# Risk factors for hypertension among middle school students*

*Fatores de risco para hipertensão arterial entre estudantes do ensino médio*

*Fatores de riesgo para la hipertensión arterial entre estudiantes de enseñanza media*

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**ABSTRACT**

**Objective:** To identify blood pressure values and estimate the frequency of risk factors for hypertension among middle school students. **Methods:** This was a descriptive, cross sectional study, conducted in schools in the southeastern region of Brazil. The sample consisted of 184 adolescents enrolled in the second semester of middle school, in 2009. In addition to the measurement of clinical variables, instruments were applied to identify risk factors associated with hypertension. **Results:** An alteration in blood pressure was a parameter detected in 22.3% of the sample. Among the risk factors investigated, family history of cardiovascular disease and alcohol consumption were the most prevalent. **Conclusion:** There is need to enhance the measures of primary prevention and early detection of arterial hypertension among adolescents, with special attention to the assessment of family history and adoption of risk habits.
**Keywords:** Blood pressure; Hypertension; Risk factors; Students

**RESUMO**

**Objetivo:** Identificar os valores pressóricos e estimar a frequência de fatores de risco para a hipertensão arterial entre estudantes do ensino médio. **Métodos:** Estudo descritivo de corte transversal, desenvolvido em escolas da Região Sudeste brasileira. Fizeram parte da amostra 184 adolescentes matriculados na segunda série do ensino médio, em 2009. Além da mensuração das variáveis clínicas, foram aplicados instrumentos para identificação de fatores de risco associados à doença hipertensiva. **Resultados:** A alteração pressórica foi um parâmetro detectado em 22,3% da amostra. Dentre os fatores de risco investigados, o histórico familiar de doenças cardiovasculares e o consumo de álcool foram os mais prevalentes. **Conclusão:** Há necessidade de valorizar as medidas de prevenção primária e detecção precoce da hipertensão arterial entre adolescentes, com especial atenção para a avaliação dos antecedentes familiares e adoção de hábitos de risco.
**Descritores:** Pressão arterial; Hipertensão; Fatores de risco; Estudantes

**RESUMEN**

**Objetivo:** Identificar los valores presóricos y estimar la frecuencia de los factores de riesgo para la hipertensión arterial entre estudiantes de enseñanza media. **Métodos:** Estudio descriptivo de corte transversal, desarrollado en escuelas de la Región Sudeste brasileña. Conformaron la muestra 184 adolescentes matriculados en la segunda serie de la enseñanza media, en el 2009. Además de la mensuración de las variables clínicas, se aplicaron instrumentos para la identificación de factores de riesgo asociados a la enfermedad hipertensiva. **Resultados:** La alteración presórica fue un parámetro detectado en el 22,3% de la muestra. Entre los factores de riesgo investigados, la historia clínica familiar de enfermedades cardiovasculares y el consumo de alcohol fueron los más prevalentes. **Conclusión:** Hay necesidad de valorizar las medidas de prevención primaria y detección precoz de la hipertensión arterial entre adolescentes, con especial atención a la evaluación de los antecedentes familiares y adopción de hábitos de riesgo.
**Descriptores**: Presión arterial; Hipertensión; Factores de riesgo; Estudiantes

## INTRODUCTION

Systemic arterial hypertension (SAH) is a multifactorial disease that involves different mechanisms, leading to increased cardiac output and vascular resistance. It represents an important risk factor for coronary disease and can determine cardiovascular complications as early as childhood or adolescence[1].

Although predominant among adults, primary hypertension manifestations at an early age cannot be ignored. Epidemiological studies appoint a global prevalence ranging between 3% and 11%[2-4].

One indicator that is strongly related with the development of SAH is obesity, which represents a growing health problem in the child-juvenile population in different parts of the world. The rising global prevalence of primary arterial hypertension in childhood and adolescence is directly related with the increasing prevalence of obesity and overweight among children and young people[5]. It is calculated that one third of obese children suffer from high blood pressure (BP)[2].

In addition, cardiovascular risks seem to increase with the body mass index (BMI) percentile[6]. Hyperinsulinemia, hyperlipidemia and centripetal distribution of body fat are other factors associated with increased BP in obese children[7].

At the same time, a family history of SAH also seems to cooperate with the outcome and enhance the impact of obesity on pressure levels in childhood and adolescence[7].

