Original Article

Blood pressure of adolescents in private schools in Fortaleza-CE*

Pressão arterial de adolescentes de escolas particulares de Fortaleza-CE

Presión arterial de adolescentes de escuelas particulares en Fortaleza-CE

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ABSTRACT

Objective: To identify the blood pressure of adolescents in private schools in the city of Fortaleza-CE. **Methods:** This is a cross-sectional and quantitative study in which 794 adolescents were surveyed - between 12 and 17 years of age - from 14 private schools of that city, in the period from March to September 2007. It was used a questionnaire that contemplated the following characteristics: socio-demographic, blood pressure, body mass index (BMI), physical activity and capillary glucose. **Results:** It was found that 19.7% of young people had high blood pressure. The male participants had systolic blood pressure (SBP) and diastolic blood pressure (DBP) higher than females (p=0.0001). The investigation found higher values of SBP and DBP in those who were overweight (p=0.0001). **Conclusion:** The blood pressure was influenced mainly by gender and BMI

Keywords: Blood pressure; Adolescent; School health

RESUMO

Objetivo: Identificar a pressão arterial de adolescentes de escolas particulares da cidade de Fortaleza-CE. **Métodos:** Estudo do tipo quantitativo com delineamento transversal no qual foram investigados 794 adolescentes, entre 12-17 anos de idade de 14 escolas privadas dessa cidade no período de março a setembro de 2007, mediante aplicação de um formulário que abrangeu o registro das características sóciodemográficas, pressão arterial, Índice de Massa Corporal (IMC), prática de atividade física e glicemia capilar. **Resultados:** Verificou-se que 19,7% dos jovens apresentavam pressão arterial elevada. Os adolescentes do sexo masculino apresentaram pressão arteial sistólica (PAS) e pressão arterial diastólica (PAD) maiores do que a do sexo feminino (p=0,0001). A pesquisa constatou valores maiores de PAS e PAD naqueles com excesso de peso (p=0,0001). **Conclusão:** A pressão arterial foi influenciada sobretudo pelo sexo e IMC.

Descritores: Pressão arterial; Adolescente; Saúde escolar

RESUMEN

Objetivo: Identificar la presión arterial de adolescentes de escuelas particulares en la ciudad de Fortaleza-CE. **Métodos:** Se trata de un estudio cuantitativo con delineamiento transversal en el cual fueron investigados 794 adolescentes - entre 12 y 17 años de edad - de 14 escuelas privadas de esa ciudad, en el período de marzo a septiembre de 2007. Se utilizó un formulario que contempló el registro de las siguientes características: socio-demográficas, presión arterial, Índice de Masa Corporal (IMC), práctica de actividad física y, glucemia capilar. **Resultados:** Se verificó que 19,7% de los jóvenes presentaban presión arterial elevada. Los adolescentes del sexo masculino presentaron presión arterial sistólica (PAS) y presión arterial diastólica (PAD) mayores que las del sexo femenino (p=0,0001). La investigación constató valores mayores de PAS y PAD en aquellos con exceso de peso (p=0,0001). **Conclusión:** La presión arterial fue influenciada, sobre todo, por el sexo y el IMC.

Descriptores: Pressión arterial; Adolescente; Salud escolar

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INTRODUCTION

Commonly, arterial hypertension is listed as an important chronic disease of the adult and geriatric population. However, during the past 30 years, prevalence has increased in the infant-juvenile age group in the world scenario. National and international publications have shown a prevalence of high arterial pressure in children and adolescents, ranging between 1% -12% and 2% -10%, respectively[1-2]. In the city of Fortaleza, in particular, the latest publication found on the subject identified a percentage of 44.7% of children and adolescents with arterial pressure above the 90th percentile[3].

Although altered levels of arterial pressure do not necessarily determine a diagnosis of arterial hypertension, the fact can point to a risk of developing this cardiovascular problem in adulthood, even with mild pressure changes[4]. For children with this problem, for example, the chances of them being a hypertensive adult are 2.4 times greater in relation to normotensive individuals[5].

