DOI: https://doi.org/10.53350/pjmhs22162689

ORIGINAL ARTICLE

Eating Attitudes, Menstruation Cycles and Physical Profiles of Turkish Female Elite Artistic Gymnasts

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ABSTRACT

It is thought that female artistic gymnasts (AG) who do long-term and high-intensity exercise and whose body fat percentage should be low may have disorders in their eating attitudes and menstruation cycles. These problems can lead to poor performance and, more importantly, undesirable health problems in the future. Therefore, the aim of this study is to examine the eating attitudes, menstrual cycles and physical profiles of female elite AG who train for long periods and at high intensity. Thirteen elite female AG participated in this study (Turkey National Team gymnasts). The height of all participants was measured with an ultrasonic height meter (Langen Messstab 5003, Germany). Body weight, body mass index (BMI), body fat percentage, total muscle mass, bone mineral weight, basal metabolic rate and body fluid ratios were determined by body composition monitor (Tanita BC 401, Japan). Eating attitudes of the participants were determined with the Eating Attitudes Test (EAT-26). With the Menstrual Cycle Form, the participants' menstrual cycles, pain conditions during menstruation, whether they had a gynecological operation, whether they gave birth or not, and the use of oral contraceptive pills were obtained. Training histories and temporal training intensities were determined with the Training Information Form. The EAT-26 Test results, which were within the normal range in the results of this study, were not different in gymnasts with and without menarche ($p<0.05$). However, the fact that 46.2% (6 gymnasts) of the elite female AG with a mean age of 18.31 ± 4.54 years did not start menarche, suggesting primary amenorrhea in these athletes.

Keywords: Female artistic gymnasts, eating attitudes, menstruation cycles, physical profiles

INTRODUCTION

It is known that exercise has many beneficial effects on health (Vina et al., 2000; Packer, 1997). Moderate regular physical exercises (40-60% maxVO2), eg; It is recommended for primary and secondary prevention of many chronic diseases and psychological disorders such as cancer, cardiovascular diseases, diabetes, osteoporosis, obesity and depression (Atalay, & Laaksonen, 2002; Hen, 2010). While exercise provides significant health benefits, intensive physical activity levels can pose some risks, especially for female athletes. The pressure of reproductive function in female athletes who are interested in sports branches where low body weight is associated with high performance is a neuroendocrine adaptation to calorie deficiency (Warren, & Perlroth, 2001).

Disordered eating behavior, amenorrhea and osteoporosis, which are called the "female athlete triad", are common in elite female athletes (Birch, 2005; Otis et al.,1997). The "female athletes triad" is particularly common among athletes who train and compete intensely in dance and sport, emphasizing traditional aesthetic criteria of slenderness (Abraham, 1996a; Abraham, 1996b; Garner, & Garfinkel, 1980; Sundgot-Borgen, 1994; Sundgot-Borgen, 1996; Sundgot-Borgen, & Torstveit, 2004). Both reproductive and metabolic hormonal profiles of amenoric women engaged in these sports are in line with those of amenoric women with eating disorders such as anorexia nervosa (AN). Thus, dietary restriction and associated metabolic adaptations may be important causative factors in the menstrual dysfunction of these athletes.

Artistic gymnastics is a physically demanding sport that requires flexibility, agility, and extreme upper and lower body strength (Desai et all, 2019). At the same time, movements / routines should be performed with an ideal aesthetic presentation. Weight control can be difficult for gymnasts in artistic gymnastics, where visuality is at the forefront. It is thought that AG who do long-term and high-intensity exercise and need to have a low body fat percentage may have disorders in their eating attitudes and menstrual cycles. These problems can cause poor performance and more importantly, undesirable health problems in the future. Therefore, the aim of this study is to examine the eating attitudes, menstrual cycle patterns and physical profiles of female elite AG who train for long periods and at high intensity.

MATERIAL AND METHODS

Participants: Thirteen elite female artistic gymnasts (AG) participated in this study (Turkey National Team gymnasts).
Procedure: The height of all participants was measured with an ultrasonic height meter (Langen Messstab 5003, Germany). Body weight, body mass index (BMI), body fat percentage, total muscle mass, bone mineral weight, basal metabolic rate and body fluid ratios were determined with body composition monitor (Tanita BC 401, Japan).

