

Cardiovascular risk factors associated with hypertension in children and adolescent students

Fatores de risco cardiovascular associados à hipertensão arterial sistêmica em escolares

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RESUMO | INTRODUÇÃO: A análise conjunta dos hábitos de vida que podem predispor ao aparecimento de doenças cardiovasculares na idade adulta tem papel importante para o conhecimento do perfil de risco cardiovascular de crianças e adolescentes. **OBJETIVO:** Investigar hábitos alimentares inadequados e fatores de risco cardiovascular associados à Hipertensão Arterial Sistêmica em escolares de 7 a 14 anos de idade, domiciliados no Cabula/Beiru na cidade do Salvador, Bahia, Brasil. **MÉTODOS:** Estudo transversal com 162 escolares matriculados na rede pública do Ensino Fundamental I, residentes no Distrito Sanitário Cabula Beiru (DSCB), na cidade do Salvador, Bahia. Regressão logística multivariada, não-condicional, hierarquizada, foi usada para avaliar a associação, após ajustes por fatores sociodemográficos e de saúde, entre a HAS, hábitos alimentares inadequados e fatores de risco cardiovascular. **RESULTADOS:** A prevalência de hipertensão arterial entre os escolares foi estimada em 23,0% e o excesso de peso (OR=4,08; IC95% 1,75 – 9,55), assim como a inatividade física (< 300 min/semana) (OR=5,69; IC95% 1,56 – 20,69), consumo inadequado de doces (OR=2,65; IC95%: 1,01 – 7,00) e de refrigerantes (OR=3,61; IC95%: 1,28 – 10,13) foram os fatores associados com pressão arterial elevada. **CONCLUSÕES:** Os dados evidenciam hábitos inadequados de alimentação e fatores de risco cardiovasculares, em especial, sobrepeso ou obesidade e ser insuficientemente ativo. Estes resultados reforçam a necessidade de programas de promoção de saúde e prevenção dos riscos direcionados à parcela mais jovem da população. Recomendamos a adoção de estratégias para o controle do peso e estímulo à prática regular de atividade física nas escolas, bem como ações de educação em saúde no Ensino Fundamental.

PALAVRAS-CHAVE: Hipertensão arterial sistêmica. Fatores de risco cardiovascular. Ensino fundamental. Obesidade. Atividade física.

ABSTRACT | INTRODUCTION: The joint analysis of lifestyles that could cause a predisposition to the occurrence of cardiovascular diseases in adulthood has an important role towards understanding the cardiovascular risk profile of children and teenagers. **OBJECTIVE:** Investigate the cardiovascular risk factors associated to Systemic Arterial Hypertension (SAH) in schoolchildren of ages between 7 and 14, domiciled in the Cabula/Beiru neighborhood, in Salvador, Bahia, Brazil. **METHODS:** A cross-sectional study with 162 schoolchildren registered in the public education network of Elementary School I, residents of Distrito Sanitário Cabula Beiru (DSCB), in the city of Salvador, Bahia. Non-conditional, hierarchical multivariate logistic regression analysis was used to evaluate the association between the SAH and cardiovascular risk factors, after adjustments for socio-demographic and health factors. **RESULTS:** The prevalence for arterial hypertension among the schoolchildren was estimated at 23.0% and overweight (OR=4.08; IC95% 1.75 – 9.55), as well as physical inactivity (< 300 min/week) (OR=5.69; IC95% 1.56 – 20.69), inadequate consumption of sugar (OR=2.65; CI95%: 1.01 – 7.00) and soft drinks (OR=3.61; CI95%: 1.28 – 10.13) were the cardiovascular risk factors associated to high blood pressure. **CONCLUSIONS:** Our data show inadequate eating habits and cardiovascular risk factors, especially being overweight or obese and being insufficiently active. These results reinforce the need for health promotion and risk prevention programs guided towards the younger population. We recommend the adoption of weight control strategies and the stimulation of regular practice of physical activities in schools, as well as health education actions in Elementary Schools.

KEYWORDS: Systemic arterial hypertension. Cardiovascular risk factors. Elementary school. Obesity. Physical activities.