Among other variables, BP control is related with regular physical exercise. When established in childhood, this habit has a greater chance of continuing in adult life. Little research exists so far on the prevalence of sedentariness among children and adolescents. In Brazil, these rates show discrepant results, but can rise up to more than 90%, depending on the adopted methodological criteria[8].

Other factors are preponderantly associated with SAH in adolescence, including smoking, contraceptive use, drugs like cocaine and amphetamines, alcohol, anabolic steroids, among others[1]. Studies show that involvement with legal and illegal drugs mainly occurs in the adolescent and young adult population. Alcohol and tobacco are the most consumed substances. Early alcohol use is a particular source of concern as, the earlier consumption starts, the greater the risk of addiction. According to the Brazilian Psychotropic Drugs Information Center (CEBRID), 48.3% of adolescents in the age range between 12 and 17 years have drunk alcohol in their lifetime (52.2% of boys and 44.7% of girls). In this group, 14.8% are regular drinkers and 6.7% are addicted[9].

Cardiovascular risk assessment in the young population is extremely important to propose strategies aimed at reducing the epidemic role of hypertension predictors in this age range.

The exposure level of adolescents to different risk indicators for HAS is fundamental for the early prevention and control of morbidity and associated co-morbidities. Thus, the aim of this study was to identify pressure levels and estimate the frequency of risk indicators for hypertensive disease among secondary students from a school in the interior of São Paulo State.

## METHODS

This descriptive and cross-sectional study was developed at two state schools located in the Brazilian Southeast, in the States of São Paulo and Minas Gerais.

The sample consisted of adolescents enrolled in the second grade of secondary education, in 2009. All students were summoned, but losses were registered due to absences, refusal to participate in the study or lack of formal consent by a legal responsible. Students aged 18 years or older were also excluded.

Data collection covered different steps: survey to identify sociodemographic variables, individual and family history, BP measurement, height, body weight, waist circumference (WC) and application of instruments to assess for sedentariness, smoking and alcohol consumption.

For BP measurement, the indirect method was used, with automatic monitors, in accordance with the specifications of the Brazilian Arterial Hypertension Guidelines-V[1]. BP was measured three consecutive times at one-minute intervals. The mean of the final two measures was considered as the actual BP; when the difference between the obtained measures was more than 4 mmHg, further measures were done until obtaining an inferior difference, discarding earlier data. The diagnostic classification of the BP was defined according to the proposed categories. The BP distribution profile was identified, considering height, age and gender.

Anthropometric data were collected in accordance with the World Health Organization-WHO's recommendation[10]. Besides body mass and height, the waist circumference was measured.

Body mass was verified with portable microelectronic scales, with a precision level of 0.1 kg and capacity of 150 kg. Height was measured on a stadiometer with a range from 20 cm to 220 cm and millimeter scale. The Body Mass Index (BMI), also known as Quetelet, was obtained by applying the following equation: weight (Kg) / square height (m). The nutritional status was classified based on the identification of the BMI percentile per age. Two cut-off points were defined (5th and 85th percentile), which permitted the following classification: ≤ 5th percentile: low weight;

> 5th percentile and < 85th percentile: adequate weight (eutrophic); ≥ 85th percentile: overweight[11].

The waist circumference (WC) was measured with the help of an inelastic metric tape, at the midpoint between the iliac crest and lower rib. Central obesity was defined as WC in centimeters (cm) corresponding to the percentile > 90 for age and gender.

To collect data on physical exercise, the International Physical Activity Questionnaire – IPAQ[12], version VIII-short was used. The adolescents were classified in four groups: very active, active, hardly active and sedentary.

The Fagerström Tolerance Scale[13] was used to collect the smoking history, which assesses the nicotine dependence level, in line with the II Brazilian DPOC Consensus[14].

To identify the alcohol consumption pattern, the Alcohol Use Disorder Identification Test – AUDIT[15] was used, developed by WHO and indicated for use in different populations, including students.

After coding and elaborating a data dictionary, the validation process of the collected information was used through double typing in Microsoft Excel worksheets. After correcting typing errors, data were exported and analyzed in SPSS (Statistical Package for Social Sciences) for absolute frequency and percentage calculations.

