

Original Research

# Prevalence of Risk Factors of the Female Athlete Triad among Young Elite Athletes of Pakistan

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### Background

Female athletes who are not vigilant about their food choices and choose extraneous physical activities may head towards negative health effects.

### Purpose

The purpose was to determine the prevalence of risk factors that may lead to the Female Athlete Triad among young elite athletes in Pakistan.

### Study Design & Methods

A cross sectional questionnaire-based study was conducted in 2018 at Pakistan Sports Board to investigate the risk factors of The Female Athlete Triad among young elite athletes based in national training camps of major metropolitan cities. Trained and professional female elite athletes of age 18 – 25 years, able to comprehend questionnaire in English were included. Athletes completed the questionnaire including demographics, educational qualifications, Body Mass Index, sports participation, and playing hours. The Eating Aptitude Test-26 (EAT-26) and questionnaires on risks of amenorrhea and risks of low bone mineral density were completed. Individual prevalence of the risk factors of three components was assessed. The data were analyzed using SPSS-20 and descriptive statistics applied.

### Results

A sample of 60 elite athletes, ( $23.57 \pm 2.37$  years, BMI  $21.97 <u">+1.90$ ) who participated in various sports were included. EAT-26 results indicated that 50% of athletes were at risk of an eating disorder. Disordered Eating behaviors in need of referral were identified in 83.3%. Risks for amenorrhea were identified in 15%, and concerning low Bone Mineral Density, no risks were identified, except the intake of caffeinated beverages in 51.7%.

### Conclusion

The prevalence of risk for disordered eating was found to be significant among female elite athletes of Pakistan, but risk of amenorrhea and low bone mineral density were not of major concern.

### Level of evidence

3b

## INTRODUCTION

In sports, amazing feats of physical, mental, and skill are

common.<sup>1</sup> An elite athlete strives hard and excels above their baseline level of participation, devoting their energy and time to grooming their individual talents. This helps

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them become a performance perfectionist in their field.<sup>2</sup> Doing more is their way of life.<sup>3</sup> The operational definition of an elite athlete for this manuscript is an athlete that was a member of a national squad representing their country nationally and internationally in a team or individual sport.

When gender specificity is considered, the number of young females participating in constant physical training, athletic activities, recreational games, and elite sport competitions has increased astonishingly in last three decades. These female athletes display amazing talent all over the globe. However, such training and talent offers another challenge for sports scientists and practitioners: the need for developing unique training programs for young female athletes according to their individual sports requirements.<sup>4</sup> Despite many good outcomes, there are certain associated risks with sports involvement. Young female athletes are prone to various health risks with sports related injuries.<sup>5</sup> Several major medical conditions are reported in young female athletes including disordered eating, menstrual cycle disturbance, and impaired bone mineral health. The female athlete triad (FAT) was initially described by Women's task force of the American College of Sports Medicine (ACSM) in 1992. Not only the ACSM but also the International Federation of Sports Medicine (FIMS) in collaboration with International Olympic Committee (IOC) have developed a consensus statement on the FAT.

The FAT is characterized by a negative balance of energy. Eating disorders and disordered eating are not gender specific, and includes Relative Energy Deficiency in Sport (RED-S). RED-S is related to the FAT and describes the interrelationship among low energy availability (with or without disordered eating) and various body systems. Due to energy imbalance, females are prone to menstrual disturbances and the development of low bone mineral density (BMD).<sup>6</sup> The interrelated nature of these three components affects the overall health of female athletes. Restrictive eating and routine strenuous or prolonged exertion can cause energy deficits, which changes hormonal levels in the body, affecting the reproductive system and ultimately the menstrual cycle is disturbed and if balance not regained, may be followed by negative effects on bones. This multifaceted syndrome is based on insufficient balance between energy intake and energy expenditure.<sup>7</sup> If not considered promptly, the triad may have irreversible health consequences, either of individual facets or all three in combination.<sup>8</sup>

A review of sixty-five studies ( $n = 10,498$ , age =  $21.8 \pm 3.5$  years, body mass index =  $20.8 \pm 2.6$  kg·m; mean  $\pm$  SD) examined the prevalence of collective triad and individual components of the FAT. It aimed to describe the prevalence of the FAT in both lean versus non-lean sports in young athletes.<sup>9</sup> Gharib et al. investigated the triad's long-term complications and suggested that a multidisciplinary approach involving family members and coaches be employed to address health concerns.<sup>10</sup> A study by Barrack et al. updated the prevalence rates of the three components of the female athlete triad present in athletes.<sup>11</sup> Miller et al. investigated whether Australian exercising women were aware of the FAT and its consequences including energy deficiency, menstrual disturbances, and low BMD. A total 191 females between the ages of 18-40 completed the survey.<sup>12</sup> Melin et al. recruited a population from the Danish and

