Eating behavior and physical activity in adolescents

Comportamento alimentar e atividade física em adolescentes

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ABSTRACT

Objective

The aim of this study was to compare the inappropriate eating behaviors of adolescents as a function of habitual level of physical activity.

Methods

Participants were 462 youth of both genders aged 10 to 19 years. The Eating Attitudes Test-26 was used for inappropriate eating behaviors assessment. A short version of the International Physical Activity Questionnaire was used for classifying the habitual level of physical activity.

Results

No statistically significant differences were found for the comparison of inappropriate eating behaviors in the multivariate covariance model either for females or males. Moreover, the level of physical activity had no significant influence on the inappropriate eating behaviors of these adolescents.

Conclusion

In conclusion, inappropriate eating behaviors in both genders were similar regardless of the habitual level of physical activity.

Indexing terms: Adolescent. Body dissatisfaction. Feeding behavior. Motor activity.

RESUMO

Objetivo

O objetivo do presente estudo foi comparar os comportamentos alimentares inadequados em função do nível habitual de atividade física em adolescentes.

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Métodos

Participaram 462 jovens, de ambos os sexos, na faixa etária entre 10 e 19 anos. Utilizou-se o Eating Attitudes Test-*26 para avaliar os comportamentos alimentares inadequados. Foi utilizada a versão curta do* International Physical Activity Questionnaire *para classificar o nível habitual da prática de atividade física.*

Resultados

Os resultados não evidenciaram diferenças estatisticamente significativas a respeito da comparação dos comportamentos alimentares inadequados no modelo multivariado de covariância, tanto no sexo feminino quanto no masculino. Ademais, o nível de atividade física não demonstrou influência significativa sobre os comportamentos alimentares inadequados nesses adolescentes.

Conclusão

Concluiu-se que tais comportamentos foram semelhantes segundo o nível habitual de atividade física em ambos os sexos.

Termos de indexação: *Adolescente. Insatisfação corporal. Comportamento alimentar. Atividade motora.*

INTRODUCTION

The stage of life starting at age 10 years and ending at age 19 years is called adolescence[1]. During this stage, individuals experience numerous morphological changes stemming from the maturation process[2,3]. These changes include the increase in body fat in girls and in lean mass in boys[4]. Hence, it is believed that these body changes may influence adolescent body image[4,5].

Body image is a multidimensional construct that involves the perception of body size, feelings, beliefs and behaviors toward physical appearance[3,6,7]. According to White & Halliwell[5], body image consists of two dimensions: perceptive and attitudinal, and the latter includes body dissatisfaction. The latter, in turn, relates to discontentment with weight and physical appearance[1].

Body dissatisfaction directly influences inappropriate eating behaviors, such as food restriction and the use of pharmaceutical drugs that promote weight loss[8]. These types of behavior are those usually developed in an attempt to lose or control body weight[9].

In the adolescent population, body dissatisfaction has been commonly associated with distinct morphological aspects, such as high weight and percentage of body fat[4,6]. However, in Brazil, there is a scarcity of studies that relate body dissatisfaction with health-compromising eating behaviors, especially in adolescent boys, indicating the need of more studies in this area.

Inappropriate eating behaviors (food restriction, self-induced vomiting and use of weight-loss drugs) are frequently found both in adolescents who practice physical activities[2,9], and in those with low habitual levels of physical activity[10-12]. Physical activity here is understood as any body movement produced by the skeletal muscles that results in greater energy expenditure than that expended in the resting state[10,13].

Therefore, although the practice of physical activity promotes positive physical and mental effects[1,13], it seems that in the context of inappropriate eating behaviors, scientific findings are inconclusive. On the one hand, some authors argue that excess physical activity may predispose youth to health-compromising eating behaviors[14]. On the other hand, it is estimated that youth with low levels of physical activity are more vulnerable to developing abnormal eating habits, since these habits are more common in overweight and obese individuals[15,16].

Then again, some authors state that the systematic practice of physical activities may positively modulate behavior towards food[7,14]. Carraro *et al.*[11] evidenced positive affective and behavioral changes towards foods in adolescents after a single exercise session.

Therefore, considering that the influence of physical activity on inappropriate eating

behaviors remains unclear, studies that compare food habits with different levels of physical activity per week (time, frequency and duration) are necessary. Hence, the objective of this study was to compare the eating behaviors of adolescents as a function of their levels of physical activity.

