# Original Article

# High Blood Pressure and some Risk Factors in a Brazilian Capital

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## Summary

**Objectives:** Estimate the prevalence of hypertension and some cardiovascular risk factors in the adult population of a major city in Brazil.

**Methods:** Descriptive, observational, transversal population-based study substantiated by the home survey of a simple random sample (>18 years old). Standardized questionnaires were used to obtain sociodemographic information, measurements of blood pressure (2 measurements), weight, height, and abdominal circumference (AC). Microsoft Access and Epi Info 6 were used for data storage and analysis, respectively. The last blood pressure reading was used (hypertension: BP≥140x90mmHg).

**Results:** The study evaluated 1,739 individuals (87% of the estimated sample). There was a predominance of females (65.4%) and mean age was 39.7 years (±15.6); arterial hypertension prevalence was 36.4%, higher for the male population (41.8%) when compared to females (31.8%). Correlation between Hypertension and Body Mass Index was positive, as well as with AC and age. The female gender and higher income were protective factors against hypertension. Prevalence of overweight and obesity were 30.0% and 13.6%, respectively; overweight was higher among females and obesity among males. The prevalence of smoking was 20.1%, more frequent among males (27.1%), when compared to females (16.4%). A sedentary lifestyle was observed in 62.3% of the population, with no difference between the genders. Regular alcohol consumption was reported by 44.4% of the individuals, being more frequent in males.

**Conclusion:** Hypertension and other cardiovascular risk factors (particularly overweight/obesity) indicators are high, reinforcing the need for objective nationwide measures to fight this disease, in order to reduce CVD morbidity and mortality.

**Key words:** Epidemiology of hypertension, high blood pressure, blood pressure, cardiovascular risk factors.

## Introduction

The significance of Arterial Hypertension (AH) as an important Cardiovascular Risk Factor (CRF), its high world prevalence and the increased probability of fatal or non-fatal circulatory events when other risk factors are associated to it, make the knowledge of its national and regional incidence a very important question, as well as its correlation with other possible elements that can be potential triggering factors of cardio-circulatory events[1-6].

The Brazilian epidemiological data on cardiovascular risk, although reliable due to the existence of well-designed and representative studies, are still restricted to some regions, which raises a few doubts whether the existing information represent the country as a whole[6-12].

Another aspect to be considered is the alteration of the Brazilian population profile regarding dietary and life habits, which indicates an increasingly severe exposition to cardiovascular risks. The change in the amount of food ingested and dietary composition has caused significant alterations in body weight and fat distribution, with the progressive increase in overweight or obesity prevalence among the population. This fact is added to the low frequency of physical activity, which also contributes to the building of this picture[13-14].

In the state of Goias in midwestern Brazil, as well as in the rest of the country, cardiovascular diseases represent the most important cause of morbimortality, which makes it so important to know the magnitude of CRF with the objective of establishing a healthcare plan, capable of applying an effective intervention in this reality[15].

The acknowledgement that changing life styles with the prevention of the onset of risk factors (RF) and adequate treatment of deviations of normality, when these are established (AH, obesity, sedentarism and dyslipidemias, among others), modify the evolution history of these injuries, makes the knowledge of its prevalence even more strategic[11,16-19].

With the objective of determining the prevalence of Arterial Hypertension and some other Cardiovascular Risk Factors (CRF), as well as their correlations within a region of Brazil, a study called the Midwestern Research Project was created, encompassing the Brazilian states of Goias and Mato

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## Methods

The present research project is a transversal, population-based study, carried out through home questionnaires, with a random sampling process with conglomerates. For the development of this study, data from the "Study of Prevalence and Knowledge of Arterial Hypertension and some Risk Factors in a Region of Brazil", a research project approved and supported by Conselho Nacional de Pesquisa (CNPq) and carried out by the team of the Arterial Hypertension League of the Federal University of Goias, in partnership with the Federal University of Mato Grosso, were used.

The sample size for the city of Goiania, the capital of the state of Goias, was calculated considering a population of 1,004,098 inhabitants, with an estimated prevalence of AH of around 20% (adult Brazilians), 95%CI and estimate error of 10%[7,20]. An extra 30% were added to the sample obtained (n=1,534) to cover losses, resulting in n=1,994. A total of 1,739 individuals were investigated, which represents 87% of the predicted sample.

