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Relationship between risk behaviors for eating disorders and maturational process in young athletes

Relação entre comportamentos de risco para transtornos alimentares e processo maturacional em jovens atletas

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Abstract

The aim of the study was to analyze the relationship between risk behavior for eating disorders (ED) and maturational process, according to sex. 580 athletes, of both genders, aged between 10 and 19 years participated of the study. ED was assessed by the Eating Attitudes Test (EAT-26). We applied the Body Shape Questionnaire (BSQ) to assess body dissatisfaction. Sitting-height, height and weight were measured to estimate the age of somatic maturation. Sexual maturation was assessed by the criteria of "Tanner". Results showed prevalence of 18,1 and 14,7% of behavior for ED in girls and boys, respectively. There was no difference in the EAT-26 scores as a function of maturational stages, but this score was associated with maturational stages in males ($p < 0.05$). Finally, the interaction between somatic and sexual maturation significantly influenced the EAT-26 score in both the female and male gender ($p<0.05$). Moreover, we found significant differences in the proportions of the BSQ ratings in both sexes ($p<0.05$). We conclude that the maturational process exerted little influence on the behavior of ED, and this relationship was observed only in male athletes. Thus, it appears that male athletes with more advanced biological ages are better protected against ED. However, female athletes appear to be at greater risk for such behaviors, regardless of maturational period in which they are.

Keywords

Eating behavior; Eating disorders; Athletes.

Resumo

O objetivo do estudo foi analisar a relação entre comportamento de risco para transtornos alimentares (TA) e processo maturacional, segundo o sexo. Participaram 580 atletas, de ambos os sexos, com idade entre 10 e 19 anos. TA foi avaliado pelo Eating Attitudes Test (EAT-26). Aplicou-se o Body Shape Questionnaire (BSQ) para avaliar a insatisfação corporal. Aferiu-se a altura tronco-cefálica, a estatura e o peso para estimar a idade de maturação somática. A maturação sexual foi avaliada pelos Critérios de "Tanner". Os resultados indicaram prevalência de 18,1 e 14,7% de comportamento para TA em meninas e meninos, respectivamente. Não houve diferenças dos escores do EAT-26 em função dos estágios maturacionais, mas houve associação deste escore com os estágios maturacionais no sexo masculino ($p<0,05$). Por fim, a interação entre maturação somática e sexual influenciou significantemente a pontuação do EAT-26 tanto no sexo feminino, quanto no masculino ($p<0,05$). Ademais, encontraram-se diferenças significantes nas proporções das classificações do BSQ em ambos os sexos ($p<0,05$). Concluiu-se que o processo maturacional exerceu pouca influência sobre o comportamento de TA, e esta relação foi observada apenas nos atletas do sexo masculino. Deste modo, parece que atletas masculinos com idades biológicas mais avançadas estão mais protegidos contra TA. No entanto, esportistas do sexo feminino parecem apresentar mais riscos para tais comportamentos, independentemente, do período maturacional em que se encontram.

Palavras-chave

Comportamento alimentar; Transtornos alimentares; Atletas.

INTRODUCTION

Adolescence is a period that ranges from 10 to 19 years of age[1], characterized by the allometric growth of body structures[2]. In this period, behaviors like independence and responsibility are expected, as well as autonomy, self-determination and the will to belong to a group, not to mention the improvement in the cognitive and social capacity[3]. Some youths start practicing sports, aiming to enhance their physical performance[4,5] and to achieve the condition of athletes, which implies participating in competitions to attain conquests and victories, always trying to exceed their limits[6,7].

However, competitive environments are full of demands that can be harmful to the youth's health[8]. It is not uncommon to find coaches, sponsors and even parents who demand the best results[7,9,10]. In this scenario, some athletes believe that, to improve their performance, they need to restrict their eating, and also use inadequate methods to control and maintain their body weight[4,11], thus running the risk of developing inappropriate eating habits.