## RESULTS

The sample consisted of 184 participants, who were mostly female (67.4%) and white (59.8%). All participants were single and between 15 and 17 years old, with predominantly 16-year olds (55.4%). Almost all students came from the States of Minas Gerais (66.3%) and São Paulo (32.6%). Among the participants, 48 (26.1%) had a paid job, 41 (85.4%) of whom were male and 7 (14.6%) female.

As for the clinical history, 12 (6.5%) students referred chronic illnesses, including cardiovascular diseases and bronchitis.

Data in Table 1 show the adolescents' distribution according to the diagnostic classification obtained through casual BP assessment.

**Table 1.** Participants according to blood pressure (BP) classification, age, gender and height percentile*. Ribeirão Preto-SP and Frutal-MG, 2009 n=184

| BP Classification | No. | % |
|---|---|---|
| Normal | 143 | 77.2 |
| Borderline | 30 | 16.3 |
| Stage 1 hypertension | 11 | 6 |
| Stage 2 hypertension | ---- | ---- |

*Source: VI Brazilian Arterial Hypertension Guidelines, 2010

The study found 41 (22.3%) individuals with pressure levels above normal, 18 (9.8%) of whom with increased systolic blood pressure (SBP) and 23 (12.5%) with higher diastolic blood pressure (DBP), all of whom denied a history of arterial hypertension. The mean SBP equaled 108.4 ± 1.4 mmHg and the mean DBP 64.2 ± 1.3 mmHg.

Figure 1 displays the frequency of risk factors for arterial hypertension in the study population.

The presence of family risk antecedents was the prevalent risk indicator in the study sample, which 129 (70.1%) participants referred. The most mentioned pathology was SAH, present in 95 (51.6%) families. First and second-degree relatives were considered in cardiovascular morbidity reports.

Concerning the BMI classification, 6 (3.3%) adolescents showed a percentile > 95, revealing considerable obesity. Centripetal obesity was detected as a parameter in 7 (3,8%) participants (5 female and 2 male). It is relevant that 18 (9.8%) individuals were classified in the 75th percentiles, indicating high potential to develop abdominal obesity.

As for the investigation of alcohol use, 67 (36.4%) young people declared they were abstemious. Among
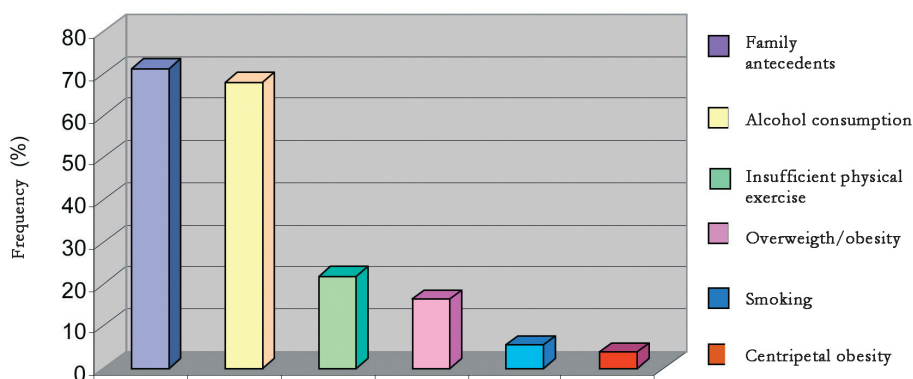


**Figure 1.** Risk factors for arterial hypertension among secondary students. Ribeirão Preto-SP and Frutal-MG, 2009

the 117 (63.6%) alcohol consumers, the majority was female (69.4%). Concerning the alcohol consumption pattern, 56 (47.9%) were ranked in the low-risk consumption category, 49 (41.9%) showed risky consumption, 8 (6.8%) harmful use and 4 (3.4%) probable dependence. The most consumed beverages were wine (43.6%), vodka (32.7%), beer (25.5%), cocktail (23.6%), whisky (10.9%), all types (9.1%).

In the assessment of physical exercise, 6 (3.3%) participants were sedentary; 34 (18.5%) insufficiently active and 76 (41.3%) active, 68 (37%) very active.

In response to the Tobacco Consumption Assessment Questionnaire, 172 (93.5%) participants declared that they did not smoke, 2 (1.1%) were former smokers (female gender) and 10 (5.4%) smoked (5 female and 5 male). Among smokers, 9 (90%) showed mild dependence (4 male and 5 female) and 1 (10%) male participant was severely dependent. The majority started smoking at the age of 15 years and 8 (8%) expressed at least one experience of giving up their addiction; and some informed between 7 and 10 fruitless attempts to give up tobacco consumption.