Swedish sport federations and aimed to examine associations between the three components and the prevalence of triad-associated conditions in endurance athletes. Forty active, exercising women participated in the study which included gynecological examination with assessment of bone health, analysis of diet, and blood analysis.<sup>13</sup> Goodwin conducted a study to profile components of the FAT among elite female athletes and non-athletes in which 25 athletes and 14 non-athletes provided their data for energy availability, menstrual function, and physical activity. Dual Energy X-rays Absorptiometry (DEXA) was done to find their Bone Mineral Density (BMD) respectively.<sup>14</sup> De Souza et al and Sundgot Borgen et al. sought to discern the prevalence of severe menstrual disturbances in exercising females and disordered eating in elite athletes involved in high intensity training. Almost half of the exercising females had menstrual disturbances and suboptimal eating habits and routines and the authors suggested that such athletes need family and team support to manage healthy eating habits.<sup>15,16</sup> Prather et al. screened and assessed 220 elite female soccer athletes for being at risk of disordered eating attitudes, menstrual dysfunction and stress fractures and found these athletes were susceptible to stress fractures and menstrual disturbances.<sup>17</sup> In female skaters, prevalence and correlation of eating disorders were studied by Voelker et al. who discussed body dissatisfaction and concern of weight and appearance as major problem.<sup>18</sup> Finally, Amrinder found that both athletes non-athletes had risk factors for the triad, hence educating the females is of utmost priority.<sup>19</sup>

A significant number of studies have been conducted internationally to determine the prevalence of risk factors of the FAT in elite athletes. Authors have described the risk factors and prevalence of the triad components individually or as a whole condition. But in Pakistan, no significant work has been done, and the FAT remains underreported concerning prevalence, prevention, awareness, screening and treatment. Therefore, the purpose of this study was to determine the prevalence of risk factors that may lead to the FAT among young elite athletes in Pakistan.

## METHODS

This was a cross sectional study conducted from July 2018-Jan 2019 at Pakistan Sports Board, which is the governing body to regulate the sports sector in Pakistan. The study variables consist of risk factors for disordered eating, risks for menstrual disturbances, and risk factors for low BMD in elite female athletes.

A questionnaire consisting of demographics, educational qualification, BMI, sports participation and risk factors' concerning the FAT was developed by the authors under supervision. It included three parts: The Eating Aptitude Test-26 (EAT-26) for risk of eating disorders, and two self-structured questionnaires for risks of amenorrhea and low BMD (Appendix A). The World Health Organization (WHO) guidelines for tool development were followed for development of the questionnaires. After proofreading, both tools were piloted on a study sample of 20 participants, as a result both questionnaires were found to be reliable and valid for further use. The finalized version of the questionnaire the

**Table 1. Demographic details of age, height and weight**

Variable	Mean±SD
Age(years)	23.57±2.4
Height(inches)	64.43±2.2
Weight(kg)	55.95±9.65

**Table 2. Demographic details of educational qualification, BMI, type of sports and training hours of included female athletes**

Variables		n(%)	Variables		n(%)
Qualification	Under matriculation	1(1.7%)	Type of Sports	Martial arts/ taekwondo	5(8.3%)
	Matriculation	6(10%)		Squash	6(10%)
	Intermediate	20(33.3%)		Handball	10(16.7%)
	Bachelors	28(46.7%)		Jump, throw, running	8(13.3%)
	Masters	5(8.3%)		Badminton	6(10%)
Body mass Index(BMI)	Underweight	9(15%)		Swimming	6(10%)
	Healthy weight	48(80%)		Table tennis	7(11.7%)
	Overweight	1(1.7%)		Volleyball / Basketball	12(20%)
	Obese	2(3.3%)		Training hours	4 hours/day
		5 hours/day			24(40%)
		6 hours/day	20(33.3%)		

risks of amenorrhea section had 13 items ( $r=0.82$ ) and risks for low BMD ( $r = 0.76$ ) section had 16 items.

The EAT-26; is a widely used self-reported standardized screening measure used to assess eating disorder risk. The EAT-26 is the short version of EAT-40, which is highly reliable and valid measure. It was formulated to screen if someone needs professional assistance for an eating disorder. It is rated on six-point scale (always, usually, often, sometimes, rarely, and never) based on how often the individual engages in specific behaviors and has three sub-scales: dieting, bulimia, and food preoccupation and oral control. The EAT-26 correlates highly with the original EAT-40 scale ( $r = 0.98$ ). Test-retest reliability for EAT-26 has ranged from .84 to .89.<sup>20</sup> The average administration time of EAT-26 is approximately two minutes. Scores on the EAT-26 above than 20 are better and give an indication for need of further assessment by a professional, whereas scores less than 20 can be an indication of serious eating problems or referral. Consent was given on every questionnaire from the participants.

