Physical inactivity and its association with nutritional status, body image dissatisfaction and sedentary behavior in adolescents of public schools.

Inatividade física e sua associação com estado nutricional, insatisfação com a imagem corporal e comportamentos sedentários em adolescentes de escolas públicas.

Andreia Pelegrini[1], Edio Luiz Petroski[2]

ABSTRACT

Objective: To determine the prevalence of physical inactivity and its association with nutritional status, body image dissatisfaction and sedentary behavior in adolescents.

Methods: A cross-sectional study was conducted with 595 schoolchildren (196 boys and 399 girls; age from 14 to 18 years old) enrolled in public schools of Florianópolis, Santa Catarina, Brazil. The independent variables were age, body image perception, nutritional status and sedentary behavior (television, video game and computer). Adolescents with less than 300 minutes of physical activity per week were classified as insufficiently active. The logistic regression model was used to identify possible associations between physical inactivity and independent variables.

Results: The prevalence of physical inactivity was 25.4% (male: 21.9%, female: 27,1%, p=0,20). No association between physical inactivity and the independent variables was observed among boys. In contrast, girls classified as insufficiently active presented a 2.55 times higher chance of presenting low weight (95%CI=1.36-4.77). In addition, the chance of physical inactivity was 1.67 times higher among girls who watched television for more than two hours per day (95%CI=1.03-2.71).

Conclusions: One out of four adolescents was classified as insufficiently active. Low weight and watching television for more than two hours per day were strongly associated with physical inactivity among adolescent girls. The results suggest that adolescents, especially girls, need to be advised regarding the importance of regular physical activity and a healthy diet.

Key-words: Adolescent; motor activity; nutritional status; students; health; life style.

RESUMO

Objetivo: Verificar a prevalência de inatividade física e sua associação com estado nutricional, insatisfação com a imagem corporal e comportamentos sedentários em adolescentes.

Métodos: Trata-se de um estudo descritivo e de associação, conduzido em 595 escolares (196 do sexo masculino e 399 do feminino; com 14-18 anos) da rede pública de Florianópolis (SC). As variáveis independentes foram: idade, percepção da imagem corporal, estado nutricional e comportamentos sedentários (televisão, videogame, computador). Os adolescentes com menos de 300 minutos de atividade física por semana foram considerados insuficientemente ativos. A regressão logística foi utilizada para verificar possíveis associações entre a inatividade física e as variáveis independentes.

Resultados: A prevalência de inatividade física foi de 25,4% (masculino: 21,9%, feminino: 27,1%; p=0,20). Entre os rapazes, não foi encontrada associação entre o desfecho e as variáveis independentes. Em contrapartida, verificou-se que as moças classificadas como insuficientemente ativas apresentaram 2,55 vezes mais chance de ter baixo peso (IC95%=1,36-4,77). Além disso, a chance de apresentar o desfecho foi 1,67 vezes maior entre aquelas que permanecem mais de duas horas diárias assistindo à televisão (IC95%=1,03-2,71).

Institution: Universidade Federal de Santa Catarina (UFSC), Florianópolis, SC, Brasil

[1]Doutoranda do Programa de Pós-Graduação em Educação Física do Núcleo de Pesquisa em Cineantropometria e Desempenho Humano do Centro de Desportos da UFSC, Florianópolis, SC, Brasil

[2]Doutor em Educação Física; Professor titular do Programa de Pós-Graduação em Educação Física da UFSC, Centro de Desportos, Núcleo de Pesquisa em Cineantropometria e Desempenho Humano, Florianópolis, SC, Brasil

Correspondece:
Edio Luiz Petroski
Caixa Postal 476 – Trindade
CEP 88040-900 – Florianópolis/SC
E-mail: petroski@cds.ufsc.br

Recebido em: 19/2/09
Aprovado em: 10/6/09

Conclusões: Um em cada quatro adolescentes foi classificado como insuficientemente ativo. Apresentar baixo peso e permanecer mais de duas horas por dia assistindo à televisão foram fatores associados à inatividade física em adolescentes do gênero feminino. Sugere-se que os adolescentes, principalmente do sexo feminino, sejam orientados sobre a importância da prática regular de atividade física e de uma alimentação saudável.

