Assessment of social and economic influences on blood pressure of adolescents in public and private schools. An epidemiological study

Avaliação de influências sociais e econômicas sobre a pressão arterial de adolescentes de escolas públicas e privadas. Um estudo epidemiológico

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ABSTRACT

Introduction: The high prevalence of hypertension in high school students in Sorocaba, São Paulo, Brazil, has already been described. In this study, within a new sample of high school students from public and private schools, we evaluated if socioeconomic and lifestyle influence on blood pressure values. **Methods:** This is an epidemiological study, which is part of the activities of a community-based work conducted by medical students. They give speeches to high school students aiming at stimulating a healthy lifestyle and primary prevention of hypertension. In a random sample of 410 students in junior high school (209 from public schools and 201 from private schools), we determined the weight, height, and blood pressure, furthermore, a questionnaire identifying epidemiological and socioeconomic status was applied. **Results:** No statistical differences were found among students from public and private schools regarding the distribution of gender, body mass index (BMI), systolic and diastolic blood pressure, prevalence of hypertension (16.3%), percentage of smokers (5.9%), regular physical activity, and family history of hypertension. In public schools, there is a higher percentage of African descendents students and a higher percentage of students who also work due to low family income. Men from public and private schools have higher prevalence of hypertension, and their mean blood pressure is higher than in women. BMI has a positive correlation with systolic and diastolic blood pressure. **Conclusions:** Hypertension and other cardiovascular risk factors have an early beginning and require

RESUMO

Introdução: Anteriormente, a alta prevalência de hipertensão arterial em alunos do Ensino Médio de Sorocaba, em São Paulo, foi descrita. Neste estudo, em nova amostra de alunos da mesma faixa etária, oriundos de escolas públicas e privadas, foi avaliado se as diferenças socioeconômicas e o modo de vida podem influenciar os valores da pressão arterial. **Métodos:** Trata-se de um estudo epidemiológico, inserido entre as atividades de um trabalho comunitário, em que estudantes de Medicina fazem palestras para alunos do Ensino Médio, objetivando estimular hábitos de vida saudáveis e a prevenção primária da hipertensão arterial. Em amostra aleatória de 410 alunos do segundo ano do Ensino Médio (209 de escolas públicas e 201 de escolas privadas), foram determinados o peso, a altura e a pressão arterial, e foi aplicado um questionário epidemiológico e socioeconômico. **Resultados:** Não há diferenças estatísticas entre os alunos das escolas públicas e privadas quanto à distribuição de sexo, ao índice de massa corporal (IMC), à pressão arterial sistólica e diastólica, à prevalência de hipertensão arterial (16,3%), à porcentagem de fumantes (5,9%), à atividade física regular e aos antecedentes familiares de hipertensão arterial. Nas escolas públicas há maior porcentagem de afro-descendentes, os alunos trabalham fora de casa com maior frequência e têm menor renda familiar. Nas escolas públicas e privadas, os homens têm maior prevalência de hipertensão arterial e a média da pressão arterial é maior que nas mulheres. O IMC tem correlação positiva com a pressão arterial sistólica e diastólica. **Conclusões:** A hipertensão arterial e outros fatores de risco cardiovasculares têm início precoce e necessitam de

educational interventions for primary prevention. Socioeconomic factors do not affect blood pressure in adolescence.
Keywords: adolescent, blood pressure, hypertension, smoking, overweight.

intervenções educativas para a prevenção primária. Fatores socioeconômicos não influenciam a pressão arterial na adolescência.
Palavras-chave: adolescente, pressão arterial, hipertensão, tabagismo, sobrepeso.

