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Examination of Energy Needs and Female Athlete Triad Components in Competitive Cheerleaders

Allison Smith

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EXAMINATION OF ENERGY NEEDS AND FEMALE ATHLETE TRIAD COMPONENTS IN
COMPETITIVE CHEERLEADERS

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Abstract

The sport of cheerleading has grown immensely over the recent decades. The current sport requires full body athletic abilities like gymnastics, ballet, and swimming and diving. These sports have previously reported high rates of eating disorder (ED) risk, body image dissatisfaction, and Female Athlete Triad (Triad) components (low energy availability with or without and eating disorder, menstrual cycle dysfunction, and low bone mineral density). Scientific research examining these factors within cheerleaders has been limited. The purpose of this study was to examine overall ED risk across cheerleading team type (All-Star, college), squad type (all-girl, coed), and by position (flyer, base, back spot). A secondary purpose was to determine differences between clothing type (daily clothing, midriff uniform, full-length uniform) and self-perceptions for perceived body image (PBI) and desired body image (DBI), and the perceptions from their meta-perceptions (peers, parents, coaches). The final purpose was to examine individual and combined Triad components within a sample of college cheerleaders. ED risk was assessed through an online survey which included the Eating Attitudes Test-26, and supplemental pathogenic behavior questions. Body image for self-perceptions and meta-perceptions were assessed through the Sex-Specific Figural Stimuli Silhouettes. Triad components were assessed through an in person measures which included anthropometric measurements, health history questionnaire, resting metabolic rate, the

Eating Disorder Inventory (EDI-3), the EDI-3 symptom checklist, blood sample, DXA scan, and a 7 day dietary and exercise log. The results of the study indicated significant differences were found between team type for age (All-Star: 16.0 ± 2.4 vs. college: 19.8 ± 1.3 years; $p \leq .001$) with 34.4% overall being at risk for and ED. Body image perceptions were different across different clothing types in cheerleaders, $F(2.301, 586.879) = 126.784$, $p < 0.0001$ $\eta^2 = .332$. Body image perceptions showed statistically significant differences across meta-perceptions $F(3.397, 550.346) = 19.110$, $p < 0.001$, $\eta^2 = .106$). Overall, 47.7% presented with one Triad component, 52.6% demonstrated two Triad components using self-reported menstrual data, and 10.5% demonstrated two Triad components using hormonal assessments. All cheerleaders demonstrated LEA for days they participated in cheerleading practice ($n=3$ days), 52.6% demonstrated LEA with the risk of ED, and 47.4% demonstrated LEA with no risk of ED, 52.6% self-reported menstrual dysfunction, 14% experienced menstrual dysfunction via hormonal assessment, and 0% demonstrated low BMD. Cheerleaders are at risk for EDs, BID, and multiple Triad components. There is a need for increased education surrounding the topic of overall health and well-being for cheerleaders of all ages.

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List of Abbreviations

ACSM	American College of Sports Medicine
BID	Body Image Dissatisfaction
BMD	Bone Mineral Density
BMI	Body Mass Index
DBI	Desired Body Image
DSM-5	Diagnostic and Statistical Manual 5 th Edition
EA	Energy Availability
EAT-26	Eating Attitudes Test
EB	Energy Balance
ED	Eating Disorder
EDI-3	Eating Disorder Inventory -3
EDI-3 SC	Eating Disorder Inventory -3 Symptom Checklist
EEE	Exercise Energy Expenditure
EI	Energy Intake
FFM	Free Fat Mass
FHA	Functional Hypothalamic Amenorrhea
IOC	International Olympic Committee
LEA	Low Energy Availability
LH	Luteinizing Hormone

MD	Menstrual Dysfunction
MET	Metabolic Equivalent
NCAA	National Collegiate Athletic Association
PBI	Perceived Body Image
RED-S	Relative Energy Deficiency in Sport
RMR.....	Resting Metabolic Rate
SIL.....	Sex Specific Figural Stimuli
TDEE	Total Daily Energy Expenditure
USASF	United States All-Star Federation

Chapter 1

Overall Introduction

Over the last two decades, cheerleading has grown in popularity as a competitive sport. As of 2004, there were millions of participants across the country.^{1,2} The new emphasis on athletic, acrobatic, and performance skills and the formation of two clearly defined team types of All-Star and college cheerleading has increased participation. Team types are defined by age and frequency of competition. All-Star cheerleaders are predominantly 18 years old and younger who compete multiple times per year, whereas college cheerleaders are often 18 years and older and only compete once. Cheer teams are further divided into squad types which include all-girl squads (all female members) and coed squads (male and female members); and are composed of 3 main positions that include flyer, base, and back spot.

Cheerleaders today, regardless of team type, squad type, and position, are asked to tumble, jump, stunt, and dance all while performing at an elite level. Due to this increase of full body, high intensity and athletic demands, competitive cheerleading is comparable to other sports like gymnastics, ballet, and swimming and diving, which have a long-reported history of risk for the Female Athlete Triad (Triad) due to the emphasis of lean body shape and the aesthetic nature.^{3,4} The Triad is defined by the American College of Sports Medicine (ACSM) as an interrelated condition that involves energy availability (EA) with or without an eating disorder (ED), menstrual dysfunction, specifically

functional hypothalamic amenorrhea (FHA), and bone mineral density (BMD).⁵

Currently the Triad is made up of a triangular continuum that spans from the healthy side of the continuum, which is comprised of optimal EA, optimal bone health, and eumenorrhea, or normal and healthy menses, to the disease side of the continuum that includes low EA with or without an ED, FHA, and osteoporosis. The Triad is a concerning condition due to the long-term health consequences; complications that involve the cardiovascular, endocrine, reproductive, skeletal, gastrointestinal, renal, central nervous systems, and the mental health of an individual.⁵

Low energy availability (LEA) is defined when an individual reaches a level of $EA \leq 30$ kcal/kg of free fat mass and is thought to be the precursor to other Triad components.⁵ While the exact etiology of LEA is not precisely known, EA reaches low levels by either unintentional or intentional methods and is defined with and without the presence of a confirmed ED.⁵⁻⁹ Risk factors for EDs and pathogenic behaviors of disordered eating include being an athlete within a sport that values low body weight, small physique, being evaluated based on subjective ideals, frequent weight cycling, early specialized sport specific training, or previous injury.^{10,11} Additionally, psychological risk factors span from body image dissatisfaction (BID) and low self-esteem, to personality traits like perfectionism. BID is defined as a preoccupation with one's one body that is characterized by the focus on a bodily defect or flaw.¹² Behaviors associated with BID are mirror checking, excessive grooming, skin picking, seeking reassurance, or comparative behaviors to others around them.¹² The symptoms of BID typically begin in the teen years, which increases the risk of suicide.¹²

The main comorbidity of BID is depressive disorder, while social anxiety disorder, obsessive-compulsive disorder (OCD), and substance abuse are also possible.¹² BID has the potential to be an even greater concern for cheerleaders due to the aesthetic nature of the sport, subjective nature of scoring, and uniform choices.¹³ Specific uniform styles currently present within the sport include a midriff option, which exposes the athletes stomach region, or a full length option, which completely covers the stomach so no skin is visible. With these uniform options, BID has the potential to increase within the cheerleading population due to factors attributed to the objectification theory which is explained by the act of an individual being treated as an object rather than a person.¹⁴⁻¹⁶ Additionally, cheerleaders must manage the effects of meta-perceptions, the way in which a cheerleader believes their peers, parents, and coaches see them, on their personal and individual body image perceptions.

The menstrual dysfunction continuum within the Triad ranges from healthy eumenorrhea, oligomenorrhea, to FHA.⁶ Reproductive hormone function is most commonly recognized by amenorrhea, which is defined as the absence of menstrual cycles for more than three months.¹⁷ The type of amenorrhea that is caused by LEA is termed FHA, which is caused by a lack of the pituitary gland secreting luteinizing hormone (LH) at high frequencies.^{5,18} BMD in the Triad ranges from optimal bone health to osteoporosis and is assessed through the gold standard measurement of a dual energy x-ray absorptiometry (DXA) scan.^{5,6,19} The three Triad components have been documented as very closely related with changes in EA forcing decreases in hormone function within five days of chronic suppression which effects reproductive function and eventual bone deterioration.^{20,21}

Previous Triad research in sports that are similar to competitive cheerleading have shown a high prevalence of Triad components when there is an emphasis on leanness and aesthetic appeal.⁵ Specifically, these types of sports, lean and aesthetic in nature, were 2-3 times more likely to suffer from the Triad.⁵ With this information, the comparison to other sports which have shown increased rates, and the large majority of participants ranging in age from 5-21 years, competitive cheerleading is thought to be at similar risk for Triad components and in turn an increased risk for injury to its participants.

This dissertation is composed of 2 independent studies. First, study one examined ED risk in cheerleaders across team type (All-Star or college), squad type (all-girl or coed), and position (flyer, base, back spot). A secondary purpose was to examine BID and clothing type (daily clothing, midriff uniform, full-length uniform) from perceived (PBI) and desired (DBI) body image as well as meta-perceptions (peers, parents, coaches) on BID across all cheerleaders. Study two examined the Triad components (low EA with or without and ED, reproductive hormone dysfunction, and low BMD) among a sample of competitive college cheerleaders.

Chapter 2

Examination of Eating Disorder Risk and Body Image Dissatisfaction among Female Competitive Cheerleaders¹

¹Allison B. Smith; Jennifer L. Gay, Dawn M. Emerson, Mark A. Sarzynski, Shawn M. Arent, Toni M. Torres-McGehee. To be submitted to *Journal of Eating Disorders*. (in preparation)

Abstract

Background: Females who participate in the sport of cheerleading may be at risk for eating disorders (EDs) and body image dissatisfaction (BID), however there has been no research on how team type may affect these risks. The study purpose was to examine overall ED risk across cheerleading team type (All-Star, college), squad type (all-girl, coed), and by position (flyer, base, back spot). A secondary purpose was to determine differences between clothing type (daily clothing, midriff uniform, full-length uniform) and self-perceptions for perceived (PBI) and desired body image (DBI), and the perceptions from their meta-perceptions (peers, parents, coaches).

Methods: Participants completed an online survey which included demographics (i.e., age, cheerleading team type, squad type, position, weight, height), the Eating Attitudes Test-26, and supplemental pathogenic behavior questions. Body image for self-perceptions and meta-perceptions were assessed through the Sex-Specific Figural Stimuli Silhouettes.

Results: A total of 268 cheerleaders participated in the study (team type: All-Star: n=134, College: n = 134; Squad Type: All-girl: n = 173, Coed: n = 95; Position: Flyer: n= 88, Base: n = 88, Back Spot: n=53). Significant differences were found between team type for age (All-Star: 16.0 ± 2.4 vs. college: 19.8 ± 1.3 years; $p \leq .001$). Overall, 34.4% (n=92) of participants were identified as being at risk for an ED. A significant difference was found between ED and team type (All-Star vs college; $\chi^2_{1,268}=5.363$, $p=.021$). Significant differences found between dieting

subscale and team type ($F_{1,268}=4.065$, $p=.045$). Significant difference found between total EAT-26 and squad type ($F_{1,268}=5.698$, $p=.018$) and between oral control subscale and squad type ($F_{268}=9.897$, $p=.002$). Significant differences found between laxative, diet pills, diuretic use and team type ($\chi^2_{1,268}=6.956$, $p=.008$). Body image perceptions were different across different clothing types in cheerleaders, $F_{(2.301, 586.879)}=126.784$, $p < 0.0001$ $\eta^2=.332$. Body image perceptions showed statistically significant differences across meta-perceptions $F_{(3.397, 550.346)}=19.110$, $p < 0.001$, $\eta^2=.106$).

Conclusions: Cheerleaders are at risk for EDs and BID. The findings indicate the midriff uniform, and coaches, have the largest impact on the BID of athletes. There should be increased education surrounding the topic of overall health and well-being for cheerleaders of all ages.

Key Words: athletes, perceptions, meta-perceptions, aesthetic, pathogenic behaviors

Word Count: 347/350

Plain English Summary

All-Star and college cheerleaders are athletes who participate in performances and competitions that require similar athletic ability to gymnasts, tumblers, and dancers. This population may be at risk for eating disorder and for personal body image dissatisfaction because of the pressure to be of a small size to ensure athletic success. This study aimed to examine the overall risk of eating disorders within All-Star and college cheerleaders, while also examining body image dissatisfaction in different clothing types (i.e., daily clothing, midriff uniform, and full-length uniform) and meta-perceptions from others in the participants' lives (i.e., peers, parents, and coaches). The

results revealed over one-third of the sample was at risk for eating disorders, while body image dissatisfaction was observed in all clothing types with the greatest reported dissatisfaction in the midriff uniform. The largest meta-perception impact on the body image dissatisfaction came from coaches.

Introduction

Females who participate in aesthetic sports (i.e., gymnastics and figure skating) are at an increased risk for eating disorders (EDs) compared to non-aesthetic sports and non-athletes.^{3,13,14,22-29} Risk factors for EDs include being an athlete within a sport that values low body weight, small physique, being evaluated based on subjective ideals, frequent weight cycling, and early specialized sport specific training.^{10,30} Cheerleading inherits multiple risk factors, including athletes being low in body weight or small physique size due to the athletic demands, subjective evaluation, and sport specific training at an early age. Perhaps the largest predisposing ED risk factor is the psychological symptom of body image dissatisfaction (BID), which is defined as a preoccupation with one's own body. Symptomology of BID begins in the teenage years, prior to the age of 18. Those who experience early onset of BID have an increased risk for suicide, depressive disorder, social anxiety disorder, obsessive-compulsive disorder, and substance abuse.³¹

Over the last three decades, cheerleading has grown in popularity as a competitive sport with participation ranging in the millions across the United States of America.^{1,2} Historically, cheerleading was only found in the high school and collegiate settings where cheerleaders' primary responsibilities were to make appearances at large events (i.e., football and basketball games) to assist in crowd enthusiasm and promote events during

the academic year. While college cheerleading is still present and popular today, a catalyst for the rapid growth of the sport was the creation of a new cheer category termed All-Star cheerleading. The intention of the All-Star team type is to foster a competitive arena where young athletes can showcase their abilities that merge dance, power tumbling, and partner stunting into a choreographed two-and a half minute routine which is evaluated and scored by a panel of judges.

With the new changes to cheerleading overall, there are four main descriptors which delineate the sport: team type, squad type, position, and uniform choice. Cheerleading team types are separated into All-Star, teams made of up of members of a gym or club who compete multiple time throughout the year, and College, teams made up of students at a college or university who are chosen to be members of the team and compete only once annually in the spring semester. Squad type is determined by the gender of the athletes who are competing with the options being all-girl members and coed, a mixture of female and male participants. Cheerleading positions have three options: flyer, base, and back spot. The flyer is the individual, usually the shortest with the lowest body weight, who is thrown and completes acrobatic skills in the air.¹³ The base and back spots who are similar in overall size, are stronger due to the need of tossing, catching, and holding a flyer. Positions are the same across the various team and squad types, however the orientation of the positions may vary. Typically, all-girl squads will compete acrobatic stunting sequences which utilize a combination of one flyer, two bases, and one back spot, whereas coed squads will employ one female flyer and one male base with no back spot.

Common uniform options within the sport of cheerleading can be separated into two styles, ones where tops reveal the midriff region of the athlete (midriff uniform) and uniforms where tops are full-length and do not display any skin of the stomach region (full-length uniform). While both uniform options are used in both team types, there is no defined reason for the selection of one variation from the other. Uniform type is an important topic regarding BID and ED risk based on reports that uniform type contributes to 54-99% of collegiate athletes experiencing increased body-consciousness and increased negative self-consciousness.^{13,32}

Currently, there are few studies which include the cheerleading population when examining overall ED risk.^{1,13,30,33,34} Of these studies, the majority are outdated, use extremely low sample sizes (i.e., n=1), and include many other sports. Of the studies which specifically identify ED risk for cheerleaders, a range of 13-33% has been documented for the overall participants with the flyer position being at the highest risk.^{1,13} There is currently no literature which investigates ED risk among differences in team type, squad type, or inclusion of participants from the new, more athletic sport.

Cheerleaders are at risk for BID, which has specifically been documented as a risk factor for EDs within the cheerleading population, due to factors attributed to the objectification theory.¹⁴ This theory is explained by the act of an individual being treated as an object rather than a person.^{15,16} Within cheerleading, females are often objectified through the subjective judging practices which are based on how they appear in their competitive uniform compared to societal norms.³⁵ In addition to objectification, cheerleaders must also navigate the concept of meta-perceptions, the way in which a cheerleader believes their peers, parents, and coaches see them, which is a contributing

source of stress and affects the individual's body image.³⁶ Cheerleading forces participants to strive for a level of perfection that is evaluated differently by peers, parents, and coaches. The variations in these perceptions can increase the amount of feedback or commentary that an individual cheerleader receives and can impact their mental health by increasing overall stress levels, which have been linked to external behaviors such as constant body checking, body shaming, and anxiety. Often these behaviors can overpower the internal commentary, such as feelings of hunger which when ignored cheerleaders may begin behaviors such as restricting or self-induced vomiting to change their body weight and shape in hopes of increasing their performance and gaining positive feedback from their peers, parents, and coaches.^{36,37} There has been a link identified between the effects meta-perceptions with ED risk within the cheerleading population.^{34,38,39}

The purpose of the current study is to examine the overall prevalence of ED risk, eating attitudes, and pathogenic behaviors of competitive cheerleaders. Additionally, a secondary purpose is to examine ED risk, eating attitudes, and pathogenic behaviors across team type (All-Star or college), squad type (all-girl or coed), and position (flyer, base, back spot). A third purpose was to examine body image perceptions (perceived (PBI) vs desired (DBI)) of cheerleaders and various clothing types (daily clothing, midriff uniform, or full-length uniform). A final purpose was to examine body image perceptions of cheerleaders and meta-perceptions (peers, parents, and coaches). We expected ED risk within this population would be highest for college cheerleaders, body image perceptions would reveal females' desire to be smaller in all clothing types but

with the largest discrepancy being in the midriff uniform, and cheerleaders would report coaches having the largest difference between PBI and DBI.

Methods

Ethics

Ethics approval for this study was granted by the University of South Carolina's Institutional Review Board (IRB-Pro00082027). Data collection was completed through both in-person and emailed survey links. All data collection for All-Star cheerleaders was completed at in-person cheerleading events through a collaboration with Varsity Spirit, an American cheerleading company that organizes cheerleading competitions across the country. Cheerleaders who were present at Varsity Spirit events were approached by study personnel and presented with an online invitation letter. If the participant was a minor, a parental invitation was provided to the parent or guardian prior to the cheerleader completing their invitation letter. All data collection for college cheerleaders was completed via an online survey link where the invitation letter was the first item that was presented to the college cheerleaders. All participants, All-Star and college, agreed to participate and were then redirected to the survey.

Participants

Participants were excluded if they were not actively a member of an All-Star or college team. All-Star cheerleaders who were a member of a team that competed within the United States All-Star Federation (USASF) competition circuit were eligible for this study. The USASF names divisions for competition based on two categories: skill level and age of competitors. Skill levels are broken down into levels ranging from 1-6 while

age ranges are described as Tiny, Mini, Youth, Junior, and Senior. For this study, participants had to be competing within the skill level of 5 and within the Senior age division which was delineated to 12-18 years old. For college cheerleaders, participants had to be an active member of a collegiate cheer team who competed in some capacity throughout the year and be between the ages of 18-25 years. A total of 268 cheerleaders from across the United States participated in this cross sectional study (mean age: 17.9 ± 2.7 years; All-Star: $n = 134$; college: $n = 134$).

Measures

Personal Demographic Information Survey

Basic demographic data was collected through an online survey which included age, team type (All-Star or college), squad type (all-girl or coed), position (flyer, base, back spot), high school or college academic status, and year of experience in the sport. Participants self-reported height (feet and inches), current weight (lbs), highest weight (lbs), lowest weight (lbs), and ideal weight (lbs). Research team members converted feet and inches to centimeters (cm) and pounds to kilograms (kg).

Eating Attitudes Test-26

The EAT-26 was used to determine individuals at risk for EDs by using standardized measures of eating attitudes and behaviors.⁴⁰ The instrument is not a diagnostic tool but is commonly used as a screening method to identify attitudes and behaviors that indicate a potential ED.⁴⁰ Three subscales include attitudes relative to dieting, bulimia, and food preoccupation/oral control. Five supplemental questions to the EAT-26 were used to identify pathogenic behaviors including binge eating, self-induced

vomiting or purging, use of weight control supplements such as laxatives, diet pills and diuretics (water pills), excessive exercise to lose or control weight, and loss of 20 pounds (9.072 kilograms) or more in the last six months. The first four pathogenic behavior questions are answered on a Likert scale 1-5 and the final question was answered with a *yes* or *no* response. To be considered at risk, a participant's score needed to be greater than 20 and/or they met the criteria for pathogenic behavior risk. Those who scored below 20 with no pathogenic behavior risk were deemed not at risk for ED behaviors.⁴⁰ The EAT-26 questionnaire has been validated and used in previous studies with collegiate athletes,⁴¹ has reliability of 0.90,⁴⁰ and the reliability for this study was 0.92. A total of 268 participants completed the EAT-26 portion of the study.

Sex-Specific Figural Stimuli Silhouette

Sex-Specific Figural Stimuli Silhouette (SIL) were used to assess BID between DBI and PBI.⁴² The scale consists of nine images that demonstrate a body silhouette denoted by a number. Each silhouette is anchored to a specific body mass index that are denoted in **Figure 2.1**.⁴² Participants were asked to identify which number and corresponding SIL best represented their current PBI and their DBI in their daily clothing and their PBI and DBI in their uniform (midriff and full-length). Additionally, participants were asked to identify PBI and DBI of the SILs from the perception of their peers, parents, and coaches (meta-perceptions). Specific questions are outlined in **Table 1.1**. A total of 256 participants completed the SIL to assess PBI and DBI in the various clothing types while 163 participants completed the SIL to assess PBI and DBI for meta-perceptions.

Procedures

We used a snowball sampling method where a survey link via Qualtrics (Qualtrics, Inc., Provo, UT) was sent through email to All-Star and college coaches and athletic trainers who worked with cheerleading teams. These individuals were asked to forward the survey link to any cheerleader they had access to in both settings. Second, a research team member, in collaboration with Varsity Spirit, attended regional cheerleading competitions to recruit participants. A subdivision of Varsity Spirit, called Varsity University, supplied a research recruiting booth for the researchers, which allowed for the recruitment of additional participants before or after competition. This in-person tactic allowed the research team to ensure parental invitation was completed prior to minor cheerleaders participating in the survey. The research team utilized a QR code which allowed potential participants to access the online survey at any time. The first page of the online survey included the invitation/consent letter followed by the demographic survey, the EAT-26, and the Sex-Specific SILs to assess BID. The survey was open for 30 days. A total of 560 surveys were initiated, however there were varying sample sizes for the EAT-26, SIL for clothing type, and SIL for meta-perceptions. The sample sizes are provided within **Tables 1.2-1.5**. Power was achieved with a minimum of 163 participants for all analyses (see below).

Data Analysis

Data were collected and exported from the web-based survey platform to SPSS (SPSS Inc., Version 27, Armonk, NY) for all analyses. Alpha level was set at $p < .05$. Using G*Power Statistical software⁴³ for a repeated measures ANOVA including factors with a moderate effect size of 0.3, the power calculation indicated a sample of 20

participants per group for a total of 60 would have an estimated power of 0.95. Means and standard deviations for age, current weight, highest weight, lowest weight, ideal weight, height, body mass index (BMI), and EAT-26 subscales were completed for the overall sample. Frequencies and proportions with 95% confidence intervals were used to determine the ED type risk and risk of pathogenic behaviors for the overall sample, team type, squad type, and position. Independent samples t-test conducted to determine differences between age, current weight, highest weight, lowest weight, ideal weight, height, BMI, and team type. Additional independent samples t-tests were used to determine differences in EAT-26 subscale scores across team type and squad type. Chi-square tests of association were conducted to determine differences in ED risk and pathogenic behavior risk across team type, squad type, and position. A one-way ANOVA with Tukey post hoc adjustment was conducted to determine differences in EAT-26 subscale scores across position. One-way within subjects, repeated measures ANOVA models with six values for PBI and DBI were conducted to determine differences in body image perceptions across clothing types (daily clothing, midriff uniform, and full length uniform), as well as differences in body image across meta-perceptions (peers, parents, coaches). The Greenhouse and Geisser correction were used to correct for violations of sphericity.

Results

A total of 268 cheerleaders were included in the study: All-Star (n=134), College (n=134); All-girl (n=173), Coed (n=95); Flyer (n=88), Base (n=126), Back spot (n=53). Self-reported age, height, current weight, ideal weight, highest weight, and lowest weight for participants are presented in **Table 2.2**. Aside from age, which differed by design

(All-Star: 16.0 ± 2.4 vs. college: 19.8 ± 1.3 years; $p \leq .001$), no significant differences were found between collegiate and All-star cheerleaders for other self-reported variables.

