

THE FEMALE ATHLETE TRIAD AND ETHNICITY

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## ABSTRACT

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**Purpose:** The purpose of this study was to summarize the current literature on the Triad and individual components, to investigate the relationship between the Triad and the prevalence in different ethnicities (White and Black), and determine if acculturation has an effect on disordered eating or the Triad in college aged females using self-report and/or objective measures. **Method:** 31 collegiate athletes (29 White & 2 Black) and 19 controls (16 White & 3 Black) completed Dual Energy X-ray Absorptiometry scans and a questionnaire on the female athlete triad. **Results:** No significant difference was found between Black and White athletes and controls when looking at the prevalence of the Triad ( $p = .326$ ) or acculturation (Unable to assess). **Conclusion:** Additional research on the prevalence of the Triad in different ethnicities and whether acculturation has an effect on disordered eating or the Triad is necessary to accurately describe the extent of the problems.

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## CHAPTER I

### INTRODUCTION TO THE STUDY

Women's participation in sports has increased to greater than 3 million over the past 40 years, in part, due to the initiation of Title IX of the Educational Amendment Act of 1972 and the Amateur Sports Act of 1978. Title IX of the Educational Amendment Act permitted the same number of females as males in competitive sports as well as providing the same opportunities as males for scholarships, financing and athletic benefits (Holschen, 2004; Lebrun & Rumball, 2002; Nichols, Rauh, Lawson, Ji & Barkai, 2006; West, 1998). The Amateur Sports Act of 1978 established the United States Olympic Committee and provided legal protection for individual athletes (Nafziger, 1983). Not only have the number of female athletes increased, but women's success in the Olympics and development of several professional women's sports teams are evidence of the impact of these legislative actions.

Women are encouraged to participate in physical activity and a variety of sports as they pose minimal risks and provide a multitude of physical and mental benefits (Warren & Shangold, 1997). In addition to the numerous health benefits, some of the other benefits for females include: improved self-confidence, decreased obesity rates, pride in their abilities as well as decreased teen pregnancy rates (Kirkcaldy, Shephard, & Siefen, 2002; Sabo, Miller, Farrell, Melnick, & Barnes, 1999). However, exercise can also have a negative impact and pose multiple risks for a female's health status if there is

not a proper balance between energy intake and energy output, potentially leading to what is known as the female athlete triad (Triad)(Cover, Hanna, & Barnes, 2012).

It has been over 20 years since the Triad was first acknowledged and defined as three interrelated health conditions including low energy availability (with or without an eating disorder), menstrual dysfunction, and low bone density. In 2007, the American College of Sports Medicine updated their position stand on the Triad, which provided a summary of the research and recommendations for screening, diagnosis, treatment, and prevention (Nattiv et al., 2007). In addition to describing the Triad, Nattiv et al. proposed the Triad consist of 3 interrelated subclinical conditions on a continuum between health and disease; illustrated in Figure 1.

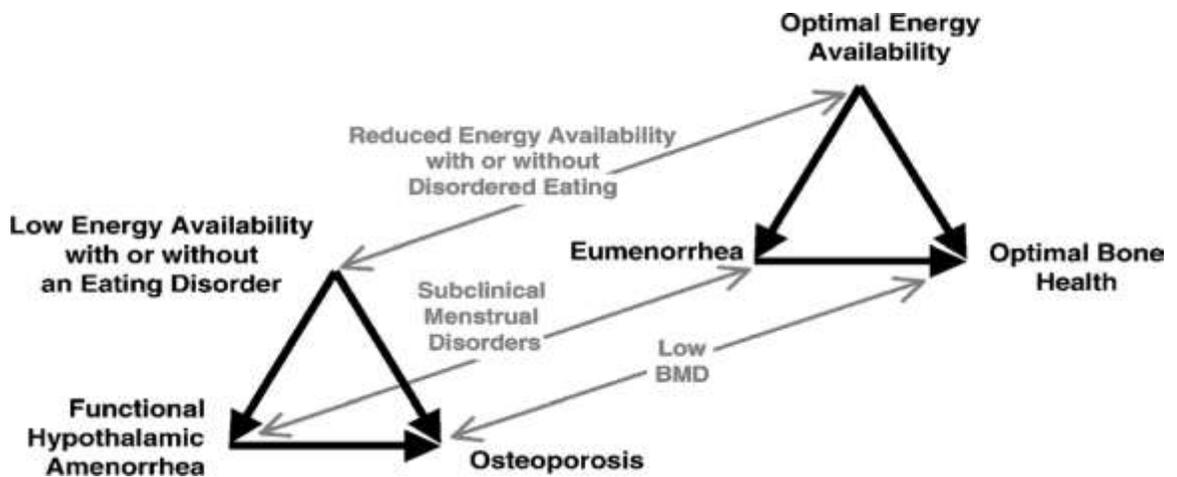


Figure 1: Triad conditions (Nattiv et al., 2007)

In the ideal world, the ultimate goal is to have every female athlete's health status mimic the upper right triangle depicted by thick dark arrows in Figure 1. This represents optimal energy availability leading to eumenorrhea and ultimately peak bone health, resulting in bone mineral density (BMD) normally above average for the female athlete's age. The light arrows between the two triangles represent a continuum between the three disorders, suggesting a female athlete can move along the spectrum at different subclinical rates depending on energy availability. Intermediate levels of decreased energy availability, with or without disordered eating, can lead to subclinical menstrual dysfunction and some degree of low BMD. On the lower left side of Figure 1, the opposite of the three interrelated health conditions a female might face are represented if she exposes herself to chronic over exercising and decreased energy availability. These three interrelated intermediate subclinical disorders can lead to serious clinical diagnoses such as eating disorders, amenorrhea, and osteoporosis. Separately and together, these conditions can have irreversible consequences concurrently with sport performance and then later in life (Nattiv et al., 2007). Consequences of short term low energy availability can include depression, fluid and electrolyte imbalances, and changes in cardiovascular, endocrine, gastrointestinal, and thermoregulatory systems (Palla & Litt, 1988; Ratnasuriya, Eisler, Szukler, & Russell, 1991). Consequences of long term low energy availability can include infertility, cardiac irregularities, stress fractures, osteoporosis and even death (Garfinkel, 1995). The risk for developing the Triad increases when the female athlete is pressured to have a thin physique, perhaps for better performance, in

addition to the athlete's willingness to go to any length to excel and achieve athletic success. This emphasizes the importance for early diagnosis and treatment, but most importantly, prevention (West, 1998).

To date, research on the individual components of the Triad and the Triad as a whole have been studied extensively. However, not until the last decade has the role of ethnicity in the individual components of the Triad, specifically between Caucasian and African American been studied. There has not been significant work to show if ethnicity, plays a role in the Triad as a whole. Therefore, the purpose of this study is threefold; 1) to summarize the findings concerning ethnicity and individual components of the Triad, including disordered eating, menstrual dysfunction, and osteoporosis; 2) to determine if ethnicity, Caucasian versus African American, has an effect on the prevalence of the Triad as a whole; and, 3) to determine if acculturation has an effect on eating disorders or the Triad in team sports. If a correlation can be determined, with ethnicity being a risk factor for the Triad, early intervention and prevention of the Triad may be realized.

### **Statement of Problem**

The female athlete triad and the individual components have been studied for many years, yet uncertainties and controversies remain. In part, the terms and definitions used to describe the Triad and components are numerous and inconsistent. Secondly, there is limited data how ethnicity, Caucasian (White) and African American (Black) relate to the individual components and the Triad as a whole. To date, there is no current research on the prevalence of the female athlete triad in specific ethnicities such as

Caucasian (White) and African American (Black). In addition to, due to inadequate research, there is inconclusive data to suggest if acculturation plays a role in eating disorders or in the female athlete triad.

### **Null Hypotheses**

The following null hypotheses will be tested by this study:

1. There will be no correlation between ethnicity and the prevalence of the female athlete triad.
2. Acculturation will have no significant effect on the prevalence of eating disorders or the female athlete triad in African American (Black) females in the team sports environment.

### **Definition of Terms**

For the purpose of clarification, below are the definitions of key terms, around which this thesis research is centered.

Acculturation: a minority group adopts the cultural norms such as language, beliefs or rituals of the of a majority group as a result of prolonged interaction (Helms & Cook, 1999; Kim & Abreu, 2001).

Amenorrhea: 3 or more consecutively missed menstrual cycles or the absence of menstrual cycle for more than 90 days (Nattiv et al., 2007).

Anovulation: a menstrual cycle without ovulation (Nattiv et al., 2007).

Assimilation: refers to an interactive process by which members from two different ethnic groups obtain cultural beliefs and ideals from each other (Atkinson, Morten, & Sue, 1998).

Bone mineral density (BMD): The quantity of mineral deposition within the bone matrix measured in g/cm<sup>2</sup> by x-ray absorptiometry as an areal density (Parfitt, 1988).

Culture: learned behaviors that can be shared or transferred to its members within large societies or smaller groups within large societies (Atkinson et al., 1998)

Dual Energy X-ray Absorptiometry (DXA): Preferred method for measuring bone mineral density using a radiographic technique that utilizes an x-ray tube as the energy source to produce a two-peak energy spectrum that differentiates bone from soft tissue (Nichols, Sanborn, & Essery, 2007; Schwivitz, Djukic, & Genant, 1990).

Disordered eating: various abnormal eating behaviors, including restrictive eating, fasting, frequently skipped meals, diet pills, laxatives, diuretics, enemas, overeating, binge-eating and then purging (Nattiv et al., 2007).

Eating disorder: a clinical mental disorder defined by DSM-IV including anorexia nervosa (AN), bulimia (BN), and eating disorders not otherwise specified (ED-NOS; Nattiv et al., 2007).

Energy availability: dietary energy intake minus exercise energy expenditure normalized to fat-free mass (Nattiv et al., 2007).

Ethnicity: groups of people divided not only by their race such as White or Black, but also by their ancestry, culture, language, customs, nationality or religion (Atkinson et al., 1998).

Eumenorrhea: menstrual cycles at intervals near the median interval for young adult women; 28 days with a standard deviation of 7 days (Nattiv et al., 2007).

Exercise energy expenditure: strictly, the energy expended during exercise training in excess of the energy that would have been expended in nonexercise activity during the same time interval (Nattiv et al., 2007).

Female athlete triad (Triad): The relationship between energy availability, menstrual function and bone mineral density that can lead to clinical manifestations including eating disorders, amenorrhea, and osteoporosis (Nattiv et al., 2007). For the purpose of this study, at least one criteria from each of the following categories (disordered eating, menstrual dysfunction, and low bone density) must be present.

Disordered eating:

- EDI Subscales: Drive for Thinness (DT)  $\geq 15$
- EDI Subscales: Body Dissatisfaction (BD)  $\geq 14$
- EDI Subscale: Bulimia (B)  $\geq 5$
- Three Factor Eating Questionnaire (TFEQ): CDR scale  $\geq 10$
- Self-reported eating disorder
- Body Mass Index ( $\text{kg}/\text{m}^2$ ):  $\leq 18.5$

- Use of one or more pathogenic weight control methods: use of diet pills, laxatives, diuretics, self-induced vomiting, and fasting (other than for religious purposes)

Menstrual dysfunction:

- Primary amenorrhea: no menstruation by age  $\geq 15$  years
- Secondary amenorrhea: absence of menstruation  $> 90$  days OR  $< 1-3$  cycles per year
- Oligomenorrhea: cycle length  $> 35$  days OR 4-9 cycles/year OR 3-4 cycles in past 6 months

Low bone density:

- Stress fracture diagnosed by physician
- Low bone mass defined by a T or Z score of between -1 and -2
- Osteoporosis is defined by a T or Z score of  $< -2$  in the presence of secondary risk factors for fracture (i.e. hypoestrogenism, under-nutrition/low energy availability, prior fracture)

Low energy availability: Energy intake  $< 30$  kcal/kg of lean body mass per day (Loucks, 2004).

Luteal suppression: a menstrual cycle with a luteal phase shorter than 11 days in length or with a low concentration of progesterone (Nattiv et al., 2007).

Menstrual dysfunction: an irregular condition in a woman's menstrual cycle when estrogen and metabolic hormones are suppressed causing pain, unusually heavy or

light bleeding, delayed menarche, or missed periods. For the purpose of this study the following criteria will be used:

- Primary amenorrhea: no menstruation by age  $\geq 15$  years
- Secondary amenorrhea: absence of menstruation  $> 90$  days OR  $< 1-3$  cyclers per year
- Oligomenorrhea: cycle length  $> 35$  days OR 4-9 cycles/year OR 3-4 cycles in the past 6 months

Race: genetically based racial groups such as White, Black, Hispanic, and Asian (Pratt, Phillips, Greydanus, & Patel, 2003).

T-Score: refers to the number of standard deviations above or below the mean for young normal adults of the same sex (Baim et al., 2008).

Z-Score: refers to the number of standard deviations above or below the mean for persons of the same age and sex (Baim et al., 2008).

### **Limitations**

The current study was subject to the following limitations:

- 1) The results may not apply to populations other than college-aged females.
- 2) The results may not apply to other sports teams
- 3) The results may not apply to other ethnicities
- 4) Accurate and honest responses when filling out questionnaires and dietary food records
- 5) Definitions of terms may vary from previous studies

- 6) Number of athletes participating in the study
- 7) Number of African American (Black) athletes participating in the study

### **Purpose and Significance of the Study**

With more and more females athletes participating in sports and physical activity, the etiology of the female athlete triad in different ethnicities needs to be evaluated to prevent serious consequences of physical activity later in life or concurrently with sport. The purpose of the current study is threefold: 1) to summarize the current literature on the female athlete triad and individual components including disordered eating, menstrual dysfunction, and osteoporosis; 2) to investigate the relationship between the female athlete triad and the prevalence in different ethnicities, specifically Caucasian (White) and African American (Black); and, 3) to determine if acculturation has an effect on eating disorders or the female athlete triad in team sports.

## CHAPTER II

### LITERATURE REVIEW

#### **The Female Athlete Triad**

The female athlete triad (Triad) has been identified in high school, collegiate and elite athletes (Beals & Hill 2006; Hoch et al., 2009; Nichols et al., 2006; Torstveit & Sundgot-Borgen, 2005). The Triad probably is initiated with disordered eating or in other words low energy availability, which can be intentional or unintentional, and then progresses to irregular menses and bone loss (Bonci et al., 2008; Nattiv et al., 2007; Loucks & Thuma, 2003). Energy availability is defined as energy intake less than 30 kcal/kg of lean body mass per day (Loucks, 2004). The female athlete who is driven and strives to perform at the highest level, may be at most risk for developing an eating disorder, thus at risk for developing the Triad (Johnson, Powers, & Dick, 1999). The complications from the Triad can be potentially fatal (West, 1998).

To date, the prevalence of the Triad in athletes is difficult to determine making correlations, generalizations, and recommendations difficult (Beals & Hill; 2006; Cobb et al., 2003; Hoch et al., 2009; Nichols et al., 2006; Torstveit & Sundgot-Borgen, 2005). Several factors are responsible for this lack, including difficulty in assessing the three interrelated disorders, acquiring honest and accurate responses from participants, varying study methodologies, inconsistent definitions of terminology, and obtaining large

numbers of participants (Johnson et al., 1999). Also, most of the data collected is limited to specific sports, levels of competition, variety of age groups, females taking or not taking oral contraceptives, or individual studies focusing on specific components of the Triad and/or a combination of any of the above (Beals & Manore, 2002).