In the context of hypertension in infancy and adolescence, the main risk factors are as follows: elevated primary levels of arterial pressure, family history of the disease, overweight, smoking (passive and/or active) and alcohol consumption. The main repercussions of the disease in adulthood and old age are the cerebrovascular diseases, coronaries, cardiac and chronic renal failure and other vasculopathies[3].

In this scenario, the importance of detecting new cases of this disease in all social spheres is highlighted, as one of the determining factors for the onset of hypertension in childhood and adolescence is socioeconomic status[6]. In the Brazilian literature, there is still no consensus on the prevalence of cases of elevated arterial pressure, according to public or private schooling[7]. There are publications that have found greater involvement of those who come from public institutions[2] and there are also studies that have found no statistical significance in this association[7].

In Fortaleza-CE, up to the present, according to a bibliographic search performed, the research has centered on public schools. The profile of arterial pressure in the adolescents of higher socioeconomic conditions of this Brazilian metropolis, attending private schools, still remains unknown to the scientific community, configured as a research problem in nursing.

In addition to the previously stated, the Ministry of Health, through the National Survey of School Health (PENSE), determines the identification of the prevalence of risk factors for chronic non-communicable diseases and the monitoring of their prevalence over time in public and private schools throughout Brazil. In order to generate evidence about the living conditions (food, stress, smoking, physical inactivity, alcohol consumption, anthropometry, etc.) of these subjects, which guides the development of health promotion measures[8].

When considering arterial hypertension in adolescence as an important negative predictor for the health of these subjects in the future, it is important to also understand this vital parameter in relation to youths of private institutions for the planning of early intervention. Thus, the purpose of this study was to identify the arterial pressure of adolescents in private schools in the city of Fortaleza-CE.

METHODS

This is a cross-sectional, quantitative study constructed for the development of the investigation "Identification of risk factors for type 2 diabetes mellitus in adolescents", as part of the project "Integrated actions in the prevention and control of type 2 diabetes mellitus", supported by the National Council of Scientific and Technological Development (CNPq).

Initially there was a non-randomized selection of 12 private sector schools in the city of Fortaleza-CE. The selection was based on their distribution by region, as specified by the Regional Centre for Educational Development (CREDE), which considers Fortaleza divided into six regions. Two schools were chosen from each region, which allowed a significant coverage of the capital city. However, in region 2 it was necessary to include two more schools to reach the determined sample, totaling four in that area, and culminating in 14 schools evaluated in the whole study. For sensitization of these institutions at least two visits to each were performed, in order to explain and define the objectives and methodology of the study and to obtain acceptance for the research.

Conforming to the previously cited information from CREDE, Fortaleza is divided into six regions. In March 2007, a total of 69,741 pupils, in the age group of interest of the research (12-17 years), were enrolled, with the regional distribution as follows: Region 1- 5,510; Region 2- 30,215; Region 3- 7,101; Region 4- 12,539; Region 5- 5,602; Region 6-8,774 students. This total represented the study population.

Based on the information, the clustering sample was composed of adolescents of both sexes, students in private schools in the city of Fortaleza. The adopted inclusion criteria for the sample were:

Belonging to the age group of 12-17 years. It must be highlighted that there was a desire to evaluate young people 18 years of age, however, it was already noticed at the stage of selecting the schools that this age group would hardly be found, in neither Elementary nor High School education levels of the private institutions.

To be duly enrolled and attending classes in the afternoon period, which was when the data was collected.

Acceptance of participation in the study, to have the acceptance of the parents or guardians and to participate in all the stages of the research.

Students with a confirmed diagnosis of chronic diseases or other diseases that could directly interfere with the arterial pressure value or in obtaining anthropometric measurements were excluded.

The sample was calculated using a formula for an infinite population.

$$n = \frac{t^2_{5\%} \times P \times Q}{e^2}$$

Where

ta 2 = Coefficient of confidence of 95% (1.96%)

P = Prevalence of the phenomenon studied

Q = Subjects that do not have the phenomenon (1-P)

e = Sampling error

It was considered that P=50% and Q=50%, considering that these values provide a maximum size of the sample, when the significance level is fixed (á=0.05) and the absolute sampling error=4%. Thus, the number of participants determined (n) was equivalent to 600 adolescents. With a view to possible loss of subjects and/or of information, a margin of 20% was added to this sample size. Based on this calculation, the sample was distributed according to the data in Chart 1.