Introduction

Hypertension is one of the most common diseases in adults. Brazilian regional epidemiologic data indicate that this prevalence ranges from 22 to 44%,[1-9] resulting in high costs for the people and also for the health system, since it strongly contributes with the increase in cardiovascular and renal morbidity and mortality.[1,10-12]

There are many risk factors involved in the genesis of hypertension, such as: heredity, age, gender, race, obesity/overweight, excessive consumption of salt and alcohol, sedentary lifestyle, and, according to some studies, stress.[1] The disease has an asymptomatic clinical course, and its clinical manifestations are late complications. However, hypertension has devastating consequences, for it is the main risk factor for cerebrovascular accidents (CVA) and congestive heart failure (CHF). It is also the main cause of end-stage renal disease in Brazil, leading to the need for renal replacement therapy, and the third risk factor for myocardial infarction.[1,10-17] These characteristics are relevant for the public health system, since the proper control of blood pressure (BP) in compromised individuals and the primary prevention of the disease are the most effective initiatives to reduce the long-term complications.[18-21]

To date, there has not been such a broad epidemiological evaluation regarding hypertension in the Brazilian population of different ages.[22,23] In the 1990s, the state of Rio de Janeiro was the first to demonstrate the worrisome prevalence of hypertension among children and adolescents.[23]

Besides, the follow-up of these adolescents at long term has shown a greater risk of disease progression, especially for obese or overweight patients.[24,25] Recent regional studies have confirmed the high prevalence of hypertension in youngsters. In Maceió, Moura *et al*. observed that the prevalence of hypertension in adolescents at the age of 15 to 17 years reaches the alarming proportion of 13.3%.[26]

Thus, it is important that primary prevention begin early. It is recommended that blood pressure be measured in all pediatric evaluations after the age of three. The blood pressure cuff must have the proper size, considering the reference values for age, height and gender.[1,27]

Because the disease is asymptomatic, multifactorial and progressive, we believe that the younger the population, the more favorable it is to perform early detection and primary prevention. In previous reports, the extracurricular activities carried out by medical students were described as a complementary strategy of medical teaching and as a way to primarily prevent hypertension.[28,29] In this similar population of youngsters, the high prevalence of the disease had been previously observed.[28,29]

At the time, the following question came up: can socioeconomic differences among families with higher and lower incomes, which result in different lifestyles for all the members, interfere in blood pressure values? It is a known fact that youngsters coming from families with lower incomes study in public schools, so the expenses with education are also lower. Together with their studies, many of them have the need to perform activities and earn resources in order to contribute with the family income.

Such socioeconomic and lifestyle differences, in comparison to the youngsters who go to private schools, may originate psychosocial stress and interfere in the behavior of biological variables at an age of great transformation.

The objective of this study was to evaluate whether or not socioeconomic and lifestyle differences between public and private school students influence the anthropometric variables, the distribution of blood pressure values and the prevalence of hypertension at this stage of life.

Methods

This study was carried out by medical students from the second to the sixth year of *Faculdade de Ciências Médicas e da Saúde*, at *Pontifícia Universidade Católica de São Paulo* (PUC – Sorocaba – São Paulo), under the orientation of Nephrology staff.

The participants were prepared to offer technical information about the disease and to maintain a pedagogic and psychological behavior compatible with the performed activity. Public and private high schools of Sorocaba (São Paulo) were randomly chosen, and the previously scheduled activity was performed during regular classes of the second year of high school. Initially, medical students did 20-minute presentations with the objective of informing high school students about: how to determine the blood pressure, what hypertension and its consequences are, risk factors and the most effective ways to prevent it. They used audiovisual projection with accessible, attractive and encouraging language. The research project and the informed consent form were in compliance with the resolution 196/96 and complementary rules by the National Health Council, and were previously approved by the Research Ethics Committee of *Faculdade de Ciências Médicas e da Saúde,* PUC-SP.

Questionnaires

Before the presentations, the informed consent form and a questionnaire were given to the participants in order to gather demographic, social and economic data. The questionnaire also aimed at identifying, by means of simple questions, previous knowledge students might have on hypertension and its risk factors.

Sample to gauge determine blood pressure

At the end of each presentation, a portion of approximately 20% of the students who had had their blood pressure, weight and height measured, was randomly selected. In this study, we present the results of 410 students whose demographic, epidemiological and social data were complete. Out of the analyzed students, 201 were from private schools and 209 were from public schools. This sample refers to 1.2% of the estimated population at this age range in Sorocaba (census 2000, Brazilian Institute of Geography and Statistics, updated). Since the mean age of the assessed students was 16.3 years, according to the census 2000 it was confirmed that, in Sorocaba, there was no percentage variety in male and female populations between 15 and 20 years old.

