Arterial Hypertension and its Correlation with Some Risk Factors in a Small Brazilian Town

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Abstract

Background: Arterial hypertension (AH) is a health problem that affects a large number of undiagnosed or inadequately treated hypertensive individuals and presents a high rate of treatment nonadherence.

Objective: To estimate the prevalence of AH and its correlation with some cardiovascular risk factors among the adult population of the town of Firminópolis, state of Goiás, Brazil.

Methods: Descriptive, observational and cross-sectional population-based study of a simple random sample (age ≥18 years): standardized questionnaires with blood pressure (BP) measurements (AH criterion: BP ≥ 140 x 90 mmHg), weight, height, body mass index (BMI) and waist circumference (WC). Data were stored (Microsoft Access) and analyzed using Epi-info software.

Results: We evaluated 1,168 individuals, with a predominance of the female sex - 63.2% and a mean age of 43.2 ± 14.9 years. There was a prevalence of overweight in 33.7% of the individuals and obesity in 16.0% of the individuals. There was a prevalence of altered WC in 51.8% demand of smoking in 23.2%. A sedentary life style at work and leisure activities was present in 67.6% and 64.8% of the individuals, respectively, with a higher proportion seen among the women. Alcohol consumption was observed in 33.3% of the sample. The prevalence of AH was 32.7%, higher among the men (35.8%) than among the women (30.9%). A positive correlation with AH was identified with BMI, WC and age range. A negative correlation was observed between AH and level of schooling, with 18.2% of hypertensive individuals with 9 or more years of schooling.

Conclusion: A high prevalence of AH, overweight and WC alteration was identified. The female sex represented a protective factor for the risk of AH. A positive correlation was found between AH and BMI, WC and age range; a negative correlation was identified between AH and level of schooling. (Arq Bras Cardiol 2010; 95(4): 502-509)

Key words: Hypertension; risk factors; adult; prevalence; women, Goiás, Brazil.

Introduction

Arterial hypertension (AH) represents an important health problem in the country. This is due not only to its high prevalence, but also to the large number of hypertensive individuals that remain undiagnosed, are not treated adequately or even due to the high rate of treatment nonadherence[1].

In addition to representing an independent and continuous risk factor for cardiovascular disease[2], the incidence of AH has increased according to data obtained from population investigations carried out in Brazil, with its rate ranging from 22.3% and 43.9%[3].

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In Brazil, cardiovascular diseases were responsible for the highest proportion of deaths in the last decades and constituted the main cause of death after 40 years of age. A total of 283,927 deaths due to the circulatory system problems were recorded in 2005, that is, 32.2% of the deaths in that year[3,4].

The prevalence of AH found in a study carried out in Goiânia, state of Goiás, Brazil (Prevalence of AH and Some Risk Factors) was 36.4% and showed a predominance of men (41.8%) over women (31.8%)[5].

There are environmental, behavioral and genetic factors that participate in the development of AH[6]. The lifestyle and inadequate dietary habits represent the main factors responsible for the disease load in the world.

Epidemiological studies have associated AH to several sociodemographic characteristics (age range, ethnicity, socioeconomic level), alcohol intake, sodium intake, stress, diabetes, obesity and sedentary lifestyle. Some risk factors (smoking and dyslipidemias) can interact with the

blood pressure (BP) and increase the risk of developing cardiovascular diseases[7,8].

Considering the scarcity of data on AH and other cardiovascular risk factors in small towns, we decided to carry out a study on this condition in a small Brazilian town with rural characteristics in the state of Goiás, Brazil.

Recently published data on this population[9] confirmed the high prevalence of individuals with excess weight (overweight and obese) and the positive correlation between these anthropometric indices and AH. The present study discloses additional information on the subject, with focus on set of factors related to high blood pressure, including the evaluation of the influence of other factors on the association between the BP and excess weight through multivariate analysis.