Introduction

Cardiovascular diseases (CVD) represent a group of chronic non-communicable diseases which have a significant impact on worldwide health indicators¹ and in Brazil, demanding high costs by the public authorities². Cerebrovascular disease, ischemic cardiopathy and systemic arterial hypertension (SAH), affect individuals during their working years, directly impairing quality of life and the maintenance of the ability to work of the population³. Despite the magnitude of these impacts on adult life, SAH may already be present at a tender age, especially in children of hypertensive parents⁴⁻⁶.

There aren't sufficient long-term studies during childhood and adolescence to relate high blood pressure (BP) in this age group to CVD established in adulthood. Conversely, the direct relation BP and the size of the left ventricle (LV) in this population has already been demonstrated, emphasizing the importance that BP has on the determinism of the left ventricle mass (LVM) since early stages of life. Accordingly, albeit predominating during adulthood, arterial hypertension in children and teenagers is not insignificant. It varies greatly in the reports of various national and foreign authors, from 1% to 13%, depending, largely, on the methodology used, in other words, on the criteria of normality adopted, age group, number of visits, number of measures per visit and monitoring period⁴⁻⁶.

Sundry longitudinal studies have demonstrated that a child with higher blood pressure levels, even if within limits considered as normal, tends to evolve during their lives, with higher blood pressure levels than others and presenting a greater probability of becoming a hypertensive adult. All these studies have in common a strong correlation between arterial hypertension and a high weight/height ratio, i.e. arterial hypertension is associated to overweight and obesity⁴⁻⁶.

The cardiovascular Risk Factors (RF) are determined, mainly, by environmental, socio-cultural and genetic determinants, changeable or not. The best strategy for approaching changeable RF are adequate nutrition, regular physical activities, weight control, alcohol consumption control and quitting smoking⁶.

The identification of risk factors for CVD at early ages is of great value for understanding the epidemiological profile of this population and thus adopting effective measures for the prevention of future events, such as Acute Myocardial Infarction and Cerebral Vascular Accident during working age. The joint analysis of lifestyles during childhood and adolescence that could predispose the occurrence of cardiovascular diseases during adulthood has an important role for understanding the cardiovascular risk profile of these individuals. Thereby, this study was performed with the purpose of identifying the lifestyles and cardiovascular risk factors associated to Systemic Arterial Hypertension in schoolchildren of ages 7 to 14 years, domiciled at Cabula/Beiru in the city of Salvador, Bahia, Brazil.

Material and methods

A cross-sectional study performed with students registered in Elementary School I, a public school, residents of the Cabula Beiru Health District (CBHD), in the city of Salvador, Bahia, Brazil. Individuals of both genders were included, with ages varying between 7 and 14 years, registered and regularly attending a public school of the area. The students who could not answer about their own health and living habits were excluded. The size of the sample was calculated using the Open-Epi version 2 (<http://www.openepi.com>) program. The parameters used were: size of the population 30,000 (<http://ibge.gov.br>), outcome prevalence of 12%, confidence limit of 5%, design effect of 1, totaling 162 respondents. The sample process adopted was consecutive and of convenience. It should be observed that Cabula Beiru is a health district with serious structural problems and with high rates of unemployment, illiteracy, homicides, maternal and infant mortality and infectious and contagious diseases.

Primary data was collected through the application of forms by fellowship students and always in the presence of a health professional, involved in the program as mentor. Data collection was performed in a municipal elementary school, between the months of February and March 2015, and the data was collected in a reserved room with the aim of

favoring privacy of the interviewed party. A pilot study was carried out in a school, also in the CBHD with the purpose of calibrating the data collection instrument as well as the researchers in the field.

A structured form was prepared by the researchers for obtaining the data and contained questions related to living habits, nutrition, levels of physical activities, and hours related to sedentary leisure time, as well as anthropometric and blood pressure measures. For the latter, the criterion of three minute rest was adopted when the student was comfortably seated, flexed knees and hip at 90 degrees and empty bladder.

