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Eating Disorder and Bone Mineral Density in Adolescent's Athletes

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ABSTRACT

One of the most important health problem; eating disorder (ED) could be detected at adolescents, especially athletes; as changes of lifestyle effect on eating behavior. Eating disorder generally begin at the teenager years associated with puberty regarding; biological, physical & psychological changes. The percentages of ED in athletes are greater than non-athlete populations, due to the pressures and demands of being an athlete; as calorie restriction and excessive exercise. ***Objectives:*** to assess knowledge and awareness of eating disorder hazards and its relation to bone mineral density among adolescent's athletes. ***Methods:*** A cross-sectional study involved 60 adolescence's athletes of both genders (30 males and 30 females), questionnaire for eating disorders and sleeping problems were collected, then anthropometric measurements followed by Dual energy X-ray Absorptiometry (DEXA) scan to assess bone mineral density (BMD) at the spine and femur. ***Results:*** 44 of participants (73.3%) had scored below 2, indicating no suspicion for an eating disorder, while 16 (26.7%) had got a score of more than 2. Regarding sleeping problems, couldn't be detected in any enrolled athletes. Males had higher (BMD) at both examined sites than females. In addition the anthropometric measurements; weight, height, waist and hip circumferences were statistically significant associated with lumbar and femur densities, Increasing of BMI (overweight and obese) were considered a predictor risk factor for ED, although BMI was associated with BMD of the lumbar spine. ***Conclusion:*** Eating disorder (ED) among adolescent's athletes is an important issue and should be aware at our community, as well increasing BMI (overweight and obese) were considered a predictor risk factor for it, although BMD didn't affect by ED.

***Keywords*:** Eating Disorder, Bone Mineral Density, Adolescent and Athletes

Introduction

One of the most important health problem; eating disorder (ED) could be detected at adolescents, especially athletes; as changes of lifestyle effect on eating behavior (Story *et al.*, 2002). ED generally begins at the teenager years associated with puberty regarding; biological, physical and psychological changes (Abell and Richards, 1996). The percentages of eating disorders in athletes are greater than non-athlete populations, due to the pressures and demands of being an athlete; as calorie restriction and excessive exercise (Gleason *et al.,* 2000), which cause to develop pathological disorders as bulimic symptoms (Vohs *et al.,* 1999) (Blodgett Salafia *et al.,* 2015).

When athletes were unsatisfied with their bodies; eating disordered will be developed. Eating disorders became the third leading chronic illness among adolescent girls in the United States and other developed countries such as Canada and Norway (WHO 2005).

The aim of this study was; to assess their knowledge and awareness of eating disorder hazards and its relation to BMD among adolescent's athletes.

Patients and Methods

Design: A cross-sectional study design.

Participants:

A total of 60 adolescence's athletes of both genders (30 males and 30 females) were enrolled into this study, their ages were ranged from 12 to 18 years, mainly from high schools and sporting

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clubs. They were given an information sheet after having parental signed informed written consent to explain the general background of the study. The protocol of this study was approved by the national research centre, ethics committee number P100530 through a project titled" Burdens of eating disorders among adolescents: Hidden effect on bone density".

Location:

Medical Research Centre of Excellence (MRCE) – National Research Centre (NRC).

Sample size estimation

Based on the previous study, 60 subjects were adequate; the sample size was calculated according to the proportional of eating disorder. Assuming α=0.05, B =0.12 and power of 87.9%, by (Hintze, J. (2011). PASS 11. NCSS, LLC. Kaysville, Utah, USA).

Questionnaire:

Participants were interviewed individually; a constructed questionnaire form was used to collect information regarding demographic data, eating and body image disturbances, in addition to sleeping problems. Data were reported in a confidential manner.

