ANTHROPOMETRIC INDICATORS OF BODY DISSATISFACTION AND INAPPROPRIATE EATING BEHAVIORS IN YOUNG ATHLETES

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ABSTRACT

Introduction: High values of body mass index (BMI) and fat percentage (%F) seem to be associated with body dissatisfaction (BD) and inappropriate eating behaviors (IEB). Objective: The goal of this study was to identify the influence of anthropometric variables on the BD and the IEB in competitive teenage athletes. Method: This is a crossed analysis with 580 participants between the ages of 10 and 19 years of both sexes, practitioners of various kinds of sports. The Body Shape Questionnaire was applied to measure the BD. The Eating Attitudes Test was used to evaluate IEB. Skinfolds were measured to estimate the fat percentage (%F). Weight and height were measured to calculate the Body Mass Index (BMI). Multiple linear regression method was performed to evaluate the influence of independent variables on the outcomes of the study. Results: The results showed that the BD in female gender was modulated only by %F, unlike the males, in which BMI and %F together explained part of its variance ($p < 0.05$). The IEB in male gender was little influenced by %F. Conclusion: It can be concluded that the %F was the only variable that influenced the BD in both genders. Furthermore, the IEB on young athletes does not seem to be influenced by anthropometric characteristics.

Keywords: body image, eating behavior, anthropometry.

INTRODUCTION

There are some overweight/obesity anthropometric indicators. The body mass index (BMI) is one of them, an index widely used in the evaluation of the nutritional status[1]. The World Health Organization[2] recommends the use of the BMI to diagnose both obesity and malnutrition in adolescents. The BMI is very used due to its low cost, simplicity to measurements measurement and high reproducibility[3]. High values of BMI have been strongly associated with body dissatisfaction[1] and inappropriate eating behavior in adolescents[4,5]; however, it has not been proved yet if the BMI influences on these variables in athletes.

Besides the BMI, body adiposity can also be used as overweight/obesity cut-off point[4]. Therefore, skinfolds need to be measured for estimation of the fat percentage[6]. Its influence in the body dissatisfaction as well as inappropriate eating behavior in athletes has not been approached in the literature yet.

Body adiposity and BMI suffer variations, especially in the period of greater physical growth which occurs during puberty[7], and it also varies according to eating habits and physical exercise practice[8]. These morphological alterations may influence on the eating behavior and body image of adolescents[1].

Body image is defined as the mental image one has about his/her body[9]. One of the subcomponents of attitude dimension of body image which is worth investigating is body dissatisfaction, which is concerned about depreciation the individual has with his/her physical appearance[1]. According to Bonci et al.[9], body dissatisfaction is one of the factors which predispose to inappropriate

eating behavior, which may trigger eating disorders (EDs). It seems that both body dissatisfaction and abnormal eating behavior occur with different frequencies between sexes. Some studies have presented results which present higher prevalence of these closings among female individuals[4,5]; therefore, it is recommended that these variables are evaluated according to sex.

The mostly known EDs are anorexia nervosa (AN) and bulimia nervosa (BN). These psychopathologies are characterized by morbid fear of gaining weight, perception distortion of body image and use of pathological methods for losing weight[5]. These are diseases which seem to affect more widely the population of athletes[10]. However, studies which have evaluated the influence of anthropometric characteristics on eating behavior and body dissatisfaction in young athletes are still scarce. It is estimated that this is the first research to study these influences in this population. Thus, the aim of the present study was to identify the influence of anthropometric variables on the body dissatisfaction and inappropriate eating behavior in adolescent athletes.

METHODS

Sample

It is a transversal analysis held in 2010 and 2011, in the cities of Rio de Janeiro, RJ, Três Rios, RJ, Barbacena, MG, and Juiz de Fora, MG, Brazil. 620 competitive athletes aged between ten and 19 years, of both sexes, practitioners of the sports modalities: track and field, basketball, fencing, soccer, artistic gymnastics, handball, judo, synchronized swimming, water polo, diving, *tae kwon do*, triathlon and

volleyball were evaluated. All volunteers practiced systematzed physical training with minimum frequency of three times a week with minimum duration of one hour/day, besides having participated in competition in their sports modalities. The ones younger than 18 years had their parents or legal tutors signing a Free and Clarified Consent Form which explained the study's aims and procedures, authorizing voluntary participation of his/her son/daughter in the research. Anonymous nature of the study was guaranteed to all volunteers of the research. Moreover, this study was only developed after having received the number of the legal opinion of the Ethics in Research in Humans Committee of the Federal University of Juiz de Fora, according to resolution # 196/96. 40 athletes were excluded from the research for many reasons, among these: not presenting the signed consent form and those who did not answer the questionnaire in full or did not participate in the anthropometric evaluation. Thus, the final sample consisted of 580 young athletes.

