

# HYPERTENSION AND ITS ASSOCIATION WITH ANTHROPOMETRIC INDEXES IN ADULTS OF A SMALL TOWN IN BRAZIL'S COUNTRYSIDE

FLÁVIA MIQUETICHUC NOGUEIRA NASCENTE<sup>1\*</sup>, PAULO CÉSAR BRANDÃO VEIGA JARDIM<sup>2</sup>, MARIA DO ROSÁRIO GONDIM PEIXOTO<sup>3</sup>, ESTELAMARIS TRONCO MONEGO<sup>4</sup>, WEIMAR KUNZ SEBBA BARROSO<sup>5</sup>, HUMBERTO GRANER MOREIRA<sup>6</sup>, PRISCILA VALVERDE DE OLIVEIRA VITORINO<sup>7</sup>, LUIZ NAZÁRIO SCALA<sup>8</sup>

Research conducted at the Liga de Hipertensão Arterial of the Hospital das Clínicas da Universidade Federal de Goiás, Brazil

## ABSTRACT

**OBJECTIVE.** Estimate the prevalence of Hypertension in adults and its association with the Body Mass Index (BMI) and Waist Circumference (WC).

**METHODS.** It is a descriptive, observational, and cross-sectional study, population-based, with simple random sample ( $\geq 18$  years old). 1,168 individuals were investigated. Standardized questionnaires. Arterial pressure measures (criterion: HA  $\geq 140 \times 90$  mmHg), weight, height and waist circumference were taken. Data were stored (Microsoft Access software) and analyzed with the Epi-info, 3.3.2.

**RESULTS.** Dominance of the female sex (63.2%), medium age of  $43.2 \pm 14.9$  years. Prevalence of arterial hypertension of 32.7%, tending to be higher among men (35.8%) than women (30.9%) ( $p=0.084$ ). Positive association ( $p<0.001$ ) of hypertension with age, BMI, and WC. Overweight prevalence of 33.7% and obesity of 16.0%. Overweight was higher in men, and obesity in women. Prevalence of enlarged and very enlarged WC in 51.9% of the population studied, 28.6% among men, and 65.5% among women.

**CONCLUSION.** A high prevalence of hypertension and a big number of individuals with BMI and WC over ideal values were found.

**KEYWORDS:** Hypertension. Body mass index. Waist circumference. Overweight. Obesity.

## \*Correspondence:

Avenida T-14 nº 961 –  
Apto.604  
Goiânia-GO  
CEP 74230-130

## INTRODUCTION

Hypertension is considered a public health problem due to its magnitude, risk, and difficulty to control. It is a common, asymptomatic, and readily detectable disease, generally of easy treatment, and that tends to generate lethal complications when not treated.<sup>1</sup>

The heightening of arterial pressure (AP) represents an independent, linear, and continuous risk factor to cardiovascular disease.<sup>2</sup> Hypertension presents high medical and socio-economic costs, resulting mainly from its complications, such as cerebrovascular disease, coronary artery disease, cardiac insufficiency, chronic renal insufficiency,

and peripheral vascular disease.<sup>3,4</sup>

According to criteria established by the V Diretrizes Brasileiras de Hipertensão Arterial (V Brazilian Guidelines on Hypertension), AP is considered normal when Systolic Arterial Pressure (SAP) is lower than 130 mmHg and the Diastolic Arterial Pressure (DAP) is lower than 85 mmHg.<sup>3</sup> Those with AP between 130 and 139 mmHg to SAP and 85 to 89 mmHg to DAP are considered limitrophe cases. Finally, the individuals with AP  $\geq 140$  mmHg for SAP and/or  $\geq 90$  mmHg for DAP are considered hypertension sufferers.<sup>3</sup>

In a study conducted in Goiânia, hypertension indicators showed alarming indexes, with a prevalence of 36.4%,