Chart 1 - Sample of adolescents from private schools according to a division by region, Fortaleza-CE, 2007

Region	No of students enrolled in age group of interest	Sample By region
1	5.510	51
2	30.215	363
3	7.101	61
4	12.539	131
5	5.602	36
6	8.774	78
Total	**69.741**	**720**

Reiterating that, in Region 2, it was necessary to choose two more schools, the final sample consisted of 794 students.

Data collection was preceded by sending the project to the Human Research Ethics Committee of the Federal University of Ceará (UFC), rigorous training of team members (one PhD, three Masters and three scientific initiation scholarships) based on the current literature on the subject and on the measurement techniques of arterial pressure, weight, height and capillary glycemia. In addition, the equipment used in the field research was sent to the National Institute of Metrology, Standardization and Industrial Quality for calibration. Data collection occurred over two periods: from March to June and from August to September 2007. For this, sociodemographic characteristics, blood pressure, body mass index (BMI), physical activity and glycemia were reported on a form.

Three visits to each institution were conducted. The first, in order to explain in the classroom the objectives and methods of the study, and to deliver the free prior informed consent form to the students and their respective parents. The second and third visits were intended to collect data from randomly selected students who met the inclusion criteria.

The measurement of arterial pressure was always performed with the same equipment and by the same researcher. It was performed using aneroid sphygmomanometers and cuffs of different sizes, with the width of the rubber corresponding to 40% of the circumference of the arm and length involving at least 80% of the circumference of the arm. The width and length of the cuffs used were 10-12 and 17-23 cm, respectively. A binaural stethoscope was also used for the auscultation technique. Measurements were taken individually, three times with an interval of one minute, and the mean of the last two was considered the individual's blood pressure[9].

Some necessary precautions were taken for the preparation of the student, before the blood pressure measurement, such as: rest in a quiet environment for at least five minutes before the measurement; seated with legs uncrossed, feet flat on the floor, leaning back in the chair; bladder emptied; arm at heart level (the level of the midpoint of the sternum or 4th intercostal space), with the palm facing upward and the elbow slightly flexed; silence during the procedure; and the observation of the non-use of stimulant drugs or foods (alcoholic beverages, coffee and tobacco)[9]. As recommended, the bottom edge of the cuff was placed two to three cm above the antecubital fossa, leaving the space for placing the diaphragm of the stethoscope in the site of the brachial pulse.

For the interpretation of arterial pressure values of the adolescents, the table of percentiles of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents[1] was used as a reference. This instrument classifies the levels of systolic arterial pressure (SAP) and diastolic arterial pressure (DAP) in relation to gender, age and height as follows: Normal (less than the 90th percentile); Borderline (equal to the 90th percentile and less than the 95th percentile); Stage 1 hypertension (between 95th and 99th percentile plus 5 mmHg); Stage

2 hypertension (5 mmHg above the 99th percentile)[1]. The subjects included in the borderline, stage 1 and/or 2 hypertension groups were considered as having elevated arterial pressure.

The nutritional status of the subjects was verified based on the calculation of the BMI and interpreted from the recommendations of Cole et al.[10]. Weight was obtained at a single measurement, with subjects barefoot and wearing light clothing, using a portable scale, digital Plenna® brand, with a capacity of 120 kg and a precision of 0.1 kg. The same scale was used in all schools and was constantly observed by the researchers with respect to reliability. This process took place under the guidance of the company responsible for selling, through their Customer Services Department. Height was verified using an ordinary tape measure with a scale of 0.5 cm. In order to ensure the accuracy of the height, the subjects were instructed to position themselves erect and motionless, with hands flat on the thighs and the head adjusted to the Frankfurt plane(10).