In 2002, Beals and Manore conducted one of the first of the larger studies that looked at prevalence of individual components of the Triad. They categorized a large sample of 425 female college athletes from seven universities in multiple sports including aesthetic, endurance or team/anaerobic sports. Only 2.3% of females met the DSM-IV criteria for bulimia (BN) and 3.3% of participants met the DSM-IV criteria for anorexia nervosa (AN), but 15.2-32.4% presented with attitudes and behaviors along the spectrum of disordered eating. Menstrual irregularities were found in 31% of females and 34.3% had bone injuries. Athletes in aesthetic sports (cheerleading, diving, gymnastics) have higher risk for developing eating disorders compared with endurance (basketball, cross-country, field hockey, crew, soccer, swimming, water polo, middle distance track and distance track events) or team/anaerobic (golf, softball, tennis, volleyball and track field events) sports. Unfortunately, prevalence of the Triad was not reported. However, the results showed those who were “at risk” for disordered eating (15.2-32.4%), put them at an increased risk for menstrual irregularities and bone injuries, also known as the Triad (Beals, & Manore, 2002).

In 2005, Torstveit and Sundgot-Borgen were the first to look at the prevalence of the Triad in athletes compared with a control group. Subjects included 186 elite female

athletes and 145 females in the control group, Norwegian citizens, aged 13-39 years. Athletes participated in a variety of 66 sports. All three components of the Triad were found in eight of the elite athletes (4.3%) and five participants of the control group (3.4%); however, up to 26.9% of athletes had two components of the Triad (Torstveit & Sundgot-Borgen, 2005).

In 2006, two other studies were completed, one with collegiate athletes and the other looking at high school athletes. In the collegiate study, 112 female athletes from seven different sports, were divided into lean-build (diving, cross-country, swimming and track sprinting events) and non-lean build sports (field hockey, softball, tennis, and track field events). The prevalence of the Triad was 2.7%, with 3 of the 112 participants presenting with the Triad. However, among those with disordered eating, prevalence ranged from 20-25% of athletes (Beals & Hill, 2006). Similarly, Nichols et al. (2006) reported 2 of the 170 female high school athletes from 6 different high schools in southern California met the criteria for the Triad, or a prevalence of 1.2%. When reporting the individual components of the Triad, 18.2% of this group had disordered eating, 23.5% had menstrual irregularities, and 21.8% had low bone mass (Nichols et al., 2006).

Most recently, in 2009, Hoch et al. findings were similar to previous studies determining the prevalence of the Triad and its individual components in high school athletes and comparing them for the first time to a control group of sedentary students. This cross-sectional study observed 80 female varsity athletes, mean age  $16.5 \pm 0.95$

years, participating in 9 different organized sports. Among the athletes, 36% had low energy availability, 54% had amenorrhea, and 13% were classified as having low bone mineral density ( $Z\text{-score} \leq -1.0$ ). In comparison, 39% of nonathletes had low energy availability, 21% reported menstrual dysfunction, and 20% had low bone mineral density ( $Z\text{-score} \leq -1.0$ ). One subject from each of the control and experimental groups had all 3 components of the Triad. These findings are similar to those in all previous studies, but more specifically to Nichols et al. (2006) who observed high school athletes as well. Overall, a small percentage of participants meet the actual criteria for the Triad; however, a significant number of participants meet one or more criteria along the spectrum of the 3 interrelated disorders and are said to be “at risk” for developing the Triad (Beals & Manore, 2002).

Understanding the individual components of the Triad and the criteria is important especially when deciphering the definitions between eating disorders and disordered eating. There has been much research on the individual aspects of the Triad, especially eating disorders and disordered eating, both leading to low energy availability to the body. Energy availability is defined as dietary energy intake minus exercise energy expenditure normalized for lean body mass (Loucks, 2004). The amount of energy left over is used for other bodily functions such as reproduction, cellular function, skeletal growth, hormone balance, and thermoregulation (Wade, Schneider, & Li, 1996). Without adequate energy availability, the athlete is at risk for developing the Triad.

## **Eating Disorders**

Eating disorders, which are classified as clinical mental disorders, comprise anorexia nervosa, bulimia nervosa and eating disorders not otherwise specified (ED-NOS). Anorexia nervosa is characterized by an individual who is at least 15% below their normal weight for height and who takes part in restrictive eating behaviors, views themselves as overweight, is afraid of gaining weight, amenorrhea, muscle loss, dry hair and skin, bradycardia, orthostatic hypertension, or lanugo (Yager et al., 2006). The diagnostic criteria for anorexia nervosa from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) states all of the criteria below must be met to be clinically diagnosed with anorexia nervosa:

1. Refusal to maintain body weight at or above 85% of normal weight for age and height.
2. Failure to make expected weight gain during the growth period leading to a body weight less than 85% of that expected.
3. Intense fear of gaining weight or becoming fat, even though underweight.
4. Disturbance in the way one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.
5. In postmenarcheal females, presence of amenorrhea; known as the absence of at least 3 consecutive menstrual cycles or a woman only having period while on hormone medication.

Bulimia nervosa (BN) is another type of clinical eating disorder. Bulimia is similar to AN in that the individual has a distorted body image and desires to be thin. However, one of the differences between the two is that an individual with BN is not usually underweight; they are often at their normal weight for height or above their normal weight for height. Secondly, BN is characterized by binge eating, followed by a variety of purging behaviors divided in to 2 subcategories: purging and nonpurging. Binge eating is defined as the rapid consumption of a large quantity of food (kcal) in a short time period, usually less than 2 hrs. Purging behaviors can include vomiting, laxative use, diuretic use, enema abuse, medication, where-as nonpurging includes severe fasting and excessive exercise. The nonpurging type is most prevalent in athletes (Lebrun & Rumball, 2002). To diagnose BN, according to the DSM-IV, all of the criteria need to be met which include:

1. Recurrent episodes of binge eating characterized by eating an abnormally large amount of food within a 2-hr period of time and a sense of lack of control to stop eating or how much is eaten.
2. Recurrent inappropriate compensatory behavior(s) to prevent weight gain, such as self-induced vomiting, misuse of laxatives, diuretics, enemas, or other medications, fasting, or excessive exercise.
3. Binge eating and inappropriate compensatory behavior(s) both occur, on average, at least twice a week for 3 months.
4. Self-evaluation is overly influenced by body shape and weight.

5. The disturbance does not occur exclusively during episodes of AN.

As noted above, one must meet the exact criteria to conform to the diagnostic criteria for AN or BN. However, there are many instances where a person might fall short of just one criteria or be in-between 2 criteria (Lebrun & Rumball, 2002).

Therefore, an additional category known as eating disorders not otherwise specified (ED-NOS) was developed. According to the DSM-IV, there are specific criteria that need to be met to diagnose ED-NOS listed below:

1. For females, all of the criteria for AN are met except that the patient has regular menses.
2. All of the criteria for AN are met except that, despite significant weight loss, the patient's current weight is in the normal range.
3. All of the criteria for BN are met except that the binge eating and inappropriate compensatory mechanisms occur less than twice a week or for less than 3 months.
4. Normal body weight is present with regular use of inappropriate compensatory behavior after eating small amounts of food.
5. Engages in repeatedly chewing and spitting out, but not swallowing, large amounts of food.
6. Binge-eating disorder: recurrent episodes of binge eating in the absence of regular inappropriate compensatory behavior characteristic of Bulimia Nervosa.

Eating disorders not otherwise specified should not be confused with other terms such as disordered eating, subclinical eating disorders, or anorexia athletica (AA). Disordered eating or subclinical eating disorders are defined as being along a continuum or spectrum of developing classic eating disorders, showing signs of abnormal eating behavior, but falling short of being clinically diagnosed with the strict DSM-IV criteria (Beals, 2004). In the early 1990's, Sundgot-Borgen and Torstveit introduced a specific method to classify an athlete with disordered eating known as anorexia athletica (Sundgot-Borgen, 1993). The individual must meet 5 criteria including: excessive fear of becoming obese, restriction of caloric intake, weight loss, no medical disorder, and gastrointestinal symptoms. In addition to the previous criteria, the individual must have at least one of the following: disturbance in body image, compulsive exercising, binge eating, purging, delayed puberty, or menstrual dysfunction. This method encompasses the characteristics of BN, AN, and ED-NOS (Sundgot-Borgen & Torstveit, 2004). Sundgot-Borgen and Torstveit believe this method is most appropriate for screening an athlete as most athletes do not fall in the strict eating disorder categories set by the DSM-IV for AN, BN, and ED-NOS. Each of these terms is incorrectly and interchangeably used throughout research which has added to the confusion (Beals, 2004; Sundgot-Borgen & Torstveit, 2004).

Various factors are involved in the development of disordered eating or eating disorders. Such factors include perfectionism, compulsiveness, high achievement expectations, distorted body image, body weight dissatisfaction, death of a family

member, being teased about body size or shape, type of sport, and cultures idealizing thinness (Powers, 1996; Thompson & Trattner Sherman, 1999). Athletes are at particular risk for disordered eating secondary to their training regimen, eating patterns, extreme diets, restriction of food intake, psychological impact of competition, social isolation, financial concerns, physical health and injury, potential termination of athletic career and academic challenges (Parham, 1993; Sundgot-Borgen & Torstveit, 2004). In addition to these, compared to the general population, athletes also face pressures from demanding coaches, family and peers as well as pressures from being in an unprepared developmental stage of performance for sport (Levine, 2002). Disordered eating is correlated with concern about body weight, body dissatisfaction, and extreme weight control behaviors, leading to increased risk and prevalence of eating disorders (Dacosta & Wilson, 1996; Schulken, Pinciario, Sawyer, Jensen, & Hoban, 1997; Zimmerman & Hoerr, 1995).

Many female collegiate athletes report their disordered eating behaviors started before high school or during high school (Pernick et al., 2006) as previously suggested by Hoch et al. (2009) Anorexia nervosa and BN are highest among late adolescent girls and young women, with a prevalence of 2% for AN and 16.8% for BN versus 1.8 and 11.8% respectively for females aged 30 to 44, and .6 and 13.4% respectively for females aged 40 to 59 years (Hudson, Hiripi, Pope, & Kessler, 2007). The prevalence of eating disorders in athletes may increase secondarily to level of competition, having a higher BMI, and media pressure (TV, magazines, billboards etc.) to be thin, sociocultural pressure to be

thin (family, peers etc.), perfectionism, early menarche, and impulsivity (Sundgot-Borgen & Torstveit, 2004). Unfortunately, prevalence of eating disorders in athletes is also difficult to assess for the same reasons as the Triad. Many studies previously done look at specific populations, have limited sample sizes, and different definitions for disordered eating as well as different screening instruments (Beals & Manore, 2002). For these reasons, prevalence of eating disorders and disordered eating in female collegiate and elite athletes has a wide range of 2 to 62% (Beals & Manore, 2002; Cobb et al., 2003; Garner, Rosen, & Barry, 1998; Johnson et al., 1999; Torstveit & Sundgot-Borgen, 2005).

In 1999, the first large study looked at the prevalence of disordered eating in 1,445 male and female collegiate athletes. Johnson et al. (1999) examined athletes from 11 NCAA Division I schools, finding 1.1% of females met the DSM-IV criteria for BN and 0% of participants met the DSM-IV criteria for AN. However, 9.2% of females showed signs of “clinically significant problems with BN”, 10.85% reported binge eating behavior and 5.52% reported purging behavior on a weekly or more basis. In addition, 25% of the female athletes were considered to be “at risk” for an eating disorder who were found to have a BMI  $\leq$  20 kg/m<sup>2</sup> or amenorrhea or both (Johnson et al., 1999). These findings did not support a previous smaller study performed on 42 gymnasts with a disordered eating prevalence of 62% (Rosen & Hough, 1988). The large sample size and specific mode of data gathering were likely explanations for differences in the results (Johnson et al., 1999). Most athletes rarely meet the strict criteria of the DSM-IV to

diagnose eating disorders, and have been said to have anorexia athletica, which parallels the findings of Johnson et al. (Sundgot-Borgen & Torstveit, 2004).

In 2002, Byrne and McLean found 31% of elite female athletes in thin-build sports (ballet, gymnastics, light-weight rowing, long distance running, diving and swimming) compared to 5.5% of the control population to have disordered eating. Whereas, in 2004, Sundgot-Borgen and Torstveit observed 1,620 female athletes and 1,696 controls, finding eating disorders or disordered eating in 24% of endurance athletes, 42% in aesthetic, 17% in technical and 16% in ball game sports, compared to 9% of the general population. Overall, athletes have a higher incidence of disordered eating compared to the general population, especially in sports that emphasize leanness (ballet, gymnastics or distance running) and weight-class sports (wrestling or rowing). In addition, females are at higher risk (20%) for developing an eating disorder or disordered eating over males (8%; Hausenblas & Carron, 2002; Sundgot-Borgen & Torstveit, 2004).

### **Ethnicity and Eating Disorders**

After understanding the prevalence of disordered eating in athletes, one must consider the different ethnicities and their cultures and how they play a role. Until the last decade, little research observed ethnicity, specifically Caucasian versus African American athletes, and the prevalence of eating disorders in athletes. However, this is an important component to consider when trying to understand if there is a difference between the two and if one ethnicity is at a greater risk. In addition, it is inconclusive

whether sports environment has an impact on acculturation and disordered eating or eating disorders.

Just as results were difficult to compile regarding the prevalence of eating disorders and the Triad among athletes, there are also barriers to compiling findings about ethnicity and make generalizations or recommendations to the public. One must consider the definitions of race, ethnicity and culture. Not only does past and present literature on this topic use the three terms interchangeably, the studies lack meanings for these terms. Atkinson et al. (1998) believe these are not the same terms; in fact, they believe race should not be used as a term; rather the term ethnicity should be used. Coakley (1998) defines race as biologically-based traits and characteristics. Pratt et al. (2003) also agree that race is just a small picture of racial groups such as White, Black, Hispanic, and Asian; however, not all racial groups have the same cultural beliefs and practices. The term ethnicity allows researchers to divide groups of people by their ancestry, culture, language, customs, nationality or religion. On the other hand, the term culture may be the most complex term among the three. Atkinson et al. (1998) believe behaviors of the culture can be shared or transferred to its members within large societies or smaller groups within large societies.

Until recently, most studies on body dissatisfaction and disordered eating in the general population have been focused on the White culture between women and adolescents (Crago & Shisslak, 2003). One area that has been extensively studied over the past decade is disordered eating behaviors and attitudes between different ethnic

groups to determine if ethnicity is a predisposing factor that contributes to disordered eating behaviors. However, much of this research is comparing White women to non-White women, instead of specifying individual ethnic backgrounds. For instance, in 2001, Wildes, Emery, and Simons reviewed 35 studies with more than 17,000 participants, on the development of disordered eating and body dissatisfaction in different ethnic groups and categorized them as White women versus non-White women. White women have greater body dissatisfaction versus non-White women, suggesting that women of color are more satisfied with their body image, reducing the risk for disordered eating (Wildes, Emery, & Simons, 2001). Yet, this study was limited in terms of identifying specific ethnic groups and correlating the prevalence of eating disorders among different ethnic groups. On the other hand, in 2003, Stiegel-Moore et al. (2003) looked specifically at race/ethnicity and the prevalence of eating disorders in a community sample of 2,054 African American and White women. All types of eating disorders were less common among Black females versus White females. In addition, no Black females had AN, whereas 1.5% of the White females were classified as having AN (Stiegel-Moore et al., 2003).

Since the early to mid-1990's, eating disorders have been found to be more prevalent among Westerners, specifically Caucasian females (Crago, Shisslak, & Estes, 1998; Parker et al., 1995; Pate, Pumariega, Hester, & Garner, 1992). Women who migrate to the Western environment from an unaffected area tend to adopt this Western

culture of preoccupation with the beauty ideal of being thin, contributing to body dissatisfaction (Bowen, Tomoyasu, & Cauce, 1992; Davis & Yager, 1992).

When comparing the general population to athletes, this belief holds true. White versus Black female collegiate athletes have approximately two times greater risk for developing disordered eating based on higher levels of body dissatisfaction. In addition, White female athletes were at almost three times greater risk for drive to be thin (Johnson et al., 2004). Similarly, among high school female athletes, the same tendency was found to be true at a younger age in Caucasian female athletes as compared to African American female athletes (Pernick et al., 2006).