METHODS

This cross-sectional study was done in 2011 and included adolescents aged 10 to 19 years from the city of *Juiz de Fora* (MG). According to the Department of Education of *Juiz de Fora,* this population numbered approximately 50,000 individuals in 2011. Thus, the sample size was determined according to the following criteria: prevalence of inappropriate eating behaviors of 30%[17], confidence of 95%, sampling error of 5% and design effect of 1.4, totaling 322 study subjects, considered a representative sample of the population. Hence, a total of 508 adolescents were assessed, of which 46 were excluded because they did not answer all the questions in the questionnaires or did not participate in the anthropometric measurements. The inclusion criteria were: adolescents enrolled in public (n=217) or private (n=245) schools of *Juiz de Fora* (MG), having a Free and Informed Consent Form signed by themselves and their guardians, and willingness to participate in anthropometric measurements and answer the questionnaires.

The project was approved by the Human Research Ethics Committee of the *Universidade Federal de Juiz de Fora*, under protocol number 2282.022.2011 - opinion 022/2011, in compliance with the Law 196/96 issued by the National Health Council.

Measurements

Eating Attitudes Test: Inappropriate eating behaviors were assessed by the Eating Attitudes Test (EAT-26). This test consists of a Likert-scale (0=never, almost never or occasionally; 1=sometimes; 2=often; 3=always) self-administered questionnaire with 26 statements, and the score of statement 25 is inverted. These statements are divided into three factors: 1) diet - regards the pathological refusal of foods with high energy content and concern with physical appearance; 2) bulimia and concern with foods - regards binging episodes followed by vomiting to lose or control body weight; and 3) dietary self-control - reflects self-control around food and assesses the environmental and social forces that encourage eating. EAT-26 has been validated for Brazilian adolescents[18], showing good psychometric indices. The internal consistency of the present sample was calculated, resulting in Cronbach's alphas of 0.89 and 0.86 for girls and boys, respectively.

International Physical Activity Questionnaire: The short version was used for classifying habitual level of physical activity. This self-administered questionnaire consists of eight open questions whose answers allow the identification of the time spent per week on different physical activities (walking, moderate physical activity and vigorous physical activity) and physical inactivity (sitting). The questions of the questionnaire are related to the activities done in the previous week. International Physical Activity Questionnaire was validated for the young Brazilian population by Guedes *et al.*[19]. The subjects are classified as:

Inactive: Does not practice any physical activity for more than 10 consecutive minutes per week;

Insufficiently active: Individuals who practice physical activities for at least 10 consecutive minutes per week, but not enough to be classified as active. For individuals to be considered active, the duration and frequency of different types of physical activities are added (walks+moderate+ intense). This category is divided into two groups:

- *Insufficiently active A*: Practices 10 consecutive minutes of physical activity followed by at least one of the cited criteria: frequency - 5 days/week or duration - 150 minutes per week;

• *Insufficiently active B*: Does not meet any of the criteria mentioned for insufficiently active individuals type A;

Active: Follows these recommendations: a) vigorous physical activity ≥3 days/week and ≥20 minutes per session; b) walk or moderate physical activity ≥5 days/week and ≥30 minutes per session; c) sum of all activities: ≥5 days/week and ≥150 minutes per week;

Very active: Follows these recommendations: a) vigorous physical activity ≥5 days/week and ≥30 minutes per session; b) vigorous physical activity ≥3 days/week and ≥20 minutes per session + moderate physical activity and/or walk ≥5 days/week and ≥30 minutes per session.

For data treatment, the individuals classified as "inactive", "insufficiently active A", and "insufficiently active B" were grouped together in the group "inappropriate", and the individuals classified as "active" and "very active" were grouped together in the group "appropriate".

Body Shape Questionnaire: Body Shape Questionnaire (BSQ) was used for assessing dissatisfaction with weight and physical appearance, and its score was used as a covariable in some analyses, since the authors emphasize that body discontentment may be the main factor that influences inappropriate eating behaviors[2,7]. This self-administered tool consists of 34 Likert-scale (0=never and 6=always) questions which assess the frequency of concern and/or discontentment with one's own weight and physical appearance in the last four weeks. The score is given by adding the answers and ranges from 34 to 204. The score increases with the degree of body dissatisfaction. BSQ has been validated for the Brazilian youth, presenting acceptable psychometric qualities for both genders[6]. For the present sample, Cronbach's alpha was calculated resulting in 0.92 for girls and 0.90 for boys.