The risk behavior for eating disorders (ED) causes serious damages to health and is manifested by induced vomiting, long periods of food restriction, exaggerated preoccupation with foods, and use of drugs to lose weight (laxatives, diuretics and appetite suppressants), among others[12]. According to Torstveit and Sundgot-Borgen[8] and Haase[6], the prevalence of these behaviors is high in the competitive environment, ranging from 20 to 70%, depending on the sport that is practiced[7] and on the screening instrument that is used[4,5]. Furthermore, young athletes who practice modalities in which physical esthetics and/or body weight are considered factors determining success (artistic gymnastics, synchronized swimming, diving, taekwondo and judo) seem to be more vulnerable to ED risks[7,10]. However, the eating disorders seem to manifest themselves differently according to sex, being more frequent in the female public[10,11]. In addition, it is known that numerous factors predispose the adolescent to such habits[7,11], and one of them may be the maturational process[4].

In girls, the maturational process generates an increase in body fat, while in boys, an increase in lean body mass is common[2]. Peak height velocity (PHV) is known as one of the main maturational markers, and it occurs around 12 years of age in girls and 14 years of age in boys[13]. This event promotes body dimorphism between some extremities (biacromial and bicrystal diameters, leg length and sitting-height), as well as an expressive increase in body weight, which, added to the morphological alterations that were described above, may cause body dissatisfaction[4]. The discontentment with one's own physical appearance can have a negative repercussion on body image[10].

In fact, body image is a multidimensional construct that is influenced by diverse factors[4]. It is conceptualized as attitudes, behaviors and perception in relation to one's own body[6]. Body dissatisfaction, in turn, concerns the individual's depreciation of his/her weight and physical appearance[14].

It is known that body dissatisfaction can predispose the individual to risk behavior for ED[15]. In this sense, subjects who are dissatisfied with their weight and physical appearance may adopt inadequate behaviors in order to lose/control their body weight[6,12]. These behaviors are considered the main risk factors for the triggering of anorexia and bulimia[15]. Among athletes, these disorders are common[7,10,11], and the prevalence ranges from 5 to 40%[6,8,16].

Up to the moment, studies have compared the risk behavior for ED before and after the menarche in the female sex[17], or have tried to compare this behavioral variable across distinct age periods[18]. Nevertheless, there has been no concern to use reliable methods (skeletal, somatic and/or sexual maturation) to identify the influence of the maturational process on the onset of ED. Besides, as far as we know, no study has proposed to carry out a similar research with the male sex.

Thus, although it is believed that the maturational process can contribute to the development of risk behavior for ED[4], in a survey performed in the databases Web of Science, Scopus and Scielo, with the keywords "eating behavior", "eating disorders", "athletes", "biological maturation" and "maturational process", no study associating these factors was found. In view of this situation, the present study aimed to analyze the association between risk behavior for ED and maturational process in young athletes.

Therefore, some hypotheses were formulated based on principles proposed by De Bruin, Oudejans and Bakker[4] and on the morphological alterations deriving from the maturational process[2]: 1) there will be significant differences in the risk behavior scores for ED among athletes at different maturational stages (somatic and sexual); 2) there will be a significant influence of the maturational process on the risk behavior scores for ED in both sexes; and 3) this influence will be characterized by the fact that boys at early pubertal stages, as well as girls at more advanced stages, have higher risk of nutritional inadequacy.

METHODS

This is a cross-sectional study that was carried out in the cities of Rio de Janeiro (State of Rio De Janeiro – RJ), Três Rios (State of Rio De Janeiro – RJ), Juiz de Fora (State of Minas Gerais – MG), and Barbacena (State of Minas Gerais – MG), in the period from February to June 2011.

Participants

The federations of many sports modalities and some clubs located in the four Brazilian States belonging to the Southeast Region were contacted and invited by telephone or e-mail to participate in the research. However, responses were obtained only in the States of Rio de Janeiro (RJ) and Minas Gerais (MG). Thus, the population of the research represented adolescent athletes aged between 10 and 19 years, of both sexes, living in the States of Rio de Janeiro/RJ and Minas Gerais/MG in Brazil. According to the Brazilian Olympic Committee, in 2010, this population totaled 24,252 individuals. Sample size was calculated, considering a prevalence of 20% for risk behaviors for ED, with a 95% confidence interval and 4% of sampling error, totaling 379 youths that should be evaluated. However, in light of the recommendations of Schaal et al.[7], it was decided to collect the maximum possible amount of data, exceeding the calculated sample size.