Methods

The present study was a descriptive, observational and cross-sectional population-based study carried out in the town of Firminópolis, in the state of Goiás, Brazil. The town has 9,666 inhabitants and the study included a sample of adult individuals aged 18 and older who resided in the urban part of the town in the year 2002.

Part of the data from the "Study of the Prevalence and Knowledge of Hypertension and some Risk Factors in a Brazilian Region - The Midwest Research Project" were used in this project. The original project was approved by and received financial support from CNPq (The National Council of Scientific and Technological Development) and was carried out by the Arterial Hypertension League of *Universidade Federal de Goiás* (LHA/UFG) and *Universidade Federal de Mato Grosso* (UFMT). This project was approved by the Ethics Committee in Human and Animal Research of *Hospital das Clínicas* of UFG, protocol # 033/2001. All participants signed the Free and Informed Consent Form (FICF).

The sample size was calculated considering a population of 9,666 inhabitants[10], the prevalence of AH of 25%[11], the 95% confidence interval and an estimation error of 10%, which resulted in n=1,030. An additional 20% was added to this total to cover eventual losses (n=1,236). The actually studied sample consisted of 1,168 individuals older than 18 years (430 men and 738 women).

The sample size allowed us to estimate the prevalence of AH in the town of Firminópolis with a maximum error of 3.8% and 2.9%, for men and women, respectively. The probabilistic sampling used in the present study guarantees the representativeness of all elements of the population.

With the objective of eliminating the bias of the observer, semi-automatic OMRON-HEM 705 CP devices were used to measure the BP, which were periodically compared with mercury column devices[5]. The LHA/UFG performs a routine assessment of all BP measurement devices every six months. Regarding the semi-automatic digital devices, the verification occurs more frequently (bimonthly). Nevertheless, before the start of the study in Firminópolis, all equipment used in BP measurements was submitted to a new reassessment. The technique used to measure the BP followed the recommendations of the 7th Joint National Committee[12].

An individual was defined as being hypertensive when he or she presented systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg, or when the individual used anti-hypertensive medication. The BP was measured twice, one in the beginning and the other at the end of the interview, always with a minimum interval of 5 minutes between the measurements. The second BP measurement was used in the analyses.

The weight was measured with the individuals in the orthostatic position, with the arms extended along the body, barefoot and wearing light clothes. A PLENA scale, model GIANT LITHIUM, with a maximum capacity of 150 kg and a precision of 100 g was used to measure weight[5]. A SECCA stadiometer, model 206, with a precision of 0.1 cm was used to measure height, with the participants standing barefoot[5].

The body mass index (BMI) was calculated as weight in kilograms divided by height in square meters (kg/m^2). The BMI values were classified as BMI < 24.9 kgm^2 (low weight/normal); BMI of 25 to 29.9 (overweight) and BMI ≥ 30 kgm^2 (obesity)[13].

The waist circumference (WC) was measured using an inextensible measuring tape, with the patient in the standing position, with arms extended along the body, wearing as little clothing as possible. The WC was measured in the horizontal plane in the midpoint between the lateral iliac crest and the last rib. As for the risk of metabolic complications, the WC was classified as normal, increased and very increased according to the values < 94 cm, between 94 and 102 cm and > 102 cm for men; < 80, between 80 and 88 cm and > 88 cm for women, respectively[13].

Other variables were collected through a standardized questionnaire and validated in relation to: age, sex, level of schooling (years of schooling), marital status (with or without partner), family income (in minimum wages - MW) and life habits (smoking, alcohol consumption and sedentary lifestyle).

The variables concerning the life habits were: smoking (current smoker; non-smoker or ex-smoker); alcohol consumption (consumption or no consumption of alcoholic beverages, regardless of the frequency and amount) and sedentary lifestyle (physical activities at leisure time and at work).

The physical activity at leisure time was classified as: sedentary (when most part of the leisure time was spent with activities that resulted in low energy expenditure, such as watching TV, using the computer etc.); light (when most part of the leisure time was spent with activities such as riding a bicycle, running or practicing sports) and moderate (when an athlete was identified, whose free time was used in trainings for competitions, running or other sports).

