

## Hypertension Prevalence in the City of Formiga, MG (Brazil)

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### Summary

**Objectives:** To estimate hypertension prevalence and identify associated socioeconomic, demographic, and anthropometric variables.

**Methods:** A cross-sectional study with probability sampling. Target population: people  $\geq 18$  years of age living in the urban area of Formiga, Minas Gerais state, and registered with the Family Health Program (Programa Saúde da Família - PSF), which covers 94% of the population. Two hundred and eighty-five subjects (131 men and 154 women) were enrolled in the study. Criteria for the diagnosis of hypertension were the following: systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg, or current use of antihypertensive medication. A standard questionnaire was used to collect socioeconomic and demographic data, as well as information on alcohol consumption, smoking, and physical activity level. Using appropriate techniques, trained interviewers with at least one year of experience in health care collected data and performed pertinent measurements (blood pressure, heart rate, plus waist and arm circumference).

**Results:** Overall prevalence of hypertension in the target population was estimated at 32.7% (95% CI: 28.2-37.2), 31.7% in men and 33.6% in women. Among subjects with prescribed antihypertensive drugs, 66% reported taking their medication regularly. Hypertension prevalence increased steadily with increasing age (OR = 1.07; 95% CI: 1.05-1.10) and was positively associated with waist circumference (OR = 3.05; 95% CI: 1.49-6.22) and negatively associated with the level of physical activity (OR = 0.45; 95% CI: 0.25-0.82).

**Conclusion:** Hypertension prevalence was very high in the adult population registered with the PSF in Formiga, representing a major public health problem. Intervention programs that boost physical activity, promote compliance with drug treatment, and focus on hypertensive subjects unaware of their condition are needed.

**Keywords:** Hypertension, prevalence, epidemiology

### Introduction

Hypertension compromises vital organs, and is considered a major public health problem and the most important risk factor for cardiovascular diseases<sup>1,2</sup>. Studies<sup>3-5</sup> show that a large part of hypertensive subjects are unaware of their condition, and that approximately 70% of those who are, do not have their blood pressure under control.

A number of studies about hypertension prevalence and associated factors have been published in the medical literature throughout the world. In Brazil, a nationwide study<sup>6</sup> on cardiovascular risk factors is currently under way, but most investigations are restricted to communities<sup>4,7</sup>, workers<sup>8</sup> or Brazilian states<sup>9</sup>. In Minas Gerais (MG), few studies<sup>10</sup> have been conducted, and the risk profile of people living in the urban areas of small towns is still unknown. Until 2003, the Formiga Health Department worked with a hypertension prevalence estimate of 11% among its adult population<sup>11</sup>.

This study was designed to estimate hypertension prevalence in the adult population of Formiga registered with the Family Health Program (which covers 94% of the

population), identify known risk factors associated with hypertension, and determine hypertension awareness and adherence to drug therapy, when applicable.

### Methods

Formiga lies in the midwestern region of Minas Gerais state, covers an area of 1404 km<sup>2</sup> and, in 2000, had 62,907 inhabitants<sup>12</sup>. Of these, 11.6% lived in the rural area. The percentage of people age  $\geq 60$  was 10.7%, very similar to that of the capital, Belo Horizonte, which had 9.2% in the same year.

From 2000 to 2002, circulatory system diseases were the leading cause of death in Formiga, and the primary cause of non-obstetric admissions in the Public Health System (SUS) from 2000 to 2003, outranking respiratory and digestive system diseases<sup>13</sup>.

In 2004, when this survey was conducted, the municipality had two hospitals, with a total of 139 beds, and 17 Family Health Program (PSF) teams. PFS coverage is wide, as it has approximately 94% of the population in its registers. Once data contained in the registration forms were validated, they were used to obtain the study sample. The target population was all subjects  $\geq 18$  years of age living in the urban area of the municipality that had been registered with the PSF in October 2003, which corresponded to 38,699 subjects. After stratification by PSF unit, gender, and age, a systematic

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random sampling was done.

Inclusion criteria were subjects  $\geq 18$  years of age living in the urban area of Formiga and registered with the PSF. Subjects who were not found at home after three attempts at different times were excluded, as were those with physical and/or mental limitations that would preclude interview and those who did not attend the rescheduled interviews twice. In case of change of address, the subject was replaced by another one previously determined during sampling.