Determining blood pressure

Blood pressure was determined and classified according to the guidelines proposed by *V Diretrizes Brasileiras de Hipertensão Arterial and by Quarto Relatório para o Diagnóstico, Avaliação e o Tratamento da Hipertensão Arterial na Infância e Adolescência* [1,27].

Systolic pressure was considered to be phase I (appearance of consecutive heartbeats) and diastolic pressure as phase V (disappearance) of the sounds described by Korotkoff. Brachial circumference was measured at the middle third of the non-dominant arm immediately before the determination of blood pressure, which was performed with mercury column sphygmomanometers, periodically checked, with the use of blood pressure cuffs adjusted for the brachial length and circumference of each individual. Blood pressure was determined three consecutive times, with the student comfortably seated for at least five minutes, with an interval of at least one minute between measurements. When systolic or diastolic pressure differed in 6 mmHg or more, such measures were discarded, and three new ones were performed. For statistical purposes, the blood pressure of each individual, with the mean of the three determinations, was considered

According to the guidelines recommendations, systolic and diastolic blood pressure values were considered normal when inferior to 90th percentile as long as the blood pressure was < 120/80 mmHg. Blood pressure values from 90th to 95th percentiles, or blood pressure ≥ 120/80 mmHg, even with values inferior to 90th percentile, were classified as "borderline". Blood pressure values between 95th and 99th percentiles plus 5 mmHg were classified as "stage 1 hypertension"; values above 99th percentile plus 5 mmHg were classified as "stage 2 hypertension".[1,27]

Standardizing demographic and epidemiological parameters

Age values were analyzed as whole numbers, rounded up or down to the closest value. Weight and height were determined by an anthropometric scale, with standard clothing, and no shoes or sweaters. Body mass index (BMI) was calculated as the ratio of weight (kg) to the squared height (m^2). Racial classification of individuals was divided into "white", "African descendants", and "Asians". The students were classified as being African descendants when at least one family member (parents or grandparents) was considered to be "black" by the participant or when the interviewer considered him or her to be black or brown, always based on the categories used by the Brazilian Institute of Geography and Statistics. In case of doubt, two other researchers were asked to give their opinions, and the decision was made according

to the opinions of at least 2/3. If the individual regularly smoked any number of cigarettes, this person was classified as "smoker". Those who practiced sports or aerobic activities at least three times a week for 30 minutes were considered to perform "regular physical activity". Those with family history of hypertension (parents, grandparents or siblings) were classified as "present"; on the other hand, those who had no knowledge about hypertension in the family and whose relatives also did not know if they had this condition were considered to be "absent".

Statistical analysis

Statistical analysis was performed by the program *Instat for Windows,* version 3.05, *GraphPad software,* San Diego (USA). The Fisher's exact test was used to compare proportions, and the Pearson's correlation coefficient to correlate continuous variables. Bicaudal Student's t-test for independent samples was used to compare the mean of continuous variables. A 5% significance level was established to reject the null hypothesis. However, the significance level for each analysis is expressed in text and graphics. Data are presented as mean and standard deviation of the mean.

Results

From the sample of 410 students, 209 went to public schools and 201 went to private schools. Table 1 presents demographic and epidemiological characteristics of these samples. Note that students in public schools were older than the ones in the private schools ($p < 0.01$), even though they were all in the second year of high school. Besides this slight but significant age difference, no other statistically significant differences were observed as to the distribution of gender, BMI, frequency of family history of hypertension, proportion of people who regularly practiced exercise and proportion of smokers among the students in public and private schools.

In high schools, both public and private ones, females were predominant in the classrooms. As to ethnicity, African descendants were at a larger proportion in public schools when compared to the private ones ($p< 0.01$). The proportion of students who had a regular job outside the household combined with school activities is larger at public school students (19.1%) than at private schools (6.5%). The percentage of students in public schools with a family income higher than R$ 1.000 a month (45.6%) was small when compared to students in private schools (96.9%; $p<0.01$).

Blood pressure

Figure 1 presents the distribution of the frequency of systolic (A) and diastolic (B) blood pressure values in the sample population (n = 410). As expected, the sample is representative of the general population because of its normal distribution.