The homes were selected by probabilistic sampling, per conglomerates in two phases. The first consisted in the identification, at IBGE (Brazilian Institute of Geography and Statistics), of the census sectors used in the National Research by Home Sampling (PNAD) of 1998, in the urban region of the city of Goiania; 15 of these sectors were then selected. Based on the calculation of the sample size, the homes in each sector were chosen at random and systematically.

At the selected homes, only one resident was interviewed, chosen among those older than 18 years of age, in order to avoid information interdependence among the interviewees. Pregnant women and those with children younger than 6 months were excluded, as well as inpatients. In case of refusal to participate, or if the chosen individuals were not found at home after two consecutive visits, the chosen home was excluded and substituted by the first home on the left.

Each interview was carried out by two researchers, adequately trained for the questionnaire use and for conducting the objective measurements, including blood pressure (BP), weight and abdominal circumference. A detailed instruction manual depicted the training and interview conduction. All interviewers wore the T-shirt and identification badge of the study, and carried a personalized presentation letter. The interviews were carried out from June to December 2002.

The questionnaire used was previously evaluated in a pilot study, and the flaws regarding question comprehension were corrected. The information included gender, age, socioeconomic data (schooling, number of residents in the house, monthly income per capita), habits of daily living (dietary habits, smoking, alcohol consumption, physical activity); knowledge about arterial pressure and treatment of the existing hypertension, if that was the case. The objective measurements of BP, weight, height and abdominal circumference were also obtained.

The variables included in the present study were:

• Socioeconomic and demographic data: Gender; age (in complete years, categorized in the age ranges: 18-29, 30-39, 40-49, 50-59, ≥74); schooling (in years of schooling: 0-3 yrs, 4-8 yrs and ≥9 yrs); monthly family income (up to ½, from ½ to 1, from 1 to 3 and > 3 minimum wages).

• Habits of daily living: Smoking, alcohol consumption and physical activity were evaluated based on a group of questions standardized by the "ORGANIZACIÓN PANAMERICANA DE LA SALUD" (1997), in the protocol of the CARMEN (Group of Actions for the Multifactorial Reduction of Non-transmissible Diseases) study [21]. Regarding smoking, the participants were categorized in three groups: those who never smoked, the ex-smokers (those who had stopped smoking for more than 6 months prior to the study) and smokers (those who currently smoke or stopped smoking less than six months prior to the study). Alcohol consumption was assessed based on questions about the consumption of alcoholic beverages (yes/no), the type of beverage, frequency and amount (doses, bottles or glasses) consumed during the previous week, with the consequent determination of the amount of grams of ethanol per day[1,3,22].

• Physical activity: Occupational physical activity was assessed in four categories of intensity of physical exertion: 1) sedentary – stays sitting most of the time or performs only slight-intensity home activities; 2) mild – walks a lot during work, without lifting or carrying heavy objects; 3) moderate – moves about frequently and carries some weight; 4) intense – performs extenuating work, which requires carrying heavy objects. Physical activity in leisure-time was categorized as: 1) sedentary – no physical activity, only activities such as reading and watching TV; 2) mild – occasional physical activities, such as walking, riding a bicycle and doing slight physical exercises; 3) moderate – regular physical activity (running, working out, swimming, team sports); 4) intense – training heavily several times a week or participating in sports competitions regularly. In the present study, categories 3 and 4 were grouped due to the small number of individuals in category 4.

• Arterial pressure: As this was a field research, with a large number of researchers and thus, subject to a large margin of error, an automated device – OMRON – HEM 705 CP – was used to measure BP. Each interviewee had his or her pressure measured twice: once at the beginning of the interview and another at the end, with an interval of at least 5 minutes between the two measurements. For the analysis, the second measurement was taken into account. The classification of individuals considered to be hypertensive followed the criteria established by the IV Brazilian Directives of Arterial Hypertension: systolic pressure ≥ 140 mmHg (PAS≥140 mmHg) and/or diastolic pressure ≥ 90 mmHg (PAD≥90 mmHg), or individuals who were known to be hypertensive and required regular use of anti-hypertensive drugs, whose pressure levels were elevated or not at the moment of the interview[1, 23,24].

• Anthropometry: All anthropometric measurements were carried out in standardized form. Weight was measured in a Plenna electronic scale, model Giant Lithium, with capacity for 150 kg and precision of 100 g. The individuals were weighed with no shoes and wearing light clothes. Height was measured in a portable Seca stadiometer, with a precision of 0.1 cm.