To select the sample, the method of convenience sampling[7] was used. In addition, the recommendations of Haase[6] and Sundgot-Borgen and Tortveit[11] were followed concerning the sample's inclusion criteria. Thus, to include the athletes in the study, the following criteria were followed: affiliation in the sports federation, participation in a systematized routine of physical training with minimum frequency and duration of 3 times/week and 1h/day, and participation in official competitions in the 12 previous months.

Initially, 620 athletes of both sexes were included in the study, but 40 of these subjects were excluded because they did not answer the questionnaire fully and/or did not participate in the anthropometric measurement, and presented incomplete maturational data. The final sample had 580 athletes of several modalities (athletics, basketball, fencing, soccer, artistic gymnastics, handball, judo, synchronized swimming, swimming, water polo, diving, taekwondo, triathlon, volleyball).

MEASUREMENTS

Risk behavior for ED

It was assessed by means of the Eating Attitudes Test (EAT-26), which has already been applied to other studies, such as the ones by Perini et al.[5] and Haase[6]. It is a questionnaire with 26 questions that investigate pathological food refusal, exaggerated preoccupation with physical appearance, purgative behaviors, influence of the environment on food intake, and self-control over foods. There are six response options that vary from 0 to 3 points (always = 3, many times = 2, frequently = 1, a few times = 0, almost never = 0 and never = 0). The score is calculated by adding its items and a total score equal to or higher than 20 (EAT+) represents individuals with risk behavior for ED.

This instrument has a validated version for the Brazilian population[12, 19] and it has satisfactory values for the internal consistency analysis (0,82 and 0,87 for the female and male sex, respectively). For the sample of the present study, the values corresponded to 0,89 for girls and 0,92 for boys.

Somatic maturation

The method described by Mirwald et al.[13] was employed to estimate PHV age. The volunteers' height, weight and sitting-height were measured once. Leg length was obtained by the difference between height and sitting-height. The combination of these values was applied to the formulas proposed by Mirwald et al.[13] to each sex and the results were classified in the following way:

- < -1 = Pre height growth spurt;
- between -1 and +1 = During height growth spurt;
- > +1 = Post height growth spurt.

Sexual maturation

The assessment was performed by means of "Tanner's Criteria"[3]. The self-reported method was employed, in which the growth and development of secondary sexual characteristics are evaluated, such as: genitalia for boys, breasts for girls and pubic hair for both sexes. The clubs provided adequate rooms for this evaluation. All the athletes participated in the evaluation individually, before the training sessions. This method was validated for the population of Brazilian adolescents by Matsudo and Matsudo[20], who found a correlation coefficient between self-assessment and pediatric assessment of r=0,61 for breasts and r=0,71 for pubic hair in girls. For the boys, these coefficients were r=0,60 for the genitals and r=0,70 for pubic hair. The classification of "Tanner's Criteria" was performed in the following way:

Stage 1 – Pre-pubertal; Stage 2 – Early pubertal; Stage 3 – Intermediate pubertal; Stage 4 – Advanced pubertal; Stage 5: Post-pubertal.

Level of Body Image Perception

The Body Shape Questionnaire (BSQ) was administered to evaluate the level of body image perception. The self-administered questionnaire is composed of 34 questions that evaluate the subject's concern regarding his/her body weight and physical appearance. The score is given by the sum of its items, which ranks dissatisfaction levels into: <80 points = free from body dissatisfaction; between 80 and 110 = mild dissatisfaction; between 110 and 140 = moderate dissatisfaction; and scores above 140 = severe body dissatisfaction, that is, the higher the score, the greater the body dissatisfaction[21]. The utilized version was validated for Brazilian adolescents[21] with α of 0,96 for both sexes and a significant correlation coefficient (test-retest), varying from 0,89 to 0,91 for girls and boys, respectively. For the present sample, the values of Cronbach's alpha were 0,91 and 0,92 for the female and male sexes, respectively.