With respect to physical activity, adolescents were considered sedentary if they participated in physical activities for a time of less than 30 minutes and a frequency of less than three times per week(11). The measurement of capillary glycemia was performed before the blood pressure measurement because it is believed that the stress and pain caused by the prick of the needle could cause an alarm reaction (nervousness) in the youths and increase arterial pressure levels. The obtained results were analyzed considering the indicators of the Ministry of Health of Brazil(12).

Data were organized using the *Excel 8.0* software and processed in the program *Statistical Package for the Social Sciences* (SPSS) version 16.0. To assess normality and homoscedasticity of the data, the Kolmogorov-Smirnov and Levene test were utilized, respectively. Given the results of the tests, the median values were used in the analysis of SAP and DAP. The Mann-Whitney and Kruskal-Wallis tests were used, paying attention to the homoscedasticity and variance. In the association of the variable presence of elevated arterial pressure with the classifications of BMI, glycemia, the regular practice of physical activity and gender, the chi-square test was used. A significance level of 5% was considered.

The study was conducted through the approval of the research project by the Research Ethics Committee of UFC, conforming to Protocol Nº. 44/07. All participants, considering that they were a group of minors, had consent forms signed by parents or guardians.

RESULTS

As shown in the profile of the adolescents surveyed, the majority were female (57.3%). Concerning the age group, a higher participation of younger adolescents was seen, with 41% and 34.2% respectively, in the range of 14-15 and 12-13 years of age. As noted, the mean age of these youths was 14.3 years. Furthermore, most of them (40%) were enrolled between the 9th grade of elementary school and 1st grade of high school.

Concerning the issue of income of the families of the youths, researched here in the form of the amount of minimum wages per month, according to the results of those who answered the question, the great majority lived in families with up to three (48.5%) or 4-6 (31.6%) minimum monthly wages, and others had incomes exceeding ten minimum wages, a condition found only in 9.3% of adolescents. Even considering this, the mean monthly income was 15.1 wages. However, 10% of all respondents did not answer this question.

Arterial pressure showed asymmetric distribution. The results showed that 19.7% of those investigated had elevated arterial pressure, with 10.1% and 9.6% classified as borderline arterial pressure and stage 1 hypertension (Table 1) respectively. Among the cases of elevated arterial pressure, 38.3% and 26% were those classified as overweight and obese respectively ($p = 0.000$). Regarding gender, 52% of cases of elevated arterial pressure occurred in males ($p = 0.003$).

In the general context, the SAP and DAP of the adolescents was 114.58/65.41 mmHg (SD= ± 11.70/

Table 1 - Classification of the levels of arterial pressure of adolescents, of private schools following the percentile criteria for SAP and DAP. Fortaleza-CE, 2007

Classification	n	%	IC
Less than the 90th percentile [1]	638	80.4%	77.4-83.0
Equal to the 90th percentile and less than the 95th percentile [2]	80	10.1%	8.1-10.4
Between the 95th and the 99th percentile more that 5 mmHg [3]	76	9.6%	7.7-11.9
Arterial pressure	Mean (±DP)	Median	KS[4]
SAP (mmHg)	114.5 (±11.7)	114.0	0.000
DAP (mmHg)	65.4 (±6.8)	65.0	0.002

[1] Normal [2] Borderline [3] Hypertension stage 1 [4] Kolmogorov Sminorv (p value)

Table 2 - Presentation of the SAP and DAP values of the adolescents, of private schools, according to gender, age, physical activity, BMI and glycemia. Fortaleza-CE. 2007

