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Hypertension prevalence and associated factors in men and women living in cities of the Legal Amazon

Prevalência de hipertensão arterial sistêmica e fatores associados em homens e mulheres residentes em municípios da Amazônia Legal

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ABSTRACT: ***Introduction:*** Hypertension is a major public health problem due to its high prevalence, low levels of control, and cardiovascular morbidity and mortality. ***Objective:*** To analyze the prevalence of hypertension and associated factors in men and women living in the cities of Legal Amazonia. ***Methods:*** A population-based, cross-sectional study was carried out with 1,296 adults in the cities of Legal Amazonia. Socio-demographic, lifestyle, and anthropometric data were collected and blood pressure was measured, being considered hypertensive those individuals who had blood pressure ≥ 140/90 mmHg and/or those who reported the use of antihypertensive drugs. Statistical analyzes were performed using the survey module prefix in Stata version 11.0. ***Results:*** The prevalence of hypertension was 22.3%. After adjusting, the variables associated with hypertension in men were in the age groups 30 – 39 years (adjusted prevalence ratio [PR] = 2.69; 95%CI 1.49 – 4.86), 40 – 49 years (adjusted PR = 3.28; 95%CI 1.82 – 5.93), and 50 – 59 years (adjusted PR = 4.80; 95%CI 2.63 – 8.76); overweight (adjusted PR = 1.97; 95%CI 1.39 – 2.78); obesity (adjusted PR = 3.32; 95%CI 2.32 – 4.75); and being born in the North or Northeast regions (adjusted PR = 0.31; 95%CI 0.18 – 0.59). Among women, the age groups 40 – 49 years (adjusted PR = 3.41; 95%CI 1.91 – 6.07) and 50 – 59 years (adjusted PR = 7.29; 95%CI 4.07 – 13.07), wine consumption (adjusted PR = 0.31; 95%CI 0.10 – 0.97), and obesity (adjusted PR = 2.39; 95%CI 1.65 – 3.45) were associated with hypertension. ***Conclusion:*** In men, hypertension was independently associated with age, nutritional status, and place of birth, whereas in women, the variables associated with hypertension were age, nutritional status, and type of alcoholic beverage.

Keywords: Hypertension. Obesity. Alcohol drinking. Risk factors. Lifestyle. Chronic disease.

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RESUMO: ***Introdução:*** A hipertensão arterial sistêmica é um importante problema de saúde pública devido à sua alta prevalência, baixas taxas de controle e causa de morbidade e mortalidade cardiovascular. ***Objetivo:*** Analisar a prevalência de hipertensão arterial sistêmica e fatores associados em homens e mulheres residentes em municípios da Amazônia Legal. ***Métodos:*** No estudo transversal de base populacional conduzido com 1.296 adultos de ambos os sexos foram coletados dados sociodemográficos, estilo de vida, antropométricos e pressão arterial, sendo considerados hipertensos os que apresentaram pressão arterial ≥ 140/90 mmHg e/ou os que referiram uso de drogas anti-hipertensivas. As análises estatísticas foram feitas no módulo survey do programa Stata versão 11.0. ***Resultados:*** A prevalência da hipertensão arterial sistêmica foi de 22,3%. Após ajustes, as variáveis que se associaram à hipertensão nos homens foram a idade de 30 a 39 anos (RP ajustada = 2,69; IC95% 1,49 – 4,86), 40 a 49 anos (RP ajustada = 3,28; IC95% 1,82 – 5,93) e 50 a 59 anos (RP ajustada = 4,80; IC95% 2,63 – 8,76), sobrepeso (RP ajustada = 1,97; IC95% 1,39 – 2,78), obesidade (RP ajustada = 3,32; IC95% 2,32 – 4,75) e ser natural da região Norte ou Nordeste (RP ajustada = 0,31; IC95% 0,18 – 0,59). Entre as mulheres, associaram à hipertensão a idade de 40 a 49 anos (RP ajustada = 3,41; IC95% 1,91 – 6,07) e 50 a 59 anos (RP ajustada = 7,29; IC95% 4,07 – 13,07); o consumo de vinho (RP ajustada = 0,31; IC95% 0,10 – 0,97) e obesidade (RP ajustada = 2,39; IC95% 1,65 – 3,45). ***Conclusão:*** A hipertensão arterial associou-se independentemente com a idade, estado nutricional e naturalidade nos homens. E nas mulheres com a idade, estado nutricional e tipo de bebida alcoólica.