Eating Disorder Risk

Overall, 34.4% ($n = 92$) of participants were identified as being at risk for an ED. When examining source of ED risk, 4.1% ($n=11$) were at risk on the EAT-26 only, 17.9% ($n=48$) were at risk based off pathogenic behaviors only, and 12.3% ($n=33$) were at risk from both the EAT-26 and pathogenic behaviors. A significant difference was found between ED risk and cheerleading team type (All-Star vs college; $\chi^2_{1,268} = 5.363$, $p = .021$), with college cheerleaders being at a higher risk for ED compared to the All-Star team discipline. No significant differences were found between ED risk and squad type (all-girl vs coed; $\chi^2 = .011$, $p = .917$) or cheerleading position (flyer, base, back spot: $\chi^2 = .572$, $p = .751$). Distribution of at risk for EDs within position groups were flyer: 37.5% ($n = 33/88$), bases: 32.5% ($n = 41/127$), and back spot: 34.0% ($n= 18/53$). All ED data can be found in **Table 2.3**.

Eating Attitudes

Descriptive statistics for EAT-26 subscales are presented in **Table 2.4**. There were significant differences between dieting subscale and team type ($F_{1,266} = 4.065$, $p = .045$), with the college team type reporting higher means than the All-Star team type. There were no significant differences between total EAT-26 and team type ($F_{1,266} = 3.206$, $p = .075$), bulimia subscale and team type ($F_{1,266} = 3.665$, $p = .057$), or oral control subscale and team type ($F_{1,266} = 2.664$, $p = .104$). When examining by squad type, significant differences were found between total EAT-26 and squad type ($F_{1,266} = 5.698$, $p = .018$) and between oral control subscale and squad type ($F_{1,266} = 9.897$, $p = .002$),

with the coed squad reporting higher means for both subscales, respectively. There was no significant differences between dieting subscale ($F_{1,266} = 2.344, p = .127$) or bulimia subscale ($F_{1,266} = 2.414, p = .121$) and squad type. When examining eating attitudes across positions, there were no significant differences between total EAT-26 and position ($F_{1,266} = .303, p = .739$), dieting subscale and position ($F_{1,266} = .694, p = .501$), bulimia subscale and position ($F_{1,266} = .105, p = .901$), or oral control subscale and position ($F_{1,266} = 1.713, p = .182$).

Pathogenic Behaviors

Descriptive statistics for pathogenic behaviors are presented in **Table 2.5**. A small but meaningful proportion of cheerleaders were at risk for each pathogenic behavior: 15.3% ($n=41$) for binge eating, 11.9% ($n=32$) for vomiting, 11.9% ($n=32$) for laxative, diet pills, and diuretics, 5.2% ($n=14$) for over exercise, and 5.2% ($n=14$) for loss of 20 lbs. When examining by team type, significant differences were found between laxative, diet pills, diuretic use and team type ($\chi^2_{1,268} = 6.956, p = .008$), with the college cheerleaders having a higher proportion at risk (17.2%, $n = 23$) compared to All-star cheerleaders. There were no significant differences between team type and binge eating ($\chi^2_{1,268} = 3.549, p = .060$), vomiting ($\chi^2_{1,268} = 1.411, p = .235$), over exercise ($\chi^2_{1,268} = 0.301, p = .583$), and the loss of 20 lbs. ($\chi^2_{1,268} = 0.01, p = .583$). When examining the risk of pathogenic behaviors and squad type, there were no significant differences between binge eating ($\chi^2_{1,268} = 0.036, p = .850$), vomiting ($\chi^2_{1,268} = 2.074, p = .150$), laxative, diet pills, diuretic use ($\chi^2_{1,268} = 0.067, p = .796$), over exercise ($\chi^2_{1,268} = 1.367, p = .242$), and loss of 20 lbs. ($\chi^2_{1,268} = 3.038, p = .081$) and squad type. When examining the risk of pathogenic behaviors and position, there were no significant differences between binge

eating ($F_{2,266} = 2.377$, $p = .095$), vomiting ($F_{2,266} = .672$, $p = .511$), laxative, diet pills, diuretic use ($F_{2,266} = 0.635$; $p = .531$), over exercise ($F_{2,266} = .432$, $p = .650$), and loss of 20 lbs. ($F_{2,266} = .311$, $p = .733$) and position.

Body Image

Data for body image variables are presented **Table 2.6. Figure 2.2, and Figure 2.3**. Body image perceptions were significantly different across different clothing types in cheerleaders ($F(2.301, 586.879) = 126.784$, $p < 0.0001$ $\eta^2 = .332$). Body image perception values presented differences from PBI to DBI with a large effect size meaning that this sample of cheerleaders felt they wanted to be smaller across all clothing types. Cheerleaders perceived themselves to be the largest when wearing the midriff uniform and perceived themselves to be the smallest in the full-length uniform.

Body image perceptions showed statistically significant differences across meta-perceptions ($F(3.397, 550.346) = 19.110$, $p < 0.001$, $\eta^2 = .106$) differences between PBI to DBI with a medium effect size, meaning that this sample of cheerleaders wanted to be smaller across all meta-perception levels. Cheerleaders perceived coaches viewed them to be the largest while parents viewed them as the smallest.

Discussion

The purpose of this study was to examine the overall prevalence of ED risk, eating attitudes, and pathogenic behaviors of competitive cheerleaders across team type, squad type, and position. Additionally, we sought to examine body image perceptions of cheerleaders and various clothing types, as well as the body image perceptions of cheerleaders and meta-perceptions. This study was unique because it is the first to study

ED risk among the All-Star cheerleading population, examine differences within team type, and include a diverse group of positions.

Eating Disorder Risk

Overall, 34.4% of our sample was at risk for EDs. These findings are similar to studies that previously reported ED risk ranging from 25-42% within aesthetic athletes.^{28,30,33,44} Our results are comparable to ED prevalence rates previously reported in other non-aesthetic sports and physically active populations: 8% of soccer athletes,⁴⁵ 11% of elite female athletes from various sports,⁴⁶ 29% of auxiliary units,⁴⁷ 32% of ROTC cadets,⁴⁸ and 42% of equestrian riders⁴⁹. Furthermore, specifically within the college cheerleading population ED risk prevalence is reported at 33.1%, consistent with our findings.¹³ When examining by team type, the All-Star cheerleading population demonstrated 27.6% at risk for EDs compared to 41.0% of college cheerleaders. An explanation for the slight difference in risk percentages when comparing the two team types comes from the traditional trajectory of All-Star cheerleading participation being a precursor to college participation. All-Star cheerleading requires early sports specialization, in most cases beginning as early as six years old (citation?). This allows for most cheerleaders to have over 5-10 years of cheerleading experience by the time they enter the college setting. Additionally, it has been identified that females aged 17-26 years demonstrate a heightened risk for EDs and will experience pressures in the college setting, which may lead them to attempt to change their body shape and appearance.³⁰

Currently, no literature exists that examines ED risk by squad type, and we found no significant differences in ED risk between all-girl and coed teams. Aside from the obvious difference in squad type being the inclusion of males, all-girl and coed teams

function similarly and are scored in the same subjective fashion that would present pressure to all participants. It could be expected that females who do participate on a coed team may experience additional pressures from being around male cheerleaders, however this was not supported by our findings. Therefore, it is suggested that squad type alone should not be considered when evaluating for ED risk.

When examining ED risk by cheerleading position, our results demonstrate no differences while previous findings found flyers were at greater odds of experiencing risks for EDs compared to bases and back spots.¹³ Over the last decade, All-Star and college teams have increased the overall athleticism and performance factors resulting in all levels and team types requiring an immense amount of athleticism from participants. Therefore, no single position should receive more ED related evaluation or resources. It is recommended that specific resources for all teams, squads, and positions should focus on proper fueling techniques (i.e., timing of meals and make up of meals) for the demands of cheerleading skills and performances. Governing organizations such as the USASF and the NCAA should work to create more available resources and training for coaches, gym owners, and program administrators related to this topic so the information can more readily be disseminated to the athletes and a more proactive approach to intervention can begin.

Overall, EDs within athletic populations have been linked to long term health consequences such as components of the female athlete triad, a condition which includes low energy availability, menstrual cycle dysfunction, and low bone mineral density.⁵ These conditions coupled with documented results of ED risk ranging from 27-40% with the cheerleading population,^{13,33} support the long term goal for this athletic population to

have access to healthcare professionals, specifically athletic trainers, on a day to day basis. While this is not always feasible for all levels of the cheerleading population, it is recommended that coaches and administrators minimally identify healthcare providers who can be contacted on a case by case, referral basis who may assist in the identification, monitoring, treatment, and education of any athlete who may exhibit risk factors for EDs.

Pathogenic Behaviors

High rates of pathogenic behaviors that were found in our sample included binge eating, purging, and the use of laxatives, diet pills, or diuretics. Our results are consistent with other aesthetic sports such as equestrian, auxiliary units (majorettes and color guards), as well as other cheerleaders, which demonstrated binge eating ranging from 11-24% and purging from 9-11%.^{13,29,50} However our findings for the use of laxatives, diet pills, or diuretics was lower than the reported rates of 15-19% in previous literature.^{13,29,50} This difference may be explained by the collaboration between the NCAA and Varsity Spirit, Inc which sought to establish risk management guidelines for the sport.¹³ However, our results found a significant difference between the use of this behavior in the All-Star and college participants with college cheerleaders reporting significantly higher rates. This may be due to the obvious age difference between these two squad types with the majority of college cheerleaders being adults over the age of 18 years. This age difference may allow for college cheerleaders to experience the freedom to purchase and use laxatives, diet pills, or diuretics without the oversight of a parent or guardian. Additionally, college cheerleaders are faced with lifestyle changes when transitioning to college, which often include weight gain.⁵¹ College cheerleaders may idealize the quick

results that are seen in weight loss when using laxatives, diet pills, and diuretics. Added education should be provided to the college cheerleading population about the health consequences related to the engagement in this pathogenic behavior, such as dehydration from a dysregulation of electrolytes and damage to internal organs.

Body Image

When examining BID of participants in relation to their self-perception in various clothing types, a similar trend was found compared to the previous literature.^{13,29,50} Participants chose silhouettes for their DBI that were smaller than their PBI for all clothing choices. Consistent with the previous cheerleading literature,¹³ our sample reported a meaningful difference in clothing type with the lowest silhouette being chosen when responding to the question referring to the DBI in a midriff uniform which is the most revealing of the clothing types. This finding supports the cultural norm of females idealizing a smaller body shape and size.¹⁴ Additionally, this finding uncovers potential for self-monitoring within the population of female cheerleaders, which can morph into high degrees of BID leading to self-objectification^{14,16} and increase the risk of ED behaviors to achieve or maintain the ideal body size.^{30,52} Within both cheer team types, midriff uniforms are frequently utilized. Within the All-Star category specifically, midriff uniforms are worn by senior level teams which creates an appeal for younger athletes to strive to be placed on higher levels to be awarded the opportunity to wear this uniform style. This, coupled with the early sports specialization that occurs within the All-Star discipline (citation?), an environment may be created which increases self-objectification and negative eating attitudes and behaviors over a long-term period. The USASF has implemented guidelines for the use of the midriff uniform and determined

appropriate ages that can perform wearing this uniform type. However, there is a need for further examination into whether this uniform type provides any additional benefit to the overall cheerleading performance for all team and squad types. Individuals who are tasked with choosing uniform styles should fully understand the risks to body image, a documented precursor of EDs, that using midriff uniforms creates for the athletes and allow for athletes' opinions prior to style selection.

We sought to identify meta-perceptions and the effect on BID due to the influential power these persons may have on an individual and in turn the increased risk for Eds, which has been previously demonstrated in the literature.^{34,36,38,39} Within our sample, cheerleaders reported a smaller silhouette for the DBI for all three levels of meta-perceptions, which identifies that the cheerleaders felt that the peers, parents, and coaches desired them to be smaller in body size and shape compared to their current status. The largest, meaningful discrepancy between PBI and DBI and meta-perceptions was found for coaches, which is consistent with a previous study.³⁶ Coaches have been identified as being the most prominent influence on athletes at the interpersonal level.⁵³ With this influence, it is important for coaches to understand the impact of their behaviors and actions on athletes' mental health and overall body image. It has been documented that coaches may act more favorably towards athletes who exhibit a body type that aligns with their personal desires and is deemed to be a more appropriate body size for the sport of cheerleading.⁵⁴ This favoritism can greatly affect a cheerleader who may perceive themselves as not aligning with those sport specific body ideals. In previous research, athletes who may be taller, heavier, or have a higher BMI have reported perceiving that their coaches are less likely to engage in positive coaching behavior.⁵⁴ Therefore, coaches

should be aware of the potential impact they have on athletes and be cautious of commenting on weight and body size towards any athlete.

Clinical Implications

Cheerleaders are faced with similar athletic requirements as gymnasts and dancers. An additional similarity is the risk of suffering from an ED and BID. However, a noted difference between these sports and cheerleading is the immediate access to healthcare to provide insight for nutritional, psychological, and medical advice. Having access to healthcare providers, like an athletic trainer, can impact the cheerleading population by providing nutritional education and performance, as well as screen for potential ED risk. Special attention and additional education should be provided focusing on ED risk as cheerleaders transition to a college team. While there are some teams that do have access to medical oversight, such as athletic trainers or team physicians, the majority do not which make these findings more concerning for cheerleading populations. While a full interview is the gold standard for diagnosing ED, other assessment tools, like the EAT-26 used in the current study, can be used to help identify those individuals at the highest risk. It is important to note that a healthcare provider using these assessments can only identify risk and should collaborate with a mental health professional to facilitate referral to a physician if necessary.

Limitations and Future Research

While this was the first study to include the All-Star cheerleading population, the following limitations should be considered. Due to the snowball sampling methods utilized to recruit participants, an acceptable response rate could not be achieved. Additionally, the EAT-26 was used to assess eating attitudes and behaviors. While a

validated tool, the measure should not be used to diagnose individuals, therefore we cannot conclude that the participants in this study who were classified at risk in fact had a clinical ED. Additionally, the EAT-26 is a self-reported measure, therefore the authors must assume all participants responded honestly and accurately. Finally, the SIL was used to assess BID which is not the gold standard of classification of the disorder. Cheerleading has participants worldwide, therefore the results of our study cannot be generalized to the entire population. Future research should include a larger sample size from a variety of geographical regions. Additionally, ED risk should be evaluated in male cheerleaders.

Conclusions

The findings of this study indicate cheerleaders, both in the All-Star and college setting, are at risk for EDs and BID. Over one fourth of All-Star cheerleaders and over one third of college cheerleaders were identified to experience attitudes and behaviors associated with EDs. These findings highlight the need for heightened awareness towards the ED risk these athletes face, and increased education surrounding the topic of overall health and well-being for cheerleaders of all ages is warranted. Moreover, our findings indicate the midriff uniform and coaches, have the largest impact on the BID of female athletes. Coaches should consider this impact when choosing uniform types and should further evaluate this clothing option to determine its use in the future in both the All-Star and college settings. It is recommended the USASF and NCAA both look to incorporate adequate training for coaches and gym owners to understand the impact they have on their athletes, as well as look to increase the use of healthcare professionals, such as athletic trainers, for medical oversight.

Table 2.1 Questions asked related to Sex-Specific Figural Stimuli Silhouettes

Self-Perceptions

1. Which picture best represents who you are now in everyday clothing (example: what you wear to school)?
2. Which picture best represents who you would like to be in everyday clothing (example: what you wear to school)?

Self-Perceptions – Female Uniform

3. Which picture best represents who you are now in your midriff uniform?
4. Which picture best represents who you would like to be in your midriff uniform?
5. Which picture best represents who you are now in your full-length uniform?
6. Which picture best represents who you would like to be in your full-length uniform?

Self-Perceptions – Male Uniform

7. Which picture best represents who you are now in your competitive uniform?
8. Which picture best represents who you would like to be in your competitive uniform?

Meta-perceptions

9. If your peers (friends/teammates) select a picture that represents you now, what pictures do you think they would select?
10. How do you think your peers (friends/teammates) would like you to look like?
11. If your parents/guardian selects a picture that represents you now, what pictures do you think they would select?
12. How do you think your parents/guardian would like you to look like?
13. If your coach selects a picture that represents you now, what pictures do you think they would select?
14. How do you think your coach would like you to look like?

Table 2.2 Descriptive statistics presented as mean (standard deviation) for self-reported age, weight, height, and body mass index.

	Females			P-Value
	All (N = 268) Mean \pm SD	All-Star (N = 134) Mean \pm SD	College (N =134) Mean \pm SD	
Age (years)	17.9 \pm 2.7	16.0 \pm 2.4	19.8 \pm 1.3	\leq .001
Weight (kg)				
Current	58.7 \pm 11.7	57.9 \pm 11.8	59.5 \pm 11.6	.378
Highest	61.0 \pm 13.4	59.5 \pm 13.9	62.6 \pm 12.9	.391
Lowest	51.0 \pm 14.5	47.9 \pm 16.6	55.9 \pm 9.8	.033
Ideal	54.5 \pm 9.4	53.1 \pm 9.0	54.1 \pm 9.8	.330
Current-Ideal	4.2 \pm 6.0	4.8 \pm 7.5	3.6 \pm 3.9	.240
Height (cm)	161.5 \pm 14.0	163.3 \pm 18.1	159.6 \pm 8.1	.891
BMI (kg/m ²)	16.1 \pm 3.12	16.5 \pm 3.4	15.8 \pm 2.9	.198

p-value for mean differences between All-Star and collegiate cheerleaders.

Table 2.3. Proportions of participants classified as at risk for ED for the entire sample and by cheer team type, squad type, and position.

	Overall At Risk % (n)	EAT-26 % (n)	Pathogenic Behavior % (n)	Both % (n)
All Participants (n = 268)	34.3 (92)	4.1 (11)	17.9 (48)	12.3 (33)
Team Type				
All-Star (n = 134)	27.6 (37)*	4.5 (6)	15.7 (21)	7.5 (10)
College (n = 134)	41.0 (55)*	3.7 (5)	20.1 (27)	17.2 (23)
Squad Type				
All-girl (n = 173)	34.1 (59)	4.6 (8)	20.2 (35)	9.2 (16)
Coed (n = 95)	34.7 (33)	3.2 (3)	13.7 (13)	17.9 (17)
Position				
Flyers (n = 88)	37.5 (33)	5.7 (5)	18.2 (16)	13.6 (12)
Bases (n = 127)	32.5 (41)	2.4 (3)	17.5 (22)	12.7 (16)
Back Spot (n = 53)	34.0 (18)	5.7 (3)	18.9 (10)	9.4 (5)

*Significant ($p < 0.05$) difference of proportion at risk of ED between groups.

Table 2.4. Descriptive statistics presented as mean (standard deviation) for total EAT 26 score and EAT-26 subscale scores.

	Total EAT-26 Mean ± SD	Dieting Mean ± SD	Bulimia Mean ± SD	Oral Control Mean ± SD
All Participants (n = 268)	10.6 ± 10.7	6.4 ± 7.6	2.1 ± 2.4	2.2 ± 2.7
Team Type				
All-Star (n = 134)	10.3 ± 0.9	7.1 ± 0.6*	2.1 ± 0.2	2.9 ± 0.3
College (n = 134)	11.1 ± 1.0	8.0 ± 0.7*	2.7 ± 0.2	2.5 ± 0.2
Squad Type				
All-girl (n = 173)	9.6 ± 0.7**	7.1 ± 0.5	2.2 ± 0.2	2.2 ± 0.2
Coed (n = 95)	12.4 ± 1.3**	8.5 ± 0.9	2.6 ± 0.3	3.4 ± 0.3
Position				
Flyers (n = 88)	11.1 ± 9.5	7.2 ± 7.2	2.1 ± 2.2	1.9 ± 2.3
Bases (n = 127)	10.7 ± 11.4	6.1 ± 7.7	2.1 ± 2.6	2.5 ± 3.0
Back Spot (n = 53)	9.7 ± 11.1	5.8 ± 8.1	1.9 ± 2.3	1.9 ± 2.6

*Significant (p<0.05) difference between Dieting subscale and Team Type.
**Significant (p<0.05) difference between Total EAT-26 score and Squad type

Table 2.5. Proportion of participants classified as at risk for pathogenic behaviors for the entire sample and by cheer team type, squad type, and position.

	Binge Eating % (n)	Vomiting % (n)	Laxatives, Diet Pills, Diuretics % (n)	Excessive Exercise % (n)	Lost 20 lbs. (9.07 kg) % (n)
All Participants (n = 268)	15.3 (41)	11.9 (32)	11.9 (32)	5.2 (14)	5.2 (14)
Team Type					
All-Star (n = 134)	12.7 (17)	8.2 (11)	6.7 (9)	4.5 (6)	6.0 (8)
College (n = 134)	17.0 (24)	15.7 (21)	17.2 (23)*	6.0 (8)	4.5 (6)
Squad Type					
All-girl (n = 173)	15.6 (27)	9.8 (17)	11.6 (20)	4.0 (7)	3.5 (6)
Coed (n = 95)	14.7 (14)	15.8 (15)	12.6 (12)	7.4 (7)	8.4 (8)
Position					
Flyers (n = 88)	20.5 (18)	9.1 (8)	13.6 (12)	6.8 (6)	4.5 (4)
Bases (n = 127)	10.3 (13)	14.3 (18)	12.7 (16)	4.0 (5)	6.3 (8)
Back Spot (n = 53)	18.9 (10)	11.3 (6)	7.5 (4)	5.7 (3)	3.8 (2)
*Significant (p<0.05) difference between Laxatives, Diet Pills, and Diuretics and Team Type					

Table 2.6. Descriptive statistics for Females presented as mean (standard deviation) for participants self-reported Likert scale anchors from silhouettes for perceptions and meta-perceptions with body mass index values (kg/m²).

	Perceived Body Image	Desired Body Image
Self-Perceptions		
Daily Clothing	3.22 (0.93)	2.62 (0.75)
Midriff Uniform	3.32 (1.09)	2.48 (0.77)
Full-length Uniform	3.16 (0.98)	2.55 (0.75)
Meta-Perceptions		
Peers/Teammates	2.96 (0.89)	2.77 (0.71)
Parents	2.98 (0.88)	2.83 (0.73)
Coaches	3.16 (1.01)	2.61 (0.79)

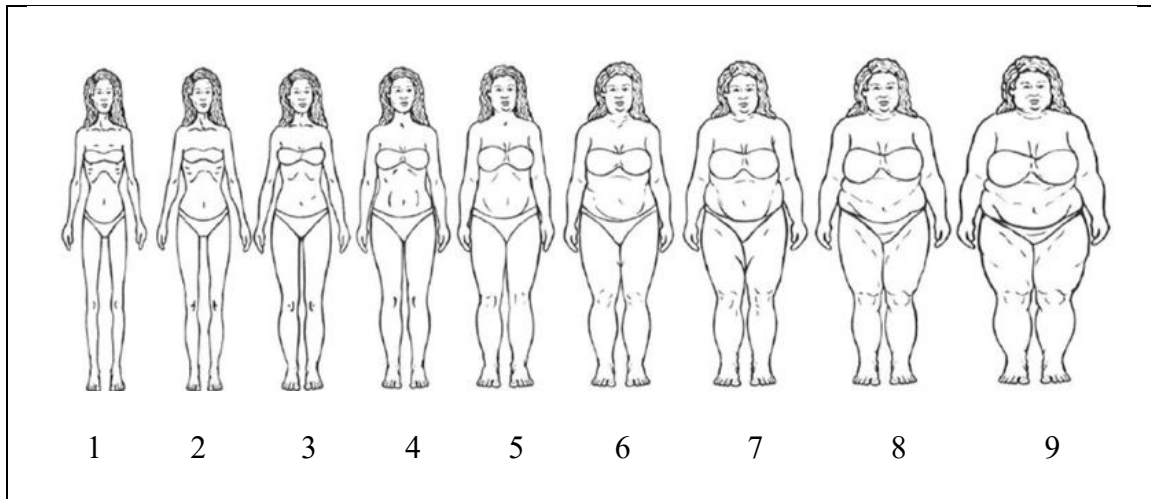


Figure 2.1. Sex-Specific Figural Stimuli Silhouettes. Female BMI anchors: 1= 17.8, 2= 18.8, 3= 20.3, 4= 22.6, 5= 26.4, 6 = 31.3, 7 = 36.7, 8= 40.8, 9= 44.1.⁵⁵

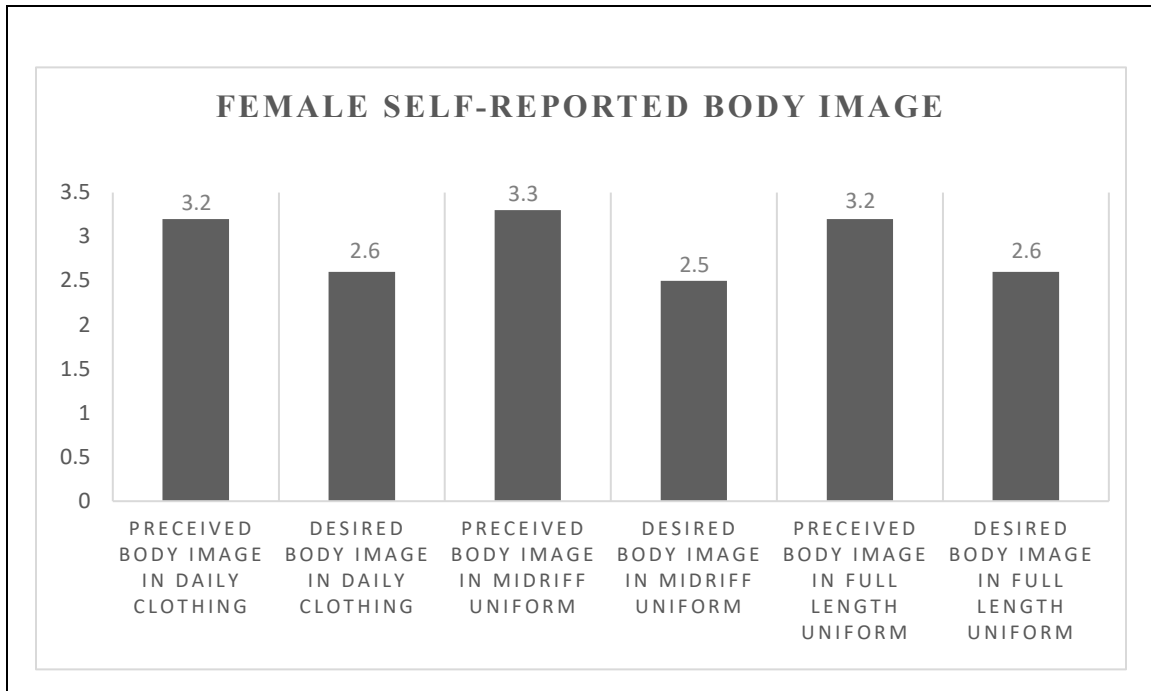


Figure 2.2. Body image scores for one-way within subjects, repeated measures ANOVA with 6 values for perceived and desired body image was conducted to determine differences in body image perceptions across clothing types (daily clothing, midriff uniform, full length uniform) using Sex-Specific Figural Stimuli Likert scale anchors.