INSTRUMENTS

Anamnesis

Eating behavior

The *Eating Attitudes Test* (EAT-26) questionnaire composed of 26 questions sorted in different aspects: factor I (diet), factor II (bulimia nervosa and concern with food) and factor III (oral control) was used. The EAT-26 applied to female adolescent athletes was validated by Bighetti et al.[11]. Male athletes had the EAT-26, validated for Brazilian adolescents by Fortes et al.[12]. The sample of the present study had the Cronbach alpha calculated, identifying values of 0.89 and 0.92 for girls and boys, respectively. The EAT-26 is done by the sum of its items. Score equal or higher than 20 represents individuals with risk eating behavior for EDs. There are six options of answer which range from 0 to 3 points (always = 3, many times = 2, frequently = 1, few times = 0, almost never = 0 and never =0). The only question which presents punctuation in inverted order number 25 (always = 0, many times = 0, frequently = 0, few times = 1, almost never = 2 and never =3).

Body dissatisfaction

It was evaluated by the *Body Shape Questionnaire*. This instrument has 34 questions in Likert scale, ranging from 1 = never until 6 = always. These questions evaluate the dissatisfaction with weight and physical appearance. The version used was validated for Brazilian adolescents[13]. The Cronbach alpha was calculated for the sample of the present research, and values of 0.91 were found for girls and 0.92 for boys. The final punctuation is the final result of the sum of the scores of each item in the questionnaire. The higher the punctuation, the higher the depreciation with weight and physical appearance.

Anthropometry

Fat percentage was estimated by double indirect method, having the tricipital and subscapular skinfolds measured. The Slaughter et al.[6] protocol was used for estimation. These measurements were performed in a rotational way and collected three times, considering the mean of the values.

Body mass was measured on a Tanita portable digital scale with precision of 100g and maximum capacity of 200 kg. A Welmy portable stadiometer with precision of 0.1cm and maximum height of 2.20 m was used to measure stature.

All anthropometric measures used the ISAK standardizations[14]. Moreover, the skinfolds were measured by the same evaluator to increase reliability of the evaluation and the measurement technical error calculation proposed by Silva et al.[15], excluding data with variance above 10%.

Body adiposity was determined by the fat percentage. The classification of this variable was attributed by the cut-out points established by Lohman[16], which consider the sex of the subject.

The body mass index [BMI = body mass (kg)/stature (m²)] was used as an indicator of the nutritional status. The BMI classification followed the WHO criteria[2], which propose classification in low weight, average weight, overweight and obese, according to percentiles (5, 85 and 95) according to chronological age.

Procedures

The procedures were performed at the training time of the teams on two subsequent days. All clubs made rooms and environments for such evaluations procedures available.

Data were collected by one researcher only. This researcher was responsible for the application of the questionnaires at the first moment. The second meeting was for the performance of the anthropometric evaluations.

On the first meeting, the BSQ and EAT-26 instruments were. The questionnaires were handed to the athletes who received the same verbal instructions. The written instructions of the suitable procedures were included in them. Occasional questions were solved by the responsible for the application of the instruments. The subjects of the study did not communicate with each other. The questionnaires were given the moment at which the athletes entered the room and its completion was voluntary. There was no time limit for its completion.

On the second encounter, the athletes were guided to variables measurement. The athletes individually entered the room and only after he/she had left, another individual was allowed to enter the room.

