (Babio et al., 2009; Bariah, 2011; Rouzitalab et al., 2015).

For the current study, BMI was split into two categories to decrease the probability of producing a false significance due to low expected frequencies. The two categories used in this study were normal BMI ($\leq 24.99 \text{ kg/m}^2$) and overweight BMI ($> 25 \text{ kg/m}^2$). The current study found that there was no significant difference between BMI categories, normal and overweight, in total EAT-26 scores. However, to look further into the EAT-26 scores, the correlation between BMI and the subscales, dieting, food preoccupation, and oral control were analyzed. There was no significant relationship found between BMI and the subscales dieting and food preoccupation, however; there was a significant negative correlation found between BMI and the subscale oral control scores. As mentioned earlier, oral control is the subscale that focuses primarily of self control with food along with the peer pressures regarding weight status (Garner et al., 1982a). These findings suggest that as BMI increased the oral control scores decreased. The practical implication of this could be that as one's self control or oral control, around food decreases, his or her weight might increase. This is supported in previous literature in which researchers found that not only do individuals who are overweight or obese exhibit less self-control around food than their normal weight counterparts but they also found that a lack of self control can lead to weight gain over time (Fan & Jin, 2014). The current study is unique because unlike previous literature it looks specifically at a specific type of athlete as opposed to a wider variation of the population.

Researchers have long searched for a relationship between education level and health status. Previous literature has shown that there is a relationship between lower

education levels and greater prevalence of obesity (Ogden & National Center for Health, 2010a, 2010b). The National Center for Health Statistics (NCHS) looked into childhood obesity from 2005 to 2008 and found that children who grew up in a home where the head of the household had a college degree or higher were less likely to become obese or overweight (Ogden & National Center for Health, 2010b). The NCHS then looked at adults and found that in women as education level decreases, obesity prevalence increases (Ogden & National Center for Health, 2010a). In another study, the researchers looked at education levels less than a high school degree or a high school degree and higher to examine differences in hypertension, diabetes, high serum cholesterol, and heart disease. They found that the participants who had below a high school degree were more likely to have hypertension, diabetes, high serum cholesterol, and heart disease. Along with these comorbidities, the prevalence of obesity was also higher in the lower educated group (Paeratakul et al., 2002). There is a lack of previous literature that explores the relationship between education level and disordered eating risk. In the current study, there was no significant relationship between EAT-26 total scores or EAT-26 subscales and education level.

Limitations and Further Research

Self reported data is one limitation of this study. The data derived from the survey (anthropometrics, marathon information, etc.) along with the EAT-26 scores were all self reported. Self reported data can be skewed based on how the participant wants to be perceived (Sallis & Saelens, 2000). Although self-reported data is a limitation, using self-reported questionnaires can provide important information on participants that may be difficult to obtain otherwise like questions on the EAT-26 pertaining to dietary practices.

Self-reported data is also beneficial because one can reach a larger geographical span of people and it reduces the time spent conducting individual interviews.

Another limitation in the current study is the lack of attention to ethnicity in the survey. Disordered eating risk differs across ethnic backgrounds. In one study, researchers found that in a large sample of 9th – 12th grade students, Hispanic and American Indian females had a higher prevalence of disordered eating compared to the white and black counterparts. The lowest prevalence of disordered eating was seen in Asian females. They also found that white males present with the lowest prevalence of disordered eating compared to their black, Asian and Hispanic counterparts (Croll, Neumark-Sztainer, Story, & Ireland, 2002). Researchers have also found that males from a range of cultural backgrounds have more extreme weight management practices compared to their white male counterparts (Ricciardelli, McCabe, Williams, & Thompson, 2007). Ethnicity is a very important aspect when looking at dietary patterns. Diet can be heavily traced to the cultural backgrounds of the participants; therefore, not including ethnicity on the current survey is a key limitation.

Another limitation of this study is that the survey did not include sexual orientation. Gender was a primary focus in this study; however, sexual orientation might offer insights into disordered eating risks and may in fact be a predictor of disordered eating. Researchers found that homosexual males grades 7-12 have a higher body dissatisfaction compared to their heterosexual counterparts. This can lead to a higher prevalence in restrictive dietary patterns or bingeing and purging. They found that the homosexual females actually had a higher body satisfaction than their heterosexual counterparts. Sexual orientation would have been a psychological factor that could have

uncovered more information on disordered eating risk and should be looked at in further research (French, Story, Remafedi, Resnick, & Blum, 1996; Matthews-Ewald, Zullig, & Ward, 2014).