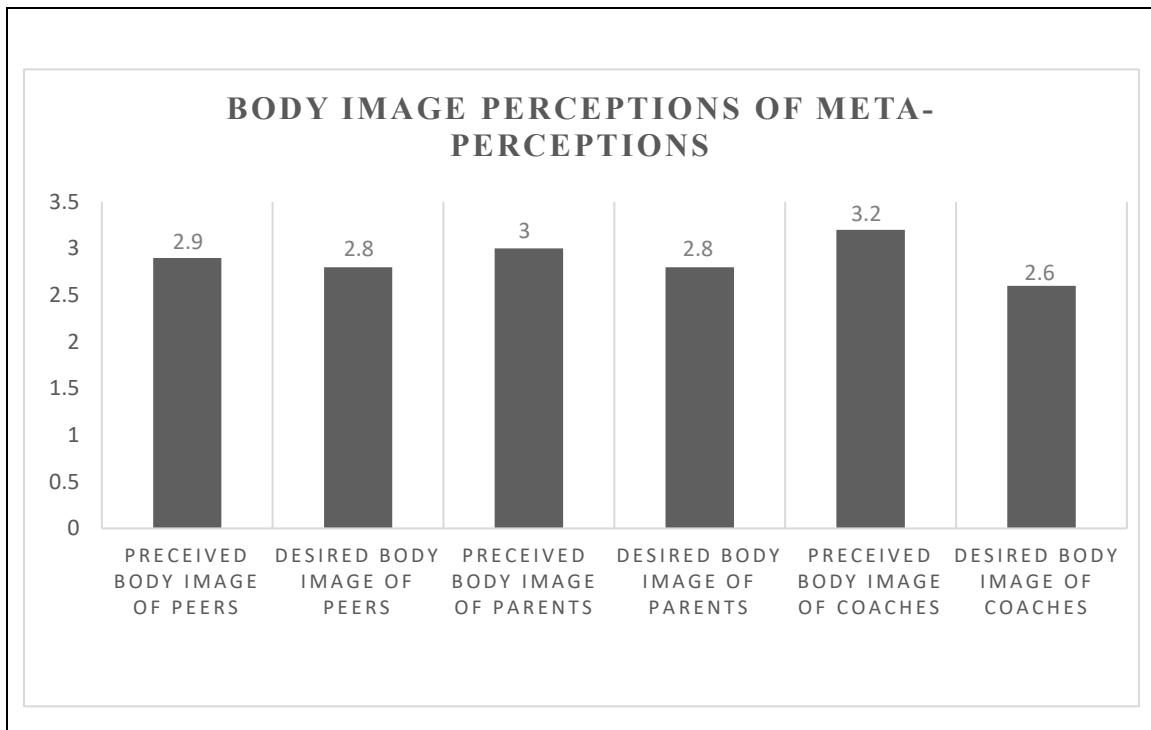


Figure 2.3. Body image scores for one-way within subjects, repeated measures ANOVA with 6 values for perceived and desired body image was conducted to determine differences in body image across meta-perceptions (peers, parents, coaches) using Sex-Specific Figural Stimuli Likert scale anchors.

Chapter 3
Examination of the Prevalence of Female Athlete Triad Components
among Competitive Cheerleaders

¹Allison B. Smith; Jennifer L. Gay, Dawn M. Emerson, Mark A. Sarzynski, Shawn M. Arent, Toni M. Torres-McGehee. To be submitted to *Nutrients*. (in preparation)

Abstract

Background: Competitive cheerleaders may be at risk of suffering from the Female Athlete Triad (Triad) but there is limited current research available. The purpose was to examine individual and combined Triad components (low energy availability (LEA) with or without an eating disorder (ED), menstrual cycle dysfunction, and low bone mineral density (BMD)) within collegiate cheerleaders.

Methods: Cheerleaders ($n=19$; age: 20.3 ± 1.2 years, height: 160.7 ± 7.8 cm, weight: 58.7 ± 7.8 kg) completed anthropometric measurements (e.g., age, height, weight, body composition), health history questionnaires, resting metabolic rate, the Eating Disorder Inventory (EDI-3), the EDI-3 symptom checklist, blood sample, and DXA scan prior to a 7-consecutive day study. Participants completed a dietary and exercise food log for 7 days and wore Polar watches to track total daily and exercise energy expenditure. Frequencies and proportions with 95% confidence intervals were calculated for EA risk, ED risk, and pathogenic behaviors. Chi-square analysis was used to determine the difference between cheerleaders who experience LEA with or without ED risk.

Results: Frequencies and proportions were calculated for LEA risk, ED risk, and pathogenic behaviors. . All cheerleaders demonstrated LEA for days they participated in cheerleading practice ($n=3$ days), 52.6% demonstrated LEA with the risk of ED, and 47.4% demonstrated LEA with no risk of ED, 52.6% self-reported menstrual dysfunction, 14% experienced menstrual dysfunction via hormonal assessment, and 0% demonstrated low BMD. Overall, 47.7% presented with one Triad component, 52.6% demonstrated two Triad components using self-reported menstrual data, and 10.5% demonstrated two Triad components using hormonal assessments.

Conclusions: All cheerleaders displayed LEA with more than half of cheerleaders displaying LEA with an ED risk. Most cheerleaders displayed 1-2 components of the Triad, with LEA with or without an ED and menstrual cycle dysfunction being the most common or in combination. These findings support the need for increased education on the Triad and medical oversight for competitive college cheerleaders.

Keywords: Female athlete triad, low energy availability, menstrual dysfunction, bone mineral density, competitive cheerleading.

Introduction

Over the last two decades, competitive cheerleading has grown in popularity as a sport in both the adolescent and college aged populations with estimates suggesting over a million annual participants.^{1,2} This growth is a result of a transition from the previous role of cheerleaders who statically stood on the sidelines of sporting events promoting crowd involvement, to the now dynamic and engaging sport that places an emphasis on athletic and acrobatic skills. Due to this increase of full body, high intensity, athletic demands, competitive cheerleading is comparable to other sports like gymnastics, ballet, swimming, and diving. These sports have a long-reported history of increased risk of eating disorders (EDs) due to the emphasis of lean body shape and the aesthetic nature of the activities required.^{3,4} This risk of EDs also places those who participate in cheerleading and other aesthetic sports at risk for low energy availability (LEA), which is a component of the Female Athlete Triad (Triad).⁵

The Triad is defined by the American College of Sports Medicine (ACSM) as an interrelated condition that involves LEA with or without an ED, menstrual dysfunction, and bone mineral density (BMD).⁵ The Triad is associated with long-term health

consequences, specifically complications that involve the cardiovascular, endocrine, reproductive, skeletal, gastrointestinal, renal, and central nervous systems, and mental health.⁵ In 2014, the International Olympic Committee (IOC) defined a new concept termed Relative Energy Deficiency in Sport (RED-S) which sought to expand the components of the Triad to include impaired metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health.⁶ The IOC acknowledged the three identified components of the Triad do exist within the newly proposed syndrome and stressed the importance of examining them individually. One main difference between the Triad and the RED-S descriptions is that within RED-S, LEA can be present when energy intake (EI) and total daily energy expenditure (TDEE) are balanced, which would indicate there is not a deficit present.^{6,7}

LEA, the precursor of other Triad components, is defined when an individual reaches a level of $EA \leq 30$ kcal/kg fat free mass (FFM) and can occur with or without a diagnosis of an ED.⁸ While the exact etiology of LEA is not precisely known, EA may reach low levels by either unintentional or intentional methods.^{5,7-10} Unintentionally achieved LEA is often due to the unawareness of proper sport specific needs or lack of education altogether on the physical and physiological needs for athletes.^{5,8,9} Intentionally lowered EA can occur by increasing the overall exercise energy expenditure (EEE) greater than EI or the inverse, lowering EI more than the energy expenditure. Methods for intentionally altering dietary intake can include pathogenic behaviors such as binge eating, purging, self-induced vomiting, use of diet pills or laxatives, engaging in excessive exercise, and fasting.^{5,11-14} These pathogenic behaviors may morph into clinical EDs if not managed and treated appropriately.

EDs are mental health conditions classified by the Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-5) and include anorexia nervosa, bulimia nervosa, binge eating disorder, other specified feeding and EDs, and unspecified feeding and EDs.¹⁴ These five categories were updated with the acceptance of the DSM-5 and allow for more precise inclusion and treatment of feeding and EDs. In addition to the reported complications of these disorders (irritability, insomnia,¹⁵ obsessive-compulsive behavior towards food,¹⁴ effects on the individual's teeth, and electrolyte imbalance¹⁶), EDs have also been linked to psychological problems (depression, anxiety, and suicide). Additionally, prolonged energy restriction has been documented to compromise athletic performance in a variety of sports.^{5,7,8,11} These clinical EDs are commonly focused around EI which greatly affects energy balance (EB). EB is defined as the total dietary EI minus TDEE with the equation being $EB = EI - TDEE$ and indicates how body weight (silhouette) can change over time. The negative effects of EB include being underweight, which can lead to a reduced metabolism, malnutrition, overall low bone mass, decreased hormonal function, and lack of concentration.^{17,18} EB should not solely be used as part of the diagnostic criteria for LEA. Previous literature has documented that athletes have experienced amenorrhea, a component of the Triad, while also maintaining a stable weight, which indicates a lack of causation between EB and LEA.¹⁹⁻²²

The second component of the Triad is menstrual dysfunction which spans a continuum that ranges from healthy eumenorrhea to oligomenorrhea to functional hypothalamic amenorrhea (FHA).⁷ Reproductive hormone function is most commonly recognized by amenorrhea, which is defined as the absence of menstrual cycles for more than three months.²³ The type of amenorrhea that is caused by LEA is termed functional

hypothalamic amenorrhea, which is caused by a lack of the pituitary gland secreting luteinizing hormone (LH) at high frequencies.^{5,24} There have been reports that when an individual suffers from LEA for as few as five days, there is a significant change in the LH pulsatility, which may lead to suppression of ovarian function and skeletal demineralization.²⁴ These complications have long-term consequences which may be irreversible.

BMD is the third component in the Triad, which ranges from optimal bone health to osteoporosis and is assessed through the gold standard measurement of a dual-energy X-ray absorptiometry (DXA) scan.^{5,7,25} The International Society for Clinical Densitometry recommends that DXA scan results utilize the Z-score for diagnosis of osteoporosis, which compares an individual's results to age and sex-matched controls. Osteoporosis, characterized by compromised bone strength, which predisposes individuals to fractures, is quantified by a Z-score of ≤ -2.0 whereas the precursor condition, osteopenia, is defined as a Z-score ranging from -1.0 to -2.0.⁷ Athletic participation impacts BMD, as shown by the findings of athletes reporting 5-15% higher Z-scores compared to nonathletes.^{5,26-28} However, when athletes suffer from other components of the Triad, there are decreases in overall bone health and increased rates of diagnosed low BMD (what is the definition of low BMD?). Prevalence of low BMD in amenorrheic athletes ranges from 1.4% to 50.0%,²⁹⁻³⁹ which demonstrates the importance of early detection and treatment of all Triad components.

Previous Triad research in sports has revealed a high prevalence of individual Triad components when the sport has an emphasis on leanness and aesthetic appeal.⁵ Specifically, aesthetic sport athletes are 2-3 times more likely to suffer from the Triad.⁵

There has been minimal research focused on the cheerleading population,⁴⁰⁻⁴² with what has been presented being outdated and lacking a reflection of the new generation of the sport. This gap in the literature coupled with the known lifelong health consequences that result from the Triad components and the large size of the cheerleading population, indicate there is a desperate need for updated research and recommendations for athletes, coaches, and governing organizations. Therefore, the purpose of this study was to examine the individual and combined Triad components of LEA with or without an ED, menstrual dysfunction, and low BMD within competitive college cheerleaders.

Materials and Methods

Participants

College cheerleaders (n=19; age: 20.2 ± 1.24 years, height: 160.71 ± 7.7 cm; weight: 58.67 ± 7.75 kg) who were an active and participating member of a southeastern university cheerleading team participated in this study. Active and participating was defined as those cheerleaders who were members of a college or university institution cheerleading team and who completed a minimum of 3 practices per week. Participants were excluded if they were unable to complete 3 practices per week during the time of the study collection, were unable to participate due to injury or illness, and were not a member of the college or institution. All 19 participants completed self-report measures related to menstrual dysfunction. However, only 14 participants were able and willing to provide a viable blood sample to be used in the hormonal analysis to determine menstrual dysfunction. Approval for the study was obtained from the institutional review board, and all participants provided written consent prior to the study measures.

Instruments

Demographic Survey

The basic demographic survey included age, education level, cheerleading participation history, current cheerleading experience, exercise background, and general medical history including menstrual cycle history. Additionally, self-reported measures related to weight included current weight, highest past weight, lowest past weight, ideal weight, and mental weight. Ideal weight is defined as the weight in which the individual would like to be at. Mental weight is defined as the perceived body weight in which the individual would reach if no conscious effort were made to control weight.

Anthropometric Measurements

Multiple anthropometric measurements were collected including height (cm), weight (kg, self-report and measured), and body composition. Height was taken using a stadiometer (Shorr Productions, Maryland) to the nearest 0.1 cm. Weight was measured wearing minimal clothes to the nearest .01 kg with a scale (Tanita, 331S, Tokyo, Japan). Body composition (FFM, fat mass, BMD) were assessed using DXA (GE Lunar Prodigy densitometer).

Dual-Energy X-ray Absorptiometry (DXA)

DXA was used to measure bone mineral density (BMD) (g/cm^2) of the lumbar spine (L1-L4) total left hip, left femoral neck, and total body utilizing a GE Lunar Prodigy densitometer. Participants underwent the DXA scan after an overnight fast (12 hour fast), a lack of vigorous exercise at least 15 hours prior to scan, and without consuming caffeine and alcohol during the preceding 24 hours. Scoring of the BMD was taken from the established Z-score which is the subject's BMD score when compared to

the average scores of subjects who are the same age, sex, weight, and ethnic background.^{5,51} Z-scores which fall between -1.0 and +1.0 were considered normal BMD whereas a score below a -1.0 is described as a low BMD. A diagnosis of osteoporosis was found when the z-score is below -2.0.^{5,51}

Resting Metabolic Rate (RMR)

RMR was measured using indirect calorimetry (*Microlife MedGem*; HealtheTech, Golden, CO) to identify the calories expended by each participant at rest. The MedGem is a clinically validated measurement device that assesses RMR and has an interclass reliability range of .91-.97 (mean = .94).^{43,44} While other methods to assess RMR are available, the MedGem is a quick, minimally invasive, and simple method.

Low Energy Availability (LEA) with or without an eating disorder (ED)

LEA was defined as EI – EE relative to lean body mass in kilograms.⁸ LEA was assessed on normal training days (3 practices) over a seven consecutive day period. LEA was defined as ≤ 30 kcal/kg FFM and ED risk was defined if a participant reported an ED risk from the EDI-3 and/or the EDI-3 SC. LEA without an ED was defined as when a participant presented with LEA but was not deemed at risk for an ED from the EDI-3 and/or the EDI-SC.

Energy Intake (EI)

EI was assessed from a 7-day diet log during the study. Each participant was asked to document all food and beverages including description of the type of food, meal type (breakfast, lunch, dinner, snack), and the amount consumed for each of the 7 days. Participants logged their intake into the food processing software FoodProdigy (ESHA food processor 8.0, Salem, OR) which provided breakdowns for total kilocalories (EI)

and macronutrients consumption (carbohydrates, proteins, fats). Macronutrients were analyzed using the ACSM recommendations for carbohydrates (5-7 g/kg of body weight per day for moderate activity), proteins (1.2-2.0 g/kg of body weight per day), and fats (20-35% of total EI).⁴⁵

Exercise Energy Expenditure (EEE)

Three methods were used to determine EEE associated with cheerleading activities: (1) Polar Ignite watches, (2) Polar H10 heart rate chest monitors, and (3) for the exercise sessions where the participants were unable to wear the watch for the full duration of the exercise bout, the compendium of physical activities by Ainsworth et al.⁴⁶ to determine the appropriate metabolic equivalent (MET). After the conversion to MET values, those values were used to calculate the energy expenditure by utilizing the Heyward⁴⁷ equation: $EEE = \text{duration}(\text{minutes}) \times ((\text{METs} \times 3.5 \times \text{weight (kg)})/200)$.

Total Daily Energy Expenditure (TDEE)

Polar Ignite watches (Polar Electro Co., Woodbury, NY, USA) were worn continuously throughout the study to monitor TDEE and EEE. The watch is a non-invasive method of data capture that can be worn in all conditions (i.e., practice, lifting, swimming, showering, etc.). Various brands of heart rate monitors, including POLAR brand, were found to accurately assess heart rates during rest and moderate activity ($r > 0.90$, $SEE < 5$ beats/min).^{48,49}

Eating Disorder Inventory-3 (EDI-3)

The EDI-3 is a self-reported measure used in identifying patients with ED patterns and consists of 91 items organized into 12 primary scales. The EDI-3 yields six composite scales, five general integrative psychological constructs (i.e., Ineffectiveness,

Interpersonal Problems, Affective Problems, Over-control, and overall Psychological Maladjustment composite) and one ED specific composite (Eating Disorders Risk Composite). Test-re-test reliability is very high with the eating disorder risk coefficient at .98 and a median value of .95; and the General Psychological Maladjustment coefficient at .97, with a median value of .93; the current study reliability was .85. EDI-3 inventories are copyrighted surveys from Psychological Assessment Resources, Inc. Permission for use is granted with purchase of inventory.

Scoring of the EDI-3 utilizes a computer-based scoring system which assess outcomes for each participant. The scoring system provides an individualized report with raw scores, T scores, percentiles, and qualitative classifications which include low clinical, typical clinical, and elevated clinical for all scales.⁵⁰ Ranges for classifications are based on percentile ranges for U.S. Adult Combined Clinical sample; low clinical ranges from the 1st to the 24th percentile, typical clinical ranges from the 25th to the 66th percentile, and elevated clinical ranges from the 37th to the 99th percentile.⁵⁰ In order to account for response style such as irregular deviant or anomalous response patterns, to be considered at risk for ED using the EDI-3 participants had to be identified as having at least 2 or more composite scores in the “typical clinical” or “elevated clinical” classifications.

Eating Disorder Inventory-3 Symptom Checklist (EDI-3 SC)

The EDI-3 SC is an additional self-report screening tool to help identify patients with ED patterns. This tool provides data regarding frequency of symptoms (i.e., binge eating; self-induced vomiting; exercise patterns; use of laxatives, diet pills, and diuretics).⁵⁰ The tool range depends on whether participants report “yes” or “no” to

engaging in behaviors and ranges between 10 to 42 questions. If a yes is denoted, additional follow up questions related to frequency are answered. If a participant reports a yes to a specific behavior but then also reports not engaging in the behavior in the last 3 months, this participant would not be classified as at risk. The EDI-3 SC is copyrighted from Psychological Assessment Resources, Inc. Permission for use is granted with purchase of inventory. To be considered at risk for ED on the EDI-3 SC, participants must meet criteria for at least one pathogenic behavior.

Self-Reported Menstrual Cycle Assessment

Participants completed questionnaires (demographic survey and EDI-3 SC) to document age of menarche, frequency of cycles per year, frequency of missed periods, history of disease, and use of birth control. Primary amenorrhea was defined as an absence of a menarche cycle by age 15,⁵ therefore if a participant reported an age of menarche higher than the age of 15 they are deemed at risk for primary amenorrhea. Secondary amenorrhea was defined as a cessation of a cycle after the original onset. To be considered at risk for secondary amenorrhea, participants reported having a cessation of a menstrual cycle after the age of menarche. To be classified at risk for overall menstrual dysfunction, participants had to be identified at risk for either primary amenorrhea, secondary amenorrhea, or a combination of both.

Hormonal Menstrual Cycle Blood Assessment

Blood was collected following an overnight fast of at least 7 hours. Participants were asked to sit comfortably while the sample was collected via venipuncture. All blood samples were allowed to clot while sitting at room temperature for 30 minutes followed by being spun in a centrifuge, and was drawn out to assess Estradiol, then stored at -80°C

until analysis. All serum samples were assayed for estradiol and analysis was completed by Bio Reference Laboratories (Elmwood Park, NJ). Bio Reference Laboratories utilize cut off points for the various menstrual cycle phases which include follicular phase = 6.20 – 315.00 (pg/mL), ovulation phase = 28.60 – 525.00 (pg/mL), luteal phase = 7.69 – 752.00 (pg/mL), and postmenopausal = <5.00 – 51.60 (pg/mL).

Procedures

After approval from the institutional review board, the research team members attended cheerleading practices during February and March of 2021 on the campus of a southeastern conference university to share details and recruit participants for the study. College cheerleaders who were interested in participating provided the research team with their contact information. During an informational meeting, participants provided consent, anthropometric measurements, RMR, DXA scans, and all surveys were completed. If the participant was fasted at that time, the blood sample was taken. If not fasted, an appointment was scheduled for later during the collection week for the sample to be collected. Participants were provided written and verbal overviews of all study procedures, which included instructions on food and exercise logs and watch usage. Self-reported EI (foods and fluids) and planned and intentional exercise began the morning following the informational meeting and continued for 7-consecutive days, which included 3 college cheerleading practice days. During the 3 practice days EE was calculated and used to determine EA. Normal exercise and sport related activities (i.e., college cheerleading practices), as well as food and fluid intake were emphasized throughout the duration of the study. At the conclusion of the 7 days, all research equipment was returned, and all logs were sent to the research team.

Statistical Analysis

Data were collected and input into SPSS statistical software (SPSS Inc., Version 27, Armonk, NY) for all analyses. Alpha level was set at $p < .05$. Using G*Power Statistical software⁵² for Chi-square analysis with a large effect size (0.7), the power calculation indicated sample size of 17 participants was needed with estimated power being 0.80. Means and standard deviations were used for all demographic information and RMR, TDEE, EEE, and EA. Frequencies and proportions were calculated for EA risk, ED risk, and pathogenic behaviors. Chi-square analysis was used to determine the difference between cheerleaders who experience LEA with or without ED risk.

Results

Twenty-one participants began the study, with 2 dropping out due to inability to complete all components of the study, yielding a total of 19 participants. Statistical power for chi square analysis was achieved when utilizing self-report data to categorize menstrual dysfunction, however when using more reliable hormonal assessments for menstrual dysfunction, power was not achieved. There were 4 instances where EEE values were not captured by the Polar watches and the equation estimation was used to determine EA.