Table 2 presents the mean values of systolic and diastolic blood pressure in males and females and the percentage of youngsters with hypertension in the samples of students analyzed in public schools, private schools and overall. Independently of gender, there are no statistically significant differences between the values of systolic and diastolic pressure in students of public and private schools. The percentage of students with hypertension did not differ among public (15.8%) and private (16.9%) schools.

There is a larger proportion of African-descendant individuals in public schools (15.5%) in relation to private schools (0.5%), $p < 0.01$. No statistically significant differences were found when young African descendants were compared to white students as to systolic and diastolic blood pressure, age and BMI.

Since there were many similarities among students from public and private schools, the whole sample was considered (n = 410) in order to evaluate the determinants of blood pressure. As to the gender, at this age range, blood pressure values were higher in men than in women ($p < 0.01$); likewise, in men there was a higher prevalence of increased blood pressure values, classified as "hypertension", in public and private schools samples and also in the total number of analyzed students (Table 2; $p < 0.01$). Among the individuals who were classified as "pre-hypertensive", no statistically significant difference was observed between genders in private (women = 16%, men = 20.8%) or public schools (women = 10.7%, men = 6.8%). When analyzing the entire sample of students (n = 410), the prevalence of pre-hypertension between genders presented no differences (women = 11.6%, men = 14.8%).

Since the number of African descendants was small in public schools and minimum in private schools, it was not possible to compare them separately by gender. Considering the group of students in public and private schools, blood pressure values in African descendant students were not different from the values of those classified as white students. In African descendants, systolic pressure was 117.6 ± 17.6 mmHg, and in white students it was 114.6 ± 13.2 mmHg. Diastolic pressure in African descendants was 74.6

Table 1 Demographic, epidemiological, and socioeconomic characteristics of the students from public and private schools

Parameter	Public schools (n = 209)	Private schools (n = 201)	Total (n = 410)
Age (years)	16.6 ± 0.6*	16.2 ± 0.6	16.3 ± 0.6
Males	43.5%	45.2%	44.4%
Body mass index (kg/m^2)	20.7 ± 2.9	21.0 ± 3.0	20.9 ± 2.9
African descendants[1]	15.5%*	0.5%	8.0%
Family history of hypertension[2]	76.7%	70.7%	73.7%
Regular physical exercise[3]	70.8%	69.5%	70.1%
Smokers	6.7%	5%	5.9%
Regular work outside the household	19.1%*	6.5%	12.8%
Family income > R$ 1.000,00	45.6%*	96.9%	71.2%

Values expressed as mean ± standard deviation. [1]See characterization of African descendants in the text; [2]At least one relative (parents, grandparents or siblings) with hypertension; [3]At least 30 minutes, three times a week; *p < 0.01 public versus private schools.

±13.2 mmHg, and in white students it was 73.8 ± 10.9 mmHg, also a non-significant difference.

Only twelve Asian students were assessed in all visited schools, and their systolic (113.8 ± 12.8 mmHg) and diastolic (70.5 ±11.6 mmHg) blood pressure values did not differ from those of other ethnicities.

When analyzing the relation between BMI and blood pressure, there is a positive and significant correlation between BMI and the systolic pressure (r = 0.39, p < 0.01), as well as in relation to the diastolic pressure (r = 0.29, p < 0.01). Figure 2 presents the graphic of distribution of individual values, correlating systolic blood pressure and BMI.

Likewise, in the analysis of the proportion of adolescents classified as "hypertensive" in relation to the BMI quartile, a positive relationship was identified, which means that as the BMI increases, so does the proportion of hypertensive adolescents (p < 0.01 for tendency), as shown in Figure 3.

Discussion

The initial experience of community work performed by medical students with high school adolescents was subject of previous publications.[28,29] Some years ago, medical students performed educational work in high schools of Sorocaba (São Paulo), under the orientation of faculty members of Nephrology.[28] The activity consisted of a multimedia presentation about the concept of hypertension, the main characteristics of the disease, its long-term risks and information on