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The abdominal circumference (AC) measurement was carried out with an inextensible measuring tape at midpoint between the upper anterior iliac crest and the last rib. An AC < 80 cm, from 80 to 88 cm and ≥88cm for women and <94cm, from 94cm to 102cm and ≥ 102 for men was classified as adequate, increased and very increased AC, respectively[1]. Body mass index (BMI) was obtained by dividing the weight in kilograms by the square height in meters. BMI values were classified as: BMI <18.5kg/m² (low weight); BMI = 18.5-24.9kg/m² (normal); BMI = 25-29.9 (overweight) and BMI ≥30kg/m² (obesity).

The data from the interviews were stored in a Microsoft Access® 2000 database. All questionnaires were revised and the data were typed in duplicate and validated later.

Initially, prevalence estimates were made and means and raw odds ratio with confidence intervals (95% CI) were calculated. The association between the several variables and the presence of arterial hypertension was tested using the $x^2$ test with a level of significance of 5%. To estimate the independent effect of control variables on outcome (arterial hypertension), a multiple logistic regression analysis was used, and the variables tested in the model were those presenting p < 0.20 at the bivariate analysis. STATA (version 7.0)[17] was used for the analysis. The statistical analyses were corrected by the outline of complex of the sample, through the use of a set of *svy* commands that consider the complex structure of the sample, incorporating at the analyses the sample weights associated to each conglomerate of the sample. The level of significance was set at 5%.

This study project was approved by the Committee of Ethics in Research of Hospital das Clínicas of the Federal University of Goiás.

## Results

Of the 1,739 interviewed individuals, 64.9% were females. The mean age was 39.7 years (SD=15.6 years), with a median of 38 years.

A total of 551 individuals presented arterial pressure ≥140 and/or 90mmHg (SAP≥140mmHg and/or DAP≥90mmHg) and 82 individuals used anti-hypertensive drugs, totaling 633 individuals (36.4%) being classified as hypertensive (Figure 1). The prevalence of AH was 41.8% (95%CI: 38.0%



**Fig. 1 -** *Prevalence of Arterial Hypertension.*

- 45.7%) among males and 31.8% (95%CI: 28.1% - 35.7%) among females.

The prevalence of AH was higher among males and increased with age (p<0.001), being 16.7% in the age range of 18 to 29 years, progressively increasing to 73.9% in those older than 60 yrs. Schooling showed an inverse association with AH, with a prevalence of 47.5% among those with fewer years of schooling and 28.0% in those with more than 9 years (p<0.001). The *per capita* income and the marital status of the interviewees did not present any association with AH (Table1).

Regarding the life styles and variables related to health, the individuals who presented the highest prevalence of AH were: ex-smokers, those who referred regular consumption of alcohol, those who performed moderate or intense physical activity at work, those who presented some degree of overweight and those who had increased or very increased abdominal circumference (Table 2).

At the bivariate analysis, the raw odds ratio showed that the male sex, age, schooling, to stop smoking, alcohol consumption, overweight and increased or very increased abdominal circumference presented a positive association (p<0.05) with AH, whereas moderate or intense physical activity in leisure-time and mild physical activity at work presented a negative association (p<0.05).

Table 3 shows the multiple logistic regression analysis that reveals the independent influence of the sociodemographic variables, life styles and adiposity on AH. The adjusted odds ratio showed that the prevalence of AH is positively associated with the male sex and progressively and markedly increases with aging.

The positive associations of AH with excess weight (overweight and obesity) and increased and very increased AC were maintained, with the odds ratio for hypertension being two-fold higher with elevated AC values, in comparison with the category of reference (<80 cm for females and < 94 cm for males).

## Discussion

This study found a prevalence of arterial hypertension > 30% in the city of Goiania, state of Goias, Brazil. It is noteworthy that since the beginning of the 90's, in several regional studies using a BP value of 140/90 mmHg as cutoff, the prevalence of hypertension has remained around this percentage[9,10,11,12]. These percentage values have also been found in studies carried out in the USA[6].

The reasons for this picture, which is delineated from the results observed, can be found in the numbers shown by the study. The question raised is how working with the possible associated causes and aggravating factors that can help establish a direction for public health policies established by the government and those established by the organized civil society, that are capable of altering this scenario.