The distribution of ethnicity for all participants was 63.2% ($n = 12$) Caucasian, 15.8% ($n = 3$) African American, 10.5% ($n = 2$) Hispanic American, and 10.5% ($n = 2$) Multiethnic; and academic status was 10.5 % ($n = 2$) Freshman, 42.1% ($n = 8$) Sophomore, 10.5% ($n = 2$) Junior, and 36.8% ($n=7$) Senior. Cheerleaders identified their primary cheer position as flyer (31.6%, $n = 6$), base (47.4%, $n = 9$), and back spot (21.1%, $n = 4$). Additional physical measures are presented in **Table 3.1**.

Energy Needs Assessment and Low Energy Availability

The energy needs assessments (i.e., RMR, EI, EE, EA) are presented in Table 3.2. All participants (100%, $n = 19$) demonstrated a negative EB over the course of the 7-day study. The average energy needs assessment from all participants are as follows: RMR (1263.7 ± 147.6 kcals;), EI (1384.7 ± 391.8 kcals;), and EE (746.0 ± 218.6 kcals;). When examining macronutrient intake, 100% ($n = 19$) of cheerleaders under consumed carbohydrates, 82.2% ($n = 16$) under consumed proteins, 15.8% ($n = 3$) consumed the recommended number of proteins (95%), 26.4% ($n = 5$) under consumed fats, and 73.7% ($n = 14$) consumed the recommended amount of fats. The average EA for all 19 participants was 12.48 ± 8.01 kcals/kg FFM/day: with 100% ($n = 19$) being identified as being at a level of LEA.

Eating Disorder Risk and Pathogenic Behaviors

This study determined ED risk through two methods: the EDI-3 and the EDI-3 SC. There were no cheerleaders who demonstrated risk by only the EDI-3; however, 42.1% ($n = 8$) were at risk for the EDI-3 SC only, while 10.5% ($n = 2$) were at risk for ED for both the EDI-3 and the EDI-3 SC. Further examination of the EDI-3 SC demonstrated 21.1% ($n = 4$) of cheerleaders reported engaging in 2 behaviors and 31.6% ($n = 6$) reported engaging in at least 1 behavior. Restricting was the most common behavior with 52.6% ($n = 10$) of cheerleaders self-identifying that they had engaged in restricting. Other behaviors that were reported included self-induced vomiting or purging (5.3%, $n = 1$), use of laxatives (10.5%, $n = 2$), and use of diet pills to control weight (5.3%, $n = 1$). Cheerleaders reported using planned and intentional exercise aside from cheerleading practice to maintain their weight, with 36.8% ($n = 7$) reporting they

exercised to lose weight 25%-50% of the time. Pathogenic behaviors and percentage of time exercise was used to control weight can be found in **Table 3.3**. Primary scales and composite scores for the EDI-3 tool are presented in **Table 3.4**.

Low Energy Availability with or without an eating disorder

When examining LEA with an ED and LEA without an ED, our study discovered 52.6% (n = 10) of cheerleaders were demonstrating LEA with an ED while 47.4% (n = 9) were at a level of LEA without an ED.

Menstrual Cycle Dysfunction

Overall, 52% (n = 10/19) of cheerleaders self-reported menstrual dysfunction in some capacity, 21.1% (n = 4/19) reported having experienced primary amenorrhea, and 52.6% (n = 10/19) reported secondary amenorrhea. Hormonal menstrual cycle assessment revealed 14.2% (n = 2/14) demonstrated below threshold levels for estradiol indicating hormonal menstrual dysfunction. Cheerleaders reported 63.2% (n = 12/19) were currently taking a birth control method at the time of the study. When asked the purpose of using the birth control, 26.3% (n = 5) reported use as a contraceptive, 15.8% (n = 3) reported use as a method to ease their cycle symptoms (flow rate, cramps, etc.), and 21.1% (n = 4) chose not to respond to the question.

Bone Mineral Density

BMD values for total body, spine, legs, pelvis, segmental lumbar levels, total left femur, and left femoral neck are presented in **Table 3.2**. No participants were identified as having a z-score which would place them at risk for low BMD.

Triad Components

Overall, 47.7% (n = 9) cheerleaders demonstrated one component, while 52.6% (n = 10) demonstrated two components of the Triad when using self-report data, and 10.5% (n = 2) demonstrated two components of the Triad when using the hormonal assessment data. No participants were identified as suffering from low BMD, therefore, the two components which were identified in the sample were LEA with or without an ED and menstrual dysfunction. Triad component frequencies and proportions are presented in **Table 3.5.**

Discussion

Competitive cheerleading is comparable in athletic demands to sports such as ballet, swimming, diving, figure skating, and gymnastics. Additionally, cheerleaders also are at risk of suffering from components of the Triad due to the emphasis on physical appearance, lean body shape, low body weight, but also on elite athletic ability. The purpose of this study was to examine individual and combined Triad components of LEA with or without an ED, menstrual dysfunction, and low BMD within competitive college cheerleaders. Our findings suggest competitive cheerleaders are at risk for Triad components, specifically LEA with or without and ED and menstrual dysfunction.

Low Energy Availability

Overall, LEA was the most prevalent Triad component for cheerleaders with 100% of the sample demonstrating below 30 kcal/kg FFM. LEA has been identified as being the most prevalent component of the Triad and is the underlying cause for the physiological changes to both the reproductive system and bone, as well as declines in sport performance.^{5-7,53,54} When compared to other athletic groups, our study had higher prevalence of LEA than gymnasts (44.8%), college soccer players (33.3%), ballet dancers

(22%) and volleyball players (20%).⁵⁵⁻⁵⁸ Similar results were found within synchronized swimmers, where 100% were also found to be at a level of LEA over the course of a 4 week study.⁵⁹

This is the first study to examine LEA within a sample of competitive cheerleaders but the high rates of LEA within the sample may be a result of multiple factors. The Triad Coalition outlines 4 distinct pathways for LEA: disordered eating behaviors, a clinical ED, intentional weight loss without a clinical ED, or inadvertent undereating due to a lack of knowledge of caloric need for activity.^{7,60} Athletes in general have 2-3 times higher risk for suffering an ED in sports that have weight classifications, aesthetic ideals, or require athletes to wear tight or revealing clothing. Those that deem a smaller body shape advantageous for the sport have been noted for even higher risk.^{40,61-64} Competitive cheerleading is a highly aesthetic sport which is judged in a subjective manner and often has athletes wear revealing uniforms; therefore, it is reasonable the participants may suffer from disordered eating or clinical EDs which could lead to LEA. LEA caused by intentional weight loss without an ED within this sample may be due to the period of data collection. This study was completed during the point in the season where the participants were preparing for the National competition in which they wanted to look their best. This factor may have led participants to engage in intentional weight loss.

LEA caused by inadvertent undereating is the most logical cause within this sample. As stated previously, there has been no research to date to understand the energy needs for competitive cheerleading; therefore, most cheerleaders and coaches may be uneducated on how to properly fuel for the sport's demands. Our sample did not have

access to formal registered dietitians or nutritionists. While having access to these resources would be exponentially beneficial to this population, it is not feasible for all competitive cheerleaders to take part in registered dietitian or nutritionist services. Due to the high percentage of cheerleaders with LEA, it is recommended that simple nutritional education opportunities are provided to cheerleaders. Athletes who are provided opportunities to increase their nutritional knowledge were more likely to consume high quality diets which included fruits, vegetables, and energy providing carbohydrate-rich foods which could help increase overall levels of EA.⁶⁵⁻⁶⁷

LEA with or without an Eating Disorder Risk

More than half of our cheerleaders demonstrated LEA with an ED risk, whereas 47.2% revealed LEA without an ED risk. Overall prevalence of ED risk varies when examining athletes compared to non-athletic controls, with 18-20% of athletes and 5-9% non-athletes demonstrating ED behaviors.^{68,69} This difference has become greater over the last decade with athletic population ED prevalence increasing approximately 10%.⁶⁹⁻⁷³ When compared to other aesthetic sports, our findings are similar to results of literature focused on modern dancers (45%).⁷⁴ and equestrian athletes (42%).⁶³ Band artists and cheerleaders are comparable due to both activities being involved in college athletics but often not receiving healthcare oversight or research focus.⁷⁰ The ED prevalence in these often understudied populations was 70.7% for band artists⁷⁰ and 29.7% for auxiliary units (color guard, dance members, and majorettes);⁷⁵ however, these studies utilized varying methods for ED identification (i.e., the EDI-3 vs the Eating Attitudes Test-26). When compared to previous cheerleading literature, 33% of cheerleaders were identified as being at risk for EDs,⁴⁰ and our findings demonstrated a higher prevalence of ED risk.

This increase from the 2012 study⁴⁰ may be explained by the increased athletic demands, media coverage, and overall athleticism of the sport.

In the current study, the EDI-3 and EDI-3 SC were used to assess ED risk along with other comorbid psychological factors. When using these tools in combination, the authors were able to examine traditional psychological constructs such as dieting, bulimia, and body image dissatisfaction, comorbid constructs like self-esteem, maturity fears, and interpersonal alienation, while also examining pathogenic behaviors such as vomiting, use of diet pills, and over exercising.⁵³ Cheerleaders within the current study did not report the traditional ED risks; however, they reported over 20% in the “typical clinical” or “elevated clinical” category in 4 psychological scales (interpersonal insecurity, emotional dysregulation, perfectionism, and maturity fears), and 2 composite scales (interpersonal problems and over control). The interpersonal problems composite score is composed of the interpersonal insecurity and interpersonal alienation scales, where the over control composite is composed of the perfectionism and ascetism scales. With our sample reporting “typical clinical” and “elevated clinical” classifications at such high frequencies, the composite scores were also high in those classifications.

The interpersonal insecurity scales assess discomfort and apprehension in silent situations, expressing personal feelings to others, the tendency to isolate, and a level of worry about rejection and hurt that is caused by a lack of support, trust, or protection.⁵⁰ For this specific sample of cheerleaders, the high proportion of risk from this scale may be attributed to multiple factors. The first may be due to the fact the cheerleaders are meant to engage with and encourage people to show school spirit in loud areas where there is little silence, which may lead these individuals to shy away from these situations.

A second explanation may be due to this study taking place during the COVID-19 pandemic where periods of isolation were at an all-time high. The participants within this study all experienced a non-traditional academic year that led to a period where cheerleading practices were canceled prior to the study beginning. An additional factor may be attributed to a feeling of lack of support from the athletic administration stemming from the lack of cheerleading specific practice space and resources such as strength and conditioning coaches and registered dietitians.

The emotional dysregulation scale assesses mood instability, impulsivity, recklessness, anger, and self-destructiveness with the use of alcohol and drugs.⁵⁰ The high proportion of at risk classifications could be explained from the sample all being current college cheerleaders. The maturation that occurs within the college years allows for individuals to reach the legal drinking age which may increase the impulsive actions and increase the frequency of drinking. The perfectionism scale assesses the extent to which a person places a premium on achieving high goals with the highest possible standards for personal achievement.⁵⁰ Due to the subjective nature of the sport of cheerleading where judges score teams based on how in sync each member is, there is a high level of perfectionism attributed to the sport. The goal within the current cheerleading culture is to “hit zero” which means the routine was perfect with no judge’s deductions. These perfectionist traits are often seen as a motivator for cheerleaders and are used to enhance performance. However, these traits can quickly become unhealthy and have been documented in those who are at risk for EDs.⁷⁶ As cheerleaders strive to be perfect, there can be an increase in overall stress and anxiety, which may also exacerbate ED behaviors. Cheerleaders within this study may also have high

perfectionism scores due to the feelings of always having to be perfect at practices. The participants within this study are all competing with over fifty other teammates in hopes of competing at the end of year National competition. This pressure of “making the mat” can also increase perfectionism traits.

The maturity fears scale assesses the desire to return to the security of childhood and is motivated by fears of psychosexual maturity.⁵⁰ Competitive cheerleading requires sport-specific training which begins at an early age. This specialized training allows for cheerleaders to be at an extremely elite skill level by the time they reach the college setting. Most of the participants within the current study were previously on teams who were very successful, many winning the Cheerleading Worlds competition, which is thought to be the pinnacle event for the sport. With this success during their younger years, the high maturity fears may be explained by internal feeling of wanting to return to that previous time of cheerleading success. This desire to return to a young age may also impact wanting to be of a smaller body size which can increase feelings of body image dissatisfaction which has been linked as a risk factor for ED in cheerleaders.⁴¹

Pathogenic Behaviors

Our findings displayed competitive cheerleaders engaged in pathogenic behaviors which included restricting, vomiting, or purging, use of laxatives, use of diet pills, and the overuse of exercise. These behaviors are commonly seen within college and elite athletes.^{64,72,77,78} The current study findings demonstrate that cheerleaders present with higher rates than college athletes for dieting (52.6% vs 15.6%) and laxative use (10.5% vs 1.5%), similar rates for purging (5.3% vs 2.9%), but lower rates for binge eating (0% vs 18.6%).⁶⁴ When further examining uncommon populations within the literature, these

pathogenic behaviors were also common among female body builders,⁷⁹ band artists,⁷⁰ color guard members and majorettes.⁷⁵ When comparing rates between cheerleaders and band artists specifically, dieting rates were comparable (52.6% vs 51.2%), however band artists presented with higher for binge eating (0% vs 19%) and purging (5.3% vs 16.7%).⁷⁰ It is important to note that while the current study utilized the EDI-3 SC, literature focused on pathogenic behaviors has varying methodology with multiple screening tools being used.^{70,75,78,79} In collegiate cheerleaders, lower rates were found for binge eating (0% vs 11.8%), vomiting (5.3% vs 9.6%), and use of laxatives (10.5% vs 19.9%) when comparing the current study with previous cheer literature. Higher rates for use of exercise were found with 89.5% reporting using exercise to control weight $\geq 25\%$ of time vs 1.5% previously.⁴⁰

In the current study, cheerleaders did not have access to any formal strength and conditioning coaches or fitness instruction. This factor may indicate why the sample utilized a higher percent of exercise to control weight. With the increase in overall athletic ability in the sport of cheerleading, females may feel added pressure to stay fit to make college competitive cheer teams.

While none of our participants reported ED risk solely from the EDI-3, there were a high number that did indicate risk from either only the EDI-3 SC or a combination of the EDI-3 and the EDI-3 SC. It is important to note some cheerleaders were at risk for LEA with an ED risk based off their risk for pathogenic behaviors. Pathogenic behaviors as well as the high classifications from psychological constructs (interpersonal insecurity, emotional dysregulation, perfectionism, and maturity fears) can lead to full ED behaviors over time. These findings present a unique opportunity to implement nutrition education,

which has led to a decrease pathogenic behavior incidence.⁸⁰ Educational resources should be created for college cheerleaders and coaches which include fueling recommendations, information on eating disorder traits (e.g., intense fear of gaining weight, distorted body image, and obsessive traits related to food intake), and resources for if there is a problem. It is recommended these resources and information should be provided by a sports dietitian and/or health and safety personnel such as an athletic trainer or team physician/medical doctor.⁵³

Energy Needs Assessment

Overall EI in cheerleaders was 1384 ± 391.80 kcals which is comparable to other college sports which include equestrian riders (1105 ± 164.2 kcals), softball players (1338.3 ± 313.5 kcals), beach volleyball players (1281.2 ± 106.8 kcals); however was lower than traditional volleyball (1785.6 ± 460.1 kcal) and women's soccer (3214.3 ± 818.4 kcals).⁵³ Further comparison to aesthetic sports who are judged subjectively, cheerleaders' EI was still comparable to college ballet dancers (1473.9 ± 312.5 kcals),⁵³ professional ballet dancers (1577 ± 89 kcals),⁸¹ and gymnasts (1802 ± 289 kcals).⁵⁵

When examining EI compared to recommendations for physically active populations⁴⁵, all cheerleaders under consumed carbohydrates, the majority under consumed proteins, and some under consumed fats. These results of overall low macronutrient intake may be due to the fact that cheerleaders are often forced to wear revealing uniforms accompanied by the popularity of fad diets, such as the low carbohydrate or ketogenic diets, which idealize quick changes to body shape and size.^{82,83} These diets should be used in caution due to research indicating that the low carbohydrate diet, which contributes to acute weight loss, also has negative effects related to

concentration and performance.⁸³ An additional explanation could be a lack of education on the energy needs for cheerleaders. With minimal research being completed regarding energy needs for cheerleading, there are no nutritional recommendations for coaches, athletes, and administrators to adhere to. With these high rates of underconsumption of macronutrients, further educational opportunities with registered dietitians should be provided to cheerleaders to improve overall understanding of the role of macronutrients.

When reviewing EEE, cheerleaders reported an average of 746 ± 218.64 kcals which appears lower when compared to other sports; soccer (1187.2 ± 39.7 kcals), volleyball (838.2 ± 77.6 kcals), and softball (811.2 ± 130.5 kcals).⁵³ However, these other sports participate in practice 5-6 days per week where cheerleaders only practiced a total of 3 days (7 hours). If cheerleaders participated in additional practices, it is likely that the EEE would be higher than the previously reported averages for other sports.

When considering the cheerleaders overall, RMR and EI were very similar which demonstrates that they were consuming just enough EI to perform metabolic functions. However, the EI was almost half of the TDEE, leading to all cheerleaders to demonstrate a negative EB. Negative EB may lead to multiple health complications such as a decrease in metabolism function, performance levels, and concentration.^{18,84} While not a component of the Triad, EB is presented as an underpinning for the RED-S framework. However, it is important to note that EB and EA are not synonymous.⁸ Research has shown females have presented with Triad components while also being in a state of energy balance therefore not demonstrating a level of energy deficiency.⁸⁵ However, within our study all cheerleaders presented with a negative EB over the 7-day study while also presenting with LEA demonstrating an obvious energy deficit. Further investigation

is needed within the cheerleading population to determine energy deficiency regarding EA.

Menstrual Cycle Dysfunction

In the current study, more than half the participants were at risk for self-reported menstrual dysfunction while only 14.2% were determined to exhibit hormonal menstrual dysfunction. Prevalence rates of menstrual dysfunction in athletic populations has been documented to range from 1-61%.⁸⁶⁻⁹¹ However, it should be noted that these studies only include clinical presentations or readily apparent menstrual dysfunctions. With the update to the Triad in 2007, there is a new focus on the subclinical conditions related to menstrual health, that occur as an individual suffers from LEA.⁵ Hormonal assay detection is the only accurate method to determine subclinical changes due to it taking long periods of time in order to become notable by the individual. Literature has shown that within five days of being at a level of $EA \leq 30 \text{ kcal/kg./FFM/day}$, there are subclinical changes that cause the pituitary gland to limit the amount of LH that is secreted.⁹² These results show the quick impact to the reproductive system as a result of other Triad components which are not always apparent to the individual but could be long lasting. Individuals who suffer from long term LH deficiency may be at further risk for infertility.⁵

When examining the specific types of amenorrhea, our study identified 21.1% of cheerleaders with self-reported primary amenorrhea, which is comparable to the only study to include cheerleaders but also gymnasts and divers which found a 22% prevalence rate.³⁰ Secondary amenorrhea is widely more common and varies drastically with respect to sport type, age, training volume, and overall body weight of the

individual.⁵ Within the current study, 52.6% of cheerleaders presented with self-reported secondary amenorrhea which is slightly lower than previous rates for dancers (69%)⁹³ and long distance runners (65%),⁹⁴ but is higher than rate within the general population (2-5%).⁹⁵⁻⁹⁷

With such a large majority of cheerleaders presenting with self-reported menstrual dysfunction and the long-term consequences associated with being amenorrheic, there is a need for education and intervention within this population. Educational efforts should be made to increase the awareness of the subclinical changes that occur within a female who is suffering from LEA and the potential life-long consequences. Recommendations should include proper fueling techniques to slightly increase overall EA. Research has shown that an increase in overall EA from a level of 20 kcal/kg/FFM/day to a level of 30 kcal/kg/FFM/day restored amenorrheic athletes back to a normal menses.⁹⁸

Additionally, those who are undergoing treatment to increase EA should also be educated on the subclinical changes associated with reversing to a normal menses. Typical treatment of menstrual dysfunction associated with or without LEA often includes the cessation of oral contraceptives. Within the current study, 63% of cheerleaders reported using birth control for various reasons including contraceptive purposes and easing side effects from menstrual cycles such as cramps. There was a variety of oral contraceptive brands used by the participants and many of the pills induced a lack of a menstrual cycle. With such a large proportion of our sample taking oral contraceptives, and with using self-reported measures, it was difficult to truly examine the frequency of secondary amenorrhea. Participants could have reported missed periods for more than 3 months which would have placed them at risk for secondary

amenorrhea in the current study, however those missed periods could be associated with the oral contraceptive and not from the hormonal imbalance related to the Triad. The Triad Coalition specifically emphasizes that for those females who are recovering from menstrual dysfunction as a component of the Triad, that oral contraceptives do not restore a spontaneous menstrual cycle.⁷ Therefore, when treatments for EA begin with an overall increase in EI, the female can produce an ovulation period without a detectable menses. Therefore, those individuals who are sexually active during treatment should use a reliable form of birth control to prevent unexpected pregnancy.⁵

Low Bone Mineral Density

Overall, there were no cheerleaders who presented with low BMD. When examining other collegiate athletes, 9.8% were classified as suffering from osteopenia while only 1.8% were classified as osteoporotic.³⁰ While there were no cheerleaders currently presenting, the BMD of an athlete is a direct reflection of an individual's comprehensive history of EA and menstrual dysfunction also coupled with their personal genetics and nutritional, behavioral, and environmental factors. These interrelated factors, make it increasingly important to not only consider where the athlete is at currently within the BMD health continuum, but also thinking where they could be headed in the future.⁵ Evidence has suggested that BMD decreases with each consecutive missed menstrual cycle and those decreases may be irreversible.⁹⁹⁻¹⁰² This impacts the sample within the current study due to a large percentage being at risk for MD.

There is a need for the collegiate cheerleading population, both athletes and coaches, to be informed about the effect of bone health in respect to the Triad and its components. Due to the increased athletic demands associated with the sport coupled

with the potential BMD deficits due to the menstrual irregularities, there is a heightened risk for injuries, specifically stress fractures. There is a wealth of literature that indicates that stress fractures occur at a higher rate in physically active women with menstrual irregularities.¹⁰³⁻¹⁰⁹ Additionally, it has been shown there is a 2-4 times greater risk for amenorrheic athletes compared to eumenorrheic athletes of suffering a stress fracture during athletic participation.¹⁰³ These findings in addition to recommendations from the Triad Coalition, lead to coaches and athletes understanding that bone injuries within this population should indicate the need for further evaluation into other Triad components.

Triad Components

There has been minimal research examining the prevalence of all three Triad components in any athletic or non-athletic population.^{30,32,33,110,111} This lack of knowledge is linked to the methodological difference and difficulties associated with measuring the components.¹¹⁰ Of the few studies which did present all three components, the prevalence rates were low ranging from 0-16%.^{32,33,35,39,110-114} This is consistent with our findings of zero competitive cheerleaders presenting with all three Triad components.

When examining the combination of two Triad components, our findings of 52.6% presenting with LEA and self-reported menstrual dysfunction is higher than previously literature while the 14.2% presenting with LEA and menstrual dysfunction via hormonal assessment was comparable to previously reported ranges of 3-27%.¹¹⁰ Additionally, our findings of only one Triad component are also comparable to the range of 16-60% which has been documented previously.¹¹⁰ These prevalence rates, the current studies and previous research, show the highest rate when only one component is present. However, it is recommended that when an athlete of any sport presents with one

component of the Triad, additional examination and screening procedures should be completed to assess for other components.^{5,115} Additionally, all Triad components should be evaluated when athletes are evaluated for other related problems such as bone stress injuries, recurrent injury or illness, and amenorrhea which is not a result of contraceptive use.

Limitations and Future Research

Our study demonstrated a risk of Triad components, singularly as well as in combination, in competitive cheerleaders, however, some limitations should be appreciated. A large portion of the instruments used in this study are self-reported (EDI-3, EDI-3 SC, food and exercise logs, and menstrual history); therefore, we assume all participants responded accurately and truthfully. The instruments used to determine ED specifically serve only as an assessment of risk, rather than a clinical diagnostic tool. The gold standard for ED diagnosis should include an in-person interview by a mental health professional, which was not included in the current study. Second, we only used estimations and did not use the gold standard to assess EEE.

Additionally, our study included participants from only one college institution in the southeast United States. Competitive cheerleading spans the entire United States, as well as the world, and includes college-aged participants as well as adolescents. Therefore, the results of the current study cannot be generalized to the entire competitive cheerleading population. Future research should look to examine the Triad components within a larger sample that includes both college and adolescent ages, and to examine components within the male cheerleading population. It is also recommended that future

research look to compare prevalence and risks between college and adolescent cheerleaders.