1 Especialista em Reabilitação Cardiovascular, Goiânia, GO

2 Doutorado em Medicina pela Universidade de São Paulo; Professor adjunto da Faculdade de Medicina da Universidade Federal de Goiás e coordenador da Liga de Hipertensão Arterial do Hospital das Clínicas da Universidade Federal de Goiás –UFG, Goiânia,GO

3 Doutorado em Saúde Pública pela Universidade de São Paulo, coordenadora e professora da Faculdade de Nutrição da Universidade Federal de Goiás – UFG, Goiânia, GO

4 Doutorado em Ciências da Saúde pela Universidade Federal de Goiás e professora da Faculdade de Nutrição da Universidade Federal de Goiás, Goiânia, GO

5 Mestrado em Ciências da Saúde pela Universidade Federal de Goiás e professor da Faculdade de Medicina da Universidade Federal de Goiás, Goiânia, GO

6 Graduação em Medicina pela Universidade Federal de Goiás- Cardiologista, Goiânia - GO

7 Mestrado em Ciências da Saúde pela Universidade Federal de Goiás e professora da Universidade Católica de Goiás, Goiânia, GO

8 Doutorado em Medicina pela Universidade Federal de São Paulo e professor adjunto da Faculdade de Medicina da Universidade Federal de Mato Grosso, Cuiabá, MT

being higher in men (41.8%) than in women (31.8%).<sup>5</sup> As occurred in this study, high hypertension prevalence has been observed both in big municipalities, as Catanduva-SP (31.5%),<sup>6</sup> Fortaleza-CE (22.5%),<sup>7</sup> Cuiabá-MS (33.4%),<sup>8</sup> and in small municipalities, such as Bambuí-MG (24.8%),<sup>9</sup> and Cianorte-PR (35.5%).<sup>10</sup>

In addition to genetic components, environmental and behavioral factors have an important participation in the development of hypertension.<sup>11</sup> Inadequate lifestyle and eating habits can be responsible for the presence of this morbidity in a great number of cases. In Brazil, as in the whole world, various epidemiologic studies have been associating the AP levels to sociodemographic features (such as age group, ethnic group, social and socioeconomic level), alcohol consumption, sodium ingestion, stress, diabetes, obesity, and sedentarianism. There are also some risk factors that interact with the AP and increase the possibility of cardiovascular diseases, such as smoking and dyslipidemias.<sup>12,6</sup>

Overweight is characterized by the weight over values considered adequate and constitutes a risk factor, responsible for early mortality and cardiovascular diseases. Obesity is characterized by the high presence of adipose tissue in relation to the quantity of other tissues. This increase, most of the times, is caused by the imbalance between calories' ingested and calories lost.<sup>13</sup>

Adipose tissue's increase in the abdominal region, known as abdominal or android obesity, is considered a risk factor for many pathologies, representing a differentiated risk when compared to other forms of body fat distribution.<sup>14,15</sup>

Various studies have been consistent in pointing Waist Circumference (WC) as the anthropometric measure more correlated to the visceral adipose tissue quantity.<sup>16,17,18</sup> Recently, due to its practical quality, the urgent need of using WC measure as routine for patient's clinical assessment was highlighted.<sup>19</sup>

Having in mind that hypertension is a multifactorial chronic disease, in which the individual might be surprised by its complications; having in mind also that the so called epidemic of obesity adds risk to the development of hypertension, it was considered as convenient to study these issues with the objective of estimating the prevalence of hypertension and its association to the Body Mass Index (BMI) and with the WC in the adult population of the municipality of Firminópolis, a small town of rural characteristics in the State of Goiás.

## METHODS

Observational study with cross-sectional design, population-based, conducted in Firminópolis, a town in the

countryside of the State of Goiás. The study included a sample of adults  $\geq 18$  years old, who lived in the town's urban area, in the year of 2002.