For further research it would be beneficial to look at the participants' current weight versus their desired weight in comparison to their EAT-26 scores. Many of the participants desired to be a lower weight than what their current weight was, therefore, it would be interesting to view that in terms of disordered eating prevalence. Future researchers could also look into disordered eating risk before, during, and after an athlete's competition season. This could help researchers understand how an athlete's dietary habits change based on their season. This could help coaches and medical professionals prepare for these mentality and body changes. Another area of further research would be to look further into the relationship between BMI and the EAT-26 subscale of Oral Control. Oral control is a subscale that focuses on self-control around food as well as peer pressure pertaining to weight (Garner, Olmsted, Bohr., & Garfinkel, 1982b). It would be beneficial to look into the subscale further because it would help orient an educator to what kind of resources and education a certain population should receive based on the behaviors associated with the Oral Control subscale.

Conclusion

There is a fine line between striving for a competitive edge and obsessively pushing the limits to achieve athletic success. Disordered eating can be a dangerous manifestation of the desire to be competitive. Disordered eating is most prominently seen

in sports that focus on leanness known as aesthetics sports such as cross country running, track, diving, gymnastics, ballet, cheer, wrestling, bodybuilding and cycling (Chapman & Woodman, 2016; Joy et al., 2016; Kong & Harris, 2015; Wells et al., 2015). In the current study, the non-elite marathon running population was evaluated for disordered eating risk. Overall, 23 of the 98 participants were at risk for disordered eating (EAT-26 ≥ 20). Although there were more participants not at risk for disordered eating, the athletes who were at risk for disordered eating cannot be ignored due to the comorbidities that might exist along with the disordered eating such as increased injury risk and an increased risk of developing an anxiety disorder or depression (El Ghoch et al., 2013; Touchette et al., 2011).

The current study contributes to disordered eating literature because it explores the subscales within the EAT-26 and found that BMI and the subscale oral control have a significant, negative correlation. The practical implication to this finding, is that those who have a lower BMI might have higher self control over their dietary choices compared to those with a higher BMI who might be more lenient with their dietary choices (Fan & Jin, 2014). Oral control also encompasses social pressures regarding weight. The participant might feel increased pressure to lose or gain weight and this might cause the oral control scores to increase (Fan & Jin, 2014; Garner et al., 1982a). Understanding the characteristics associated with disordered eating can help educators, medical professionals, and coaches combat the development of this issue. Educating athletes on the dangers of disordered eating can help prolong their athletic career and preserve their physical and mental health.

Joan Benoit, an Olympic Gold Medalist marathon runner once said "There's not a better feeling than when you have found that moment of balance and harmony when both running and life come together. Then you know why you run and that you couldn't live without it." (Luff, 2016). The hope of this research is to shed light on disordered eating risk in non-elite marathon runners and ultimately continue to encourage athletes to find the balance in their sport and their dietary practices so they can continue to compete in what they love.

REFERENCES

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Retrieved from <http://dsm.psychiatryonline.org/book.aspx?bookid=556>
- Alberti, M., Galvani, C., Capelli, C., Lanza, M., El Ghoch, M., Calugi, S., & Dalle Grave, R. (2013). Physical fitness before and after weight restoration in anorexia nervosa. *Journal of Sports Medicine and Physical Fitness*, 53(4), 396-402.
- Anestis, M. D., Smith, A. R., Fink, E. L., & Joiner, T. E. (2009). Dysregulated eating and distress: examining the specific role of negative urgency in a clinical sample. *Cognitive Therapy & Research*, 33(4), 390-397. doi:10.1007/s10608-008-9201-2
- Atkinson, M. (2011). Male athletes and the culture of thinness in sport. *Deviant Behavior*, 32(3), 224-256. doi:10.1080/01639621003748860
- Babio, N., Canals, J., Pietrobelli, A., Pérez, S., & Arija, V. (2009). A two-phase population study: relationships between overweight, body composition and risk of eating disorders. *Nutricion Hospitalaria*, 24, 485-491.
- Bariah, H. a. S. (2011). Eating attitude, body Image, body composition and dieting behaviour among dancers. *Asian Journal of Clinical Nutrition*, 3, 92-102. doi:10.3923/ajcn.2011.92.102
- Becker, D. F., & Grilo, C. M. (2015). Comorbidity of mood and substance use disorders in patients with binge-eating disorder: Associations with personality disorder and

