



## Original Research—CME

# Are Elite Female Soccer Athletes at Risk for Disordered Eating Attitudes, Menstrual Dysfunction, and Stress Fractures?

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## Abstract

**Objective:** To determine the prevalence of stress fractures, menstrual dysfunction and disordered eating attitudes in elite female soccer athletes.

**Design:** Cross-sectional descriptive study.

**Setting:** Female soccer athletes were recruited from a national level youth soccer club, an NCAA Division I university team, and a women's professional team.

**Participants:** Two hundred twenty female soccer athletes with a mean age of  $16.4 \pm 4$  years and BMI of  $20.8 \pm 2$  kg/m<sup>2</sup> completed the study, representing all athletes from the included teams.

**Methods:** One-time surveys completed by the athletes.

**Main Outcome Measurements:** Height and weight were recorded, and body mass index (BMI) was calculated for each athlete. Athletes reported age of menarche, history of missing 3 or more menses within a 12-month period and stress fracture. The Eating Attitudes Test (EAT-26) was used to assess the athlete's body perception and attitudes toward eating.

**Results:** Of the 220 soccer athletes, 3 athletes (1.6%) had a low BMI for their age, and 19 (8.6%) reported stress fractures of the lower extremity. Among athletes who had reached menarche, the average onset was  $13 + 1$  year; menstrual dysfunction were present in 21 (19.3%). On the EAT-26, 1 player scored in the high risk range ( $>20$ ) and 17 (7.7%) scored in the intermediate risk range (10-19) for eating disorders. Athletes with an EAT-26 score  $\geq 10$  points had a significantly higher prevalence of menstrual dysfunction in the past year compared to athletes with an EAT-26 score of less than 10 ( $P = .02$ ).

**Conclusions:** Elite female soccer athletes are susceptible to stress fractures and menstrual dysfunction and have delayed onset of menarche despite normal BMI and appropriate body perception and attitudes towards eating. Further studies are needed to better understand stress fracture risk in female soccer athletes and in other team sports to determine how these findings relate to long-term bone health in this population.

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## Introduction

The combination of disordered eating, amenorrhea, and osteoporosis in female athletes was first recognized and defined as the Female Athlete Triad (Triad) in 1992 by the American College of Sports Medicine [1,2]. The updated position statement in 2007 defined the Triad as a spectrum of energy availability, menstrual function, and bone health [3]. Menstrual dysfunction and restrictive eating in adolescence is associated with low bone mineral density, which has been shown to persist at 4.7 and 6 years despite resumption of normal menses [4,5]. The prevalence of all 3 components of the

Triad ranges from 1%-14%. Up to 78% of female athletes [6] have at least 1 of the 3 components of the Triad [6-12]. Burrows and colleagues [13] suggest that the Triad components do not identify all females at risk and that exercise-related menstrual dysfunction, eating disorders, and osteopenia may be more appropriate markers of risk.

Studies have surveyed female athletes involved in various sports and levels of play regarding the components of the Triad [6-12,14], but little is known about components of the Triad as they pertain specifically to soccer. In a study of 17 Norwegian national soccer team athletes, 24% had an eating disorder, 9.3%

had menstrual dysfunction, and 13% had a history of stress fracture [15]. All athletes had normal bone mineral density. The percentage with menstrual dysfunction is higher than that reported in the general population in data from the National Health Interview Survey, which demonstrated a prevalence of 5.3% for menstrual dysfunction in U.S. women between 1984 and 1992 [16]. Although the number of reports in the literature of lower extremity stress fractures in female soccer athletes is small [17-22], a study by Yildirim and colleagues [23] found that 21 female soccer athletes had 32 focal tracer uptake changes in the femur and tibia on a 3-phase bone scan consistent with bone stress injuries. The authors concluded that stress fractures are likely underdiagnosed and treated.

