SCREENING AND PREVENTION OF THE FEMALE ATHLETE TRIAD IN HIGH SCHOOL ENDURANCE ATHLETES

by

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As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Christina Michelle DeRosa entitled “Screening and Prevention of the Female Athlete Triad in High School Endurance Athletes” and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

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DEDICATION

To my fiancé who has been by my side for my entire graduate degree and shares the same passion about running and life fulfillment; I am so excited to start our future together. To my parents and sister who always believed in my pursuit of any goal I have chosen or will ever choose. Most of all, to every female distance runner challenging herself to be the best athlete possible; you have inspired me to research the female athlete triad and positively impact future generations entering the sport.
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ABSTRACT

Background: The American College of Sports Medicine defines the female athlete triad (FAT) as interrelated components of energy availability, menstrual function, and bone mineral density. High school athletes have likely not experienced a lengthy duration of exposure to disordered eating, amenorrhea, and low bone density compared to older athletes because of their young age; the purpose for screening and creating awareness is to educate before negative consequences reach full effect later in life and running career.

Purpose: The purpose of this study is to screen high school distance runners for awareness and baseline knowledge of the components of FAT.

Methods: Four surveys submitted to high school female athletes assessing FAT knowledge, a questionnaire assessing triad risk factors, calcium intake, and demographic information.

Results: Significant findings include faster 5k times with a body mass index (BMI) under 18.5 mg/kg$^2$, increased calcium intake correlated with positive awareness to the FAT, and a higher FAT knowledge score correlating with triad awareness.

Conclusion: The results from this study did not show a relationship between BMI and menstrual history, 5k time and menstrual history, and BMI and calcium intake. All of the athletes’ responses indicated having one or more components of the triad. Education of the components of the triad is needed in high schools, and screening should be incorporated into preparticipation health physicals to ensure athletes minimize their risks for stress fractures and impaired bone health.
INTRODUCTION

Background Knowledge

The American College of Sports Medicine (ACSM) defines the female athlete triad as interrelated components of energy availability, menstrual function, and bone mineral density (Barrack, Rauh, & Nichols, 2008). As found in Barrack, Rauh, and Nichols (2008), there is an increased prevalence of menstrual irregularities and low bone mineral densities (BMD) in female distance runners due to the energy demands of running and inadequate caloric replenishing. Among US high school and collegiate athletes, the prevalence of the triad ranges from 0-1.2%; however, individual prevalence of triad factors is much higher, with 23.5% female athletes experiencing menstrual dysfunction, 18.2% exhibiting disordered eating, and 4.1% with low bone mineral density (Javed, Tebben, Fischer, & Lteif, 2013).

Disordered eating can cause hypothalamic dysfunction in female athletes with normal menarche leading to secondary amenorrhea, which is the absence of at least three consecutive menstrual cycles in a female who has begun menstruating. Prolonged amenorrhea leads to decreased levels of estrogen, which inhibits adequate bone formation leading to osteopenia and premature osteoporosis (Dena & Snella, 2005). Amenorrhea is as high as 65% among runners in studies involving women in sports that emphasize leanness. The leanness emphasized in running is attributed to a low body weight; decreasing body mass thought to increase VO2 max reported by ml/kg/min. Among amenorrheic distance runners with negative energy balance, there is reduced bone turnover, highlighting the link between energy deficit, hypothalamic dysfunction, and body mass index (Warren & Chua, 2008).

Chronic low energy availability reduces estradiol, lowers bone deposition, and increases
bone resorption as confirmed by laboratory studies. Energy deficit sustained over a period of weeks or months can decrease leptin, estradiol, and growth factor 1, and can increase cortisol levels, as well. Hormones can also decrease osteoblast activity and increase bone resorption, therefore creating an imbalance of bone turnover and thereby a reduction of the body’s ability to repair micro damage (Rauh, Barrack, & Nichols, 2014). Females with eating disorders exemplify chronic energy deficit and have been shown to have an increased risk of fracture compared to the general population. Young females with nutritionally restrictive diets and chronic energy drain have an absent response of bone strengthening to chronic weight-bearing stress (Warren & Chua, 2008).

During adolescence, there is a period of rapid bone mineral accumulation; by age 17, this accumulation accounts for 40-50% of an individual’s concurrent bone content that is estimated to be 90% of their total adult bone mineral content. Female adolescents involved in long distance running, which is associated with subsequent higher potential for low energy availability, may not achieve peak bone density, therefore increasing their risk for injury (Barrack et al., 2008). During adolescence, 26% of adult bone mineral content is acquired during the two years when peak height and growth velocity occurs and is almost completely acquired by the third decade of life. The ACSM defines low bone mineral density (BMD) in athletes as a BMD Z score between -1.0 and -2.0 with a history of hypoestrogenism, stress fractures, and nutritional deficiencies (Javed et al., 2013). Bone loss with the triad components during collegiate years is serious since poor bone health increases injury risk, as the window for building bone density closes during early adulthood (National Collegiate Athletic Association (n.d.). In Barrack et al. (2014), 10.1% of female athletes researched had a bone stress injury and the risk of bone stress injury increased
by 15-21% with single risk factors of the triad to 30-50% for combined triad factors.

Education and routine screening can be beneficial tools to promote health awareness. Identifying risk factors early helps to create strategies that promote optimal bone mineral accumulation during adolescent years. When considering risk reduction, the environment of a high school cross-country practice is an effective setting to both educate athletes and implement methods to identify and reduce risk factors leading to the triad (Brown, Wengreen, & Beals, 2014). If a female runner’s diet is not adequate to support the high-energy needs of her training, she may enter a chronic energy deficit affecting bone mass. Additionally, periodic screening and monitoring during the training and competition seasons is recommended to detect disturbances in menstrual patterns (Barrack et al., 2008). As noted in Brown et al. (2014), one-half of the sampled athletes had menstrual irregularities and 42% had more than two triad risk factors. Female athletes may only present with one or two components of the triad, yet it is important to assess and address these risk factors in the early years of training at the high school level. Coaches have a unique ability to influence beliefs, knowledge, and behaviors of their athletes related to triad screening and prevention through a multidisciplinary approach, which incorporates health professionals (Brown et al., 2014). Talented female high school athletes often consider pursuing collegiate running and have the mindset to continue training after their college years since it has become part of their daily routine and overall lifestyle (National Collegiate Athletic Association (n.d.).

Directing education about amenorrhea, energy availability, and proper fueling for bone health towards female high school student athletes will create increased awareness of triad symptoms and allow athletes to become knowledgeable of the consequences of sub-optimal
fueling. Calculation of resting energy expenditure (REE) can be determined by the Harris-Benedict equation: 
\[655.1 + (9.563 \times \text{weight [kg]}) + (1.85 \times \text{height [cm]}) - (4.676 \times \text{age [y]})\].