The blood pressure was measured with a Solidor® adult aneroid sphygmomanometer or child Premium®, considering the circumference of the arm and the weight of the child/teenager, as proposed by the Brazilian Cardiology Society (Sociedade Brasileira de Cardiologia)(7). Subsequently the student was taken for measuring weight and height. For body weight measurement the participant should be barefoot and wearing light clothing. For body weight measurement the Wiso® W801 digital scale was used with a precision of 100 grams adopting the measurement in kilograms. Height was measured using a MD® stadiometer with precision of 0.1 cm and Body Mass Index was calculated and classified in accordance with the following cut-off points for children and adolescents, varying in accordance with age and gender (8). Waist circumference (WC) was measured halfway between the inferior border of the last rib and the superior border of the iliac crest, after normal expiration, with a Seca® anthropometric tape. After these measurements the student should once again rest for another 3 minutes before collection of the second and last measurement of the blood pressure, carried out by the same professional in both measurements in order to assure reliable test-retest measurement.

The presence of Acanthosis Nigricans, a dermatological condition with a velvety aspect characterized by an increase in the thickness of the skin and hyperpigmentation, commonly related to obesity and metabolic dysfunctions, was dichotomically evaluated and classified. The level of physical activity was measured using a Physical

Activity Questionnaire for Adolescents (PAQ-A)(9), according to the period of time in minutes per week of the mentioned practice. The cut-off point of 300 minutes was adopted, whereby individuals above this margin were considered as sufficiently active. Eating habits, or consumption, was investigated in accordance with the Food Consumption Markers Form standardized by the Brazilian Food and Nutrition Monitoring (SISVAN) and developed for children equal to or over five years of age. This instrument verifies the frequency of consumption, in the seven days prior to the research, for ten food groups, preparation and food, considering food consumption markers: raw salads; cooked vegetables and greens (except potato and cassava); fruit; beans; milk or yogurt; potato chips, packaged or fried; hamburgers and sausages; salty biscuits or packaged snacks; sweet cookies, sweets and chocolates and soft drinks. This questionnaire contains eight increasing options of frequency of consumption, from “haven’t eaten in the last seven days” to “ate every day during the past seven days”. The following were considered as inadequate: the consumption of raw salad and vegetables, and beans less than 7 days; salty snacks equal to or over twice a week and stuffed cookies and soft drinks over 3 days a week.

Skin color was categorized in accordance with the definition by the IBGE as black, brown, white, yellow and indigenous. For the purpose of analysis, in this study, this variable was collapsed into black and brown, considering the non-identification of other categories in the studied population.

The databank was prepared on Excel program for Windows with double input with the purpose of minimizing inputting mistakes. Next, cleaning procedures were carried out. Bivariate analyses were performed to identify the set and variables mostly associated to high blood pressure. The magnitude of the association among the studied variables and high blood pressure was estimated using the odds ratio (OR), adopting the confidence interval (CI) of 95% (CI95%) as measure of precision. Subsequently, multivariate analyses were performed using logistic regression, from the theoretical model defined a priori, breaking down risk factors into hierarchical blocks. The strategy used for hierarchical entry of variables in block was the

forward type (anterograde process), through the step module – first block: socio-demographic variables; second block: variables related to lifestyle; third block: variables related to the quality of healthcare offered in primary healthcare. Variables with statistic levels of significance remained in the model, according to $p < 0.10$. Statistical packages used were Excel for Windows (version 3.2) and Stata (version 10.0). The research project was approved by the Research Ethics Committee of Universidade do Estado da Bahia (CEP/UNEB), Report 1.355.188, CAAE 49119315.4.0000.0053, fulfilling in this manner the determinations of Resolution 466/2012.

Results

Amongst the children and adolescents studying in the selected public school, data was collected from 162 individuals. Of these, 23.0% presented high blood pressure in accordance with the percentage per age. The population of the study was made up predominantly by individuals of the male gender 92 (56.8%), 89 (54.9%) with ages varying between 7 and 10 years and 97 (59.9%) skin color black/brown. Gross and adjusted logistic regression for the outcome of arterial blood pressure did not evidence association among these factors (Table 1).