Eating attitudes of the participants were determined with the Eating Attitudes Test (EAT-26). EAT-26 is a test developed by Garner et al., 1982. For the EAT-26, 20 points is considered the cutoff point. A score of 20 and above is defined as "abnormal eating behavior", and values less than 20 points are defined as "normal eating behavior". The EAT-26 was adapted into Turkish by Devran, 2014 and used as a measurement tool in his study. However, EAT-26 alone does not provide a specific eating disorder diagnosis. Scores greater than 20 indicate further investigation by a qualified professional. Low scores (below 20) may still be consistent with severe eating problems, as denial of symptoms can be a problem in eating disorders. Results should be interpreted in conjunction with body weight history, current BMI, and percent ideal body weight.

With the Menstrual Cycle Form, the participants' menstrual cycles, pain conditions during menstruation, whether they had a gynecological operation, whether they gave birth or not, and the use of oral contraceptive pills were obtained. Training histories and temporal training intensities were determined with the Training Information Form. Eating attitudes, menstrual cycle patterns and physical profiles of gymnasts were analyzed. Differences in eating attitudes and physical profiles of gymnasts with and without menarche were determined.

Statistical Analysis: SPSS 23.0 program (SPSS Inc., Chicago, IL) was used for statistical analysis of the study. Within the scope of the research, descriptive statistics, frequency and Independent Sample T-Test analyzes were performed. Whether the data showed normal distribution or not was analyzed with the Shapiro-Wilk Test. Descriptive statistical analyzes were performed to determine the mean±standard deviation values of the participants' eating attitudes and physical profiles. Menstrual cycles were evaluated with frequency analysis. Differences in eating attitudes and physical profiles of gymnasts with and without menarche were analyzed with the Independent Sample T-Test. The level of significance in the analyzes was $p<0.05$.

RESULTS

It was determined that 13 elite female artistic gymnasts (AG) participating in this study trained for 30 hours a week, 5 hours a day, 6 days a week on mean (age: 18.31 ± 4.54 years). The descriptive analysis results of the physical profiles and EAT-26 scores of elite female AG are shown in Table 1.

Table 1: Descriptive analysis results of the physical profiles and EAT-26 scores of elite female AG'.

(N= 13)	Mean ± Std. Deviation	Max	Min
Body Weight (kg)	51.48 ± 6.97	60.10	40.10
Height (cm)	157.23 ± 4.97	164.00	146.00
BMI	20.64 ± 2.08	23.70	16.90
Body Fat Ratio (%)	17.07 ± 5.32	24.10	8.00
Muscle Mass (kg)	39.91 ± 4.07	46.70	33.20
Bone Mineral Weight (kg)	2.14 ± 0.24	2.50	1.70
Basal Metabolic Rate (kcal)	1310.23 ± 117.71	1504.00	1117.00
Body Fluid Ratio (%)	59.67 ± 3.96	67.00	55.00
EAT-26	14,31 ± 6,79	27.00	3.00

Mean ± Std. Deviation; Mean ± Standart Deviation, **Max;** Maximum, **Min;** Minimum, **BMI;** Body Mass Index.

Frequency analysis of menstrual cycle data of 7 gymnasts with menarche is shown in Table 2.

Table 2: Frequency analysis of data on menstrual cycles of 7 gymnasts with menarche.

	Regular Menstruation		Pain during Menstruation		Gynecological Operation		Contraceptive Use		Delivery	
	N	%	N	%	N	%	N	%	N	%
Yes	5	71.4	6	85.7	-		-		1	14.3
No	2	28.6	1	14.3	7	100	7	100	6	85.7

N; Number of gymnast.

According to the information obtained in the Menstrual Cycle Form, it was determined that 53.8% (7 gymnasts) of the elite female AG had menstrution and 46.2% (6 gymnasts) did not have menarche. Of the gymnasts who started menarche, 71.4% (5 gymnasts) reported that they had regular menstruation, 28.6% (2 gymnasts) reported that they had irregular menstruation. While 85.7% of them said that they experienced pain during menstruation, 14.3% did not, it was determined that 1 gymnast gave birth.

The differences between the physical profiles and EAT-26 scores of elite female AG with and without menarche are shown in Table 3.