Anthropometry

The anthropometric measures that were collected were: body mass, height and skinfolds (subscapular and triceps). The procedures described by the ISAK[22] were used. In addition, all the measurements were performed by the same researcher, who was considered experienced in this type of evaluation. Furthermore, all the measures were taken in the afternoon period (2 p.m. to 6 p.m.)

Body mass and height were measured with the subjects barefooted and wearing minimal clothing. A portable electronic scale of the make Tanita® was used, with precision of 0,1 kg, for weight, and a portable stadiometer with precision of 0,1 cm, of the make Tonelli®, for height. These variables were measured only once. The Body Mass Index (BMI) was obtained by the ratio between body mass (kg) and the square of the height (m).

The skinfolds were measured three times, in a non-consecutive way. They were measured with a plicometer of the make Lange with precision of 0,1 mm. To calculate fat percentage (%F), the prediction equation proposed by Slaughter et al.[23] was used.

Procedures

Initially, the project was presented to federations, directors and coaches of several teams from many sports modalities, and information about the procedures and aims of the study was provided. However, some of them denied the voluntary participation of their athletes, on the grounds that the evaluation of sexual maturation would invade the athlete's intimacy, or the youth would think that the research would aim to detect future sports talents; thus, they would run the risk of losing their athletes.

After the consent of some federations, directors and coaches, a meeting was scheduled with each team to make the invitation to the athlete and to explain the technical and ethical procedures of the research. In addition, those younger than 18 years received a consent document, and they were requested to give it to their parents or guardians and bring it signed on the following week.

The study was divided into two moments. In the first phase, the anthropometrical measurements were performed (body mass, height, sitting-height and skinfolds). Every club had an adequate room for the evaluation and each athlete was individually evaluated. The anthropometrical measures were taken by the same researcher to guarantee the reliability of the measurements. Even so, if the data

presented variance higher than 10%, it would be excluded[24]. However, no datum was excluded for this reason[24].

In the second stage, the same researcher administered the instruments BSQ and EAT-26 collectively. The doubts were clarified during the administration and the subjects did not communicate with each another. The questionnaires were distributed when the athletes entered the room. Answering the questionnaires was a voluntary activity, and there was no limit of time to answer them.

Data analysis

Measures of central tendency (mean) and dispersion (standard deviation) were used for all the variables of the study. The chi-square test was applied to compare frequencies of categorical variables. The univariate analysis of covariance (ANCOVA) was performed, using age, BMI and %F as covariables, to compare the EAT-26 scores between the stages of sexual and somatic maturation. To verify the odds ratio of risk behavior for ED (reference category: negative), binary logistic regression was used. Stepwise multiple linear regression was applied to determine the influence that sexual and somatic maturation, together with body dissatisfaction, had on the EAT-26 score. All the data were treated in the software SPSS version 17.0, and the level of significance that was adopted was 5%.

Ethical aspects

The research was developed after the project was approved by the Research in Human Beings Ethics Committee of *Universidade Federal de Juiz de Fora*, opinion number 232/2010.

RESULTS

For both sexes, there was predominance of the collective practice (soccer, basketball, volleyball, handball, water polo, artistic gymnastics and synchronized swimming), corresponding to 72,4% and 78,6% for girls and boys, respectively (Table 1).

Regarding the EAT-26 ratings, the results showed a prevalence of 18,1% and 14,7% for risk behaviors for ED (EAT+) in girls and boys, respectively. The chi-square test did not show a difference in prevalence for the EAT-26 ratings according to sex. However, in both sexes, higher prevalence of the "EAT-" rating ($p<0,05$) was identified, as it can be observed on Table 2.

In somatic maturation, the majority of the girls was classified as "Post PHV" (69%), while among the boys, the groups "During PHV" and "Post PHV" had similar frequencies (41,4% and 47,4%, respectively) (Table 2).

In sexual maturation, the prevalences were higher in the more advanced stages in both sexes, as it is illustrated on Table 2.