Culture also plays a significant role in contributing etiological factors when evaluating differences between Black and White females (Crago et al., 1998; Pate et al., 1992; Stice & Shaw, 2002). Important information is lost if culture is not understood as a developing role in the existence or nonexistence of disordered eating. To decrease health risks related with disordered eating, such as the Triad, accounting for cultural norms regarding body dissatisfaction and weight control behaviors must occur. Identifying cultural differences among White and Black ethnic groups is critical to understanding where the disordered eating attitudes and behaviors arise (Pernick et al., 2006).

Low self-esteem is one of the main risk factors for developing an eating disorder and is linked with body dissatisfaction (Johnson et al., 2004). As discussed earlier, Black women report higher self-esteem and a decreased drive for thinness and body dissatisfaction than White women, putting them at lower risk for developing an eating

disorder or disordered eating (Chandler, Abood, Lee, Cleveland, & Daly, 1994; Rucker & Cash, 1992; Smith, Thompson, Raczynski, & Hilner, 1999; Wildes et al., 2001). In 1995, Wilfley & Rodin found 34% of Black and 38% of White women of the general population have body dissatisfaction. Black females are not as likely to diet or to overestimate their weight, again, suggesting Black females have greater satisfaction with their size and body appearance and are at less risk for disordered eating patterns. In addition to this, the difference in body dissatisfaction between Blacks and Whites is greatest at the age of 25 and diminishes around the age of 40, leading to a parallel in the prevalence of disordered eating that is highest among White versus Black female collegiate athletes (Roberts, Cash, Feingold, & Johnson, 2006).

Why this difference? Why do White females have decreased body satisfaction in comparison to Black females? Wilfley et al. (1998) suggest it may pertain to weight status, but also to cultural identity, cultural assimilation, cultural traditions, acculturative stress due to attitudes and eating behaviors, socioeconomic status (income and education), minority, social/cultural pressures about being thin, and negative perceptions about being overweight.

In 2009, 31.8% of nonminority female athletes were found to be symptomatic or have disordered eating compared to 14% of minority female athletes (Greenleaf, Petrie, Carter, & Reel, 2009). Greenleaf et al. (2009) suggest minority athletes report fewer symptoms and irregular behavior. Perhaps Black women have less social pressure about their weight and have positive attitudes about being overweight. This may protect the

Black female population from developing disordered eating, but possibly promote the opposite extreme of obesity by having no fear of being overweight or obese (Wilfley et al., 1998). Also, Wilfley et al., mentions Black women may have a better support system than White women do. In addition, role models in the Black culture tend to be of larger size, therefore there is less pressure to be thin (Wildes et al., 2001). Overall, much is still to be understood about the etiology of ethnic differences in terms of body dissatisfaction and disordered eating.

On the other hand, speculation about whether acculturation, enculturation, or culture assimilation can be applied to the sports environment has been observed. Davis and Yager (1992) believe that women who identify with the White or Western cultures report more symptoms of disordered eating than woman who do not identify with these cultures. The “melting pot” theory within sports teams, where sport provides a vehicle for prolonged interethnic interaction, facilitating the disappearance of minority cultural differences in a majority group has been suggested (Allison, 1982).

Again, the terms acculturation, assimilation, ethnic orientation and enculturation have been used interchangeably used or studies fail to provide a definition, yet all of these terms have different meanings (Atkinson et al., 1998; Crago et al., 1998; Mumford, 1993; Striegel-Moore & Smolak, 1996). Acculturation is defined as the process of a minority group adopting the cultural norms such as language, beliefs or rituals of the multicultural or monocultural majority group as a result of prolonged interactions (Helms & Cook, 1999; Kim & Abreu, 2001). Whereas, assimilation refers to more of an

interactive process by which members from both ethnic groups obtain cultural beliefs and ideals from each other. Ethnic orientation refers to the ethnic group one belongs to (Atkinson et al., 1998). Lastly, enculturation is the socialization process in which a person develops cultural and psychological beliefs and skills to be considered a member in one's own ethnic group (Berry, 1993).

Much controversy still exists about acculturation of the Western dominant culture on the Black culture in athletics. The little research that has been done in the area of acculturation has conflicting findings. Equivocal results exist about the idea that acculturation occurs. One idea suggests that as Black females become more acculturated, their beauty ideals begin to shift to the majority group, in this case, to the White culture (Rucker & Cash, 1992). Similarly, as acculturation occurs in minority groups to the White culture, the risk for developing an eating disorder also occurs (Osvold & Sadowsky, 1993).

On the other hand, not all research supports this idea of acculturation followed by an increased risk for eating disorders. Even in situations where a majority culture exists, minority groups can maintain cultural behaviors and values (Allison, 1982). Lester and Petrie (1998) did not find a link between high levels of acculturation in Black females and disordered eating. Similarly, urban female high school athletes were studied and despite Black females being surrounded by White culture, no significant influence on body image was observed (Rhea, 1999). In addition, the tendency of eating disorders (AN & BN) in a sample of 379 Black-American and White-American female college

athletes was examined. There were no significant differences between Black-Americans and White-Americans due to acculturation or socioeconomic status (Edwards-Hewitt & Gray, 1993). Perhaps the strong emphasis of body satisfaction from families of Black females is untouched by acculturation to the White culture (Rucker & Cash, 1992).

Learning more about the protective factor of how Black culture instills size acceptance and self-esteem would help understand a part of the etiology of the Triad (Johnson et. al, 2004). These are only a few studies that have looked at acculturation in athletes and the impact it may have on Black females and eating disorders. Much controversy still exists when considering ethnic groups in regards to the impact of athletics on disordered eating and presumably the Triad (Rhea, 1999).

One must also consider whether a higher incidence of disordered eating among Black females in sports exists where the majority of athletes are White females. Based on the 2009-2010 NCAA ethnicity report, participation was highest for White females in equestrian (93.8%), skiing (91.1%), field hockey (90.5%), lacrosse (90.5%), and ice hockey (89.3%). The trend was similar for Division I White athletes with equestrian being the highest (92.8%), rifle (90.5%), lacrosse (89.9%), rugby (89.4%) and field hockey (86.5%). During the same year, the NCAA reported the highest percentages of Black females in bowling (40.8%), basketball (32.8%), outdoor track and field (21.8%) and indoor track and field (21.5%). This trend was also seen in Division I Black athletes with basketball being the highest at 51%, bowling at 40.6%, outdoor track and field at 29.1% and indoor track and field at 29.2% of black females. If a Black female were to

participate in any of the predominantly white sports, would this increase her chances of being exposed to the White culture and acculturation to occur? Overall, little research has been done on this topic suggesting the role of acculturation in athletes who may be at risk for an eating disorder should be studied further.

### **Amenorrhea**

Females usually experience menarche around 12 to 13 years old, except in the non-Hispanic Black population. Menarche is 5.5 months earlier in the non-Hispanic Black population (Diaz, Laufer, & Breech, 2006). Menarche is often delayed in elite female athletes until they reach the age of 15 years old (Holschen, 2004). By the age of 15, 98% of females have reached menarche (Diaz et al., 2006).

There are many causes of menstrual-related disorders including poorly controlled diabetes mellitus, polycystic ovarian syndrome (PCOS), Cushing's disease, thyroid dysfunction, ovarian tumors and adrenal tumors to name a few. However, in the Triad, menstrual dysfunction is often associated with high levels of training, low body weight related to weight loss, low percent body fat, inadequate nutrition, poor nutrition, eating disorders (both AN and BN), stress related hypothalamic dysfunction, hypoestrogenism and elevated levels of glucocorticoids from stress and exercise (Diaz et al., 2006).

Irregular menses occur in 6 to 79% of female athletes versus 2 to 5% in nonathletes (Reel, SooHoo, Doetsch, Carter, & Petrie, 2007). More specifically, irregular menses occur in 23.5% of high school athletes and 26% of collegiate athletes (Beals & Hill, 2006; Nichols et al., 2006). Sports that emphasize leanness such as running,

dancing, gymnastics, and ballet, pose higher risks for developing the Triad and more specifically delayed menarche and amenorrhea (Sundgot-Borgen & Torstveit, 2004). Prevalence of amenorrhea is thought to be as high as 69% for females in lean class sports (Abraham, Beumont, Fraser, & Llewellyn-Jones, 1982). The incidence of amenorrhea among female athletes varies widely due to inconsistent definitions of amenorrhea, type of athlete, age, length and intensity of training prior to menarche, levels of competition, nutritional status and questionable methodology (Dueck, Manore, & Matt, 1996; Lebrun & Rumball, 2002).

Menstrual function exists on a spectrum from eumenorrhea to amenorrhea. The normal, healthy menstrual cycle, referred to as eumenorrhea, is every 26-35 days or 11 to 13 cycles per year. Eumenorrhea should be present within 1 to 2 years after menarche (Birch, 2005; Bloomfield, 2006). Menarche is defined as the stage of puberty when a female gets her first menstrual period, normally occurring between 2 to 3 years after the Tanner stage IV breast budding occurs (Marshall & Tanner, 1969). There are three types of menstrual dysfunction: luteal phase deficiency, oligomenorrhea, and the most severe form, amenorrhea, consisting of two forms classified as primary or secondary amenorrhea. Luteal phase deficiency, known as the least severe form of menstrual dysfunction, is defined as having a normal cycle length, but lower levels of progesterone and a shorter luteal phase of the menstrual cycle (Bloomfield, 2006). The luteal phase is marked by high levels of estrogen and progesterone. Without these hormones, an individual is at increased risk for osteoporosis, coronary artery disease, endometrial

cancer and decreased fertility, especially in females (Lebrun & Rumball, 2002). Without proper treatment, the luteal phase can progress to anovulation, cycle lengths averaging from < 21days, and characterized by a decrease in progesterone secretion (Beals, 2004). If not treated, anovulation can lead to the next form of menstrual dysfunction known as oligomenorrhea. Oligomenorrhea is defined as a menstrual cycle between 35 to 90 days or 4 to 10 times per year (Lebrun & Rumball, 2002).

Amenorrhea, as mentioned previously, is the most severe form of menstrual dysfunction defined by ACSM as the lack of a menstrual cycle lasting longer than 3 months or 0 to 3 cycles per year (Nattiv et al., 2007; Practice Committee of the American Society for Reproductive Medicine, 2004). There are two types of amenorrhea, primary and secondary. Primary amenorrhea refers to a delay in menarche when the female has not begun menarche until after the age of 15 or is without sexual development by 14 years old. Whereas, secondary amenorrhea is the occurrence of amenorrhea post menarche for at least 3 months after regular cycles have been established (Bloomfield, 2006). Unfortunately, many female athletes prefer to have irregular menses and view it as “one less hassle while training”, not realizing the potential lifelong impact prolonged amenorrhea can have on bone density (Fagan, 1998). Also, athletes who are vegetarian are said to be at greater risk for menstrual dysfunction (Benson, Engelbert-Fenton, & Eisenman, 1996).

In addition to the common terms for menstrual dysfunction, one that is specific to athletes is known as athletic amenorrhea, also termed exercise-associated or exercise-

induced amenorrhea or functional hypothalamic amenorrhea. Athletic amenorrhea is similar to secondary amenorrhea, however it specifically occurs when a female has irregular menses because she is either exercising too much, eating too few calories or both, in addition to, having a disordered hypothalamic hormone profile over a period of time. This profile is characteristic of a deficiency in gonadotropin-releasing hormone (GnRH), which in-turn decreases luteinizing hormone (LH) and follicle-stimulating hormone (FSH), causing the ovaries to produce less estrogen and progesterone, leading to hypoestrogenism and termination of menses (Warren, 1999).

Females need to consume adequate calories to meet energy needs to have regular menses (Levine, 2002). It was once believed that to menstruate, a female had to reach about 17% body fat and maintain greater than 22% body fat to avoid amenorrhea (Frisch & McArthur; 1974). It is speculated that when a female has too little body fat, the ovaries stop producing estrogen and menstruation stops. Again, if a female stops ovulating and menstruating, it is to protect against pregnancy during extreme physiological stress and temporarily conserve available energy to support basic physiological processes (Levine, 2002). On the other hand, the percent body fat philosophy is based on correlation, rather than experimental evidence, supporting the theory of inadequate caloric intake leading to lack of menses (Schneider & Wade, 1989; Warren & Perloth, 2001). For example, female athletes (distance runners) with as little as 4% body fat can still maintain regular menses (Marcus et al, 1985). If amenorrhea develops, osteoporosis can occur within 1 year (Bachrach, Guido, Katzman, Litt, & Marcus, 1990).

### **Ethnicity and Amenorrhea**

Just as ethnicity and culture play a role in disordered eating, it is suggested they also contribute to the differences in menarche between Black and White females. Both the effects of early or late maturation can have a negative effect on body image and disordered eating patterns (Herman-Giddens et al., 1997; Striegel-Moore et al., 2001). The relationship between sexual maturation in 2,379 Black and White females and symptoms of disordered eating was evaluated. Menarche occurred at 12 years of age in Black females and 12.7 years of age in White females. Late maturation was more beneficial in terms of body dissatisfaction; individuals with late maturation had less signs of body dissatisfaction. There is also a link between the timing of maturation and adiposity suggesting that as BMI increases, a female is more likely to begin menses (Striegel-Moore et al., 2001). According to the 1999-2010 NHANES data, 27.8% of 6-11 year old Black females are overweight (> 95<sup>th</sup> percentile for age and sex) as compared to 10.7% of White females and Black females aged 20 to 39 years old, 74.2% are overweight (BMI 25-29.9) and 56.2% are obese (BMI >30) versus 50.7 and 26.9%, respectively for White females (Flegal, Carroll, Kit, & Ogden, 2012). This suggests Black females will have an earlier onset of puberty and therefore may be at greater risk for disordered eating. However, this is not supported in the literature (Graber, Brooks-Gunn, & Warren, 1999; Striegel-Moore, Dohm et al., 2000; Striegel-Moore, Wilfley et al., 2000). Black Females have escaped body dissatisfaction, in which they still consider themselves physically attractive (Kumanyika, Wilson, & Guilford-Davenport, 1993).

On the other hand, Osbold & Sadowsky (1993) believe there are several factors that protect the Black female from disordered eating habits and therefore menstrual dysfunction. First, disordered eating habits begin in late adolescence; this tends to be a shorter time frame for Black females as compared to White females, putting them at less risk for disordered eating habits and menstrual irregularities. Second, Black girls at a younger age do not have enough time to absorb the dominant Western White culture of being thin and dieting. Third, Black females are expected to have a no-nonsense attitude, learning responsibility and being career oriented early on. Lastly, Black females recognize early on they may have to work and raise children as a single parent in addition to growing up in a low socioeconomic environment, persuading them to mature at an earlier age. In contrast, the cultures of White females predisposes them at an early age to be preoccupied with appearance and are taught to conform to the standard White concept of beauty (Osbold & Sadowsky, 1993).

Another controversial issue is whether socioeconomic status alone plays a role in body dissatisfaction, disturbed eating behaviors, and menstrual irregularities as this tends to coincide with different ethnic groups. Low socioeconomic status has been associated with obesity in the Western society, particularly among females, suggesting early menarche, less time for distraction to the White culture and a decrease in menstrual dysfunction (Paeratakul, White, Williamson, Ryan, & Bray, 2002). Likewise, those of middle to upper-middle socioeconomic class are at greatest risk for developing disordered eating behaviors leading to menstrual irregularities (Andersen & Hay, 1985).

To summarize, Black females are at less risk for developing menstrual irregularities. However, there is still limited data of how menstrual dysfunction in different ethnic groups plays a role in female athletes in terms of the Triad as a whole.