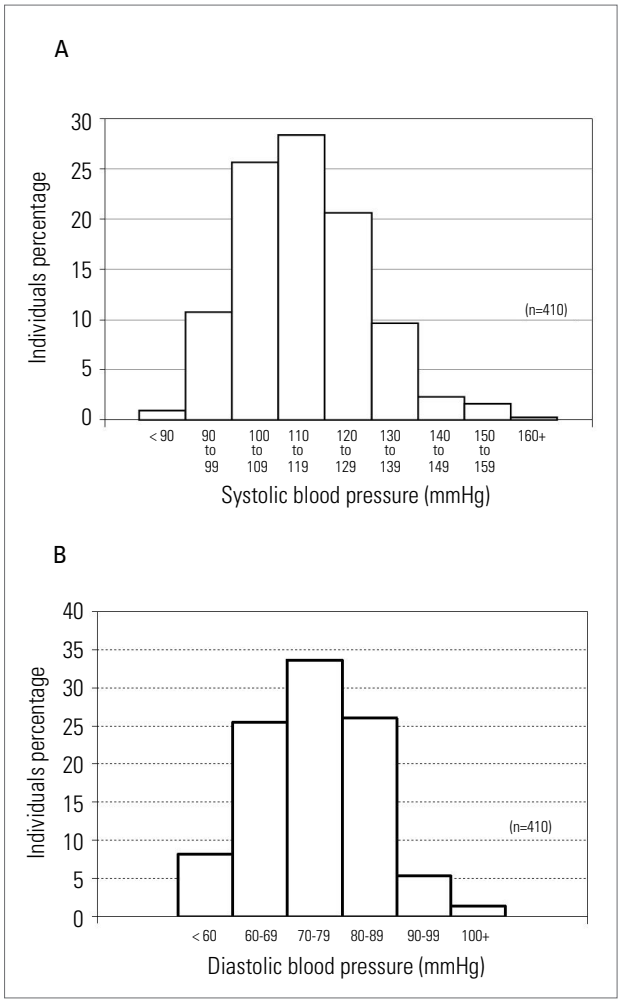

Figure 1. Systolic (A) and diastolic (B) blood pressure values in high school adolescents of Sorocaba (SP, Brazil).

prevention. Then, all interested students had their blood pressure checked. At the same time, in a formal and random sample of students, an epidemiological inquiry was performed, and the blood pressure was determined aiming to evaluate the hypertension prevalence in this age group.

Previous studies analyzed preexisting knowledge about hypertension, its consequences, prevention, knowledge acquired during the lectures, and the distribution of blood pressure among the assessed individuals.[28,29] When analyzing this information, the question came up: can social and economic differences influence blood pressure values and the prevalence of hypertension at this age? So, the present study was designed to evaluate that possibility.

Although the present sample assessed only 1.2% of the estimated population, we believed that it is representative of students at this age range. The sample was randomly selected and, as expected, blood pressure values had normal distribution.

The key question of the study was: can behavior, social and economic variables influence blood pressure in this age group? The strategy to compare this variables in students from public and private schools seemed to be more appropriate.

Current data confirm the existing social and economic differences among students from private and public schools. Such differences are represented by a larger proportion of students from public schools who have a regular job besides school activities; also, they live with a lower family income. However, these

Table 2 Blood pressure values and percentage of high school students with hypertension in Sorocaba, São Paulo

Parameters	Public schools (n = 209)	Private schools (n = 201)	Total (n = 410)
Systolic blood pressure (mmHg)	114.9 ± 12,6	114,4 ± 13.7	114.7 ± 13.1
Diastolic blood pressure (mmHg)	73.6 ± 11.1	74.2 ± 11.0	73.9 ± 11.1
Systolic blood pressure in women (mmHg)	112.2 ± 11.1	109.3 ± 12.3	110.9 ± 11.7
Systolic blood pressure in men (mmHg)	119.1 ± 14.6*	120.7 ± 12.8*	119.9 ± 13.8*
Diastolic blood pressure in women (mmHg)	72.0 ± 10.0	72.4 ± 10.2	72.2 ± 10.1
Diastolic blood pressure in men (mmHg)	76.0 ± 12.1*	76.5 ± 11.6*	76.2 ± 11.8*
Students with arterial hypertension[1]	15.8%	16.9%	16.3%
Men with arterial hypertension[1]	22.0%*	26.4%*	24.2%*
Women with arterial hypertension[1]	11.0%	9.1%	10.1%