		SAP			DAP		
	n	MEDIAN	(±DP)	p value	MEDIAN	(±DP)	p value
Gender							
Female	455	112.00	(±10.16)	0.000*	64.00	(±5.44)	0.002*
Male	339	117.00	(±11.80)		65.00	(±7.91)	
Age							
12	124	109.00	(±9.86)		63.00	(±5.87)	
13	148	114.00	(±10.12)		64.00	(±5.19)	
14	154	116.00	(±9.77)	0.0000**	65.00	(±5.73)	0.0000**
15	169	117.00	(±11.19)		65.00	(±6.12)	
16	112	116.00	(±12.89)		66.00	(±8.17)	
17	87	114.00	(±12.52)		65.00	(±9.01)	
Physical activity							
Yes	288	115.00	(±10.21)	0.028*	65.00	(±6.18)	0.5302*
No	506	114.00	(±11.70)		65.00	(±6.87)	
BMI							
Normal	600	114.00	(±10.66)		64.00	(±6.05)	
Overweight	158	114.00	(±10.80)	0.0000**	65.00	(±7.66)	0.0000**
Obese	36	129.00	(±13.92)		67.00	(±8.39)	
Glycemia							
Normal	754	114.00	(±11.09)		65.00	(±6.31)	
Uncertain	38	114.00	(±10.86)	0.5160**	64.00	(±5.00)	0.5786**
Altered	2	90.50	(±34.64)		35.00	(±46.66)	

* Mann-Whitney ** Kruskal-Wallis

6.80 mmHg). The male adolescents had higher arterial pressure levels than the females (p=0.0000, p=0.002). The same occurred in those in the age group 12-15 years: 109.00/63.00 mmHg; 114.00/65.00 mmHg; 116.00/65.00 mmHg; 117.00/65.00 mmHg; respectively (p=0.0000) (Table 2).

Approximately 25% of the youths presented accumulated weight (overweight or obesity). The respondents with obesity had higher arterial pressure levels in relation to the youths with normal BMI or overweight (p = 0.000) (Table 2). Around 63% of the youths did not practice physical activities routinely. The sedentary youths had lower SAP values (p = 0.028). Only 5% of those surveyed had glycemia levels outside the normal parameters.

DISCUSSION

In this study, although the arterial pressure verification was performed three times, the mean of the last two considered the arterial pressure of the individual, this occurred at only one visit. From this, the prevalence of youths with arterial pressure above normal values was 19.7%. Other studies that proceeded in an identical manner, found a prevalence of 44.7%, 16.2% and 7%(3,7,13). It is believed that this discrepancy lies in the fact that they were also based on a single evaluation of arterial pressure. However, authors of a study in which measurements were performed over six visits that occurred during one year, found that the SAP and DAP of children and adolescents decreased throughout the evaluations(5).

As many other studies show, the male adolescents presented higher levels of SAP and DAP and were more affected by the problem of elevated arterial pressure[3,5,7]. However, there are authors who have not observed any association between arterial pressure and gender among children and adolescents[14-15]. In contrast, up to 12 years of age, the specialists stress that both SAP and DAP did not differ as to gender, only during adolescence is there an inversion of this condition with males having higher arterial pressure values[16].

The blood pressure levels were higher in older individuals and those with accumulated weight. Although the majority of epidemiological studies use the nomograms of gender and age for the detection of systemic infantile arterial hypertension, age may act as a confounding factor. It should be noted that variables such as height and weight are directly proportional to age, which complicates the study of this factor. Researchers suggest the analysis be controlled for age to verify its real importance[1].

Among the risk factors, the most relevant implicated in the pathogenesis of arterial hypertension in childhood and adolescence is obesity. As observed in this study, other studies also showed significant associations between

BMI and arterial pressure. Most of these studies emphasize the linearity between the weight and vital signs, noting an increased risk for hypertension in the order of five to six times. In addition to BMI, other anthropometric measurements important in the prediction of risk of being overweight and, consequently, elevated arterial pressure would be waist-hip ratio and skinfold thickness[3, 5,7,14,17].

In obese adolescents, the SAP may increase by 10mmHg and DAP by 4mmHg[18]. The chances of an obese individual becoming hypertensive are 7.53 times higher compared to an overweight individual[16]. When overweight and normal individuals are compared, the risk of the former developing arterial hypertension is increased by 180%. A recent study carried out in Fortaleza showed that youths with higher BMI values also had higher SAP and DAP values than their counterparts[5]. Thus, the incentive for weight reduction should be a priority, because even a small loss of body weight can result in a significant drop in arterial pressure[18].

