

The Relationship of Disordered Eating Attitudes With Body Composition and Anthropometric Indices in Physical Education Students

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Background: Abnormal eating behavior, unhealthy weight control methods, and eating disordered symptoms have risen among college students.

Objectives: The aim of this study was to examine disordered eating attitudes and their relationship with anthropometric and body composition indices in physical education students in Tabriz, the capital of East Azerbaijan province, Iran.

Patients and Methods: This cross-sectional study was conducted on 210 physical education students, 105 males and 105 females aged 18 to 25, who were selected by systematic random sampling from physical education faculty of Tabriz University in Tabriz, Iran, in 2013. Eating attitude test (EAT-26) was used for the assessment of disordered eating attitudes. In addition, anthropometric and body composition indices were assessed.

Results: About 10% of the studied subject had disturbed eating attitudes; significantly more males (15.4%) reported an EAT-26 ≥ 20 (disordered eating attitudes) than females (4.8%) ($P < 0.05$). In males, the EAT-26 score was positively correlated with waist perimeter (WP) ($r = 0.21$, $P < 0.05$) and the waist-to-hip ratio ($r = 0.26$, $P < 0.01$). In females, the EAT-26 score was positively correlated with weight ($r = 0.19$, $P < 0.05$) and the WP ($r = 0.28$, $P < 0.01$). In females, weight ($P < 0.05$), body mass index (BMI) ($P < 0.05$), WP ($P < 0.01$), and waist-to-hip ratio ($P < 0.05$) were significantly different between disordered eating attitude and healthy subjects, while in males there was no significant difference between the two groups regarding the anthropometric and body composition indices.

Conclusions: Abnormal eating attitude was notable among physical education students in Tabriz, Iran. It seems that some anthropometric indices such as BMI and central obesity indices were related to the increase of disordered eating attitude.

Keywords: Physical Education and Training, Eating Disorders, Body Composition, Anthropometry

1. Background

Eating disorders are psychiatric diseases with abnormal eating habits. Their complications are nutritional, psychiatric, and physical health disturbances (1, 2). Eating disorders vary from nonclinical eating disorders, as feeling of being too fat or dieting, to severe clinical forms, as anorexia nervosa and bulimia nervosa (2, 3). Eating disorders are more common at the age of 25 or below and mainly occur among females (4). However, studies showed that eating disorders are increasing in young males (5, 6).

Abnormal eating behavior, unhealthy weight control methods and eating disordered symptoms have risen among college students (7, 8). The prevalence of disordered eating behaviors is far more than clinical eating disorders in college settings (9, 10). Biological, psycho-

logical, and environmental factors are risk factors for the development of eating disorders (11). Many risk factors of disordered eating attitudes and eating disorders are specific to university settings. Adolescents after transition from high school to college environment face many new environmental factors which influence them in a different ways. Many of these factors contribute to the development and exacerbation of disorder eating behaviors (12). The competitive environment of university and excellence among peers increase the demand for adaptation to the new environment (13). Studies report a high prevalence of dieting and practicing to lose weight among university students (14, 15). Dieting has been identified as a disordered eating risk factor (16). Special groups in universities such as collegiate athletes and society or so-

cial clubs for female undergraduates are at high risk for disordered eating (17, 18). The selection of vulnerable peer groups or choosing friends from them increase the development of disordered eating (19).

Individuals in careers related to exercise, health, food and nutrition are more susceptible to disordered eating behavior, body image concerns, dieting, and high-level of body dissatisfaction (20, 21). According to the literature, few studies have assessed disordered eating behaviors in physical education students. In a study, O'Brien and Hunter (22) in New Zealand showed that female physical education students had higher eating attitude test (EAT) scores and disordered eating compared to non-physical education ones. They showed that disordered eating behavior was related to weight and physical condition. Yager and O'Dea (20) reported that health and physical education teachers in both genders had higher rates of dieting, disordered eating behavior, and body dissatisfaction than other teachers. In some studies, the relationships between eating disorders and body composition indices have been evaluated. Babio et al. (23) in a study among adolescents aged 12 - 18 years showed that the increasing risk of eating disorders was positively associated with body mass index (BMI) and fat mass (FM) percentage and negatively associated with waist-to-hip ratio. A study conducted on female swimmers in two age groups (11 - 14 and 15 - 19 years old) showed that in both groups athletes with disordered eating had higher fat percentage and FM than athletes without disordered eating (24). In a study on those participating to aesthetic sports aged 19.2 ± 1.2 years, the comparison of anthropometric and body fat percentage between groups of at risk eating disorder and not at risk showed that weight, BMI and hip perimeter (HP) were significantly different (25). Unlike these studies, Hidayah and Bariah (26) reported that there was not significant correlation between body composition and anthropometric indices and EAT-26.