DATA ANALYSIS

In order to evaluate the influence of anthropometric variables on the body dissatisfaction and the eating behavior, the step by step of the multiple linear regression analysis was adopted as parameter (*stepwise*). Prior to this analysis, the Kolmogorov-Smirnov normality test was applied in the criterion (body dissatisfaction and inappropriate eating behavior) variables. Since violation in the data distribution was not identified in the data distribution of these variables, multiple linear regression was performed. For this analysis, the BMI and the fat percentage were used with explanation variables. Moreover, binary logistics regression was performed to evaluate the risks of the nutritional status and body adiposity in the predisposition on the body dissatisfaction and inappropriate eating behavior. For this test, the BSQ classifications "light dissatisfaction", "moderate dissatisfaction" and "severe dissatisfaction" were grouped in "dissatisfied". The body adiposity classifications "very low", "low", were termed as "low" and the classifications "moderately high", "high" and "very

high", were grouped in "high". The statistical tests were performed in the SPSS software, version 17.0, adopting significance level of 5%.

RESULTS

40 athletes were excluded from the research for many reasons, among which: not presenting the signed consent form and those who did not completely answer the questionnaires or did not participate in the anthropometric evaluation. Thus, 580 athletes from 14 modalities, out of which 116 of the female sex and 464 of the male sex ended up participating in the study. The modalities with the highest number of data collected in the female sex were swimming (22) and handball (20). In the male sex, soccer (271) and basketball (56) were the sports which obtained the highest number of participants.

Tables 1 and 2 present, respectively, the influence of anthropometric indicators on the body dissatisfaction and inappropriate eating behavior. Body dissatisfaction in the female sex seemed to be modulated only by the fat percentage, contrary to in the male sex in which BMI and fat percentage together explained part of the variance of the body dissatisfaction. Inappropriate eating behavior in the male sex was little influenced by the fat percentage. In the female sex, neither the fat percentage nor BMI explained the variance of inappropriate eating behavior.

The simple logistics regression model evidenced that body dissatisfaction was associated with the nutritional status and body adiposity in both sexes (table 3). When the model was adjusted for all variables, the nutritional status was associated with body dissatisfaction in the two sexes. It is worth mentioning that girls with low weight and boys with obesity presented more chances to be dissatisfied than the healthy athletes. However, body adiposity was related to body dissatisfaction only in the female sex. In addition to that, athletes with high fat percentage presented higher chances to be dissatisfied than girls with normal body adiposity.

Table 1. Multiple linear regression using the BMI and fat percentage as explanation variables on the body dissatisfaction variance of competitive adolescent athletes divided by sex.

Sex	Variable	R	R^2	adjusted R^2	p value
Female	BMI	0.35	0.12	0.11	$p \le 0.39$
	%F	0.44	0.19	0.18	$p \le 0.01$
	BMI * %F	0.44	0.19	0.18	$p \le 0.01$
Male	BMI	0.37	0.14	0.14	$p \le 0.01$
	%F	0.36	0.13	0.13	$p \le 0.01$
	BMI * %F	0.42	0.17	0.17	$p \le 0.01$

Bmi = body mass index; %f =fat percentage; bmi * %f = body mass index and fat percentage interaction.

Table 2. Multiple linear regression using BMI and fat percentage as explanation variables on the inappropriate eating behavior variance of competitive adolescent athletes divided by sex.

Sex	Variable	R	R^2	Adjusted R^2	p value
Female	BMI	0.15	0.02	0.02	$p \le 0.09$
	%F	0.18	0.03	0.02	$p \le 0.06$
	BMI * %F	0.19	0.03	0.02	$p \le 0.14$
Male	BMI	0.06	0.004	0.001	$p \le 0.2$
	%F	0.16	0.03	0.02	$p \le 0.01$
	BMI * %F	0.17	0.03	0.02	$p \le 0.01$

Bmi = body mass index;; %f = fat percentage; bmi * %f = body mass index and fat percentage.
.interaction

Table 3. Odds ratio for dissatisfaction with body image (reference category: satisfied) in adolescent athletes divided by sex according to anthropometric indicators

Sex	Variable	Classification	OR	CI (95%)	OR*	CI (95%)
F	NS[a, b]	Low weight	6.09	0.60 – 60.92	7.39	0.72 – 75.22
		Average weight	1.00		1.00	
		Overweight	2.84	0.84 – 9.66	1.37	0.35 – 5.38
		Obese	3.28	0.50 – 21.99	1.15	0.1 – 13.15
	%F[a,b]	Low	0.27	0.03 – 2.28	0.31	0.36 – 2.62
		Average	1.00		1.00	
		High	3.94	1.63 – 9.50	3.44	1.29 – 9.17
M	NS[a,b]	Low weight	0.10	0.05 – 4.76	0.10	0.03 – 14.12
		Average weight	1.00		1.00	
		Overweight	6.88	3.47 – 13.63	5.85	2.86 – 11.94
		Obese	9.41	3.94 – 22.49	7.67	3.11 – 18.90
	%F[a]	Low	0.48	0.16 – 1.47	0.57	0.18 – 1.78
		Average	1.00		1.00	
		High	2.38	1.32 – 4.28	1.36	0.71 – 2.59