Table 1. Association between high blood pressure and sociodemographic variables of schoolchildren enrolled in a public school in the DSCB, Salvador, Bahia, 2015. N = 162

Variables	n (%)	Prevalence (%)	High Blood Pressure		p- value
			OR gross (IC 95%)	OR adjusted (IC 95%)	
Gender					
Female	70 (43,2)	24,3	1	1	0,605
Male	92 (56,8)	21,9	0,92 (0,44 – 1,91)	1,82 (0,38 – 1,73)	
Age (years)					
7 a 10	89 (54,9)	20,5	1	1	0,453
11 a 14	73 (45,1)	26,0	1,29 (0,65 – 2,85)	1,33 (0,63 – 2,68)	
Skin color					
Brown	97 (59,9)	16,9	1	1	0,143
Black	65 (40,1)	27,1	1,89 (0,86 – 4,01)	1,81 (0,81 – 4,15)	

* Variables with a value of $p \leq 0.10$ integrated the multivariate logistic regression model adjusted for sex and age.

Under Table 2 are described the prevalence, gross and adjusted odds ratio of risk factors related to clinical status and living habits with high blood pressure. It should be observed that 23.5% of the individuals were overweight, 6.2% presented signs compatible to Acanthosis Nigricans, 56.5% spent over three hours in front of computer/television/smartphones and 24.1% were insufficiently active. In the bivariate and multivariate analyses excess weight and being insufficiently active were demonstrated to be associated in a statistically significant manner to high blood pressure, OR=4.22; CI95%:1.74–10.22 and OR=5.87; CI95%:1.58–21.72 respectively.

Table 2. Association between high blood pressure and clinical status and living habits of schoolchildren enrolled in a public school in the DSCB, Salvador, Bahia, 2015. N = 162

Variables	n (%)	High Blood Pressure			p- value
		Prevalence (%)	OR gross (IC 95%)	OR adjusted (IC 95%)	
Body Mass Index					
Low weight or eutrophy	124 (76,5)	17,1	1	1	0,001
Overweight	38 (23,5)	42,1	3,37 (1,52 – 7,44)	4,22 (1,74 – 10,22)	
Presence of Acanthosis Nigricans					
No	152 (93,8)	23,2	1	1	0,569
Yes	10 (6,2)	22,2	1,24 (0,25 – 6,11)	1,71 (0,26 – 10,98)	
Hours in front of computer/television/smartphones					
< 3	70 (43,5)	28,4	1	1	0,279
≥ 3	91 (56,5)	19,2	1,43 (0,67 – 3,02)	1,56 (0,69 – 3,49)	
Level of physical activity					
Sufficiently active	123 (75,9)	27,9	1	1	0,008
Insufficiently active	39 (24,1)	7,7	4,72 (1,37 – 16,51)	5,87 (1,58 – 21,72)	

* Variables with a value of $p \leq 0.10$ integrated the multivariate logistic regression model adjusted for sex and age and block variables.

The objective of Table 3 is to describe the association between high blood pressure and variables related to food consumption, using specific cut-off points for each group of food, in order to classify them as factors of risk or of protection. Among those assessed, there was an association between the consumption of soft drinks for 3 or more days a week and high blood pressure (OR=3.77; CI95%: 1.31 – 10.80).

Table 3. Association between high blood pressure and variables related to food consumption of schoolchildren enrolled in a public school in the DSCB, Salvador, Bahia, 2015. N = 162

Variables	n (%)	Prevalence (%)	High Blood Pressure		p-value
			OR gross (IC 95%)	OR adjusted (IC 95%)	
Raw Salad / Cooked Vegetables / Fresh Fruits (days)					
≥ 5	111 (68,5)	18,0	1	1	
< 5	51 (31,5)	34,0	2,48 (1,17 – 5,25)	1,91 (0,81 – 4,46)	0,135
Beans (days)					
7	7 (4,3)	14,3	1	1	
< 7	155 (95,7)	23,4	1,88 (0,21 – 16,13)	2,34 (0,21 – 25,46)	0,485
Milk or yogurt (days)					
7	23 (14,2)	21,7	1	1	
< 7	139 (85,8)	23,2	1,12 (0,38 – 3,25)	0,67 (0,20 – 2,27)	0,528
Fried potato, package potato and fried salted / hamburger and sausages / Snacks package (days)					
< 2	144 (89,4)	25,0	1	1	
≥ 2	17 (10,6)	15,3	1,00 (0,30– 3,25)	0,92 (0,21 – 3,92)	0,920
Sweet or Stuffed Biscuits, Sweet Candies and Chocolates (days)					
≤ 2	113 (69,7)	21,4	1	1	
≥ 3	49 (30,3)	26,5	1,27 (0,58 – 2,75)	1,92 (0,74 – 4,96)	0,177
Soda (days)					
≥ 3	44 (27,2)	15,9	1	1	
≤ 2	118 (72,8)	25,6	0,53 (0,21 – 1,31)	0,39 (0,12 – 1,19)	0,100