Palavras-chave: adolescente; atividade motora; estado nutricional; estudantes; saúde; estilo de vida.

Introduction

Industrialization has been accompanied by greater levels of physical inactivity among people of all ages, despite widespread awareness of the health benefits of physical activity[1]. Insufficient levels of physical activity have often been linked to coronary heart disease[2], obesity[3-5], diabetes mellitus[6], osteoporosis[7], and some varieties of cancer[8].

Though most of the diseases associated with physical inactivity only manifest themselves in adulthood, it is increasingly evident that they begin to develop during childhood and adolescence[9]. Meanwhile, we have also seen declining levels of physical activity in adolescence[10,11], which is linked to higher chances of physical inactivity in adulthood[12],

Though physical inactivity is more widespread in developed countries, developing countries are experiencing strong trends towards that sort of behavior, especially due to rapid urbanization, economic growth, and technological changes[13]. Brazilian studies[3,14] show high rates of adolescents with low levels of physical inactivity, ranging from 39 to 93.5 percent. In international literature[5,15], estimates range from 50 to 70%.

The rate of physical inactivity among Brazilian adolescents, as well as associated factors, has yet to be established. In that sense, more research into that population is needed, in all parts of the country, so that interventions are possible, since deep seated habits acquired at this stage in life often carry over into adulthood, becoming harder to change. Thus, the objective of this study was to determine the prevalence of physical inactivity and its association with nutritional status, body image dissatisfaction, and sedentary behavior in adolescents from public schools in a Brazilian state capital.

Methods

This cross-sectional study used data extracted from project "Níveis de atividade física, aptidão física e comportamento social relacionados à saúde em escolares de Florianópolis-SC" ("Levels of physical activity, physical aptitude and social behavior related to health among schoolchildren in Florianópolis, Santa Catarina"), from 2007, collected from a sample of high-schoolers. Intervention protocols for the study were approved by the Research Ethics Committee of Universidade Federal de Santa Catarina. The adolescents and their parents and/or guardians (for underage participants) signed release forms giving their free and informed consent, agreeing to participate in the study.

Sample selection procedures followed a series of steps, attempting to collect a representative sample of high-schoolers from the public schools of Florianópolis. First, the municipality was divided into five regions: Downtown, Continent, East, North, and South; using a non-probability intentional method, the school from each region with the most students enrolled was selected, totaling five schools. Afterwards, enough classes were drawn at random from each school to total the number of adolescents determined for each region and per grade (1st to 3rd grade, in the Brazilian system). All adolescents present in class were invited to participate.

To determine sample size, we used the procedures suggested by Luiz and Magnanini[16] for finite populations, considering a 30 percent prevalence of sedentary behavior, 95% confidence interval (95%CI), estimated margin of error of 5 percent, and an addition of 20 percent as possible loss ratio. We thus estimated that we would need to collect information for 543 adolescents. Due to the nature of the sampling process, which involved all individuals belonging to the clusters, 892 adolescents ended up participating in the sample.

Adolescents were excluded from the sample if they were older than 18 (n=40). Also considered as sample loss were adolescents who did not fill out questionnaires about physical activity (n=68), body image perception (n=130), time spent playing video games (n=14), at computer (n=39), and watching television (n=6). Thus, the final sample consisted of 595 adolescents (196 males, 399 females), ages 14 to 18 (average=16.05; SD=0.98 years).

Body mass and height were measured according to standard procedure[17]. The body mass index [BMI = body mass (kg)/height squared (m^2)] was used as index of nutritional status. BMI classification followed the criteria

established by the International Obesity Task Force[18,19], which suggests a classification of underweight[18], normal[19], and overweight[19], by gender and by age. The term "overweight" was used to define both overweight and obesity.

Body image was verified by the nine-silhouette scale proposed by Stunkard *et al*[20] validated for Brazilian adolescents[21], representing a continuum from thinness (silhouette 1) to severe obesity (silhouette 9). The subject chooses the silhouette number they consider most similar to their actual body image, as well as the silhouette number they believe would be their ideal body image. Assessment of body image consisted of subtracting ideal body image from actual body image. When variation was equal to zero, adolescents were rated satisfied; if not equal to zero, they were rated as unsatisfied. If the difference was positive, dissatisfaction was held to be caused by excess weight; if negative, by thinness.

