Prevalence of Arterial Hypertension and Associated Factors in Adults in São Luís, State of Maranhão

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Summary

Background: Little is known about the prevalence of arterial hypertension (AH) and its risk factors in the less developed regions of Brazil.

Objective: To estimate the prevalence of arterial hypertension and its associated factors in the population > 18 years in São Luís, state of Maranhão according to the Seventh Report of the Joint National Committee (JNC 7) criteria.

Methods: A cross-sectional study was conducted in São Luís, MA, from February to March 2003, with 835 individuals >18 years who completed a structured household questionnaire. Measurements of arterial pressure (AP), weight, height and waist circumference were taken, and other risk factors for cardiovascular disease were assessed. The Poisson regression method was used for the identification of factors associated with AH, with an estimate of the prevalence ratio (PR) and its corresponding 95% confidence interval.

Results: Age varied from 18 and 94 years (mean age was 39.4 years), 293 (35.1%) individuals were normotensive and 313 (37.5%) were pre-hypertensive. The AH prevalence was 27.4% (95% CI – 24.4% to 30.6%), and it was higher among men (32.1%) than among women (24.2%). In the adjusted analysis, the following remained independently associated with AH: male gender (PR 1.52, 95% CI, 1.25-1.84), age ≥ 30 years, with PR=6.65, 95% CI, 4.40-10.05 for ≥60 years of age, overweight (PR 2.09 95% CI 1.64-2.68), obesity (PR 2.68, 95% CI, 2.03-3.53) and diabetes (PR 1.56, 95% CI, 1.24-1.97).

Conclusion: These findings suggest the need to control overweight, obesity and diabetes, especially among women and individuals ≥ 30 years of age in order to reduce the prevalence of arterial hypertension. (Arq Bras Cardiol 2008;91(4):236-242)

Key words: Hypertension / epidemiology; risk factors; Brazil.

Introduction

Among the modifiable causes of early cardiovascular morbidity/mortality, Arterial Hypertension (AH) is one of the most important worldwide and an independent risk factor for cardiovascular disease[1,2]. Epidemiological studies point out that high levels of AP raise the risk for Encephalic Vascular Disease (EVD)[2], Coronary Artery Disease (CAD)[3,4], Congestive Heart Failure (CHF)[5], Chronic Renal Failure (CRF)[6,7] and Vascular Involvement (VI)[8]. In Brazil, in 2003, 27.4% of the deaths were due to cardiovascular diseases, and the leading cause was EVD among women[9].

Kearny et al[10] estimated the worldwide prevalence of AH to be 26.4% in the year 2000, which corresponded to 972 million hypertensive individuals. The SBH (Brazilian Society of Hypertension) estimates that there 30 million hypertensive people in Brazil (30% of the adult population). Among individuals above 60 years of age, 60% are hypertensive[11]. Epidemiological studies on AH conducted especially in Brazil's south and southeast regions indicate a rate above 25%[12,13]. In 2005, in Campo Grande, state of Mato Grosso do Sul, the prevalence of AH was 41.1%[14]. The risk factors associated with hypertension more consistently found in the Brazilian studies were overweight and/or obesity, low level of schooling and black skin color[15].

Reliable information on hypertension prevalence in the different regions of Brazil is essential for the development of prevention and control policies. Moreover, it is important to know the risk factors for hypertension which can vary according to the sites studied. This study, which was conducted in 2003 in São Luís, state of Maranhão, in northeast Brazil, intended to estimate the prevalence of AH and its association with other cardiovascular risk factors in subjects 18 years of age or over.

Methods

With an area of 828.01 sq km, the city of São Luís has a population of 870,028 inhabitants living in 202,231

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permanent private households. Women compose the majority of the population (463,628 females – 53.2%); most inhabitants are in the 10-19 age bracket (208,309 - 23%); population concentration is greater in cities (837,584 inhabitants – 96.2%); and the literacy rate among individuals aged 10 years and over is 93.1% (Censo 2000 – IBGE)[16].

The research, which was approved by the Research Ethics Committee of the *Hospital Universitário da Universidade Federal do Maranhão*, consisted of a population-based cross-sectional study, conducted with the adult population of São Luís, Maranhão, aged 18 years or over, from February to March 2003, through representative cluster sampling. Age ranged from 18 to 94 years. The inclusion criteria were to be 18 years of age or over and be a resident of the selected household.