Utilizing the REE with a 72-hour food record and assessment of estimated energy expenditure (EEE), it can be determined whether the athlete is in a positive or negative energy balance.

Energy availability is defined as the energy remaining from energy intake after exercise energy expenditure. According to the ACSM, the recommended energy intake for sedentary females is 1800 to 2000 kcal/d with an additional 500 to 1000 kcal/d for active females (Javed et al., 2013).

Amenorrheic athletes are shown to have an average energy deficit of 150 to 650 calories per day, so determining a deficit at an early age can help prevent potential future issues.

Adolescence is a time where screening and prevention of the triad can occur and training errors can be rectified to ensure optimal bone health. Female athletes have up to a 62% occurrence of disordered eating along with up to 60% occurrence of menstrual dysfunction as running mileage increases from less than 8 to more than 70 miles per week. In addition, caloric restriction and weight fluctuations are linked to bone loss, with 10% decrease in weight resulting in 1% to 2% loss in BMD. In young amenorrheic athletes, bone mass loss of 2% to 6% per year can result in a three-fold increased risk for stress fractures, and adolescent girls with exercise-induced amenorrhea with bone response to weight-bearing stress, such as in distance running, puts them at risk for fracture (Javed et al., 2013; Warren & Chua, 2008). Unfortunately, many at risk females are never aware that they even are at risk.

The goal of female athlete triad prevention is to create awareness for females in at-risk sports such as long distance running and incorporate strategies as part of health prevention and routine training. Recommendations include weekly discussion of diet in order to ensure enough
caloric and calcium intake, and for athletes to recognize an absence of menstruation as a red flag that their body is in a negative calorie deficit and adjustments need to be made (Brown et al., 2014). A balance of strategies needs to be implemented to promote optimal bone mineral accumulation during adolescent years (Rauh et al., 2014). Recognizing the components of bone mineral density, menstruation, and energy intake will help sustain healthy females and provide for consistent training and athletic achievement. Bone stress injuries require cessation of running to heal and involve genetic, hormonal, metabolic, biomechanical, musculoskeletal, training, and nutritional components (Rauh et al., 2014). Through an approach, which generates awareness about triad prevention, athletes can be better equipped for later success.

Over 763,000 female athletes participated in interscholastic cross-country, indoor, and outdoor track and field in the United States during the 2013-2014-calendar school year (Rauh et al., 2014). Female high school athletes have likely not experienced a lengthy duration of exposure to disordered eating, amenorrhea, and low bone density when compared to older athletes because of their young age; the purpose for screening and creating awareness is to educate before negative consequences reach full effect later in their life and their running career. Younger runners who are exposed to all three components of the female athlete triad may shorten their participation in the sport of long distance running (Tenford, Arroyo, & Collado, 2010). Key stakeholders in the equation for screening and awareness include athletes, parents, coaches, and health care professionals.

Intended Improvement: Purpose

The purpose of this study is to screen adolescent high school distance runners, aged 14 to 17 years, for awareness and baseline knowledge of the components of the female athlete triad
The objectives of the study are to:

- Describe demographic characteristics, running information and triad knowledge of high school female distance runners.
- Examine the relationships between body mass index (BMI), calcium intake, menstrual history, 5k performance times, athlete triad knowledge score, and awareness of the female athlete triad.
- Compare female athletes with normal and underweight BMI, with menstrual history indicating amenorrhea, and inadequate calcium intake to triad awareness and triad knowledge score.

The long-term goals are to uncover and identify risk factors and early signs of the triad in the adolescent population being screened.

An athlete who is experiencing at least one component of the triad should be evaluated for all three components (Javed et al., 2013). Offering this opportunity to learn more about the female athlete triad, and the realization that the adolescent years are a time where bone mineral density is maximized will offer the population insight into how they can train meaningfully, perform optimally, and avoid the pitfalls associated with the female athlete triad (Brown et al., 2014).

**Study Question**

The study question of this DNP project is, “What is the knowledge of the female athlete triad of high school female athletes, ages 14 to 17 years?”
Framework

Quality improvement related to screening components of the female athlete triad can be achieved through the utilization of the PDSA (Plan, Do, Study, Act) cycle in an intervention at the start of their fall cross-country season including assessing health status of all female distance runners with surveys about BMI, nutrition, menses, and training regimens. The “plan” of PDSA covers all who, what, when, where, and how questions for the intervention. The “do” involves recording what happened during the intervention, while the “study” requires a comparison of the predictions to what actually happens and the identification of any new issues. “Act” is the final step: a response based upon information learned from the test (Little, 2009). A successful cycle for PDSA engages all athletes. Athletes included this study are cross country, indoor and outdoor track and field athletes running longer distances with ranges of ability and experience in the sport.

According to Steinwach and Hughes (2008), goals for health services and patient outcomes include patient safety, timeliness, efficiency, and equity. Effectiveness of care is based on scientific evidence-based practice with parents, athletes, and coaches each educated on early risk factors of the female athlete triad in young athletes. Performing the survey in a team practice setting, with time set aside for questions, helps to foster team bonding and the importance of the topic. If an athlete is at high risk, in other words, screening at team practice can provide support and encourage the athlete to follow up. In addition, assessing a team in the beginning of their season, prior to their competitive races and challenging workouts, can help to provide markers in athletic improvement and note health and body limitations at specific points in the season. A change model supported by theory will help guide successful interventions and implementation
of new practices and training philosophies to follow.

The Transtheoretical Model of Change applies to this scenario of female distance runners in a high school setting, thus making them the target group as early adopters. The female athlete triad can result in short and long-term health problems for females such as irreversible bone loss, infertility, and osteoporosis, and is a growing concern for girls involved in athletics. Prevention should be the highest priority for female athletes, with educational programs being the basis for prevention targeting coaches, athletes, and parents. The best time to screen a female athlete for the triad is during the preparticipation physical exam where education and increasing awareness of the triad can take place (Dena & Snell, 2005). Consciousness-raising refers to becoming aware of problems and their potential solutions (Prochaska, Prochaska, & Levesque, 2001). In this phase, a health practitioner can assess the need for knowledge of the female athlete triad in an established female high school athlete population. Screening provided to athletes can create an initial awareness, yet athletes that have positive risk factors for developing the triad may be fearful of modifying their behaviors if they have had athletic success in the past. According to Prochaska et al. (2001), self-reevaluation, however, allows for appreciation of the fact that the change is important to one’s success. The health practitioner at this point must address the negative outcomes to health and competition over time if the female athlete triad is present. Through screening, an individual’s mindful, small changes in diet, vitamin supplementation, and self-awareness of one’s bio-patterns can be implemented to overcome negative outcomes associated with the triad.