Palavras-chave: Hipertensão. Obesidade. Consumo de bebidas alcoólicas. Fatores de Risco. Estilo de vida. Doença crônica.

INTRODUCTION

Hypertension is considered as a major public health problem due to its high prevalence, low levels of control, and cardiovascular morbidity and mortality[1]. In Brazil, the disease affects 25% of the adult population and by 2025 this number is projected to be 60% higher, reaching a prevalence of 40%. In addition to being a major cause of deaths from circulatory system diseases, hypertension brings a high socioeconomic burden, due to economically active people being transformed into temporarily or permanently disabled[2].

Hypertension is characterized as a multifactorial, chronic, and non-communicable disease associated with functional, structural, and metabolic changes[3]. The estimates from the World Health Organization (WHO) indicate that chronic, non-communicable diseases account for 58.5% of all deaths worldwide and 45.9% of the global burden of diseases[4].

According to the National Heart Lung and Blood Institute, the main risk factors for hypertension are age, race, gender, overweight or obesity, and unhealthy lifestyle habits, such as physical inactivity, abusive consumption of alcohol, smoking, and excessive salt intake. Other risk factors are associated with high blood pressure such as genetic susceptibility and stress[5].

The literature shows different data on the prevalence of hypertension between genders. In women, the following situations may influence the level of blood pressure: use of contraception, polycystic ovary syndrome, pregnancy, hormone replacement, and menopause. Some of these situations can lead to significant increases in blood pressure and development

of hypertension. The mechanisms responsible for the differences in the regulation of blood pressure between the genders are not fully understood but may be related to the effects of sex hormones on sodium handling by the renal system[6].

Other situations may justify this increase in blood pressure in women such as the inclusion in the domestic and professional world. The female stress level has increased because of the increased participation of women in the labor market, leading to overloading of professional requirements combined with domestic duties. This situation would explain the higher levels of stress in women compared to men, being an important factor for the increase of blood pressure[7]. Another factor that may also be related to the increase of blood pressure in women is the fact that women are more aware of their health problems than men, leading to greater use of health services[8-10].

In relation to men, various aspects may be related to health care. A research carried out with a men's population that seeks the primary health-care services found that the preventive practices related to health, whether they be structural and/or cultural, are not routine to the majority of this population, being more prevalent in women. This indicates that the explanation of this phenomenon also involves a gender issue, where men and women, under the influence of different cultural elements, develop different patterns of behavior with respect to self-care[11].

Considering that hypertension is a major problem of public health and researches indicate the difference in prevalence between genders, this is an important study for health monitoring to better understand this reality and, consequently, the magnitude of the health problems in the Legal Amazon region. It is a region of agricultural expansion and population migration from different regions of the country. This process of expansion may cause significant environmental impacts, influencing lifestyle, changing the quality of life, and the morbidity and mortality profile of the population. Previous studies on the health status of the population and their main determinants allow comparisons with future assessments and understanding of the magnitude of the risks of morbidity and mortality in these populations. In this context, this study aims at analyzing the prevalence of hypertension among men and women and identifying factors associated with the disease in the adult population living in cities of the Legal Amazon.

METHODS

This study is part of the Food Security and Nutrition project of resident population in the urban area of influence of BR 163. It is a cross-sectional, population-based study, with a probabilistic cluster sampling in two stages, among individuals living in the urban area of the cities of Alta Floresta, Sinop, Sorriso, and Diamantino in 2007[12].

These cities are located in the catchment area of the highway BR163, linking Cuiabá, Mato Grosso, to Santarém, Pará, considered the most important region of the Legal Amazon,

both from ecological and economic points of view. It is a region of agricultural expansion and population migration from different regions of the country[13].