Disordered eating behavior was screened by the SCOFF questionnaire: simple, memorable, easily applied and scored tool. The SCOFF questions included; (Do you make yourself Sick because you feel uncomfortably full? Do you worry that you have lost Control over how much you eat? Have you recently lost more than One stone (14 lb) in a 3-month period? Do you believe yourself to be Fat when others say you are too thin? Would you say that Food dominates your life?) then each "yes" equals 1 point; a score of 2 indicates a likely diagnosis of anorexia bulimia or nervosa (Morgan et. al., 2000).

Sleep problems were evaluated using "Sleeping problems BEARS" this instrument has five major sleep domains, providing a screen of major sleep disorders affecting children; (B = bedtime problems, E = excessive daytime sleepiness, A = awakenings during the night, R= regularity and duration of sleep, S = snoring).

Anthropometric measurements:

Both height and weight of participants were measured by the researcher using a balance scale. Height was measured to the nearest millimeter with no shoes and light clothing, the participant was asked to stand straight with head positioned in the horizontal Frankfurt plane, feet together, knees straight, and heels, buttocks & shoulder blades in contact with the wall. Weight was measured with no shoes and light clothing, and was recorded to the nearest 0.1 kg. The participant was asked to stand straight ahead unassisted in the center of the platform in which the scale was checked for zero balance before each measurement (Hochberg and Belsky, 2013). Body mass index (BMI) of participants was calculated as weight (kg)/height (m^2).

Waist Circumference (WC) was measured in cm to the nearest 0.1 at a standing position using a non-stretchable tape during expiration in midway between the last rib and the heights point of the iliac crest. Hip circumference (HC) was measured at the same way at the maximum dimension of the gluteal region. Then waist hip ratio was calculated (WHR) (Mederico *et al.,* 2013).

DEXA measurements:

Dual energy X-ray Absorptiometry was used to measure BMD (g/cm2) using (Norland Xr 46, version 3.9.6/2.3.1, America). The lumbar spine and femoral neck densities were assessed for; bone mineral content (BMC) in gm, area in cm^2 and density (BMD), in gm/cm^2, as well Z-score was calculated by comparing observed BMD to the same age and sex matched values, according to WHO (Kocks *et al.,* 2010).

Statistical analysis

Statistical analysis was performed using Package for Social Sciences (SPSS program, version 22 windows, IBM Corporation). P value ≤ 0.05 was considered significant. The parametric data were expressed as mean ± standard deviation, while the non-parametric data (qualitative) were expressed as

a frequency distribution. Pearson correlation coefficient was done between different variables, also chi-square test, and odd ratio to predict risk factor.

Results

Characteristics of the subjects

The present study includes 60 athletes were recruited from two Egyptian sporting clubs; 30 males and 30 females, their mean age (15.1 years ± 1.8 SD and 13.5 years ± 1.7 SD) respectively. They classified into three groups according to age; (12-14 years, 14.1-16 years and 16.1-18 years), the age group one included 7 males (23.3%) and 16 females (53.3 %) & the second group 8 males (26.7%) and 11 females (36.7 %), while third group included 15 males (50%) and 3 females (10 %).

Table (1) shows mean ± SD of anthropometric measurements at both sex; weight was ranged from (33-108 Kg), height (145-181 cm), BMI (14.9- 35.4 Kg\m^2), waist circumference (59-106cm) and hip circumference (74-118cm). Also, there was a highly statistically significant difference between both sex at the age and height (p = 0.001 and 0.005) respectively.

The concern about their weight; 68% of the participant mentioned their weight correctly, while 17% didn't know their weight and other 15% had underestimation of their weight.

To test the hypothesis that athletes would be more at risk of developing ED we used SCOFE screening tool; 73.3% of participants (44 athletes) had a score below 2, indicating no suspicion for an eating disorder, while 26.7% had got scored more than 2.