This study found no statistically significant association between physical activity and levels of arterial pressure. In the schools surveyed, physical activity is mandatory, but only takes place once or twice a week, which is not sufficient to meet the needs of adolescents. When asked if they play soccer, walk, weight train or ride a bicycle only 36% of students responded affirmatively.

The literature is rich in arguments that highlight the benefits of physical exercise on blood pressure homeostasis, as shown in a meta-analysis that demonstrated that aerobic physical exercise reduces the level of SAP and DAP by 3 mmHg in normotensive individuals, the SAP by 6 mmHg and DAP by 7 mmHg in borderline hypertensive individuals, and the SAP and DAP by 10 mmHg and 8 mmHg respectively in individuals with severe hypertension[19]. This healthy behavior is also responsible for the prevention of chronic diseases such as diabetes, coronary heart disease, osteoporosis and cancer, among other illnesses[20].

At the onset of elevated blood pressure in youths there are other important factors, such as: insulin resistance, lipid metabolism and reduction of arterial compliance. Regarding glycemia, no study was found on the relationship between spontaneous capillary glycemia and the development of hypertension. For many experts, the development of arterial hypertension in obese subjects is closely related to hyperinsulinemia[21-22].

Several longitudinal studies have demonstrated interest in evaluating arterial pressure levels in children and adolescents, in view of the negative prognosis of this condition over the life of these subjects[2]. Also according to other publications that evaluated the evolution of arterial pressure in children and adolescents, the greater the number of measurements taken, the greater the chance of obtaining a lower arterial pressure level[4-5,14]. Thus the examination of pressure levels in children and adolescents must be part of the routine physical examination of this population in order to prevent and/ or detect early new cases of system arterial hypertension.

CONCLUSIONS

It was found that almost 20% of those surveyed had elevated arterial pressure. The cases were prevalent in male subjects and those who were overweight.

Despite the limitations of this study, such as the evaluation of blood pressure at a single moment, some strengths can be highlighted, namely: the survey covered all regions of Fortaleza-CE and evaluated a representative sample of the youth population coming from private schools of that city. In evaluating the arterial pressure levels, the results, in large part, were similar to those publications that have ratified the BMI, age and gender as important factors in determining the of arterial pressure level. Although the practice of physical activity and glycemia have not be directly associated with elevated systolic pressure and diastolic pressure, it is believed that these aspects can favor the homeostasis of arterial pressure among the youths studied.

Even observing the dimension of these findings the information on the prevalence of these conditions is insufficient. Interventions are also necessary to treat the cases detected, as well as preventative actions, since elevated arterial pressure is a major negative predictor of quality of life and health of the adult.

In this sense, the nurse can collaborate in the development of public health policies designed to combat risk factors for arterial hypertension in children and adolescents such as overweight/obesity, physical inactivity, glucose intolerance, smoking and alcohol consumption, among others. From this perspective the schools where children and adolescents remain for long periods, are spaces conducive to learning and socialization, presenting themselves as suitable places for the nurse to implement actions in health education focusing on dietary habits, on the practice of physical activity and on the monitoring of weight and of arterial pressure levels. It is important to involve not only students, but the family, teachers and other professionals working in the institution.

REFERENCES

1. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents.