- eating disorder pathology. *Journal of Psychosomatic Research*, 79(2), 159-164.
doi:<http://dx.doi.org/10.1016/j.jpsychores.2015.01.016>
- Blackwell, J. (2002). Identification, evaluation, and treatment of overweight and obesity in adults. *Journal of the American Academy of Nurse Practitioners*, 14(5), 196.
- Brechan, I., & Kvaalem, I. L. (2015). Relationship between body dissatisfaction and disordered eating: Mediating role of self-esteem and depression. *Eating Behaviors*, 17, 49-58. doi:<http://dx.doi.org/10.1016/j.eatbeh.2014.12.008>
- Brown, C., Glastetter-Fender, C., & Shelton, M. (2000). Psychosocial identity and career control in college student-athletes. *Journal of Vocational Behavior*, 56(1), 53-62.
doi:<https://doi.org/10.1006/jvbe.1999.1691>
- Chapman, J., & Woodman, T. (2016). Disordered eating in male athletes: a meta-analysis. *Journal of Sports Sciences*, 34(2), 101-109.
doi:10.1080/02640414.2015.1040824
- Clemente-Suarez, V., & Nikolaidis, P. (2017). Use of bioimpedanciometer as predictor of mountain marathon performance. *Journal of Medical Systems*, 41(5), 1-7.
doi:10.1007/s10916-017-0722-7
- Compte, E. J., Sepulveda, A. R., & Torrente, F. (2015). A two-stage epidemiological study of eating disorders and muscle dysmorphia in male university students in Buenos Aires. *International Journal of Eating Disorders*, 48(8), 1092-1101.
doi:10.1002/eat.22448
- Council of Europe, & Committee for the Development of Sport. (1993). *Eurofit : handbook for the Eurofit tests of physical fitness* (2nd ed.). Strasbourg: Council of Europe, Committee for the Development of Sport.

- Croll, J., Neumark-Sztainer, D., Story, M., & Ireland, M. (2002). Prevalence and risk and protective factors related to disordered eating behaviors among adolescents: relationship to gender and ethnicity. *Journal of Adolescent Health, 31*(2), 166-175. doi:[https://doi.org/10.1016/S1054-139X\(02\)00368-3](https://doi.org/10.1016/S1054-139X(02)00368-3)
- Dunkley, D. M., Masheb, R. M., & Grilo, C. M. (2010). Childhood maltreatment, depressive symptoms, and body dissatisfaction in patients with binge eating disorder: The mediating role of self-criticism. *International Journal of Eating Disorders, 43*(3), 274-281. doi:10.1002/eat.20796
- El Ghoch, M., Soave, F., Calugi, S., & Dalle Grave, R. (2013). Eating disorders, physical fitness and sport performance: a systematic review. *Nutrients, 5*(12), 5140-5160. doi:10.3390/nu5125140
- Fan, M., & Jin, Y. (2014). Obesity and self-control: food consumption, physical activity, and weight-loss intention. *Applied Economic Perspectives & Policy, 36*(1), 125-145.
- Flegal, K. M., Kit, B. K., & Graubard, B. I. (2014). Body mass index categories in observational studies of weight and risk of death. *American Journal of Epidemiology, 180*(3), 288-296. doi:10.1093/aje/kwu111
- Forney, K. J., & Ward, R. M. (2013). Examining the moderating role of social norms between body dissatisfaction and disordered eating in college students. *Eating Behaviors, 14*(1), 73-78. doi:<http://dx.doi.org/10.1016/j.eatbeh.2012.10.017>
- Forrester-Knauss, C., & Zemp Stutz, E. (2012). Gender differences in disordered eating and weight dissatisfaction in Swiss adults: Which factors matter? *BMC Public Health, 12*, 809-809. doi:10.1186/1471-2458-12-809

- Fortes, L. D. S., Kakeshita, I. S., Almeida, S. S., Gomes, A. R., & Ferreira, M. E. C. (2014). Eating behaviours in youths: A comparison between female and male athletes and non-athletes. *Scandinavian Journal of Medicine & Science in Sports*, 24(1), e62-e68. doi:10.1111/sms.12098
- French, S. A., Story, M., Remafedi, G., Resnick, M. D., & Blum, R. W. (1996). Sexual orientation and prevalence of body dissatisfaction and eating disordered behaviors: A population-based study of adolescents. *International Journal of Eating Disorders*, 19(2), 119-126. doi:10.1002/(SICI)1098-108X(199603)19:2<119::AID-EAT2>3.0.CO;2-Q
- Galli, N., Petrie, T., Greenleaf, C., Reel, J., & Carter, J. (2014). Personality and psychological correlates of eating disorder symptoms among male collegiate athletes. *Eating Behaviors*, 15(4), 615-618.
doi:<http://dx.doi.org/10.1016/j.eatbeh.2014.08.007>
- Gapin, J. I., & Petruzzello, S. J. (2011). Athletic identity and disordered eating in obligatory and non-obligatory runners. *Journal of Sports Sciences*, 29(10), 1001-1010. doi:10.1080/02640414.2011.571275
- Garfinkel, P., & Newman, A. (2001). The Eating Attitudes Test: Twenty-five years later. *Eating and Weight Disorders Studies on Anorexia, Bulimia and Obesity*, 6(1), 1-21.
- Garner D.M., & Garfinkel P.E. (1979). The Eating Attitudes Test: an index of the symptoms of anorexia nervosa. *Psychology Medicine*, 9(2), 273-279.