Table 3: Differences between physical profiles and EAT-26 scores of elite female artistic gymnasts with and without menarche.

	Gr 1 (N=7)	Gr 2 (N= 6)	Mean ± Std. Deviation	t	P
Body Weight (kg)	Gr 1		55.83 ± 3.54	3.12	0.02*
	Gr 2		46.40 ± 6.65		
Height (cm)	Gr 1		159.57 ± 3.16	2.07	0.06
	Gr 2		154.50 ± 5.54		
BMI	Gr 1		21.86 ± 1.52	2.90	0.01*
	Gr 2		19.22 ± 1.76		
Body Fat Ratio (%)	Gr 1		20.24 ± 3.92	2.99	0.01*
	Gr 2		13.37 ± 4.35		
Muscle Mass (kg)	Gr 1		41.91 ± 2.93	2.21	0.05
	Gr 2		37.57 ± 4.16		
Bone Mineral Weight (kg)	Gr 1		2.26 ± 0.15	2.27	0.04*
	Gr 2		2.00 ± 0.25		
Basal Metabolic Rate (kcal)	Gr 1		1367.43 ± 91.00	2.16	0.05
	Gr 2		1243.50 ± 115.72		
Body Fluid Ratio (%)	Gr 1		57.04 ± 1.74	-3.53	0,01*
	Gr 2		62.73 ± 3.61		
EAT-26	Gr 1		16.29 ± 7.18	1.15	0.27
	Gr 2		12.00 ± 6.07		

Mean ± Std. Deviation; Mean ± Standart Deviation, **BMI;** Body Mass Index, **Gr 1;** Group 1: Onset of menarche gymnasts, **Gr 2;** Group 2: Menarche has not started gymnasts ***p<0.05.**

Independent Sample T-Test analysis results of gymnasts with menarche (Group I; Gr I) compared to gymnasts without menarche (Group II; Gr II); body weights (p= 0.02), BMI (p= 0.01), body fat ratio (p= 0.01), bone mineral weight (p= 0.04) and body fluid ratio (p= 0.01) were statistically significantly higher. There was no significant difference between Gr I and Gr II for EAT-26 results (Table 3).

DİSCUSSİON

In this study, which aimed to investigate the eating attitudes, menstruation cycles and physical profiles of elite female artistic gymnasts (AG), the EAT-26 descriptive analysis results of the gymnasts were found below 20 points (14.31 ± 6.79), which is considered 'normal eating behavior'. Considering the participants' body weight (51.48 ± 6.97 kg) and body mass index (BMI) means (20.64 ± 2.08), which were within the normal range of values, it was concluded that there was no problem with the eating attitudes of the AG' (Table 1). However, according to the frequency data analysis results obtained in the Menstrual Cycle Form, it was determined that 53.8% (7 gymnasts) of elite female AG menstruated and 46.2% (6 gymnasts) did not have menarche (Table 2). In the Independent Sample T-Test analysis results, the body weights (p= 0.02), BMI (p= 0.01), body fat ratio (p= 0.01), bone mineral weight (p= 0.04) and body weight of gymnasts with menarche (Group I; Gr I) fluid ratio (p= 0.01) was statistically significantly higher than the AG' without menarche (Group II; Gr II) (Table 3).

When exercise is performed without sufficient energy intake to compensate for the exercise-related energy expenditure, there may be negative effects on reproductive, bone and cardiovascular health (Weiss Kelly, & Hecht, 2016). To maximize gymnastics performance, it is emphasized that gymnasts in the growth and development period are exposed to the training stress created by their intense training, as well as various restrictions to maintain low-fat mass (Maimoun et al., 2016). Sports that require high levels of performance can expose young athletes to physical, mental, and emotional stress. This may cause many disorders in the central mechanisms that activate the hypothalamic-pituitary-adrenal axis (Skrzypulec-Plinta, & Drosdzol-Cop, 2017; Guebels et al., 2014; Triantafyllou et al., 2016). For this reason, it is emphasized that young female athletes may encounter situations such as delayed menarche (Czajkowska et al., 2019) and studies are showing that intense physical activity is a factor delaying menarche (Guebels et al., 2014; Gordon, 2017; Jacks et al., 2005). Castelo-Branco et al., 2006 found that 58% of ballerinas had regular menstrual cycles, 34% had oligamenorrhea, and 8% had amenorrhea. In the control group, they found that 75% had a regular menstrual cycle, 14% had oligamenorrhea, and the remaining 11% had polymenorrhea and menorrhagia. When the analyzes of menstrual disorders were examined, the rates of oligamenorea and amenorrhea in ballerinas were found to be significantly higher than the control group.