* Variables with a value of $p \leq 0.10$ integrated the multivariate logistic regression model adjusted for gender, age, BMI, physical activity level and block variables.

Under Table 4 the final model of multivariate logistic regression is presented. High blood pressure was independently associated to overweight/obesity factors (OR=4.08; CI 95% 1.75 – 9.55), sedentary lifestyles (OR=5.69; CI95% 1.56 – 20.69) and consumption of sweet or stuffed cookies (OR=2.65; CI95%: 1.01 – 7.00) and soft drinks (OR=3.61; CI95%: 1.28 – 10.13). Gender and age remained on the model for adjustment.

Table 4. Final logistic regression model between high blood pressure and selected variables of schoolchildren enrolled in a public school in the DSCB, Salvador, Bahia, 2015. N = 162

Variables	High Blood Pressure		p-value
	OR gross (IC 95%)	OR adjusted (IC 95%)	
Male	0,92 (0,44 – 1,91)	0,72 (0,32 – 1,59)	0,418
Age group 11 - 14 years old	1,29 (0,65 – 2,85)	1,43 (0,65 – 3,15)	0,369
Body Mass Index indicating that overweight	3,37 (1,52 – 7,44)	4,08 (1,75 – 9,55)	0,001
Level of physical activity indicating insufficient active	4,72 (1,37 – 16,51)	5,69 (1,56 – 20,69)	0,008

* Variables with a value of $p \leq 0.10$ integrated the multivariate logistic regression model adjusted for gender, age, BMI and physical activity level.

Discussion

The high prevalence of cardiovascular diseases worldwide in adults and the elderly is already well documented, nevertheless little attentions has been directed towards the younger population, comprising children and adolescents which are subject, just like the adults, to an increasing routine of lower caloric expenditure^{4-6,12}, higher consumption of simple sugars¹² and lipids^{6,13}, smoking^{5,6,14} and alcohol consumption¹⁴ generating a strong risk potential for the incidence of early arterial hypertension and cardiovascular diseases in adulthood.

Children with higher blood pressures, even within limits considered as normal, tend to evolve during their lives with a blood pressure higher than others and with greater probability of becoming hypertensive adults. Accordingly, considering that SAH in adults could have its origin during childhood, preventive strategies, namely those related to the identification of cardiovascular risk factors associated to SAH in this age group, should be adopted in the early stages, in the attempt of reducing late complications related to this disease^{6,11-14}.

The prevalence of arterial hypertension was relatively high in this study. High pressure levels in school children in public schools were also reported by other authors. Moura et al.¹⁵ estimated prevalence of 13.7% in a study performed in schools of the northeastern region with a sample of 211 adolescents between the ages of 12 and 18 years. Gomes et al.¹⁶, reported a frequency of 17.3% for students of between the ages of 14 and 20 years

residents in the city of Recife and, finally, Farias Júnior et al.¹⁷ in 2013, estimated 18.0% in high blood pressure for adolescents of ages between 14 and 17 years in Piauí.

The investigation into co-occurrence of risk factors, as performed herein, has also been the aim of investigations due to the increase in the risk for cardiovascular diseases. This condition of simultaneity which could propitiate repercussions in other phases of the lifecycle was reiterated by Farias Júnior et al.¹⁷ in 2011, when investigating the health conditions of 782 adolescents and verifying that 51.4% presented concomitantly two or more risk factors. In this study, excess weight and insufficient level of physical activities were some of the risk factors associated to higher blood pressure elementary school students, as has been reported in prior studies^{5,6,11-13}.