Economic level: The socioeconomic level of the sample was determined by the *Critério de Classificação Econômica Brasil* (CCEB, Criterion of Economic Classification Brazil), developed by the[20] *Associação Brasileira de Empresas de Pesquisas* (ABEP, Brazilian Association of Survey Companies). CCEB emphasizes its objective of estimating the purchasing power of individuals and families living in urban areas, dismissing the pretension of classifying individuals into *"social classes"*. This instrument assesses the number of comfort items (automobile, refrigerator and television set, among others) in the household and the education level of the family head. The economic classes are classified according to the following cutoff points: A1 - 30 to 34 points; A2 - 25 to 29; B1 - 21 to 24; B2 - 17 to 20; C - 11 to 16; D - 6 to 10; E - 0 to 5, in decreasing order of economic level. Researchers have pointed out that economic level may be an important factor for inappropriate eating behaviors[9,20]. Since the sample of the present study consisted of youth attending private and public schools, the CCEB score was included as a covariable in some analyses, reducing the effects of economic level on EAT-26 scores.

Anthropometric Assessment: The anthropometric data were collected by the same researcher with experience in this type of assessment. Body weight was determined by a digital scale of the brand Tanita with a capacity of 200kg and accuracy of 100g. Height was determined by a portable stadiometer of the brand Welmy with a maximum length of 2.20m and accuracy of 0.1cm. Body Mass Index (BMI) was calculated by dividing body weight (kg) by the square of the height (m^2).

Each skinfold thickness was measured non-consecutively three times. Skinfold thickness was measured by a plicometer of the brand Lange with an accuracy of 0.1mm. The percentage of body Fat (%F) was estimated by an equation developed for adolescents by Slaughter *et al.*[21]. All measurements used the standardizations and recommendations provided by the International Society for the Advancement for Kineanthropometry[22].

Procedures

The principals of eight schools (five private and three public schools) were informed about the study objectives and procedures. However, only six of these principals (three from private and three from public schools) agreed to dismiss the students for them to participate in the study. Therefore, a meeting was arranged with each of these student groups to repeat the objectives and required procedures for including them in the study. A Free and Informed Consent Form was given to the students, signed by their guardians and returned in the following week.

The study was divided into two stages. The first stage consisted of the administration of the questionnaires, and the second stage, of collecting anthropometric data. The questionnaires were given to the students along with verbal instructions. The instruments also contained header instructions. This stage was done in group. However, only one researcher was responsible for this stage to avoid inter-researcher variability.

Once the questionnaires were filled out, the students were taken individually to another room wearing their physical education uniform and barefoot. In this other room, the anthropometric data were collected. Only one student was allowed in the room at a time.

Central tendency measures (mean and standard deviation) were used for describing the study variables. Multivariate Analysis of Covariance (Manova) was used for comparing the three EAT-26 factors with the level of physical activity (inadequate or adequate), using BSQ and CCEB as covariables. Additionally, stepwise multiple regression was used for determining the influence of the independent variables (IPAQ, BSQ, CCEB, BMI and %F) on EAT-26 scores. All statistical tests were done by the software Statistical Package for the Social Sciences (SPSS) version 17.0, with a significance level of 5%. Finally, the analyses were separated by gender as recommended by Fortes & Ferreira[2] and White & Halliwell[5].

RESULTS

The final study sample consisted of 462 adolescents (249 girls and 213 boys). The mean age of the girls was 12.73 (±1.59) years, their mean body mass was 19.77 (±3.66) kg/m² and their mean %F was 25.66 (±7.27). The mean age of the boys was 12.65 (±1.69) years, their mean body mass was 19.97 (±3.51) kg/m² and their mean %F was 21.74 (±10.26). The mean EAT-26 scores of the girls and boys were 15.08 (±11.18) and 11.49 (±11.46), respectively. The mean BSQ scores of the girls and boys were 79.96 (±35.29) and 62.81 (±28.33), respectively. The mean CCEB scores of the girls and boys were 18.93 (±4.89) and 19.06 (±4.59), respectively.