Table 1: Mean ± SD of anthropometric measurements at both sex

Variable	Male Mean ± SD	Female Mean ± SD	p-value
Age (years)	15.1 ± 1.8	13.5 ± 1.7	0.001**
Weight (Kg)	60.8 ±16.2	55.9±16.9	0.265
Height (cm)	162.4 ±9.6	156.2 ±6.2	0.005*
BMI(Kg\m^2)	22.8±4.1	22.6±5.1	0.863
Waist circumference(cm)	72.1±10.1	74.9 ±11.8	0.457
Hip circumference(cm)	85.4±9.1	89.6±10.8	0.230
Waist/ Hip ratio	0.84±0.06	0.83±0.05	0.327

*Significant at P≤ 0.05 ** Highly Significant at P≤ 0.001

For more details about age group and sex difference of frequency and percentage of eating disorder (ED) described at Table (2), which revealed that females were more predominant to ED (30%); especially at second age group (14.1-16 years) (20%) followed by at first age group (12-14 years) (10%). While (23.3%) of males had ED; (10%) at first age group (12-14 years) and (13.3%) at a third group (16.1-18years).

Regarding, sleeping problems, couldn't detect any of it at the enrolled athletes using the "Sleeping problems BEARS".

Table 2: Eating disorder (ED) frequency and percentage according to age group at both sex

Age group	Male		Female	
	No ED No. (%)	ED No. (%)	No ED No. (%)	ED No. (%)
12-14 Years	4 (13.3%)	3 (10%)	13 (43.3%)	3 (10%)
14.1-16 Years	8 (26.7%)	0	5 (16.7%)	6 (20%)
16.1-18 Years	11(36.7%)	4 (13.3%)	3 (10%)	0

Association between ED and BMI

The association between ED and BMI was studied, regarding females; 9 were categorized as overweight & obese and 33.3% of them had ED, while males 7 were overweight & obese and 28.6% of them had ED.

Table (3) showed the odd ratio to predict the effect of BMI (overweight and obese) as a risk factor of ED among both sex; data revealed that the odd value more than one, which meaning overweight and obese were considered a predictor risk factor for ED.

Table 3: Odds ratio to predict the effect of BMI (overweight and obesity) as a risk factor of ED among both sex

BMI	Odd Value	95% Confidence Interval	P-Value
Overweight and obese male	1.740	0.212 - 9.782	0.708
Overweight and obese female	1.550	1.196- 1.497	0.794

Bone Mineral Density (BMD)

Table (4) shows the mean and SD of BMD at the lumbar spine (L2-L4) and femoral neck at both sex, revealed that males had higher BMD at both examined sites than females with a highly statistically significant difference at the lumbar spine and statistically significant difference at the femoral neck.

Table 4: The mean ± SD of BMD at the lumbar spine and femoral neck at both sex

Variable	Male mean ±SD	Female mean ±SD	P-Value
Lumbar BMD (gm/cm2) (L2-L4)	0.949 ± 0.26	0.792± 0.18	0.008**
Femur BMD (gm/cm2) (Neck)	0.870± 0.25	0.760±0.20	0.062*

*Significant at P≤ 0.05 * * Highly Significant at P≤ 0.001

Table (5) shows the correlation coefficient between BMD of lumbar and femur with anthropometric measurements; that revealed weight, height, waist and hip circumferences were statistically significant associated with lumbar and femur densities, which highly associated at the lumbar spine, although BMI was associated with lumbar spine only.

Further, there was insignificant correlation between BMD of the lumbar and femur with the eating disorder (ED), (*p*-value; 0.307 and 0.295) for lumbar and femur densities respectively.