Pediatrics. 2004;114(2 Suppl 4th Report):555-76.
2. Ribeiro RQC, Lotufo PA, Lamounier JA, Oliveira RG, Soares JF, Botter DA. Fatores adicionais de risco cardiovascular associados ao excesso de peso em crianças e adolescentes: o estudo do coração de Belo Horizonte. Arq Bras Cardiol. 2006;86(6):408-18.
3. Araújo TL, Lopes MVO, Cavalcante TF, Guedes NG, Moreira RP, Chaves ES, Silva VM. Análise de indicadores de risco para hipertensão arterial em crianças e adolescentes. Rev Esc Enferm USP. 2008;42(1):120-6.
4. Brandão AP, Brandão AA, Magalhães MEC, Pozzan R. Epidemiologia da hipertensão arterial. Rev Soc Cardiol Estado de São Paulo. 2003;13(1):7-19.
5. Araújo TL, Lopes MVO, Moreira RP, Cavalcante TF, Guedes NG, Silva VM. Pressão arterial de crianças e adolescentes de uma escola pública de Fortaleza - Ceará. Acta Paul Enferm. 2007;20(4):476-82.
6. Rosa AA, Ribeiro JP. Hipertensão arterial na infância e adolescência: fatores determinantes. J Pediatr (Rio J). 1999;75(2):75-82.
7. Silva KS, Farias Júnior JC. Fatores de risco associados à pressão arterial elevada em adolescentes. Rev Bras Med Esporte. 2007;13(4):237-40.
8. Brasil. Ministério do Planejamento, Orçamento e Gestão. Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saúde do Escolar 2009. Disponível em: http://www.ibge.gov.br/home/estatistica/populacao/pense/default.shtm.
9. Sociedade Brasileira de Cardiologia, Sociedade Brasileira de Hipertensão, Sociedade Brasileira de Nefrologia. V Diretrizes Brasileira de Hipertensão Arterial. São Paulo: SBC, SBH, SNN; 2006.
10. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000;320(7244): 1240-3. Comment in: BMJ. 2000;321(7269):1158-9. BMJ. 2000;321(7269):1158. BMJ. 2000;321(7269):1159. BMJ. 2001;323(7319):999.
11. World Health Organization. Report of a WHO. Consultation Group on Obesity. Obesity: preventing and managing the global epidemic. Geneva; 2000. [WHO Technical Report Series, 894].
12. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Diabetes Mellitus. Brasília: Ministério da Saúde; 2006. (Cadernos de Atenção Básica, n. 16; Série A. Normas e Manuais Técnicos)
13. Silva MAM, Rivera IR, Ferraz MRMT, Pinheiro AJT, Alves SWS, Moura AA, Carvalho ACC. Prevalência de fatores de risco cardiovascular em crianças e adolescentes da rede de ensino da cidade de Maceió. Arq Bras Cardiol. 2005;84(5):387-92.
14. Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: a working group report from the National High Blood Pressure Education Program. National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents. Pediatrics. 1996;98(4 Pt 1): 649-58.
15. Borges LMP, Peres MA, Horta BL. Prevalência de níveis pressóricos elevados em escolares de Cuiabá, Mato Grosso. Rev Saúde Pública = J Public Health. 2007;41(4):530-8.
16. Haffner SM, Ferrannini E, Hazuda HP, Stern MP. Clustering of cardiovascular risk factors in confirmed prehypertensive individuals. Hypertension. 1992;20(1):38-45.
17. Mellina Ramírez E, Gonzáles Montero A, Moreno Del Sol JM, Jiménez Paneque R, Peraza Roque G. Factores de riesgo asociados com la tensión arterial en adolescentes. Rev Cuba Med Gen Integr. 2001;17(15):435-40.
18. Carneiro G, Faria AN, Ribeiro Filho FF, Guimarães A, Lerário D, Ferreira SRG, Zanella MT. Influência da distribuição da gordura corporal sobre a prevalência de hipertensão arterial e outros fatores de risco cardiovascular em indivíduos obesos. Rev Assoc Med Bras (1992). 2003;49(3):306-11.
19. Fagard R, Amery A. Physical exercise in hypertension. In: Laragh JH, Brenner BM. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Reaven; 1995. p. 2669-79.
20. Nielsen GA, Andersen LB. The association between high blood pressure, physical fitness, and body mass index in adolescents. Prev Med. 2003;36(2):229-34.
21. Zhang CY, Baffy G, Perret P, Krauss S, Peroni O, Grujic D, et al. Uncoupling protein-2 negatively regulates insulin secretion and is a major link between obesity, beta cell dysfunction, and type 2 diabetes. Cell. 2001;105(6):745-55. Comment in: Cell. 2001;105(6):705-7.
22. Pereira MA, Jacobs DR, Horn LV, Slattery LV, Kartashov AI, Ludwig DS. Dairy consumption, obesity, and the insulin resistance syndrome in young adults: the CARDIA Study. JAMA. 2002; 287(16):2081-9.