## DISCUSSION

The frequency of students with altered pressure levels was similar to incidence levels in the global population and appointed the relevance of investigating manifestations of cardiovascular diseases at a young age. Other studies developed in Brazil reported SAH in 3.4% of a sample of school-age children[16], in 12% of young people with metabolic syndrome[17] and in 11.2% of students with a mean age of 12 years[18].

Also, the large number of adolescents with borderline BP should be taken into account. Similar studies found 7.6% and 6.6% of young people in the same pressure level classification[16-19].

It is alerted that increased BP in puberty can play a determinant role in the establishment of hypertension in adults. Early diagnosis associated with prevention of risk indicators could minimize the future effects of high pressure levels. The data under discussion justify the need for further research and the implementation of educative programs directed at this population, addressing the set of potentially determinant factors for increased BP.[2]

Significant family risk history findings are especially important if we consider the correlation between a positive family history for hypertension and youth hypertension[20]. The influence of the family history of SAH demands a prophylactic approach of hypertensive patients' descendants since childhood, as these children can present a genetic predisposition to blood pressure alterations[16].

In view of the BMI and WC classifications, the results reaffirm the trend towards increased weight in the juvenile population. The adverse consequences of obesity among young people should motivate researchers to study the theme and, mainly, to conduct orientation, prevention and treatment actions regarding the disease, led by health professionals.

It is interesting to highlight that the effect of body fat distribution on the metabolic profile of obese children and adolescents is more related to metabolic syndrome alterations than peripheral fat[21]. Another study also suggests that the specific diagnosis of each of the components characterizing the syndrome can be more relevant for clinical practice than the combination of all parameters, especially in obese adolescents[17]. One limitation in the present study, however, was the impossibility to assess visceral fat through direct methods, which are more sensitively related to metabolic disorders.

The common practice of alcohol consumption was an alarming piece of information. A similar study showed that experimental alcohol consumption among young Brazilian students of between 12 and 18 years of age figures around 70%, with slightly higher levels among girls than boys[22]. In 2007, the National Anti-drugs Secretary (SENAD) published a folder to assess alcohol consumption in the Brazilian population. It was ascertained that regular alcohol consumption among adolescents starts at the age of 14.8 years and, among young adults, at the age of 17.3 years, without gender differences[23].

As observed in this research, the prevalence of alcoholism cases among girls has increased[22], suggesting a behavioral change in the last decade. A Brazilian study in 52 Southeastern cities with more than 200 thousand inhabitants indicates that 6.4% of inhabitants in São Paulo between 12 and 17 years of age displayed signs of alcohol dependence. Among boys of the same age, the rate corresponded to 4.9%[9].

Other Brazilian studies investigated physical exercise among adolescents and found high levels of sedentariness[8,24]. Although most of the population was active in the above results, a significant percentage of insufficiently active adolescents were found, suggesting that the frequency and intensity of the activities practiced may not attend to what is necessary for positive influence on health.

Cigarette consumption among adolescents is a large public health problem around the world. The data expressed in this research border on current global statistics, indicating 9.5% of smoking among students and that one in every ten students consumes tobacco-related products different from cigarettes, like cigars and chew tobacco[25]. Results similar to the present study were observed in another sample of Brazilian adolescents

between 12 and 14 years of age, in which it was verified that 5.3% had smoked at least one cigarette per week during the month before the assessment[26].

## CONCLUSION

The study showed that secondary students displayed altered BP levels, besides demonstrating a family history of cardiovascular disease and the adoption of risky habits for hypertension development. Information needs to be explored in further depth and disease prevention measures need to be valued, with particular attention for alcohol abuse.

Primary prevention and early detection are the most effective ways to avoid diseases and should represent health professionals' priority targets. The early adoption of educative, therapeutic and surveillance actions, stimulating young students' greater interest in incorporating and socializing healthy habits, so that actions can effectively contribute to the control of SAH and its risk factors.

In view of this population's vulnerability, it is fundamental to closely monitor this trend towards SAH development among adolescents; only future research can show whether this emerging phenomenon can be reverted.

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