Table 5: Correlation coefficient of lumbar and femur BMD with anthropometric measurements

Parameters	Lumbar BMD (gm/cm^2) (L2-L4)	Femur BMD (gm/cm^2) (Neck)
Weight (Kg)	0.389**	0.293*
Height (cm)	0.452**	0.352*
BMI (Kg\m2)	0.293*	0.216
Waist Circumference (cm)	0.383**	0.256*
Hip Circumference (cm)	0.383**	0.297*
Waist/ Hip ratio	0.233	0.051

Significant at * P ≤ 0.05 Highly Significant at ** P ≤ 0.001

Discussion

Adolescence is regarded as a period of developmental risk for ED (Fortes et.al. 2013). The incidence of bulimia or anorexia disorders are not accidental, as high-performance athletes are usually concerned with "perfection", which is often an influencing factor in developing an eating disorder. So trainees and coaches should be aware of ED in athletes and identified predictors of those behaviors to avoid it (Vohs *et al.* 1999). Eating struggles; include not only formal eating disorders but also a wide variety of what is called "sub-threshold" disordered eating behaviors that do not meet formal criteria for eating disorder diagnosis (Abebe *et al.* 2012). ED was documented in developing and Arab countries (Al-Subaie *et al.* 1996); 19.6% of Saudi adolescent girls had abnormal eating attitudes (Afifi-Soweid *et al.* 2002).

This study was designed to assess knowledge and awareness about ED hazards among Egyptian young athletes, in addition to studying bone density by Dual energy X-ray absorpotiometry (DEXA) at the lumbar spine and the femur. The results revealed that 68% of the participant knew exactly their weight and were concerned about having the perfect weight with food restriction, dieting, over exercising and unhealthy behaviors. This agreement with Krane *et al.,* (2001), who studied the relationships of eating behaviors and body satisfaction in female athletes, found that the eating disorder occurred due to body dissatisfaction.

Regarding SCOFE screening tool; 26.7% of participants got the score of 2 or more indicating further assessment by higher sensitive and specified questionnaire to rule out bulimia nervosa. This

agreement with other studies, who suggested that eating disorders and exercise behaviors were developed at athletes when dissatisfaction by their bodies (Goltz *et al.* 2013 and Yager *et al.* 2017). Moreover prospective studies found that there was 5 to 18-fold increased risk of developing an eating disorder among adolescent were noticed when unhealthy dieting used (Patton *et al.* 1999 and Grigg *et al.* 1996).

The BMI mean among participant was 22.8±4.1 in this study, almost near to a study enrolled at Jordan athletes where the mean BMI was 20.9±3.8 (Mousa *et al.* 2010). Although there was an association between BMI and ED founded in this study, as overweight and obese were considered a risk factor for ED. This finding was agreement with some researchers examined the risk factors of ED and found that BMI was a predictor of negative eating attitudes in adolescent girls (Jones et. al. 2001), while another study at UAE, found that adolescent girls with high BMI had significantly associated with ED ($p<0.05$) and reported that the risk of developing ED among overweight participants increased by 2 folds more than normal weight (Eapen *et al.* 2006). However, Al-Subaie *et al.* (1996) reported an insignificant relationship between BMI and ED.

All athletes had normal bone densities of the lumbar spine and femur in this study, although males had higher BMD than females, as well there was a correlation between BMD and anthropometric measurements; (weight, height, waist and hip circumferences). BMI was significantly associated with bone mineral density of the lumbar spine, while weight and height were highly significantly associated with both lumbar and femur. This is coordinate with Kong *et al.* (2015), who found that, weight was significantly correlated with the BMD in the dual femur of the female athletes, this was explained due to their training nature, specifically running.

However, no significant correlation between BMD and ED could be detected. This disagreement with Joy *et al.* (2016), suggested that female athletes had three inter-related conditions with ED; low bone mineral density, menstrual dysfunction and low energy availability. Another study by Ortega-Luyandoa *et al.* (2015), revealed that male athletes had also three related conditions with eating disorders; lower bone mineral density, gonadal steroid imbalances and low energy availability.

In conclusion, eating disorder (ED) among adolescent's athletes is an important issue and should be aware at our community; as well increasing BMI (overweight and obese) considers a predictor risk factor for it, although bone mineral density didn't affected by ED.

Conflict of interest

No conflict of interest associated with this manuscript.

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