Part of the data from the prevalence study and the knowledge about hypertension and some risk factors in a region of Brazil, Projeto Centro-Oeste de Pesquisa, were used for this project. The original project was approved and financed by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council of Scientific and Technological Development; CNPq), and was performed by teams of the Liga de Hipertensão Arterial of the Universidade Federal de Goiás (LHA/UFG) and of the Universidade Federal de Mato Grosso (UFMT). It was approved by the Human and Animal Research Ethics Committee of the Hospital de Clínicas of the UFG. All the participants signed an informed consent protocol.

The size of the sample was calculated over a population of 9,666 inhabitants,<sup>20</sup> with hypertension prevalence of 25%,<sup>21</sup> confidence interval of 95%, and estimation error of 10%, with an  $n=1030$  obtained. To this total were added 20% to cover eventual losses ( $n=1236$ ). The size actually studied consisted of 1,168 individuals over 18 years old (430 men and 738 women).

The size of the sample enabled the estimation of the hypertension prevalence in the municipality of Firminópolis with a maximum error of 3.8% and 2.9 % for men and women, respectively. Probabilistic sampling, used in this study, ensures the representativeness of all the elements of the population.

Households were selected by probabilistic sampling, in two phases. The first one consisted of the identification, along with the town hall, of the households in the urban area of the municipality. The second phase consisted of a systematic random selection of the 1236 households, given that in each only one inhabitant was interviewed, randomly selected among the inhabitants who were over 18 years old.

More frequent losses ( $n = 158$ , 11.9%) were due to empty households or inhabitants who were not located after three visits in different days or times.

Data collection was performed by previously trained interviewers. For measuring AP, semiautomatic OMRON-HEM 705 CP devices were used. The devices were periodically confronted to a mercury sphygmomanometer to ensure their precision.<sup>5</sup> The technique for measuring AP followed the recommendation of the III Consenso Brasileiro de Tratamento da HA<sup>22</sup> (III Brazilian Consensus for the Treatment of Hypertension).

Individuals who presented SAP  $\geq 140$  mmHg and/or DAP  $\geq 90$  mmHg, or individuals who were taking anti

hypertensive medication were defined as hypertensive. AP was checked twice, the first time in the beginning, and the second in the end of the interview, always with a minimum interval of 5 minutes between them. The second measurement of the AP was considered for the analysis.

Individuals were weighted in orthostatic position, with the arms stretched along the body, without shoes and wearing light clothes. A PLENA weighing scale, GIANT LITHIUM model, with maximum capacity of 150 kg, and precision of 100g was used.<sup>5</sup> For obtaining their height, the individuals studied had their shoes off, and a SECA stadiometer, model 206, with precision of 0.1cm<sup>5</sup> was used.

For calculating the BMI, the weight of the individual was used (in kilograms), divided by their height (in meters) squared. The values of BMI were classified as: BMI ≤ 24.9 kg/m<sup>2</sup> (low weight/normal); BMI equal to 25-29.9 (overweight), and BMI ≥ 30 kg/m<sup>2</sup> (obesity).<sup>23</sup>

For measuring the WC, a tape measure was used, with the patient standing, erect, with the arms loose along the body, wearing as few pieces of clothing as possible. The WC was measured in the horizontal plane in the medium spot between the lateral iliac crest and the last rib. The WC was classified as normal, enlarged and very enlarged, according to the values of <94cm, between 94cm and 102cm, and >102cm in men; and <80cm, between 80 and 88cm and >88cm in women, respectively.<sup>3</sup>

After the collection, data were inserted in duplicate, using the *Microsoft Office Access* software. The final data bank was analyzed using the 3.3.2 *Epi-info* software. The Chi-square test was applied to verify the association between variables (categorical nominal variables). The BMI and the WC were tested separately in logistic regression models, adjusted by age and years of instruction. Due to the high collinearity between BMI and WC, these measures were not placed as independent variables in the same regression model, having hypertension as conclusion. The level of significance was considered to be p<0.05, and the level of confidence, 95%. Absolute and relative frequencies of analyzed data were identified in figures and tables.