### **Bone Mineral Density**

Osteoporosis, in general, is a bone disorder characterized by decreased bone strength, increasing a person's risk for fracture (Hellekson, 2002). Osteoporosis is commonly thought to occur primarily in adulthood with accelerated bone loss in postmenopausal woman; however, it can also develop when there is a failure to accumulate optimal bone mineral density (BMD) during childhood and adolescence, particularly seen in female athletes (NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, 2001). In postmenopausal women, estrogen withdrawal can lead to an increase in osteoclastic bone resorption, and ultimately osteoporosis. As aging occurs, women are said to be at greater risk for developing osteoporosis versus men (Cass, Shepherd, & Carlson, 2006). In female athletes this process holds true also. The female athlete who is in a state of hypoestrogenism, secondary to amenorrhea, caused by a chronic decrease in energy availability, may likely be predisposed to low BMD or osteoporosis (Keen & Drinkwater, 1997).

The prevalence of osteoporosis and osteopenia in females (ages 20-29) in the general population is 5.4 and 40.9% respectively (Kanis et al., 2000). In comparison, the prevalence of osteoporosis in female athletes (ages 21-29) ranges from 0 to 13% and osteopenia (low BMD) varies from 22 to 50% (Khan et al., 2002). Again, there is a wide

range of the prevalence of low BMD and osteoporosis in female athletes for some of the same reasons as disordered eating and amenorrhea. These include: different definitions of terms, a variety of tools used to measure BMD, age of athletes, age at which competitive physical activity began, length of time of amenorrhea, type of sport, age, ethnicity, pubertal stage, skeletal maturity, and body composition (Nazem & Ackerman, 2012).

Regular physical activity is directly associated with increased bone mineral density (BMD), especially in activities that promote weight-bearing exercises such as sprinting or stair climbing, or in sports such as gymnastics or volleyball (Kohrt, Bloomfield, Little, Nelson, & Yingling, 2004; Khan et al., 2001). Exercise is especially important to incorporate in a daily routine during the peak bone mass years (adolescence) to obtain maximal BMD to help prevent osteoporosis and fractures later in life (Nichols et al., 2007). However, if there is not a proper balance, physical activity can negatively impact bone health. A female athlete with disordered eating and amenorrhea not only faces the impact of those disorders, but also must be aware of their BMD, the third component of the Triad.

There are several different factors that influence the risk of bone fracture, such as, bone mineral content (BMC) also known as bone mass, bone mineral density (BMD), bone protein, and bone quality also known as bone microarchitecture related to bone remodeling (Rubin, 2005). Bone mineral gives bone its hardness primarily consisting of hydroxyapatite (Nichols et al., 2007). Whereas bone protein makes up approximately

50% of the volume of bone and 1/3 its mass providing bone its toughness (Heaney & Layman, 2008). Bone mineral density is the quantity of mineral deposition within the bone matrix measured in  $\text{g}/\text{cm}^2$  by x-ray absorptiometry as an areal density (Parfitt, 1988). Bone quality refers to the process of bone turnover, also known as bone remodeling (Burr, 2002).

Bone remodeling is a necessary and normal continuous process of bone formation and matrix growth. Osteoblasts are the bone building cells of the matrix, whereas, osteoclasts breakdown bone to allow for resorption and bone remodeling to occur. There are three primary factors that impact bone remodeling. First, hormonal status, specifically estrogen, when compromised can have a negative influence on BMD. Second, physical activity, mainly weight-bearing, when present, can positively impact bone health. Finally, dietary habits, particularly adequate calcium, vitamin D and overall energy intake. When bone remodeling is disturbed, bone becomes weak and injury is more likely to occur (Nazem & Ackerman, 2012; Nichols et al., 2007). One of the major causes interrupting this process is decreased production of estrogen, leading to abnormal osteoclast activity, and causing a high risk for osteoporosis, the most severe form of irreversible bone loss (Drinkwater, Bruemner, & Chesnut, 1990). As previously mentioned, a decrease in energy intake or an increase in energy expenditure or both can lead to a decrease in estrogen production, thus putting a female athlete at greater risk for developing osteoporosis. In addition, genetic factors explain 60 to 80% of peak skeletal

mass. Differences in height and weight are correlated with skeletal mineralization during puberty (Slemenda, Miller, Hui, Reister, & Johnston, 2009).

Not only are there different ways to assess bone strength, but there are several ways to define the results of bone strength, making a comparison of the literature, once again, difficult. Although BMD is one component of bone strength, the preferred method for diagnosing osteoporosis and predicting fracture risk is by dual energy x-ray absorptiometry (DXA; Hans et al., 2006). DXA provides the most accurate and precise quantitative results, in addition to being the easiest to use, most accessible, least radiation dose, and lowest cost technique (Kalkwarf et al., 2007).

There are several different parameters set by various organizations for classifying osteoporosis and low BMD. According to the World Health Organization (WHO), osteoporosis is defined as a BMD greater than 2.5 standard deviations below the mean of a young healthy female, 20 years of age. However, this criterion is used for postmenopausal women. On the other hand, osteopenia is the least severe form, defined as a low BMD of -1.0 standard deviations below the mean (Kanis, 2002).

The International Society for Clinical Densitometry (ISCD) position stand states the WHO criteria should not be used for premenopausal women or children. Thus, a *Z-score* should be used instead of a *T-score* in these situations because a *T-score* or *Z-score* of zero would indicate a BMD exactly equal to the mean of the reference group, which may not adequately represent the group being observed. The ISCD defines osteoporosis as a *Z-score* below -2.0 standard deviations of the average value for age, sex, and race

matched controls and the term osteopenia is not used at all. Instead, the term ‘low BMD for chronological age’ is used for adolescents defined by a *Z-score* of  $\leq -2.0$  and ‘low BMD for age’ is used in premenopausal women. In addition, ISCD recommends that the diagnosis of osteoporosis should not be exclusively based on BMD, rather, in combination with secondary risk factors such as disordered eating, hypoestrogenism, and history of fractures (Baim et al., 2008; Leslie et al., 2006).

Lastly, the American College of Sports Medicine (ACSM) developed their own definition secondary to athletes having a higher BMD in weight bearing activities than nonathletes. ACSM defines osteoporosis similar to the ISCD, as a *Z-score* of  $-2.0$  or more standard deviations below the mean with secondary clinical risk factors for fracture. ACSM defines low BMD as an athlete who has a history of inadequate nutrition, decreased estrogen levels, incidence of stress fracture with a BMD *Z-score* between  $-1.0$  and  $-2.0$  standard deviations from the mean (Nattiv et al., 2007).

Common sites for fracture in a person with osteoporosis are the spine, hip, and wrist, where BMD is measured most often in studies (Hans, 2006). Sufficient estrogen and mechanical loading on the bones have a positive effect on BMD and overall bone architecture, especially in premenopausal women (Drinkwater, 1996). Also, athletes participating in weight bearing sports (gymnastics and figure skating) or physical activity (running) have 5-15% higher BMD than nonathletes (Fehling, Alekel, Clasey, Rector, & Stillman, 1995; Risser et al., 1990; Robinson et al., 1995). When a female reaches 18 years of age, it is said she has reached 92% of her peak bone mass and about 99% peak

bone mass is reached between the ages of 25 and 29 (Harel et al., 2007; Recker et al., 1992). Females ages 11 to 14, during the stage of early to mid-puberty, have the greatest increase in BMD, in which bone appears to be particularly responsive to lifestyle factors (Khan et al., 2002; Khan et al., 2000; Wang et al., 2003). Physical activity and dietary intake have a greater influence on BMD just before the end of puberty, versus postpuberty (Khan et al., 2002; Wang et al., 2003). Once peak bone mass is obtained, women lose an average of 1% BMD per year until the beginning of menopause (Lebrun & Rumball, 2002). An increase in bone resorption (breakdown) as compared to bone formation, leads to an overall BMD loss (Keen & Drinkwater, 1997). When menopause begins, there is a 10-fold increase in the rate of bone loss, putting a woman at higher risk for developing osteoporosis (Lebrun & Rumball, 2002). This exemplifies the importance of a strong bone structure during adolescence to prevent problems later in life.

Exercise and sports participation becomes problematic when the demands are too high for the female athlete's body to handle. When amenorrhea is present, a female athlete will have a lower BMD as compared to a female athlete who is eumenorrheic. More specifically, there is a 10 to 20% decrease in BMD in the lumbar spine in amenorrheic athletes (Drinkwater et al., 1984). In addition, Nichols, Rauh, Barrack, and Barkai (2007) suggest there is a lower BMD at the hip in amenorrheic athletes in repetitive/non-impact athletes (swimmers, cross country runners, track distance runners). Also, BMD at the hip is primarily affected by mechanical loading, whereas BMD of the spine is primarily affected by estrogen (Gremion, Rizzoli, Slosman, Theintz, & Bonjour,

2001). In women who resume regular menses by decreasing their training or increasing their caloric intake, a small amount of BMD is regained, but never completely returned to normal BMD for their age (Rencken, Chesnut, & Drinkwater, 1996; Russell et al., 2009). It is now clear exercise-associated amenorrhea leads to irreversible bone loss (Keen & Drinkwater, 1997).

Collectively, athletes with amenorrhea have decreased peripheral bone density and decreased BMD in the lumbar spine, femoral neck, femoral shaft, tibia and whole body. When a diagnosis of osteoporosis is made in a female athlete, there is a 2 to 6% decrease in BMD per year, putting an athlete at a 3-fold greater risk for developing stress fractures, impacting sport performance and having a bone structure similar to that of a 60-year-old woman (Yurth, 1995). In adolescents with amenorrhea in high impact sports, to some extent, athletes are still at risk for bone loss. Even if normal menses are re-established, the female athlete is still at an increased risk for developing osteoporosis later in life. For every decrease of 1 standard deviation below normal for BMD, fracture risk is nearly doubled (Lebrun & Rumball, 2002).

There are several factors increasing a woman's risk for developing osteoporosis including: nonmodifiable factors and modifiable risk factors. Nonmodifiable factors include age, gender, heredity, hormones, personal history and ethnicity. Modifiable risk factors include diet (energy intake), extent of amenorrhea, body composition, calcium and vitamin D intake, and physical activity (type of exercise, high impact versus low impact) and altered hormone levels (cortisol and estrogen; Martin et al., 2004).

## **Ethnicity and Bone Mineral Density**

As mentioned previously, genetics plays 60 to 80% of the role in reaching peak skeletal mass (Martin et al., 2004; Slemenda et al., 2009). The focus of this study is to understand ethnicity's role in BMD and more specifically in female athletes to determine if this is an important factor to consider when developing a plan for prevention. Black females are at lower risk for developing osteoporosis and fractures. One of the largest studies looking at ethnicity and BMD in 197,848 postmenopausal women was in 2005, which found Blacks to have the highest BMD, with Caucasian second and Asians had the lowest BMD in every age group (Barrett-Connor et al., 2005). This trend is seen in adolescents as well with significantly higher increases in BMD in Black females versus White females, especially toward the end of puberty (Gilsanz, Roe, Mora, Costin, & Goodman, 1991). In addition, in all ages of Black females, the BMC of the whole body and BMD of the whole body, hip and radius are greater as compared to non-Black females (Bachrach, Hastie, Wang, Narasimhan, & Marcus, 1999; Horlick et al., 2000; Nelson, Simpson, Johnson, Barondess, & Kleerekoper, 1997). Lastly, height and weight in Black and White girls has been correlated, suggesting Black girls are taller or heavier with a higher BMI, thus have faster pubertal development, leading to a higher BMD (Anderson, Dallal, & Must, 2003; Kimm et al., 2002).

There are numerous benefits of exercise, but without a proper balance of energy availability and energy expenditure, problems may occur along the spectrum of the female athlete triad. This chapter reviewed and summarized the literature in relation to

the female athlete triad and ethnicity. The Triad and its individual components including disordered eating, amenorrhea, and low bone mineral density were summarized as to what we know now, in addition, the role ethnicity plays in each component of the Triad is addressed. As already indicated, in athletes, it has been theorized the Triad is initiated with low energy availability, which can be intentional or unintentional, and then progresses to irregular menses and bone loss (Bonci et al., 2008; Nattiv et al, 2007; Loucks & Thuma, 2003). The research highlights an interesting phenomenon. Women who migrate to the Western environment from an unaffected area tend to adopt Western, White culture of preoccupation about beauty and idealize being thin. Yet, when put in the sport environment, acculturation may or may not have an effect on Black females. Black females may adopt the majority culture or they may hold to their cultural norms. In regards to amenorrhea, early and late menses could be beneficial in preventing amenorrhea in Black females. Lastly, there is a plethora of research suggesting Black females have greater bone mineral density than White females and thus would be at less risk for developing low bone mineral density, leading to osteoporosis. However, there is limited research, if any, on the relationship of the Triad as a whole and how it is affected by ethnicity.

## CHAPTER III

### METHODS

#### **Overview**

To better understand how ethnicity, Caucasian (White) and African American (Black), and acculturation play a role in the female athlete triad, data was collected in Denton, Texas at Texas Woman's University (TWU) in the Exercise and Sports Nutrition Clinic (ESN). Dual-energy X-ray absorptiometry (DXA) scans were performed in the Institute for Women's Health (IWH) Laboratory. For the purpose of this study, athletes and controls were asked to complete a questionnaire on the female athlete triad. Upon completion of the written portion, DXA scans were done and data were collected. The questionnaire was administered in the fall of 2012 and collected immediately upon completion.

#### **Participants**

A convenience sampling method was used by recruiting female students who participated in National Collegiate Athletic Association (NCAA) Division II athletics at TWU or who attended TWU. The athletes participated in one of the following sports: soccer, volleyball, basketball, gymnastics or softball. Athletes and controls were grouped separately according to their ethnicity (White versus Black) as well as grouped by "White dominant" and "Black dominant" sports. Sports classified as White dominant were

volleyball, soccer, gymnastics, and softball, whereas, basketball was classified as a Black dominant sport. Athletes were excluded from the study if they trained less than 10 hr per week, were pregnant, or taking glucocorticoids or thyroid medication. Control subjects were excluded from the study if they trained greater than 5 hr per week, had a competitive athletic history (competed regionally, nationally, or internationally), were pregnant, taking glucocorticoids or thyroid medication, and had a BMI greater than 28. Each participant was knowledgeable of the purposes, procedures, risks and benefits of this study and was provided a written informed consent form (Appendix A) and instructed to sign if willing to participate. A numerical code was assigned to each participant and the corresponding data to maintain confidentiality. Approval from the TWU Institutional Review Board was obtained (Appendix B) before recruiting the athletes.

## **Equipment and Procedures**

### **Questionnaires**

The “Triad Project Questionnaire USA” (*Appendix C and D*) was administered and provided general demographic, physical activity and health characteristics of both athletes and controls. Of particular interest in the health history questionnaire were questions addressing body weight, menstrual history, current menstrual status, eating habits, body image, and overall wellbeing. The Triad questionnaire was developed by Nanna Meyer, PhD from the University of Colorado, and has been validated (N. Meyer,

personal communication, January 11, 2012). The Triad questionnaire was completed and collected in the fall 2012.

### **Bone Mineral Density and Body Composition**

The participant's height and weight were measured. To obtain the height and weight, the participant was asked to remove their shoes, socks and empty their pockets. The height was measured using a wall mounted stadiometer. The participant was instructed to keep their feet flat, heels, hips and shoulders against the wall, stand straight up, knees locked, and eyes focused straight forward. The technician then slid the flat horizontal marker on top of their head and the height was recorded in inches to the nearest 1/8<sup>th</sup> inch. To measure the weight a digital scale was used. The scale was calibrated to zero and then the participant was asked to step on the scale, facing forward, with arms hanging freely at their sides. Weight was recorded to the nearest 0.2 pounds.

Next, the technician made sure the participant was not pregnant, over 265.3 lbs., or taller than 74". If criteria were met, the participant was asked to remove all attenuating material (metallic objects) from their body. Each participant's BMD and body composition were measured using DXA scanning (Lunar DPX-IQ software version 4.6 c; Lunar, Madison, WI). Prior to DXA scans, quality control procedures were completed.