- Garner D.M., Olmsted M.P., Bohr Y., & Garfinkel P.E. (1982a). The Eating Attitudes Test: psychometric features and clinical correlates. *Psychology Medicine*, 12(4), 871-878.
- Garner D.M., Olmsted M.P., Bohr Y., & Garfinkel P.E. (1982b). The eating attitudes test: psychometric features and clinical correlates. *Psychology Medicine*, 12(4), 871-878.
- Garner D.M., Olmsted M.P., & Polivy J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International Journal of Eating Disorders*, 2(2), 15-34. doi:10.1002/1098-108X(198321)2:2<15::AID-EAT2260020203>3.0.CO;2-6
- Helsel, D. R. (1990). Less than obvious - statistical treatment of data below the detection limit. *Environmental Science & Technology*, 24(12), 1766-1774.
doi:10.1021/es00082a001
- Hidayah, G., & Bariah, A. S. (2011). Eating attitude, body image, body composition and dieting behaviour among dancers. *Asian Journal of Clinical Nutrition*, 201, 1.
- Hiza, H. A. B., Casavale, K. O., Guenther, P. M., & Davis, C. A. (2013). Diet quality of americans differs by age, sex, race/ethnicity, income, and education level. *Journal of the Academy of Nutrition and Dietetics*, 113(2), 297-306.
doi:<http://dx.doi.org/10.1016/j.jand.2012.08.011>
- Johnson, F., & Wardle, J. (2005). Dietary restraint, body dissatisfaction, and psychological distress: a prospective analysis. *Journal of Abnormal Psychology*, 114(1), 119.

- Jones, K., Mendenhall, S., & Myers, C. A. (2016). The effects of sex and gender role identity on perceived stress and coping among traditional and nontraditional students. *Journal of American College Health, 64*(3), 205-213.
- Joy, E., Kussman, A., & Nattiv, A. (2016). 2016 update on eating disorders in athletes: A comprehensive narrative review with a focus on clinical assessment and management. *British Journal of Sports Medicine, 50*(3), 154-162.
doi:10.1136/bjsports-2015-095735
- Khalid, S., Razia, E. T., Raza, M. H., Sheikh, H., Salman, M., Shehzadi, N., . . . Saleem, F. (2017). It's not just a "female issue": eating attitudes and behaviors of Pakistani male and female pharmacy students. *Russian Open Medical Journal, 6*(4), 1-4.
doi:10.15275/rusomj.2017.0406
- Kong, P., & Harris, L. M. (2015). The sporting body: body image and eating disorder symptomatology among female athletes from leanness focused and nonleanness focused sports. *Journal of Psychology, 149*(2), 141-160.
- Loucks, A. B. (2007). Low energy availability in the marathon and other endurance sports. *Sports Medicine, 37*(4/5), 347-352.
- Luff, C. (2016). Running Quotes From Joan Benoit Samuelson. Retrieved from <https://www.verywell.com/running-quotes-from-joan-benoit-samuelson-2911743>
- Martinsen, M., & Sundgot-Borgen, J. (2013). Higher prevalence of eating disorders among adolescent elite athletes than controls. *Medicine and Science in Sports Exercise, 45*(6), 1188-1197. doi:10.1249/MSS.0b013e318281a939
- Matthews-Ewald, M. R., Zullig, K. J., & Ward, R. M. (2014). Sexual orientation and disordered eating behaviors among self-identified male and female college students. *Eating Behaviors, 15*(3), 441-444.