A final limitation was the small sample size in which hormonal assessment for menstrual dysfunction was completed. The study was only able to collect blood samples from 14 participants which did not meet power for the study and therefore generalizations should be made with caution. Future studies should rely on blood assays rather than self-report measures for menstrual health due to the risk of oral contraceptives masking subclinical changes related to menstrual function.

Conclusion

In conclusion, this study provides the first look into the sport of competitive cheerleading and the Triad components. Overall, our study revealed most competitive cheerleaders are at risk for LEA with an ED risk and menstrual dysfunction; but are not at risk for low BMD. Additionally, cheerleaders are under consuming macronutrients, such as carbohydrates and proteins, and are susceptible for sustain negative energy balance. These results provide important health related information to athletes, coaches, school administrators, and competition organizers on the existence of the Triad components within this population. The rates that were found between LEA with or without an eating disorder and menstrual dysfunction support the need for increased education, oversight, and resources for cheerleaders. The authors believe that energy intake and proper fueling techniques should be the first focus due to the impact overall EA has on the other components of the Triad. Additionally, increased education and awareness to all three Triad components, LEA with or without and ED, menstrual dysfunction, and low BMD, needs to be implemented. Appropriate evaluation of all three components should also be

completed when an athlete is thought to be at risk or is diagnosed with any one component.

Table 3.1: Self-reported and measured physical measurements for cheerleaders (n=19).

	All (n=19)	
	Mean	SD
Height		
Measured Height (cm)	160.70	7.77
Weight		
Measured Weight (kg)	58.67	7.75
Highest Weight (kg)	62.12	8.50
Lowest Weight (kg)	54.67	6.67
Mental Weight (kg)*	60.95	11.15
Ideal Weight (kg)	56.38	6.26
Self-Reported Weight-Ideal Weight (kg)	-5.75	4.67
Mental Weight – Ideal Weight (kg)	4.57	7.14
Self-Reported - Weight-Mental Weight (kg)	39.02	22.11
Measured Weight-Mental Weight (kg)	-2.27	5.03
BMI		
Measured BMI (kg/m ²)	22.62	1.96
Body Fat Percent		
DXA Body Fat (%)	26.11	4.19

***Mental Weight:** Perceived weight if one did not consciously try to control weight.

Table 3.2: Energy need assessments, LEA risk, and bone mineral density scores for cheerleaders (n=19).

Energy Needs Assessment	Mean	SD
Resting Metabolic Rate (kcal)	1263.68	147.58
Energy Intake (kcal)*	1384.7	391.80
Total Daily Energy Expenditure (kcal)	2467.60	426.95
Energy Balance (kcal)	-1043.14	580.59
Exercise Energy Expenditure (kcal)*	746.04	218.64
Energy Availability (kcal/kg ⁻¹ FFM)*	12.48	8.01
Macronutrients		
Carbohydrates (g)	153.00	44.49
Carbohydrates (g/kg of body weight)	2.64	0.80
Proteins (g)	60.83	16.80
Proteins (g/kg of body weight)	1.03	0.25
Fats (g)	57.82	19.81
Bone Mineral Density		
Total Z-score	1.7	.74
Total Score (g/cm ²)	1.2	.11
Legs (g/cm ²)	1.1	.12
Spine (g/cm ²)	1.1	.13
Pelvis (g/cm ²)	1.2	.09
L1 vertebra (g/cm ²)	1.3	.15
L2 vertebra (g/cm ²)	1.4	.18
L3 vertebra (g/cm ²)	1.4	.15
L4 vertebra (g/cm ²)	1.4	.17
Left femoral neck (g/cm ²)	1.1	.11
Note: *means and standard deviations are reflective of values calculated based on days where cheerleading practice was completed.		

Table 3.3: Eating disorder characteristics among competitive cheerleaders (n=19). Scores taken from the EDI-3 survey.

	Raw Score		Classification					
			Low Clinical		Typical Clinical		Elevated Clinical	
	Mean	SD	n	%	N	%	n	%
Eating Disorders Risk Scale								
Drive for Thinness	5.94	6.67	17	89.5	2	10.5	0	0
Bulimia	1.05	1.43	18	94.7	1	5.3	0	0
Body Dissatisfaction	10.36	8.22	17	89.5	2	10.5	0	0
Eating Disorder Risk Composite	97.47	17.75	19	100.0	0	0	0	0
Psychological Scale								
Low Self-Esteem	2.36	2.89	17	89.5	2	10.5	0	0
Personal Alienation	3.52	2.83	18	94.7	2	10.5	0	0
Interpersonal Insecurity	6.89	3.87	8	42.1	11	57.9	0	0
Interpersonal Alienation	4.78	4.32	15	78.9	3	15.8	1	5.3
Interceptive Deficits	5.21	6.81	17	89.5	1	5.3	1	5.3
Emotional Dysregulation	3.26	4.05	13	68.4	5	26.3	1	5.3
Perfectionism	12.52	5.91	8	42.1	6	31.6	5	26.3
Asceticism	3.42	3.22	17	89.5	2	10.5	0	0
Maturity Fears	8.31	4.33	7	36.8	8	42.1	4	21.1
Composite								
Ineffectiveness Composite	66.10	8.15	18	94.7	1	5.3	0	0
Interpersonal Problems Composite	82.21	12.40	14	73.7	4	21.1	1	5.3
Affective Problems Composite	76.89	15.25	17	89.5	1	5.3	1	5.3
Over control Composite	81.52	14.72	14	73.7	4	21.1	1	5.3
General Psychological Maladjustment	353.05	44.76	17	89.5	2	10.5	0	0

Table 3.4: Pathogenic behaviors among cheerleaders (n=19). Data comes from the EDI- Symptom Checklist and is presented in frequency (n) and percent (%).

All Data		
	N	%
Eating Behaviors		
Dieting	10	52.6
Binge Eating	0	0.0
Purging*	1	5.3
Laxatives	2	10.5
Diet Pills	1	5.3
Diuretics	0	0
Exercise to Control Weight		
0% of time	2	10.5
<25% of time	8	42.1
25%-50% of time	7	36.8
More than 50% of time	1	5.3
100% of time	1	5.3

Table 3.5: Triad assessments with breakdown of spectrum components (energy availability, menstrual disturbance, and bone mineral density scores) are listed for cheerleaders (n=19).

Female Athlete Triad Risk	At Risk %(N)
1 component	47.4% (9)
2 components using self-report measures	52.6% (10)
2 components using hormonal assessment	10.5% (2)
Triad Risk Type	At Risk %(N)
LEA with ED Risk	52.6% (10)
Self-Reported Menstrual Dysfunction	52.6% (10)
Self-Reported Primary Menstrual Dysfunction	21.1% (4)
Self-Reported Secondary Menstrual Dysfunction	52.3% (10)
Hormonal Menstrual Dysfunction	14.2% (2)
Low Bone Mineral Density	0% (0)
LEA with Menstrual Dysfunction	52.6% (10)
EDI-SC Behavior Risk (e.g.: bingeing, purging, dieting, laxatives, diet pills, etc.)	At Risk %(N)
Zero Behaviors	47.4 (9)
1 Behaviors	31.6 (6)
2 Behaviors	21.1 (4)
*Note: LEA for the week was calculated by taking the average of the 3 days of EA on practice days.	

Table 3.6. Hormonal levels for estradiol with menstrual dysfunction categorization.		
Participant	Estradiol Level	Menstrual Dysfunction Category
1	<5.00 pg/mL	Below Range
2	6.98 pg/mL	Within Range
3	20.88 pg/mL	Within Range
4	39.66 pg/mL	Within Range
5	9.34 pg/mL	Within Range
6	76.34 pg/mL	Within Range
7	17.50 pg/mL	Within Range
8	35.23 pg/mL	Within Range
9	34.67 pg/mL	Within Range
10	156.40 pg/mL	Within Range
11	46.54 pg/mL	Within Range
12	7.59 pg/mL	Within Range
13	<5.00 pg/mL	Below Range
14	58.22 pg/mL	Within Range
<p>Hormonal ranges were based on the following ranges for menstrual cycle phases: follicular phase = 6.20 – 315.00 (pg/mL), ovulation phase = 28.60 – 525.00 (pg/mL), luteal phase = 7.69 – 752.00 (pg/mL), and postmenopausal = <5.00 – 51.60 (pg/mL).</p> <p>*No participants were in the postmenopausal phase</p>		

References

1. Thompson SH, Digsby S. A preliminary survey of dieting, body dissatisfaction, and eating problems among high school cheerleaders. *J Sch Health*. 2004;74(3):85-90.
2. Jacobson BH, Hubbard M, Redus B, et al. An assessment of high school cheerleading: injury distribution, frequency, and associated factors. *The Journal of orthopaedic and sports physical therapy*. 2004;34(5):261-265.
3. Smolak L, Murnen SK, Ruble AE. Female athletes and eating problems: a meta-analysis. *The International journal of eating disorders*. 2000;27(4):371-380.
4. Coelho GM, Gomes AI, Ribeiro BG, Soares Ede A. Prevention of eating disorders in female athletes. *Open access journal of sports medicine*. 2014;5:105-113.
5. Nattiv A, Loucks AB, Manore MM, Sanborn CF, Sundgot-Borgen J, Warren MP. American College of Sports Medicine position stand. The female athlete triad. *Med Sci Sports Exerc*. 2007;39(10):1867-1882.
6. De Souza MJ, Nattiv A, Joy E, et al. 2014 Female Athlete Triad Coalition consensus statement on treatment and return to play of the female athlete triad: 1st International Conference held in San Francisco, CA, May 2012, and 2nd International Conference held in Indianapolis, IN, May 2013. *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*. 2014;24(2):96-119.
7. Loucks AB, Kiens B, Wright HH. Energy availability in athletes. *J Sports Sci*. 2011;29 Suppl 1:S7-15.
8. Mountjoy M, Sundgot-Borgen J, Burke L, et al. International Olympic Committee (IOC) Consensus Statement on Relative Energy Deficiency in Sport (RED-S): 2018 Update. *International journal of sport nutrition and exercise metabolism*. 2018;28(4):316-331.
9. Logue D, Madigan SM, Delahunt E, Heinen M, Mc Donnell SJ, Corish CA. Low Energy Availability in Athletes: A Review of Prevalence, Dietary Patterns, Physiological Health, and Sports Performance. *Sports medicine (Auckland, NZ)*. 2018;48(1):73-96.
10. Nichols JF, Rauh MJ, Lawson MJ, Ji M, Barkai HS. Prevalence of the female athlete triad syndrome among high school athletes. *Arch Pediatr Adolesc Med*. 2006;160(2):137-142.
11. Greenleaf C, Petrie TA, Carter J, Reel JJ. Female collegiate athletes: prevalence of eating disorders and disordered eating behaviors. *Journal of American college health : J of ACH*. 2009;57(5):489-495.
12. Association AP. Diagnostic and statistical manual of mental disorders. *BMC Med*. 2013;17:133-137.

13. Torres-McGehee, Monsma, Dompier, Washburn. Eating disorder risk and the role of clothing in collegiate cheerleaders' body images. *Journal of Athletic Training*. 2012;47(5):541-548.
14. Monsma, Gay J, Torres-McGehee T. Physique Related Perceptions and Biological Correlates of Eating Disorder Risk among Female Collegiate Equestrians. *J Athl Enhancement* 2: 2. of. 2013;8:2.
15. Tylka TL, Hill MS. Objectification theory as it relates to disordered eating among college women. *Sex roles*. 2004;51(11-12):719-730.
16. Fredrickson BL, Roberts TA. Objectification theory: Toward understanding women's lived experiences and mental health risks. *Psychology of women quarterly*. 1997;21(2):173-206.
17. Current evaluation of amenorrhea. *Fertility and sterility*. 2008;90(5 Suppl):S219-225.
18. Loucks AB, Mortola JF, Girton L, Yen SS. Alterations in the hypothalamic-pituitary-ovarian and the hypothalamic-pituitary-adrenal axes in athletic women. *J Clin Endocrinol Metab*. 1989;68(2):402-411.
19. NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, March 7-29, 2000: highlights of the conference. *Southern medical journal*. 2001;94(6):569-573.
20. Ihle R, Loucks AB. Dose-response relationships between energy availability and bone turnover in young exercising women. *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research*. 2004;19(8):1231-1240.
21. Petkus DL, Murray-Kolb LE, De Souza MJ. The Unexplored Crossroads of the Female Athlete Triad and Iron Deficiency: A Narrative Review. *Sports medicine (Auckland, NZ)*. 2017;47(9):1721-1737.
22. Bonci CM, Bonci LJ, Granger LR, et al. National athletic trainers' association position statement: preventing, detecting, and managing disordered eating in athletes. *Journal of athletic training*. 2008;43(1):80-108.
23. De Bruin AK, Oudejans RR, Bakker FC. Dieting and body image in aesthetic sports: A comparison of Dutch female gymnasts and non-aesthetic sport participants. *Psychology of Sport and Exercise*. 2007;8(4):507-520.
24. Engel SG, Johnson C, Powers PS, et al. Predictors of disordered eating in a sample of elite Division I college athletes. *Eating Behaviors*. 2003;4(4):333-343.
25. Krentz EM, Warschburger P. Sports-related correlates of disordered eating in aesthetic sports. *Psychology of Sport and Exercise*. 2011;12(4):375-382.
26. Peebles R, Bell K, Carlson J, et al. Competitive sports, eating behaviors, and menstrual health in female college athletes. *Journal of Adolescent Health*. 2009;44(2):S19-S20.
27. Rouveix M, Bouget M, Pannafieux C, Champely S, Filaire E. Eating attitudes, body esteem, perfectionism and anxiety of judo athletes and nonathletes. *International journal of sports medicine*. 2007;28(04):340-345.
28. Sundgot-Borgen, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*. 2004;14(1):25-32.

29. Torres-McGehee, Green JM, Leeper JD, Leaver-Dunn D, Richardson M, Bishop PA. Body image, anthropometric measures, and eating-disorder prevalence in auxiliary unit members. *Journal of athletic training*. 2009;44(4):418-426.
30. Greenleaf, Petrie TA, Carter J, Reel JJ. Female collegiate athletes: prevalence of eating disorders and disordered eating behaviors. *Journal of American college health : J of ACH*. 2009;57(5):489-495.
31. Association AP. *Diagnostic and Statistical Manual of Mental Disorders: DSM-V*. 5 ed. Washington, DC: Am Psychiatr Assoc; 2013.
32. Reel JJ, Gill DL. Slim enough to swim? Weight pressures for competitive swimmers and coaching implications. *The Sport Journal*. 2001;4(2):1-4.
33. Black DR, Larkin LJ, Coster DC, Leverenz LJ, Abood DA. Physiologic screening test for eating disorders/disordered eating among female collegiate athletes. *Journal of athletic training*. 2003;38(4):286.
34. Reel JJ, Gill DL. Psychosocial factors related to eating disorders among high school and college female cheerleaders. *The Sport Psychologist*. 1996;10(2):195-206.
35. Kaschak E. *Engendered lives*. New York: Basic Books; 1992.
36. Monsma, Gay JL, Torres-McGehee TM. Body Image, Maturation, and Psychological Functioning in College Cheerleaders: A Matter of Position? *Translational Journal of the American College of Sports Medicine*. 2016;1(8):71-81.
37. Parsons EM, Betz NE. The relationship of participation in sports and physical activity to body objectification, instrumentality, and locus of control among young women. *Psychology of Women Quarterly*. 2001;25(3):209-222.
38. Rosen LW, McKeag DB, Hough DO, Curley V. Pathogenic weight-control behavior in female athletes. *The physician and sportsmedicine*. 1986;14(1):79-86.
39. Shanmugam V, Jowett S, Meyer C. Eating psychopathology amongst athletes: The importance of relationships with parents, coaches and teammates. *International Journal of Sport and Exercise Psychology*. 2013;11(1):24-38.
40. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE. The eating attitudes test: psychometric features and clinical correlates. *Psychol Med*. 1982;12(4):871-878.
41. DiPasquale LD, Petrie TA. Prevalence of disordered eating: A comparison of male and female collegiate athletes and nonathletes. *Journal of Clinical Sport Psychology*. 2013;7(3):186-197.
42. Pulvers K, Bachand J, Nollen N, Guo H, Ahluwalia JS. BMI-based norms for a culturally relevant body image scale among African Americans. *Eating behaviors*. 2013;14(4):437-440.
43. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods*. 2007;39(2):175-191.
44. Byrne S, McLean N. Elite athletes: effects of the pressure to be thin. *Journal of science and medicine in sport*. 2002;5(2):80-94.
45. Prather H, Hunt D, McKeon K, et al. Are elite female soccer athletes at risk for disordered eating attitudes, menstrual dysfunction, and stress fractures? *PM&R*. 2016;8(3):208-213.

46. Toro J, Galilea B, Martinez-Mallén E, et al. Eating disorders in Spanish female athletes. *International journal of sports medicine*. 2005;26(8):693-700.
47. Torres-McGehee TM, Green JM, Leeper JD, Leaver-Dunn D, Richardson M, Bishop PA. Body image, anthropometric measures, and eating-disorder prevalence in auxiliary unit members. *Journal of Athletic Training*. 2009;44(4):418-426.
48. Smith A, Emerson D, Winkelmann Z, Potter D, Torres-McGehee T. Prevalence of Eating Disorder Risk and Body Image Dissatisfaction among ROTC Cadets. *International Journal of Environmental Research and Public Health*. 2020;17(21):8137.
49. Torres-McGehee TM, Monsma EV, Gay JL, Minton DM, Mady-Foster AN. Prevalence of eating disorder risk and body image distortion among National Collegiate Athletic Association Division I varsity equestrian athletes. *J Athl Train*. 2011;46(4):431-437.
50. Torres-McGehee, Monsma EV, Gay JL, Minton DM, Mady-Foster AN. Prevalence of eating disorder risk and body image distortion among National Collegiate Athletic Association Division I varsity equestrian athletes. *Journal of athletic training*. 2011;46(4):431-437.
51. Holm-Denoma JM, Joiner TE, Vohs KD, Heatherton TF. The "freshman fifteen" (the "freshman five" actually): predictors and possible explanations. *Health Psychol*. 2008;27(1s):S3-9.
52. Javed A, Tebben PJ, Fischer PR, Lteif AN. Female athlete triad and its components: toward improved screening and management. *Mayo Clinic proceedings*. 2013;88(9):996-1009.
53. Beckner BN, Record RA. Navigating the thin-ideal in an athletic world: influence of coach communication on female athletes' body image and health choices. *Health communication*. 2016;31(3):364-373.
54. Cumming SP, Eisenmann JC, Smoll FL, Smith RE, Malina RM. Body size and perceptions of coaching behaviors by adolescent female athletes. *Psychology of Sport and Exercise*. 2005;6(6):693-705.
55. Bulik CM, Wade TD, Heath AC, Martin NG, Stunkard AJ, Eaves LJ. Relating body mass index to figural stimuli: population-based normative data for caucasians. *Int J Obes*. 2001;25(10):1517.
56. Thompson SH, Digsby S. A preliminary survey of dieting, body dissatisfaction, and eating problems among high school cheerleaders. *Journal of School Health*. 2004;74(3):85-90.
57. de Oliveira Coelho GM, da Silva Gomes AI, Ribeiro BG, de Abreu Soares E. Prevention of eating disorders in female athletes. *Open access journal of sports medicine*. 2014;5:105.
58. Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC consensus statement: beyond the female athlete triad—relative energy deficiency in sport (RED-S). *British journal of sports medicine*. 2014;48(7):491-497.
59. Wade GN, Schneider JE, Li HY. Control of fertility by metabolic cues. *The American journal of physiology*. 1996;270(1 Pt 1):E1-19.
60. Heaney S, O'Connor H, Gifford J, Naughton G. Comparison of strategies for assessing nutritional adequacy in elite female athletes' dietary intake.

- International journal of sport nutrition and exercise metabolism*. 2010;20(3):245-256.
61. Sundgot-Borgen J. Nutrient intake of female elite athletes suffering from eating disorders. *International journal of sport nutrition*. 1993;3(4):431-442.
 62. Association AP. *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub; 2013.
 63. Zerwas S, Von Holle A, Watson H, Gottfredson N, Bulik CM. Childhood anxiety trajectories and adolescent disordered eating: findings from the NICHD Study of Early Child Care and Youth Development. *The International journal of eating disorders*. 2014;47(7):784-792.
 64. Thompson SH, Rofeiroiu AC, Sargent RG. Examining gender, racial, and age differences in weight concern among third, fifth, eighth, and eleventh graders. *Eating behaviors*. 2003;3(4):307-323.
 65. Uzogara SG. Underweight, the less discussed type of unhealthy weight and its implications: a review. *American Journal of Food Science and Nutrition Research*. 2016;3(5):126-142.
 66. Torres-McGehee TM, Emerson DM, Moore EM, et al. Examination of Energy Balance, Eating Disorder Risk, and Pathogenic Behaviors among Athletic Trainers. *J Athl Train*. 2020.
 67. Deuster PA, Kyle SB, Moser PB, Vigersky RA, Singh A, Schoomaker EB. Nutritional intakes and status of highly trained amenorrheic and eumenorrheic women runners. *Fertility and sterility*. 1986;46(4):636-643.
 68. Kaiserauer S, Snyder AC, Sleeper M, Zierath J. Nutritional, physiological, and menstrual status of distance runners. *Medicine and science in sports and exercise*. 1989;21(2):120-125.
 69. Myerson M, Gutin B, Warren MP, et al. Resting metabolic rate and energy balance in amenorrheic and eumenorrheic runners. *Medicine and science in sports and exercise*. 1991;23(1):15-22.
 70. Marcus R, Cann C, Madvig P, et al. Menstrual function and bone mass in elite women distance runners. Endocrine and metabolic features. *Annals of internal medicine*. 1985;102(2):158-163.
 71. Fehling PC, Alekel L, Clasey J, Rector A, Stillman RJ. A comparison of bone mineral densities among female athletes in impact loading and active loading sports. *Bone*. 1995;17(3):205-210.
 72. Risser WL, Lee EJ, LeBlanc A, Poindexter HB, Risser JM, Schneider V. Bone density in eumenorrheic female college athletes. *Med Sci Sports Exerc*. 1990;22(5):570-574.
 73. Robinson TL, Snow-Harter C, Taaffe DR, Gillis D, Shaw J, Marcus R. Gymnasts exhibit higher bone mass than runners despite similar prevalence of amenorrhea and oligomenorrhea. *J Bone Miner Res*. 1995;10(1):26-35.
 74. Barrack MT, Rauh MJ, Nichols JF. Prevalence of and traits associated with low BMD among female adolescent runners. *Med Sci Sports Exerc*. 2008;40(12):2015-2021.
 75. Beals KA, Hill AK. The prevalence of disordered eating, menstrual dysfunction, and low bone mineral density among US collegiate athletes. *Int J Sport Nutr Exerc Metab*. 2006;16(1):1-23.

76. Burrows M, Shepherd H, Bird S, MacLeod K, Ward B. The components of the female athlete triad do not identify all physically active females at risk. *J Sports Sci.* 2007;25(12):1289-1297.
77. Hoch AZ, Pajewski NM, Moraski L, et al. Prevalence of the female athlete triad in high school athletes and sedentary students. *Clin J Sport Med.* 2009;19(5):421-428.
78. Nichols JF, Rauh MJ, Lawson MJ, Ji M, Barkai H-S. Prevalence of the female athlete triad syndrome among high school athletes. *Archives of pediatrics & adolescent medicine.* 2006;160(2):137-142.
79. Pettersson U, Stålnacke B, Ahlén G, Henriksson-Larsén K, Lorentzon R. Low bone mass density at multiple skeletal sites, including the appendicular skeleton in amenorrheic runners. *Calcif Tissue Int.* 1999;64(2):117-125.
80. Pollock N, Grogan C, Perry M, et al. Bone-mineral density and other features of the female athlete triad in elite endurance runners: a longitudinal and cross-sectional observational study. *Int J Sport Nutr Exerc Metab.* 2010;20(5):418-426.
81. Rauh MJ, Nichols JF, Barrack MT. Relationships among injury and disordered eating, menstrual dysfunction, and low bone mineral density in high school athletes: a prospective study. *J Athl Train.* 2010;45(3):243-252.
82. Rutherford OM. Spine and total body bone mineral density in amenorrheic endurance athletes. *J Appl Physiol (1985).* 1993;74(6):2904-2908.
83. Young N, Formica C, Szmukler G, Seeman E. Bone density at weight-bearing and nonweight-bearing sites in ballet dancers: the effects of exercise, hypogonadism, and body weight. *J Clin Endocrinol Metab.* 1994;78(2):449-454.
84. Schtscherbyna A, Soares EA, de Oliveira FP, Ribeiro BG. Female athlete triad in elite swimmers of the city of Rio de Janeiro, Brazil. *Nutrition.* 2009;25(6):634-639.
85. Monsma EV, Gay JL, Torres-McGehee TM. Body Image, Maturation, and Psychological Functioning in College Cheerleaders: A Matter of Position? *Translational Journal of the American College of Sports Medicine.* 2016;1(8):71-81.
86. McDoniel SO. Systematic review on use of a handheld indirect calorimeter to assess energy needs in adults and children. *Int J Sport Nutr Exerc Metab.* 2007;17(5):491-500.
87. Van Loan MD. Do hand-held calorimeters provide reliable and accurate estimates of resting metabolic rate? *J Am Coll Nutr.* 2007;26(6):625-629.
88. Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. *J Acad Nutr Diet.* 2016;116(3):501-528.
89. Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Medicine and science in sports and exercise.* 2000;32(9; SUPP/1):S498-S504.
90. Gibson AL, Wagner D, Heyward V. *Advanced Fitness Assessment and Exercise Prescription, 8E.* Human kinetics; 2018.
91. Drenowatz C, Eisenmann JC, Pivarnik JM, Pfeiffer KA, Carlson JJ. Differences in energy expenditure between high- and low-volume training. *European journal of sport science.* 2013;13(4):422-430.