Level of Physical Activity (LPA) was measured using the short version of the International Physical Activity Questionnaire – IPAQ, developed by the World Health Organization. The Brazilian Portuguese version of the questionnaire has been validated for adolescents[22], and results show that, for adolescents of both sexes over the age of 14, IPAQ has acceptable measurement properties for monitoring levels of regular physical activity. For LPA classification, adolescents who did not have at least 300 minutes per week[10] were rated as insufficiently active, while those with more than 300 minutes were rated as active.

Sedentary behavior was determined by the questionnaires, which investigated how much time was spent watching television, at the computer, and playing video games. Over two hours per day of television, computer and video game time was considered excessive[23].

Descriptive statistics were used to fully explore the data (average, standard deviation, and frequency distribution). Student's t test for independent samples was used to compare averages, while the chi-square test was used for differences between ratios. Since the dependent variable consisted of two categories ("insufficiently active" and "active"), logistic regression was used to verify possible associations between physical inactivity and independent variables. Initial analysis included calculating the *Odds Ratio* (OR) and 95% confidence interval (95%CI) for each exposure variable regarding a reference category. Next, the model was adjusted for all variables. In all analysis, significance level was set at 5% (p<0.05 or 95%CI).

Results

There were significant differences between males and females in terms of body mass (63.36±10.42 *versus* 55.08±11.01kg), height (1.73±0.06 *versus* 1.61±0.06m), ideal body image (3.59±0.92 *versus* 2.60±0.70), and physical activity (1132.1±1165.0 *versus* 779.36±741.7 minutes per week). Results from Table 1 show the differences between sexes regarding ratios of body image, time spent playing video games and time spent watching television (p<0.05).

The prevalence of physical inactivity, stratified by sex, in each category of the various variables analyzed, can be found in Tables 2 and 3. For males, there was no difference between active and insufficiently active adolescents for any independent variable (Table 2). For females, however, there was higher prevalence of physical inactivity for adolescents with normal, and for those who watch more than 2 hours of television per day (Table 3).

Tables 4 and 5 list the results of raw and adjusted *Odds Ratios* for all variables, stratified by sex. No association between outcome and independent variables was found among male adolescents (Table 4). In contrast, being underweight (95%CI=1.36-4.77) and spending more than two hours watching television per day (95%CI=1.03-2.71) were predictors of physical inactivity for female adolescents.

Discussion

The prevalence of physical inactivity for Florianópolis adolescents was 25.4%. This rate is worrisome, since sedentary behavior tends to increase with age, and may carry over into adulthood[11,12], as well as become a risk factor for countless adult diseases.

The findings of this study supported those by Silva *et al*[24], who studied adolescents from the state of Santa Catarina, Brazil. On the other hand, greater results were found in adolescents in Niterói, state of Rio de Janeiro[14]; Pelotas, state of Rio Grande do Sul[3,4]; and João Pessoa, state of Paraíba[25]. Likewise, international surveys[5,26] show higher prevalence of physical inactivity than those found among adolescents in this study. Recently, Tassitano *et al*[27] performed a systematic survey of physical inactivity and sedentary behavior among Brazilian adolescents, identifying prevalence of adolescents exposed to sedentary habits ranging from 39 to 93.5%.

Table 1 – Variables for adolescents ages 14 to 18 from public schools in Florianópolis, Santa Catarina, Brazil, 2007

	Male		Female		Total	
	n	%	n	%	n	%
Body image perception*						
Satisfied	55	28.1	152	38.1	207	34.8
Unsatisfied	141	71.9	247	61.9	388	65.2
Nutritional status						
Underweight	17	8.7	52	13.0	69	11.6
Normal weight	156	79.6	292	73.2	448	75.3
Overweight	23	11.7	55	13.8	78	13.1
Time spent playing video games per day*						
<2h	78	39.8	206	51.6	284	47.7
>2h	118	60.2	193	48.4	311	52.3
Time spent at the computer per day						
<2h	164	83.7	327	82.0	491	82.5
>2h	32	16.3	72	18.0	104	17.5
Time spent watching television per day*						
<2h	105	53.6	166	41.6	271	43.5
>2h	91	46.4	233	58.4	324	54.5

*p<0.05 for difference between sexes.