- Maxwell, M., Thornton, L. M., Root, T. L., Pinheiro, A. P., Strober, M., Brandt, H., . . . Bulik, C. M. (2011). Life beyond the eating disorder: Education, relationships, and reproduction. *International Journal of Eating Disorders, 44*(3), 225-232. doi:10.1002/eat.20804
- Mountjoy, M., Sundgot-Borgen, J., Burke, L., Carter, S., Constantini, N., Lebrun, C., . . . Ljungqvist, A. (2014). The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S). *British Journal of Sports Medicine, 48*(7), 491-497. doi:10.1136/bjsports-2014-093502
- Murray, S. B., Rieger, E., Hildebrandt, T., Karlov, L., Russell, J., Boon, E., . . . Touyz, S. W. (2012). A comparison of eating, exercise, shape, and weight related symptomatology in males with muscle dysmorphia and anorexia nervosa. *Body Image, 9*(2), 193-200. doi:<http://dx.doi.org/10.1016/j.bodyim.2012.01.008>
- Murray, S. B., Rieger, E., Touyz, S. W., & De la Garza García, L. Y. (2010). Muscle dysmorphia and the DSM-V conundrum: Where does it belong? A review paper. *International Journal of Eating Disorders, 43*(6), 483-491. doi:10.1002/eat.20828
- Mussap, A. J. (2007). The relationship between feminine gender role stress and disordered eating symptomatology in women. *Stress & Health: Journal of the International Society for the Investigation of Stress, 23*(5), 343-348.
- Nevill, A. M., Winter, E. M., Ingham, S., Watts, A., Metsios, G. S., & Stewart, A. D. (2010). Adjusting athletes' body mass index to better reflect adiposity in epidemiological research. *Journal of Sports Sciences, 28*(9), 1009-1016. doi:10.1080/02640414.2010.487071

- Nurkkala, M., Keränen, A.-M., Koivumaa-Honkanen, H., Ikäheimo, T. M., Ahola, R., Pyky, R., . . . Korpelainen, R. (2016). Disordered eating behavior, health and motives to exercise in young men: cross-sectional population-based MOPO study. *BMC Public Health, 16*(1), 1-8. doi:10.1186/s12889-016-3162-2
- Ogden, C. L., & National Center for Health, S. (2010a). *Obesity and socioeconomic status in adults United States, 2005-2008*. Hyattsville, MD: Hyattsville, MD : U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Ogden, C. L., & National Center for Health, S. (2010b). *Obesity and socioeconomic status in children and adolescents United States, 2005-2008*. Hyattsville, MD: Hyattsville, MD : U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Overman, S. J. (1999). 'Winning isn't everything. it's the only thing': The origin, attributions and influence of a famous football quote. *Football Studies, 2*(2), 77-99.
- Paeratakul, S., Lovejoy, J. C., Ryan, D. H., & Bray, G. A. (2002). The relation of gender, race and socioeconomic status to obesity and obesity comorbidities in a sample of US adults. *International Journal of Obesity, 26*, 1205. doi:10.1038/sj.ijo.0802026
- Pettersen, I., Hernæs, E., & Skårderud, F. (2016). Pursuit of performance excellence: a population study of Norwegian adolescent female cross-country skiers and biathletes with disordered eating. *BMJ Open Sport & Exercise Medicine, 2*(1). doi:10.1136/bmjsem-2016-000115

- Rauh, M. J., Nichols, J. F., & Barrack, M. T. (2010). Relationships among injury and disordered eating, menstrual dysfunction, and low bone mineral density in high school athletes: a prospective study. *Journal of Athletic Training, 45*(3), 243-252. doi:doi:10.4085/1062-6050-45.3.243
- Ricciardelli, L. A., McCabe, M. P., Williams, R. J., & Thompson, J. K. (2007). The role of ethnicity and culture in body image and disordered eating among males. *Clinical Psychology Review, 27*(5), 582-606. doi:<https://doi.org/10.1016/j.cpr.2007.01.016>
- Rouzitalab, T., Pourghassem Gargari, B., Amirsasan, R., Asghari Jafarabadi, M., Farsad Naeimi, A., & Sanoobar, M. (2015). The relationship of disordered eating attitudes with body composition and anthropometric indices in physical education students. *Iranian Red Crescent Medical Journal, 17*(11), e20727. doi:10.5812/ircmj.20727
- Sallis, J. F., & Saelens, B. E. (2000). Assessment of physical activity by self-report: status, limitations, and future directions. *Research Quarterly for Exercise and Sport, 71*(sup2), 1-14.
- Saunders, J., & Smith, T. (2010). Malnutrition: causes and consequences. *Clinical Medicine, 10*(6), 624-627. doi:10.7861/clinmedicine.10-6-624
- Shanmugam, V., Jowett, S., & Meyer, C. (2014). Eating psychopathology as a risk factor for depressive symptoms in a sample of British athletes. *Journal of Sports Sciences, 32*(17), 1587-1595.