**RESULTS**

1,168 individuals were investigated, representing 12% of the municipality's population. There was a dominance of the female sex, which corresponded to 63.2% of the interviewees. The average age was 43.3±14.9, with a minimum of 18 and a maximum of 78 years. Men and women presented significant difference (p<0.001) in SAP, PAD, and WC (Table 1).

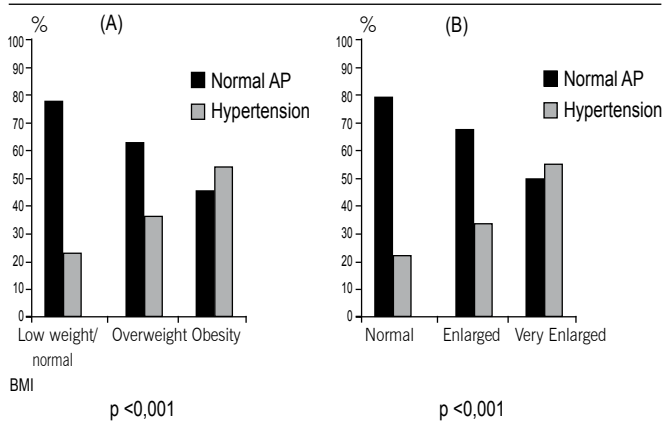
A prevalence of hypertension of 32.7% was found

**Table 1. Averages and standard deviations of variables selected according to sex. Firminópolis-GO, Brazil, 2002.**

Variables	Sex		Total (n=1168)
	Male (n=430)	Female (n=738)	
Age (years)	44.1±15,1	42.8±14.7	43.3±14.9
Instruction (years)	5.9±4.1	5.5±4.0	5.7±4.0
SAP (mmHg)*	128.9±20.3	118.7±23.7	122.5±23.1
DAP (mmHg)*	81.8±12.4	78.1±14.8	79.5±14.0
BMI (kg/m <sup>2</sup> )	25.3±3.9	25.7±5.6	25.5±5.1
WC (cm)*	87.0±11.3	85.2±12.3	85.8±11.9

\*p<0,001. Abbreviations: SAP (systolic arterial pressure); DAP (diastolic arterial pressure); BMI (body mass index); WC (waist circumference)

**Figure 1 – Distribution of the individuals according to hypertension and Body Mass Index (BMI) (A), and according to hypertension and waist circumference (WC) (B). Firminópolis-GO, Brazil, 2002.**



in the population, which usually was higher in male individuals (35.8%), if compared to the female ones (30.9%). However, no significant difference was observed (p=0.084).

There was a positive association between the prevalence of hypertension and the age increase, the prevalence being of 14% in the age group that ranges from 30 to 39 years, increasing to 34.6% from 40 to 49 years, and reaching 63.1% in those who were 60 years old or over (p<0.001).

The BMI indicated that 49.7% of the population presented excessive weight (33.7% overweight and 16%

**Table 2. Raw and adjusted odds ratio (OR) for hypertension according to the Body Mass Index and Waist Circumference by sex. Firminópolis-GO, Brazil, 2002**

Variables	N	Raw OR	IC 95%	OR adjusted <sup>1</sup>	IC 95%
<b>Men</b>					
Body mass index					
< 25 kg/m <sup>2</sup>	209	1.00	-	1.00	-
25 to 29 kg/m <sup>2</sup>	178	1.22	[0.80 ; 1.85]	1.52	[0.95 ; 2.45]
≥ 30 kg/m <sup>2</sup>	43	1.80	[0.92 ; 3.51]	2.34	[1.13 ; 4.85]
Waist circumference					
< 94 cm					
94 to 102 cm	307	1.00	-	1.00	-
≥ 102 cm	92	2.41	[1.49 ; 3.88]	2.21	[1.31 ; 3.74]
	31	3.34	[1.56 ; 7.09]	3.24	[1.41 ; 7.42]
<b>Women</b>					
Body mass index					
< 25 kg/m <sup>2</sup>					
25 to 29 kg/m <sup>2</sup>	378	1.00	-	1.00	-
≥ 30 kg/m <sup>2</sup>	216	2.58	[1.76 ; 3.77]	2.12	[1.36 ; 3.29]
	144	6.03	[3.95 ; 9.19]	5.34	[3.28 ; 8.68]
Waist circumference					
< 80 cm					
80 to 87cm	255	1.00	-	1.00	-
≥ 88 cm	191	3.34	[1.71 ; 6.53]	2.47	[1.39 ; 4.80]
	292	4.84	[3.15 ; 7.44]	3.02	[1.87 ; 4.87]