Regarding the comparison of EAT-26 factors as a function of the level of physical activity, no significant differences were found by the multivariate covariance model (Manova) for girls (Table 1) or boys (Table 2). These results indicate that, for both genders, the frequencies of inappropriate eating behaviors (food restriction,

Table 1. Mean and standard deviation of EAT-26 factors and score as a function of level of physical activity in female adolescents. *Juiz de Fora* (MG), Brazil, 2011.

IPAQ	n	EAT-26 factors						EAT-26	
		Diet		Bulimia and CF		DSC		Total	
		M	SD	M	SD	M	SD	M	SD
Inadequate	101	8.43	0.57	2.26	0.26	4.87	0.44	15.55	0.91
Adequate	148	8.37	0.44	2.24	0.20	4.69	0.34	15.61	0.70

Note: EAT-26: Eating Attitudes Test-26; IPAQ: International Physical Activity Questionnaire; CF: Concern With Foods; DSC: Dietary Self-Control; M: Mean; SD: Standard Deviation.

Table 2. Mean and standard deviation of EAT-26 factors and score as a function of level of physical activity in male adolescents. *Juiz de Fora* (MG), Brazil, 2011.

IPAQ	n	EAT-26 factors						EAT-26	
		Diet		Bulimia and CF		DSC		Total	
		M	SD	M	SD	M	SD	M	SD
Inadequate	65	6.12	0.78	2.21	0.41	3.82	0.54	12.42	1.47
Adequate	148	6.26	0.45	1.79	0.24	3.52	0.31	11.66	0.84

Note: EAT-26: Eating Attitudes Test-26; IPAQ: International Physical Activity Questionnaire; CF: Concern With Foods; DSC: Dietary Self-Control; M: Mean; SD: Standard Deviation.

Table 3. Influence of IPAQ, BSQ, CCEB, BMI and percentage of body fat on the inappropriate eating behaviors of girls. *Juiz de Fora* (MG), Brazil, 2011.

Variable	Block	B	F	R	R^2	*p*
IPAQ	1	0.11	2.48	0.11	0.01	0.117
BSQ	2	0.67	155.63	0.67	0.44	<0.01
CCEB	3	0.10	2.12	0.10	0.01	0.146
BMI	3	0.26	14.66	0.26	0.07	<0.01
%F	3	0.23	10.91	0.23	0.05	<0.01
Total	-	9.66	31.06	0.67	0.45	<0.01

Note: IPAQ: International Physical Activity Questionnaire; BSQ: Body Shape Questionnaire; CCEB: *Critério de Classificação Econômica Brasil*; BMI: Body Mass Index; %F: Percentage of body fat; R^2: Adjusted model.

Table 4. Influence of IPAQ, BSQ, CCEB, BMI and percentage of body fat on the inappropriate eating behaviors of boys. *Juiz de Fora* (MG), Brazil, 2011.

Variable	Block	B	F	R	R^2	*p*
IPAQ	1	0.11	1.92	0.11	0.01	<0.167
BSQ	2	0.54	64.11	0.54	0.29	<0.01
CCEB	3	0.11	1.79	0.10	0.01	0.183
BMI	3	0.34	21.64	0.34	0.12	<0.01
%F	3	0.21	7.66	0.21	0.04	<0.05
Total	-	8.36	14.13	0.56	0.31	<0.01

Note: IPAQ: International Physical Activity Questionnaire; BSQ: Body Shape Questionnaire; CCEB: Criterion of Economic Classification Brazil; BMI: Body Mass Index; %F: Percentage of Body Fat; R^2: Adjusted model.

binge eating and weight loss method) of adolescents with different habitual levels of physical activity (adequate and inadequate) were similar.

Regarding the influence of the independent study variables on EAT-26 score, the stepwise multiple regression model revealed significant data ($p<0.05$). Regardless of gender, BSQ, BMI and %F modulated the EAT-26 scores (Tables 3 and 4). However, the regression model explained the variance of abnormal eating behaviors in girls (45%) better than in boys (31%).