All the athletes that participated in national as well as international tournaments came under the jurisdiction of Pakistan Sports Board, which is the governing body to regulate the sports sector in Pakistan. Ethical approval for this study was granted from Internal Review Board of Riphah International University, Islamabad. Non-probability convenient sampling technique was used to select a total of 60 female elite athletes from metropolitan cities like Karachi, Lahore and Islamabad who attended National and Regional

training camps.<sup>21-23</sup> The inclusion criteria included: trained and professional female elite athletes of Pakistan, menstrual-age females without a diagnosed eating disorder any menstrual disturbance or osteoporosis, and those who could easily interpret the questionnaire language(English).

## RESULTS

The sample size consisted of 60 elite female athletes of Pakistan and the three components of the FAT were assessed individually. Data were analyzed by descriptive statistical methods. Demographics of the subjects are provided below. (Table 1)

Regarding educational qualifications, the responses were: under matriculation, matriculation, intermediate certification, a bachelor's in any field, and master's degree holders.

All sixty female athletes were of 18-28 years of age. The athletes participated in a variety of different sports including: Martial arts/ Taekwondo, Squash, Handball, Jump/ Throw/Running sports, Badminton, Swimming, Table tennis and Volleyball or Basketball. The BMI was calculated for each player and categorized as underweight, healthy weight, over-weight, or obese as per the definition of United States Center for Disease Control and Prevention and three subcategories regarding training hours were reported. (Table 2)

EAT -26 scoring results are presented in Table 3. Fifty percent of the sample displayed a risk for an eating disorder.

**Table 3. Frequency of major risk factors of The Triad**

Variables		n(%)	Variables		n(%)	
Risk of Eating Disorder	Yes	30 (50%)	Menstrual Cycle in past 12 months	10-12 cycles	51 (85%)	
	No	30 (50%)		4-9 cycles	7 (11.7%)	
	Total	60 (100%)		< 4 cycles	2 (3.3%)	
Eating disordered behaviors'	Binge eating	31 (51.7%)		Total	60 (100%)	
	Vomiting	16 (26.7%)		Intake of caffeinated beverages (that may affect bone mineralization)	Yes	31 (51.7%)
	Abusing laxatives	39 (65%)			No	29 (48.3%)
	Intensive training routine	12 (20%)	Total		60 (100%)	
	Total	60 (100%)				

Disordered eating behaviors and their prevalence of binge eating, vomiting, abusing laxatives and with intensive training routines were also recorded, and 83.3% of the athletes engaged in different categories of disordered eating behaviors.

Amenorrhea risks are also presented in [Table 3](#), 24 (40%) females reported menarche at 14, 17 (28.3%) when they were 13, and 14 (23.3%) at 15 years of age. Fifty-one (85%) reported regular menstrual cycles whereas seven (11.7%) reported 4-9 cycles past year and only two (3.3%) reported less than four cycles over the year. On response to a question if they ever missed menstrual cycles 23 (38.3%) said yes and when asked about the regularity of their cycles 51 (85%) reported regular and nine (15%) reported irregular cycles. With change in intensity, frequency and duration of training 29 (48.3%) reported changes in their menstrual cycle whereas 45 (75%) reported no changes and out of all significant stressors in their lives, most commonly reported were: family stress in 25 (41.7%), 12 (20%) said financial, seven (11.7%) had professional, and four (6.7%) reported other stressors like hostel life and peer pressure, respectively. When asked regarding intensive training and exercises, 28 (46.7%) reported an intensive routine, and 32 (53.3%) did not participate in intensive exercises. Out of all subjects, only three (5%) were on estrogen supplementation, four (6.7%) on steroids/thyroid hormones, and eight (13.3%) took diuretics or weight reducing drugs.

Risk factors for low BMD were less common, and only one (1.7%) reported history of vertebral stress fracture, parents of eight (13.3%) had ever sustained a hip fracture, nine (15%) were smokers, two (3.3%) were on steroids for three months or longer, and only two reported drinking three to four alcoholic drinks per day. Most commonly reported was the intake of caffeinated beverages (51.7%). ([Table 3](#))

History of medications showed that 12 (20%) took no

medications, 18 (30%) took calcium, and 30 (50%) took vitamin D. Those who performed weight bearing exercises regularly were 21 (35%).