Table 2 – Prevalence of physical inactivity and associated factors among male adolescents, ages 14 to 18, from public schools in Florianópolis, Santa Catarina, Brazil, 2007

	Insufficiently active		Active		p
	P	95%CI	P	95%CI	
Age (years)					0.205
14	21.4	16.2-27.6	78.6	72.3-83.7	
15	32.7	26.5-39.5	67.3	60.4-73.4	
16	15.2	10.8-20.8	84.8	79.1-89.1	
17	22.8	17.4-29.1	77.2	70.8-82.5	
18	10.0	6.5-14.9	90.0	85.0-93.4	
Body image perception					0.427
Satisfied	18.2	13.4-24.1	81.8	75.8-86.5	
Unsatisfied	23.4	18.0-29.8	76.6	70.1-81.9	
Nutritional status					0.091
Underweight	21.2	16.0-27.4	78.8	72.5-83.9	
Normal weight	41.2	34.5-48.1	58.8	51.8-65.4	
Overweight	13.0	8.9-18.4	87.0	81.5-91.0	
Time spent playing video games per day					0.162
<2h	16.7	12.1-22.5	83.3	77.4-87.8	
>2h	25.4	19.8-31.9	74.6	68.0-80.1	
Time spent at the computer per day					0.065
<2h	24.4	18.9-30.8	75.6	69.1-81.0	
>2h	9.4	6.0-14.3	90.6	85.6-93.4	
Time spent watching television per day					0.563
<2h	21.9	16.6-28.2	78.1	71.8-83.3	
>2h	22.0	16.7-28.3	78.0	71.6-83.2	

P: prevalence; CI: confidence interval.

Table 3 – Prevalence of physical inactivity by associated factors among female> adolescents, ages 14 to 18, from public schools in Florianópolis, Santa Catarina, Brazil, 2007

	Insufficiently active		Active		*p*
	P	95%CI	P	95%CI	
Age (years)					0.182
14	42.9	38.1-47.8	57.1	52.1-61.8	
15	23.6	19.6-28.0	76.4	71.9-80.3	
16	23.8	19.8-28.2	76.2	71.7-80.1	
17	28.4	24.1-33.0	71.6	66.9-75.8	
18	40.9	36.1-45.7	59.1	54.2-63.8	
Body image perception					0.842
Satisfied	27.6	23.4-32.1	72.4	67.8-76.5	
Unsatisfied	26.7	22.5-31.2	73.3	68.7-77.4	
Nutritional status					0.008
Underweight	23.6	19.6-28.0	76.4	71.9-80.3	
Normal weight	44.2	39.4-49.1	55.8	50.8-60.5	
Overweight	29.1	24.8-33.7	70.9	66.2-75.1	
Time spent playing video games per day					0.524
<2h	27.2	23.0-31.7	72.8	68.2-76.9	
>2h	26.9	22.7-31.4	73.1	68.5-77.2	
Time spent at the computer per day					0.283
<2h	27.8	23.6-32.3	72.2	67.6-76.3	
>2h	23.6	19.6-28.0	76.4	71.9-80.3	
Time spent watching television per day					0.015
<2h	21.1	17.3-25.3	78.9	74.6-82.6	
>2h	31.3	26.9-36.0	68.7	63.9-73.0	

P: prevalence; CI: confidence interval.

Analysis of the different results between studies should be considered, because there were disparate cutoff points for the definition of physical inactivity. For adolescents from the states of Santa Catarina[24] and Rio Grande do Sul[4], the cutoff point was established at 300 minutes per week, a methodology similar to that adopted in other studies. For adolescents from Niterói[14], sedentary behavior was defined as a score lower than three in a scale from zero to five, which included sports played as leisure. In Pelotas[3], sedentary behavior was defined as less than 20 minutes of physical activity at least three times per week. In Lages[28], the study used a variation of the physical activity journal proposed by Bouchard *et al*[29], which provides information on daily energy consumption, while in João Pessoa[25] physical inactivity was defined as a weighted average of energy consumption during the three days analyzed below 37 kcal/kg/day. As for other international studies, adolescents were classified as sedentary if they had less than 60 minutes of physical activity each day, every day[5,26].