The sample was determined based on the population of the cities, by simple random sampling and cluster sampling in two stages. The calculation of the sample size considered confidence level of 95%, proportion of 50%, and estimation error of 3.5%, with estimated 3,075 individuals for the four cities. Considering that individuals in the population surveys are identified in their homes, the number of households to be drawn in the survey was determined for each municipality. Thus, the total number of households was calculated by dividing the number of individuals in the sample by the average number of residents per household in each city. Foreseeing the loss of households not interviewed, an increase of 20% in the total number of households was stipulated. The final size of the population of this study is 1,296 adults of both genders, after applying the exclusion criteria and 20.27% sample loss (because of denial or absence) in individuals aged from 20 to 59 years[14].

The data were collected using a structured questionnaire and household interview, after participants signed the informed consent form. Pregnant women, mothers of children less than 6 months, and people who presented physical and/or mental limitations that prevented obtaining the data were excluded.

The demographic and socioeconomic variables analyzed in this study were: gender; age (categorized into 20 – 29, 30 – 39, 40 – 49, and 50 – 59 years); race/color (white, black, brown, and yellow/indigenous); marital status (single, married, and separated/divorced/widowed); place of birth by region (Midwest, South, Southeast, and North/Northeast); schooling in years of study (0 – 4, 5 – 8, and ≥ 9 years); and per capita family income in minimum wages (< 0.50, 0.50 – 0.99, 1.00 – 1.99, and ≥ 2.00). The information on the demographic and socioeconomic status of adults and householders was obtained by structured questionnaire applied to the householders.

With regard to lifestyle, the following variables were analyzed: physical activity, alcohol consumption, and smoking. Physical activity was considered in two areas: leisure and commute. Physical activity during leisure time was measured in minutes per week and categorized as inactive (0 minutes/week), low active (10 – 149 minutes/week), or active (≥ 150 minutes/week). Commuting to school and/or work on foot or by bicycle is classified into three categories: none (when there was no commute or people commuted by motor vehicles), 1 – 29 minutes, and ≥ 30 minutes[15]. With regard to smoking, the categories were: smokers, ex-smokers, and never smoked.

The consumption of alcoholic beverage referred to the alcohol intake in the last 30 days preceding the interview and the types of drinks were categorized into beer, wine, and distilled beverage.

The weight rating was defined according to the body mass index (BMI) calculated as the weight (in kilograms) divided by the square of height (in meters). The BMI cutoff points used were those recommended by the WHO[16], that is < 18.5 kg/m² (underweight), 18.5 – 24.9 kg/m² (normal weight), 25.0 – 29.9 kg/m² (overweight), and ≥ 30.0 kg/m² (obesity).

The techniques recommended by the WHO were used to obtain the anthropometric measurements (weight and height) of adults[17]. Weight was measured using portable digital scale. Participants were weighed once and the amounts were recorded on the card in kilograms. A portable stadiometer was used to measure the participants' height and the measurement was taken twice, with individuals wearing light clothes, barefoot in the standing position.

Blood pressure was measured three times with an interval of 3 minutes between each measurement, using a semi-automatic apparatus. The average of the last two measurements was used in the analysis. Those individuals who had systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and/or those who reported use of antihypertensive drugs were defined as hypertensive individuals[3].

The data were entered by the double-entry method, in the statistical software Epi Info 2000 (Centers for Disease Control and Prevention, Atlanta, USA), which allows the consistency of their analysis. Statistical analyzes were performed using Stata version 11.0 (Stata Corp., College Station, USA), using the procedures for complex samples in the survey module (svy) for population inquiries[18]. Absolute frequencies were calculated and the proportions were compared by the chi-squared (χ^2) Pearson test, with a significance level of $p < 0.05$.

The prevalence ratios (PRs) were estimated with confidence intervals of 95% (95%CI) to determine the association between the dependent variables (hypertension) and independent variables of the study. The variables that presented $p < 0.20$ by χ^2 test were selected to compose the Poisson regression model, and those which remained in the model were the variables that presented significance level of $p < 0.05$[19].