In developing countries such as Iran, the prevalence of eating disorders (0.9% for anorexia nervosa, 3.2% for bulimia nervosa, and 6.6% for partial syndrome) has been comparable with rates of western countries (27). In our country, we did not find any study on disordered eating attitude in physical education students. In a study on 400 female nursing and midwifery students, Safavi et al. (28) showed that 21.5 % of female students were at risk of eating disorders ($EAT-26 \geq 20$).

2. Objectives

With regard to the literature, the purpose of the present study was to examine and compare disordered eating attitude in male and female physical education students and its relationship with anthropometric and body composition indices.

3. Patients and Methods

3.1. Study Design and Participants

This cross-sectional study was conducted at the Physical Education Faculty of Tabriz University in Tabriz, the capital of East Azarbaijan province of Iran, from June to July 2013.

To estimate the sample size of this study, the relation of the EAT-26 score and weight was considered as the effect size of interest. Considering 95% confidence, 80% power, a two-tailed test and utilizing G-Power, the sample size was calculated to be 210 cases.

From the total of 442 students of four academic years, with systematic random sampling, 221 (111 males and 110 females) physical education students were recruited. We chose a random number as the total number of students (442) divided by the sample size (210). From the name list of each academic year class with alphabetical order, the first student was randomly selected. Thereafter, every second person following the first student chosen was selected.

Only students 18 - 25 years old were selected, because this study was on college students whose usual age distribution was 18 - 25. In addition, the number of the subjects out of the age group of 18 - 25 was very low, so the age range of the studied subjects was limited.

The inclusion criteria were: age 18 - 25 and having been a physical education student for at least six months. Seven subjects were excluded due to their age (above the range of 18 - 25). Questionnaires of four students were excluded due to incomplete responses. Finally, 210 students remained (105 males) for the current analysis.

The Ethics Committee of Tabriz University of Medical Sciences approved this study (ethical code: 5/4/2357; 11/6/2013). The students were assured about the confidentiality of personal information. After giving information about the details and goals of the study, all the studied subjects participated voluntarily and signed informed consent.

The main outcome measures of the study were student's demographic characteristics, disordered eating attitudes, anthropometric indices such as weight (kg), height (cm), BMI (kg/m^2), waist perimeter (WP) (cm), HP (cm), waist-to-hip ratio, and body composition variables such as FM (kg), muscle mass (MM) (kg), fat free mass (FFM) (kg) and total body water (TBW) (kg) and their percentages.

3.2. Instruments

A questionnaire was used to obtain demographic data including age, gender, educational level and any specific disease. For disordered eating attitudes evaluation, EAT-26 questionnaire was used. EAT-26 is an adjusted version of the EAT-40. It is a valid and self-reporting instrument with 26 items for the assessment

of risk factors for eating disorders such as dietary restriction, bingeing, purging, and environmental influences on food intake (29). We used 6-point Likert scale for each question. For questions 1 to 25, the scales of “always”, “usually” and “often” were scored as 3, 2, and 1, respectively, and three other scales (never, rarely and sometimes) were scored as zero; but in question 26, the scores of “never”, “rarely”, and “sometimes” were 3, 2, and 1, respectively, and three other scales were scored as zero. The range of the total score was 0-78. A total score of 20 or more indicated at risk of eating disorders. We defined $EAT \geq 20$ as positive to disordered eating attitudes. The Farsi version of EAT-26 has been validated in several studies (30, 31). In a pilot study on 30 Iranian females the Farsi version was used; the internal consistency (Cronbach's alpha) and test-retest reliability after 15 days were 0.75 and 0.85, respectively (30). In a study on Brazilian youth, the EAT-26 was validated in both genders; internal consistency (Cronbach's alpha) was 0.88 for females and 0.85 for males and there was no significant difference between males and females (32).

Weight was measured to the nearest 0.1 kg using a calibrated electronic balance (Seca 769 scale, capacity: max 200 kg, Germany) in light clothes and without shoes. The scale was calibrated against 100 kg weight at the beginning of each data collection day. Height was measured to the nearest 0.1 cm using a stadiometer (Seca 220 stadiometer, range: 60 - 200 cm, Germany) without shoes and with shoulders in a normal position.