Biographical data (name, birth date, height, weight, sex, ethnicity, client's ID number) was then entered into the DXA program. To perform the lumbar spine scan, the participant was asked to lie in the center of the table with their head on a standard bed pillow and their hands folded across their chest. Their legs were held together at the

knees and feet with Velcro straps. The scan was performed in the Hi-Res Medium 3000 scan mode. Scans were analyzed by placing the intervertebral disc space markers at the lowest density region in the disc space such that the low-density region is included with the vertebra above it. The L1-L4 region was reported.

To perform the total body scan, the participant was then asked to lie in the center of the table with the top of their head ½ to 1” below the top of the horizontal guide line of the table pad. The participant’s hands were placed by their sides with the palms down. The thighs and feet were held loosely together with a velcro strap. The scan was performed in the Fast 150  $\mu$ A scan mode. The scan was analyzed according to the manufacturer’s directions, utilizing the Extended Research analysis mode. Total body and lumbar spine scans were measured in the same scanning session. These scans were used for reporting total body BMD as well as body composition.

### **Statistical Analysis**

All analyses were conducted using SPSS statistical software program (version 19.0; SPSS Inc, Chicago, IL). To address the null hypothesis, a logistic regression test was performed to determine if an association existed between the independent variable, ethnicity (Black vs White) and the dependent variable, prevalence of the female athlete triad. To address the second null hypothesis, a two-way chi square analysis was used to identify if acculturation has an effect on the prevalence of eating disorders or the female athlete triad in African American (Black) females in a team sports environment. To do this, the prevalence of disordered eating in Black athletes was measured in the sports

classified as White dominant (volleyball, soccer, gymnastics, softball) and in sports classified as Black dominant (basketball). A  $p$  value  $< .05$  was considered significant.

## CHAPTER IV

### RESULTS

In fall 2012, a total of 43 collegiate female athletes and 25 controls were recruited for assessments. No participants were excluded for any medical conditions that influenced DXA scans. For the athlete group, 10 participants did not complete the Triad questionnaire and of the control group, five participants did not complete the Triad questionnaire. Also, three participants (two athletes, one control) were given the wrong questionnaire, so data from those participants were not included in reporting baseline results. A total of 31 collegiate female athletes and 19 controls were included in the study. Of the athletes, two indicated they were African American and 29 indicated they were Caucasian. Of the controls, three indicated they were African American and 16 indicated they were Caucasian.

#### **Anthropometrics**

Average self-reported age for athletes ( $n = 31$ ) was 20.1 years with a range of 18-21 years. Average self-reported age for controls ( $n = 19$ ) was 23.7 years with a range of 18-37 years (Table 1). There were no significant differences in mean height, weight and BMI between the athletes and controls. The athletic group included 12 soccer players, 12 volleyball players, five gymnasts, one softball player, and one basketball player.

Table 1

<i>Anthropometrics</i>		
	Athletes	Controls
Age (year)	20.1	23.7
Height (cm)	166.6	164.5
Weight (kg)	65.2	61.3
BMI (kg/m <sup>2</sup> )	23.3	22.8

Note: Athletes n = 31. Controls n = 19.

### **Female Athlete Triad Prevalence**

Prevalence of the Triad components is presented in Table 2 and 3. For this study, those having all three components of the triad were considered to have the female athlete triad. Table 2 shows the prevalence of the number of Triad components by ethnicity looking at athletes versus controls. Table 3 shows the prevalence of the number of Triad components of athletes versus controls. Of the two Black athletes, both had one component of the triad. Of the three Black controls, one had zero components, one had one component, and one had two components of the triad. Of the 29 White athletes, zero had three components, nine had two components, 13 had one component, and seven had zero components of the triad. Of the 16 White controls, one had three components, seven had two components, eight had one component, and zero had zero components. In summary, only one White control had all three components of the triad. No significant difference was found between Black and White athletes and controls when looking at the prevalence of the Triad ( $p = .326$ ).

Table 2

*Prevalence of the Number of Components of the Triad by Ethnicity*

Triad Components	Black Athletes	Black Controls	White Athletes	White Controls
0	n = 0	n = 1 (33%)	n = 7 (24.1%)	n = 0
1	n = 2 (100%)	n = 1 (33%)	n = 13 (44.8%)	n = 8 (50%)
2	n = 0	n = 1 (33%)	n = 9 (31%)	n = 7 (43.75)
3	n = 0	n = 0	n = 0	n = 1 (6.25%)

Note: Black Athletes n = 2. Black controls n = 3. White athletes n = 29. White controls n = 16.

Table 3

*Prevalence of the Number of Components of the Triad in Athletes vs Controls*

Triad Components	Athletes	Controls
0	n = 7 (22.6%)	n = 1 (5.3%)
1	n = 15 (48.4%)	n = 9 (47.4%)
2	n = 9 (29%)	n = 8 (42.1%)
3	n = 0	n = 1 (5.3%)

Note: Athletes n = 31. Controls n = 19.

Table 4 represents each component of the triad (disordered eating, menstrual dysfunction, and low bone mineral density) and ethnicity in athletes versus controls. In the White athlete versus control group, 19 (65.5%) versus 13 (81.25%) had at least one criteria for disordered eating, respectively. One criteria for menstrual dysfunction was found in eight (27.6%) White athletes and nine (56.3%) White controls. One criteria for low bone density were met in four (13.8%) White athletes and three (18.8%) White controls. In the Black athletes versus Black controls, one (50%) versus two (66.7%) had at least one criteria for disordered eating respectively. At least one criteria for menstrual dysfunction was found in zero White athletes and one (33%) White control. One criteria for low bone density was met in one (50%) White athlete and zero White controls.

Table 4

*Prevalence of Each Component of the Triad by Ethnicity*

	Black Athletes	Black Controls	White Athletes	White Controls
Disordered Eating	n = 1 (50%)	n = 2 (66.7%)	n = 19 (65.5%)	n = 13 (81.25%)
Menstrual Dysfunction	n = 0 (0%)	n = 1 (33%)	n = 8 (27.6%)	n = 9 (56.3%)
Low Bone Mineral Density	n = 1 (50%)	n = 0	n = 4 (13.8)	n = 3 (18.8%)

Note: Black Athletes n = 2. Black controls n = 3. White athletes n = 29. White controls n = 16.

**Acculturation and the Female Athlete Triad**

Athletes and controls were grouped by “White dominant” and “Black dominant” sports. Sports classified as White dominant were volleyball, soccer, gymnastics, and softball (n = 30). Basketball was classified as a Black dominant sport (n = 1; Lapchick, 2012). In both the White and Black dominant sports, there was only one athlete participant in each group that classified their ethnicity as Black. The prevalence of disordered eating in Black athletes was measured in the sports classified as White dominant and in sports classified as Black dominant. The Black athlete in the White dominant sports had disordered eating and the Black athlete in the Black dominant sport (basketball) did not. However, the athlete who did not have disordered eating in the Black dominant sport suffered from one of the other criteria for low bone mineral density. In summary, both Black athletes in each group (White vs Black dominant sports) had one component of the Triad.

Table 5

*Acculturation in White Dominate vs Black Dominate Sports*

Triad Components	White Dominant	Black Dominant
Disordered Eating	n = 1 (100%)	n = 0
Menstrual Dysfunction	n = 0	n = 0
Low Bone Mineral Density	n = 0	n = 1 (100%)

Note: White dominant n = 30, Black athlete n = 1. Black dominant n = 1, Black athlete n = 1.

## CHAPTER V

### DISCUSSION

This study contributes to the limited amount of research that has been conducted on ethnicity and the Triad. To date, little is known about the prevalence of the female athlete triad in different ethnicities, particularly Caucasian (White) and African American (Black). This study is among the first to assess such components in collegiate female athletes compared to a control group, in addition to, exploring possible influential factors affecting trends, including acculturation.

The Triad questionnaire, developed by Nanna Meyer, PhD from the University of Colorado, has been shown to be a valid and reliable method for measuring the prevalence of the female athlete triad (N. Meyer, personal communication, January 11, 2012). This method of investigation was chosen for this study due to the consistency and the accuracy when assessing the prevalence of the Triad. This study is one of the first to use this method to analyze the prevalence of the Triad in female collegiate athletes. Other studies looking at the Triad have reported analysis methods such as The Eating Disorder Inventory (EDI), Rosenberg Self Esteem Scale, and the Questionnaire for Eating Disorder Diagnosis (QEDD; Greenleaf, Petrie, Carter, & Reel, 2009; Johnson, Powers, & Dick, 1999).

There was not a significant difference in the prevalence of the Triad between Black and White athletes and controls. In the control group, only one person met the criteria for all three components of the Triad. For literature comparison, concerns still exist related to the methods of detection used in various studies, the lack of appropriate and consistent definitions, good documentation, criteria used for each Triad component, selection bias, and the limitations in the experimental design and methods of assessment. Without consistency in all of these factors, understanding of the etiology of the Triad is compromised. In the current study, due to the small frequency and self-reported measures, comparing these findings to other results in the literature is difficult. However, identifying that all three components of the Triad exist in the collegiate population, used in the present study, is consistent with Beals and Hills' work with collegiate athletes and an important step in understanding to what extent the Triad may affect this population (Beals & Hill, 2006).

A study by Beals and Hill (2006) with Division II college athletes ( $n = 112$ ) in seven different sports (diving, swimming, x-country, track, tennis, field hockey, and softball), found 25% of athletes had disordered eating, 26% reported menstrual dysfunction, 10% had low bone mineral density, and 2.6% had all three Triad components. In the athlete group in the current study, 64.5% had disordered eating, 25.8% had menstrual dysfunction, 16.1% had low bone mineral density and 0% had all three Triad components. Compared to Beals and Hill (2006), the prevalence of athletes with disordered eating in the current study was higher. However, menstrual dysfunction

and low bone mineral density prevalence were similar. Again, the results of higher disordered eating are likely reflective of lower participation numbers in this study and perhaps different sport representation.

A recent review in 2012 by Gibbs, Williams, and De Souza examined the prevalence of any one, two, or three conditions of the Triad in 122 studies, including 10,498 participants with a mean age of  $21.8 \pm 3.5$  yr. They specifically looked at the prevalence of both clinical and subclinical conditions. Issues related to inconsistency in definitions, documentation, criteria for each component, and selection bias all played a role in the difficulty of combining data for analysis. However, the prevalence of all three Triad conditions simultaneously was low, ranging from 0% to 15.9% (nine studies,  $n = 991$ ). A greater percentage of these athletes presented with any two of the Triad conditions, ranging from 2.7 to 27% (seven studies,  $n = 865$ ) and an even greater proportion presented with any one of the Triad conditions ranging from 16-60% (six studies,  $n = 537$ ). The authors also concluded prevalence of subclinical Triad conditions is absent from the literature and needs further evaluation (Gibbs, Williams, & De Souza, 2012).

Another study to compare with a similar population as the current study was the Vardar et al. study (2005). In this study there were 224 female athletes, ages 16 to 25, in 10 different sports (basketball, handball, running, swimming, rhythmic gymnastics, wrestling, tennis, volleyball, taekwondo, and dancing), and they found the prevalence of all three Triad components simultaneously was low 1.36% ( $n = 3$ ). These findings are

similar to the present study with 0% having all three components, 29% having two components, and 48.4% having one component. An athlete who presents with just one condition of the Triad serves as a warning sign that should be taken seriously as they may progress to having all three components of the Triad.

Overall, the results for this study are most likely due to poor recruitment, poor compliance when completing the Triad questionnaires, inaccuracy when providing the correct questionnaires to the participants, and existence of a sports nutrition program on campus at Texas Woman's University (TWU). During recruitment for this study, basketball, softball and gymnastics teams were at the height of their seasons, making it challenging to schedule appointments that would accommodate traveling and competition. When questionnaires were collected by coaches or turned into the researcher for the study, questionnaires were not immediately assessed for completion. Educational obligations were also a factor in participation and completion of the triad questionnaires. In addition, inaccurate data were obtained from some participants leading to further reductions in data available for analysis.

It was expected the Triad would be most prevalent in athletes, since they would be most at risk for inadequate energy intake, leading to amenorrhea, and loss of bone mineral density. However, that was not observed in this study. In fact, only one of the participants, a control, had all three components of the Triad. One explanation for this observation may be the fact that TWU is the only Division II school that provides a sports nutrition clinic to their athletes. The majority of the athletic sample reported a dietitian

(45.2%) and coach/athletic trainer (19.4%) as their primary source of nutrition information. Whereas, in the control group, the primary source of nutrition information was from text books/university courses (42.1%) and magazines/friends/parents (31.6%).

Each year, for every sport, a preseason and postseason nutritional and physical fitness assessment is completed for each athlete at Texas Woman's University. These assessments provide specific knowledge to the athletes in areas the athlete could use improvement (nutritionally and physically). Also, each sport receives nutrition education several times a month during season on various nutrition topics to assure each athlete is knowledgeable of proper nutrition. This factor may have had a large impact on the prevalence of the Triad not being present in the athlete group, but rather in the control group, who did not receive any prior nutritional education or physical fitness assessments from TWU prior to the study.

Acculturation can be applied to the sports environment. Women who identify with the White or Western cultures report more symptoms of disordered eating than women who do not identify with these cultures (Davis & Yager, 1992). The "melting pot" theory within sports teams, where sport provides a vehicle for prolonged interethnic interaction, facilitating the disappearance of minority cultural differences in a majority group has been suggested (Allison, 1982). Unfortunately, this is a new concept and to date there is no literature for comparison regarding acculturation's impact on risk for eating disorders, disordered eating or ultimately the Triad in a team sports environment. In the current study lack of overall participation and lack of Black participants did not

allow for an accurate assessment regarding a potential effect of acculturation on disordered eating or the Triad.

In summary, White female athletes and controls versus Black female athletes and controls did not have significant differences in the prevalence of the female athlete triad. It would have been ideal to start the study after finishing competitive seasons to obtain better compliance. Further investigation among a greater population including athletes and controls would be warranted to determine if the prevalence of the Triad in this age group is different between ethnicities of White and Black. Due to the lack of volunteers and Black participants for this study, an accurate assessment of acculturation was not able to be found, so there is still a need for determining if acculturation impacts the prevalence of the triad in Black athletes in White dominant sports. In conclusion, implementing nutrition clinics with registered dietitians in all schools with athletic programs as well as focusing on Triad prevention education programs toward collegiate athlete's parents, coaches, and athletic trainers would help provide awareness and prevention of the Triad. Also, accurate prevalence estimates of subclinical conditions are needed to fully appreciate the effect of the Triad from a clinical standpoint. Future research is needed to identify the point at which each of the subclinical Triad conditions can reliably predict risk of future negative health consequences to effectively prevent the development of clinical Triad conditions. Ongoing research into the prevalence of the Triad will advance our understanding of the etiology of the Triad.

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Appendix A  
Consent Form

TEXAS WOMAN'S UNIVERSITY  
CONSENT TO PARTICIPATE IN RESEARCH

Influence of Race on the Female Athlete Triad in Active Women

Investigator: Nancy DiMarco .....ndimarco@twu.edu 940/898/2785  
Student Assistant: Nicole Leschak.....nleschak@twu.edu 520/403/2757

Explanation and Purpose of the Research

The purpose of this study is to investigate the influence of race and sports participation on the risk of the Triad. The primary aim of this project is to (a) compare the Triad prevalence and its disorders between racial groups of athletes (African American vs. Caucasian American), (b) explore the relationship among Triad disorders to identify whether race plays a role in its etiology, and (c) investigate the prevalence of the Triad and its disorders in racial groups of athletes and normally active, non-athletic controls. As a participant in this study, you will be asked to complete a questionnaire in which you will need to fill in demographic information, data on past and current exercise habits, weight history, menstrual history and current status, injury history and status as well as general questions about food intake, eating habits, and stress.