RESULTS

The study was carried out with 1,296 subjects, 51.1% were male. Among the respondents, 34.2% belonged to the age group 20 – 29 years and 72.1% were married. Regarding the variable race/color, 54.0% self-reported as brown and 38.7% as white. Among the participants, 40.6% were born in the South and 30.8% were born in the state of Mato Grosso. With regard to education, 31.2% had 5 – 8 years of schooling and 32.0% had per capita family income lower than the minimum wage. The prevalence of hypertension was 22.0%, being 26.9% (95%CI 23.14 – 30.93) for males and 17.6% (95%CI 15.15 – 20.28) for females (Table 1).

The prevalence of hypertension in men, according to demographic and socioeconomic variables was associated with age, marital status, and place of birth, as shown in the Table 2. However, after adjusting for age, marital status lost its significance as seen in the 95%CIs that consider the value 1.0. In relation to the place of birth, those who were born in the North and Northeast regions had a lower prevalence (PR = 0.36, 95%CI 0.19 – 0.66) than those who were born in the Midwest region, regardless of age (Table 2).

In anthropometric and lifestyle variables, hypertension among men was associated with weight, being the PR = 1.95 (95%CI 1.37 – 2.77) for those who were overweight and PR = 3.18 (95%CI 2.24 – 4.52) for the obese, regardless of age, compared to men classified

Table 1. Demographic and socioeconomic characteristics of adults interviewed, Legal Amazon, Mato Grosso, 2007.

Variables	n	%*
Gender		
Male	506	51.08
Female	790	48.92
Age (in years)		
20 – 29	392	34.15
30 – 39	370	29.79
40 – 49	316	23.29
50 – 59	218	12.77
Marital status		
Single	240	20.47
Married	936	72.05
Separated/divorced/widowed	120	7.48
Race/color		
White	500	38.67
Black	72	6.50
Brown	702	53.96
Yellow/indigenous	13	0.87
Place of birth		
Midwest	463	37.31
South	534	40.57
Southeast	140	10.16
North/Northeast	154	11.96
Schooling (in years)		
≥ 9	513	40.93
5 – 8	389	31.17
0 – 4	391	27.90
Per capita family income (in minimum wages)		
< 1	696	54.19
1 – 1.99	354	27.47
≥ 2	238	18.34

*Percentage of the weighted sample.

as underweight or normal weight. With regard to smoking, even though it was verified as a significant association with hypertension, when adjusting for age this association disappears, as shown in Table 3.

The variables shown in Tables 2 and 3 with $p \leq 0.20$ were used in the multiple analyses and the following remained associated with hypertension: age, weight, and place of birth. The prevalence of hypertension increases with increasing age. Regarding the weight classification, the prevalence of hypertension among those who presented overweight was almost 100% higher compared to the underweight and normal weight, for those obese the prevalence was 232% higher, regardless of age, place of birth, and schooling. With regard to the place of birth, those who were born in the North and Northeast presented approximately 70% lower prevalence for hypertension when compared to those who were born in the Midwest region, indicating a protective factor for the disease, adjusted by the other variables in the model. The variable schooling was used in the final model for adjusting for other variables, as shown in Tables 4 and 5.

Table 2. Prevalence and prevalence ratio of hypertension in men and women according to demographic and socioeconomic variables, Legal Amazon, Mato Grosso, 2007.

Variables	Men			Women		
	%*	p-value	Adjusted PR** (95%CI)	%*	p-value	Adjusted PR** (95%CI)
Marital status		0.0069			0.0141	
Single	15.9		1.00	12.7		1.00
Married	29.8		1.15 (0.75 – 1.75)	17.2		0.62 (0.38 – 0.99)
Separated/ divorced/widowed	36.8		1.19 (0.56 – 2.54)	27.2		0.65 (0.38 – 1.10)
Place of birth		0.0021			< 0.001	
Midwest	24.3		1.00	13.3		1.00
South	31.9		1.02 (0.75 – 1.40)	17.3		0.92 (0.66 – 1.28)
Southeast	35.7		0.88 (0.54 – 1.41)	32.2		1.20 (0.81 – 1.77)
North/Northeast	10.5		0.36 (0.19 – 0.66)	20.7		1.20 (0.80 – 1.85)
Schooling (in years)		0.0660			< 0.001	
≥ 9	21.3		1.00	10.3		1.00
5 – 8	29.1		1.01 (0.70 – 1.45)	18.3		1.37 (0.96 – 1.95)
0 – 4	32.1		1.19 (0.85 – 2.17)	27.2		1.41 (0.94 – 2.11)

PR: prevalence ratio; 95% CI:95% confidence interval; *percentage of the weighted sample; **adjusted only for age.