When physical inactivity is stratified by sex, we see that female adolescents (27.1%) have higher prevalence than males ones (2.9%); however, these results were not significantly different. Brazilian[3,4,14,25] and international studies[5,26] show greater prevalence of physical inactivity among female adolescents.

For males, physical inactivity was expected to be associated with nutritional status and time spent playing video games per day; however, no association was found. Therefore, nutritional status and time spent playing video games per day seem to have no bearing on the prevalence of physical inactivity for Florianópolis adolescents. Unlike the findings from adolescents in this study, the survey of adolescents from the state of Santa Catarina showed that overweight adolescents had 73% more chance of being physically inactive than others[24]. As for time spent playing video games, in Pelotas, Rio Grande do Sul, Brazil, more time spent playing video games was positively associated with the level of physical activity[4].

Table 4 – Physical inactivity and associated factors by logistic regression among male adolescents, ages 14 to 18, from public schools in Florianópolis, Santa Catarina, Brazil, 2007

	Raw OR (95%CI)	Adjusted OR** (95%CI)
Age (years)		
14	1	1
15	1.77 (0.43-7.27)	1.61 (0.38-6.89)
16	0.65 (0.15-2.77)	0.58 (0.13-2.56)
17	1.08 (0.26-4.47)	1.04 (0.24-4.51)
18	0.40 (0.03-4.62)	0.53 (0.04-6.61)
Body image perception		
Satisfied	1	1
Unsatisfied	1.37 (0.62-3.02)	1.65 (0.71-3.83)
Nutritional status		
Normal weight	1	1
Underweight	2.60 (0.92-7.37)	2.38 (0.78-7.29)
Overweight	0.55 (0.15-1.99)	0.47 (0.13-1.75)
Time spent playing video games per day		
<2h	1	1
>2h	1.71 (0.83-3.52)	1.81 (0.85-3.86)
Time spent at the computer per day		
<2h	1	1
>2h	0.32 (0.09-1.11)	0.27 (0.07-0.98)
Time spent watching television per day		
<2h	1	1
>2h	1.00 (0.51-1.98)	0.90 (0.44-1.87)

OR: *Odds Ratio*; CI: confidence interval. ***Odds Ratio* adjusted for all variables.

Among girls, the study did find an association between outcome and nutritional status. The results show that the risk of being insufficiently active is greater among underweight adolescents. Unlike the findings from Florianópolis adolescents, the literature suggests that overweight and obesity are strongly associated with sedentary lifestyles[30]. Also, physical inactivity during adolescence is a strong predictor of risk of obesity in adulthood, favoring a vicious circle of obesity and physical inactivity[31].

For female adolescents, physical inactivity was also positively associated with time spent watching television. These findings corroborate those from Pelotas, where adolescents who spent more time watching television had higher prevalence of sedentary behavior[4]. Likewise, in a study with Canadian adolescents, watching television was found to be correlated with physical inactivity independently of overweight[5]. Rey-Lópes *et al*[32], analyzing cross-sectional studies, found no association between sedentary behaviors (television) and percentage of body fat. On the other hand, longitudinal studies found that children (ages 7 through 11) who watched more than 2 hours of television per day had 13.2 times greater chance of experiencing increased body fat percentages than those who spent less than 2 hours per day watching television[33].

We should note some study limitations. The data were collected at a single point in time, making it cross-sectional, thus preventing the establishment of a cause and effect relationship between physical activity, nutritional status, and sedentary behavior, especially since exposure and outcome variables were collected simultaneously.

Recent research has found high rates of physical inactivity among adolescents, but this study did not. This may be a consequence of the infrastructure of Florianópolis, which, as a coastal city, has plenty of open spaces available for physical activity. The lack of association between the outcome and independent variables may be due to the low rates of inactivity, since studies[3,4] show that high prevalence of physical inactivity is associated with sociodemographic and behavioral variables.