The physical activity at work was classified as: sedentary (when the individual spent most of the time sitting or performed activities that involved little physical exertion); light/moderate (when the individual walked a lot while working, with the possibility of lifting or carrying heavy objects); and intense (when the individual performed extenuating work, or had to carry heavy objects).

After the data collection, they were entered in duplicate using Microsoft Office Access program. The final database was

analyzed using Epi-info software, release 3.3.2. The Chi-square test was used to verify the correlation between the variables (categorical nominal variables) and a simple logistic regression was performed (bivariate) to evaluate the association between AH and the independent variables. Subsequently, the multiple logistic regression was used to test the variables that showed an association ($p < 0.20$) at the bivariate analysis[14]. The final model included the variables that were associated with the outcome ($p < 0.05$) and a 95% level of confidence.

Results

A total of 1,168 individuals were investigated, which represented 12.0% of the population of the town. There was a predominance of the female sex, which corresponded to 63.2% of the interviewed individuals. The mean age was 43.2 ± 14.9 years, with a minimum of 18 and a maximum of 78 years. The highest percentage observed consisted of individuals in the age range 30 to 39 years (23.9% of the total), for both the male (21.6%) and the female (25.2%) sex. The percentage of elderly individuals that were 60 years or older was 17.6%.

There was a prevalence of AH in 32.7% of the population. This prevalence was higher in the male sex (35.8%) when compared to the female sex (30.9%), although there was no significant difference between the sexes (p=0.08), as shown in Table 1.

Table 1 shows a positive correlation between AH and age range, with a prevalence of 14% from 30 to 39 years, which increases to 34.6% from 40 to 49 years, reaching 63.1% in individuals aged 60 years or older ($p < 0.001$).

The sample showed that 25.2% of the individuals had an income > 1 MW *per capita*. According to Table 1, no significant association was identified between AH and income (p=0.06).

Of the studied population, 67.5% declared that they had more than four years of schooling. There was a negative correlation between AH and level of schooling, both in the general population and after it was divided by sex (p<0.001). Of the hypertensive individuals, 79.3% had up to 9 years of schooling and 18.2% had 9 or more years of schooling (Table 1).

When analyzing the marital status of the population, most of the study individuals informed the existence of a partner (69.0%) and therefore, according to Table 1, there was no statistical difference for the marital status variable in its correlation with AH (p=0.32).

Table 1 - Prevalence of arterial hypertension according to sociodemographic variables in the population aged ≥ 18 years in the town of Firminópolis, state of Goiás, Brazil, 2002

Variable		n (1,168)	AH prevalence		Crude OR (95%CI)	p value
			n	%		
Sex				p^1=0.08		
	Female	738	228	30.9	1	
	Male	430	154	35.8	0.80 (0.62 – 1.03)	0.093
Age (years)				p^1<0.01		
	18 to 29	248	20	8.1	1	
	30 to 39	279	39	14.0	1.85 (1.05 – 3.27)	0.034
	40 to 49	231	80	34.6	6.04 (3.55 – 10.27)	0.001
	50 to 59	204	113	55.4	14.16 (8.30 – 24.14)	0.001
	≥ 60	206	130	63.1	19.50 (11.39 – 33.38)	0.001
Income (MW)				p^1=0.06		
	< 0.5 MW	400	117	29.3	1	
	0.5 to 0.9 MW	473	168	35.5	1.33 (1.00 – 1.77)	0.049
	1.0 to 3.0 MW	256	79	30.9	1.08 (0.76 – 1.51)	0.660
	≥ 3.0 MW	39	18	46.2	2.07 (1.06 – 4.03)	0.045
Schooling				p^1<0.01		
	0 to 3 years	380	199	52.4	1	
	4 to 8 years	458	123	26.9	0.33 (0.25 – 0.44)	0.001
	≥ 9 years	330	60	18.2	0.20 (0.14 – 0.28)	0.001
Marital status*				p^1=0.32		
	With partner	806	249	30.9	1	
	Without partner	348	130	37.4	1.33 (1.02 – 1.73)	0.351

*AH - arterial hypertension; n - absolute number; OR - odds ratio; MW - minimum wages; p^1 - p at X^2 test. *Absent data (n=1,154).*

A total of 32.9% of the sample individuals smoked. There was a significant correlation between AH and smoking (p<0.001). Table 2 shows that, proportionally, the prevalence of AH was higher among the ex-smokers (48.8%) and smokers (32.9%) than among the nonsmokers (26.1%).