In women, the prevalence of hypertension according to demographic and socioeconomic variables is presented in Tables 2 and 3. Hypertension was associated with age ($p < 0.001$), marital status, place of birth, and schooling. When adjusting for age, both place of birth and schooling lost significance, indicating that age is an important confounding factor for hypertension, as also verified by reversing the PR in the category of married (Table 2).

Table 3. Prevalence and prevalence ratio of hypertension in men and women according to anthropometric variables and lifestyles, Legal Amazon, Mato Grosso, 2007.

Variables	Men			Women		
	%*	p-value	Adjusted PR** (95% CI)	%*	p-value	Adjusted PR** (95% CI)
Weight classification		< 0.001			< 0.001	
Underweight/ normal weight	14.7		1.00	10.5		1.00
Overweight	33.3		1.95 (1.37 – 2.77)	20.4		1.40 (1.00 – 1.96)
Obesity	60.1		3.18 (2.24 – 4.52)	43.5		2.45 (1.73 – 3.47)
Commute (to work or school)		0.0176			0.0811	
Yes	21.0		1.00	14.5		1.00
No	30.7		1.34 (0.98 – 1.82)	19.3		1.12 (0.83 – 1.52)
Smoking		0.0156			0.0571	
Never smoked	21.3		1.00	15.7		1.00
Smoker	31.2		1.21 (0.87 – 1.69)	19.7		1.06 (0.73 – 1.54)
Ex-smoker	34.5		1.13 (0.80 – 1.60)	24.4		1.13 (0.81 – 1.57)
Alcohol consumption		0.7380			< 0.001	
No	27.9		1.00	21.7		1.00
Yes	26.5		1.08 (0.80 – 1.47)	11.6		0.72 (0.52 – 0.99)
Type of alcoholic beverage		0.4209			0.0027	
Do not drink	27.7		1.00	21.6		1.00
Only beer	23.3		0.98 (0.70 – 1.38)	12.0		0.70 (0.49 – 1.00)
Only wine	29.8		1.23 (0.57 – 2.64)	4.5		0.30 (0.08 – 1.08)
Only distilled	38.2		1.08 (0.61 – 1.91)	23.8		1.60 (0.66 – 3.89)
Two or more types	31.9		1.38 (0.95 – 2.01)	10.9		0.86 (0.31 – 2.36)

PR: prevalence ratio; 95%CI: 95% confidence interval; *percentage of the weighted sample; **adjusted only for age.

As observed in males, among women hypertension associated with weight, regardless of age. The prevalence of hypertension was 40% higher in the category overweight and 145% higher among those obese compared to those with normal weight or underweight (Table 3). Another association that remained significant after adjusting for age was the consumption of alcohol. The prevalence of hypertension is approximately 28% lower among women who consume alcohol. In relation to commute, smoking, and the type of alcoholic beverage, the association disappears when adjusting for age.

Table 5 shows the variables included in the final model for women. After adjustment, the classification of the weight and type of alcoholic beverage remain associated with hypertension, regardless of age and education. The prevalence of hypertension is approximately 140% higher in obese women compared to normal weight or underweight and approximately 70% lower in those who consume wine, even when considering the confounders and modifying effect variables.

Table 4. Crude and adjusted prevalence ratios of the association between hypertension and study variables in men, Legal Amazon, Mato Grosso, 2007.