92. Berntsen S, Hageberg R, Aandstad A, et al. Validity of physical activity monitors in adults participating in free-living activities. *Br J Sports Med*. 2010;44(9):657-664.
93. Garner DM. EDI-3, eating disorder inventory-3: professional manual: psychological assessment resources, Incorporated. 2004.
94. Osteoporosis prevention, diagnosis, and therapy. *Jama*. 2001;285(6):785-795.
95. Torres-McGehee TM, Emerson DM, Pritchett K, Moore EM, Smith AB, Uriegas NA. Energy Availability with or without Eating Disorder Risk in Collegiate Female Athletes and Performing Artists. *J Athl Train*. 2020.
96. Elliott-Sale KJ, Tenforde AS, Parziale AL, Holtzman B, Ackerman KE. Endocrine Effects of Relative Energy Deficiency in Sport. *Int J Sport Nutr Exerc Metab*. 2018;28(4):335-349.
97. Silva MR, Paiva T. Low energy availability and low body fat of female gymnasts before an international competition. *Eur J Sport Sci*. 2015;15(7):591-599.
98. Woodruff SJ, Meloche RD. Energy availability of female varsity volleyball players. *Int J Sport Nutr Exerc Metab*. 2013;23(1):24-30.
99. Reed JL, De Souza MJ, Kindler JM, Williams NI. Nutritional practices associated with low energy availability in Division I female soccer players. *J Sports Sci*. 2014;32(16):1499-1509.
100. Civil R, Lamb A, Loosmore D, et al. Assessment of Dietary Intake, Energy Status, and Factors Associated With RED-S in Vocational Female Ballet Students. *Front Nutr*. 2018;5:136.
101. Schaal K, Tiollier E, Le Meur Y, Casazza G, Hausswirth C. Elite synchronized swimmers display decreased energy availability during intensified training. *Scand J Med Sci Sports*. 2017;27(9):925-934.
102. Williams NI, Statuta SM, Austin A. Female Athlete Triad: Future Directions for Energy Availability and Eating Disorder Research and Practice. *Clin Sports Med*. 2017;36(4):671-686.
103. Greenleaf C, Petrie TA, Carter J, Reel JJ. Female collegiate athletes: Prevalence of eating disorders and disordered eating behaviors. *Journal of American College Health*. 2009;57(5):489-496.
104. Condo D, Lohman R, Kelly M, Carr A. Nutritional Intake, Sports Nutrition Knowledge and Energy Availability in Female Australian Rules Football Players. *Nutrients*. 2019;11(5).
105. Alaunyte I, Perry JL, Aubrey T. Nutritional knowledge and eating habits of professional rugby league players: does knowledge translate into practice? *J Int Soc Sports Nutr*. 2015;12:18.
106. Birkenhead KL, Slater G. A Review of Factors Influencing Athletes' Food Choices. *Sports Med*. 2015;45(11):1511-1522.
107. Sundgot-Borgen J. Knowledge and Practice of Top Level Coaches about Weight Control and Eating Disorders. *Medicine and Science in Sports and Exercise*. 1993;5(Suppl. 25):180.
108. Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. *Clinical journal of sport medicine*. 2004;14(1):25-32.

109. Uriegas NA, Emerson DM, Smith AB, Kelly MR, Torres-McGehee TM. Examination of eating disorder risk among university marching band artists. *Journal of Eating Disorders*. 2021;9(1):1-10.
110. Torstveit M, Rosenvinge J, Sundgot-Borgen J. Prevalence of eating disorders and the predictive power of risk models in female elite athletes: a controlled study. *Scandinavian journal of medicine & science in sports*. 2008;18(1):108-118.
111. Sundgot-Borgen J. Prevalence of eating disorders in elite female athletes. *International Journal of Sport Nutrition and Exercise Metabolism*. 1993;3(1):29-40.
112. Sundgot-Borgen J, Torstveit M. Aspects of disordered eating continuum in elite high-intensity sports. *Scandinavian Journal of Medicine & Science in Sports*. 2010;20:112-121.
113. Black DR, Larkin LJ, Coster DC, Leverenz LJ, Abood DA. Physiologic Screening Test for Eating Disorders/Disordered Eating Among Female Collegiate Athletes. *J Athl Train*. 2003;38(4):286-297.
114. Prnjak K, Jukic I, Tufano JJ. Perfectionism, Body Satisfaction and Dieting in Athletes: The Role of Gender and Sport Type. *Sports (Basel)*. 2019;7(8).
115. Chatterton JM, Petrie TA. Prevalence of disordered eating and pathogenic weight control behaviors among male collegiate athletes. *Eat Disord*. 2013;21(4):328-341.
116. Petrie TA, Greenleaf C, Reel J, Carter J. Prevalence of eating disorders and disordered eating behaviors among male collegiate athletes. *Psychology of Men & Masculinity*. 2008;9(4):267.
117. Goldfield GS. Body image, disordered eating and anabolic steroid use in female bodybuilders. *Eating disorders*. 2009;17(3):200-210.
118. Torres-McGehee TM, Green JM, Leaver-Dunn D, Leeper JD, Bishop PA, Richardson MT. Attitude and knowledge changes in collegiate dancers following a short-term, team-centered prevention program on eating disorders. *Percept Mot Skills*. 2011;112(3):711-725.
119. Doyle-Lucas AF, Akers JD, Davy BM. Energetic efficiency, menstrual irregularity, and bone mineral density in elite professional female ballet dancers. *J Dance Med Sci*. 2010;14(4):146-154.
120. Kuchkuntla AR, Limketkai B, Nanda S, Hurt RT, Mundi MS. Fad Diets: Hype or Hope? *Curr Nutr Rep*. 2018;7(4):310-323.
121. Schutz Y, Montani JP, Dulloo AG. Low-carbohydrate ketogenic diets in body weight control: A recurrent plaguing issue of fad diets? *Obes Rev*. 2021;22 Suppl 2:e13195.
122. Hall KD, Heymsfield SB, Kemnitz JW, Klein S, Schoeller DA, Speakman JR. Energy balance and its components: implications for body weight regulation. *Am J Clin Nutr*. 2012;95(4):989-994.
123. De Souza MJ, Williams NI, Nattiv A, et al. Misunderstanding the female athlete triad: refuting the IOC consensus statement on Relative Energy Deficiency in Sport (RED-S). *Br J Sports Med*. 2014;48(20):1461-1465.
124. Dale E, Gerlach DH, Wilhite AL. Menstrual dysfunction in distance runners. *Obstet Gynecol*. 1979;54(1):47-53.

125. Feicht CB, Johnson TS, Martin BJ, Sparkes KE, Wagner WW, Jr. Secondary amenorrhoea in athletes. *Lancet*. 1978;2(8100):1145-1146.
126. Glass AR, Deuster PA, Kyle SB, Yahiro JA, Vigersky RA, Schoomaker EB. Amenorrhea in Olympic marathon runners. *Fertil Steril*. 1987;48(5):740-745.
127. Sanborn CF, Martin BJ, Wagner WW, Jr. Is athletic amenorrhea specific to runners? *Am J Obstet Gynecol*. 1982;143(8):859-861.
128. Shangold MM, Levine HS. The effect of marathon training upon menstrual function. *Am J Obstet Gynecol*. 1982;143(8):862-869.
129. Wakat DK, Sweeney KA, Rogol AD. Reproductive system function in women cross-country runners. *Med Sci Sports Exerc*. 1982;14(4):263-269.
130. Loucks AB, Thuma JR. Luteinizing Hormone Pulsatility Is Disrupted at a Threshold of Energy Availability in Regularly Menstruating Women. *The Journal of Clinical Endocrinology & Metabolism*. 2003;88(1):297-311.
131. Abraham SF, Beumont PJ, Fraser IS, Llewellyn-Jones D. Body weight, exercise and menstrual status among ballet dancers in training. *Br J Obstet Gynaecol*. 1982;89(7):507-510.
132. Dusek T. Influence of high intensity training on menstrual cycle disorders in athletes. *Croat Med J*. 2001;42(1):79-82.
133. Bachmann GA, Kemmann E. Prevalence of oligomenorrhea and amenorrhea in a college population. *Am J Obstet Gynecol*. 1982;144(1):98-102.
134. Pettersson F, Fries H, Nillius SJ. Epidemiology of secondary amenorrhea. I. Incidence and prevalence rates. *Am J Obstet Gynecol*. 1973;117(1):80-86.
135. Singh KB. Menstrual disorders in college students. *Am J Obstet Gynecol*. 1981;140(3):299-302.
136. Kopp-Woodroffe SA, Manore MM, Dueck CA, Skinner JS, Matt KS. Energy and nutrient status of amenorrheic athletes participating in a diet and exercise training intervention program. *Int J Sport Nutr*. 1999;9(1):70-88.
137. Drinkwater BL, Bruemner B, Chesnut CH, 3rd. Menstrual history as a determinant of current bone density in young athletes. *Jama*. 1990;263(4):545-548.
138. Lloyd T, Myers C, Buchanan JR, Demers LM. Collegiate women athletes with irregular menses during adolescence have decreased bone density. *Obstet Gynecol*. 1988;72(4):639-642.
139. Keen AD, Drinkwater BL. Irreversible bone loss in former amenorrheic athletes. *Osteoporos Int*. 1997;7(4):311-315.
140. Warren MP, Brooks-Gunn J, Fox RP, Holderness CC, Hyle EP, Hamilton WG. Osteopenia in exercise-associated amenorrhea using ballet dancers as a model: a longitudinal study. *J Clin Endocrinol Metab*. 2002;87(7):3162-3168.
141. Bennell K, Matheson G, Meeuwisse W, Brukner P. Risk factors for stress fractures. *Sports Med*. 1999;28(2):91-122.
142. Bennell KL, Brukner PD. Epidemiology and site specificity of stress fractures. *Clin Sports Med*. 1997;16(2):179-196.
143. Bennell KL, Malcolm SA, Thomas SA, et al. Risk factors for stress fractures in track and field athletes. A twelve-month prospective study. *Am J Sports Med*. 1996;24(6):810-818.

144. Lauder TD, Dixit S, Pezzin LE, Williams MV, Campbell CS, Davis GD. The relation between stress fractures and bone mineral density: evidence from active-duty Army women. *Arch Phys Med Rehabil.* 2000;81(1):73-79.
145. Myburgh KH, Hutchins J, Fataar AB, Hough SF, Noakes TD. Low bone density is an etiologic factor for stress fractures in athletes. *Ann Intern Med.* 1990;113(10):754-759.
146. Warren MP, Brooks-Gunn J, Hamilton LH, Warren LF, Hamilton WG. Scoliosis and fractures in young ballet dancers. Relation to delayed menarche and secondary amenorrhea. *N Engl J Med.* 1986;314(21):1348-1353.
147. Winfield AC, Moore J, Bracker M, Johnson CW. Risk factors associated with stress reactions in female Marines. *Mil Med.* 1997;162(10):698-702.
148. Gibbs JC, Williams NI, De Souza MJ. Prevalence of individual and combined components of the female athlete triad. *Med Sci Sports Exerc.* 2013;45(5):985-996.
149. Torstveit MK, Sundgot-Borgen J. The female athlete triad exists in both elite athletes and controls. *Med Sci Sports Exerc.* 2005;37(9):1449-1459.
150. Hoch AZ, Stavrakos JE, Schimke JE. Prevalence of female athlete triad characteristics in a club triathlon team. *Arch Phys Med Rehabil.* 2007;88(5):681-682.
151. Quah YV, Poh BK, Ng LO, Noor MI. The female athlete triad among elite Malaysian athletes: prevalence and associated factors. *Asia Pac J Clin Nutr.* 2009;18(2):200-208.
152. Vardar SA, Vardar E, Altun GD, Kurt C, Oztürk L. Prevalence of the female athlete triad in edirne, Turkey. *J Sports Sci Med.* 2005;4(4):550-555.
153. Otis CL, Drinkwater B, Johnson M, Loucks A, Wilmore J. American College of Sports Medicine position stand. The Female Athlete Triad. *Med Sci Sports Exerc.* 1997;29(5):i-ix.

Appendix A

Invitation to Participate - Manuscript 1

Dear All-Star Cheerleader,

My name is Allison Smith and I am a doctoral student in the Department of Exercise at the University of South Carolina. I am working with Nicole Pruchnik, a Master's of Advanced Athletic Training student and Dr. Toni Torres-McGehee an Associate Professor. As part of the requirements of our graduate degrees, we are conducting a research study that will evaluate eating attitudes and body image perceptions of elite college and all-star cheerleaders. I have 10 years of competitive cheerleading experience in both the all-star and college levels which has led to my passion for wanting to study the cheerleading population. You are receiving this invitation due to you being a female or male member of an all star cheerleading team, (level 1-6) and are under the af. We would like to invite you to participate in the study.

The study will help us better understand cheerleaders' eating attitudes and body image. It is our hope that the results of the study will add insight into proper ways to maintain the overall mental and physical health of cheerleaders where currently there is little research. If you choose to participate, you will be asked to answer questions that refer to your personal demographics (age, height, weight, etc), potential weight pressures, menstrual cycle (females only), eating attitudes, and body image perceptions of yourself and your teammates. The survey will take approximately 30-35 minutes to complete.

Your parent has given permission for you to participate in this study but your participation is voluntary. Not participating or withdrawing at any time will not affect your position on current or future cheerleading teams. Participation is confidential and no one but the researchers will know anything about your answers. Your responses will not be shared with anyone including your parents, coaches, or teammates. Study information will be kept in a secure location at the University of South Carolina. The results of the study may be published or presented at professional meetings, but your identity will not be revealed.

You may contact any member of the research team if you have any more questions about the study or your participation. If you would like to participate, please click "yes" below and then you will be redirected to the survey. If you chose not to participant, please select "No", and we thank you for your consideration.

Sincerely,

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Appendix B

Eating Disorder Risk and Body Image Dissatisfaction in Cheerleaders Survey

Smith & Pruchnik/Torres-McGehee/Minors

Weight Policy

In the following section you will be asked questions about weight requirements and pressure of weight loss.

2. How often do you weigh yourself?

- ☐ Daily
- ☐ Weekly
- ☐ Bi-Weekly
- ☐ Monthly
- ☐ Other (please specify)

3. Is there a policy on your cheerleading team that requires you to be a certain weight?

- ☐ Yes
- ☐ No

4. If yes, is that policy enforced?

- ☐ Yes
- ☐ No

5. Do you gain or lose weight regularly to meet the demands of your cheerleading team?

- ☐ Yes
- ☐ No

6. Has anyone ever recommended that you change your weight or eating habits?

☐ Yes

☐ No

7. If yes, who made the recommendation? (check all that apply)

☐ Coach

☐ Parent(s)

☐ Teammate(s)

☐ Significant Other

☐ Friend(s)

☐ Other (please specify)

Smith & Pruchnik/Torres-McGehee/Minors

Pressures In Your Sport

8. Do you feel pressured to LOOK a certain way for the cheerleading team you are currently on?

☐ Yes

☐ No

9. If yes, who or what is the source of this pressure? (Check all that apply)

☐ Coach

☐ Parent(s)

☐ Teammate(s)

☐ Officials/Judges

☐ Significant Other

☐ Friend(s)

☐ Social Media

☐ Other (please specify)

10. Do you feel pressured to Lose/Maintain a certain weight for the current cheerleading team?

☐ Yes

☐ No

11. If yes, who or what is the source of this pressure? (check all that apply)

☐ Coach

☐ Parent(s)

☐ Teammate(s)

☐ Officials/Judges

☐ Significant Other

☐ Friend(s)

☐ Social Media

☐ Other (please specify)

Smith & Pruchnik/Torres-McGehee/Minors

Females ONLY

The following section contains questions about your menstrual cycle.

12. Are you currently taking birth control or female hormones?

☐ Yes

☐ No

13. If yes, what are they prescribed for? (check all that apply)

☐ Irregular Periods

☐ No Periods

☐ Painful Periods

☐ Birth Control

☐ Other (please specify)

14. Have you had your first menstrual cycle (period)?

☐ Yes

☐ No

15. If yes, how old were you? (ex: 16 and 4 months)

16. When was your last period? (Month/Day/Year)

17. When was your last pelvic exam? (Month/Year)

18. How many days are there between your periods from first day of your menstrual cycle to the last day of your cycle?

☐ 3 days

☐ 3-10 days

☐ +10 days

19. How many days are there between your periods from the first day of your cycle to the first day of your next cycle?

☐ 10-15 days

☐ 15-20 days

☐ 20-25 days

☐ 25-30 days

☐ Other (please specify)

20. How many periods have you had in the last 12 months?

21. How many periods have you had in the last 6 months?

22. Have you ever missed 3 or more consecutive months of your menstrual cycle?

☐ Yes

☐ No

23. If yes, how many have you missed?

24. Does your menstrual cycle change with exercise?

☐ Yes

☐ No

25. If yes, how does it change?

☐ Lighter

☐ Longer

☐ Heavier

☐ Disappear

☐ Shorter

☐ Other (please specify)

26. Do you ever have heavy bleeding?

☐ Yes

☐ No

27. Do you ever experience cramping during your period?

☐ Yes

☐ No

28. Have you ever had irregular periods (no periods for more than 3 consecutive months) after the age of 16?

☐ Yes

☐ No

29. If yes, which of the following best describes your menstrual cycle?

- ☐ Had 6-10 periods, but irregular ☐ Had 3 or less periods
☐ Had 6-10 periods, regularly but missed a few months in a row ☐ Did not menstruate
☐ Had 3-6 periods

30. Have you ever missed periods?

- ☐ During competitive season
☐ During off season
☐ Both
☐ Have not missed a period

31. Do you feel it is healthy and OK to miss a period?

- ☐ Yes
☐ No

32. Do you feel that it is healthy and OK to miss periods over a long duration?

- ☐ Yes
☐ No

Smith & Pruchnik/Torres-McGehee/Minors

P2: Eating Attitudes Test - 26 (EAT-26)

Please take the time to fill out the below form accurately, honestly, and completely as possible. All of your responses are confidential.

Reference: Garner, D.M, et al. (1982). The eating attitudes test: Psychometric features and clinical correlates. Psychological Medicine, 12, 871-878.

33. The following screening questionnaire is designed to help you determine if you're eating behaviors and attitudes warrant further evaluation. The questionnaire is **not intended to provide a diagnosis**. Please check a response for each of the following statements:

	Always	Usually	Often	Sometimes	Rarely	Never
1. Am terrified about being overweight.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Always	Usually	Often	Sometimes	Rarely	Never
2. Avoid eating when I am hungry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Find myself preoccupied with food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Have gone on eating binges where I feel I may not be able to stop.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Cut food into small pieces.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Aware of the calorie content of foods I eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Particularly avoid food with high carbohydrate content (bread, rich, potatoes, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Feel others would prefer if I ate more.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Vomit after I have eaten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Feel extremely guilty after eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Am preoccupied with a desire to be thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Think about burning up calories when I exercise.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Other people think I'm too thin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Am preoccupied with the thought of having fat on my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Take longer than others to eat my meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Avoid foods with sugar in them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Eat diet foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Feel that food controls my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Display self-control around food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Feel that others pressure me to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Always	Usually	Often	Sometimes	Rarely	Never
21. Give too much time and thought to food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Feel uncomfortable after eating sweets.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Engage in dieting behavior.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Like my stomach to be empty.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Have the impulse to vomit after meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Enjoy trying new rich foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

34. Please Respond to each of the following questions (Check the most appropriate response):

In the past three months, how often have you:

	Never	Once a month or less	2-3 times a month	Once a week	2-6 times per week	Once a day or more
1. Gone on Eating Binges (eating large amount of food while feeling out of control)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Made yourself sick (vomited) to control your weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Used Laxatives, diet pills, or diuretics (water pill) to control your weight or shape?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Exercised 60 minutes or more to lose or control your weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. In the past 6 months, have you lost 20 pounds or more?

- ☐ Yes
- ☐ No

36. Have you ever been treated for an eating disorder?

☐ Yes

☐ No

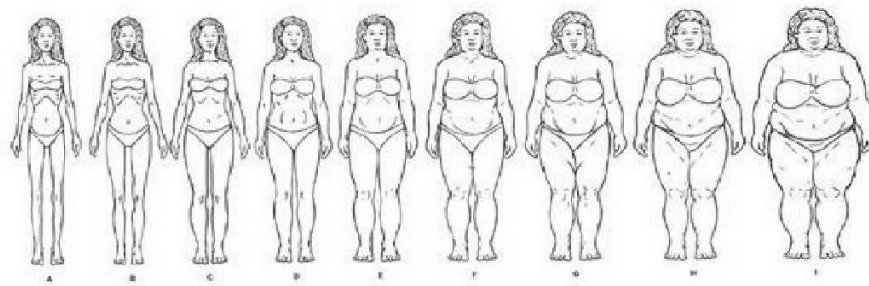
☐ If Yes, please specify when you were diagnosed.

Smith & Pruchnik/Torres-McGehee/Minors

P3: Standard Figural Stimuli

Using the silhouettes, please answer the following questions. (use the letter below the picture to identify the picture that best suits your answer)

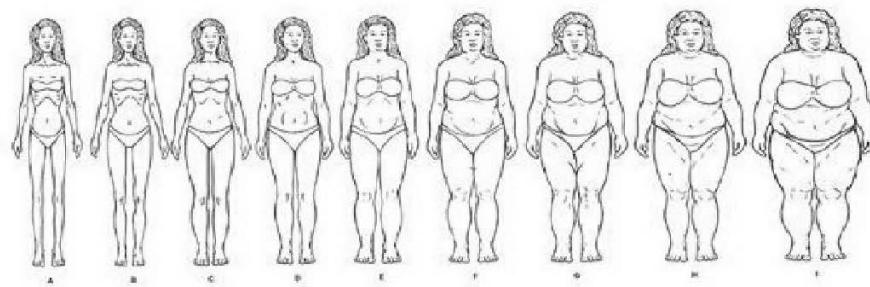
Stunkard et al, 1983



37. **FEMALES ONLY:** Using the Silhouettes above, please answer the following questions.

Picture A Picture B Picture C Picture D Picture E Picture F Picture G Picture H Picture I

1. Which picture best shows who you ARE now in everyday clothing (Example: What you wear to school)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Which picture best shows who you would LIKE to be in everyday clothing (Example: What you wear to school)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Which picture best shows who you ARE in your MIDRIFF shell cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Which picture best shows who you would LIKE to be in your MIDRIFF shell cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Which picture best shows who you ARE in your FULL LENGTH shell cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Which picture best shows who you would LIKE to be in your FULL LENGTH shell cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



38. **FEMALES ONLY:** Using the Silhouettes above, please answer the following questions.