Concerning body dissatisfaction, significant differences were found in the proportions of the BSQ class ratings in both sexes, with prevalences decreasing as the degree of dissatisfaction increased ($p<0,05$) (Table 2). In addition, the chi-square test presented higher prevalence of dissatisfaction in girls when compared to boys ($p<0,05$).

The results of the comparison of the EAT-26 scores across the maturational stages, using age, BMI and %F as covariables, did not show significant differences (Table 3).

Table 1 – Frequency of adolescent athletes by sports modality and sex

Modality	Sex		
	Male	Female	Total
	N (%)	N (%)	N (%)
Athletics	10 (2,2)	-	10 (1,72)
Basketball	56 (12,1)	16 (13,8)	72 (12,41)
Fencing	8 (1,7)	-	8 (1,39)
Soccer	271 (58,4)	-	271 (46,72)
Artistic gymnastics	-	14 (12,1)	14 (2,41)
Handball	16 (3,4)	20 (17,2)	36 (6,20)
Judo	14 (3,0)	-	14 (2,41)
Synchronized swimming	-	18 (15,5)	18 (3,10)
Swimming	42 (9,1)	22 (19,0)	64 (11,03)
Water Polo	16 (3,4)	-	16 (2,78)
Diving	5 (1,1)	5 (4,3)	10 (1,72)
Taekwondo	6 (1,3)	5 (4,3)	11 (1,90)
Triathlon	14 (3,0)	-	14 (2,41)
Volleyball	6 (1,3)	16 (13,8)	22 (3,80)
Total	464 (100)	116 (100)	580 (100)

Table 2 – Descriptive values of the study's variables, according to sex.

Classification/Description		Sex			
		Male		Female	
		Mean	Standard Deviation	Mean	Standard Deviation
Age (years)		15,05	2	14,54	2
BMI (kg/m²)		21,28	2,90	20,43	3,17
%F		18,43	7,26	23,03	6,22
EAT-26		11,59	11,78	11,89	7,93
BSQ		59,75	21,90	75,45	28,81
		N	%	N	%
EAT-26	EAT+ (≥20)	68	14,7[a]	21	18,1[a]
	EAT- (<20)	396	85,3	95	81,9
Somatic M.	Pre PHV	52	11,2[b,c]	12	10,3[b,c]
	During PHV	192	41,4	24	20,6[c]
	Post PHV	220	47,4	80	69
Sexual M.	Pre Pubertal	13	2,8[e]	7	6[d,e]
	Early Pubertal	19	4,1[e]	15	12,9[e]
	Intermediate Pubertal	118	25,4	28	24,1
	Advanced Pubertal	177	38,2[e]	39	33,6[e]
	Post Pubertal	137	29,5[f]	27	23,3[f]
Body Diss.	No diss.	396	85,3	71	61,2
	Mild	49	10,6[g,h]	29	25[g,h]
	Moderate	13	2,8[g,h,i]	13	11,2[g,h,i]
	Severe	6	1,3[g,h,i]	3	2,6[g,h,i,j]

EAT+ = score ≥20 in the EAT-26; EAT- = score <20 in the EAT-26; M = Maturation; PHV = Peak Height Velocity; BSQ = Body Shape Questionnaire; Diss. = Dissatisfaction; BMI = Body Mass Index. [a]p<0,05 in relation to "EAT-"; [b]p<0,05 in relation to "During PHV"; [c]p<0,05 in relation to "Post PHV"; [d]p<0,05 in relation to "Early Pubertal"; [e]p<0,05 in relation to "Intermediate Pubertal"; [f]p<0,05 in relation to "Advanced Pubertal"; [g]p<0,05 in relation to "No diss."; [h]p<0,05 in relation to "Mild"; [i]p<0,05 in relation to "Moderate"; [j]p<0,05 between sexes.

Table 3 – Comparison of the EAT-26 scores across different stages of somatic and sexual maturation of competitive adolescent athletes, according to sex.