Of the 18 million Americans who play soccer, 78% are younger than 18 years and more than 40% are female [24]. Since the inception of Title IX, female participation in the National College Athletic Association (NCAA) sports program has increased by greater than 5-fold from 1972 to 2008 [25,26].

Women's collegiate soccer increased from 1855 athletes on 80 teams during the 1981-1982 season to 22,682 athletes on 956 teams during the 2007-2008 season, making women's soccer the NCAA sport with the greatest number of athletes [25]. Concurrently, the number of girls playing high school soccer in the United States has also grown from 700 in 1972-1973 to 344,534 in 2008-2009 [24].

Given the increasing prevalence of female soccer participation in the United States, particularly among youths and adolescents, a large number of female athletes may be at risk for developing components of the Triad or the Triad itself. The purpose of this study is to determine the prevalence of stress fractures within the previous 2 years, menstrual dysfunction 1 year after the onset of menses, and disordered attitudes toward body perception and eating attitudes in an elite group of female soccer athletes.

## Methods

After obtaining Institutional Review Board approval, female soccer athletes were recruited from a youth soccer club, an NCAA Division I university team, and a women's professional team. Athletes were recruited at the beginning of their respective competitive seasons in 2009-2010. One team from each year of age for the grade school, middle school, and high school girls were recruited. These athletes were considered elite for their age group because they were competing at the highest possible level of play, including the youth soccer club athletes who competed regionally and nationally. Athletes completed questionnaires regarding their age, height, weight, age at menarche, menstrual function, history of an eating disorder, and a detailed

history of musculoskeletal injuries, including stress fractures. All responses were self-reported. Athletes were asked their age at onset of menses. For any year after the first year of menses, athletes were asked if they had missed 3 menstrual cycles within a 12-month period. Stress fractures were recorded if they had been confirmed by a physician. All athletes reported soccer to be their only or primary sport. The grade school and middle school athletes did participate in other sports and play.

The Eating Attitudes Test (EAT-26) was administered to the athletes to assess their body image perception, attitudes toward eating, and eating behaviors. The EAT-26, validated by Garner et al [27], assigns 0 to 3 points to each of the 26 questions for a maximum of 78 possible points. A score of 20 or higher indicates an at-risk individual, and a score of 10-19 indicates an intermediate-risk individual.

All athletes from each team participated in the study. Data were analyzed on the basis of competitive level of experience: grade school/middle school, high school, collegiate, and professional levels. Menstrual dysfunction was defined as a disruption in the normal menstrual cycle or onset of menarche at 15 years of age or older [28,29]. Athletes 1 year past the onset of menarche were asked if they had a history of 3 or more missed periods in the past year [29]. The percentages and mean for the entire group and each subgroup were determined for the EAT-26, menstrual function, body mass index (BMI), and self-reported history of stress fractures. Comparisons between subgroups were completed for the EAT-26 using a  $\chi^2$  analysis. Unless otherwise noted, data are reported as mean  $\pm$  standard deviation. All analyses were performed by a research statistician who used SAS software (SAS Institute Inc, Cary, NC).

## Results

The study was completed by all athletes from each team that was invited to participate. Two hundred twenty female soccer athletes ranging from preadolescent (10 years old) to adult (30 years old) with a mean age of  $16.4 \pm 4$  years were enrolled and completed the questionnaires. On average, athletes participated in  $9.5 \pm 6$  (range,  $5.2 + 2$  to  $17.9 + 5$ ) hours of organized soccer training per week.

Seventy-five athletes aged 10-14 years were in the grade school/middle school group (34.0%); 81 athletes aged 15-17 years were in the high school group (36.8%); 28 athletes aged 18-21 years were in the collegiate group (12.7%); and 36 athletes aged 19-30 years were in the professional group (16.3%). The average BMI for all groups was  $20.8 + 2$  kg/m<sup>2</sup>, with no significant difference by age (Table 1). Only 3 athletes (1.6%) were considered underweight based on their BMI (ie, a BMI of less than the 5th percentile for their age up to age

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