Table 5 – Physical inactivity and associated factors by logistic regression among female adolescents, ages 14 to 18, from public schools in Florianópolis, Santa Catarina, Brazil, 2007

	Raw OR (95%CI)	Adjusted OR** (95%CI)
Age (years)		
14	1	1
15	0.41 (0.15-1.11)	0.41 (0.15-1.12)
16	0.41 (0.16-1.07)	0.42 (0.16-1.10)
17	0.53 (0.20-1.37)	0.56 (0.21-1.49)
18	0.92 (0.27-3.10)	1.04 (0.30-3.63)
Body image perception		
Satisfied	1	1
Unsatisfied	0.95 (0.60-1.50)	0.87 (0.53-1.43)
Nutritional status		
Normal weight	1	1
Underweight	2.56 (1.39-4.71)	2.55 (1.36-4.77)
Overweight	1.32 (0.69-2.51)	1.26 (0.63-2.49)
Time spent playing video games per day		
<2h	1	1
>2h	0.99 (0.64-1.54)	0.94 (0.59-1.51)
Time spent at the computer per day		
<2h	1	1
>2h	0.80 (0.44-1.45)	0.72 (0.39-1.35)
Time spent watching television per day		
<2h	1	1
>2h	1.71 (1.07-2.72)	1.67 (1.03-2.71)

OR: *Odds Ratio*; CI: confidence interval. ***Odds Ratio* adjusted for all variables.

To sum up, we conclude that one in four adolescents was classified as insufficiently active. The primary risk factors for physical inactivity in the study were underweight and time spent watching television per day for female schoolchildren. Thus, we suggest programs enabling higher levels of physical activity, since devoting at least 60 minutes per day to physical activity is related to healthier cardiovascular capacity in adolescents, regardless of sexual maturation and body fat[34]. We also recommend that parents of adolescents be targeted by public health messages, urging them to adopt a more active lifestyle, since parents positively impact the likelihood of adolescents taking on healthy practices of physical activity[35].

References

1. Bauman AE. Updating the evidence that physical activity is good for health: an epidemiological review 2000-2003. J Sci Med Sport 2004;7:6-19.
2. Thompson PD, Buchner D, Pina IL, Balady GJ, Williams MA, Marcus BH *et al*. Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: a statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). Circulation 2003;107:3109-16.
3. Oehlschlaeger MH, Pinheiro RT, Horta B, Gelatti C, San'Tana P. Prevalência e fatores associados ao sedentarismo em adolescentes de área urbana. Rev Saude Publica 2004;38:157-63.
4. Hallal PC, Bertoldi AD, Gonçalves H, Victora CG. Prevalência de sedentarismo e fatores associados em adolescentes de 10-12 anos de idade. Cad Saude Publica 2006;22:1277-87.
5. Koezuka N, Koo M, Allison KR, Adlaf EM, Dwyer JJ, Faulkner G *et al*. The Relationship between sedentary activities and physical inactivity among adolescents: results from the Canadian Community Health Survey. J Adolesc Health 2006;39:515-22.
6. Kriska A. Can a physically active lifestyle prevent type 2 diabetes? Exerc Sport Sci Rev 2003;31:132-7.
7. Todd JA, Robinson RJ. Osteoporosis and exercise. Postgrad Med J 2003;79:320-3.
8. Friedenreich CM, Orenstein MR. Physical activity and cancer prevention: etiologic evidence and biological mechanisms. J Nutr 2002;132: S3456-64.
9. Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity: a systematic review. Int J Obes Relat Metab Disord 1999; 23:S1-107.