Other authors refer the simultaneous presence of these factors as risk determinants. Among these, Sánchez-Zamorano et al.¹⁴ who, in Morelos, Mexico, described the results of unhealthy conducts, such as consumption of alcohol, tobacco, illegal drugs, and physical activities among 2,813 adolescent school students. The principal component analysis was used to derive the unhealthy standards of conduct and these are related in a significant manner to the prevalence of systemic arterial hypertension. Also Ribas et al.¹⁸, in Belém, opted for investigating the presence of risk factors such as obesity/overweight, dyslipidemia and sedentary lifestyles in adolescents of ages between 6 and 19 years, with findings of 20.4%, 48.1% and 66.2% respectively.

In this study the inadequate consumption of food considered as protective, such as raw salad and vegetables, as well as food considered as having health risks such as salty snacks, stuffed cookies and soft drinks was evidenced. These findings point out to a positive association between the inadequate consumption of sweets, such as sweet or stuffed cookies, candies and chocolates and soft drinks with high blood pressure. It is possible that excess calories and sodium consumed could justify such associations. Pinto et al.¹⁹, corroborate these findings when reporting the association between inadequate eating habits with pre-hypertension and hypertension in adolescents from public schools in Bahia. The prevalence in risk food consumption is also reported by various authors^{6,8,11,13,14}. Lancarotte et al.¹¹ studied children with average age of 12.9 years and verified that, among these, 80% consumed fruit in an inadequate manner, 45.3% ingested excessive quantities of salt and 74% drank excessive amounts of soft drinks. Campos et al.¹³, in the city of Curitiba, reiterated the fact that school children of ages between 10 and 18 years, consume lipids and saturated fats inadequately. Considering not only the short-term effects, overweight or obesity, when present during childhood, are associated to the early development of Diabetes Mellitus, cardiovascular diseases, dyslipidemia and hypertension in adulthood. In a population consisting of children and adolescents, this reinforces the importance of inadequate living habits such as physical inactivity and a hyper caloric diet could lead to obesity, and in this manner can be related to the higher blood pressure levels.

According to the World Health Organization (WHO) model, social health determinants, or “the causes of the causes”, define the standard and the epidemiological profile of a population and have, therefore, direct impact on health. Among the ‘causes of the causes’ involved herein, it is possible to mention urban violence and the availability of restricted spaces for child leisure and the commodity of packaged, industrialized and ultra-processed foods. Once these are cheap and can be stored, they end up being the most frequent options for parents who work and do not have the time to prepare healthier meals. It is estimated that low income and lower schooling levels exercise a great influence on

the choice of such food. Once the purchasing power is reduced, processed food is more accessible. Such behavior can be reinforced further by the lack of awareness about the its harms contributing towards continued acquisition.

With reference to physical inactivity in the present study there is a prevalence of 24.1%. Similar results were presented by Sánchez-Zamorano et al.¹⁴ in Morelos, México, in which a prevalence of 42.2% of physical inactivity in adolescents of average age of 12.5 years. Campos et al.¹³, in Curitiba, in a population of ages between 10 and 18 years there were 17.3% of boys with physical inactivity and 22.6% inactive girls. A higher frequency was reported by Gonçalves et al.²⁰, in 2007 in a cohort study in the city of Pelotas, RS. The authors evaluated adolescents born in 1993, and in 2005 verified that the total prevalence for sedentary lifestyles, adopting 300 minutes/week as cut-off point, was of 48.7%. These researchers also observed that the level of physical activity was greater in children that usually met with friends outside the school environment against those that were more reclusive in their homes. Sedentary lifestyles may be justified by the preference for electronic games and television²¹, considered as passive leisure rather than playing in the streets or practicing sports. It should be emphasized that a large amount of time allocated to passive activities is harmful to these children and adolescents, moreover stimulating bad eating habits, once publicity of industrialized food influences children who ask their parent to buy the items advertised in the media.