Maturation	EAT-26					
	Sex					
	Male			Female		
	M	SD	p	M	SD	p
Somatic						
Pre spurt	12,64	2,23		15,01	6,29	
Spurt	11,23	1,01	0,28	18,19	2,08	0,13
Post spurt	12,64	1,16		15,01	1,02	
Sexual						
Pre-pubertal	16,24	6,93		17,38	6,02	
Early pubertal	16,41	2,82		16,60	2,99	
Intermediate pubertal	11,45	1,12	0,092	11,60	1,54	0,086
Advanced pubertal	12,06	0,86		12,55	1,12	
Post pubertal	10,34	1,13		17,38	1,74	

Table 4 – Odds ratio of risk behavior for eating disorders (ED) in competitive adolescent athletes, according to sex and maturational stages.

Maturation	Risk behavior for ED			
	Sex			
	Male*		Female	
	OR	CI (95%)	OR	CI (95%)
Sexual				
Pre pubertal	25,20	12,09 – 30,25*	1,00	-
Early pubertal	4,50	1,34 – 5,04*	0,25	0,01 – 5,98
Intermediate pubertal	3,05	1,40 – 6,65*	0,16	0,00 – 3,23
Advanced pubertal	2,07	0,95 – 4,47	0,28	0,01 – 5,01
Post pubertal	1,00	-	0,12	0,00 – 2,56
Somatic				
Pre spurt	2,98	1,38 – 6,42*	1,00	-
Spurt	1,79	1,00 – 3,20	1,86	0,00 – 8,95
Post spurt	1,00	-	1,89	0,02 – 7,61

F = Female; M = Male. OR = odds ratio; CI = confidence interval. *p<0,05.

Moreover, risk behavior for ED was associated with the maturational stages only in the male sex (Table 4). Thus, pre-spurt male adolescents in somatic maturation had higher odds of presenting risk behaviors for ED (p<0,05) when compared to the post-spurt group. Besides, in sexual maturation, pre -pubertal boys had higher odds of ED compared to the post-pubertal athletes (p<0,05).

Finally, the interaction between somatic and sexual maturation, carried out in a single block by the multiple regression, significantly influenced the EAT-26 score both in the female and in the male sex (p<0,05). On the other hand, body dissatisfaction (BSQ) explained in greater detail the variance of the EAT-26 score in both sexes (p<0,05) (Table 5).

Table 5 – Influence of the maturational process and of body dissatisfaction on the EAT-26 scores in adolescent athletes.

Variable	EAT-26							
	Sex							
	Male				Female			
	R	R^2	R^2*	p value	R	R^2	R^2*	p value
Sexual	0,16	0,03	0,02	<0,01	0,10	0,01	0,003	<0,25
Somatic	0,15	0,02	0,02	<0,01	0,14	0,02	0,01	<0,14
BSQ	0,34	0,12	0,12	<0,01	0,63	0,40	0,39	<0,01
Sexual*Somatic	0,17	0,03	0,02	<0,01	0,26	0,07	0,05	<0,01
Sexual*Somatic*BSQ	0,37	0,14	0,13	<0,01	0,63	0,40	0,39	<0,01

R^2* = adjusted R^2; BSQ = Body Shape Questionnaire; Sexual*Somatic = Interaction between Sexual and Somatic Maturation; Sexual*Somatic*BSQ = Interaction between Sexual Maturation, Somatic Maturation and BSQ.

DISCUSSION

The study aimed to analyze the association between risk behavior for ED and the maturational process in young athletes. The main findings were: there is an association of risk behavior for ED with the maturational process only for the male sex; the maturational process influenced the EAT-26 scores in both sexes: 2% and 7% of the variance of the EAT-26 scores were explained by the interaction between sexual and somatic maturation in boys and girls, respectively. Thus, the findings corroborated the hypotheses formulated for the present study.

Concerning the EAT-26 ratings, there was 14.7% and 18.1% of prevalence of risk behavior for ED in male and female athletes, respectively. Therefore, these results corroborate other investigations[6,25]. However, there is evidence that such prevalences are higher in girls when compared to boys[6,7,8,10]. Nevertheless, this difference was not significant in the present study. Perhaps, in Brazilian athletes, the frequency of unhealthy eating habits is similar between sexes[19]. However, the prevalence above 10% for risk behavior for ED is considered high, according to Haase[6]. Thus, it is necessary to implement nutritional education programs in the sports environment, so as to reduce ED risks among young athletes.