Body mass index was calculated as weight (kg)/height (m^2). According to the BMI, the participants were divided into four groups; underweight ($BMI < 18.5 \text{ kg}/m^2$), normal weight ($18.5 \leq BMI < 25.0 \text{ kg}/m^2$), overweight ($25 \leq BMI < 30.0 \text{ kg}/m^2$), and obese ($BMI \geq 30 \text{ kg}/m^2$) (33). WP was measured using a tape at the midpoint between the lower costal border and above the iliac crest at the end of normal expiration. HP with light clothing was measured at the maximum perimeter. Both of these measurements were carried out by a non-stretchable tape (Seca 201 calibrated tape measurer, accurate at 0.1 cm, Germany) and without any pressure on the surface of body (34). Waist-to-hip ratio was calculated as the waist size divided by the hip size. Bioelectric impedance using an auto-calibrated in body 230 (Biospace, Dogok-dong, South Korea) was used for the assessment of body composition to determine the FM, MM, FFM and TBW and their percentages. Standardized conditions before measuring the body composition were two hours of fasting, lack of intense activity 12 hours before the test, no menstrual period and ± 2 days, and slight clothes (35).

3.3. Statistical Analyses

All the statistical analyses were carried out with SPSS

13 (SPSS Inc., Chicago, IL). Data for continuous variables were expressed as mean \pm SD if they distributed normal or median (25 - 75 percentiles) with non-normal distribution. Categorical variables were shown as frequency (percentage). Normality distributions of numeric variables were assessed with Kolmogorov-Smirnov test. The distribution of EAT-26 scores was not normal; therefore, were performed nonparametric tests (Mann-Whitney U test, Kruskal-Wallis test and Spearman correlation test) to assess the differences and relationships between groups and variables. Anthropometric and body composition data were normally distributed; so, t-test was used to evaluate the differences between the groups. Chi-squared test were applied to compare the disordered eating attitudes between males and females. A P value less than 0.05 was regarded to be significant.

4. Results

The mean ages of male and female students were 21.54 ± 1.65 and 20.62 ± 1.61 years, respectively. Table 1 displays the main anthropometric and body composition characteristics of the students. Weight, height, WP, waist-to-hip ratio, FM (kg), FM (%), MM (kg), MM (%), FFM (kg), FFM (%), TBW (kg), and TBW (%) were significantly different between male and female students.

The median (25 - 75 percentiles) of the EAT-26 score in total participants was 7.0 (3.0 - 13.0). Males obtained higher scores of EAT-26 than females ($P < 0.001$). Among the total studied subjects, according to EAT-26, 21 students (10%) obtained scores 20 or above. Disordered eating attitudes were significantly more frequent among males (15.2%) compared with females (4.8%) [$\chi^2 = 6.40$, $df = 1$, $P = 0.01$].

The median (25 - 75 percentiles) of the EAT-26 score in underweight, normal weight, overweight and obese subgroups were 6.50 (2.50 - 11.0), 6.0 (3.0 - 12.50), 9.0 (4.50 - 14.0), and 13.50 (11.50 - 21.50), respectively. The statistical analyses did not show any difference between the groups ($P = 0.13$).

In the studied subjects, the score of EAT-26 was correlated with BMI ($r = 0.20$, $P = 0.003$), HP ($r = 0.14$, $P = 0.03$). In male students, positive significant correlation was seen between the EAT-26 score and WP ($r = 0.21$, $P = 0.03$) and waist-to-hip ratio ($r = 0.26$, $P = 0.007$). In female students, positive significant correlation was seen between the EAT-26 score and weight ($r = 0.19$, $P = 0.04$) and WP ($r = 0.28$, $P = 0.003$).

In males students, there were no significant differences between disordered eating attitudes and healthy subjects on the anthropometric and body composition indices. In females, weight ($P = 0.02$), BMI ($P = 0.03$), WP ($P = 0.008$), and waist-to-hip ratio ($P = 0.03$) were significantly different between disordered eating attitudes and healthy subjects (Table 2).

Table 1. Anthropometric and Body Composition Characteristics of the Studied Subjects ^{a,b}