Variables	Crude PR (95%CI)	Adjusted PR* (95%CI)
Age (in years)		
20 – 29	1.00	1.00
30 – 39	3.08 (1.74 – 5.46)	2.69 (1.49 – 4.86)
40 – 49	4.29 (2.46 – 7.49)	3.28 (1.82 – 5.93)
50 – 59	6.12 (3.56 – 10.51)	4.80 (2.63 – 8.76)
Weight classification		
Underweight/normal weight	1.00	1.00
Overweight	2.27 (1.58 – 3.26)	1.97 (1.39 – 2.78)
Obesity	4.10 (2.88 – 5.83)	3.32 (2.32 – 4.75)
Place of birth		
Midwest	1.00	1.00
South	1.31 (0.94 – 1.83)	0.82 (0.59 – 1.13)
Southeast	1.47 (0.94 – 2.23)	0.70 (0.45 – 1.10)
North/Northeast	0.43 (0.22 – 0.86)	0.31 (0.17 – 0.59)
Schooling (in years)		
≥ 9	1.00	1.00
5 – 8	1.37 (0.95 – 1.96)	1.30 (0.91 – 1.87)
0 – 4	1.51 (1.05 – 2.17)	1.26 (0.92 – 1.74)

PR: prevalence ratio; 95% CI: 95% confidence interval; *adjusted for schooling.

DISCUSSION

The prevalence of hypertension found in the cities that were part of this study was similar to that obtained in other studies carried out in Mato Grosso with adults of both genders, in the same age group, as noted in the cities of Sinop[20], Cuiabá,[21] and Nobres[22].

The data from the National Health Survey (2014) pointed out that, among the most frequent chronic diseases in the Brazilian population, hypertension had a prevalence of 21.40% in individuals aged ≥18 years[23].

Table 5. Crude and adjusted prevalence ratios of the association between hypertension and study variables in women, Legal Amazon, Mato Grosso, 2007.

Variables	Crude PR (95%CI)	Adjusted PR* (95%CI)
Age (in years)		
20 – 29	1.00	1.00
30 – 39	1.85 (0.96 – 3.55)	1.52 (0.78 – 2.96)
40 – 49	4.09 (2.27 – 7.37)	3.41 (1.91 – 6.07)
50 – 59	10.41 (6.00 – 18.07)	7.29 (4.06 – 13.07)
Weight classification		
Underweight/normal weight	1.00	1.00
Overweight	1.94 (1.36 – 2.78)	1.38 (0.98 – 1.94)
Obesity	4.41 (2.95 – 5.80)	2.39 (1.65 – 3.45)
Type of alcoholic beverage		
Do not drink	1.00	1.00
Only beer	0.55 (0.38 – 0.81)	0.76 (0.53 – 1.10)
Only wine	0.21 (0.05 – 0.82)	0.31 (0.10 – 0.97)
Only distilled	1.10 (0.45 – 2.70)	1.87 (0.75 – 4.65)
≥ 2	0.51 (0.20 – 1.30)	1.05 (0.39 – 2.88)
Schooling (in years)		
≥ 9	1.00	1.00
5 – 8	1.78 (1.17 – 2.70)	1.18 (0.83 – 1.67)
0 – 4	2.65 (1.82 – 3.84)	1.29 (0.86 – 1.95)

PR: prevalence ratio; 95% CI:95% confidence interval; *adjusted for schooling.

In the United States, hypertension affects 33.6% of adults and the estimates reveal that more than 74 million North Americans are hypertensive, accounting for 50% of total mortality by cardiovascular diseases[24].

In the present study, the prevalence of hypertension was higher in males compared to females. Similar results were found in a study carried out in Cuiabá, Mato Grosso, where the prevalence of hypertension was 33.5% in males and 23.5% in females[21].

The variable age was significantly associated with hypertension in both genders. The prevalence of hypertension both in males and in females was higher among individuals aged 50–59 years. Similar results were observed in studies carried out in Brazil with association between age and hypertension for individuals aged ≥ 40 years[22,23,25-28]. This factor may be related to the hemodynamic changes of hypertension such as the increased cardiac output or peripheral vascular resistance starting between 20 and 30 years of age; however, high levels occur between 30 and 50 years of age[3]. The age variable was maintained in the models for confounding adjustment, showing what is the independent relationship of other variables with high blood pressure.