In order to determine the size of the sample, we considered 25% to be the estimated prevalence of the disease, with a 5% relative accuracy and a 99% confidence level, which resulted in 497 subjects. In order to assess the risk factors, the power of the study was considered to be 80%, the type-I error probability was 5%, the exposed/non-exposed ratio was 1:1, the prevalence in those non-exposed was 10%, and the prevalence ratio was 2, which resulted in a minimum sample size of 438 subjects. As we chose to work with a cluster sampling technique, the design effect was approximately 2. The final sample consisted of 835 subjects.

Initially, 70 census sectors were drawn and maps of these sectors were obtained with IBGE; next, the sectors were subdivided into smaller sub-sectors with more than 20 households each, from which two households were randomly drawn. Seven other sectors were used as a sample to conduct a pilot study.

In the first sub-sector, the survey was started at one of the corners. Systematic sampling was used, and the first five households at the right-hand side of the interviewer who was facing the street were visited. When it was not possible to complete the five households in the first sub-sector, visits to the second sub-sector were started following the same procedure. In the five households visited, we expected to find 12 people aged ≥18 years, in each sector. A closed house was considered a loss when, after 2 visits at different times of the day, no information could be obtained. Empty houses were excluded. Household census was performed at each house, and all members aged 18 years or over were interviewed irrespective of kinship.

The survey team consisted of an epidemiologist, a cardiologist and two medical students. The interviews were conducted by 40 medical and/or nursing students, who had been previously selected and trained under the supervision of the researchers. All selected individuals were asked to sign the informed consent form to confirm they were in agreement. A structured questionnaire on coronary risk factors (arterial hypertension, sedentarism, diabetes, smoking status, alcohol consumption) and socio-demographic characteristics (sex, age, skin color, schooling, family income, marital status and occupational status) was applied to all adults aged 18 years or over living in the selected household. Interviewed individuals had their weight, height, waist circumference and arterial pressure measured by the interviewers.

The classification proposed by JNC7[17] was used to analyze data relative to systemic arterial hypertension. Blood pressure was considered normal when the SAP (systolic arterial pressure) value was lower than 120 mmHg, and the DAP (diastolic arterial pressure) value was lower than 80 mmHg. Pre-hypertension was considered when SAP ranged from 120 to 139 mmHg, and DAP from 80 and 89 mmHg; stage I hypertension when SAP was between 140 and 159 mmHg, and DAP between 90 and 99 mmHg; and stage II hypertension when SAP was equal to 160 mmHg and DAP greater than or equal to 100 mmHg.

Duly calibrated aneroid tensiometers and stethoscopes were used. Measurements were performed with the patient seated, with the right forearm on a table level with the heart, checking to see whether his/her bladder was full, whether he/she had performed physical exercises, had drunk any alcoholic beverages, coffee, eaten or smoked up to 30 minutes before the measurement. The brachial artery was located by palpation. The cuff was firmly attached approximately 2 to 3 cm above the antecubital fossa, centering the rubber bulb over the brachial artery. The criterion to determine the systolic pressure was the moment the first Korotkoff sound (Korotkoff's Phase I) appears, which becomes stronger with the increasing speed at which the cuff is deflated, whereas the determination of the diastolic pressure was the disappearance of the sound (Korotkoff's Phase V). As the heart beats continued until level 0, the diastolic pressure was determined at the muffling of the sounds (Korotkoff's Phase IV). Two measurements were performed: one right after the identification of the patient, and the other at least fifteen minutes after the questionnaire had been applied. The lowest arterial pressure was recorded.

The height and weight were measured using a Filizola PL-180 Adult Scale (scale with anthropometer). Patients were barefoot, standing on both feet and wearing minimum clothing.

The waist circumference was measured half-way between the iliac crest and rib margin using a non-elastic measuring tape. Regular physical activity was defined as the practice of physical exercises at least three times per week, during at least 30 minutes per day. A smoker was defined as the individual who declared himself a smoker at the moment of the interview, irrespective of the quantity of cigarettes smoked. Consumers of alcohol beverages were those who reported drinking, irrespective of the type and quantity of drinks. As to the frequency of alcohol consumption, the following situations were considered: patient does not drink; drinks rarely, weekly and daily. Waist circumference > 102 in men and > 88 in women were considered as altered, according to NCEP ATP III (National Cholesterol Education Program - Adult Treatment Panel III)[18]. Skin color was recorded as per the interviewer's observation. Family income was classified as >5, 3 to 5, 2 to 3, >1 to <2, and ≤1 minimum wages. Schooling was evaluated according to the number of years of schooling and categorized as ≥12, 9 to 11, 5 to 8, and ≤4 years. As to occupation, individuals were classified as unemployed, salaried workers, self-employed and businesspeople. Marital status was classified as married, consensual union and without a partner. The subject was asked to inform about his/her family history of hypertension. Diabetic individuals were considered as those

who used oral antidiabetic agents and/or insulin.