Similarly to several population-based studies[6,9,10], it was observed that there is an important association between AH and age, which shows that in a developing society, together with the increased longevity of the population, there is the
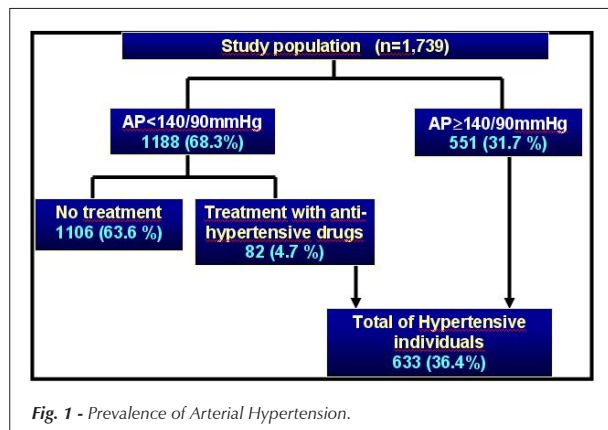
**Table 1 – Prevalence of arterial hypertension according to socio-demographic variables in the population older than 18 years in the city of Goiânia-GO, Brazil, 2001**

| Variable | N (1739) | Prevalence of AH | | Gross OR (95%CI) | p Value |
|---|---|---|---|---|---|
| | | n | % | | |
| Gender | | | p<0.01 | | |
| Female | 1130 | 378 | 31.8 | 1 | |
| Male | 609 | 255 | 41.8 | 1.54 (1.27 – 1.86) | 0,00 |
| Age (years) | | | p<0.01 | | |
| 18-29 | 530 | 86 | 16.7 | 1 | |
| 30-39 | 391 | 94 | 25.5 | 1.72 (1.25 – 2.34) | 0.001 |
| 40-49 | 338 | 136 | 38.2 | 3.09 (2.21 – 4.31) | 0.000 |
| 50-59 | 220 | 130 | 54.9 | 6.09 (4.08 – 9.09) | 0.000 |
| ≥60 | 260 | 187 | 73.9 | 14.15 (8.94 – 22.42) | 0.000 |
| Income (Minimum Wages) | | | p=0.50 | | |
| < 0.5 MW | 971 | 347 | 34.2 | 1 | |
| 0.5 – 0.9 MW | 374 | 135 | 36.2 | 1.09 (0.88 – 1.37) | 0.448 |
| 1.0 – 3.0 MW | 292 | 114 | 37.8 | 0.94 (0.94 – 1.46) | 0.164 |
| ≥ 3.0 MW | 102 | 37 | 38.8 | 1.22 (0.76 – 1.97) | 0.406 |
| Schooling | | | p<0.01 | | |
| 0 to 3 yrs | 292 | 160 | 47.5 | 1 | |
| 4 to 8 yrs | 642 | 242 | 36.6 | 0.64 (0.40 – 1.01) | 0.057 |
| ≥ 9 yrs | 805 | 231 | 28.0 | 0.43 (0.28 – 0.65) | 0.000 |
| Married status | | | p=0.39 | | |
| With spouse | 974 | 366 | 35.9 | 1 | |
| Without spouse | 764 | 266 | 34.3 | 0.93 (0.78 – 1.11) | 0.411 |

*AH - arterial hypertension; N and n - absolute number in the non-weighted sample; OR - odds ratio; PA - physical activity; BMI - body mass index; $p^1$ - p at the $x^2$ test.*

**Table 2 – Prevalence of arterial hypertension according to lifestyle and adiposity in the population older than 18 yrs in Goiânia-GO, Brazil, 2001**

| Variable | N (1739) | Prevalence of AH | | Gross OR (95%CI) | p Value |
|---|---|---|---|---|---|
| | | n | % | | |
| Cigarette smoking | | | $p^1$ <0.01 | | |
| Non-smoking | 997 | 318 | 29.8 | 1 | |
| Smoking | 350 | 119 | 32.4 | 1.12 (0.89 – 1.41) | 0.306 |
| Ex-smoker | 392 | 196 | 51.6 | 2.50 (1.85 – 3.37) | 0.000 |
| Alcohol consumption | | | p<0.01 | | |
| No | 772 | 237 | 30.2 | 1 | |
| Yes | 967 | 967 | 39.1 | 1.48 (1.22 – 1.79) | 0.000 |
| PA at leisure | | | p<0.14 | | |
| Sedentary | 1084 | 382 | 35.7 | 1 | |
| Slight | 472 | 201 | 38.3 | 1.12 (0.71 – 1.79) | 0.633 |
| Moderate | 183 | 50 | 24.0 | 0.57 (0.36 – 0.89) | 0.014 |
| PA at work | | | p<0.01 | | |
| Sedentary | 1240 | 474 | 37.8 | 1 | |
| Slight/Moderate | 408 | 121 | 27.4 | 0.62 (0.44 – 0.87) | 0.006 |
| Intense | 91 | 38 | 36.8 | 0.96 (0.28 – 0.61) | 0.855 |
| Overweight | | | p<0.01 | | |
| No (BMI < 25 kg/m2) | 978 | 242 | 25.6 | 1 | |
| Yes (BMI ≥ 25 kg/m2) | 759 | 390 | 48.8 | 2.78 (2.05 – 3.77) | 0.000 |
| Abdominal circumference | | | p<0.01 | | |
| Normal | 1069 | 264 | 25.1 | 1 | |
| Increased | 336 | 164 | 47.3 | 2.67 (2.09 – 3.40) | 0.000 |
| Very increased | 334 | 205 | 58.1 | 4.13 (2.55 – 6.71) | 0.000 |