- Stommel, M., & Schoenborn, C. A. (2010). Variations in BMI and prevalence of health risks in diverse racial and ethnic populations. *Obesity, 18*(9), 1821-1826.
doi:10.1038/oby.2009.472
- Sundgot-Borgen, J. (1994a). Eating disorders in female athletes. *Sports Medicine, 17*(3), 176-188.
- Sundgot-Borgen, J. (1994b). Risk and trigger factors for the development of eating disorders in female elite athletes. *Medicine & Science in Sports & Exercise, 26*(4), 414-419.
- Sundgot-Borgen, J., & Torstveit, M. K. (2004). Prevalence of eating disorders in elite athletes is higher than in the general population. *Clinical Journal of Sports Medicine, 14*(1), 25-32.
- Sundgot-Borgen, J., & Torstveit, M. K. (2010). Aspects of disordered eating continuum in elite high-intensity sports. *Scandinavian Journal of Medicine & Science in Sports, 20*, 112-121.
- Taranis, L., Touyz, S., & Meyer, C. (2011). Disordered eating and exercise: Development and preliminary validation of the compulsive exercise test (CET). *European Eating Disorders Review, 19*(3), 256-268. doi:10.1002/erv.1108
- Thein-Nissenbaum, J. (2013). Long term consequences of the female athlete triad. *Maturitas, 75*(2), 107-112. doi:<http://dx.doi.org/10.1016/j.maturitas.2013.02.010>
- Thiemann, P., Legenbauer, T., Vocks, S., Platen, P., Auyeung, B., & Herpertz, S. (2015). Eating disorders and their putative risk factors among female german professional athletes. *European Eating Disorders Review, 23*(4), 269-276.
doi:10.1002/erv.2360

- Touchette, E., Henegar, A., Godart, N. T., Pryor, L., Falissard, B., Tremblay, R. E., & Cote, S. M. (2011). Subclinical eating disorders and their comorbidity with mood and anxiety disorders in adolescent girls. *Psychiatry Researches*, *185*(1-2), 185-192. doi:10.1016/j.psychres.2010.04.005
- Treasure, J., Claudino, A. M., & Zucker, N. (2010). Eating disorders. *The Lancet*, *375*(9714), 583-593. doi:10.1016/s0140-6736(09)61748-7
- Vartanian, L. R., Smyth, J. M., Zawadzki, M. J., Heron, K. E., & Coleman, S. R. M. (2014). Early adversity, personal resources, body dissatisfaction, and disordered eating. *International Journal of Eating Disorders*, *47*(6), 620-629. doi:10.1002/eat.22313
- Wells, E. K., Chin, A. D., Tacke, J. A., & Bunn, J. A. (2015). Risk of disordered eating among division I female college athletes. *International Journal of Exercise Science*, *8*(3), 256-264.
- Williams, G. (2016). Binge eating and binge eating disorder in athletes: a review of theory and evidence. *Sport Journal*, *19*, 1-1.
- Wyon, A. M., Hutchings, M. K., Wells, M. A., & Nevill, M. A. (2014). Body mass index, nutritional knowledge, and eating behaviors in elite student and professional ballet dancers. *Clinical Journal of Sport Medicine*, *24*(5), 390-396. doi:10.1097/JSM.0000000000000054

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APPENDICES

13. Please indicate the percentage (%) of the miles run when training for a marathon that you complete on each of the following surfaces.
 - a. Treadmill
 - b. Trail/Offroad
 - c. Track
 - d. Concrete/Asphalt
 - e. Other
14. Please indicate the percentage (%) of the miles run when not training for a marathon that you complete on each of the following surfaces.
 - a. Treadmill
 - b. Trail/Offroad
 - c. Track
 - d. Concrete/Asphalt
 - e. Other
15. Do you participate in any form of cross-training when training for a marathon?
 - a. Yes
 - b. No
16. Please indicate all forms of cross-training performed when training for a marathon.
 - a. Cycling/Stationary biking
 - b. Swimming
 - c. Boot camp/Crossfit
 - d. Strength training
 - e. Group exercise class (i.e. Zumba, Kickboxing)
17. How many hours per week, on average, do you spend cross-training when training for a marathon?
18. Do you participate in any form of cross-training when not training for a marathon?
 - a. Yes
 - b. No
19. Please indicate all forms of cross-training performed when not training for a marathon.
 - a. Cycling/Stationary biking
 - b. Swimming
 - c. Boot camp/Crossfit
 - d. Strength training
 - e. Group exercise class (i.e. Zumba, Kickboxing)
20. How many hours per week, on average, do you spend cross-training when not training for a marathon?
21. Have you ever worked, or are you currently working with, a running coach while training for a marathon?
 - a. Yes
 - b. No