Description of Procedures

Your bone health will be assessed using a DXA (Dual X-ray Absorptiometer), which is a low dose X-ray machine. Before you are tested, we will ask you about your menstrual cycle. If it is absent or irregular, you will be asked to perform a pregnancy test in the bathroom at Texas Woman's University and report the results to us. Although pregnancy is unlikely if you are an athlete having menstrual problems, we want to reduce the risk of radiation to a potential fetus. During the DXA measurement, you will lie on a padded platform for a few minutes while a mechanical arm-like device passes over your body. Measurements will be taken at your hip, lumbar spine and whole body. The device will not touch you and no pain is associated with this test. This test is the preferred test for assessing risk for osteoporosis (i.e. brittle bones). It usually takes 15 minutes to complete. This test will also give you information on your body composition which includes your percentage of body fat. You will also be asked to record your diet and any physical activity details using diaries and recalls. To improve the accuracy of these methods you will be asked to take pictures of your meals (breakfast, lunch, dinner) as well for three days. Note: These pictures will only be viewed by the researcher and will not be used to identify any of the participants; they will be kept strictly confidential in the same way as the diet and activity records and body composition test results. Participants will document their diet and activity for 3 days over a period of one week with one of these days falling on the weekend; either Saturday or Sunday. You may also be asked to wear a device called an accelerometer to track your steps and movements. You will be given specific instructions on how to complete these forms and procedures. At the end of each of the recording days, a dietitian will call you and ask you about all the foods and fluids you consumed during the day and your physical activity details. You will be asked to come to the laboratory at the end of the third day and meet with a dietitian to go over all the food and fluids you consumed during the three days. Participants should allow 3 hours to ensure completion of these assessments.

Potential Risks

During the DXA test, you will be exposed to an amount of radiation equivalent to that experienced during a flight from the east coast to the west coast. Radiation could potentially harm a fetus. Prior to the DXA,

Participants Initials \_\_\_\_\_

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test participants will be asked about their menstrual cycle. If absent or irregular, participants must take a pregnancy test in the bathroom at TWU to decrease risk to a fetus. Additional risks to the participants may include emotional discomfort, loss of confidentiality and loss of time. If you have decided to participate in this project, please understand that your participation is voluntary and that you have the right to withdraw your consent or discontinue participation at any time with no penalty. If aid or counseling is required, participants will be referred to TWU's Counseling Center on campus. In addition, your individual privacy will be maintained in all publications or presentations resulting from this study. You will be assigned a number and will never be asked to write down your full name when you fill out the questionnaires. Your name will also not be used in the final research document. All the information you share will remain confidential and your results will not be shared with friends, coaches or family members. All data will be kept on a USB data card and hard drive of a computer within the principal investigator's office. All files will be backed up and regularly archived. All data will be kept in locked filing cabinets within the office of the principal investigator. Only the researchers will have access to the photographs and once the data is collected, the images will be deleted from the cell phone or the computer of the researcher. There is a potential risk of loss of confidentiality in all email, downloading, and internet transactions." Confidentiality will be protected to the extent that is allowed by law. The risk of lost time will be minimized by allowing participants to take the questionnaires home and complete them at their convenience. Additionally, researchers will accommodate participants' schedules by offering flexible appointment times. The total time commitment by each participant should not exceed 3 hours. The researchers will try to prevent any problem that could happen because of this research.

You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

#### Participation and Benefits

After completion of the DXA test, you will be provided with information on your body composition which includes your percentage of body fat and bone mineral density. By recording all of your meals and snacks for three days, you will benefit from receiving a dietary analysis which will give you information on your calorie, fat, protein, carbohydrate, fiber, vitamin and mineral intake. After the research study, you will be given the opportunity to schedule a complimentary consultation with a dietitian. During this session, the dietitian will go over the dietary and physical activity results and give you individualized recommendations to help you meet your nutrition and weight goals.

#### Questions Regarding the Study

You will be given a copy of this signed and dated consent form to keep. If you have any questions about the research study you should ask the researchers; their phone numbers are at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the Texas Woman's University Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at [IRB@twu.edu](mailto:IRB@twu.edu).

Participants Initials \_\_\_\_\_

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\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Date

\*If you would like to know the results of this study tell us where you want them to be sent:

Email: \_\_\_\_\_

or

Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Appendix B

Institutional Review Board (IRB) Approval Letter



**Institutional Review Board**  
Office of Research and Sponsored Programs  
P.O. Box 425619, Denton, TX 76204-5619  
940-898-3378 FAX 940-898-4416  
e-mail: IRB@twu.edu

January 22, 2013

Dr. Nancy DiMarco  
Institute for Women's Health

Dear Dr. DiMarco:

*Re: Influence of Race on the Female Athlete Triad in Active Women (Protocol #: 16070)*

The request for an extension of your IRB approval for the above referenced study has been reviewed by the TWU Institutional Review Board (IRB) and appears to meet our requirements for the protection of individuals' rights.

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. A copy of the approved consent form with the IRB approval stamp is enclosed. Please use the consent form with the most recent approval date stamp when obtaining consent from your participants. A copy of the signed consent forms must be submitted with the request to close the study file at the completion of the study.

This extension is valid one year from February 19, 2013. Any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any unanticipated incidents. If you have any questions, please contact the TWU IRB.

Sincerely,

Dr. Rhonda Buckley, Chair  
Institutional Review Board - Denton

cc. Ronald Hovis, Department of Nutrition & Food Sciences

Appendix C

Triad Project Questionnaire USA Athletes

**Triad Project Questionnaire USA**

**Demographic Information**

Participant Number:		Date:	
Name of your University:		Date of birth:	Age:
Year in School (check one):			
<input type="checkbox"/> Freshman	<input type="checkbox"/> Sophomore	<input type="checkbox"/> Junior	<input type="checkbox"/> Senior <input type="checkbox"/> Post-Graduate
Team you are training with:			
Name of your Work Place:			
Year in School (check one):			
<input type="checkbox"/> Freshman	<input type="checkbox"/> Sophomore	<input type="checkbox"/> Junior	<input type="checkbox"/> Senior
Race (check one):			
<input type="checkbox"/> American Black	<input type="checkbox"/> African Black	<input type="checkbox"/> American White	<input type="checkbox"/> African White
<b>Primary</b> source of nutrition information/education (check only one):			
<input type="checkbox"/> Magazines	<input type="checkbox"/> Textbooks	<input type="checkbox"/> Friends	<input type="checkbox"/> Dietitian <input type="checkbox"/> Coach
<input type="checkbox"/> Physician	<input type="checkbox"/> Health food store	<input type="checkbox"/> Parents	<input type="checkbox"/> Athletic trainer
<input type="checkbox"/> Other medical professionals	<input type="checkbox"/> University course	<input type="checkbox"/> Sports Nutrition seminar	

**CURRENT Sports and Physical Activity Participation**

If you participate in a competitive sport please identify what season you are currently in (choose one).

Pre-season  
 In season  
 Playoffs/Championships  
 Off-season

What was the highest sporting level you have ever reached?

Regional  
 National  
 International  
 not applicable

If you are currently a student for which program/club did you compete before coming to the University?

**CURRENT Sport and Physical Activity Participation**

Please list the sports or activities you **currently** play at your University (A) and outside of the University (B; activities you do on your own not part of your training). For each sport you list, please check the **hours per week** you spend training and/or competing in your sport and the **number of years** you have participated.

**Section A: University Sports**

<b>Sport</b>	<b>Hours per week</b>	<b># years</b>
1.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	
2.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	
3.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	

**Section B: Outside University Sports and/or Activities**

<b>Sport</b>	<b>Hours per week</b>	<b># years</b>
1.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	
2.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	
3.	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-5 <input type="checkbox"/> 6-8 <input type="checkbox"/> ≥ 9	

**Current Sport/Activity:** please list each sport or activity in which you are currently participating on a very *regular* basis. For each activity, please indicate the average length of each training or practice session, the number of sessions per week, and the average intensity of your training.

Sport	Length of training/practice session	Sessions per week		Intensity of sessions
1.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard
2.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard
3.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard

When practice/training is shorter or less intense, do you usually compensate by eating less?  
 YES  NO  I don't know

When practice/training is longer and more intense, you train twice a day or compete, do you usually compensate by eating more?  
 YES  NO  I don't know

When practice/training is shorter or less intense, do you usually train more on your own?  
 YES  NO  I don't know

If you get injured or sick and need to take some time off from training and competition, do you get worried about food and weight gain?  
 YES  NO

On a scale from 1 to 10, please rate the intensity of your worries about food and weight gain when you are injured or sick. (1 = least worry, 10 = most worry)

1     2     3     4     5     6     7     8     9     10

**PAST Sport and Physical Activity Participation**

Please list the sports or activities you played in the past before you came to University, in high school (A) and outside of high school (e.g., club, team) (B). For each sport you list, please check the *hours per week* you spent training and/or competing in your sport and the *number of years* you have participated in the past.

**Section A: High School Sports**

Sport	# years
1.	
2.	
3.	
4.	

**Section B: Outside School Sports (teams, clubs) and/or Activities**

Sport	# years
1.	
2.	
3.	
4.	

**Body Weight Information**

Length of time at current weight? _____ yr/mo	Lowest weight at your current height? _____ lbs.	Highest weight at your current height? _____ lbs.
How long have you been at your current height? _____ yrs		
What do you consider to be your "ideal or competitive" weight? _____ lbs.		
Do you gain or lose weight regularly to meet the demands or weight requirements for your sport? <input type="checkbox"/> YES <input type="checkbox"/> NO		
How many times per year do you make weight (lose weight to compete) for your sport? _____ times/year		
Do you experience changes in your weight (>5 lbs) throughout the year? <input type="checkbox"/> YES <input type="checkbox"/> NO If you checked YES, are the changes (check one) <input type="checkbox"/> weight gain <input type="checkbox"/> weight loss <input type="checkbox"/> weight gain and weight loss		
Did you experience any weight change during the past 12 month? <input type="checkbox"/> YES <input type="checkbox"/> NO If YES, please indicate if you gained or lost weight and the amount (check one). <input type="checkbox"/> gained <input type="checkbox"/> lost <input type="checkbox"/> 0-2 lbs. <input type="checkbox"/> 3-5 lbs. <input type="checkbox"/> 6-8 lbs. <input type="checkbox"/> 9-11 lbs. <input type="checkbox"/> 12-14 lbs. <input type="checkbox"/> ≥ 15 lbs.		
Are you satisfied with your current weight? <input type="checkbox"/> YES <input type="checkbox"/> NO		
In the past, I used to think of myself... (check one) <input type="checkbox"/> very underweight (>10 lbs) <input type="checkbox"/> slightly underweight (5-10 lbs) <input type="checkbox"/> at an "ideal" weight <input type="checkbox"/> slightly overweight (<10 lbs) <input type="checkbox"/> moderately overweight (10-20 lbs) <input type="checkbox"/> very overweight (>20 lbs)		
Presently, I think of myself as... (check one) <input type="checkbox"/> very underweight (>10 lbs) <input type="checkbox"/> slightly underweight (5-10 lbs) <input type="checkbox"/> at an "ideal" weight <input type="checkbox"/> slightly overweight (<10 lbs) <input type="checkbox"/> moderately overweight (10-20 lbs) <input type="checkbox"/> very overweight (>20 lbs)		
Which of the following are you currently trying to do about your weight? (check one) <input type="checkbox"/> lose weight <input type="checkbox"/> gain weight <input type="checkbox"/> maintain weight <input type="checkbox"/> I am doing nothing		
If you are trying to change your weight, what is the <i>primary</i> reason? (check one) <input type="checkbox"/> Sports performance <input type="checkbox"/> Appearance <input type="checkbox"/> Health <input type="checkbox"/> other (explain):		

Do you feel pressure to achieve/maintain a lean body shape? <input type="checkbox"/> YES <input type="checkbox"/> NO				
If you checked YES, from whom do you feel pressure? (check all that apply)				
<input type="checkbox"/> Yourself <input type="checkbox"/> Coach <input type="checkbox"/> Friends <input type="checkbox"/> Parents <input type="checkbox"/> Media <input type="checkbox"/> other (explain):				
On a scale from 1 to 10, please rate the intensity of pressure you feel to achieve/maintain a lean body shape? (1 = least pressure, 10 = most pressure)				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	7	8	9	10
Please indicate whether you have ever used any of these methods to control your body weight (check all that apply). Also specify <i>how many times</i> (per week or month) and the <i>length of time</i> (months or years) you used each method.				
<b>Method</b>	<b># times</b>		<b>Length of time used</b>	
	<b>per month</b>	<b>per week</b>	<b># months</b>	<b># years</b>
<input type="checkbox"/> fasting				
<input type="checkbox"/> skipping meals				
<input type="checkbox"/> commercial weight loss programs				
<input type="checkbox"/> liquid supplements (i.e. slim fast)				
<input type="checkbox"/> very low calorie diet (<1200 Kcal/d)				
<input type="checkbox"/> self-induced vomiting				
<input type="checkbox"/> laxatives or diuretics				
<input type="checkbox"/> diet pills or "fat-burning" supplements				
<input type="checkbox"/> additional exercise beyond training for sport				
<input type="checkbox"/> low-fat diet/high carbohydrate diet				
<input type="checkbox"/> high protein/low carbohydrate diet				
<input type="checkbox"/> vegetarian diet				
<input type="checkbox"/> nutritional counseling (i.e. with a dietitian)				
<b>Menstrual History</b>				
Have you ever had a menstrual period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
How old were you when you had your first menstrual period?			_____ years	
If you participate in sports or activities competitively, did you have your first menstrual period before or after you began training for your sport or activity?			<input type="checkbox"/> Before <input type="checkbox"/> After <input type="checkbox"/> Not applicable	
In the past, about how many times per year did you get your menstrual period?			<input type="checkbox"/> 10-13 times per year <input type="checkbox"/> 6-9 times per year <input type="checkbox"/> 4-6 times per year <input type="checkbox"/> 1-3 times per year	
Have you ever gone for more than 3 months without having a menstrual period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
If you checked YES for the previous question, please answer the following questions.				
a. How old were you when you missed $\geq 3$ menstrual periods?			_____ years	
b. How many months or years did you go without a menstrual period?			_____ months or years	
c. Did you see a physician during this time period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
d. Did your physician prescribe some form of contraception to				

regulate your menstrual periods?	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA
How many menstrual periods have you had a. In the past 12 months? _____ b. In the past 6 months? _____	
<b>Current Menstrual Status</b>	
Currently, how would you describe your menstrual cycle? In order to determine the number of days your cycle lasts, begin with the first day of bleeding and count the number of days until the next month when you began bleeding again. <input type="checkbox"/> I am very regular (every 26-35 days) <input type="checkbox"/> I am somewhat regular (every 21-25 days) <input type="checkbox"/> I am very irregular (every 36-45 days) <input type="checkbox"/> I do not have a menstrual cycle (no cycle for longer than 3 months)	
How would you describe the length of your menstrual cycle during this month (check one) <input type="checkbox"/> the same as always <input type="checkbox"/> shorter than usual <input type="checkbox"/> longer than usual	
How would you describe your menstrual bleeding during this month's cycle? (check one) <input type="checkbox"/> the same as always <input type="checkbox"/> lighter than usual <input type="checkbox"/> heavier than usual	
Does your menstrual cycle change with your training?	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> Not applicable
If you checked <b>YES</b> , choose all that apply:	<input type="checkbox"/> Longer cycle (>35 days) <input type="checkbox"/> Skipping a cycle <input type="checkbox"/> Shorter cycle (<21 days) <input type="checkbox"/> Heavier bleeding <input type="checkbox"/> Absence of 3 or more consecutive cycles <input type="checkbox"/> Other, please specify: _____
Does your menstrual cycle change during your competition season?	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> Not applicable
If you checked <b>YES</b> , choose one of the following:	<input type="checkbox"/> Longer cycle (>35 days) <input type="checkbox"/> Skipping a cycle <input type="checkbox"/> Shorter cycle (<21 days) <input type="checkbox"/> Heavier bleeding <input type="checkbox"/> Absence of 3 or more consecutive cycles <input type="checkbox"/> Other, please specify: _____
Do you currently use contraception/birth control (e.g., oral contraceptive pills, rings, implants)? <input type="checkbox"/> YES # yrs____ <input type="checkbox"/> NO <input type="checkbox"/> Not applicable If YES, what are you using them for? <input type="checkbox"/> Birth control <input type="checkbox"/> Regulate cycle <input type="checkbox"/> Both <input type="checkbox"/> other If NO, have you used contraception/birth control (e.g., oral contraceptive pills, rings, implants) in the past? <input type="checkbox"/> YES # yrs____ <input type="checkbox"/> NO- never used <input type="checkbox"/> NA If YES, what did you use them for? <input type="checkbox"/> Birth control <input type="checkbox"/> Regulate cycle <input type="checkbox"/> Both <input type="checkbox"/> other	
Have you ever been to a gynecologist?	<input type="checkbox"/> YES <input type="checkbox"/> NO
If you checked <b>YES</b> for the previous question, was any reproductive disorder identified/diagnosed?	<input type="checkbox"/> YES <input type="checkbox"/> NO If <b>YES</b> , please give more

details: \_\_\_\_\_

Do you currently monitor your menstrual cycle?