Thirteen interviewers were selected, all of them PSF nursing assistants with at least one year of experience in the field. They were selected according to their availability and familiarity with the population seen at the health centers. The aim was to facilitate compliance with the study, since they were well known in the community.

To prevent any bias in blood pressure (BP) readings, such as preference for digits 0 and 5 or deeply-ingrained habits, duly calibrated digital devices (Omrom® HEM 705-CP) were used. These devices are recommended by the British Hypertension Society and the American Association for the Advancement of Medical Instrumentation<sup>14</sup>.

Before beginning data collection, interviewers were given an eight-hour course by a physician to update their knowledge of hypertension and standardize blood pressure measurement. Another two hours were spent in audiovisual presentations and clarification of any doubts. The interviewers were also instructed on some details about questionnaire administration and BP readings. Standard-size cuffs (12-cm) were used. Because of this, BP values were adjusted for arm circumference<sup>15</sup>, in order to further validate measurements.

The respondent was invited to go to the basic health unit of his/her neighborhood so that, in a quiet and ventilated environment, their BP could be measured twice, at the beginning and at the end of the interview; the mean value of the two measurements was used for the analysis. Respondents were classified as hypertensive according to criteria proposed by the WHO<sup>16</sup> and VII Joint National Committee<sup>17</sup>, in which hypertension is defined as systolic blood pressure (SBP)  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg, or current treatment with antihypertensive drugs.

Before commencing field work, a pilot test was performed

in a 10% subsample, to detect potential problems with the research tool. After being informed about their measurements, all respondents signed an informed consent; patients with hypertension were referred for clinical follow-up. This study was approved by the Research Ethics Committee of the São Paulo Federal University.

In addition to PA reading or the presence of hypertension (dependent variables), the following (independent variables) were of interest to the study: gender, age (in completed years, continuous or in categories), marital life (with or without), skin color (white or black/dark), schooling (lower or  $\geq$  elementary school), work (salaried or unsalaried and retired/pensioner); family income ( $\leq$  two or  $>$  two minimum wage), smoking (yes or no), weekly alcohol intake ( $< 30$  mL or  $\geq 30$  mL), level of physical activity according to the International Physical Activity Questionnaire (IPAQ), short version, proposed by the WHO<sup>18</sup>, and waist circumference (optimal:  $\leq 102$  cm for men and  $\leq 88$  cm for women). Previous knowledge of hypertension diagnosed by a physician and use of prescribed antihypertensive drugs were also evaluated.

Data were collected from April to July 2004 (14 weeks). Statistical analyses were performed using STATA™7.0 and Excel® 97 software.

Hypertension prevalence by gender was corrected for the respective age structures of the population so that it could be estimated for each gender. To eliminate the age problem when comparing genders, adjustment was made for the age structure of the whole population. Ninety-five per cent confidence intervals (95% CI) were calculated using Cochran's technique<sup>19</sup> for finite populations. In the logistic regression analysis, a univariate analysis was first performed, and those with  $p \leq 0.25$  were selected for multivariate analysis. Association measurements are shown in OR (odds ratio) with their respective 95% confidence intervals. A  $p$  value  $< 0.050$  was set as criterion for rejection of the null hypothesis.

## Results

Sample composition by gender and age bracket was very similar to that of the population registered in the PSF and also to the population living in the urban area of Formiga (Table 1). Of the 334 subjects randomly selected (155 men and 179 women)

Table 1 – Composition by gender and age group (%) of the study sample, urban population registered with the Family Health Program (PSF) in 2004, and the urban population from the year 2000 census conducted by the Brazilian Institute of Geography and Statistics (IBGE), Formiga, MG

Age group (years)	Sample		PSF population		IBGE population	
	Male	Female	Male	Female	Male	Female
18-24	8.7	10.8	9.2	9.7	9.5	9.5
25-34	10.2	10.2	10.2	11.2	10.9	11.9
35-44	9.9	11.1	10.3	11.4	10.9	11.7
45-54	7.8	8.4	7.6	8.7	7.4	8.1
55-64	4.8	6.9	4.6	5.7	4.6	5.4
$\geq 65$	5.1	6.3	4.8	6.6	4.2	6.0
Total	46.4	53.6	46.6	53.4	47.4	52.6

to compose the sample, 285 were interviewed, a loss of 14.7%. The number of losses was similar for both genders.