Data were processed and analyzed using EPI INFO 2000 and Stata 9.0 software. Poisson's regression was initially used to evaluate the association between the study risk factors and the prevalence of AH[19]. Studies have shown that when the prevalence of the event is greater than 10%, the use of the logistic regression model to estimate the odds ratio results in overestimation of the risk[19]. The prevalence ratios were calculated according to the robust method and its respective 95% confidence interval. The level of significance used was 5%. All variables presenting p<0.20 in the non-adjusted analysis were selected for the multivariable analysis. For the adjusted analysis, we used the method of stepwise variable selection with backward elimination. Only those variables associated with a P<0.10 value remained in the final model.

Results

Eight hundred and thirty-five inhabitants of São Luís, state of Maranhão, were evaluated, 340 of them men (40.7%) and 495 women (59.3%); their mean age was 39.4 (± 16.6) years.

AH prevalence was 27.4% (95% CI – 24.4% to 30.6%), and this prevalence was higher among men (32.1%) than among women (24.2%).

Table 1 shows the percentages of the sample in each level of classification of arterial pressure, per gender. Among the individuals evaluated, 293 (35.1%) presented pressure levels within normal ranges. Pre-hypertension levels were detected in 313 (37.5%) of the respondents. Eighty-seven individuals (10.4%) were classified within the Stage I hypertension category. Thirty-eight individuals (4.6%) were classified within the Stage II hypertension category. One hundred and four individuals (12.5%) were on antihypertensive medication. These individuals were hypertensive, but could not have their hypertension classified as Stage I or II. A higher percentage of women used antihypertensive medication, and a higher percentage of men within the pre-hypertension and Stages I and II arterial hypertension was observed (P<0.001 as per the chi-square test).

In the non-adjusted analysis (Table 2), the following items were associated with arterial hypertension: male gender, age equal to or over 30 years, being married, daily consumption of alcohol, overweight/obesity, altered waist circumference, greater physical activity and diabetes. Low family income, unemployment and rare consumption of alcohol were protective factors against arterial hypertension. The highest prevalence of hypertension was detected among those individuals who went to school for ≥12 and <4 years, whereas the lowest prevalence was observed among groups with intermediate levels of schooling. Skin color, smoking status and family history of hypertension were not associated with hypertension.

In the adjusted analysis (Table 3), the following items remained independently associated with hypertension: male gender (PR 1.52, 95% CI, 1.25-1.84), age ≥ 30 years, overweight (PR 2.09, 95% CI, 1.64-2.68), obesity (PR 2.68, 95% CI, 2.03-3.53) and diabetes (PR 1.56, 95% CI, 1.24-1.97).

Discussion

It is estimated that approximately 1 billion people worldwide have hypertension. In the United States, an estimated 50 million people suffer from high blood pressure[13]. According to the 5th Brazilian Guidelines on Arterial Hypertension[11] (2006) and using the current criterion for diagnosing arterial hypertension (SAP ≥140 and/or DAP ≥90 mmHg), the prevalence rates among the Brazilian adult urban population in selected studies ranged from 22.3% to 44%, with values estimated to be between 15.0% and 47.8% among men, and 15.0% and 41.1% among women. (Araraquara 1990 – 43%; São Paulo 1990 – 22%; Piracicaba 1991 – 33%, Porto Alegre 1994 – 26%, Cotia 1997 – 44%, Catanduva 2001 – 32%, Cavange 2003 – 36.5% and Rio Grande do Sul 2004 – 33.7%)[11]. In this study, 27.4% of the individuals evaluated were found to be hypertensive, and the prevalence among men was 32.1% and 24.2% among women.

Classification of AP values can be made according to several published national or international guidelines. We chose the classification system proposed by the JNC7 (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure)[17] which divides patients into four categories: normal, pre-hypertension, stage I hypertension, and stage II hypertension. The establishment of the new "pre-hypertension" category is important because physicians already recommend lifestyle changes according to the JNC7[17], since cardiovascular morbidity/mortality starts at this stage or at even lower AP values. In our study, the greatest prevalence was detected among pre-hypertensive patients (37.5%), showing that

Table 1 – Distribution of individuals according to the JNC7 classification of arterial blood pressure*

JNC7 Classification	Normal		Pre-hypertension		Stage I Hypertension		Stage II Hypertension		Treatment with anti-hypertensive medication		Total
Gender	n	%	n	%	n	%	n	%	n	%	n
Male	82	24.1	149	43.8	54	15.9	23	6.8	32	9.4	340
Female	211	42.6	164	33.1	33	6.7	15	3.0	72	14.6	495
Total	293	35.1	313	37.5	87	10.4	38	4.6	104	12.5	835