Self-liberation, or believing that a change can be successful, is then achieved. During this phase, the athlete must trust training adaptations and modifications, understanding that it makes
them a stronger and healthier athlete. Environmental reevaluation is appreciating that the change will have a positive impact on the work environment (Prochaska et al., 2001). In this phase, the changes made will positively impact the work environment, as a team will generally positively reinforce one another. Periodic screening and monitoring during competition season is recommended to detect disturbances in menstrual patterns (Barrack et al., 2008). This mindful monitoring will help the athlete gain heightened awareness of her body and its function, thereby increasing the potential for fending off injury.

Reinforcement management is met through finding intrinsic and extrinsic rewards for new ways of working. Counter-conditioning builds upon the positive attributes aforementioned, and substitutes new behaviors and cognitions for the previous ways of working while using relationships as social support to facilitate change. Addressing dietary demands with increased training and incorporating it as a team activity helps the athletes to learn from one another and build bonds. Stimulus control is met through restructuring the environment to inhibit old habits and social liberation provides more choices and resources for individuals (Prochaska et al., 2001). Previously established training regimens that did not consider or monitor risk factors of the female triad need to be addressed and modified to reflect current empirical knowledge. In young women, 60-70% of peak bone mass is acquired before age 20; therefore targeting high school athletes can help promote optimal bone mineral accumulation (Dena & Snell, 2005).

An effective treatment of the female athlete triad involves increasing energy availability, which results in restoration of menstrual function and improvement in BMD. Weight gain of 1 to 2 kg or a 10% reduction in exercise can restore menstruation and increase BMD up to 5% over a one-year span. Adequate nutrition and intake of calcium at 1300 mg/day and vitamin D intake at
800 to 1000 IU/d is recommended; vitamin D deficiency may be associated with stress fracture risk in active young women (Javed et al., 2013). Assessment of triad knowledge along with screening for the components can guide the path for athletes to create a positive change to their health.

Donabedian’s framework introduces the structure, process, and outcome model as a foundation for healthcare quality measurement. A well-organized structure leads to improved processes and therefore better patient outcomes (Gardner, Gardner, & O’Connell, 2014). Donabedian’s framework includes obtaining data on performance, analyzing patterns, interpreting and generating hypothesis specific to patterns, taking action based on hypotheses, and assessing the consequences of action (Kobayashi, Takemura, & Kanda, 2011).

Structural measures determine the care attributes of the healthcare setting including material resources, organization, structure, and human resources (Gardener et al., 2014). Staff expertise includes an experienced healthcare practitioner with female endurance athletes and the time spent with athletes to answer and clarify questions.

As is discussed in Gardener et al. (2014), process measure is the method healthcare is provided which reflects the procedures, tests, and other actions provided for the patient. Female athletes completing healthcare surveys assessing for history, nutritional status, and female health contribute to the process measures.

An outcome measure is the result from care processes and demonstrates the effect structure and process measure of the patient resulting in the entire care processes (Gardener et al., 2014). Quality improvement is measured by the surveys completed and assessing for gaps in knowledge of the female athlete triad.
Step 1 includes setting program goals, which includes student athletes, to have increased awareness of the female athlete triad. Step 2 includes developing an assessment plan, which includes the time, place, person, and function of the plan with a high school practice setting, before practice begins, in the supervision of a female healthcare provider who will distribute surveys and healthcare questionnaires. Step 3 is implementing the assessment plan and includes engaging student athletes in answering questionnaires with the outcome goal of student athletes obtaining an increased awareness of the female athlete triad. Step 4 includes analyzing assessment results, which can be completed by quantitative descriptive statistics to compare knowledge assessment with positive components to the female athlete triad. Step 5 is closing the loop and provides feedback (Kobayashi et al., 2011). Although each athlete’s results will be made confidential through the use of surveys that allow for anonymity, specific questions related to bone health, menstrual history, and eating patterns can potentially increase awareness to a topic that an athlete was not educated on. Comparing baseline knowledge of the female athlete triad to positive components of the triad can provide links to common attributes in female athletes who may or may not have an established understanding of the knowledge, therefore warranting education in schools.

The Transtheoretical model of change and Donabedian’s model will both be utilized to create the framework of this project. The Transtheoretical Model of Change supports the female athletes as early adopters due to their young age and time to correct imbalances and Donabedian’s model highlights structure, process, and outcome to prevent negative occurrences of the triad.
Synthesis of Evidence

Databases from PubMed, EMBASE, and CINAHL were searched with keywords “athlete, female, menstruation, and adolescence.” Thirty-two articles published within the last 10 years were retrieved. Articles were grouped into categories that focused on runners and education interventions in providing knowledge assessments of the triad. Literature was outlined defining outcomes of measured components and relationships between menstrual history, bone mineral density, and eating patterns. In female high school athletes, education, knowledge, and prevention measures of the triad are often minimal and need further strengthening for proper awareness. Many female athletes experience one or two conditions of the triad without meeting complete criteria (Javed et al., 2013).

Barrack et al. (2008), identified the prevalence and traits associated with increasing the risk of low bone mineral density in competitive distance runners found total hip and spine BMD were lower in runners with menstrual irregularities. Relationships between disordered eating, menstrual dysfunction, and low BMD demonstrate athletes with menstrual irregularities have a higher percentage of severe injuries compared to athletes with normal menses (Rauh et al., 2014). Disordered eating, amenorrhea, and low BMD are associated with musculoskeletal injuries in high school athletes (Thein-Nissenbaum et al., 2012). Furthermore, Brown et al., (2014), found that awareness and knowledge of the triad among high school athletes and their coaches was reported as low with half the participants demonstrating menstrual irregularity and 42% with more than two triad risk factors.

Current management practice for the female athlete triad for healthcare practitioners caring for adolescents athletes with amenorrhea include nonpharmacological nutritional therapy,
prevention, and screening (Carlson, Curtis, & Halpern-Felsher, 2007). In addition, vitamin D and calcium supplementation, increased caloric intake, and reduction of exercise can all be utilized (Javed et al., 2013). Weight gain and increased energy availability for young women are priorities in resuming menses (Warren & Chua, 2008). Educational programs regarding the female athlete triad in school are lacking, and one third of high schools report having education programs that do not require attendance (Dena & Snell, 2005). Tenford et al. (2011), identified risk factors with low bone mineral density and compared performance times associated with injury and concluded that decreased lumbar spine BMD was associated with stress fracture history and amenorrhea, whereas a greater number of menstrual periods throughout one year was associated with better lumbar spine BMD.

Strengths of the methodologies used in Tenford et al. (2011), and Barrack et al. (2008), studies include use of dual-energy X-ray absorptiometry (DEXA) scans to measure BMD which were then matched for age and gender from the GE/ Lunar pediatric database. Barrack et al. (2008), and Brown et al. (2014), used similar questionnaires such as the eating disorder examination questionnaire (EDE-Q), self-reported menses history, and categorized sports and activity participation to lean versus non-lean sports. “Lean Sports” emphasize weight categories or aesthetics, such as ballet, gymnastics, or endurance running and are at an increased risk of developing the triad. The Female Athlete Triad Coalition consists of organizations including ACSM, AAFP, Orthopedic Society for Sports Medicine, AAP, and the International Olympic Committee that have developed guidelines for screening and management of the triad (Javed et al., 2013).