**Appendix A:
Survey Questions
for the research study on:
Training practices and dietary habits of nonelite marathon runners**

1. Please indicate your gender (male or female).
2. Please indicate your current age (in years).
3. Please indicate your height (in inches).
4. Please indicate your highest level of education achieved.
 - a. High school diploma
 - b. Some college
 - c. Associate's Degree
 - d. Bachelor's Degree
 - e. Graduate Degree (MS, MA, or PhD)
5. Please indicate your age (in years) at the time you completed, or will complete, your first marathon.
6. Are you currently serving or have you previously served as a member of the United States Armed Forces?
 - a. Yes
 - b. No
7. Please indicate under which branch you are serving/served.
 - a. U.S. Army
 - b. U.S. Air Force
 - c. U.S. Navy
 - d. U.S. Marine Corps
 - e. U.S. Coast Guard
 - f. U.S. Army Reserve
 - g. U.S. Air Force Reserve
 - h. U.S. Navy Reserve
 - i. U.S. Marine Corps Reserve
 - j. U.S. Coast Guard Reserve
 - k. Army National Guard
 - l. Air National Guard
8. How many years and months have you been running on a regular basis (3 or more days per week)?
9. On average, how many miles per week do you run when training for a marathon?
10. On average, how many hours per week do you run when training for a marathon?
11. On average, how many miles per week do you run when not in training for a marathon?
12. On average, how many hours per week do you run when not in training for a marathon?

22. Which of the following statements best describes your primary motivation for seeking the instruction of a running coach?
- I was new to running
 - I wanted to improve my running technique
 - I wanted to improve my running speed
 - I wanted to improve my accountability
 - I wanted assistance with a post-injury return to running
23. How often did you meet with your running coach?
- 1-2 times per month
 - 3-4 times per month
 - 1-2 times per week
 - 3-4 times per week
 - Other
24. As a percentage (%) of the time in months during your training, how long did you meet with your running coach?
- < 20%
 - 21-40%
 - 41-60%
 - 61-80%
 - > 80%
25. Have you ever worked, or are you currently working with, a personal trainer while training for a marathon?
- Yes
 - No
26. How often did you meet with your personal trainer?
- 1-2 times per month
 - 3-4 times per month
 - 1-2 times per week
 - 3-4 times per week
 - Other
27. As a percentage (%) of the time in months during your training, how long did you meet with your personal trainer?
- < 20%
 - 21-40%
 - 41-60%
 - 61-80%
 - > 80%

28. Where do you get the majority of your marathon training information?
- a. Internet
 - b. Magazines
 - c. Books
 - d. Running store
 - e. Word of mouth
 - f. Running Coach
 - g. Fitness professional (CPT, CSCS)
29. Do you consume energy drinks? If so, how often?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. More than one/day
30. Do you consume a multivitamin? If so, how often?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. 2-3x/week
31. Do you consume any vitamin, mineral, or herbal supplements other than a multivitamin?
If so, how often?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. 2-3x/week
-
32. Do you take creatine? If so, how often?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. 2-3x/week
33. Do you take whey protein? If so, how often?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. 2-3x/week

34. Where do you get the majority of your nutrition information?
- a. Internet
 - b. Magazines
 - c. Books
 - d. Myplate.gov
 - e. Supplement store
 - f. Word of mouth
 - g. Medical professional (MD's, RD's)
35. During exercise, do you use energy supplements (ie: gu, gels, beans, etc.)? If so, what kind?
36. During exercise, do you use a sports drink? If so, what kind?
37. Have you changed your eating habits since you started your marathon training?
- a. Yes
 - b. No
38. Have you changed your eating habits in the last 3-6 months?
- a. Yes
 - b. No
-

Eating Attitudes Test (EAT-26)