Another condition associated to pre-hypertension or arterial hypertension is excess weight, a factor of strong impact on health and the high prevalence in various regions of Brazil. Mazor-Aronovitch et al.²², found statistically significant association between overweight/obesity and hypertension in Israeli adolescents with average age of 12.5 years. These researchers also describe the prevalence of 31.7% in high blood pressure in overweight school children, while in eutrophics the prevalence was of 1.9%. In Brazil, a study by Rinaldi et al.²³ reaffirmed national and international data on the association between excess weight on arterial blood pressure already during childhood.

In the same manner as with adults, the association of obesity and arterial hypertension can be detected early in childhood and is of great clinical importance, due to the association with silent diseases, such as dyslipidemia, diabetes mellitus type II and the syndrome of insulin resistance^{4-6,12,14}. In a longitudinal study performed in Rio de Janeiro it was demonstrated that the presence of excess weight was associated to the maintenance of a high percentage of arterial blood pressure and that the disappearance of the excess weight determined a significant reduction in the blood pressure levels of adolescents⁴. The results of the present study are amply corroborated by authors of various nationalities and signal a disseminated problem and, up to date, and difficult to reverse without investing considerable resources, involving parents, schools, the community and public powers. Evidence points out to the need for investments in primary healthcare in order to offer health education, nutritional and clinical monitoring services guided towards weight control. Additional investments should be guaranteed with the offer of full-time education for children and adolescents, with comprehensive education encouraging the practice of sports, as well as other activities that qualify the time of these subjects in their formation process. This could be the answer of the public sector for the control of this health issue of adults the roots of which lie in their childhood.

With the knowledge that CVD are diseases generated by cumulative factors, nutrition during this phase of life may not be the most important factor for the increase in blood pressure, although the permanence of inadequate nutritional habits, mainly when concomitant to other RF throughout their lives, represents an important causal factor for CVD¹²⁻¹⁴. It is important to observe that the sample of this study comprised children and adolescents of ages between 7 and 14 years. In this manner, it is possible to suppose that some of these already have between 6 and 13 years of exposure to inadequate nutrition, in view that the literature points to early introduction from early childhood of food rich in fats, sugars and sodium²⁵. Attention is drawn to the fact that this study did not aim to find the causal relation between risk factors and outcome, but to identify the most prevalent risk factors and associated to arterial hypertension in the studied population.

The advantages of this study are considered as the pilot study and the acquisition of primary data from face-to-face collection. Whereas the use of the PAQ-A for lower age groups may be considered as a limitation, once this instrument uses the form of self-reported answers. Another factor to be highlighted and that could hinder the accuracy of the data related to nutrition is the manner of preparation of the food, once it could vary greatly with reference to the quantity of ingredients that offer risk such as salt and animal fat, where beans is the food that best reflect this situation.

Conclusions

It was verified that a significant portion of the population of the study, made up of schoolchildren from Elementary School, presented systemic arterial hypertension, whereby overweight/obesity, physical inactivity and inadequate eating habits were the associated factors. The implementation of preventive actions and health promotion in communities is recommended, guided towards the younger segment of the population and the adoption of strategies for weight control and the promotion of the regular practice of physical activities in schools, as well as regular health education actions for this part of the population. Finally, we also point out the need for regular measurement of blood pressure in schoolchildren, especially for those with overweight, obesity and sedentariness issues. Furthermore, this is a primary-care sensitive condition that can assist in the prevention of damages in working ages.

Acknowledgements

To the financial support obtained for the realization of the research with the Department of Life Sciences I / State University of Bahia (UNEB), in the form of printing of the instruments. To the financial support of FAPESB and CNPQ by the Scientific Initiation Grants UNEB.

Author contributions

Study design: Fraga-Maia H, Silva RS, Tosta LS, Cavalcante LLR, Brito LL; Statistical analysis and manuscript writing: Fraga-Maia H, Silva RS, Tosta LS, Cavalcante LLR, Brito LL, Brito LL, Zarife A.; Data analysis and interpretation: Fraga-Maia H, Silva RS, Tosta LS, Cavalcante LLR, Brito LL, Zarife A; Critical review of the manuscript regarding important intellectual content: Fraga-Maia H, Silva RS, Tosta LS, Cavalcante LLR, Brito, LL, Zarife A.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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