F = female; m = male; ns = nutritional status; %g = body adiposity; or = odds ratio; * = or adjusted for all variables; ci = confidence interval; [a]p < 0.05 For simple logistics regression model; [b]p < 0.05 For adjusted logistics regression model.

Table 4 presents the results of the logistics regression analysis for inappropriate eating behavior concerning nutritional status and body adiposity of the athletes. In the female sex, the regression models did not indicate association with inappropriate eating behavior. In the male sex, only the nutritional status presented association with eating behavior in the two models. Obese athletes presented more chances of eating inappropriateness than healthy adolescents.

Table 4. Odds ratio for inappropriate eating behavior (reference category: negative) in adolescent athletes divided by sex according to anthropometric indicators.

Sex	Variable	Classification	OR	CI (95%)	OR*	CI (95%)
F	NS	Low weight	1.57	0.15 – 16.00	1.51	0.15 – 15.67
		Average weight	1.00		1.00	
		Overweight	0.94	0.19 – 4.68	0.89	0.16 – 5.08
		Obese	2.35	0.20 – 27.45	2.22	0.16 – 31.15
	%F	Low	0.55	0.06 – 4.79	0.57	0.07 – 4.92
		Average	1.00		1.00	
		High	1.06	0.37 – 3.08	1.02	0.30 – 3.48
M	NS[a,b]	Low weight	1.14	0.32 – 4.04	1.38	0.37 – 5.10
		Average weight	1.00		1.00	
		Overweight	1.19	0.50 – 2.81	1.15	0.47 – 2.79
		Obese	2.66	1.05 – 6.75	2.52	0.96 – 6.60
	%F	Low	0.44	0.18 – 1.12	0.44	0.17 – 1.12
		Average	1.00		1.00	
		High	0.97	0.56 – 1.68	0.88	0.49 – 1.59

F = female; m = male; ns = nutritional status; %f = body adiposity; or = odds ratio; * = or adjusted for all variables; ci = confidence interval; [a]p < 0.05 For simple logistics regression model; [b]p < 0.05 For adjusted logistics regression model.

DISCUSSION

The study tried to understand the influence of anthropometric indicators on the body dissatisfaction and inappropriate eating behavior of competitive adolescent athletes according to sex. Some results will be highlighted during this session.

The findings of the present study showed that the BMI modulated the body dissatisfaction only in the male sex; however, the

nutritional status presented association with body dissatisfaction in the adjusted logistics regression model in both sexes. Girls with low weight and overweight were pointed with higher tendency (7.39 and 1.37, respectively) to be dissatisfied with physical appearance, compared with the athletes classified in 'average weight'. The findings of the female sex corroborate trends exposed in the literature that adolescents with overweight/obesity are more dissatisfied with their weight and physical appearance[1,5]. However, it was unexpected to find odds ratio of 7.39 of body dissatisfaction in athletes with low weight nutritional status, since girls usually wish to lose weight and present thinness as esthetics goal[4,17]. These results corroborate the study by De Bruin et al.[18], who identified that female athletes, even with low body weight, were dissatisfied with their bodies and still wanted to lose weight. Therefore, the results in the female sex may be a reflex of the characteristics of part of the sample which came from modalities with esthetical profile (artistic gymnastics, synchronized swimming and diving), since research shows that in these sports, regardless of the morphological characteristics, the athletes tend to present body dissatisfaction[18-20]. Thus, it seems that girls are dissatisfied with their bodies and physical appearance, regardless of their nutritional status[1,5]. On the other hand, overweight and obesity were predictors of body dissatisfaction, a fact which was already expected. Despite the low number of association studies, the findings of this research seem to be similar to results of studies with students in the same age group[4]. The nutritional status may manifest similar affection feelings in the two sexes of the population of young athletes, since weight excess is considered depreciation in the western culture[5].