Weaknesses and limitations in methodology from Javed et al. (2013), and Barrack et al.
(2008), include that in young women who reached menarche more than two years previous, menstrual irregularity would be less common and is due to lower energy availability than girls with more recent menarche who will have irregularity in the early years of their cycle. Athletes may also not realize that they do not consume enough for their energy expenditure. Many studies have been done on university athletes. In Brown (2014), calcium and bone health may gear athletes to thinking in terms of diet quality rather than the amount of calories they are consuming. Almost 90% of universities do not use standardized preparticipation evaluation (PPE) and over half of NCAA Division I universities use forms that do not contain the recommended screening items (Javed et al., 2013). Barrack et al. (2008), and many studies assessing the female athlete triad gather information from questionnaires and responses that may have been biased due to sensitive topics. Athletes may not be willing to report eating or menstrual dysfunctions.

Gaps in knowledge include that there are no current mandatory guidelines for screening, prevention, and education of the female athlete triad. There should be routine seminars and workshops designated for athletes and coaches about body weight and nutrition for promoting health and performance, and there should be a component that addresses the triad on the sports pre-participation history and physical forms (Dena & Snell, 2005). Coaches have reported observing triad risk factors but had limited knowledge of the negative health outcomes (Brown et al., 2014). There are no studies comparing athletes with a female coach versus a male coach and the corresponding prevalence of athletes with triad risk factors. Javed et al. (2013), discussed many gaps in knowledge among physicians, physical therapists, coaches, and trainers regarding the triad. Physical forms for a pre-season physical exams are likely to assess stress fracture
history and menstrual function, but less likely to assess knowledge relating to the triad and low energy availability (Javed et al., 2013). Brown et al. (2014), determined that coach triad knowledge was limited; however, most coaches were comfortable discussing menstruation with athletes. Coaches reported that nutrition education with their teams was minimal and that they failed to address the triad. The discussion of optimizing energy availability to minimize the risk of the triad and the importance of bone health throughout childhood and adolescence is reported as minimal (Brown et al., 2014).

**METHODS**

**Population Sample**

This descriptive cross-study design used quantitative and descriptive statistics to establish a relationship between baseline knowledge of the female athlete triad and having one or more positive components of the triad in high school distance runners.

Participants secured for this study include 20 high school distance runners from Suffolk County, New York during the cross-country season in September 2015. Athletes were between the ages of 14-17 years old, participate in three seasons of running including cross-country, indoor, and outdoor track, and compete for the same high school team.

**Setting**

At the beginning of the off-school grounds practice, which took place at Sunken Meadow State Park in Kings Park, NY, the study participants were gathered without the presence of their male coach. A female assistant coach who interacts with the team on a regular basis was present for supervision. Participants in attendance were the athletes, female assistant coach, and healthcare provider.
Ethical Considerations

Approval to obtain research in this study was obtained through the University of Arizona Institutional Review Board. The consent process contained assent since the age of this population requires parental permission. The minors had the decision to participate in the study by answering the survey with permission from their parents. The protocol for obtaining consent provided information in an easy to understand reading level and included information such as the duration of participation, procedures, and ensured confidentiality of records. In addition, contact information regarding questions to research and subject’s rights was provided. Any risks, harms, or benefits were provided to both the parents and the minors since minors are considered a vulnerable population. Participation was voluntary, and there was not a consequence if an athlete chose not to participate in the study or withdrew from it. A participant’s answers were kept confidential and were only used for purposes of the study, and surveys were kept anonymous.

Informed parental consents were mailed directly to the parents, and the parents had the opportunity to sign the form and mail it back to the health care researcher. The parental consents were placed in a sealed envelope, mailed to the University of Arizona College of Nursing, and stored in room 410 in a locked cabinet. The researcher health care practitioner had access to the research surveys for the purpose of coding data for quantitative descriptive statistics and was the only person with access to the surveys along with committee members. Once the coding data was complete, surveys were placed in a sealed envelope and sent to University of Arizona College of Nursing room 410 in a locked cabinet where they will be stored for six years until after the children turn 18. Once the youngest child turns 18, the surveys are then moved to Records Management and they will be shredded. The parental consents and child assents were mailed in a
sealed envelope to the University of Arizona College of Nursing and stored in room 410. Child assents were separated from the survey packets and there was no identifying information on the surveys completed by the athletes.

There were minimal risks associated with this study and did not exceed risks of daily living. Questions were answered based on current health history and past experiences; there was no current harm. Benefits include awareness for the minors of female athlete triad in their sport, identifying if they have any risk factors for the female athlete triad, and how to correct issues in their adolescent years if risk factors are present.

The sample recruited for this study was 20 long distance female adolescent runners from 14-17 years old, all with similar demographic criteria; however, this sample of female athletes was representative of an at risk population with the demands of distance running up to 40 miles per week, their adolescent age range, and similar training methods under the same coaching staff. Inclusion criteria for the study include being a member of the same cross-country team and participation in all three seasons of high school interscholastic running to ensure these are athletes that train all year long and do not take significant breaks from training. Distance running will be the only focus in order to target the population that is most at risk.

**Data Collection**

The Athlete Triad Knowledge score survey used in Brown et al. (2014), consisting of nine “true” or “false” questions was utilized (Appendix A). Questions assessed in the triad knowledge/awareness survey are related to general nutrition, menstrual dysfunction, and stress fracture knowledge (Brown et al., 2014). Triad knowledge and awareness was assessed using modified versions of questions used by Feldman, Belsha, Eissa, and Middleman (2011). In a
study by Feldman et al. (2011), this instrument was reviewed by four experts in the fields of bone health and adolescent medicine and was piloted with three adolescents who met eligibility criteria. Pilot participants’ data from this study were not included in the final analysis and summative knowledge score was tallied for each participant based on the number of correct answers. A summative attitude score was not created given low knowledge and the impact this was found to have on attitudes therefore a validity score was not calculated (Feldman et al., 2011). The level of evidence is level VI, evidence is from a single descriptive or qualitative study (University of Wisconsin-Madison Health Sciences, 2016). Six knowledge questions were given on topics including menstrual patterns, awareness of long-term impact of adolescent osteopenia/osteoporosis, the relationship between missed menses and stress fractures, and the link between hard training and menstrual irregularity. A knowledge score was tallied for each participant based upon the number of correct answers (Feldman et al., 2011). A 4-point Likert scale ranging from “strongly agree” to “strongly disagree” with a fifth response of, “I don’t know” was utilized. Dependent variables of knowledge and attitudes towards menstrual irregularity and its connection to BMD were assessed in Feldman et al. (2011). Three additional questions were added in Brown et al. (2014), in addition to the six knowledge questions to assess information about energy availability. To prevent guessing, knowledge and awareness questions had response options of “True/False” or “I don’t know” (Brown et al., 2014).