<sup>1</sup>Adjusted according to age and instruction.

obesity). Among men, 41.4% presented overweight, and 10%, obesity. In relation to the women, 29.3% were considered overweight and 19.5% obese. Men had higher overweight than women ( $p < 0.001$ ). Female individuals, on the other hand, had higher obesity when compared to individuals of the opposed sex ( $p < 0.001$ ).

There was a progressive and significant rise in the BMI across the different age groups ( $p < 0.001$ ). As was observed in Figure 1, there was a positive association between hypertension and BMI ( $p < 0.001$ ). The prevalence of hypertension among individuals with overweight was of 36.5%, and among the obese ones was of 54.5%.

There was also a progressive and significant rise of the WC proportional to the age rise ( $p < 0.001$ ). There was equally a positive association between WC and hypertension ( $p < 0.001$ ).

An enlarged and very enlarged WC was observed in 51.9% of the studied individuals. Among men, 28.6%

presented altered WC (enlarged and very enlarged), while 65.5% of the women also presented this cardiovascular risk factor ( $p < 0.001$ ).

The multiple logistic regression analysis showed that the odds ratio for hypertension was around twice or thrice higher for men with elevated values of WC ( $\geq 94$  cm and  $\geq 102$  cm) if compared to the referential category ( $< 94$  cm). Obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) presented an association with hypertension when adjusted by age and years of instruction, given that the magnitude of this association was close to values observed to a very enlarged WC. For women, the elevated values of BMI and WC presented an association with hypertension in the adjusted models, and the women with WC  $\geq 88$  cm presented an increase of 3.7 times in the odds ratio, and those with BMI  $\geq 30$  kg/m<sup>2</sup> an increase of 5.3 times if compared to the referential categories. Table 2.

## DISCUSSION

The prevalence of 32.7% of hypertension found was very close to the one obtained in three other studies conducted in the same region (Center-West), using the same methodology. In surveys conducted in the cities of Cuiabá and Goiânia, considered big, and in Nobres, a town in the State of Mato Grosso (MT), the values obtained were 33.4% in Cuiabá,<sup>8</sup> 36.4% in Goiânia,<sup>5</sup> and 30.1% in Nobres,<sup>24</sup> revealing a consistency in data observed and firmly indicating that this is the average prevalence in the region.

Moreover, the percentage of individuals with hypertension found in our research and in the other cities of the Center-Western region showed values equal to the one observed in various other population-based Brazilian studies carried out in other regions of the country.<sup>3</sup> The prevalence of hypertension found varied between 20% and 44%, and this fact strongly indicates that, in the country considered as a whole, the percentage of hypertension sufferers must have values around 30%.<sup>3</sup>

The main limitation of this study is its cross-sectional design, which does not permit to safely establish the precedence in time between the variables investigated and the conclusion. Other limitation that must be highlighted is the higher percentage of women interviewed, which suggests a tendency in the selection. Among the probable explanations to this fact is the bigger difficulty in finding men in the households in comparison to women. The positive point is the fact that it is a population-based research, with data collection carried out in the interviewees' houses by well-trained interviewers.