Picture A Picture B Picture C Picture D Picture E Picture F Picture G Picture H Picture I

7. If your peers (friends) pick a picture that represents **you** NOW, what picture do you think they would pick?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

8. Which picture best shows how **you** think your friends **WOULD LIKE** you to look like?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

9. If your parents pick a picture that represents **you** NOW, what picture do you think they would pick?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

10. Which picture best shows how **you** think your parents **WOULD LIKE** you to look like?

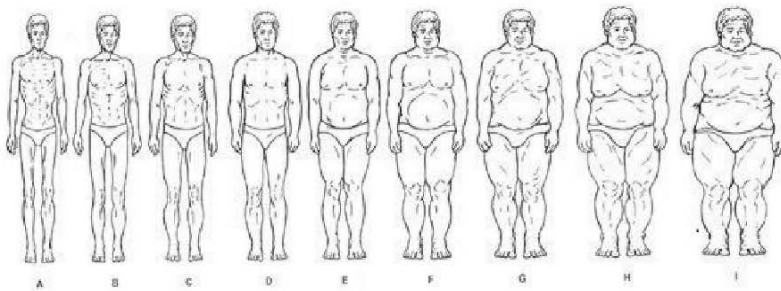
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

11. If your coach picks a picture that represents **you** NOW, what picture do you think they would pick?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

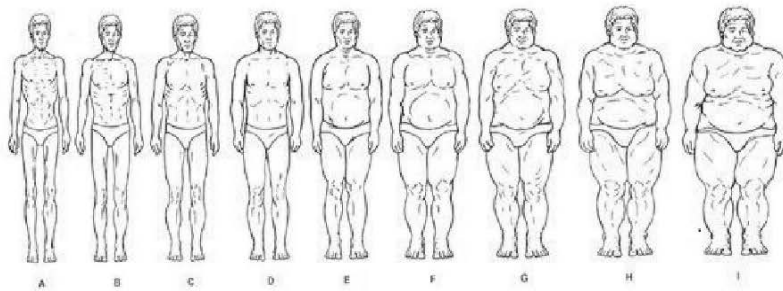
12. Which picture best shows how **you** think your coach **WOULD LIKE** you to look like?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐



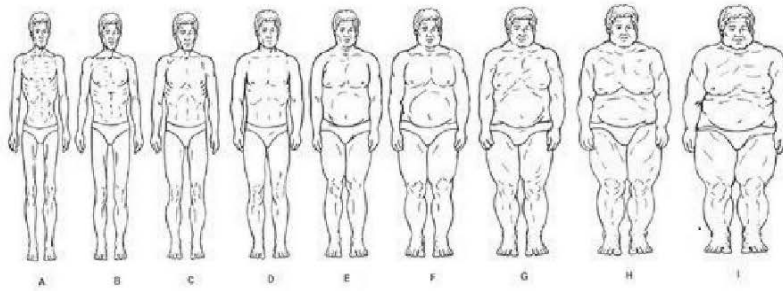
39. **MALES ONLY:** Using the Silhouettes above, please answer the following questions.

	Picture A	Picture B	Picture C	Picture D	Picture E	Picture F	Picture G	Picture H	Picture I
1. Which picture best shows who you ARE now in everyday clothing (Example: What you wear to school)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Which picture best shows who you would LIKE to be in everyday clothing (Example: What you wear to school)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



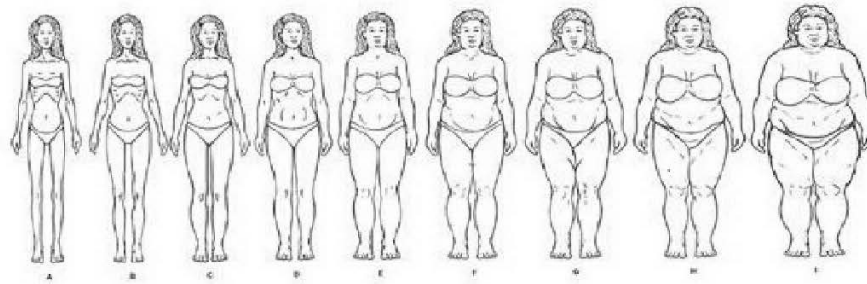
40. **MALES ONLY:** Using the Silhouettes above, please answer the following questions.

	Picture A	Picture B	Picture C	Picture D	Picture E	Picture F	Picture G	Picture H	Picture I
3. Which picture best shows who you ARE in your cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Which picture best shows who you would LIKE to be in your cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



41. **MALES ONLY:** Using the Silhouettes above, please answer the following questions.

	Picture A	Picture B	Picture C	Picture D	Picture E	Picture F	Picture G	Picture H	Picture I
5. If your peers (friends) pick a picture that represents you NOW, what picture do you think they would pick?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Which picture best shows how you think your friends WOULD LIKE you to look like?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. If your parents pick a picture that represents you NOW, what picture do you think they would pick?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Which picture best shows how you think your parents WOULD LIKE you to look like?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. If your coach picks a picture that represents you NOW, what picture do you think they would pick?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Which picture best shows how you think your coach WOULD LIKE you to look like?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



42. ALL GIRL FLYERS ONLY: Using the Silhouettes above, please answer the following questions.

Picture A Picture B Picture C Picture D Picture E Picture F Picture G Picture H Picture I

1. Which picture best shows who your **Main Base** is in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. Which picture best shows who you would **LIKE** your **Main Base** to be in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

3. Which picture best shows who your **Secondary Base** is in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

4. Which picture best shows who you would **LIKE** your **Secondary Base** to be in their cheerleading uniform?

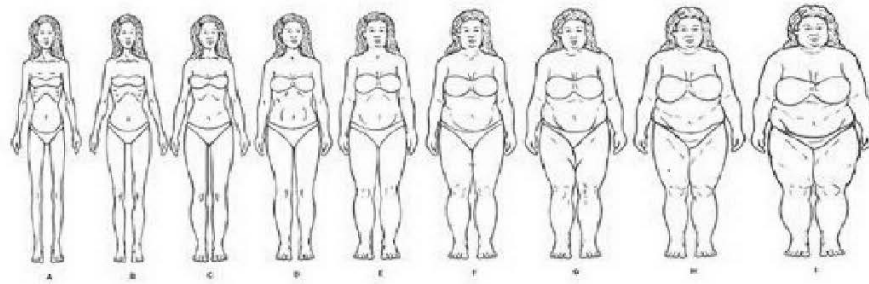
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

5. Which picture best shows who your **Back Spot** is in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

6. Which picture best shows who you would **LIKE** your **Back Spot** to be in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐



43. BASES only (MALE and Female): Using the Silhouettes above, please answer the following questions.

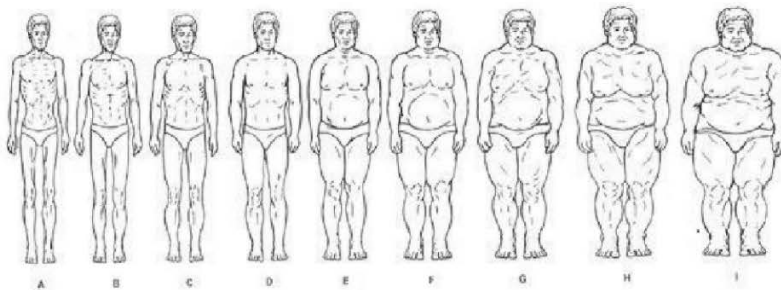
Picture A Picture B Picture C Picture D Picture E Picture F Picture G Picture H Picture I

1. Which picture best shows who your **Flyer** is now in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. Which picture best shows who you would LIKE your **Flyer** to be in their cheerleading uniform?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐



44. COED FLYERS ONLY: Using the Silhouettes above, please answer the following questions.

	Picture A	Picture B	Picture C	Picture D	Picture E	Picture F	Picture G	Picture H	Picture I
1. Which picture best shows who your MALE base is in their cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Which picture best shows who you would LIKE your MALE base to be in their cheerleading uniform?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Smith & Pruchnik/Torres-McGehee/Minors

P4: Social Physique Anxiety Scale

45. The following questions will ask about your physique or figure. By physique we mean your body's form and structure; specifically, body fat, muscle tone, and general body proportions.

Leary, M. R.. (2013) . Social Physique Anxiety Scale (SPAS) . Measurement Instrument Database for the Social Science. Retrieved from www.midss.ie

	Not at all characteristic of me	Slightly characteristic of me	Moderately characteristic of me	Very characteristic of me	Extremely characteristic of me
1. I am comfortable with the appearance of my physique or figure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I would never worry about wearing clothes that might make me look too thin or overweight.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I wish I wasn't so up-tight about my physique or figure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. There are times when I am bothered by thoughts that other people are evaluating my weight or muscular development negatively.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. When I look in the mirror I feel good about my physique or figure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17

Not at all Slightly Moderately Very characteristic Extremely
characteristic of me characteristic of me characteristic of me of me characteristic of me

6. Unattractive features of my physique or figure make me nervous in certain social settings.

☐ ☐ ☐ ☐ ☐

7. In the presence of others, I feel apprehensive about my physique or figure.

☐ ☐ ☐ ☐ ☐

8. I am comfortable with how fit my body appears to others.

☐ ☐ ☐ ☐ ☐

9. It would make me uncomfortable to know others were evaluating my physique or figure.

☐ ☐ ☐ ☐ ☐

10. When it comes to displaying my physique or figure to others, I am a shy person.

☐ ☐ ☐ ☐ ☐

11. I usually feel relaxed when it's obvious that others are looking at my physique or figure.

☐ ☐ ☐ ☐ ☐

12. When in a bathing suit, I often feel nervous about how well-proportioned my body is.

☐ ☐ ☐ ☐ ☐

Smith & Pruchnik/Torres-McGehee/Minors

P5: Male Body Dissatisfaction Scale

46. MALES ONLY: Please choose the best answer according to how YOU currently feel about your body.

Strongly agree Agree Neutral Disagree Strongly disagree

1. I am happy with how much muscle I have compared to how much fat I have.

☐ ☐ ☐ ☐ ☐

2. Other people think I have a good body.

☐ ☐ ☐ ☐ ☐

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
3. I am a good weight for my height.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I wish I had more muscular arms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am hesitate to take my shirt off in public because people will look at my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I fantasize about having more muscle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I have thoughts of dissatisfaction towards my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I think I have a generally attractive body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I wish I had more of a V-shaped torso (upper body).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I wish I could become more toned in order to accentuate the muscle I do have.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I am more muscular than the average male my age.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I worry about being more muscular.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I wish I had bigger biceps.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I think my pectoral (chest) muscles are well developed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I have a "six-pack" or "washboard" stomach.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Others would find me more attractive if I had more muscle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I wish I could lose more fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. My body looks healthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I like to show off my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
20. The shape of my body is one of my assets.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. I look like I could lift more weight than the average male my age.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. I wish I had better muscle definition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. My body is sexually appealing to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. I think about how different my body looks from what my ideal body would look like.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. I wish I could build a better body for myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MALES ONLY: Please rate how important each item is to you on a scale of 1 to 10. (1 = no importance; 10 = great importance)

47. I am happy with how much muscle I have compared to how much fat I have.

0

10

☐

48. Other people think I have a good body.

0

10

☐

49. I am a good weight for my height.

0

10

☐

50. I wish I had more muscular arms.

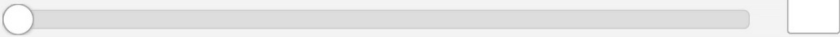
0

10

☐

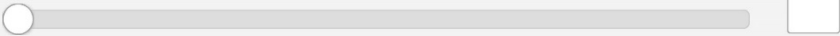
51. I am hesitate to take my shirt off in public because people will look at my body.

0 10



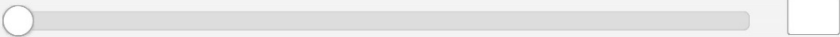
52. I fantasize about having more muscle.

0 10



53. I have thoughts of dissatisfaction towards my body.

0 10



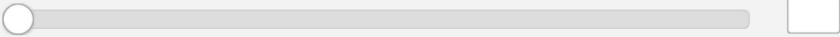
54. I think I have a generally attractive body.

0 10



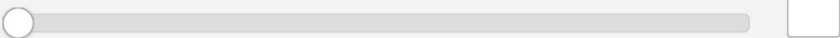
55. I wish I had more of a V-shaped torso (upper body).

0 10



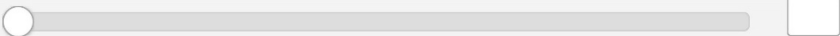
56. I wish I could become more toned in order to accentuate the muscle I do have.

0 10



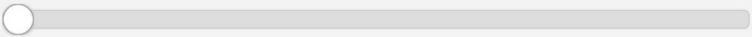
57. I am more muscular than the average male my age.

0 10



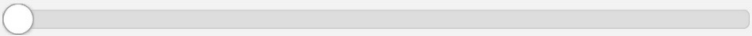
58. I worry about being more muscular.

0 10



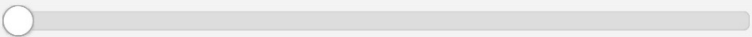
59. I wish I had bigger biceps.

0 10



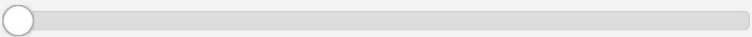
60. I think my pectoral (chest) muscles are well developed.

0 10



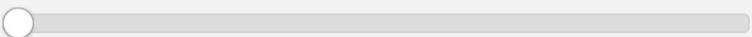
61. I have a "six-pack" or "washboard" stomach.

0 10



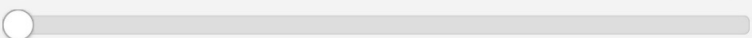
62. Others would find me more attractive if I had more muscle.

0 10



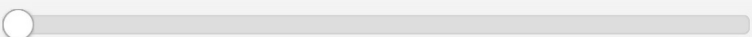
63. I wish I could lose more fat.

0 10



64. My body looks healthy.

0 10



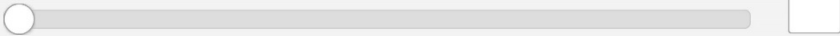
65. I like to show off my body.

0 10



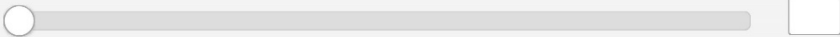
66. The shape of my body is one of my assets.

0 10



67. I look like I could lift more weight than the average male my age.

0 10



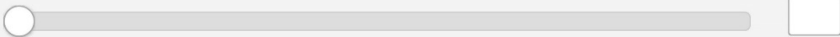
68. I wish I had better muscle definition.

0 10



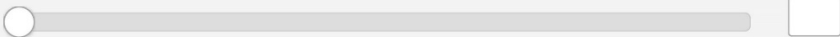
69. My body is sexually appealing to others.

0 10



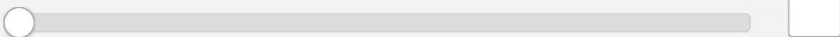
70. I think about how different my body looks from what my ideal body would look like.

0 10



71. I wish I could build a better body for myself.

0 10



Smith & Pruchnik/Torres-McGehee/Minors

Demographics

72. Age (years)

☐ 12

☐ 16

☐ 13

☐ 17

☐ 14

☐ 18

☐ 15

73. Date of Birth (Month)

Date / Time

DD/MM/YYYY

74. Gender

☐ Male

☐ Female

☐ Other (please specify)

75. Height (ft/in)

76. Weight (lbs)

77. Ideal Weight

78. Highest Weight (lbs)

79. Lowest Weight (lbs)

80. Education (Current Grade)

- ☐ 7th ☐ 10th
☐ 8th ☐ 11th
☐ 9th ☐ 12th
☐ Other (please specify)

81. Ethnic/Racial Group

- ☐ African American ☐ Caucasian
☐ Asian American ☐ Indian/Native American
☐ Hispanic American ☐ Multi-Ethnic
☐ Other (please specify)

82. How long have you participated in cheerleading?

- ☐ 0-5 Years
☐ 6-10 Years
☐ 11-15 Years
☐ +16 Years

83. What level(s) have you participated in cheerleading?

- ☐ All Star (USASF)
☐ High School
☐ College (Competitive)
☐ College (Non-Competitive)

84. What team do you participate on?

- ☐ All-Girl
☐ Coed

85. What is your position on the team?

- | | |
|--------------------------------------|---|
| <input type="radio"/> Main Base | <input type="radio"/> Flyer |
| <input type="radio"/> Secondary Base | <input type="radio"/> Non-Stunting Position |
| <input type="radio"/> Back Spot | |

86. FEMALES ONLY: What type of uniform(s) are you currently using for performance and competitions?

- ☐ Midribs (half-top)
- ☐ Full Length
- ☐ Both

87. All Girl Flyers: Do you always have the same bases?

- ☐ Yes
- ☐ No

88. Coed Flyers: Do you always have the same bases?

- ☐ Yes
- ☐ No

89. All Girl Bases: Do you always have the same flyer?

- ☐ Yes
- ☐ No

90. Coed Bases: Do you always have the same flyer?

- ☐ Yes
- ☐ No

Appendix C

Informed Consent Manuscript 3

UNIVERSITY OF SOUTH CAROLINA CONSENT TO BE A RESEARCH SUBJECT

Examination of Energy Needs across a Season in Female Cheerleaders

KEY INFORMATION ABOUT THIS RESEARCH STUDY:

You are invited to volunteer for a research study conducted by Ms. Allison Smith (doctoral student in the Department of Exercise Science) and Dr. Toni Torres-McGehee (Associate Professor, Department of Exercise Science) at the University of South Carolina. The purpose of this study is to examine the prevalence of the Female Athlete Triad Components: low energy availability (LEA), eating attitudes and behavior risks, effects of LEA on metabolism and reproductive hormones, and bone health in female, All-Star and College Cheerleaders.

You are being invited to participate because you are a female All-Star or College cheerleader. An All-Star cheerleader for this study is defined as a female who competes in the senior division of United States All-Star Federation events and is 13-25 years of age. A college cheerleader for this study is defined as a female who is a participating member of a college team who competes nationally at either the Universal Cheerleaders Association (UCA) or National Cheerleaders Association (NCA) College Nationals and is 18-25 years old. This study is being done at the University of South Carolina and will involve approximately 40 volunteers.

Active individuals, which includes those engaging in competitive/organized sport such as cheerleading, have the potential to be at risk from a condition known as the Female Athlete Triad (Triad). This is a combination of 3 interrelated conditions known as low energy availability (LEA) with or without a disordered eating, reproductive hormone dysfunction, and low bone mineral density. LEA has been described as the difference between energy intake (what you eat and drink) and exercise energy expenditure (what you burn by being active through exercise). When an individual consistently stays at level of LEA, there can be changes that are hard to reverse such as hormonal changes, decreases in bone mineral density, and potential eating disorders. The following is a short summary of this study to help you decide whether to be a part of this study. More detailed information is listed later in this form.

In this study, you will complete three collection periods (pre-competition, in-competition, and post-competition) that each span across a 7-day period. The study will begin with an information meeting and then will have 3 short follow-up meetings that will be scheduled before each collection period. Each of the collection periods concludes with a visit to the lab for physical data collection measurements.

During the information meeting, you will fill out surveys that will target individual eating behaviors and attitudes, have your height and weight recorded, have your resting metabolic rate measured, and schedule a visit to the Public Health Research Center at the University of South Carolina where you will undergo a VO₂Max test and DXA scan. The VO₂Max testing can cause some physical discomfort. However, the test that will be completed for this study will be a sub-maximal test. This means you will be able to limit and ultimately choose to conclude the test whenever you feel necessary. The DXA scan is a measure of your body composition where you will lay on a comfortable table while the machine scans your body. The information meeting will take approximately 60-90 minutes. The combination of the VO₂Max testing and DXA scan will last approximately 60 minutes.

Prior to each data collection, a follow-up meeting will take place. This meeting will be used to provide you with the study equipment (activity watches and chargers) as well as to re-familiarize you with the study procedures and food/drink logging. This meeting will take place in your gym or practice facility and will take approximately 15 minutes.

During each of the 7-day collection periods which will happen during the pre-competition, in-competition, and post-competition time points, you will record the food and drinks that you eat/drink into a software program, and wear an activity watch which will track any planned/ intentional exercise, and practice and training activity. This process will take approximately 15 minutes per day to complete.

The final step of each data collection period is the post-collection day where you will undergo a fasting blood draw (1 blood draw per collection period. i.e. 3 overall) to assess hormone levels within your body. There may be a little discomfort with the blood draws, but there will be a max of 2 needle sticks per session.

This study benefits will help to provide preliminary data on cheerleading athletes which include basic energy needs and the amount of energy expended through cheerleading training. This knowledge will help prevent potentially serious medical outcomes from the low energy availability for All-Star and College cheerleaders who participate in year-round training. This study is unique because it will examine a multiple time points over the course of a competitive season. The results of this study will be applicable to researchers, physicians, athletes, coaches, school administrators, and other sports medicine professionals to improve overall prevention, and treatment for the overall mental and physical health of All-Star and College female cheerleaders.

The remainder of this form explains what you will do in detail, if you decide to participate in this study. Please read it carefully and feel free to ask questions before you decide about participating.

PROCEDURES:

If you agree to participate in this study, you will do the following:

Information Meeting

Surveys: You will complete a series of in-depth surveys to assess more questions pertaining to your medical history and eating attitudes and behaviors, a brief interview (follow-up on medical history). You do not have to answer any questions that you feel uncomfortable with. The questions will include:

- Age, education level, questions related to athletic and or physical activity/exercise experience and background
- Previous medical history including questions related to female's menstrual cycle
- Questions pertaining to missed time due to injury relating to bone, muscle, ligament, concussion and general medical conditions.
- Questions related to your current and previous weight, eating attitudes, and weight loss methods/behaviors.

Physical exam: We will measure your height, weight, and body composition.

Resting Metabolic Rate (RMR): You will complete an RMR measure. This will estimate the number of calories your body needs at rest. Only 1 RMR measure will be conducted for the entire study. You will sit down in a comfortable chair and put a small, plastic nose plug securely around your nose. You will then place an individualized mouthpiece and the MedGem unit into your mouth and breathe normally until the machine reaches a stable, consistent reading and stops. This measure typically takes around 15 minutes.

Equipment Overview: Throughout one-year study period you will resume normal, planned and intentional exercise as well as a normal cheer practice schedule throughout the 7 days of each data collection period. During your planned exercise and practices, you will use a POLAR Heart Rate (HR) monitor that resembles a watch. You will be given the “watch face” tracker, a watch band, and a charger. This watch will record your physical activity and exercise using heart rate and energy expended. You will be required to “start” the recording during any exercise over the 7-days for each data collection period. These activity watches CAN and should be worn in the shower. You can take off the watch at night during sleep and should use this time to recharge the watch every night. Specific directions for the maintenance and use of the tracker will be provided in a separate information sheet.

You will use the Food Prodigy food tracker software to track the food and drinks you consume. The research team will provide you with a username and password that you should not change throughout the entire study. Additional information on food tracking and example food portions will be given as a supplemental document. The research team would like to get a glimpse of your normal diet intake and activity

patterns, so during the 7-day data collection periods you should not change your diet or activity levels throughout the 7 days.

Scheduling: You will schedule a good time (convenient) for you to return to the Public Health Research Center to complete your DXA scan and VO₂Max testing. It will take roughly 60-90 minutes to complete this portion of the study. All measurements will be taken by a member of the research team. You will wear shorts and a t-shirt to both measurements. All measurements will be taken in private.

Dual Energy X-ray Absorptiometry (DXA) Scan:

At your convenience, before the end of first collection period you complete, a Dual Energy X-ray Absorptiometry (DXA) Scan will be conducted. DXA is a method used to measure bone mineral density and body composition (body fat). The machine uses x-rays that yield precise, high quality images of specific sections of your body. You will meet with one of the researchers to schedule the scan at your convenience during the data collection period. You will wear athletic, loose clothing and avoid clothing with belts, zippers, or buttons made of metal to your scan appointment.

The DXA scan will be administered by an individual current in their certification to apply X-rays to humans for diagnostic purposes by the South Carolina Radiation Quality Standards Association (SCRQAS). During the scan you will lie still on a padded table, with an x-ray generator below the table, and an imaging device above your head. The DXA machine will send a thin, invisible beam of low-dose x-rays with two distinct energy peaks through the body. This procedure will take approximately 10-20 minutes to complete. The DXA unit, based on the standards of the manufacturer, will automatically generate the bone mineral density measurement. If at any point throughout the test that you become uncomfortable and want to stop the test, you can raise your hand to notify the researcher and the scan will be terminated.

The scan will not be read by a radiologist and results are for research purposes only. The research investigators will not go over individual results with you. All DXA scans will be completed at the Arnold School of Public Health Research Center at the University of South Carolina.

VO₂ Max Testing: The exercise testing is designed to measure your level of physical fitness. The VO₂max Testing will measure how well your heart responds to exercise. A member of the research team will take your blood pressure and will instruct you to wear a mouthpiece. This will help measure the amount of air you breathe in and out. You will exercise up to a certain level of effort or until you feel that you can no longer perform. You will be able to self-select to stop the test at any point. During the test, your heart rate, blood pressure and oxygen level will be monitored, and you will rate your perceived level of exertion by pointing to a standardize chart. If you feel faint or uncomfortable, then you can request that the test be stop. Prior to the treadmill testing, you will be provided instructions on the location of the safety stop

button for the treadmill. You will also develop a hand signal to communicate with the research team to notify them if you would like to stop or are having trouble with the exercise or exercise protocol. This will help the researcher safely help you end the testing.

Post-Collection (Day-7) of each Collection Period

Review of Dietary and Exercise Logs: A research team member will review your dietary and exercise logs by logging into your individual profile on Food Prodigy (ESHA food processor 8.0, Salem, OR) at each data collection session (pre-competition, in-competition, and post-competition). The review of both logs for detail (amount of food, timing of meal, intensity of exercise, etc.) will be done to ensure completeness.