A questionnaire with items recommended by the Female Athlete Triad Coalition for screenings on Preparticipation Evaluation (PPE) was also used in this study. The questions identify an athlete at risk in addition to initiating topics for conversation between the female athlete and her health care provider related to her nutritional status, body image, and overall
health (The Female Athlete Triad, n.d.). The screening questions in The Female Athlete Triad (n.d) cover topics including disordered eating/eating disorders, body image, menstrual history, and bone health. The President of the Female Athlete Triad Coalition granted permission to use the Female Athlete Triad Screening Questionnaire. The coalition recommends 12 screening items for female athletes: eight for disordered eating, three for menstrual dysfunction, and one for stress fracture risk (Javed et al., 2013). As described in Javed et al. (2013), secondary amenorrhea is defined as cessation of menstruation for at least three of the previous cycle intervals. Less than four menses per year on average places an athlete in the category of secondary amenorrhea. Demographic information, mileage per week on average, fastest 5k times, medication use, self-reported height and weight, and awareness of the female athlete triad, will be collected, as well. Daily calcium intake was calculated from a chart adopted from the National Osteoporosis Foundation using the Steps to Estimate Your Calcium Intake.

The Female Athlete Triad Screening Questionnaire and demographic information will allow screening of athletes at-risk based on findings that are positive to one or more of the components of the triad.

**Procedures**

1) After IRB approval was obtained, a parental consent was mailed to athlete’s parents regarding the surveys that were to be distributed to their children. Parents signed the consent forms and mailed them back to the health care researcher.

2) A meeting took place with 20 high school athletes at cross-country practice after IRB approval and parental permission and described the project and purpose of the study.

3) After obtaining informed consent from the child and parent, the surveys were handed out
in packet form. Each athlete received the Female Athlete Triad Coalition questionnaire, athlete triad knowledge score, demographic information, and calcium intake chart. Surveys were filled out on site and then collected and handed back to the health care researcher.

4) Collected the surveys and provided time for the athletes to ask questions and obtain feedback. This was not an educational seminar, but an assessment of knowledge while identifying athletes at risk for having one or more components of the triad.

**Data Analysis**

The Athlete Triad Knowledge Score adopted from Brown et al. (2014), was used to describe actual female athlete triad knowledge and each correct answer was granted one point. Questions answered incorrectly or with an “I don’t know” response received a zero. A perfect score of ‘9’ meant that athletes are knowledgeable on the topic. Athletes’ scores were determined as percentages for questions they scored correctly.

Demographic information including height and weight allowed for calculation of BMI and ability to classify BMI < 18.5 mg/kg² as underweight to determine a percentage of underweight athletes on the team. Miles per week was likely consistent among the runners, however, performance 5k times varied and a relationship between BMI and 5k race times could possibly be determined. Athletes assessed were between the ages of 14-17 years old. A “yes” or “no” response was given in response to whether or not the athletes have heard of the female athlete triad. The percentage of athletes who have heard of the female athlete triad was calculated.

The Steps to Estimate Your Calcium Intake, adopted from the National Osteoporosis
Foundation, estimates daily calcium intake. The recommended calcium intake for females between 14-18 years old is 1300 mg/day (Calcium, 2013). Responses were categorized for athletes who responded with a calcium intake value less than 1300 mg/day and calcium intake greater than 1300 mg/day. The percentage of athletes who have an intake less than 1300 mg per day was calculated.

Answers to the Female Athlete Triad Screening Questionnaire were granted one point for each answer of “no” except for question 10, which received a point for the answer of “yes.” Questions 9 and 11 were short answer and a point was granted to question 11 if there were more than four menses per year. Questions 9 and 11 were used for demographic information and to determine averages among the athletes. The percentage of athletes who have less than four menses per year was calculated.

Descriptive statistics was used in analysis of the survey for BMI, average miles run per week, and 5k times. With these values, measures for central tendencies and standard deviations could be provided.

BMI was split into two categories: less than 18.5 mg/kg\(^2\) and greater than 18.5 mg/kg\(^2\). A t-test compared BMI to 5k times.

A correlation table used Pearson r for all of the descriptive statistics. The correlation table included all-important study variables, including scores from the Steps to Estimate Your Calcium Intake compared to descriptive statistics.

The Steps to Estimate Your Calcium Intake assessed a value for calcium intake and is a dependent variable. An independent samples t-test with the demographic information for question 6 was performed because it is a continuous dependent variable. Scores for nutrition
were checked for normal distribution, and if normal distribution did not exist, a non-parametric

A simple linear regression for the Athlete Triad Knowledge Score compared to the Steps
to Estimate Your Calcium Intake was performed.

On the Female Athlete Triad Screening Questionnaire, question 11, there was a $t$-test for
four or less menses per year and more than four menses per year. A Chi-square test compared
BMI less than 18.5 mg/kg$^2$ and BMI greater than 18.5 mg/kg$^2$ with four or less menses per year
and more than four menses per year.

A $t$-test compared menses per year and 5k times.

A $t$-test predicted BMI and calcium intake.

A score for the Female Athlete Triad Screening Questionnaire minus, questions 9 and 11
was compared to the demographic table using Pearson $r$.

**RESULTS**

**Data Collection**

Survey distribution and data collection occurred on Sunday, November 1, 2015 at Sunken
Meadow State Park in Kings Park, NY at 8:30 a.m. Child assent was distributed first followed by
the four questionnaires in packet form. There were 25 female athletes in attendance and 20
participated in the study with parental permission. The head cross-country coach at the other side
of the park supervised the other five athletes while the principle investigator and the female
assistant coach supervised the 20 female athletes participating in the study. Identifying
information was not collected and answers were kept anonymous.
Sample

A total of 20 female athletes started and completed the four questionnaires and were eligible to participate with parental permission. The sample consisted of female athletes with the mean age 15.55 (SD=.88). The mean BMI was 19.535 (SD=1.66) kg/m². The mean 5k time was 19:53 (SD=51.26) seconds. Results from the Athlete Triad Knowledge score determined a mean score of 5.65 (SD=1.42) out of 9. Calcium intake among the athletes was a consumption of 1427 mg (SD=420) mg. Results of the Female Athlete Triad Questionnaire had a mean score of 7.05 (SD=1.76) out of 10. Menses per year reported among athletes was a mean of 6.6 (SD=3.51). Miles run per week was consistent among most of the athletes and the mean was 43.75 (SD=3.9) miles.

Findings and Interpretation

Categorical variables for menses in the last year, awareness of the female athlete triad, calcium intake, and BMI were calculated as percentages. The majority of female athletes have never heard of the female athlete triad. One quarter of athletes had less than four menses in one year and three quarters had greater than four menses over the year. Slightly less than half of athletes consume less than the recommended 1300 mg of calcium daily and slightly more than half consume 1300 mg or more of calcium daily. The majority of athletes have a BMI greater than 18.5 mg/kg².