Regarding alcohol consumption, 33.3% of the population reported the habit of drinking alcoholic beverages. There was a significant difference between the sexes (51.1% of the men and 23.1% of the women).

There was a negative association between AH and alcohol consumption (p<0.001), as demonstrated in Table 2.

Regarding the physical activity in leisure, the sedentary individuals presented a prevalence of hypertension of 31.4% and in relation to physical activity at work, the hypertensive sedentary individuals were 34.09%. Data in Table 2 show that in both categories, however, no significant difference was verified regarding AH (p=0.260 and p=0.240 respectively).

The BMI indicated that 49.7% of the interviewed individuals presented excess weight (33.7% overweight and 16.0% obesity). There was a positive correlation between AH and BMI (p<0.001). The prevalence of overweight hypertensive individuals was 36.5% and of obese hypertensive individuals was 54.5% (Table 2).

WC alteration was observed in 51.9% of the studied individuals (24.2% increased and 27.7% very increased) and there was a positive correlation between AH and WC (p<0.001). The prevalence of hypertensive individuals with increased WC was 33.6% and of hypertensive individuals with very increased WC was 50.8% (Table 2).

At the bivariate analysis, the crude odds ratio (OR) showed that age, schooling, smoking, alcohol consumption, BMI and WC had a positive association with AH (p<0.001).

The multiple logistic regression analysis explains the independent influence of the sociodemographic variables, lifestyle and adiposity on AH. The adjusted OR show that the prevalence of AH is positively associated to the male sex and increases progressively with age. The positive associations between AH and IMC (excess weight), as well as altered WC were maintained and also the negative associations with level of schooling. The association between AH and smoking and

Table 2 - Prevalence of arterial hypertension according to life habits and adiposity among the population aged ≥ 18 years in the town of Firminópolis, state of Goiás, Brazil, 2002

Variable		n (1,168)	Prevalence of AH		Crude OR (95%CI)	p value
			n	%		
Smoking status				p^1<0.01		
	Nonsmoker	642	168	26.17	1	
	Smoker	270	89	32.96	1.38 (1.02 – 1.89)	0.038
	Ex-smoker	256	125	48.83	2.69 (1.99 – 3.64)	0.001
Alcohol consumption*				p^1<0.01		
	Yes	389	107	27.51	1	
	No	776	274	35.31	1.43 (1.10 – 1.88)	0.008
PA in leisure*				p^1=0.26		
	Sedentary	756	238	31.48	1	
	Mild	358	128	35.75	1.21 (0.93 – 1.58)	0.156
	Moderate	51	14	27.45	0.82 (0.44 – 1.55)	0.548
PA at work*				p^1=0.24		
	Sedentary	788	269	34.09	1	
	Mild/moderate	224	63	28.13	0.76 (0.55 – 1.05)	0.094
	Intense	153	49	32.03	0.91 (0.63 – 1.32)	0.621
BMI				p^1<0.01		
	Normal	587	136	23.2	1	
	Overweight	394	144	36.5	1.91 (1.44 – 2.52)	0.001
	Obesity	187	102	54.5	3.97 (2.81 – 5.62)	0.001
WC				p^1<0.01		
	Normal	562	123	21.9	1	
	Increased	283	95	33.6	1.80 (1.31 – 2.47)	0.001
	Very increased	323	164	50,8	3,68 (2,73 – 4,94)	0,001

*AH - arterial hypertension; n - absolute number ; OR - odds ratio; PA - physical activity; BMI - body mass index; WC - waist circumference; p^1 - p at X^2 test. * Absent data (n=1,165).*

alcohol consumption were not maintained. The OR for AH was approximately three-fold higher for overweight individuals, four-fold higher for obese individuals and two-fold higher for very increased WC values (Table 3).