## DISCUSSION

According to review of several studies on the prevalence of individual and combined components of the female athlete triad, the presence of all three aspects of the triad in athletes is less well investigated than reporting on individual components. Most of the prior authors have reported the presence of one or two of the three components of the triad, which is similar to the results of the current study which shows risk factors for eating disorders. Sixty elite athletes (23.57 ± 2.37 years, BMI 21.97 ± 1.90) who participated in various sports were included. EAT -26 results indicated that 50% of athletes were at risk of an eating disorder. Disordered Eating behaviors in need of referral were identified in 83.3%. Risks for amenorrhea were identified in 15%, and concerning low bone mineral density, no risks were identified, except the intake of caffeinated beverages in 51.7%.

A review of 65 studies<sup>9</sup> (n=10,498, age= 21.8 ± 3.5 years, BMI = 20.8 ± 2.6 kg•m; mean ± SD) that evaluated the prevalence of triad risk factors and clinical conditions in exercising women showed that only small percentage of athletes (0%-15.9%) in nine studies exhibited all three components of the triad. In this same study the presence of two or any one of the Triad conditions ranged from 2.7% to 27.0% and from 16.0% to 60.0%, respectively, whereas the results of this study were different indicating 50% of athletes (age in years = 23.57±2.4) were at risk of eating disorders with only one presenting with highest risk, only 15% reported amenorrhea risk, and none really reported any risks concerning low BMD except caffeinated beverages intake.

Barrack et al. studied the prevalence of the three com-

ponents of the FAT and found the occurrence was very low (0-16%). When one or two components were considered, the percentage of affected athletes was 50-60% which is partially consistent with the results of the current study as one component was high with 50% females at risk of eating disorders, however risk for amenorrhea was only 15% and low BMD was almost negligible with only beverages intake reported in 51.7% elite athletes of Pakistan. It appears that FAT prevalence as a syndrome (all three parts) is low in Pakistani athletes as others have found.<sup>11,12</sup>

Another review study by Gharib Nazem, et al.<sup>10</sup> suggested that early detection of risk factors leading towards the triad is very important to minimize the complications of the FAT. Clinical features associated with aspects of the triad often do not always appear initially, therefore prevention is the best measure. Diagnosis and treatment come later and should involve interdisciplinary therapeutic approach

Singh Amrinder et al.<sup>19</sup> studied prevalence of the FAT and its associated risk factors and amongst 200 athletes from India, and only seven (3.5%) participants of the total sample were determined to have all aspects of the triad. Of the 200, 49 (24.5%) were at risk of an eating disorder, 48 (24%) had irregular menstrual cycles, and 51 (25.5%) were at risk for osteoporosis. Whereas in the current study of 60 elite athletes the most prevalent risk factor was for eating disorder found in 30 (50%) participants and no athlete presented with risk for all three complications.

Cross-sectional studies may be limited by the presence of uncontrolled factors. This study had limitations including that the athletes were not assessed for their energy availability status. Secondly, the athletes completed these questionnaires at varied times (in season or out of season) in their sports related specific training, and this may have had an impact on the risk factors. Finally, the nutritional behaviors and life style factors/choices of the athletes were not recorded and may also have affected the results.

## CONCLUSION

The presence of all three components of the triad in athletes appears very low in Pakistan; with the greatest num-

ber of the athletes showing risk for eating disorders/disordered eating. Amenorrhea risk factors appear to be low in Pakistani athletes as 85% reported regular menstrual cycles. Among all studied risks associated with bone health, only the ingestion of caffeinated beverages was noted as a possible risk with 51.7% of the athlete's reporting consumption.

This study may be used to inspire further research, prevention, practice, education, awareness, and screening related to the FAT in Pakistan. The authors recommend that awareness regarding the female athlete triad syndrome and its risk factors be provided for all young female athletes of Pakistan.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval of the study was sought from Riphah Internal Review Board, Islamabad, Pakistan.

## CONSENT FOR PUBLICATION

Written informed consent was obtained from all the participants.

## FUNDING

None

## CONFLICT OF INTEREST

The authors declare 'No Conflicts of Interest' financial or otherwise.

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## SUPPLEMENTARY MATERIALS

### **Appendix A**

Download: [https://ijspt.scholasticahq.com/article/31641-prevalence-of-risk-factors-of-the-female-athlete-triad-among-young-elite-athletes-of-pakistan/attachment/79414.docx?auth\\_token=NfCvIDU04wB2TFTeTCH](https://ijspt.scholasticahq.com/article/31641-prevalence-of-risk-factors-of-the-female-athlete-triad-among-young-elite-athletes-of-pakistan/attachment/79414.docx?auth_token=NfCvIDU04wB2TFTeTCH)

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