DISCUSSION

The findings of the present study did not evidence different inappropriate eating behaviors as a function of habitual level of physical activity in adolescents of both genders. More specifically, the frequency of dietary restriction, vomiting and

food intake influenced by the environment was similar in adolescents with distinct physical activity levels. In this sense, it seems that the systematic practice of physical activity did not have a positive effect on food habits. However, some factors, such as body dissatisfaction and economic level, were included as covariables in the analyses. Therefore, maybe these results stem from the type of statistical analysis used (Manova).

Similar results were found by Asci *et al.*[10]. These authors explained that abnormal eating attitudes usually do not differ as a function of physical activity level during adolescence, and found no significant statistical relationship between eating behaviors and level of physical activity. Likewise, Lepage & Crowther[7] found unhealthy eating behaviors in women with high and low levels of physical activity. These authors did not identify differences between the groups. Pelegrini & Petroski[12] did not find an association between level of physical activity and dietary behavioral aspects in adolescents of both genders.

A possible explanation for these findings may be found in the study by Fortes & Ferreira[2]. These authors point out that unhealthy eating behaviors may not be influenced by the time spent on physical activities or by their intensity. These same authors argue that the type of physical activity may be the greatest factor of influence on such behaviors. For example, the practice of resistance training (weightlifting) or the participation in sports that emphasize leanness because of predominantly aesthetic characteristics are considered greater risk factors for the development of unhealthy eating behaviors.

However, the results of some studies differed from those of this study when they emphasized that the psychological dependence on exercise may predispose youth of both genders to abnormal eating habits[23]. Considering the absence of a clear conclusion in the literature for this theme, longitudinal or experimental studies should be performed to clarify if the level and type of physical activity have any impact on food intake habits.

The results of the multiple regression model show that only body dissatisfaction and the morphological variables (BMI and %F) were capable of affecting eating behaviors in both genders. Hence, again, habitual level of physical activity had no significant impact on adolescents' eating habits. Therefore, these findings indicate that the regular practice of physical activity seems unable to have an effective and positive impact on adolescents' eating behaviors, despite the fact that the physical and mental benefits stemming from this habit are well documented in the literature[1,7].

Among girls, body dissatisfaction, BMI and %F explained 44%, 7% and 5%, respectively, of the variance in inappropriate eating behaviors. Therefore, corroborating previous studies, the eating attitudes of female adolescents were more affected by morphological aspects and discontentment with physical appearance[2,3,15].

Likewise, the multiple regression results for males indicated that body dissatisfaction (29%), BMI (12%) and percentage of body fat (4%) modulated the EAT-26 scores significantly. Comparisons and discussions of this result with previous studies are limited because there is a scarcity of studies on the inappropriate eating behaviors of male adolescents[2].

The descriptive values of the EAT-26 means found by the present study corroborate some results[15,17], while others have found greater EAT-26 means[23]. However, the abovementioned studies used predominantly female samples. Therefore, there is a scarcity of studies on the eating habits of boys in Brazil[2,9].

Some of the limitations of this study include: 1) Self-administering questionnaires were used as the research tools. Some authors criticize this method because these are subjective measures and may not represent the reality of the study context[14,23,24]. However, these instruments are recommended for population-based studies or those with epidemiological characteristics, since they are easy to use and inexpensive[2,3,25]; 2) The

cross-sectional design did not allow causality inference. This means that it is not possible to assess the intensity and direction of the associations found between the study outcome and independent variables. In fact, this is a limitation of cross-sectional studies because they reflect a point in time of a given context. Finally, the findings of the present study deserve to be compared and discussed in other studies, since the theme is relevant but scarcely explored in the scientific literature.

CONCLUSION

The results of the present study indicate that the characteristics of inappropriate eating behavior as a function of level of physical activity were similar in male and female adolescents. Furthermore, the level of physical activity did not seem to influence unhealthy eating habits in these adolescents.

Other studies should search for factors that may explain the variance in the inappropriate eating behaviors of adolescents. Additionally, studies using experimental protocols of physical exercise are recommended in order to investigate possible dietary behavioral differences in the pre- and posttest.

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CONTRIBUTIONS

LS FORTES data collection, article writing and data treatment. FFR MORGADO article review, participated in statistical analyses and table creation. SS ALMEIDA article review and participated in statistical analyses. MEC FERREIRA article review and study supervision.

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