The present research evidenced that the fat percentage significantly influenced the body dissatisfaction variance in both sexes, being it modulated in 19% in the girls and 13% in the boys. Body adiposity was associated only in the female sex in the logistic regression model. Girls with high lipid percentage presented 3.44 times more chances of body dissatisfaction compared with athletes with average body adiposity. In athletes, the body adiposity, besides influencing on the body dissatisfaction, seems to be its prediction in the female sex, since the amount of fat is inversely proportional to the sports performance in many modalities[17]. Therefore, many female athletes, together with their coaches, believe that low lipid percentage is a crucial characteristic for performance optimization. However, too low fat percentage may lead these athletes to physiological problems such as amenorrhea and psychological ones, such as ED[21]. Conversely, boy fat was not a predictor of body dissatisfaction in the male sex. Boys seem to bother less about morphological aspects when compared with girls[22], regardless of being athletes or not[1]. Male athletes are probably more concerned about sports results than with their body composition[17].

The results of the present study showed that the BMI and fat percentage did not influence on the EAT-26 variance in the female sex. Moreover, nutritional status and body adiposity were not significant predictors of unhealthy eating habits in this sex. The findings of the research by Haase[23] agree with the ones found in the present study, since this author when assessing athletes from many modalities, found significantly higher punctuations in the EAT-26 in individuals with overweight. De Bruin et al.[24] showed results similar to the ones by Haase[23], since they identified that the BMI influenced on the frequency of pathological behavior for weight control/ loss in Dutch female athletes. It seems that girls are concerned about eating habits despite presenting body weight and fat within the normality standards [5,19], which may somehow explain the findings of the present study. Furthermore, the characteristics of the modalities assessed in the present research are different from the studies mentioned above. Thus, we should be careful when comparing and interpreting them. In the boys, the results evidenced that only the fat percentage influenced on the inappropriate eating behavior (3%) and only body adiposity remained associated with the positive factor of the EAT-26 in the logistics regression model. This last analysis evidenced that athletes with overweight and obesity, respectively, presented 5.85 and 7.67 times more chances of disorganized eating habits than the healthy athletes. In that public, the conducted research usually aassociated inappropriate eating behavior with psychological aspects such as perfectionism[25], competitive anxiety[10], substances dependence[11] self-esteem and depression[25]. Studies associating or checking the influence of anthropometric indicators on the inappropriate eating behavior in male athletes have not been found. However, differently from the results in the female sex, it seems that weight excess and high body adiposity may be considered risk factors for abnormal eating behavior in male athletes.

Although the present research has identified original and relevant findings, it presented some limitations One of them was to use questionnaires as evaluation instruments. Researchers state that the participants may not answer be reliable with self-applied instruments[17,19,26]. Therefore, the results may not reflect the reality of the evaluated context, since the final result is a product of subjective answers. Another limitation was to use a double indirect method for estimation of body fat of the athletes. Nevertheless, we highlight the difficulty in accessing sophisticated equipment and cost in the use of these apparatuses. Thus, in studies with large samples, the authors recommend the use of low cost methods with easy application, such as in the case of skinfolds[15].

It is believe that the results of this research may help coaches of Brazilian athletes to find treatment and approach to these young individuals. Exposure to situations and characteristics concerning the adolescents' bodies may reflect on unhealthy behavior and attitudes, negatively influencing on the athletes' health. Thus, even if the individuals present body morphology inappropriate to sports performance of his/her respective modality, it is recommended that he/she is not excessively pushed to alter his/her body characteristics.

CONCLUSION

It can be said that the nutritional status classification low weight in the female sex and overweight and obese in male athletes more accurately predicted risks for body dissatisfaction in adolescent athletes. On the other hand, it can be stated that only the body

composition classification "high" presented risks for body dissatisfaction in the female sex. Additionally, the fat percentage was the only variable which influenced body dissatisfaction in both sexes.

Concerning the inappropriate eating behavior, it can be concluded that only the classification "obese" of the nutritional status demonstrated risks for disorganized diet in the male sex. Among the girls, a good anthropometric indicator for prediction of inappropriate eating habits was not identified. Further studies which evaluate the influence of other physical variables on body dissatisfaction and inappropriate eating behavior in athletes are suggested, as well as research which compare these variables in different stages of the maturation process in adolescence are needed.

All authors have declared there is not any potential conflict of interests concerning this article.

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