The high prevalence of unhealthy eating habits that was found in the population of female athletes[8] seems to be influenced by several factors. One of them seems to be the type of sports, for according to Krentz and Warchsburger[10], modalities that prioritize lean bodies and sports that divide categories by weight class present higher risks of this outcome. The female sample of the present investigation was constituted of, approximately, 30% of athletes who practice sports that emphasize leanness (artistic gymnastics, synchronized swimming and diving). Perhaps, this characteristic explains the high prevalence that was found of risk behavior for ED.

As for the distribution of the athletes according to classifications of somatic and sexual maturation, a higher amount of athletes in the most advanced stages was found. However, the distribution of frequency according to the utilized method (somatic and sexual) was not similar for both sexes. In fact, Siervogel et al.[2] argue that somatic and sexual maturation are distinct maturational markers. It is important to emphasize that somatic maturation assesses the PHV age, while sexual maturation estimates the maturational stage based on secondary sexual characteristics. In addition, according to Malina, Bouchard and Bar-Or[3], the intense growth of pubic hair usually occurs approximately one year after the PHV. This explains the higher prevalence of subjects in the "Post PHV" classification of

somatic maturation, while in sexual maturation this proportion was reduced in the stages "Advanced pubertal" and "Post-pubertal" in both sexes.

Regarding the BSQ ratings, the results showed higher prevalence of body dissatisfaction in the female sex when compared to the male sex. These findings corroborate other studies[21, 25, 26]. It seems that the female public is more affected by body dissatisfaction when compared to boys, independently of being athletes or not[14, 17]. Nevertheless, some authors argue that the instruments that evaluate negative feelings/thoughts about weight and physical appearance prioritize morphological aspects depreciated by the female sex in the Western culture[19, 25]. Thus, it is possible that differences found between sexes in body image studies reflect the self-reported tools that were used. Anyway, it would be interesting if coaches reduced the demands on the female athletes regarding weight loss for optimizing sports performance. In this way, young female athletes would feel less pressed to lose body weight, and this might make them become more satisfied with their body morphology.

The results found for the female sex did not show significant differences according to the maturational stages. Moreover, these stages were not associated with risk behavior for ED, and distanced themselves from the trends formulated in the Introduction. Perhaps the fact that no differences were found in the EAT-26 scores according to maturational stages can be explained by the type of analysis that was conducted (ANCOVA), as the percentage of fat and the BMI were matched, and the scores of the questionnaire were reconfigured to draw comparisons. However, it is possible to observe that girls are more likely to show higher scores in the EAT-26 in the different maturational stages when compared to boys. Due to this, it is recommended that more attention is paid to female athletes regarding ED risks, independently of the maturational stage in which they are.

For the male sex, it was found that the EAT-26 scores in adolescent athletes were similar in different maturational stages (Table 2). These findings do not corroborate the initial hypotheses. Probably, like in the female sex, the type of analysis (ANCOVA) that was used to draw such comparisons may explain the results described above. On the other hand, it was identified that, with the pubertal advance, there was a reduction in the odds of ED (Table 3), which corroborates the hypotheses formulated in the Introduction. Perhaps, the increase in lean body mass in young male athletes, due to the advance in the maturational process[2], reduced their risks of developing unhealthy eating behaviors. Therefore, younger athletes seem to be more vulnerable to these risks.

It is known that high percentage of fat and high BMI are factors that can increase the risks of inadequate eating behaviors in the female sex[4]. On the other hand, it seems that female athletes suffer from body dissatisfaction, independently of their bodies' morphological characteristics[6, 8]. This may be the reason why no association was found between the stages of the maturational process and risk behavior for ED, as the female athletes presented body dissatisfaction in the entire adolescence stage[25].