As for sample composition according to the characteristics of interest, 54.7% of the respondents had a marital life, a large share of the participants were white (82%) and had very little schooling (48.8% had not finished elementary school). With respect to work, 51.3% had paying jobs, but family income of 40% was equal to or lower than two minimum wages. In the study sample, 22.8% were smokers and 27.1% drank  $\geq$  30 mL of alcohol per week.

As for physical activity, women were found to be more active than men, the latter being nearly twice as likely to be sedentary: 16.8% versus 9.1% ( $p = 0.051$ ). Mean waist circumference in men (86.6 cm) was greater than that of women (81.6 cm) ( $p = 0.002$ ).

Overall prevalence of hypertension in each gender was 33.6% in men and 35.1% in women (Table 2). These prevalences, adjusted for the respective age structures of the population for each gender, resulted in 31.7% in men (95% CI: 24.7-38.6%) and 33.6% in women (95% CI: 27.8-39.6%). The difference found between adjusted prevalences, male and female, is almost entirely explained by the difference in age composition of both genders, because age adjustment produced rates of 32.5% (95% CI: 25.5-39.6%) and 32.6% (95% CI: 26.9-38.3%), respectively.

Based on the  $p \leq 0.25$  criterion, the following characteristics were selected for multivariate logistic regression analysis: age, marital status, schooling, paid work, family income, smoking, physical activity level, and waist circumference (Table 3). Of these eight variables, age, level of physical activity, and waist circumference were retained in the final model. The final model with OR (Table 4) was adequate according to the goodness-of-fit test ( $p = 0.556$ ).

Approximately 16% of the subjects who were unaware of their hypertension had high blood pressure levels, and among those who declared themselves hypertensive, 85.3% did not have their BP under control (Table 5). Of the 75 subjects previously diagnosed with hypertension, 66 (88%) had been prescribed medication, 44 (66.7%) of whom took

their medication regularly, although more than half of them had elevated blood pressure at the time.

Prescription of antihypertensive drugs varied widely: combined diuretic and sympatholytic therapy was the most frequently prescribed (18.7%), followed by angiotensin-converting enzyme inhibitors – ACE (14.7%) alone, sympatholytic agents alone (13.3%), and diuretics plus ACE inhibitors (12.0%).

## Discussion

The fact that the PSF covers 94% of Formiga's population made sample selection easier, because there is already a list of households and residents, thus avoiding the expensive and time-consuming process of visiting census tracts, listing households, and identifying residents, factors common in population studies. It is likely, however, that the PSF does not encompass the well-off local families, that may prefer private health care. Quantitatively, the number of losses (14.7%) was within that expected, but qualitatively it could not be assessed. In regard to losses due to PSF geographical location, these were similar for those residing in the outskirts and in the central area of the city.

As for obesity, measurement of the body mass index (BMI) would have made the information derived from this study comparable to that of several studies using this index<sup>3,21,22</sup>; however, there were no financial resources to purchase portable weighing scales. Therefore, waist circumference was used, because in addition to being inexpensive and easy to obtain, it is a known risk factor for circulatory system diseases and diabetes mellitus<sup>23</sup>.

In the present study, 31.2% of the women had waist circumference above that expected, compared with 9.2% of men, but the inverse situation was reported by Gus et al<sup>24</sup>, in a study carried out in 1998, in Porto Alegre.

Age-adjusted prevalence of hypertension for each gender showed that in the adult male population (age  $\geq$  18) registered with the PSF, there must be 31.7% of hypertensives and in the female population, 33.6%. Overall

Table 2 – Number (n) of people studied, hypertension prevalence (%) and 95% confidence interval (CI) by age group and total sample (obtained in the sample adjusted for the target population), in each gender, in Formiga, MG, in 2004

Age (years)	Male			Female		
	n	%	95% CI	n	%	95% CI
18-24	23	4.3	0.1 – 21.9	24	4.2	0.1 – 21.1
25-34	25	16.0	4.5 – 36.1	33	9.1	1.9 – 24.3
35-44	30	30.0	14.7 – 49.4	33	18.2	7.0 – 35.5
45-54	25	48.0	27.8 – 68.7	24	62.5	40.6 – 81.2
55-64	13	61.5	31.6 – 86.1	19	57.9	33.5 – 79.7
$\geq$ 65	15	66.7	38.4 – 88.2	21	85.7	63.7 – 97.0
Total sample	131	33.6	25.6 – 42.4	154	35.1	27.6 – 43.2
Corrected prevalence*		31.7	24.7 – 38.6		33.6	27.8 – 39.4

\* Corrected for the age structure of the target population of each gender.