YES  NO

If you checked YES for the previous question, how many months or years have you monitored your menstrual cycle?

# \_\_\_\_\_  years OR # \_\_\_\_\_  months

### Eating and Food Questions

Please check the answer that most applies to you for each of the following questions.

1.	When I have eaten my quota of calories, I am usually good about not eating anymore. <input type="checkbox"/> True <input type="checkbox"/> False
2.	I deliberately take small helpings as a means of controlling my weight <input type="checkbox"/> True <input type="checkbox"/> False
3.	Life is too short to worry about dieting. <input type="checkbox"/> True <input type="checkbox"/> False
4.	I have a pretty good idea of the number of calories in common food. <input type="checkbox"/> True <input type="checkbox"/> False
5.	While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. <input type="checkbox"/> True <input type="checkbox"/> False
6.	I enjoy eating too much to spoil it by counting calories or watching my weight. <input type="checkbox"/> True <input type="checkbox"/> False
7.	I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. <input type="checkbox"/> True <input type="checkbox"/> False
8.	I consciously hold back at meals in order not to gain weight. <input type="checkbox"/> True <input type="checkbox"/> False
9.	I eat anything I want, any time I want. <input type="checkbox"/> True <input type="checkbox"/> False
10.	I count calories as a conscious means of controlling my weight. <input type="checkbox"/> True <input type="checkbox"/> False
11.	I do not eat some foods because they make me fat. <input type="checkbox"/> True <input type="checkbox"/> False
12.	I pay a great deal of attention to changes in my figure. <input type="checkbox"/> True <input type="checkbox"/> False

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Please circle one response for each of the following questions.

**Sample Question:**

How likely are you to take small helpings as a means of controlling your weight?

1                      2                      3                      4

Rarely    Sometimes    Usually    Always

13.	How often are you dieting in a conscious effort to control your weight? 1                      2                      3                      4 Rarely    Sometimes    Usually    Always
14.	Would a weight fluctuation of 5 pounds affect the way you live your life? 1                      2                      3                      4 Not at all    Slightly    Moderately    Very much
15.	Do your feelings of guilt about overeating help you to control your food intake? 1                      2                      3                      4 Never    Rarely    Often    Always
16.	How conscious are you of what you are eating? 1                      2                      3                      4 Not at all    Slightly    Moderately    Extremely
17.	How frequently do you avoid 'stocking up' on tempting foods? 1                      2                      3                      4 Almost never    Seldom    Usually    Almost always
18.	How likely are you to shop for low calorie foods? 1                      2                      3                      4 Unlikely    Slightly unlikely    Moderately likely    Very likely
19.	How likely are you to consciously eat slowly in order to cut down on how much you eat? 1                      2                      3                      4 Unlikely    Slightly unlikely    Moderately likely    Very likely
20.	How likely are you to consciously eat less than you want? 1                      2                      3                      4 Unlikely    Slightly unlikely    Moderately likely    Very likely
21.	On a scale of 0-5, where 0 means no restraint in eating (eating whatever and whenever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself? 0 Eat whatever you want, whenever you want it 1 Usually eat whatever you want, whenever you want it 2 Often eat whatever you want, whenever you want it 3 Often limit food intake, but often 'give in' 4 Usually limit food intake, rarely 'give in' 5 Constantly limiting food intake, never 'giving in'

**Medical**

Have you ever been diagnosed with any of the following? (check all that apply)

scoliosis       heart problems       osteoporosis       low bone mass       constipation

food allergies       food intolerance (eg, lactose, gluten)       hypoglycemia       dehydration

anorexia nervosa       bulimia nervosa       mononucleosis       diarrhea       anemia

low ferritin level/iron depletion       high cholesterol/blood lipids       low vitamin D levels

diabetes mellitus, please specify: \_\_\_\_\_

GI problems, please specify: \_\_\_\_\_

thyroid problems, please specify: \_\_\_\_\_

If you were diagnosed, which conditions were you treated for? (check all that apply)

scoliosis       heart problems       osteoporosis       low bone mass       constipation

food allergies       food intolerance (eg, lactose, gluten)       hypoglycemia       dehydration

anorexia nervosa       bulimia nervosa       mononucleosis       diarrhea       anemia

low ferritin level/iron depletion       high cholesterol/blood lipids       low vitamin D levels

diabetes mellitus, please specify: \_\_\_\_\_

GI problems, please specify: \_\_\_\_\_

thyroid problems, please specify: \_\_\_\_\_

How often do you get sick per year (e.g. common cold and/or influenza)?

0     1-2     3     >3

**Injury & Medical Assessment**

1. Please check any of the injuries listed below that you have experienced in your *lifetime*.

2. For each injury you checked, please complete additional questions regarding the injury.

Injury	Please check if the injury was diagnosed by a physician.	When did the injury occur? Date (mo/yr)	What were you doing when the injury occurred?	If you were playing a sport when the injury occurred, what sport were you playing?	Did the injury occur during practice or competition?  (Practice can mean either training with a team or on your own.)
<b>Anterior Cruciate Ligament (ACL)</b>					
<input type="checkbox"/> Contact	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Non-Contact	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<b>Stress Fracture</b>					
<input type="checkbox"/> Tibia	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Femur	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Foot	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Spine	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<b>Other</b>					
<input type="checkbox"/> Sprain, strain, dislocation	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Tendinitis, tendinosis, bursitis	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Broken bone	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Meniscal or Posterior Cruciate Ligament (PCL) injury	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Iliotibial (IT) band syndrome	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition

**Eating Habits**

<p>Are you a vegetarian? <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If YES, please indicate type: <input type="checkbox"/> vegan <input type="checkbox"/> lacto/ovo <input type="checkbox"/> lacto <input type="checkbox"/> other _____</p>
<p>Are you hungry before your workouts?</p> <p><input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never</p>
<p>Are you thirsty before your workouts?</p> <p><input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never</p>
<p>Do you limit/restrict the <b>amount</b> of food you eat to control your weight? <input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p>Do you limit/restrict the <b>types</b> of food you eat to control your weight? <input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p>If <b>YES</b>, please check the groups of food you limit/restrict.</p> <p><input type="checkbox"/> dairy (milk, cheese) <input type="checkbox"/> red meat <input type="checkbox"/> other meat/protein (chicken, turkey, fish, eggs)</p> <p><input type="checkbox"/> carbohydrates rich foods (breads, pasta, rice, potatoes)</p> <p><input type="checkbox"/> sweets (ice cream, cookies, candy)</p> <p><input type="checkbox"/> fats (butter, oil, cream sauces, salad dressings, mayonnaise, etc.)</p> <p><input type="checkbox"/> fast food (hamburgers, hot dogs, fries etc)</p> <p><input type="checkbox"/> sweetened beverages (soda, juices, energy drinks etc)</p> <p><input type="checkbox"/> alcoholic beverages</p>
<p>Do you currently experience changes in your appetite? <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If YES, please indicate the direction of change. <input type="checkbox"/> increase <input type="checkbox"/> decrease</p>
<p>In general, how would you currently describe your calorie intake during this month?</p> <p><input type="checkbox"/> the same as usual <input type="checkbox"/> more than usual <input type="checkbox"/> less than usual</p>
<p>Do you take dietary/sport supplements?</p> <p><input type="checkbox"/> YES, daily <input type="checkbox"/> YES, but not every day <input type="checkbox"/> NO</p>
<p>Please check all the dietary supplements you use.</p> <p><input type="checkbox"/> multi vitamin/mineral <input type="checkbox"/> iron <input type="checkbox"/> calcium <input type="checkbox"/> zinc <input type="checkbox"/> magnesium <input type="checkbox"/> vitamin E</p> <p><input type="checkbox"/> B-complex vitamins <input type="checkbox"/> vitamin C <input type="checkbox"/> vitamin A <input type="checkbox"/> herbals (eg. echinacea, ginseng)</p> <p><input type="checkbox"/> Immune enhancers (eg. Vitamin C + zinc) <input type="checkbox"/> other (please specify):</p>
<p>Please check all the sports supplements you currently use?</p> <p><input type="checkbox"/> protein powder/drink <input type="checkbox"/> Amino acids <input type="checkbox"/> sports bars (Luna, Powerbar, Clif) <input type="checkbox"/> HMB</p> <p><input type="checkbox"/> glutamine <input type="checkbox"/> creatine <input type="checkbox"/> sports drinks (eg. Gatorade, Powerade) <input type="checkbox"/> energy drinks (eg. Red Bull)</p> <p><input type="checkbox"/> recovery drinks (Endurox, PowerBar) <input type="checkbox"/> liquid meal supplements (eg. Boost, Ensure)</p> <p><input type="checkbox"/> sodium bicarbonate or citrate <input type="checkbox"/> caffeine <input type="checkbox"/> Pro-hormones (andro, DHEA) <input type="checkbox"/> anabolic steroids</p> <p><input type="checkbox"/> fat burners (ephedrine, green tea, ma huang, synephrine)</p> <p><input type="checkbox"/> other (please specify):</p>
<p><i>Thoughts about your body, your eating patterns, your feelings...</i></p>
<p>9</p>

Please check one response for each of the following questions.

**Sample Question:**

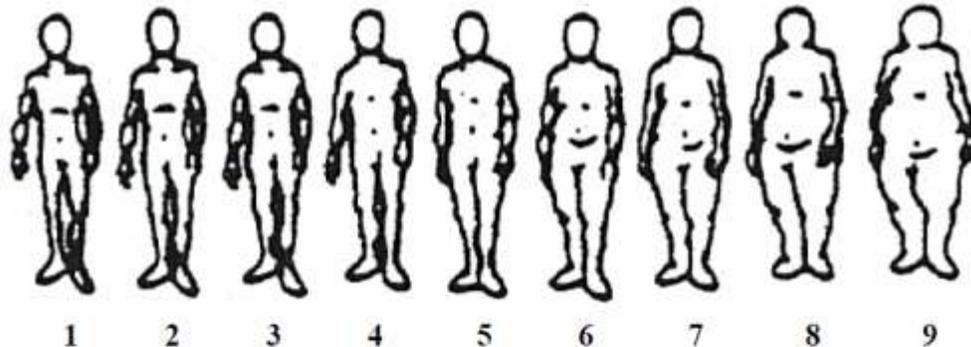
I think that my stomach is too big.

Always  Usually  Often  Sometimes  Rarely  Never

1.	I eat sweets and carbohydrates without feeling nervous <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
2.	I think that my stomach is too big. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
3.	I eat when I am upset. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
4.	I stuff myself with food. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
5.	I think about dieting. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
6.	I think that my thighs are too large. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
7.	I feel extremely guilty after overeating. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
8.	I think that my stomach is just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
9.	I am terrified of gaining weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
10.	I feel satisfied with the shape of my body. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
11.	I exaggerate or magnify the importance of weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
12.	I have gone on eating binges where I have felt that I could not stop. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
13.	I like the shape of my buttocks. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
14.	I am preoccupied with the desire to be thinner.

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	<input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
15.	I think about bingeing (overeating). <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
16.	I think my hips are too big. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
17.	I eat moderately in front of others and stuff myself when they're gone. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
18.	If I gain a pound, I worry that I will keep gaining. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
19.	I have the thought of trying to vomit in order to lose weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
20.	I think that my thighs are just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
21.	I think my buttocks are too large. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
22.	I eat or drink in secrecy. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
23.	I think that my hips are just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never



In the picture above, what best represents your outline drawing (1-9)? \_\_\_\_\_

In the picture above, what best represents your ideal outline drawing (1-9)? \_\_\_\_\_

**Personal Well-Being**

In general, how would you describe your stress level this month?

the same as always     higher than usual     less than usual

Please indicate if you experienced any of the following *life events* during the past month.

Life Event	YES	Life Event	YES
Death of a close family member or friend		First or final year in school	
Pregnancy		Serious illness or injury	
Parents remarried or divorced		Any personal problems	
Family or personal financial difficulties		Major change in personal habits	
Frequent arguments with your siblings		Change in living environment	
Major disagreements with your parents		Failure in a course	
Beginning or ending a job		Poor result on an exam or assignment	
Problems with your boss or teacher		Preparing for a final exam period or SAT	
Outstanding personal achievement		Start a new relationship	
Change in sleeping habits		Vacation	
Change in school environment		Family reunion	
Started a diet		Negative feedback from coach	
Poor performance in a competition/game		Playoffs/Tournaments	
Change in recreational or sport activities		Acceptance/rejection from college application	
Relationship ended with boyfriend/girlfriend		Suspension from school	
Suspension from your sport/activity		Sudden weight gain (> 7 lbs)	
Large increase in amount of training		Sudden weight loss (> 7 lbs)	

**THANK YOU VERY MUCH FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE**

*Please take a moment to fill in any questions you may have skipped.*

Appendix D

Triad Project Questionnaire USA Control

**Triad Project Questionnaire USA CONTROL**

**Demographic Information**

Participant Number:		Date:	
Name of your University:		Date of birth:	Age:
Year in School (check one):			
<input type="checkbox"/> Freshman <input type="checkbox"/> Sophomore <input type="checkbox"/> Junior <input type="checkbox"/> Senior <input type="checkbox"/> Post-Graduate			
Name of your Work Place:			
Race (check one):			
<input type="checkbox"/> American Black <input type="checkbox"/> African Black <input type="checkbox"/> American White <input type="checkbox"/> African White			
Primary source of nutrition information/education (check only one):			
<input type="checkbox"/> Magazines <input type="checkbox"/> Textbooks <input type="checkbox"/> Friends <input type="checkbox"/> Dietitian <input type="checkbox"/> Coach <input type="checkbox"/> Physician <input type="checkbox"/> Health food store <input type="checkbox"/> Parents <input type="checkbox"/> Athletic trainer <input type="checkbox"/> Other medical professionals <input type="checkbox"/> University course <input type="checkbox"/> Sports Nutrition seminar			

**Sports and Physical Activity Participation**

Are you currently physically active?  YES  NO  
 If you checked **NO**, go directly to the **Past Sport and Physical Activity Participation** Section.

On average, how many hours per week do you exercise?  
 1     2-3     4-5     >5

**Current Activity:** please list each sport or activity in which you are currently participating on a very **regular** basis. For each activity, please indicate the average length of each training or practice session, the number of sessions per week, and the average intensity of your training.

Sport	Length of exercise session	Sessions per week		Intensity of sessions
1.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard
2.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard
3.	<input type="checkbox"/> < 30 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> 90 minutes <input type="checkbox"/> 120 minutes <input type="checkbox"/> 180 minutes	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Very easy <input type="checkbox"/> Easy <input type="checkbox"/> Moderate <input type="checkbox"/> Hard <input type="checkbox"/> Very hard

If you don't have time to exercise or exercise at a shorter and lower intensity, do you usually compensate by eating less?  YES  NO  I don't know

When you exercise more often or intense than usual, do you usually compensate by eating more?  YES  NO  I don't know

If you get injured or sick and need to take some time off from exercising, do you get worried about food and weight gain?  YES  NO

On a scale from 1 to 10, please rate the intensity of worry you perceive about food and weight gain

when you are injured or sick. (1 = least worry, 10 = most worry)

1     2     3     4     5     6     7     8     9     10

**Past Sport and Physical Activity Participation**

Please list the sports or activities you played in the past before you came to University, in high school (A) and outside of high school (e.g., club, team) (B). For each sport you list, please check the **hours per week** you spend training and/or competing in your sport and the **number of years** you have participated.