In this study, it was determined that 46.2% (6 gymnasts) of the elite female AG with a mean age of 18.31 ± 4.54 years did not have menarche. The fact that the eating attitudes of gymnasts who train for 30 hours a week are in the normal range indicates intense training loads for gymnasts who are at the age limit (or delayed) of menarche. This result is compatible with the literature (Guebels et al., 2014; Czajkowska et al., 2019; Gordon, 2017; Jacks et al., 2005; Castelo-Branco et al., 2006). Primary amenorrhea is defined as the absence of menarche by the age of 15 years (Maimoun et al., 2016). The findings in this study may suggest primary amenorrhea for elite female AG without menarche. In addition, the fact that the body weights, BMI, body fat ratio, bone mineral weight, body weight and body fluid ratio of gymnasts with menarche were statistically significantly higher than those of non-menarche gymnasts in this study, suggesting that these results are related to hormonal changes during the developmental period (Table 3). Hypothalamic disorders associated with intensive exercise and the resulting disturbance of gonadotropin-releasing hormone (GnRH) pulsatility are thought to result in delayed menarche and amenorrhea. It can be said that the pressure of reproductive function in women who are interested in sports branches where low body weight is thought to increase performance is a neuroendocrine adaptation to calorie deficiency (Warren, & Perlroth, 2001).

Rosen, & Hough, 1988 found that 75% of overweight gymnasts resort to pathogenic techniques to control their weight. It has been reported that stress may be associated with menstrual disorders (Stefani et al., 2016). The female athlete triad has been recognized as three interrelated conditions of amenorrhea, osteoporosis, and eating disorder (Otis et al., 1997). Female athlete triad disorders can be seen in all branches. However, it can be said that athletes with endurance, aesthetics or weight class components or those requiring weakness are at higher risk. Specialization in sports at an early age, family dysfunction, abuse and diet are other risk factors for female athlete triad (Nattiv et al., 2007; Sundgot-Borgen, 1994). Studies show that the rate of simultaneous occurrence of 3 components of the triad is 1%-1.2% in high school girls, and this rate rises up to 16% in female athletes (Hoch et al., 2009; Nichols et al., 2006). It is emphasized that the prevalence of 2 components of the triad at the same time is between 4% and 18% in high school female athletes, while the prevalence of one component may increase up to 16% to 54% (Hoch et al.,2009a; Hoch et al., 2009b). Continual irregular nutrition, skipping meals, diet and laxative use, overeating and vomiting may occur. Reproductive and skeletal health are associated with carbohydrate consumption. Menstrual dysfunction and low mineral density are the result of insufficient energy due to irregular diet (Marc, 2021). In the study of Beals et al., 2000 & 2002 they found that the rate of eating disorders in athletes was not different from that of non-athletes, but they emphasized that the rate of eating disorders in athletes in branches requiring weak body structure may be higher.

The EAT-26 Test results, which were within the normal range in the results of this study, were not different in gymnasts with and without menarche. However, the fact that 46.2% (6 gymnasts) of the elite female artistic gymnasts with a mean age of 18.31 ± 4.54 years did not start menarche, suggesting primary amenorrhea in these athletes.

CONCLUSİON

The EAT-26 test, which is one of the measurement tools in this study, is not sufficient to diagnose people's eating disorders. However, the data obtained helps to form an opinion. In order to reach clear results, an expert examination and opinion is absolutely necessary. At the same time, the fact that 46.2% (6 gymnasts) of the elite artistic gymnast women with a mean age of 18.31 ± 4.54 did not start menarche, suggesting that these athletes have primary amenorrhea. For this reason, it is recommended to control and regulate the nutrition processes of female gymnasts, to carry out gynecological examinations, to undergo regular health screenings, and to prepare training programs considering these factors in the artistic gymnastics branch.

Limitations: The participants of this study include only Turkish National Team athletes. Studies with a larger number of participants are thought to be beneficial.

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