However, the size of the sample, for both sexes, was sufficient to assess the associations made in this study, the possibility of men who did not respond being different to the ones who did respond. Among the probable explanations to this fact is the bigger difficulty in finding men in the households in comparison to women.

In the Firminópolis study the findings also showed a big number of individuals with weight over the ideal, existing 49.7% of individuals with weight above what is desired (overweight and obesity), the women being more obese, and men more overweight. This finding is also very close to the ones obtained in other studies in the Center-Western region: 43.65% in Goiânia,<sup>5</sup> 50.80% in Cuiabá,<sup>8</sup> and 49.05% in Nobres,<sup>24</sup> the same can be said about various Brazilian regions, pointing to the importance of this anthropometric alteration in the country as a whole.

In a study conducted in São Paulo, similar to various others that evaluated the influence of body fat distribution on the prevalence of hypertension and other cardiovascular

risk factors, it was found that the obese individuals have a higher predisposition to present cardiovascular problems than individuals of normal weight.<sup>25</sup> The authors, in São Paulo reported a prevalence of hypertensive individuals with overweight of 23% and others with obesity of 67.1%.

With the available information,<sup>26,27,28,29</sup> the close association of WC with BMI, its increase with the age and the bigger risk of hypertension are consolidated, and these indicators can be used in conjunction or isolatedly.<sup>30</sup>

There is also an important relation between WC and the probability of emerging cardiovascular events due to movable fat deposition in abdominal region,<sup>31</sup> and regardless of the BMI value, the WC is recognized as a predictive factor of cardiovascular disease.<sup>32,33</sup>

Information obtained in Firminópolis indicates that there was also, similarly to what was observed in various other population-based studies, a positive association between hypertension, age, BMI,<sup>7</sup> and WC.<sup>34,35</sup> The multiple logistical regression analysis showed that increased levels of BMI and WC presented association with risk of hypertension to both sexes.

Enlarged WC is one of the criteria used in the definition of the Metabolic Syndrome, given that the International Diabetes Federation (IDF), in 2005, proposed as normality for this parameter values <80 cm (women) and <90 cm (men); cut points established for South Asians, which must be used also for South American or Central American individuals. When these cut points were tested in the multiple logistic regression model, the values of the odds ratio were close to the average of the values found for the two cut points analyzed in this study (results not presented). Other epidemiologic studies have observed similar results to those of Firminópolis.<sup>30,36</sup>

It is important to take into consideration that the WC's measure is a very simple, low cost procedure; once it is incorporated as routine in the patients' evaluation, it can bring great advantages in terms of investigation and possibilities of measures for controlling the nutritional state and cardiovascular risk, given that only a tape measure is necessary to perform it.

The great prevalence of hypertension in obese individuals have been attributed to hyperinsuline (resulting from resistance to insulin), mainly in individuals that present excessive fat in the abdominal region. This excess of insulin provokes the activation of the Sympathetic Nervous System and a higher sodium absorption, resulting in an increase in peripheral vascular resistance and in AP.<sup>25</sup>

What draws attention and justifies the undertaking of the investigation in Firminópolis is the fact that a small

urban nucleus, with features apparently closer to those of a rural population, have presented such a high prevalence of hypertension, beside showing anthropometric indicators of obesity and overweight with significant deviations that add important morbimortality risk.

The findings in Firminópolis indicate that even in small towns, with urban characteristics different from big centers, there is already an association among these cities, such as similar prevalence found in other studies, both in Brazil and abroad.

In face of that, it is necessary to intensify control programs for hypertension and other cardiovascular risk factors, even in all the types of urban nuclei, aiming at diminishing cardiovascular diseases and improving the populations' quality of life.

The whole and the uniformity of the pieces of information currently existing lend consistency to the findings and warn us about the importance of the specific researches that characterized the population under health perspective, both in local and regional levels. At the same time they reinforce the idea that, in the country as a whole, there is already sufficient information for a global planning, even if, giving local features the due respect, to its implementation.