**Section A: High School Sports**

Sport	# years
1.	
2.	
3.	
4.	

**Section B: Outside School Sports (teams, clubs) and/or Activities**

Sport	# years
1.	
2.	
3.	
4.	

**Body Weight Information**

Length of time at current weight? _____ yr/mo	Lowest weight at your current height? _____ lbs.	Highest weight at your current height? _____ lbs.
---	--	---

Are you pregnant?  YES  NO

How long have you been at your current height? \_\_\_\_\_ yrs

What do you consider to be your "ideal" weight? \_\_\_\_\_ lbs.

Do you gain or lose weight frequently?

YES  NO

Do you experience changes in your weight (>5 lbs) throughout the year?  YES  NO

If you checked YES, are the changes (check one)

weight gain     weight loss     weight gain and weight loss

Did you experience any weight change during the past 12 month?  YES  NO

If YES, please indicate if you gained or lost weight and the amount (check one).

gained  lost

0-2 lbs.     3-5 lbs.     6-8 lbs.     9-11 lbs.     12-14 lbs.     ≥ 15 lbs.

Are you satisfied with your current weight?

YES  NO

In the past, I used to think of myself... (check one)

very underweight (>10 lbs)     slightly underweight (5-10 lbs)     at an "ideal" weight

slightly overweight (<10 lbs)     moderately overweight (10-20 lbs)

very overweight (>20 lbs)

Presently, I think of myself as... (check one)

very underweight (>10 lbs)     slightly underweight (5-10 lbs)     at an "ideal" weight

slightly overweight (<10 lbs)     moderately overweight (10-20 lbs)

very overweight (>20 lbs)

Which of the following are you currently trying to do about your weight? (check one)

lose weight     gain weight     maintain weight     I am doing nothing

If you are trying to change your weight, what is the **primary** reason? (check one)

<input type="checkbox"/> Appearance <input type="checkbox"/> Sports performance <input type="checkbox"/> Health <input type="checkbox"/> other (explain):				
Do you feel pressure to achieve/maintain a lean body shape? <input type="checkbox"/> YES <input type="checkbox"/> NO				
If you checked YES, from whom do you feel pressure? (check all that apply) <input type="checkbox"/> Yourself <input type="checkbox"/> Friends <input type="checkbox"/> Parents <input type="checkbox"/> Media <input type="checkbox"/> other (explain):				
On a scale from 1 to 10, please rate the intensity of pressure you feel to achieve/maintain a lean body shape? (1 = least pressure, 10 = most pressure)				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	7	8	9	10
Please indicate whether you have ever used any of these methods to control your body weight (check all that apply). Also specify <i>how many times</i> (per week or month) and the <i>length of time</i> (months or years) you used each method.				
Method	# times		Length of time used	
	per month	per week	# months	# years
<input type="checkbox"/> fasting				
<input type="checkbox"/> skipping meals				
<input type="checkbox"/> commercial weight loss programs				
<input type="checkbox"/> liquid supplements (i.e. slim fast)				
<input type="checkbox"/> very low calorie diet (<1200 Kcal/d)				
<input type="checkbox"/> self-induced vomiting				
<input type="checkbox"/> laxatives or diuretics				
<input type="checkbox"/> diet pills or "fat-burning" supplements				
<input type="checkbox"/> additional exercise beyond training for sport				
<input type="checkbox"/> low-fat diet/high carbohydrate diet				
<input type="checkbox"/> high protein/low carbohydrate diet				
<input type="checkbox"/> vegetarian diet				
<input type="checkbox"/> nutritional counseling (i.e. with a dietitian)				
<b>Menstrual History</b>				
Have you ever had a menstrual period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
How old were you when you had your first menstrual period?			_____ years	
In the past, about how many times per year did you get your menstrual period?			<input type="checkbox"/> 10-13 times per year <input type="checkbox"/> 6-9 times per year <input type="checkbox"/> 4-6 times per year <input type="checkbox"/> 1-3 times per year	
Have you ever gone for more than 3 months without having a menstrual period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
If you checked YES for the previous question, please answer the following questions.				
a. How old were you when you missed $\geq 3$ menstrual periods?			_____ years	
b. How many months or years did you go without a menstrual period?			_____ months or years	
c. Did you see a physician during this time period?			<input type="checkbox"/> YES <input type="checkbox"/> NO	
d. Did your physician prescribe some form of contraception to regulate your menstrual periods?			<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA	
How many menstrual periods have you had				

- a. In the past 12 months? \_\_\_\_\_  
 b. In the past 6 months? \_\_\_\_\_

**Current Menstrual Status**

Currently, how would you describe your menstrual cycle? In order to determine the number of days your cycle lasts, begin with the first day of bleeding and count the number of days until the next month when you began bleeding again.

- I am very regular (every 26-35 days)  
 I am somewhat regular (every 21-25 days)  
 I am very irregular (every 36-45 days)  
 I do not have a menstrual cycle (no cycle for longer than 3 months)

How would you describe the length of your menstrual cycle during this month (check one)

- the same as always     shorter than usual     longer than usual

How would you describe your menstrual bleeding during this month's cycle? (check one)

- the same as always     lighter than usual     heavier than usual

Do you currently use contraception/birth control (e.g., oral contraceptive pills, rings, implants)?

- YES # yrs \_\_\_\_\_  NO  NA

If YES, what are you using them for?

- Birth control     Regulate cycle     Both     other

If NO, have you used contraception/birth control (e.g., oral contraceptive pills, rings, implants) in the past?

- YES # yrs \_\_\_\_\_  NO- never used     NA

If YES, what did you use them for?

- Birth control     Regulate cycle     Both     other

Have you ever been to a gynecologist?

- YES     NO

If you checked YES for the previous question, was any reproductive disorder identified/diagnosed?

- YES     NO

If YES, please give more details: \_\_\_\_\_

Do you currently monitor your menstrual cycle?

- YES     NO

If you checked YES for the previous question, how many months or years have you monitored your menstrual cycle?

- # \_\_\_\_\_  years OR # \_\_\_\_\_  months

### Eating and Food Questions

Please check the answer that most applies to you for each of the following questions.

1.	When I have eaten my quota of calories, I am usually good about not eating anymore. <input type="checkbox"/> True <input type="checkbox"/> False
2.	I deliberately take small helpings as a means of controlling my weight <input type="checkbox"/> True <input type="checkbox"/> False
3.	Life is too short to worry about dieting. <input type="checkbox"/> True <input type="checkbox"/> False
4.	I have a pretty good idea of the number of calories in common food. <input type="checkbox"/> True <input type="checkbox"/> False
5.	While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. <input type="checkbox"/> True <input type="checkbox"/> False
6.	I enjoy eating too much to spoil it by counting calories or watching my weight. <input type="checkbox"/> True <input type="checkbox"/> False
7.	I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. <input type="checkbox"/> True <input type="checkbox"/> False
8.	I consciously hold back at meals in order not to gain weight. <input type="checkbox"/> True <input type="checkbox"/> False
9.	I eat anything I want, any time I want. <input type="checkbox"/> True <input type="checkbox"/> False
10.	I count calories as a conscious means of controlling my weight. <input type="checkbox"/> True <input type="checkbox"/> False
11.	I do not eat some foods because they make me fat. <input type="checkbox"/> True <input type="checkbox"/> False
12.	I pay a great deal of attention to changes in my figure. <input type="checkbox"/> True <input type="checkbox"/> False

Please circle **one** response for each of the following questions.

**Sample Question:**

How likely are you to take small helpings as a means of controlling your weight?

1                      2                      3                      4

Rarely    Sometimes    Usually    Always

13.	How often are you dieting in a conscious effort to control your weight? 1                      2                      3                      4 Rarely    Sometimes    Usually    Always
-----	---



**Medical**

Have you ever been diagnosed with any of the following? (check all that apply)

scoliosis       heart problems       osteoporosis       low bone mass       constipation

anorexia nervosa       bulimia nervosa       mononucleosis       diarrhea

Diabetes mellitus, please specify: \_\_\_\_\_

GI problems, please specify: \_\_\_\_\_

Thyroid problems, please specify: \_\_\_\_\_

If you were diagnosed, which conditions were you treated for? (check all that apply)

scoliosis       heart problems       osteoporosis       low bone mass       constipation

anorexia nervosa       bulimia nervosa       mononucleosis       diarrhea

Diabetes mellitus, please specify: \_\_\_\_\_

GI problems, please specify: \_\_\_\_\_

Thyroid problems, please specify: \_\_\_\_\_

How often do you get sick per year (e.g. common cold and/or influenza)?

0     1-2     3     >3

**Injury & Medical Assessment**

1. Please check any of the injuries listed below that you have experienced in your *lifetime*.

2. For each injury you checked, please complete additional questions regarding the injury.

Injury	Please check if the injury was diagnosed by a physician.	When did the injury occur? Date (mo/yr)	What were you doing when the injury occurred?	If you were playing a sport when the injury occurred, what sport were you playing?	Did the injury occur during practice or competition?  (Practice can mean either training with a team or on your own.)
<b>Anterior Cruciate Ligament (ACL)</b>					
<input type="checkbox"/> Contact	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Non-Contact	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<b>Stress Fracture</b>					
<input type="checkbox"/> Tibia	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Femur	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Foot	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Spine	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<b>Other</b>					
<input type="checkbox"/> Sprain, strain, dislocation	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Tendinitis, tendinosis, bursitis	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Broken bone	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Meniscal or Posterior Cruciate Ligament (PCL) injury	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition
<input type="checkbox"/> Iliotibial (IT) band syndrome	<input type="checkbox"/>	___/___	<input type="checkbox"/> Sport <input type="checkbox"/> Other		<input type="checkbox"/> Practice <input type="checkbox"/> Competition

**Eating Habits**

Are you a vegetarian?     YES     NO

If YES, please indicate type:  vegan  lacto/ovo  lacto  other \_\_\_\_\_

If you currently engage in physical activity, are you hungry before your workouts?  
 Always  Usually  Often  Sometimes  Rarely  Never  Don't exercise

If you currently engage in physical activity, are you thirsty before your workouts?  
 Always  Usually  Often  Sometimes  Rarely  Never  Don't exercise

Do you limit/restrict the **amount** of food you eat to control your weight?  YES  NO

Do you limit/restrict the **types** of food you eat to control your weight?  YES  NO

If YES, please check the groups of food you limit/restrict.  
 dairy (milk, cheese)  red meat  other meat/protein (chicken, turkey, fish, eggs)  
 carbohydrates rich foods (breads, pasta, rice, potatoes)  
 sweets (ice cream, cookies, candy)  
 fats (butter, oil, cream sauces, salad dressings, mayonnaise, etc.)

Do you currently experience changes in your appetite?  YES  NO

If YES, please indicate the direction of change.  increase  decrease

In general, how would you currently describe your calorie intake during this month?  
 the same as usual  more than usual  less than usual

Do you take dietary/sport supplements?  
 YES, daily  YES, but not every day  NO

Please check all the dietary supplements you use.  
 multi vitamin/mineral  iron  calcium  zinc  magnesium  vitamin E  
 B-complex vitamins  vitamin C  vitamin A  herbals (eg. echinacea, ginseng)  
 Immune enhancers (eg. Vitamin C + zinc)  other (please specify):

Please check all the sports supplements you currently use?  
 protein powder/drink  Amino acids  sports bars (Luna, Powerbar, Clif)  HMB  
 glutamine  creatine  sports drinks (eg. Gatorade, Powerade)  energy drinks (eg. Red Bull)  
 recovery drinks (Endurox, PowerBar)  liquid meal supplements (eg. Boost, Ensure)  
 sodium bicarbonate or citrate  caffeine  Pro-hormones (andro, DHEA)  
 anabolic steroids  fat burners (ephedrine, green tea, ma Huang, synephrine)  
 other (please specify):

**Thoughts about your body, your eating patterns, your feelings...**  
Please check one response for each of the following questions.

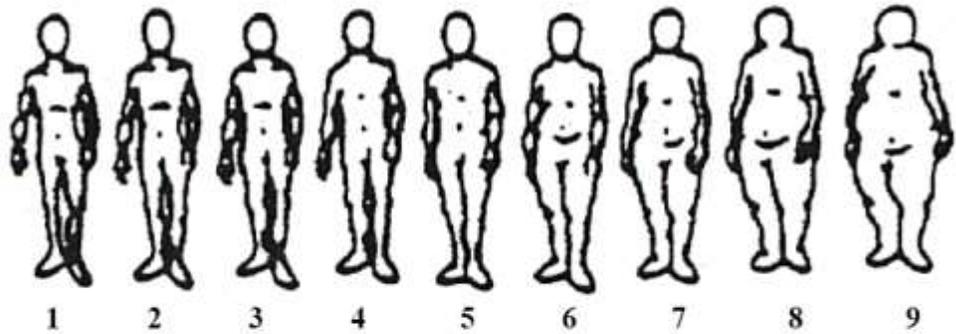
**Sample Question:**

I think that my stomach is too big.

Always  Usually  Often  Sometimes  Rarely  Never

1.	I eat sweets and carbohydrates without feeling nervous <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
2.	I think that my stomach is too big. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
3.	I eat when I am upset. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
4.	I stuff myself with food. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
5.	I think about dieting. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
6.	I think that my thighs are too large. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
7.	I feel extremely guilty after overeating. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
8.	I think that my stomach is just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
9.	I am terrified of gaining weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
10.	I feel satisfied with the shape of my body. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
11.	I exaggerate or magnify the importance of weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
12.	I have gone on eating binges where I have felt that I could not stop. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
13.	I like the shape of my buttocks. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
14.	I am preoccupied with the desire to be thinner. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
15.	I think about bingeing (overeating). <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never

	<input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
16.	I think my hips are too big. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
17.	I eat moderately in front of others and stuff myself when they're gone. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
18.	If I gain a pound, I worry that I will keep gaining. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
19.	I have the thought of trying to vomit in order to lose weight. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
20.	I think that my thighs are just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
21.	I think my buttocks are too large. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
22.	I eat or drink in secrecy. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never
23.	I think that my hips are just the right size. <input type="checkbox"/> Always <input type="checkbox"/> Usually <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never



In the picture above, what best represents your outline drawing (1-9)? \_\_\_\_\_

In the picture above, what best represents your ideal outline drawing (1-9)? \_\_\_\_\_

**Personal Well-Being**

In general, how would you describe your stress level this month?

the same as always   
 higher than usual   
 less than usual

Please indicate if you experienced any of the following *life events* during the past month.

Life Event	YES	Life Event	YES
Death of a close family member or friend		First or final year in school	
Pregnancy		Serious illness or injury	
Parents remarried or divorced		Any personal problems	
Family or personal financial difficulties		Major change in personal habits	
Frequent arguments with your siblings		Change in living environment	
Major disagreements with your parents		Failure in a course	
Beginning or ending a job		Poor result on an exam or assignment	
Problems with your boss or teacher		Preparing for a final exam period or SAT	
Outstanding personal achievement		Start a new relationship	
Change in sleeping habits		Vacation	
Change in school environment		Family reunion	
Started a diet		Negative feedback from coach	
Poor performance in a competition/game		Playoffs/Tournaments	
Change in recreational or sport activities		Acceptance/rejection from college application	
Relationship ended with boyfriend/girlfriend		Suspension from school	
Suspension from your sport/activity		Sudden weight gain (> 7 lbs)	
Large increase in amount of training		Sudden weight loss (> 7 lbs)	

**THANK YOU VERY MUCH FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE**  
*Please take a moment to fill in any questions you may have skipped.*