** JNC7 The Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure ; Chi-square=52.70, p<0.001.*

Table 2 – **Non-adjusted analysis of risk factors for arterial hypertension. São Luís, Maranhão, 2003**

Variable	n	% hypertensive	Prevalence Ratios	95% CI	p
Gender					**0.013**
Female	495	24.2	1		
Male	340	32.1	1.32	1.06-1.65	
Age					**< 0.001**
18 -29	309	7.8	1		
30 -39	161	19.3	2.48	1.51-4.08	
40 -49	136	25.7	3.31	2.05-5.35	
50 -59	106	49.1	6.32	4.11-9.72	
≥ 60	123	70.7	9.11	6.10-13.60	
Skin color					**0.557**
White	227	29.1	1		
Mulatto	414	25.6	0.88	0.68-1.14	
Black	191	28.8	0.99	0.73-1.34	
Years of Schooling					**< 0.001**
≥ 12	133	39.1	1		
9 -11	344	17.2	0.44	0.32-0.60	
5 -8	129	22.5	0.57	0.39-0.84	
≤ 4	227	39.2	1.01	0.77-1.31	
Family Income					**< 0.001**
> 5	273	36.6	1		
3 -5	135	24.4	0.67	0.48-0.93	
2 -3	97	15.5	0.42	0.26-0.69	
> 1 to < 2	149	25.5	0.70	0.51-0.95	
≤ 1	180	23.9	0.65	0.48-0.88	
Marital Status					**< 0.001**
With no partner	423	21.0	1		
Consensual union	107	23.4	1.11	0.75-1.64	
Married	305	37.7	1.79	1.42-2.27	
Occupation					**< 0.001**
Unemployed	255	16.5	1		
Salaried worker	403	32.0	1.94	1.42-2.65	
Self-employed	37	37.8	2.30	1.40-3.78	
Own business	138	31.9	1.94	1.34-2.80	
Smoking status					**0.221**
No	702	26.5	1		
Yes	123	31.7	1.20	0.90-1.60	
Alcohol consumption					**< 0.001**
No	394	30.7	1		
Rarely	278	16.9	0.55	0.41-0.74	
Weekly	129	36.4	1.19	0.90-1.56	
Daily	17	52.9	1.72	1.07-2.76	

Continuation of table 2 – **Non-adjusted analysis of risk factors for arterial hypertension. São Luís, Maranhão, 2003**

Variable	n	% hypertensive	Prevalence Ratios	95% CI	p
Body Mass Index					**< 0.001**
< 25	483	14.9	1		
25-29.9	237	42.2	2.83	2.18-3.67	
≥ 30	82	61.0	4.09	3.11-5.38	
Waist circumference					**< 0.001**
Normal	619	19.2	1		
Altered	207	51.7	2.69	2.18-3.31	
Family history of hypertension					**0.569**
No	223	25.6	1		
Yes	475	27.4	1.07	0.82-1.40	
Unknown	137	30.7	1.20	0.86-1.68	
Physical activity					**0.003**
No	604	24.7	1		
Yes	231	34.6	1.40	1.12-1.76	
Diabetes					**< 0.001**
No	792	25.3	1		
Yes	43	67.4	2.67	2.10-3.39	

** Totals may differ for each variable due to not informed data.*

Table 3 – **Adjusted analysis of risk factors for arterial hypertension. São Luís, Maranhão, 2003**

Variable	Prevalence Ratio	95% CI	P
Gender			**< 0.001**
Female	1		
Male	1.52	1.25-1.84	
Age			**< 0.001**
18 -29	1		
30 -39	1.90	1.17-3.11	
40 -49	2.44	1.52-3.92	
50 -59	4.01	2.59-6.22	
≥ 60	6.65	4.40-10.05	
Body Mass Index			**< 0.001**
< 25	1		
25 -29.9	2.09	1.64-2.68	
≥ 30	2.68	2.03-3.53	
Diabetes			**<0.001**
No	1		
Yes	1.56	1.24-1.97	

there is an indication to treat patients with an AP between 130x139 mmHg and 80x89 mmHg, thus delaying the onset of hypertension.