Public policies in every level that aim at modifying life habits and preventing risk factors detected, associated with actions to adequately confront of those already existing (hypertension, obesity, and others) may change history and ensure a longer and healthier life to the population.

## CONCLUSION

The hypertension, BMI and WC indicators appeared as high and there was also positive association between those and hypertension.

The Firminópolis study's findings reflect a risk in the population of developing cardiovascular diseases. Besides that, due to the fact that data are too similar to those found in big cities, there is the impression that more important than the dimension of the urban nucleus are the life habits that end up incorporating important risks to the population.

## FINANCIAL SUPPORT:

Trabalho original financiado pelo Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

**No conflicts** of interest declared concerning the publication of this article.

## REFERENCES

- Williams GH. Doença vascular hipertensiva. In: Fauci As, Braunwald E, Isselbacher KJ, Wilson JD, Martin JB, Kasper DL, et al. Harrison: medicina interna. Rio de Janeiro: McGraw-Hill Interamericana do Brasil; 1998.
- Lewington S, Clarke R. Age-specific relevance of usual blood pressure to vascular mortality. *Lancet*. 2002;360:1903-13.
- Sociedade Brasileira de Hipertensão. Sociedade Brasileira de Cardiologia. Sociedade Brasileira de Nefrologia. V Diretrizes Brasileiras de Hipertensão Arterial. São Paulo; 2006.
- The Pan American Health Organization Promoting Health in the Americas. CARMEN: Initiative for integrated non-communicable diseases prevention in the Americas, 2004 [citado 15 out 2008]. Disponível em: <http://www.paho.org/english/ad/dpc/nc/carmen-info.htm>.
- Jardim PCBV, Gondim MRP, Monego ET, Moreira HC, Vitorino PV, Souza WK, et al. High blood pressure and some risk factors in a Brazilian capital. *Arq Bras Cardiol*. 2007;88:398-403.
- Freitas OC, Carvalho FR, Neves JM, Veludo PK, Parreira RS, Gonçalves RM, et al. Prevalência da hipertensão arterial sistêmica na população urbana de Catanduva - SP. *Arq. Bras Cardiol*. 2001;77:16-21.
- Feijão AMM, Gadelha FV, Bezerra AA, Oliveira AM, Silva MSS, Lima JWO. Prevalência de excesso de peso e hipertensão arterial em população urbana de baixa renda. *Arq Bras Cardiol*. 2005;84:29-33.
- Franco GP, Scala LCN, Alves JC, De França GVA, Cassanelli T, Jardim PCBV. Síndrome metabólica em hipertensos de Cuiabá-MT: prevalência e fatores associados. *Arq Bras Cardiol*. 2009. [No prelo]
- Barreto SM, Passos VMA, Firmo JOA, Guerra HL, Vidigal PG, Lima-Costa MFF. Hypertension and clustering of cardiovascular risk factors in a community in southeast Brazil - the Bambuí Health and Ageing Study. *Arq Bras Cardiol*. 2001;77:576-81.
- Oliveira RZ, Nogueira JL. Hipertensão arterial no município de Cianorte, estado do Paraná, Brasil. *Acta Scientiarum*. 2003;25:75-9.
- Waeber B, Brunner HR. The multifactorial nature of hypertension: the greatest challenge for its treatment? *J Hypertens Suppl*. 2001;19(Suppl 3):S9-16.
- Costa EA, Rose GA, Kelin CH, Leal MC, Szwarcwald CL, Bassanesi SL, et al. Salt and Blood pressure in Rio Grande do Sul, Brazil. *Bull PAHO*. 1990;24:159-76.
- Pierin AMG. Hipertensão arterial: uma proposta para cuidar. Baueri: Ed. Manole; 2004.
- Michels KB, Greenland S, Rosner BA. Does body mass index adequately capture the relation of body composition and body size to health outcomes? *Am J Epidemiol*. 1998; 147:167-72.
- Mollarius A, Seidell JC, Sans S, Tuomiheto J, Kuulasmaa K. Waist and hip circumferences, and waist-hip ratio in 19 populations of the WHO MONICA Project. *Int J Obes Relat Metab Disord*. 1999; 23:116-25.
- Clasey JL, Bouchard C, Teates CD, Riblett JE, Thorner MO, Hartman ML, et al. The use of anthropometric and dual-energy X-ray absorptiometry (DXA) measures to estimate total abdominal and abdominal visceral fat in men and women. *Obes Res*. 1999;7:256-64.
- Lemieux S, Prudhomme D, Bouchard C, Tremblay A, Després JP. A single threshold value of waist girth identifies normal-weight and overweight subjects with excess visceral adipose tissue. *Am J Clin Nutr*. 1996;64:685-93.
- Pouliot MC, Després JP, Lemieux S, Moorjani S, Bourchard C, Tremblay A, et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. *Am J Cardiol*. 1994;73:460-8.
- Scarsella C, Després JP. Tratamiento de la obesidad: necesidad de centrar la atención en los pacientes de alto riesgo caracterizados por la obesidad abdominal. *Cad Saúde Pública*. 2003;19(Suppl 1):S7-19.
- Instituto Brasileiro de Geografia e Estatística. Cidades. [citado set 2008]. Disponível em: <http://www.ibge.gov.br/cidades>.
- Ribeiro AB, Zanella MT, Kohlmann O. Tratamento da hipertensão arterial. Atualização em hipertensão arterial: clínica, diagnóstico e terapêutica. São Paulo: Atheneu; 1996. p.193-223.
- Sociedade Brasileira de Hipertensão Arterial. Sociedade Brasileira de Cardiologia e Sociedade Brasileira de Nefrologia. III Consenso Brasileiro de Hipertensão Arterial. Campos do Jordão; 1998.
- World Health Organization. Obesity. Preventing and managing the global epidemic. Geneva: Report of a WHO Consultation on Obesity; 1997.
- Rosário TMR, Scala LCN, Araújo GVA, França MRP, Jardim PCBV. Prevalência, controle e tratamento da hipertensão arterial sistêmica em Nobres-MT. *Arq Bras Cardiol*. 2009. [No prelo]
- Carneiro G, Faria NA, 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;49:306-11.
- 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;87:462-70.
- 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 Geriatria Gerontol*. 2006;9:46-51.
- 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 (Suppl 1):S55-65.
- Martins IS, Marinho SP. O potencial diagnóstico dos indicadores da obesidade