Variables	All (n = 210)	Gender		P Value
		Male ^c	Female ^c	
Weight, kg	63.95 ± 9.70	69.61 ± 8.32	58.30 ± 7.43	< 0.001
Height, cm	170 ± 9.13	177.11 ± 6.12	163.27 ± 5.80	< 0.001
Body mass index, kg/m ²	22.03 ± 2.51	22.17 ± 2.23	21.89 ± 2.77	0.42
Waist perimeter, cm	75.40 ± 8.17	79.89 ± 6.65	70.90 ± 7.01	< 0.001
Hip perimeter, cm	93.95 ± 5.96	94.37 ± 5.09	93.52 ± 6.70	0.30
Waist-to-hip ratio	0.83 ± 0.03	0.84 ± 0.03	0.83 ± 0.03	0.01
Fat mass, kg	12.78 ± 6.18	9.31 ± 4.67	16.25 ± 5.53	< 0.001
Fat mass, %	20.34 ± 9.66	13.20 ± 5.9	27.48 ± 7.07	< 0.001
Muscle mass, kg	28.8 ± 6.83	34.33 ± 4.41	23.04 ± 3.17	< 0.001
Muscle mass, %	44.54 ± 6.18	49.39 ± 3.52	39.69 ± 4.12	< 0.001
Fat free mass, kg	51.22 ± 11.06	60.33 ± 7.13	42.11 ± 5.25	< 0.001
Fat free mass, %	79.73 ± 9.57	86.85 ± 5.60	72.62 ± 7.12	< 0.001
Total body water, kg	37.51 ± 8.14	44.23 ± 5.27	30.78 ± 3.78	< 0.001
Total body water, %	58.38 ± 7.14	63.67 ± 4.32	53.10 ± 5.22	< 0.001

^a The results are presented as mean ± SD.

^b P value was calculated with independent t-test.

^c n = 105.

Table 2. The Comparison of Anthropometric and Body Composition Indices Between Disordered Eating Attitudes and Healthy Subjects in Males and Females ^{a,b,c}

Variables	Males		Mean Difference (95% CI)	P Value	Females		Mean Difference (95% CI)	P Value
	EAT-26 ≥ 20 (n = 16)	EAT-26 < 20 (n = 89)			EAT-26 ≥ 20 (n = 5)	EAT-26 < 20 (n = 100)		
Weight, kg	70.12 ± 9.16	69.52 ± 8.22	0.60 (-3.90 to 5.10)	0.79	65.70 ± 8.74	57.93 ± 7.21	7.76 (1.14 to 14.38)	0.02
Height, cm	176 ± 7.64	177.19 ± 5.85	-0.50 (-3.81 to 2.81)	0.76	164.40 ± 4.50	163.22 ± 5.86	1.18 (-4.11 to 6.47)	0.65
BMI, kg/m ²	22.43 ± 2.31	22.12 ± 2.22	0.30 (-0.89 to 1.51)	0.61	24.43 ± 4.26	21.76 ± 2.64	2.66 (0.18 to 5.14)	0.03
WP, cm	81.59 ± 6.76	79.58 ± 6.62	2.00 (-1.57 to 5.58)	0.26	79.0 ± 7.64	70.50 ± 6.76	8.50 (2.31 to 14.68)	0.008
HP, cm	93.71 ± 5.38	94.48 ± 5.06	-0.77 (-3.52 to 1.98)	0.58	98.20 ± 7.88	93.29 ± 6.61	4.90 (-1.15 to 10.96)	0.11
WHR	0.85 ± 0.03	0.84 ± 0.03	0.01 (-0.001 to 0.31)	0.70	0.86 ± 0.04	0.83 ± 0.03	0.03 (0.003 to 0.06)	0.03
Fat mass, kg	9.59 ± 3.66	9.26 ± 4.85	0.32 (-2.20 to 2.85)	0.80	19.96 ± 11.25	16.07 ± 5.13	3.88 (-10.05 to 17.82)	0.48
Fat mass, %	13.48 ± 4.21	13.15 ± 6.17	0.32 (-2.86 to 3.52)	0.83	29.45 ± 13.64	27.38 ± 6.69	2.06 (-14.81 to 18.94)	0.75
Muscle mass, kg	34.51 ± 4.59	34.30 ± 4.40	0.20 (-2.18 to 2.59)	0.86	25.36 ± 4.58	22.92 ± 3.07	2.43 (-3.22 to 8.09)	0.09
Muscle mass, %	49.27 ± 2.34	49.41 ± 3.70	-0.13 (-2.04 to 1.76)	0.88	39.08 ± 8.21	39.72 ± 3.89	-0.63 (-10.79 to 9.52)	0.87
FFM, kg	60.54 ± 7.48	60.29 ± 7.10	0.25 (-3.60 to 4.10)	0.89	45.74 ± 7.10	41.93 ± 5.13	3.80 (-0.94 to 8.54)	0.11
FFM, %	86.53 ± 4.21	86.90 ± 5.83	-0.37 (-3.40 to 2.65)	0.80	70.54 ± 13.64	72.72 ± 6.75	-2.18 (-19.06 to 14.69)	0.74
TBW, kg	44.46 ± 5.44	44.18 ± 5.27	0.27 (-2.58 to 3.12)	0.85	33.46 ± 5.28	30.65 ± 3.68	2.80 (-0.61 to 6.22)	0.10
TBW, %	63.56 ± 3.13	63.69 ± 4.51	-0.13 (-2.47 to 2.20)	0.90	51.61 ± 10.11	53.17 ± 4.94	-1.56 (-6.32 to 3.19)	0.74

^a Abbreviations: EAT, Eating Attitude Test; HP, hip perimeter; FFM, fat free mass; TBW, total body water; WHR, waist-to-hip ratio; WP, waist perimeter.