A t-test was calculated for 5k times and BMI (Table 1). Athletes who are underweight, which is indicated by a BMI less than 18.5 mg/kg², were slightly faster in their 5k race performance times. An independent-samples t-test was performed to determine if differences in 5k run time existed between the underweight and normal weight BMI groups. The difference
between underweight ($M = 19:15:00.00$) and regular weight ($M = 20:30:00.00$) was not statistically significant ($t = -1.448$, $df = 17$, $p = .166$).

**TABLE 1. 5K Time versus BMI.**

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>BMI</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>5k Time</td>
<td>Under 18.5</td>
<td>3</td>
<td>19:15:00.00</td>
<td>0:41:08.765</td>
<td>0:23:45.342</td>
</tr>
<tr>
<td></td>
<td>18.5 or more</td>
<td>16</td>
<td>20:00:30.00</td>
<td>0:51:00.039</td>
<td>0:12:45.010</td>
</tr>
</tbody>
</table>

A t-test was performed for calcium intake and triad awareness (Table 2). Those who have heard of the female athlete triad reported more calcium intake with a large standard deviation between the two groups. An independent-samples t-test was performed to determine if differences in triad awareness existed between the less than 1300 mg calcium intake group and greater than 1300 mg calcium intake group. The difference between hearing of the female athlete triad ($M = 1910$) and never hearing of the female athlete triad ($M = 1341$) was statistically significant ($t = -2.419$, $df = 18$, $p = .026$). A Pearson product-moment correlation was measured for the correlation between triad knowledge and calcium intake, which was not significant ($r = .294$, $p = .209$). A scatter plot for calcium intake and increasing triad knowledge was performed and a trend of increasing calcium with increasing knowledge appears. (Figure 1). These findings are interpreted with caution due to the small sample size and unequal cell sizes between calcium intake and triad knowledge.
TABLE 2. Calcium Intake versus Triad Awareness.

<table>
<thead>
<tr>
<th>Triad Awareness</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Intake</td>
<td>No</td>
<td>17</td>
<td>1341.76</td>
<td>313.852</td>
</tr>
<tr>
<td>Yes</td>
<td>3</td>
<td>1910.00</td>
<td>691.954</td>
<td>399.500</td>
</tr>
</tbody>
</table>

FIGURE 1. Calcium Intake versus Athlete Triad Knowledge Score.
There was no significant correlation between BMI and number of menses per year. A t-test comparing 5k times and menses frequency was not significant. An independent samples t-test was performed to determine if differences in 5k run time existed between those that have four or more menses per year and those that have fewer than four menses per year. The difference between less than four (M=19:29) and four or more menses (M=20:01) was not statistically significant (t= -1.217, df = 17, p = .24).

A t-test comparing BMI and calcium intake was not significant. An independent samples t-test was performed to determine if differences in BMI that is underweight or normal and calcium intake of less than 1300 mg and greater than 1300 mg have a significant relationship. The difference between less than 1300 mg (M=19.01) and more than 1300 mg (M=19.96) was not statistically significant (t= -1.294, df = 18, p = .212).

**DISCUSSION AND IMPLICATIONS**

**Discussion of Findings Relative to Other Evidence**

**Triad Awareness and Knowledge Score**

In this sample, only a small minority of athletes had heard of the female athlete triad. The mean score of the Athlete Triad Knowledge score was 5.65/9. These findings are consistent with findings in the literature (Brown et al., 2014; Feldman et al., 2011), that education about the triad is minimal. Female athletes have little awareness of the relationships that exist between training, menstrual status, and bone health.

**Menstrual History**

In this sample, self-reported menses yielded results that the majority of athletes had four or more menses per year; therefore these athletes are not amenorrheic. Amenorrhea is defined as
missing more than three consecutive cycles, and oligomenorrhea is having less than nine cycles in the year (Dena & Snell, 2005). According to Thein-Nissenbaum, Rauh, Carr, Loud, and McGuine (2012), more than half of athletes in their study reported their periods stopped or became lighter during competition season and has a correlated higher injury rate. Oligomenorrhea was not assessed and absence of menarche was only present in one athlete, however these are risk factors for chronic menstrual dysfunction with risks for low bone mineral density (Gibbs, Nativ, Barrack, Williams, Rauh, Nichols, & De Souza, 2014).

**Calcium Intake**

In this sample, self-reported calcium intake was calculated and slightly more than half of athletes reported consuming more than 1300 mg of calcium daily meeting their dietary needs. Those that heard of the triad reported more calcium intake and also had a higher triad knowledge score. Although calcium intake is not as accurate as measuring bone mineral density with a DXA scan, meeting the daily requirements for calcium is consistent with gaining healthy bone mass. There is a positive relationship between calcium intake and premenopausal bone density and interventions are recommended to encourage female athletes to increase calcium intake to slow bone loss in the future. Consistent with findings from Thompson (2007), nutritional education is needed for athletes to provide choices from the milk, yogurt, and cheese group to consume an adequate level of calcium while not promoting weight gain that athletes may feel hinders performance (Thompson, 2007). Low BMD and disordered eating were present in adolescent exercising females and demonstrate a negative effect on bone mineral content in the lumbar spine (Gibbs et al., 2014).
BMI

In this sample, self-reported values used to calculate BMI demonstrated the majority of athletes having a BMI above 18.5 mg/kg²; therefore, these athletes would not be classified as underweight. Reduced bone formation is associated with low BMI and estrogen deficiency and increased BMI is the most important predictor to increase BMD (Warren & Chua, 2008). Those athletes with BMI less than 18.5 mg/kg² reported faster 5k performance times. Participants with low BMI and low body weight were two to five times more likely to demonstrate low bone mineral density and present with a cumulative effect of other triad risk factors with late menarche, lean sport participation, dietary restraint, and current oligomenorrhea and amenorrhea (Gibbs et al., 2014).

OTHER INFORMATION

Limitations

Limitations to this study include a small sample size. With 20 participants, this sample size may not be representative of high school female endurance athletes. This sample was limited to athletes with the same coach and therefore has a similar training regimen and volume of distance each week and may not apply to other high school athletes throughout the country. Self-reported surveys regarding height and weight to calculate BMI, estimated calcium intake, menstrual history, and attitudes about eating behaviors may have potential impacts to validity. Appendix A, adopted from Brown et al. (2014), did not have a validity of content reported and is level VI evidence. In addition, a 14-17 year old population sample is in the early phases of menarche and may have not established regular menstrual cycles, thus menstrual irregularities are more common. Self-reported menstrual history does not detect subclinical menstrual
disturbances and may only be apparent if they have an absence of menses for more than three months. In addition, estimating calcium intake displayed a wide range of intake, thus under or overestimating the amount of calcium in foods and understanding language including “fortified foods” may have been advanced for this age group.