*AH - arterial hypertension; N and n - absolute number in the non-weighted sample; OR - odds ratio; PA - physical activity; BMI - body mass index; $p^1$ - p at the $x^2$ test.*

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**Table 3 – Factors associated to arterial hypertension - identified by the multiple logistic regression analysis. Goiânia-GO, Brazil, 2001**

| Variables | OR | CI (95%) | p |
|---|---|---|---|
| **Gender** | | | |
| Female | 1 | - | - |
| Male | 1.86 | 1.47 – 2.35 | 0.000 |
| **Age range** | | | |
| 18-29 | 1 | - | - |
| 30-39 | 1.46 | 0.98 – 2.18 | 0.060 |
| 40-49 | 2.04 | 1.44 – 2.88 | 0.000 |
| 50-59 | 4.06 | 2.78 – 5.93 | 0.000 |
| ≥60 | 8.92 | 5.64 – 14.11 | 0.000 |
| **Overweight** | | | |
| No (BMI < 25 kg/m$^2$) | 1 | - | - |
| Yes (BMI ≥ 25 kg/m$^2$) | 1.44 | 1.13 – 1.83 | 0.004 |
| **Abdominal circumference** | | | |
| Normal | 1 | - | - |
| Increased | 1.76 | 1.34 – 2.30 | 0.000 |
| Very increased | 2.18 | 1.39 - 3.42 | 0.001 |

addition of other risk factors that end up impairing the quality of life of the elderly, as well as causing severe damage to the country and the public health system as a whole[25].

The worldwide epidemics of excess weight (whether overweight or obesity) has also been shown in this study[1,3,26,27]. In Goiania, 43.6% of the people have excess weight, 13.6% of whom are already obese. The strong association between excess weight and the occurrence of AH indicates how urgent the measures capable of acting on risk factors that can definitely interfere on the determination of AH prevalence in a population group are.

The Goiania study found, similarly to other studies, a positive correlation between AC and AH. This finding identifies a simple, low-cost and easy-to-apply measure as an important marker for AH and indicates one more path to follow, by encouraging the use of AC measurement as a routine healthcare assessment and the adoption of early preventive

measures in cases where discrepant values are found. This can also be a major issue for the better control of risk factors, preventing the onset of AH and promoting its control in situations where it is already established[28,29].

No association between AH and social class was observed, in opposition to what has been reported in other studies[9,30,31]. Regarding the educational level, there was no statistically significant association between schooling and hypertension at the adjusted analysis.

Finally, there was no correlation between smoking, alcohol consumption or sedentarism and the occurrence of AH. Nevertheless, sedentarism, although very frequent among the interviewees, was more frequent in the lower socioeconomic classes, exactly those where the risk of AH was more significant, which can be a complicating factor for prevention and treatment.

At the logistic regression analysis, age, BMI and AC maintained a positive correlation with AH, whereas the female sex represented a protection factor.

It is noteworthy the fact that, in the sample studied, the number of females was higher than that of males at random, and it was chosen not to use strategies to correct this difference. The values obtained, however, had statistical significance even after correction for this sample difference.

These data, when added to the others available in the country, show that there are sufficiently consistent data regarding the magnitude of arterial hypertension and some important cardiovascular risk factors in Brazil and allow us to carry out the objective planning of public health policies, aiming at better strategies to fight this health problem.

The actions must seek the better control of known hypertensive individuals, establishing goals to increase the degree of knowledge of these factors by the population directly involved with them, and mainly, to give the population in general more information regarding the prevention of the onset of risk factors and thus prevent cardiovascular diseases.

### Potential Conflict of Interest

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

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