Discussion

The results of the present study were obtained from a representative sample of the adult population of both sexes, from a small town in the countryside of the state of Goiás, Brazil.

It is noteworthy the finding of a prevalence of 32.7% of patients classified as hypertensive in a small urban center. These data are similar to those found in large cities and corroborate other data, also from small and medium-sized towns. Therefore, it can be verified that actions related to AH and associated factors are of utmost importance due to its high prevalence, social importance in all socioeconomic classes, cultural groups, regardless of the geographic location or size of the urban conglomerate.

The Firminópolis study showed, similarly to others[5,15,16], a positive correlation of AH with age range, BMI and WC and a negative one with schooling. The female sex represented a protective factor for the risk of AH.

Similarly to other population-based studies[17,18], there was a positive association between AH and age, showing that the disease mainly appears in elderly individuals. This population is exactly the one that more frequently uses the Public Health System due to the onset of multiple pathologies, resulting in high costs for the system and reinforcing the need for adopting health-promotion measures and adequate control of the disease.

In the Firminópolis study, the prevalence of AH was inversely proportional to the population's level of schooling. The level of schooling has been shown to be the most important socioeconomic factor in the health status, particularly regarding the cardiovascular health[19]. A low level of schooling is associated with the highest rates of non-transmissible chronic diseases, especially AH[20]. Therefore, the level of schooling is an essential element to be considered in the approach of the population regarding the practices of health promotion, protection and recovery[21]. Some population-based cross-sectional studies also found an inverse correlation between schooling and AH prevalence[8,18,22,23].

In the present study, it was verified that the anthropometric data indicated a clear increase in the AH prevalence as the BMI increased and this same trend was observed concerning the WC measurement.

The association between obesity and AH has been extensively recognized. The excess of body fat remains the most important isolated factor related to BP increase and AH[24], thus, obesity is one of the main factors responsible for AH and several studies[25,26] have demonstrated the cause-and-effect relationship between body mass increase and BP increase.

In a study carried out in São Paulo on the influence of body fat distribution on the prevalence of AH and other cardiovascular risk factors, it was observed that obese individuals present a higher predisposition to cardiovascular problems than individuals with normal weight[27]. The authors reported a prevalence of hypertensive overweight individuals of 23% and hypertensive obese individuals of 67.1%. The data of the Firminópolis study confirm the ones described above and indicate that this correlation is present even in small towns, with urban characteristics that are completely different from those of large cities.

The high rates of overweight and obesity reinforce the need to implement objective measures to fight them, aiming at reducing the morbidity and mortality due to cardiovascular disease.

The Firminópolis study showed that there was an increase in BP with the increase in the WC. There is an important association between the WC and the probability of cardiovascular events caused by the deposition of mobilizable fat in the abdominal region[28]. Regardless of the BMI value, the increase in WC has been a predictive factor of cardiovascular disease[1]. There is evidence that the central deposition of fat is an important risk marker for chronic diseases and among them, AH. Such findings have been constantly reported in different studies[29,30].

In a research carried out in the city of Goiânia, state of Goiás, Brazil, on the WC and BMI as predisposing factors for AH, the authors reported that the WC is associated with AH, not only in the male, but also in the female sex[31], corroborating the Firminópolis study. This correlation showed to be important, as the WC measurement is a simple, low-cost method and a good risk marker for AH. This finding must be seen as a stimulus for adopting this technique as a routine assessment in all health centers, aiming at identifying

Table 3 - Factors associated with arterial hypertension identified through the multiple logistic regression analysis; Firminópolis-GO, Brazil, 2002