Although the prevalence of hypertension was lower in males who were born in the North and Northeast of Brazil compared to those males who were born in the Midwest region, a study of association between hypertension and behavioral aspects such as stress and migration indicates that the migration presented itself as a risk factor for hypertension. This is due to changes in eating habits and lifestyle of individuals, characterizing as a stressor and resulting in an increase in blood pressure mediated by the central nervous system and neurohormonal processes[29].

Another significant variable in this study was the classification of weight categorized by BMI. Considered a non-communicable chronic disease, obesity is also a major public health problem in developed as well as in developing countries, causing a great impact on the population's morbidity pattern besides being considered an important risk factor for several morbidities[30]. In this study, the prevalence ratio of hypertension observed in both obese men and women was about three times compared to non-obese individuals. This finding is similar to those obtained in other studies in Mato Grosso[20,21]. Other studies also indicate the importance of BMI in association with hypertension[25-27,31,32].

Obesity mechanisms associated with hypertension are complex and not yet completely understood. The main mechanisms involved are as follows: sympathetic overactivity, insulin resistance, hyperactivity of renin–angiotensin–aldosterone system, changes in the secretion of adipokines and fatty acids by the adipose tissue, endothelial dysfunction, in addition to losses caused by structural and functional changes of renal medulla[33]. Furthermore, weight gain results in an increase in sympathetic activity, insulin resistance, and hyperinsulinemia. As per the kidney function, hyperinsulinemia promotes tubular reabsorption of sodium and water and, consequently, vasoconstriction hypertension. Visceral adiposity accumulation is directly involved in the genesis of an inflammatory and atherogenic process[34].

Regarding the consumption of alcohol and hypertension, the intake was analyzed according to the types of alcoholic beverages. The results of this study showed a significant

association only for females, reducing the prevalence of hypertension in approximately 70% when the women reported consumption of wine compared to those who do not drink.

A Women's Health study performed in the United States found a J-shaped association between alcohol consumption and hypertension, adjusted for age and lifestyle, and concluded that low-to-moderate alcohol consumption decreases the risk of hypertension in females[35].

Combined analysis of eight prospective studies in North America and Europe found an inverse association between alcohol and risk of coronary heart disease in all age groups[36]. Another meta-analysis with articles analyzed until October 2009 by a research in PubMed and Embase found that the overall relationship between cardiovascular mortality and alcohol intake was interpreted as a J-shaped curve, revealing a protective effect in intake amounts from 5 to 10 g/day[37].

The consumption of alcohol raises blood pressure and its effects vary according to gender, ethnicity, and consumption characteristics. The magnitude of the risk of alcohol consumption on hypertension is determined by the amount and frequency of ethanol intake[38].

The Ministry of Health established as moderate alcohol consumption the intake of up to one drink/day for women (15 g ethanol) and up to two drinks/day for men (30 g ethanol). The consumption of daily doses above this standard is considered harmful and a risk to individuals' health[39].

The mechanisms involved in the increase of blood pressure associated with the increase of alcohol intake can be determined by direct influence on the heart or the vascular smooth muscle, or by stimulation of the sympathetic nervous system or renin–angiotensin–aldosterone system and may increase the plasma cortisol levels by magnesium loss in the urine. Alcohol consumption has been associated not only to increased blood pressure levels but also to the various elements of the metabolic syndrome, such as increased levels of triglycerides, abdominal adiposity, and high level of uric acid[40].

Worldwide, it is estimated that the alcohol-related mortality is equal to 5.9% of the total mortality and alcohol is a risk factor that contributes most to the global burden of disease, accounting for 5.1% of them. In Brazil, the mortality rate, standardized by age by cirrhosis of the liver was 28.8 and 5.8 per 100,000 inhabitants aged ≥ 15 years[41].

This study is a population-based survey with data collection carried out in the home of those interviewed by a team of trained interviewers, with sufficient sample size to evaluate the associations performed; however, the cross-sectional design is a limitation that makes it impossible to establish causal relationships between exposure and the disease development[42].

The findings related to hypertension in major cities as well as in the small places reinforce the concern with this public health problem and the knowledge of its determinants is essential to apply measures and preventive actions. Therefore, it is important to intensify the hypertension control programs, as well as other cardiovascular risk factors to control or reduce this prevalence through prevention and a better quality of life of the population.

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