Other potential weaknesses include not identifying any females who use oral contraceptives or other hormone therapy to regulate their menstrual cycles. Depot medroxyprogesterone acetate (DMPA) is an injectable progestin-only contraceptive that is scheduled for dosing four times per year (ACOG, 2014). Amenorrhea can occur while using DMPA, which may improve conditions such as menorrhagia, dysmenorrhea, and iron deficiency anemia and decrease the risk of dysfunctional menstrual bleeding. DMPA is associated with loss of bone mineral density, cross sectional evidence suggestions that after discontinuation of DMPA, recovery of BMD occurs. There is no evidence in an increased risk of skeletal fractures.

Mirena is a levonorgestrel-releasing intrauterine device that prevents pregnancy for up to five years. Alterations in menstrual bleeding and unpredictable, frequent light bleeding for the first three months may occur. Amenorrhea is reported in about one-third of users after the first year.

Nexplanon is a birth control implant inserted under the skin of the upper arm and protects against pregnancy for up to three years and releases progestin. Irregular bleeding is a common side effect of Nexplanon in the first six to twelve months of use, after the first year of use one third of women report amenorrhea, however some women report increased spotting between periods or longer and heavier periods. Nuvaring is an estrogen and progestin form of birth control that is inserted into the vagina, kept in place for three weeks, and removed for one week when mensuration will occur. Nuvaring may cause light bleeding or spotting with use and may cause
dysmenorrhea. Oral contraceptives are combination pills and include estrogen and progestin. Bleeding in between periods may occur but generally occur within the first few months. Menstrual cycles may become lighter and less painful when taking oral birth control pills (ACOG, 2014).

Responses about weight, feelings towards weight, or signs of an eating disorder could have been inaccurate because of social bias or the secretive nature that exists with disordered eating. Injury history was not assessed except for one question on the Female Athlete Triad Questionnaire regarding stress fracture history, with 3/20 athletes answering, “yes” to having a stress fracture. It is also unknown if whether the stress fracture was diagnosed with an MRI by a health care provider or a self-diagnosis of bone pain and result in overestimating the number of bone stress injuries. Athletes participating in sports may reduce injury risk by optimizing bone mass and strength through consuming nutrient-rich foods and obtaining the recommended level of bone-building nutrients (Barrack et al., 2014).

Although the population was not directly screened for eating disorders, from the Female Athlete Triad Questionnaire, there were no athletes that reported having an eating disorder currently or in the past on question 7.

**Implications for Clinical Practice**

The importance of early intervention in the presence of one or more of the triad risk factors must be stressed to prevent the accumulation of risk for low BMD in active females (Gibbs et al., 2014). As a doctorally prepared nurse practitioner, it is recommended that health care providers screen student athletes to assess and determine females at risk for components of the triad at the time of the preparticipation physical exam for sports and at every physical
assessment with an athlete who may be at risk. In a practical approach, easy-to-obtain and noninvasive measures to risk for the triad are necessary as a first step and if further investigation is needed, assessment of BMD using a DXA can be analyzed (Gibbs et al., 2014). Screening females for menstrual irregularities is important because women who have prolonged amenorrhea may never achieve age-appropriate BMD (Thompson, 2007). Recommendations include that coaches and health care providers place greater emphasis and education of prevention components of the female athlete triad and to not stress the importance of low body weight for positive athletic performance. Future studies could include assessing levels of knowledge about the female athlete triad in high school coaches and providing education about prevention and treatment of the syndrome (Pantano, 2006). To ensure optimal health among these athletes, health professionals, coaches, athletes, trainers, athletic department directors, health educators, parents, and healthcare providers need to have increased awareness and education on the topic (Thompson, 2007).

Future studies investigating the female athlete triad should consider using more detailed training logs, dietary histories, menstrual histories, DXA scans, and injury history on a larger sample of athletes. Effective screening for menstrual dysfunction history should include age of menarche, frequency and duration of amenorrhea, and changes in menstruation during the summer when athlete participation decreases (Dena & Snell, 2005). In addition, surveys should assess prior knowledge of the triad, attitudes towards the triad, athletic performance, and desire to compete at a lower body weight with awareness of the risks of the triad. Data from this study and similar studies could be translated into a clinical setting as an opportunity for screening, education, and to create guidelines for decisions for athletes to participate or return to
participation in endurance sports such as running.

The American Academy of Pediatrics (AAP) recommends that each female athlete have a review of dietary practices, exercise intensity, duration, and frequency, and menstrual history (Dena & Snell, 2005).

**Conclusion**

This study supported findings consistent with the literature that female adolescent athletes may have one or more components of the female athlete triad and education on the topic is minimal in schools, thus increasing the need for awareness. The results from this study did not show a relationship between BMI and number of menses per year, 5k time and menses per year, and BMI and calcium intake. Results indicated a relationship between BMI under 18.5 mg/kg\(^2\) and faster 5k performance times, increased calcium intake and triad awareness, and triad awareness and a higher triad knowledge score. Adolescent female athletes with menstrual irregularities, low bone mineral density, and/or energy availability are at risk for the female athlete triad and its negative implications that may hinder health in later years of life. The triad is a complex syndrome to assess, and studying this condition is limited due to experimental challenges and merging data from multiple studies. The majority of high school athletes represented in this study have never heard of the female athlete triad and there was not a single athlete who scored 9/9 on the athlete triad knowledge score. Athletes’ responses indicated primary amenorrhea and menstrual dysfunction, low BMI, and inadequate calcium intake, therefore having one or more components of the triad. Education of the triad is needed in schools, and screening should be indicated at the time of the pre-participation health physical to ensure athletes minimize their risks for stress fractures and decreased bone health. The ACSM
recommends every physically active female should be educated about proper nutrition, safe training, and warning signs and risks for the triad (Dena & Snell, 2005). Education early in an athlete’s life can greatly impact potential and longevity in the sport of distance running for young females.
APPENDIX A:

ATHLETE TRIAD KNOWLEDGE SCORE
APPENDIX A:

Directions: Please answer the following questions. The answers should reflect your knowledge and not personal history.

ATHLETE TRIAD KNOWLEDGE SCORE:

1) Skipping my period makes my bones weak. True False
2) Skipping my period is my body's way of saying I’m training too hard. True False
3) Teenagers with weaker bones will likely still have weaker bones as adults. True False
4) I feel that skipping my period while playing sports is normal. True False
5) I’m not old enough to have weak bones. True False
6) Not eating enough could cause me to lose my period. True False
7) Stress fractures (very small cracks or breaks) occur more often in girls that skip their period. True False
8) How much I eat does not affect bone health. True False
9) Not eating enough calories could cause me to have brittle bones. True False

APPENDIX B:

DEMOGRAPHIC INFORMATION
APPENDIX B:

Directions: Please answer the following categories as they pertain to your personal history.