Values expressed in mean ± standard deviation. [1]According to *V Diretrizes Brasileiras de Hipertensão Arterial*[1]; *p < 0.01 men *versus*

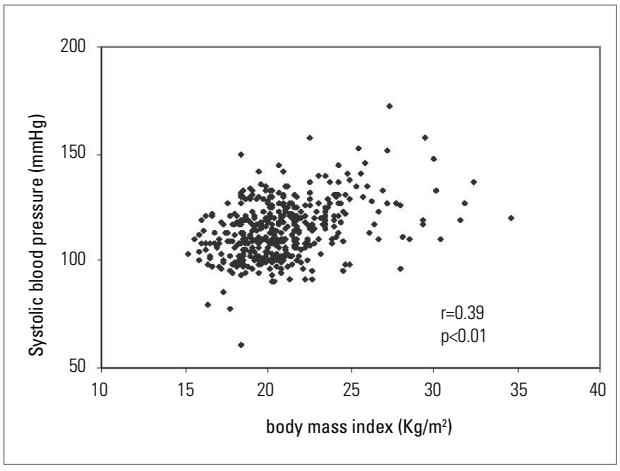

Figure 2. Correlation between individual systolic blood pressure values and body mass index

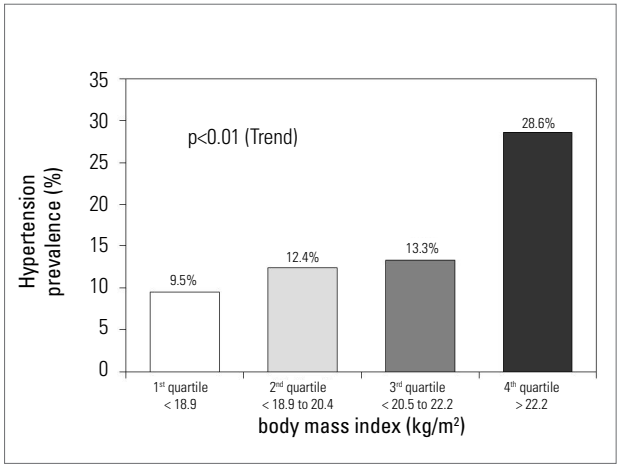

Figure 3. Prevalence of hypertension as to body mass index quartiles.

socioeconomic differences do not influence blood pressure values at this age, since we found no differences among the mean values of systolic and diastolic blood pressure. No significant difference was observed as to the prevalence of hypertension among students of public (15.8%) and private (16.9%) schools. Ethnicity represented by a larger proportion of African descendant students at public schools did not influence blood pressure values.

Also regarding blood pressure values, these data confirm other epidemiological studies which indicate a higher prevalence of hypertension among men at this age.[4,6,22-24,26,27,29] The study presented twice as many men with hypertension when compared to women. Like other studies made with children and adolescents, we observed that overweight is closely related to the increase in blood pressure in this age group.[23,24,27] A positive correlation between systolic and diastolic blood pressure values and BMI was found. When blood pressure values were analyzed as to BMI quartile, we observed that the prevalence of hypertension progressively increased from the lower to the upper BMI quartile.

At public schools, the mean age of students was superior to private schools. Since all students were on the second year of high school, this might reflect the access to school at an older age or the higher frequency at repeating school years in students coming from public schools. There were no differences between groups as to gender distribution, regular practice of exercise, smoking habit and family history of hypertension. The percentage of smokers at this age range (5.9%) is already a point of concern from the public health point of view.

This data suggest that nutritional orientation associated with regular exercise should be the focus of adolescents' education. This could contribute with the primary prevention of hypertension and other overweight-related complications, besides being the main therapeutic approach for those who already have high blood pressure.[23-28]

In this study, we observed that even though students from public schools are African descendants, work outside the household at a larger proportion and have lower family income, they do not present significant differences as to the distribution of blood pressure and anthropometric values. The prevalence of hypertension in students at the age of 16 is around 16%, and is clearly associated with overweight, mostly among males. The percentage of smokers at this age range is also alarming. When combined, these risk factors for cardiovascular diseases, which are already present at such a young age, explain future cardiovascular and renal complications. That is why they should be the main focus of attention, orientation, education and intervention in order to prevent such diseases.

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