Variable		OR	(95%)CI	p
Sex	Male	1	-	-
	Female	0.56	0.38 – 0.81	0.002
Age range	18 to 29	1	-	-
	30 to 39	1.58	0.88 – 2.84	0.125
	40 to 49	4.33	2.50 – 7.50	0.001
	50 to 59	10.88	6.24 – 18.95	0.001
	≥ 60	15.55	8.85 – 27.32	0.001
BMI	Normal	1	-	-
	Overweight	2.90	1.15 – 7.36	0.024
	Obesity	4.47	1.60 – 12.52	0.004
WC	Normal	1	-	-
	Increased	1.35	0.89 – 2.05	0.015
	Very increased	2.08	1.22 – 3.54	0.007
Years of schooling	0 to 3 yrs	1	-	-
	4 to 8 yrs	0.63	0.44 – 0.90	0.011
	≥ 9 yrs	0.51	0.33 – 0.77	0.002

OR - odds ratio; BMI - body mass index; WC - waist circumference.

individuals at higher risk for cardiovascular diseases.

It is noteworthy that, in the studied sample, the number of women was higher than the number of men and different from the expected through the distribution of the population by sex. There was, at the moment of data collection, a concern regarding a possible selection bias, but the systematic quality control of the research showed that this was a random fact and thus, no strategies were used to correct such difference. The values obtained, however, maintained their statistical significance even after correction for this sample difference. As the frequency of AH was higher among men, there could be a possibility that, for this reason, there would an underestimation of the prevalence of hypertension in the total population, which does not invalidate, but rather reinforces, the importance of the obtained data.

We must emphasize that, in order to adopt CVD prevention strategies, it is not enough to know the isolated prevalences of the risk factors, but it is also necessary to know the factors that are independently related to them. In this sense, two case-control studies were published a few years ago, which showed a significant importance for populations around the world and particularly for populations in our continent.

The first study, AFIRMAR[32], published in 2003, was developed in 104 hospitals from 51 Brazilian cities and was designed to evaluate risk factors for a first acute myocardial infarction (AMI) in our country. A total of 1,279 patients with AMI were paired for age and sex with the same number of controls. This study demonstrated that smoking, diabetes, central obesity, family history, dyslipidemia, arterial hypertension, lower socioeconomic status and lower level of schooling were independent risk factors, indicating that Brazil has the same risk distribution seen in the rest of the world.

The second study, INTERHEART[33], was more comprehensive. It involved 52 countries from the five continents, with more than 29,000 individuals between cases and controls. In this study, patients with AMI were also paired by age and sex with controls in hospitals or in the community. The study showed that the traditional risk factors (smoking, dyslipidemia, arterial hypertension, diabetes, central obesity, stress, moderate alcohol consumption, regular physical activity and fruit and vegetable consumption) were responsible positively (the first six) or negatively (the last three) for 90% of the attributable risk for men and 94% of the risk for women.

Both studies are complementary and reaffirm the importance of traditional risk factors (smoking, arterial hypertension, diabetes, central obesity, levels of cholesterol and family history) as responsible for the higher risk of coronary artery disease.

When we compare these data with the ones obtained in our study, i.e., data collected from a population of a small town located in the countryside, we see that some of the same risk factors are present or indicate that the possibility of outcome occurrence is equally important.

What can be observed when we look at the circumstances is that several regions of the world and populations at different stages of development are submitted to the same unfavorable conditions for the onset of cardiovascular diseases and it must be emphasized that most of these factors are preventable.

Thus, the results found in the present study show the necessity to implement measures to modify this scenario, through systematic interventions aimed at decreasing the prevalence of risk factors, which can contribute to a future that is different from the predicted one, regarding the main causes of morbidity and mortality as a whole.

Conclusion

The study carried out in Firminópolis found a high prevalence of AH, as well as excess weight and altered WC. There was a significant correlation between AH and age range, low level of schooling, BMI and WC. The female sex represented a protective factor for AH risk. These findings can be used as the basis for the implementation of actions that aimed at the effective control of BP and other cardiovascular risk factors in this population.