^b The results are presented as mean ± SD

^c P value was calculated with independent t-test.

5. Discussion

The study showed that 10% of young students scored positively to disordered eating attitudes. The prevalence of abnormal eating attitudes was less than some previous studies on the college student population in Iran and other countries (28, 36, 37). Safavi et al. (28) showed that using EAT-26, 21.5% of female nursing and midwifery students had disordered eating attitudes in Iran. Memon et al. (37) reported that 22.75% of Karachi medical students with EAT-26 were at high risks of eating disorders.

Similar results of prevalence of disordered eating attitudes in our study were reported in other studies. In a study on college students of Puerto Rico with EAT-26 questionnaire, the rate of individuals at risk of eating disorders was 9.59% (38). Similar result was seen in a study on medical students in Brazil. In this study, with the EAT-26 scale, 10% of students had abnormal eating attitudes (39). The prevalence of disordered eating attitude in females was less than those that of other studies in the course of physical education. In studies in New Zealand and Brazil on female physical education students, 12.9% and 6.9% had disordered eating attitudes, respectively, on EAT-26 (22, 40).

In our study, the rate of abnormal eating attitudes in males (15.2%) was more than that in females (4.8%). Our finding is in contrast to many other studies. In some studies among college students, the prevalence of disordered eating attitudes in females were reported higher than males (25.7% vs. 20.4% in Turkey; 19.9% vs. 2.7% in Pakistan, and 10.9% vs. 1.4% in the United States) (36, 37, 41). It is possible that muscular ideals and great desire to larger muscles and physique can cause higher rates of disordered eating attitudes in male compared to female students (20, 42). The drive for muscularity, body shape and body dissatisfaction may be considered as other factors for our results (43-45).

In subjects, the EAT-26 score was positively related to BMI and HP. Considering gender, in males, WP and waist-to-hip ratio, and in females, weight and WP had positive relationships with EAT-26 score. Liao et al. (43) reported positive relationship between BMI and EAT-26 score in male and female Chinese medical students. Parallel with our study, in a study among male and female college students, significant positive correlations were found between EAT-40 score and body weight, BMI and mid-upper arm, waist and HPs (36). Altug et al. (46) found correlation between eating disorders and weight in Turkish female university students. In a study, in adolescent females, EAT score showed significant correlations with BMI, WP and FM, while in males, it was not related to body composition or anthropometric indices (23).

In the present study, comparing the two groups of at-risk and not-at-risk for eating disorders in male students showed that there was no difference between

the two groups; but in females, the disordered eating attitudes group had higher body weight, BMI, WP, and waist-to-hip ratio than the healthy one. In a study on female dancers (aged 18 - 25 years), Torres-McGehee et al. (25) showed that body weight, HP and BMI were higher in the at-risk group than the not-at-risk one for eating disorders. Being overweight is relevant to body dissatisfaction and weight concerns and can lead to eating disorders (47). Disordered eating behaviors relate to psychological stress (48). Stress, with activation of hypothalamic-pituitary-adrenal axis, increases the secretion of cortisol. Elevated levels of circulating cortisol lead to the development of visceral obesity (49). Gluck et al. (50) reported that in obese females with binge eating disorder, there is a positive correlation between cortisol stress response and abdominal obesity.

The strengths of the current study included the use of calibrated and modern devices for measuring body composition and anthropometric variables and inclusion of males in addition to females, as most of the previous studies focused on females.

Our study had some limitations. Cross-sectional design was the main limitation of this study. Our study was limited to physical education faculty students in Tabriz; future studies should be conducted on larger sample populations from various physical education students in Iran to generalize the results. With EAT-26, we only examined nonclinical eating disorders; we also did not use interview and instruments for identifying the clinical forms of eating disorders. We did not measure the measurement error for each observer. With attention to the limitations of our study, further researches need to be conducted to clarify the exact association of body composition indices with disordered eating attitudes.

In conclusion, the prevalence of abnormal eating attitude was notable among physical education students in Tabriz, Iran. Disordered eating attitude was higher in males than in female physical education students. The increase of BMI and central obesity indices were related to disordered eating attitude.

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Authors' Contributions

All the authors participated equally in writing the paper.

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