DEMOGRAPHIC INFORMATION:

1) Age  
2) Height  
3) Weight  
4) Miles run per week on average  
5) Fastest 5k race time  
6) Have you ever heard of the female athlete triad? Yes No
APPENDIX C:

STEPS TO ESTIMATE YOUR CALCIUM INTAKE
APPENDIX C:

Directions: Please estimate the amount of the following products you consume on a daily basis. Multiply the servings per day of food by the associated calcium (mg) that corresponds to the product.

**STEPS TO ESTIMATE YOUR CALCIUM INTAKE**

<table>
<thead>
<tr>
<th>Product</th>
<th>Servings Per Day</th>
<th>Calcium (mg)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (8 oz.)</td>
<td>X 300</td>
<td>=</td>
<td></td>
</tr>
<tr>
<td>Yogurt (6 oz.)</td>
<td>X 300</td>
<td>=</td>
<td></td>
</tr>
<tr>
<td>Cheese (1 oz. or 1 cubic inch)</td>
<td>X 200</td>
<td>=</td>
<td></td>
</tr>
<tr>
<td>Fortified Foods &amp; Juices</td>
<td>X 80-1,000</td>
<td>=</td>
<td></td>
</tr>
<tr>
<td>Estimated total from other foods</td>
<td>Notes: Increase this amount if you get more than 250 mg of calcium from other foods.</td>
<td>= 250</td>
<td></td>
</tr>
<tr>
<td>Total Daily Calcium Intake, in mg</td>
<td></td>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX D:

FEMALE ATHLETE TRIAD SCREENING QUESTIONNAIRE
APPENDIX D:

Directions: Please answer the following questions to reflect your personal history.

1) Do you worry about your weight or body composition? Yes No

2) Do you limit or carefully control the foods that you eat? Yes No

3) Do you try to lose weight to meet weight or image/appearance requirements in your sport? Yes No

4) Does your weight affect the way you feel about yourself? Yes No

5) Do you worry that you have lost control over how much you eat? Yes No

6) Do you make yourself vomit, use diuretics or laxatives after you eat? Yes No

7) Do you currently or have you ever suffered from an eating disorder? Yes No

8) Do you ever eat in secret? Yes No

9) What age was your first menstrual period?

10) Do you have monthly menstrual cycles? Yes No

11) How many menstrual cycles have you had in the last year?

12) Have you ever had a stress fracture? Yes No

APPENDIX E:

PERMISSION TO USE AN EXISTING SURVEY
PERMISSIONS


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PERMISSION: TO USE AN EXISTING SURVEY

June 1, 2015

Permissions Editor
University of Utah School of Medicine
Salt Lake City, UT

Dear Ms. Joy:

I am a doctoral student from The University of Arizona writing my DNP project tentatively titled Screening and Prevention of the Female Athlete Triad in High School Endurance Athletes under the direction of my dissertation committee chaired by Dr. Robin Poedel.

I would like your permission to reproduce the use of this survey instrument in my research study. I would like to use and print your survey under the following conditions:

- I will use this survey only for my research study and will not sell or use it with any compensated or curriculum development activity
- I will include the copyright statement on all copies of the instrument.
- I will send my research study and one copy of reports, articles, and the like that make use of these survey data promptly to your attention.

If these are acceptable terms and conditions, please indicate so by signing one copy of this letter and returning it to me through postal mail or e-mail:

9551 East Redfield Road
Unit 1023
Scottsdale, AZ 85260

cmderosa@email.arizona.edu

Sincerely,

Christina M. DeRosa
Doctoral Candidate
Signature

Elizabeth Joy, MD, MPH
President, Female Athlete Triad Coalition
APPENDIX F:

INSTITUTIONAL REVIEW BOARD APPROVAL
Date: October 06, 2015  
Principal Investigator: Christina Michelle DeRosa  
Protocol Number: 1509141174  
Protocol Title: Screening and Prevention of the Female Athlete Triad in High School Endurance Athletes  
Level of Review: Expedited  
Determination: Approved  
Expiration Date: October 04, 2016  

Documents Reviewed Concurrently:
- Data Collection Tools: Data Collection Tools_DNP.docx  
- HSPP Forms/Correspondence: Appendix A Children_DeRosa.doc  
- HSPP Forms/Correspondence: IRB_DeRosa.docx  
- HSPP Forms/Correspondence: Signature page.pdf  
- HSPP Forms/Correspondence: Verification of Training.doc  
- Informed Consent/PHI Forms: MinorAssentForm_DeRosa.pdf  
- Informed Consent/PHI Forms: ParentalConsent_DeRosa.pdf  
- Other Approvals and Authorizations: Coach Permission_92015.pdf  
- Participant Material: cover letter consent (003).docx  
- Participant Material: ParentLetter.docx

This submission meets the criteria for approval under 45 CFR 46.110, 45 CFR 46.111 and/or 21 CFR 50 and 21 CFR 56. This project has been reviewed and approved by an IRB Chair or designee.

- No changes to a project may be made prior to IRB approval except to eliminate apparent immediate hazard to subjects.
- The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).
- All research procedures should be conducted in full accordance with all applicable sections of the Investigator Manual.
- The current consent with the IRB approval stamp must be used to consent subjects.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others.
- For projects that wish to continue after the expiration date listed above please submit an F212, Continuing Review Progress Report, forty-five (45) days before the expiration date to ensure timely review of the project.
APPENDIX G:

INSTITUTIONAL REVIEW BOARD CORRESPONDENCE PARENTAL PERMISSION
Date: October 23, 2015
Principal Investigator: Christina Michelle DeRosa
Protocol Number: 1509141174A001
Protocol Title: Screening and Prevention of the Female Athlete Triad in High School Endurance Athletes
Level of Review: Expedited
Determination: Approved
Expiration Date: October 04, 2016

Change Description: I am submitting a revised F215 to correct the parental permission form. The parental consent form had the same language as the Minor Assent. I am revising the document to state Parental Permission and have the parental language in the Permission document. The parental permission forms have already been mail out. I have contacted the IRB and they state to send in a F215 to document the change. Since nothing else is changing, besides the prior "# parental permission" language, it is okay to for the parents to sign the already approved permission form.

Documents Reviewed Concurrently:
HSPP Forms/Correspondence: F215 v2015-08 (2).doc
HSPP Forms/Correspondence: IMG_2641.JPG
Informed Consent PHI Forms: ParentalConsent_DeRosa.pdf

This submission meets the criteria for approval under 45 CFR 46.110, 45 CFR 46.111 and/or 21 CFR 50 and 21 CFR 56. This project has been reviewed and approved by an IRB Chair or designee.

- No changes to a project may be made prior to IRB approval except to eliminate apparent immediate hazard to subjects.
- The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).
- All research procedures should be conducted in full accordance with all applicable sections of the Investigator Manual.
- The current consent with the IRB approval stamp must be used to consent subjects.
- The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others.
REFERENCES