In Salvador, in 1999/2000, the assessment of 1,439 adults over 20 years of age and considering hypertension as SAP ≥140 and/or DAP ≥90 mmHg, revealed that the prevalence of hypertension was 29.9%, lower among men (27.4%) than among women (31.7%)[13], whereas in São Luís the prevalence was higher among men (32.1%) than among women (24.2%). When age is taken in consideration, the prevalence in São Luís was 70.7% for patients over 60 years, whereas in Salvador it was 72.5% and 73.3% for men and women, respectively. In São Luís, the highest prevalence was among black and mulatto women, whereas in Salvador the prevalence did not vary according to skin color. It is possible that the different ways used for assessing skin color may account for the difference observed, as skin color was observed by the interviewer in São Luís, and self-reported in Salvador.

Age over 30 years and overweight/obesity were considered risk factors for hypertension, similar to the data recorded by Lessa et al[20] In Salvador, abdominal obesity was a risk factor for arterial hypertension in women, whereas in São Luís, this factor did not remain associated with hypertension in the adjusted analysis. In São Luís, diabetes was a risk factor for arterial hypertension, whereas in Salvador, it was associated with hypertension only among women[20].

In São Luís, in the non-adjusted analysis, hypertension prevailed at the extreme ends of schooling, i.e., lower than or equal to 4 years (39.1%) and higher than or equal to 12 years (39.2%) of schooling. In Salvador, a high level of schooling was a risk factor for hypertension only among men after the adjustment. The highest prevalence of obesity at the extreme ends of schooling may indicate the start of an inverse association between hypertension and higher schooling levels, which has already occurred in developing countries[21].

In Pelotas, during the year 2000, the assessment of 1,968 adults aged 20-69 years and considering hypertension as SAP ≥160 and/or DAP ≥95 mmHg, showed that the prevalence of hypertension was 23.6%. Using the same criterion of São Luís (SAP ≥140 and/or DAP ≥90 mmHg), the prevalence of hypertension was 37.2%, thus higher than that recorded in São Luís. As in São Luís, in Pelotas, being ≥30 years of age and obese were risk factors for hypertension[22].

In Campo Grande (state of Mato Grosso do Sul), in 2005, 892 people > 18 years of age were assessed. The same criterion for diagnosing hypertension used in São Luís (SAP ≥140 and/or DAP ≥90 mmHg) was used in Campo Grande. The prevalence of AH was 41.4%. As in São Luís, pressure levels rose with age; the highest prevalence was among men, in those overweight and obese[14].

By comparing risk factors in four Brazilian cities (São Luís-MA, Salvador-BA, Pelotas-RS, and Campo Grande-MS), some risk factors were observed in all cities, especially older age, overweight and/or obesity, whereas other risks, such as diabetes and gender, were different among the cities.

Many lifestyle factors seem to directly influence AP levels, the most important of them obesity, alcohol consumption, physical activity and eating patterns[11]. In our study, alcohol consumption did not determine an increase of arterial hypertension in the adjusted analysis. Therefore, the greatest risk for hypertension associated with daily consumption of alcohol beverages disappeared in the adjusted analysis due to the confounding nature of these variables. The altered abdominal circumference was associated with hypertension in the non-adjusted analysis, but the association was not significant after the adjustment.

In our study, unemployment was a protective factor against hypertension in the non-adjusted analysis. Unemployed individuals had a lower prevalence of obesity (7.1%) than those self-employed (18.9%) and those who operated their own businesses (12.6%) (P<0.001), were younger (P<0.001) and were predominantly women (P=0.002), so they were less exposed to these risk factors for hypertension. This explains why the lower risk for hypertension among unemployed individuals disappeared in the adjusted analysis. The association between physical activity and hypertension observed in the non-adjusted analysis may indicate that hypertensive individuals are more engaged in physical activities, probably following medical recommendations. Family history was not a risk factor for hypertension. It may well be the case that the family history of hypertension was underestimated, as it was based on the individual's report.

Low family income was a risk factor for hypertension in the non-adjusted analysis. However, this association disappeared in the analysis adjusted for confounding variables. Individuals with higher family incomes (>5 minimum wages) had a higher prevalence of obesity (14.8%) than those with lower family incomes (8.1%), P<0.001, besides being older (P<0.001). Thus, the disappearance of association in the adjusted analysis was due to the fact that the individuals with higher family incomes had a higher prevalence of hypertension because they were older and had a higher prevalence of obesity.

This study had a few limitations as it did not analyze other variables that may be associated with hypertension, such as eating patterns. The possibility of reverse causality is another limitation that may restrict the interpretation of cross-sectional study findings.

It is important that further epidemiological studies on AH be conducted in our country in order to detect if the risk factors differ according to locations, which is suggested by this study, and also to plan more effective interventions. The results suggest the need to control overweight, obesity and diabetes, especially among women and individuals ≥ 30 years of age in order to reduce the prevalence of arterial hypertension.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any graduation program.

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