Such data reveal that AH is a significant problem in the urban area of the town of Firminópolis, state of Goiás, Brazil, showing a tendency that is higher than that seen in medium-sized and large urban centers and demonstrating that AH is a serious health problem among the population.

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Potential Conflict of Interest

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

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Study Association

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References

1. Brandão AP, Brandão AA, Magalhães MEC, Pozzan R. Epidemiologia da hipertensão arterial no Brasil. Rev Soc Cardiol Estado de São Paulo. 2003; 13 (1): 7-19.

2. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. Lancet. 2002; 360 (9349): 1903-13.

3. Mion Jr D, Kohlmann Jr O, Machado CA, Amodeo C, Gomes MAM, Praxedes

JN, et al/Sociedade Brasileira de Cardiologia. V Diretrizes brasileiras de hipertensão arterial. Arq Bras Cardiol. 2007; 89 (3): e24-e79.

4. The Pan American Health Organization Promoting Health in the Americas. CARMEN: Iniciative for integrated non-communicable diseases prevention in the Americas, 2004. [Access in 2008 Oct 15]. Available from: http://www.paho.org/english/ad/dpc/nc/carmen-info.htm.

5. Jardim PC, Gondim MR, Monego ET, Moreira HG, Vitorino PV, Souza WT, et al. High blood pressure and some risk factors in a Brazilian capital. Arq Bras Cardiol. 2007; 88 (4): 452-7.

6. Waeber B, Brunner HR. The multifactorial nature of hypertension: the greatest challenge for its treatment? J Hypertens. 2001; 3 (Suppl): S9-S16.

7. Costa EA, Rose GA, Kelin CH, Leal MC, Szwarcwald CL, Bassanesi SL, et al. Salt and blood pressure in Rio Grande do Sul, Brazil. Bulletin of PAHO. 1990. 24 (2): 159-76.

8. Freitas OC, Carvalho FR, Neves JM, Veludo PK, Parreira RS, Gonçalves RM, et al. Prevalence of hypertension in the urban population of Catanduva, in the State of São Paulo, Brazil. Arq Bras Cardiol. 2001; 77 (1): 6-21.

9. Nascente FMN, Jardim PC, Peixoto MR, Monego ET, Barroso WK, Moreira HG, et al. Hipertensão arterial e sua associação com índices antropométricos em adultos de uma cidade de pequeno porte no interior do Brasil. Rev Assoc Med Bras. 2009; 55 (6): 716-22.

10. Instituto Brasileiro de Geografia e Estatística (IBGE). Cidades. [Acesso em 2008 set. 10]. Disponível em: http://www.ibge.gov.br/cidades

11. Lessa I. Prevalência da hipertensão arterial sistêmica e da insuficiência cardíaca no Brasil. Rev Bras Hipertens. 2001; 8 (4): 383-92.

12. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. The Seventh Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure: The JNC 7 report. JAMA. 2003; 289 (6): 2560-72.

13. World Health Organization (WHO). Obesity: preventing and managing the global epidemic. Geneva: WHO; 1997.

14. Victora CG, Huttly SR, Fuchs SC, Olinto MTA. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol (London). 1997; 26 (1): 224-7.

15. Castanheira M, Olinto MTA, Gigante DP. Associação de variáveis sócio-demográficas e comportamentais com a gordura abdominal em adultos: estudo de base populacional no Sul do Brasil. Cad Saúde Pública. 2003; 19 (supl 1): S55-65.

16. Martins IS, Marinho SP. O potencial diagnóstico dos indicadores da obesidade centralizada. Rev Saúde Pública. 2003; 37 (6): 760-7.

17. Mill JG, Molina MCB, Silva IO, Marquezini AJ, Ferreira AVL, Cunha RS, et al. Epidemiologia da hipertensão arterial na cidade de Vitória - Espírito Santo. Rev Hipertens Art. 2004; 7 (3): 109-16.