Age: _____
pregnancy): _____

Current Weight: _____

Highest weight (excluding

Sex: _____

Height: _____

Lowest Adult Weight: _____

Ideal Weight: _____

	✓ Please choose one response by marking a check to the right for each of the following statements:	Always	Usually	Often	Some times	Rarely	Never	Score	
1.	Am terrified about being overweight.	—	—	—	—	—	—		
2.	Avoid eating when I am hungry.	—	—	—	—	—	—		
3.	Find myself preoccupied with food.	—	—	—	—	—	—		
4.	Have gone on eating binges where I feel that I may not be able to stop.	—	—	—	—	—	—		
5.	Cut my food into small pieces.	—	—	—	—	—	—		
6.	Aware of the calorie content of foods that I eat.	—	—	—	—	—	—		
7.	Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	—	—	—	—	—	—		
8.	Feel that others would prefer if I ate more.	—	—	—	—	—	—		
9.	Vomit after I have eaten.	—	—	—	—	—	—		
10.	Feel extremely guilty after eating.	—	—	—	—	—	—		
11.	Am preoccupied with a desire to be thinner.	—	—	—	—	—	—		
12.	Think about burning up calories when I exercise.	—	—	—	—	—	—		
13.	Other people think that I am too thin.	—	—	—	—	—	—		
14.	Am preoccupied with the thought of having fat on my body.	—	—	—	—	—	—		
15.	Take longer than others to eat my meals.	—	—	—	—	—	—		
16.	Avoid foods with sugar in them.	—	—	—	—	—	—		
17.	Eat diet foods.	—	—	—	—	—	—		
18.	Feel that food controls my life.	—	—	—	—	—	—		
19.	Display self-control around food.	—	—	—	—	—	—		
20.	Feel that others pressure me to eat.	—	—	—	—	—	—		
21.	Give too much time and thought to food.	—	—	—	—	—	—		
22.	Feel uncomfortable after eating sweets.	—	—	—	—	—	—		
23.	Engage in dieting behavior.	—	—	—	—	—	—		
24.	Like my stomach to be empty.	—	—	—	—	—	—		
25.	Have the impulse to vomit after meals.	—	—	—	—	—	—		
26.	Enjoy trying new rich foods.	—	—	—	—	—	—		
Total Score =									
Behavioral Questions:									
In the past 6 months have you:								Yes	No
A.	Gone on eating binges where you feel that you may not be able to stop? (Eating much more than most people would eat under the same circumstances) If you answered yes, how often during the worst week: _____								
B.	Ever made yourself sick (vomited) to control your weight or shape? If you answered yes, how often during the worst week: _____								
C.	Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape? If you answered yes, how often during the worst week? _____								
D.	Ever been treated for an eating disorder? When: _____								

EAT-26 From: Garner et al. 1982, *Psychological Medicine*, 12, 871-878); adapted by D. Garner with permission.

Oklahoma State University Institutional Review Board

Date: Monday, December 19, 2016 Protocol Expires: 12/18/2019
IRB Application No: ED13200
Proposal Title: Training Practices an Dietary Habits of Nonelite Marathon Runners

Reviewed and Processed as: Exempt
Continuation

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s)

John Sellers
226 Hartford Street
Stillwater, OK 74078
Douglas Smith
180 CRC
Stillwater, OK 74078

Katherine Williams
101 CCR
Stillwater, OK 74078

Gena Wollenberg
1015 E Franklin
Stillwater, OK 74075

Approvals are valid until the expiration date, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office **MUST** be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

- The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

Subject involvement complete approval for analysis of identifiable data only.
No new changes. No withdrawals, complaints, or new/additional funding.

Signature



Hugh Crethar, Chair, Institutional Review Board

Monday, December 19, 2016
Date

Oklahoma State University Institutional Review Board

Date: Friday, December 20, 2013
IRB Application No ED13200
Proposal Title: Training Practices an Dietary Habits of Nonelite Marathon Runners

Reviewed and Exempt
Processed as:

Status Recommended by Reviewer(s): Approved Protocol Expires: 12/19/2016

Principal
Investigator(s):

John Sellers 226 Hartford Street Stillwater, OK 74078 Douglas Smith 180 CRC Stillwater, OK 74078	Katherine Williams 101 CCR Stillwater, OK 74078	Gena Wollenberg 1015 E Franklin Stillwater, OK 74075
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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI, advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,



Shelia Kennison, Chair
Institutional Review Board

VITA

KALYN SPARKS

Candidate for the Degree of

Master of Science

Thesis: DISORDERED EATING IN NON-ELITE MARATHON RUNNERS

Major Field: Nutritional Sciences

Biographical:

Education:

Completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in July, 2018.

Completed the requirements for the Bachelor of Science in Nutrition Dietetics at Oklahoma State University, Stillwater, Oklahoma in 2016.

Experience:

Waitress | Jimmy's Egg, Newcastle, OK:

May 2015- Aug. 2015 & May 2016 – Aug. 2016

LifeKids Leader | LifeChurch, Stillwater, OK

Nov. 2012- Jan. 2015

Professional Memberships:

Oklahoma Academy of Nutrition and Dietetics Aug.2014

- Reviewed policies and events that effect nutrition and dietetics in Oklahoma

Academy of Nutrition and Dietetics Aug.2014

- Remained informed on national legislatures and events that correlate with nutrition and dietetics.