- centralizada. Rev Saúde Pública. 2003;37:760-7.
30. Gus M, et al. Waist circumference cut-off values to predict the incidence of hypertension: an estimation from a Brazilian population-based cohort. *Nutr Metab Cardiovasc Dis.* 2009;19:15-9.
31. Mueller WH, Wear ML, Hanis CL, Emerson JB, Hewett-Emmett D, Schull WJ, et al. Which measure of body fat distribution is best for epidemiologic research? *Am J Epidemiol.* 1991;133:858-69.
32. Porto CC. Doenças do coração. Prevenção e tratamento. 2ª ed. Rio de Janeiro: Ed. Guanabara Koogan; 2005. p.514-20.
33. Pereira RA, Sichiere R, Marins VMRV. Razão cintura/quadril como preditor de hipertensão arterial. *Cad Saúde Pública.* 1999;15:333-44.
34. 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;13:1515-7.
35. Hans TS, Van Leer EM, Seidell JC, Lean MEJ. Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample. *BMJ.* 1995;311:1401-5.
36. Alberti KG, Zimmet PZ, Shaw J. International Diabetes Federation: epidemiology task force consensus group: the metabolic syndrome: a new world wide definition. *Lancet.* 2005;366:1059-62.

---

Artigo recebido: 10/03/08  
Aceito para publicação: 13/03/09

---