10. Pate RR, Freedson PS, Sallis JF, Taylor WC, Sirard J, Trost SG *et al*. Compliance with physical activity guidelines: prevalence in a population of children and youth. Ann Epidemiol 2002;12:303-8.
11. Telama R, Yang X. Decline of physical activity from youth to young adulthood in Finland. Med Sci Sports Exerc 2000;32:1617-22.
12. Azevedo MR, Araújo CL, Silva MC, Hallal PC. Tracking of physical activity from adolescence to adulthood: a population-based study. Rev Saude Publica 2007;41:69-75.
13. Guthold R, Ono T, Strong KL, Chatterji S, Morabia A. Worldwide variability in physical inactivity a 51-country survey. Am J Prev Med 2008;34:486-94.
14. Silva RC, Malina RM. Nível de atividade física em adolescentes do Município de Niterói, Rio de Janeiro, Brasil. Cad Saude Publica 2000;16: 1091-7.
15. National Center for Chronic Disease Prevention and Health Promotion [homepage on the Internet]. Physical Activity and Health: a report of the surgeon general, 1999 [cited 2008 Mar 13]. Available from: http://www.cdc.gov/nccdphp/sgr/chapcon.htm
16. Luiz RR, Magnanini MM. A lógica da determinação do tamanho da amostra em investigações epidemiológicas. Cad Saude Coletiva 2000;8: 9-28.
17. Canadian Society for Exercise Physiology. The Canadian Physical Activity, Fitness and Lifestyle Appraisal: CSEP's guide to health active living. 3ª ed. Ottawa: CSEP; 2004.
18. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. BMJ 2007;335:194.
19. Cole TJ, Bellizi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320:1240-3.
20. Stunkard AJ, Sorensen T, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. Res Publ Assoc Res Nerv Ment Dis 1983;60:115-20.
21. Scagliusi FB, Alvarenga M, Polacow VO, Cordás TA, de Oliveira Queiroz GK, Coelho D *et al*. Concurrent and discriminant validity of the Stunkard's figure rating scale adapted into Portuguese. Appetite 2006;47:77-82.
22. Guedes DP, Lopes CC, Guedes JE. Reprodutibilidade e validade do Questionário Internacional de Atividade Física em adolescentes. Rev Bras Med Esporte 2005;11:151-8.
23. American Academy of Pediatrics. Committee on Public Education. American Academy of Pediatrics: Children, adolescents, and television. Pediatrics 2001;107:423-6.
24. Silva KS, Nahas MV, Hoefelmann LP, Lopes AS, Oliveira ES. Associações entre atividade física, índice de massa corporal e comportamentos sedentários em adolescentes. Rev Bras Epidemiol 2008;11:159-68.
25. Farias Júnior JC, Mendes JK, Barbosa DB. Associação entre comportamentos de risco à saúde em adolescentes. Rev Bras Cineantropom Desempenho Hum 2007;9:250-6.
26. Scully M, Dixon H, White V, Beckmann K. Dietary, physical activity and sedentary behaviour among Australian secondary students in 2005. Health Promot Int 2007;22:236-45.
27. Tassitano RM, Bezerra J, Tenório MC, Colares V, Barros MV, Hallal PC. Atividade física em adolescentes brasileiros: uma revisão sistemática. Rev Bras Cineantropom Desempenho Hum 2007;9:55-60.
28. Arruda EL, Lopes AS. Gordura corporal, nível de atividade física e hábitos alimentares de adolescentes da região serrana de Santa Catarina, Brasil. Rev Bras Cineantropom Desempenho Hum 2007;9:5-11.
29. Bouchard C, Tremblay A, Leblanc C, Lortie G, Savara R, Thériault G. A method to assess energy expenditure in children and adults. Am J Clin Nutr 1983;37:461-7.
30. Rennie KL, Johnson L, Jebb SA. Behavioural determinants of obesity. Best Pract Res Clin Endocrinol Metab 2005;19:343-58.
31. Pietiläinen KH, Kaprio J, Borg P, Plasqui G, Yki-Järvinen H, Kujala UM *et al*. Physical inactivity and obesity: a vicious circle. Obesity 2008;16;409-14.
32. Rey-López JP, Vicente-Rodríguez G, Biosca M, Moreno LA. Sedentary behaviour and obesity development in children and adolescents. Nutr Metab Cardiovasc Dis 2008;18:242-51.
33. Davison KK, Marshall SJ, Birch LL. Cross-sectional and longitudinal associations between TV viewing and girls' body mass index, overweight status, and percentage of body fat. J Pediatr 2006;149:32-7.
34. Ortega FB, Ruiz JR, Hurtig-Wennlöf A, Sjöström M. Physically active adolescents are more likely to have a healthier cardiovascular fitness level independently of their adiposity status. The European youth heart study. Rev Esp Cardiol 2008;61:123-9.
35. Bauer KW, Nelson MC, Boutelle KN, Neumark-Sztainer D. Parental influences on adolescents' physical activity and sedentary behavior: longitudinal findings from Project EAT-II. Int J Behav Nutr Phys Act 2008;5:12.