On the other hand, the findings pointed to a significant association between maturational stages and inadequate eating behavior in the male sex. In this sense, athletes who are biologically younger showed higher risks of ED when compared to athletes with more advanced biological maturation. Thus, younger athletes should be monitored by professionals of the mental health and nutritional areas, so as to prioritize the reduction in the frequency of nutritional inadequacy. Accor-

ding to Torstveit, Rosenvinge and Sundgot-Borgen[25], unhealthy eating behaviors can negatively affect the athlete's sports performance, causing dehydration and respiratory tract infections, among other problems.

The maturational process modulated only 9% of the variance of the EAT-26 in female athletes. However, the BSQ was the instrument that most influenced the frequency of nutritional inadequacy, modulating the EAT-26 score in 40%. This result corroborates the findings of studies that used samples of school-aged children and adolescents[17] and athletes[5]. Therefore, it is possible to infer that female athletes suffer cultural influences that are similar to those of the non-athletes, regarding the idealization of the body that is broadcast in the media[11, 24]. Nevertheless, researchers emphasize that female athletes are more likely to develop unhealthy eating habits due to the peculiarities of the sports environment, like pressures that are extrinsic to the desire for better results and clothes that mark the body format[6, 7]. On the other hand, Torstveit, Rosenvinge and Sundgot-Borgen[25] argue that systematic physical training in athletes can be considered a protective factor against the development of psychological alterations. Perhaps this statement is valid only for athletes of sports modalities that do not praise leanness for the optimization of sports performance.

For the male sex, the maturational process explained only 3% of the modulation of this variable. However, like what happened in the female sex, the BSQ score among the boys was the independent variable that explained with highest impact (12%) the variance of the EAT-26. It seems that the depreciation of weight and physical appearance in male athletes can negatively influence their eating habits[14, 16]. According to Picket, Lewis and Cash[14], body dissatisfaction does not affect male athletes so intensely, but it seems to be one of the main precursors of the development of inadequate eating behaviors.

Furthermore, it is estimated that there are other factors intervening in the competitive environment which may influence negatively the male athletes' eating habits. Nutritional inadequacy may be more connected with sports performance, that is, if the athlete reaches a performance potential that is compatible with his efforts in trainings, this individual will not need to use pathogenic behaviors to alter his body morphology[25], independently of his body composition.

Even so, it is estimated that the risk behavior for ED is a phenomenon that is influenced by many factors, mainly in the sports context. In addition to cultural, family and media influences that are exposed to the adolescents[21], as well as demands for better results and the control of body weight[5], athletes may be more likely to develop inadequate behaviors. The sports environment is too complex for us to believe that only some variables can explain risks for such psychological problems.

The present study tried to fill a knowledge gap existing in the literature. It is believed that this is the first study to use biological maturation as an explanatory variable of behavioral outcomes (risk behavior for ED) in the population of competitive adolescent athletes. However, the present study had some limitations. The main one was the utilization of self-administered instruments, as individuals may not provide the requested information with reliability. Therefore, the results may not fully reflect the reality of the evaluated context, as the final result derives from subjective answers. Even so, this is one of the main resources used in epidemiological research, as it enables to work with large samples, as it was the case of the present research. However, this study provides important evidences concerning the influence and the risks that the maturational process can pose for the risk

behavior for ED in competitive adolescent athletes, and it discusses relevant issues about this theme that, up to the moment, had not been explored.

It was concluded that the maturational process (interaction between sexual and somatic maturation) influenced the risk behavior for ED in both sexes and the stages of biological maturation were associated with the outcome only for the male sex. It seems that male athletes with more advanced biological ages are more protected against inadequate eating habits. Nevertheless, female athletes seem to present more risks for such behaviors, independently of the period in which they are.

It is suggested that further research is carried out in this population with characteristics that are similar to those of this study, including other sports modalities and investigating whether the type of sport influences the risk behavior for ED.

Evaluation and guiding programs, both psychological and nutritional, are necessary in the sports environment. These initiatives should be developed so as to prevent and detect diseases, like ED in athletes.

Authors' contributions

Leonardo de Sousa Fortes collected the data, wrote the manuscript and performed the statistical procedures. Maria Aparecida Conti helped tabulating the data in specialized software and revised the paper. Maria Elisa Caputo Ferreira supervised the entire work.

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