Injury Questionnaire: You will complete a short survey where you will self-report the occurrence of various injuries or general medical conditions. The questionnaire will prompt you to report on injuries related to bone, sprains, strains, concussions, and general medical conditions. You will also report the amount of time, if any that was missed from activity or practice.

Blood Draw and Lab Work: A **fasting** blood draw will be completed. This means you cannot eat anything or drink anything (other than water) more than 8 hours prior to the blood draw. The blood will be used to evaluate reproductive (i.e. Estradiol) and metabolic hormones to estimate levels that are circulating in your body. Analysis reports will allow the research team to categorize the sample into low, normal, or high ranges for each individual hormone. Changes in specific hormones help researchers to determine the presence of the Female Athlete Triad, and specifically low energy availability. At the conclusion of each collection period, you will have roughly 40 ml, or about 3 tablespoons, of blood taken from your arm. All members of the research team are Athletic Trainers by the Board of Certification and DHEC (State of South Carolina) who have been additionally trained in drawing blood.

DURATION:

The full duration of the study will collect data over the pre-competition, in-competition, and post-competition time points which will last approximately one calendar year. Participation in the study involves 1 informational meeting (approximately 60-90 minutes), a scheduled measurement for DXA and VO2 Max testing (approximately 60 minutes for both tests), a short follow-up meeting prior to each collection periods (approximately 15 minutes), 3 collection periods of 7 days each (pre-competition, in-competition, and post-season), and 3 post-collection sessions which will include fasted blood draws (one at each collection period lastly approximately 30-40 minutes). During the 7-days at each collection period, it should take you ~15-20 minutes each day to record your food and exercise logs for the day.

Screening Process	Informational Meeting (60-90 min)	Follow-Up Meeting (15 minutes)	Daily Data Collection (Day 1 – Day 7)	Post-Collection (Day 7 Morning) (30-40 min)
Survey to assess eligibility sent via Qualtrics.	Consent form signed Surveys and injury questionnaire Anthropometric measurements Equipment overview RMR measurement Schedule DXA Scan and VO ₂ Max testing (tests together take 60 minutes)	Equipment provided to you Review of study procedures	Frequent reminders to complete food and activity logs Wear POLAR HR monitor (initiates tracker when active). DXA and VO ₂ max testing	Review and submission of Food/Activity logs Injury questionnaire Fasted Blood Draw Collect equipment
<p>Note: DXA scan and VO₂Max testing will be scheduled during the Informational Meeting.</p> <p>Both measures must be completed before the end of the Post-Collection (Day-7) period of the first collection period that is completed.</p> <p>*Equipment overview will include POLAR HR watches, Food Prodigy website, and activity/diet logs.</p> <p>**Location for most of the research interactions will occur at the Public Health Research Center (PHRC) at the University of South Carolina. Specifically, all measurements for DXA Scan, VO₂Max testing and blood draws will occur at the PHRC. The initial screening process, informational meeting, follow-up meeting, food logs (online), anthropometric measurements, RMR, and equipment overview will be occurring in the gymnasium for the cheer team.</p> <p>***Follow-up meeting, Daily Collection, and Post Collection procedures will be the same for all three of the collection periods which include pre-competition, in-competition, and post-competition.</p>				

RISKS/DISCOMFORTS:

Sharing personal and confidential information may make you uncomfortable. Surveys will be used strictly to examine eating attitudes, behaviors and exercise habits. They will NOT be used as a diagnostic tool for eating disorders. While completing surveys, you may become concerned that you have an eating disorder. You will be provided

with a referral list with contact information of local counselors, physicians, and psychologists who you may contact for additional help at their own expense. You may also contact the investigators for additional referral information if the one provided does not work for you.

DEXA/DXA

The exposure levels from the DEXA (or DXA) X-ray unit are very low. While the radiation used for the DEXA scan has no observable radiological or biological effect, there is always a risk associated with radiation exposure, even very low exposure. If you want more information on the exposure levels, contact the research study principal investigator listed on this document.

VO2 Max Test

The risk associated with the VO2max test are fatigue, muscle soreness, irregular heartbeat, chest pain and sudden heart attack. All research team members are CPR/AED/ First Aid certified. Prior to the treadmill testing, you will be provided instructions on the location of the safety stop button for the treadmill. You and researcher will develop a hand signal to communicate with the research team to notify them if you would like to stop or are having trouble with the exercise or exercise protocol. This will help the researcher safely help you end the protocol.

Your blood pressure will be assessed throughout and the procedures will be discontinued if any abnormal heart rate or rhythm or change in blood pressure is detected. If a cardiovascular event occurs, the research facility where the testing will be administered will be equipped with necessary equipment such as an Automatic External Deliberator.

Blood Draw:

The risks for drawing blood include temporary discomfort from the needle stick, bruising, and infection. Fainting could occur.

Loss of Confidentiality:

There is the risk of a breach of confidentiality, despite the steps that will be taken to protect your identity. Specific safeguards to protect confidentiality are described in a separate section of this document.

BENEFITS:

Taking part in this study is not likely to benefit you personally. However, this research may help researchers understand how low energy availability can be used to guide recommendations for nutritional deficiencies, monitor safety trends for ED behaviors, general health, and weight management policies.

COSTS:

There will be no costs to you for participating in this study other than possible costs related to transportation to and from the research site and parking for study procedures that occur at the University of South Carolina.

PAYMENT TO PARTICIPANTS:

At the conclusion of the data collection period, participants will be entered in a drawing. The winner of the drawing will receive a \$50.00 gift card. The drawing will take place one week following the completion of the post collection meeting and the winner will be notified immediately.

COLLECTION OF IDENTIFIABLE PRIVATE INFORMATION OR IDENTIFIABLE BIOSPECIMENS:

Information about you or your bio specimens may be used for future research studies or may be shared with other researchers; however, this only will be done after identifiers linking the information/bio specimens to you are removed. This will be done without additional consent from you.

RESEARCH RELATED INJURY:

In the event you are injured while participating in this research study, a member of research study team will provide first aid using available resources, and if necessary, arrange for transportation to the nearest emergency medical facility. The University of South Carolina has not set aside funds to compensate you for any injury, complication or related medical care that may arise from participation in this study. Any study-related injury should be reported to the research study team immediately.

USC STUDENT PARTICIPATION:

Participation in this study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without negative consequences. Participation, non-participation, and/or withdrawal will not affect your grades or your relationship with professors, college(s), or the University of South Carolina.

CONFIDENTIALITY OF RECORDS:

All data collected for this study will only be accessible by the research investigators. All surveys will be kept on a password-protected computer to ensure confidentiality. Unless required by law, information that is obtained in connection with this research study will remain confidential. Any information disclosed would be with your express written permission. Study information will be securely stored on password-protected computers and/or locked cabinets. Results of this research study may be published or presented at seminars; however, the report(s) or presentation(s) will not include your name or other identifying information about you.

VOLUNTARY PARTICIPATION:

Participation in this research study is voluntary. You free not to participate, or to stop participating at any time, for any reason without negative consequences. If you do withdraw from this study, the information already provided will be kept in a confidential manner. If you wish to withdraw from the study, please call or email the principal investigator listed on this form.

I have been given a chance to ask questions about this research study. These questions have been answered to my satisfaction. If I have any more questions about my participation in this study, or a study related injury, I am to contact Dr. Toni Torres-McGehee at 803-777-0636 or (email) and/or Allison Smith at 740-255-1323 or email.

Questions about your rights as a research subject are to be directed to, Lisa Johnson, Assistant Director, Office of Research Compliance, University of South Carolina, 1600 Hampton Street, Suite 414D, Columbia, SC 29208, phone: (803) 777-6670 or email: LisaJ@mailbox.sc.edu.

I agree to participate in this study. I have been given a copy of this form for my own records.

Signature of Subject / Participant

Date

Signature of Qualified Person Obtaining Consent

Date

*For Minors 13-17 years of age:

My participation has been explained to me, and all my questions have been answered. I am willing to participate.

Print Name of Minor

Age of Minor

Signature of Minor

Date

Appendix D

Medical History Questionnaire

1. Name		
2. Age		
3. Educational Level		
4. Current Cheerleading Level	All- Star	College
5. Are you currently, or have you in the past year, followed a particular “diet”?	Y	N
6. How many meals (i.e., breakfast, lunch, dinner) do you eat each day? Example: 3		
7. How many snacks do you have each day? Example: 2		
8. Are there certain food groups that you refuse to eat (meat, breads, etc.)?		
9. Do you ever limit food intake to control weight?	Y	N
If yes, do you (circle below):		
a. Decrease the amount of food you eat during the day b. Skip meals c. Limit carbohydrates intake d. Limit fat intake e. Cut out snack items f. Other _____		
10. Do you ever feel out of control when eating or feel that you cannot stop eating?	Y	N

11. Do you take vitamin supplements?	Y	N
If yes, what type: _____		
How often (daily, a few times a week)? _____		

12. Do you take nutritional supplements?	Y	N
If yes, what type: _____		
How often (daily, a few times a week)? _____		
13. Do you currently take a method of oral contraceptive / birth control?	Y	N
If yes, what is the name of the medication? _____		
If yes, what is the reason for taking the medication?		
14. What do you currently weight?		lbs
15. Are you happy with this weight?	Y	N
If not, what would you like to weight? _____ lbs		
16. What was the most you've weighed in the past year?		lbs
17. What was the least you've weighted in the past year?		lbs
18. Do you gain or lose weight regularly to meet the demands of your sports or activity?	Y	N
19. Has anyone recommended that you change your weight or eating habits?	Y	N
If yes, specify (instructor, director, etc.): _____		
20. Has anyone ever set a target weight for you or subjected you to routine weigh ins?	Y	N
If yes, specify (instructor, director, etc.): _____		
21. Have you ever had to lose weight using any of the following methods? a. Vomiting b. Laxatives c. Diuretics d. Diet Pills e. Exercise	Y	N
22. Do you regularly exercise outside of your normal practice schedule?	Y	N

If yes, describe your activities: _____		
<p>23. Have you ever been treated for a stress fracture?</p> <p>If yes, how many have you had?</p> <p>_____</p> <p>What body part(s) were involved?</p> <p>_____</p> <p>When did the injury occur (year)?</p> <p>_____</p> <p>How was the diagnosis made (x-ray, bone scan, MRI, CT)? _____</p>	Y	N
<p>24. Have you ever had an injury related to cheerleading or physical activity? (torn ligament, strained muscles, tendonitis, overuse injuries, etc.)</p> <p>If YES, please explain in detail the type of injury:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>If YES, were you ever held out of practice, training, or competitions? and how long?</p> <p>_____</p> <p>If YES, were you injured during:</p> <p>_____ Training / Practice (on your own, not with a team)</p> <p>_____ Training / Practice (organized, with a team or group)</p> <p>_____ Competition / Performance</p>	Y	N
<p>25. Have you ever had surgery?</p> <p>IF YES, what was the surgery?</p> <p>_____</p>	Y	N

26. Have you ever seen a Physician, Athletic Trainer, and Physical Therapist for an injury?	Y	N
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Appendix E

Eating Attitudes Test

Instructions: This is a screening measure to help you determine whether you might have an eating disorder that needs professional attention. This screening measure is not designed to make a diagnosis of an eating disorder or take the place of a professional consultation. Please fill out the below form as accurately, honestly and completely as possible. There are no right or wrong answers. All of your responses are confidential.						
Part A: Complete the following questions:						
1) Birth Date		Day:	Year:	2) Gender:	Male	Female
Month:						
3) Height	Inches:				<input type="checkbox"/>	<input type="checkbox"/>
Feet :						
4) Current Weight (lbs.):		5) Highest Weight (excluding pregnancy):				
6) Lowest Adult Weight:		7: Ideal Weight:				
Part B: Please check a response for each of the following statements:				Always	Usually	Often
				Some times	Rarely	Never
1. Am terrified about being overweight.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Avoid eating when I am hungry.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Find myself preoccupied with food.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Have gone on eating binges where I feel that I may not be able to stop.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Cut my food into small pieces.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Aware of the calorie content of foods that I eat.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Feel that others would prefer if I ate more.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Vomit after I have eaten.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Feel extremely guilty after eating.				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11.	Am preoccupied with a desire to be thinner.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Think about burning up calories when I exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Other people think that I am too thin.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Am preoccupied with the thought of having fat on my body.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Take longer than others to eat my meals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Avoid foods with sugar in them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Eat diet foods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Feel that food controls my life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Display self-control around food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	Feel that others pressure me to eat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21.	Give too much time and thought to food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22.	Feel uncomfortable after eating sweets.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23.	Engage in dieting behavior.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24.	Like my stomach to be empty.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25.	Have the impulse to vomit after meals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26.	Enjoy trying new rich foods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part C: Behavioral Questions: In the past 6 months have you:		Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
A	Gone on eating binges where you feel that you may not be able to stop?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B	Ever made yourself sick (vomited) to control your weight or shape?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C	Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	Exercised more than 60 minutes a day to lose or to control your weight?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E	Lost 20 pounds or more in the past 6 months	Yes <input type="checkbox"/>		No <input type="checkbox"/>			
* Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control							

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

Appendix F

Eating Inventory 3



Item Booklet

David M. Garner, PhD

DIRECTIONS

Enter your name, the date, your age, gender, marital status, and occupation. Complete the questions on the rest of this page. Then, turn to the inside of this booklet and carefully follow the instructions.

Name _____ Date ____/____/____
 *Age _____ Gender _____ Marital Status _____ Occupation _____

- A. *Current weight: _____ pounds
- B. *Height: _____ feet _____ inches
- C. Highest past weight (excluding pregnancy): _____ pounds
 How long ago did you first reach this weight? _____ months
 How long did you weigh this weight? _____ months
- D. *Lowest weight as an adult (or lowest weight as an adolescent if not yet age 18): _____ pounds
 How long ago did you first reach this weight? _____ months
 How long did you weigh this weight? _____ months
- E. What weight have you been at for the longest period of time? _____ pounds
 At what age did you first reach this weight? _____ years old
- F. If your weight has changed a lot over the years, is there a weight that you keep coming back to when you are not dieting? _____ Yes _____ No
 If yes, what is this weight? _____ pounds
 At what age did you first reach this weight? _____ years old
- G. What is the most weight you have ever lost? _____ pounds
 Did you lose this weight on purpose? _____ Yes _____ No
 What weight did you lose to? _____ pounds
 At what age did you reach this weight? _____ years old
- H. What do you think your weight would be if you did not consciously try to control your weight?
 _____ pounds
- I. How much would you like to weigh? _____ pounds
- J. Age at which weight problems began (if any): _____ years old
- K. Father's occupation: _____
- L. Mother's occupation: _____

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INSTRUCTIONS

First, write your name and the date on the EDI-3 Answer Sheet. Your ratings on the items below should be circled on the Answer Sheet. The items ask about your attitudes, feelings, and behaviors. Some of the items relate to food or eating; other items ask about your feelings about yourself.

For each item, decide if the item is true about you **ALWAYS (A)**, **USUALLY (U)**, **OFTEN (O)**, **SOMETIMES (S)**, **RARELY (R)**, or **NEVER (N)**. Circle the letter that corresponds to your rating on the Answer Sheet. For example, if your rating for an item is **OFTEN**, you would circle the **"O"** for that item on the Answer Sheet.

Respond to *all* of the items, making sure that you circle the letter for the rating that is true about you. **DO NOT ERASE!** If you need to change an answer, mark an "X" through the incorrect letter, and then circle the correct one.

1. I eat sweets and carbohydrates without feeling nervous.
2. I think that my stomach is too big.
3. I wish that I could return to the security of childhood.
4. I eat when I am upset.
5. I stuff myself with food.
6. I wish that I could be younger.
7. I think about dieting.
8. I get frightened when my feelings are too strong.
9. I think that my thighs are too large.
10. I feel ineffective as a person.
11. I feel extremely guilty after overeating.
12. I think that my stomach is just the right size.
13. Only outstanding performance is good enough in my family.
14. The happiest time in life is when you are a child.
15. I am open about my feelings.
16. I am terrified of gaining weight.
17. I trust others.
18. I feel alone in the world.
19. I feel satisfied with the shape of my body.
20. I feel generally in control of things in my life.
21. I get confused about what emotion I am feeling.
22. I would rather be an adult than a child.
23. I can communicate with others easily.
24. I wish I were someone else.
25. I exaggerate or magnify the importance of weight.
26. I can clearly identify what emotion I am feeling.

(continued)

27. I feel inadequate.
28. I have gone on eating binges where I felt that I could not stop.
29. As a child, I tried very hard to avoid disappointing my parents and teachers.
30. I have close relationships.
31. I like the shape of my buttocks.
32. I am preoccupied with the desire to be thinner.
33. I don't know what's going on inside me.
34. I have trouble expressing my emotions to others.
35. The demands of adulthood are too great.
36. I hate being less than best at things.
37. I feel secure about myself.
38. I think about bingeing (overeating).
39. I feel happy that I am not a child anymore.
40. I get confused as to whether or not I am hungry.
41. I have a low opinion of myself.
42. I feel that I can achieve my standards.
43. My parents have expected excellence of me.
44. I worry that my feelings will get out of control.
45. I think my hips are too big.
46. I eat moderately in front of others and stuff myself when they're gone.
47. I feel bloated after eating a normal meal.
48. I feel that people are happiest when they are children.
49. If I gain a pound, I worry that I will keep gaining.
50. I feel that I am a worthwhile person.
51. When I am upset, I don't know if I am sad, frightened, or angry.
52. I feel that I must do things perfectly or not do them at all.
53. I have the thought of trying to vomit in order to lose weight.
54. I need to keep people at a certain distance (feel uncomfortable if someone tries to get too close).
55. I think that my thighs are just the right size.
56. I feel empty inside (emotionally).
57. I can talk about personal thoughts or feelings.
58. The best years of your life are when you become an adult.
59. I think my buttocks are too large.
60. I have feelings I can't quite identify.

(continued)

61. I eat or drink in secrecy.
62. I think that my hips are just the right size.
63. I have extremely high goals.
64. When I am upset, I worry that I will start eating.
65. People I really like end up disappointing me.
66. I am ashamed of my human weaknesses.
67. Other people would say that I am emotionally unstable.
68. I would like to be in total control of my bodily urges.
69. I feel relaxed in most group situations.
70. I say things impulsively that I regret having said.
71. I go out of my way to experience pleasure.
72. I have to be careful of my tendency to abuse drugs.
73. I am outgoing with most people.
74. I feel trapped in relationships.
75. Self-denial makes me feel stronger spiritually.
76. People understand my real problems.
77. I can't get strange thoughts out of my head.
78. Eating for pleasure is a sign of moral weakness.
79. I am prone to outbursts of anger or rage.
80. I feel that people give me the credit I deserve.
81. I have to be careful of my tendency to abuse alcohol.
82. I believe that relaxing is simply a waste of time.
83. Others would say that I get irritated easily.
84. I feel like I am losing out everywhere.
85. I experience marked mood shifts.
86. I am embarrassed by my bodily urges.
87. I would rather spend time by myself than with others.
88. Suffering makes you a better person.
89. I know that people love me.
90. I feel like I must hurt myself or others.
91. I feel that I really know who I am.

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Appendix G

Eating Disorder Inventory – 3 Symptoms Checklist



David M. Garner, PhD

DIRECTIONS

Enter your name, the date, your age, gender, marital status, and occupation. Complete the questions in this booklet as accurately as you can.

ID# _____ Date _____
*Age _____ Gender _____ Marital Status _____ Occupation _____

A. DIETING

*Have you *ever* restricted your food intake due to concerns about your body size or weight?
_____ Yes _____ No

How old were you the *very first time* that you began to seriously restrict your food intake due to concerns about your body size or weight? _____ years old

B. EXERCISE

On average, over the *last 3 months*, how often have you exercised (including going on walks, riding a bicycle, etc.)? _____ If you exercise more than once a day, please count the *total number of times* that you exercise in a typical week. _____ times a week

On average, how long do you exercise each time? _____ minutes

*What percentage of your exercise is aimed at controlling your weight?

_____ 0% _____ less than 25% _____ 25%-50% _____ more than 75% _____ 100%

C. BINGE EATING

Please remember in answering the following questions that an eating binge *only* refers to eating an amount of food that others of your age and gender regard as *unusually large*. It does *not* include times when you may have eaten a normal quantity of food that you would have preferred not to have eaten.

*Have you *ever* had an episode of eating an amount of food that others would regard as *unusually large*?
_____ Yes _____ No

If *no*, please skip to Question D.

How old were you when you *first* had an eating binge? _____ years old

How old were you when you began binge eating on a *regular* basis? _____ years old

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*During the *last 3 months*, how often have you typically had an eating binge?

_____ I have not binged in the last 3 months.
_____ Monthly I usually binge _____ times(s) a month.
_____ Weekly I usually binge _____ time(s) a week.
_____ Daily I usually binge _____ times(s) a day.

*At the *worst* of times, what was your average number of binges per week? _____ binges per week

How long ago was that? _____ months ago _____ at its worst right now

If you have not binged in the last 3 months, please skip to Question D.

*Do you feel out of control when you binge?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

Do you feel that you can stop once a binge has started?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

Do you feel that you can prevent a binge from starting in the first place?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

Do you feel that you can control your *urges* to eat large quantities of food?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

Do you feel distressed by your bingeing?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

Do you find bingeing pleasurable?

_____ Never _____ Rarely _____ Sometimes _____ Often _____ Usually _____ Always

D. PURGING

*Have you *ever* tried to vomit after eating in order to get rid of the food eaten? _____ Yes _____ No

If no, please skip to Question E.

How old were you when you induced vomiting for the first time? _____ years old

*During the *last 3 months*, how often have you typically induced vomiting?

_____ I have not vomited in the last 3 months.
_____ Monthly I usually vomit _____ time(s) a month.
_____ Weekly I usually vomit _____ time(s) a week.
_____ Daily I usually vomit _____ time(s) a day.

*At the *worst* of times, what was your average number of vomiting episodes per week?

_____ vomiting episodes per week
How long ago was that? _____ months

E. LAXATIVES

*Have you *ever* used laxatives to control your weight or "get rid of food?" _____ Yes _____ No

If no, please skip to Question F.

How old were you when you *first* took laxatives for weight control? _____ years old

How old were you when you began taking laxatives for weight control on a *regular* basis? _____ years old

*During the *last 3 months*, how often have you taken laxatives for weight control?

_____ I have not taken laxatives in the last 3 months.

_____ Monthly I usually take laxatives _____ time(s) a month.

_____ Weekly I usually take laxatives _____ time(s) a week.

_____ Daily I usually take laxatives _____ time(s) a day.

How many laxatives do you usually take each time? _____ laxatives

What kind of laxatives do you take? _____

*At the *worst* of times, what was the average number of laxatives that you were taking per week?

_____ laxatives per week

How long ago was that? _____ months

F. DIET PILLS

*Have you *ever* taken diet pills? _____ Yes _____ No

If no, please skip to Question G.

*During the *last 3 months*, how often have you typically taken diet pills?

_____ I have not taken diet pills in the last 3 months.

_____ Monthly I usually take diet pills _____ time(s) a month.

_____ Weekly I usually take diet pills _____ time(s) a week.

_____ Daily I usually take diet pills _____ time(s) a day.

*At the *worst* of times, what was the average number of diet pills that you were taking per week?

_____ diet pills per week

How long ago was that? _____ months

G. DIURETICS

*Have you *ever* taken diuretics (water pills) to control your weight? _____ Yes _____ No

If no, please skip to Question H.

*During the *last 3 months*, how often have you typically taken diuretics?

_____ I have not taken diuretics in the last 3 months.

_____ Monthly I usually take diuretics _____ time(s) a month.

_____ Weekly I usually take diuretics _____ time(s) a week.

_____ Daily I usually take diuretics _____ time(s) a day.

*At the *worst* of times, what was the average number of diuretics that you were taking per week?

_____ diuretics per week

How long ago was that? _____ months

H. MENSTRUAL HISTORY *(For females only)*

*Have you ever had a menstrual period? _____ Yes _____ No

If **no**, please skip to Question I.

How old were you when you first starting menstruating? _____ years old

*Do you have menstrual periods now? *(Check one)*

_____ Yes, regularly every month.

_____ Yes, but I skip a month once in a while.

_____ Yes, but not very often (for example, once in 6 months).

_____ No, I have not had a period in at least 6 months.

_____ No, I am postmenopausal, have had a hysterectomy, or am pregnant.

_____ *How long has it been since your last period? _____ months

*Have you ever had a period of time when you did not menstruate for 3 months or more (excluding pregnancy)? _____ Yes _____ No

If yes, how old were you when you *first* missed your period for 3 months or more? _____ years old

For how many months did you miss your period? _____ months

How much did you weigh when you stopped menstruating? _____ pounds

Are you currently taking birth control pills? _____ Yes _____ No

If yes, how old were you when you first started using the pill? _____ years old

I. CURRENT MEDICATION

Are you currently taking any medication prescribed by a physician? _____ Yes _____ No

If yes, please list the medications you are taking.

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