18. Gus I, Harzheim E, Zallavsky C, Medina C, Gus M. Prevalência, reconhecimento e controle da hipertensão arterial sistêmica no Estado do Rio Grande do Sul. Arq Bras Cardiol. 2004; 83 (5): 424-8.

19. Vargas CM, Ingram DD, Gillum RF. Incidence of hypertension and educational attainment: the NHANES I Epidemiologic Followup Study. Am J Epidemiol. 2000; 152 (3): 272-8.

20. Brasil. Ministério da Saúde. Coordenação de Doenças Cardiovasculares. Doenças Cardiovasculares no Brasil. Sistema Único de Saúde – SUS/MS. Brasília-DF. 2003.

21. Ministério da Saúde. Saúde Brasil 2004: uma análise da situação de saúde. Brasília-DF; 2004.

22. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Atenção à Saúde. Instituto Nacional do Câncer. Coordenação de Prevenção e Vigilância. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis: Brasil, 15 Capitais e Distrito Federal. Rio de Janeiro: INCA; 2004.

23. Stamler J, Elliott P, Appel L, Chan Q, Buzzard M, Dennis B, et al. Higher blood pressure in middle-aged American adults with less education – role of multiple dietary factors: The INTERMAP Study. J Human Hypertens. 2003; 17 (9): 655-64.

24. Avila AL, Chediac AL, Silva CC, Van Aanholt D, Lopes GC, et al. Sociedade de Cardiologia do Estado de São Paulo. I Diretrizes nutricionais em cardiologia. Rev Soc Cardiol Estado de São Paulo. 2001; 11 (3 supl. A): 21-57.

25. Cabral PC, Melo AMC, Amado TCF, Santos RMAB. Avaliação antropométrica e dietética de hipertensos atendidos em ambulatório de um hospital universitário. Rev Nutr. 2003; 16 (1): 61-71.

26. Rosini N, Machado NJ, Xavier HT. Estudo de prevalência e multiplicidade de fatores de risco cardiovascular em hipertensos do município de Brusque, SC. Arq Bras Cardiol. 2006; 86 (3): 219-22.

27. Carneiro G, Faria AN, Ribeiro FF, Guimarães A, Lerário D, Ferreira SRG, et al. Influência da distribuição da gordura corporal sobre a prevalência de hipertensão arterial e outros fatores de risco cardiovascular em indivíduos obesos. Rev Assoc Med Bras. 2003; 49 (3): 306-11.

28. Mueller WH, Wear ML, Hanis CL, Emerson JB, Barton SA, Hewett-Emmett B, et al. Which measure of body fat distribution is best for epidemiologic research? Am J Epidemiol. 1991; 133 (9): 858-69.

29. Fuchs FD, Gus M, Moreira LB, Moraes RS, Wiehe M, Pereira GM. Anthropometric indices and the incidence of hypertension: a comparative analysis. Obes Res. 2005; 13 (9): 1515-7.

30. Tinoco ALA, Brito LF, Sant'Ana MSL, Abreu WC, Mello AC, Silva MMS, et al. Sobrepeso e obesidade medidos pelo índice de massa corporal, circunferência da cintura e relação cintura/quadril, de idosos de um município da Zona da Mata Mineira. Rev Bras Geriatr Gerontol. 2006; 9 (2): 46-51.

31. Peixoto MRP, Benício MHD, Latorre MRDO, Jardim PCBV. Circunferência da cintura e índice de massa corporal como preditores da hipertensão arterial. Arq Bras Cardiol. 2006; 87 (4): 462-70.

32. Piegas LS, Avezum A, Pereira JC, Castello MT, Palacio MA, Ramos RF, et al. Risk factors for myocardial infarction in Brazil. Estudo AFIRMAR - Avaliação dos fatores de risco associados com infarto agudo do miocárdio no Brasil. Am Heart J. 2003; 146 (2): 331-8.

33. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. INTERHEART Study Investigators. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet. 2004; 364 (9438): 937-52.