**Table 3 – Univariate analysis for the association between hypertension and 11 characteristics of 285 subjects ≥ 18 years of age, registered with the PSF and living in Formiga, MG, in 2004**

Characteristics	Categories	OR	95% CI	p
Gender	Female	1.00	0.57 – 1.53	0.794
	Male	0.94		
Age	Continuous variable	1.08	1.06 – 1.10	< 0.001
Marital life	No marital life	1.00	0.91 – 2.46	0.112
	Marital life	1.49		
Skin color	White	1.00	0.69 – 2.41	0.424
	Dark/Black	1.29		
Education level	< elementary school	1.00	0.28 – 0.76	0.003
	≥ elementary school	0.46		
Work	Unpaid work	1.00	0.51 – 1.92	0.984
	Paid work	0.99		
	Retired/Pensioner	4.82		
Monthly family income	≤ 2 minimum wages	1.00	0.44 – 1.20	0.222
	> 2 minimum wages	0.73		
Smoking	No	1.00	1.23 – 5.09	0.011
	Ex-smoker	2.50		
	Smoker (%)	1.15		
Weekly intake of alcohol	< 30 mL	1.00	0.55 – 1.67	0.893
	≥ 30 mL	0.96		
Level of physical activity	Inactive	1.00	0.26 – 0.73	0.001
	Active	0.44		
Waist circumference	Optimal	1.00	3.11 – 10.64	< 0.001
	Less than optimal	5.76		

prevalence in the target population should be 32.7%. This percentage is higher than the 24.8% found by Barreto et al., in a study conducted in 1997 in Bambuí<sup>10</sup>, a city near Formiga, and much higher than that estimated by Formiga Health Department (11%)<sup>11</sup>.

Studies involving residents of urban areas, using the same hypertension criterion as this study (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, or current treatment with antihypertensive drugs), also revealed lower percentages compared with Formiga's: Porto Alegre<sup>3</sup>, 29.8% (in 1991) and Ilha do Governador<sup>26</sup>, RJ, 24.9% (in 1991-92). By the older WHO criteria (SBP > 160 mmHg and/or DBP > 90 mmHg, or use of antihypertensive medication), hypertension prevalence in some localities in Brazil was the following: Passo Fundo<sup>21</sup>, RS, 21.9% (in 1995), Pelotas<sup>7</sup>, RS, 19.8% (in 1992), and Araquara<sup>25</sup>, SP, 28.3% (in 1987). In Formiga, prevalence of hypertension was slightly higher in

**Table 4 – Association between hypertension and selected variables, study on hypertension prevalence in Formiga, MG, in 2004. Final model of multiple logistic regression: results with odds ratio (OR)**

Hypertension	OR	95% CI	p
Age in years	1.07	1.05 – 1.10	< 0.001
Waist circumference	3.05	1.49 – 6.22	0.002
Level of physical activity	0.45	0.25 – 0.82	0.010

\* As age is a continuous variable, and as OR = e0,0709 (test age – reference age), so: if age = 18 → OR = 1.00; if age = 29 → OR = 2.18; if age = 49 → OR = 9.02, and so on.

women (which may be explained by the population's age composition), similar to that of Bambuí<sup>10</sup>, MG.

**Table 5 – Prevalence of uncontrolled blood pressure (BP) according to previous knowledge of being hypertensive in people ≥ 18 years of age living in Formiga, MG, in 2004**

		Controlled BP			Uncontrolled (%)
		No	Yes	Total	
Previous knowledge of hypertension	Yes	64	11	75	85.3
	No	34	176	210	16.2
	Total	98	187	285	34.4

p < 0,001.

In the present study, physical activity showed an inverse association with hypertension prevalence (OR = 0.45). Other Brazilian studies including investigation on physical activity<sup>7,10,27</sup> reported similar results, even though different definitions were used.

With regard to waist circumference, the group of people with less-than-optimal measurement (men > 102 cm and women > 88 cm) was three times as likely to have hypertension, as compared to the group with optimal measurement (OR = 3.05). The IV Brazilian Guidelines for Arterial Hypertension<sup>1</sup> recommend that all hypertensive patients with overweight be included in weight reduction programs focused on attaining a BMI lower than 25 kg/m<sup>2</sup> and waist circumference ≤ 102 cm (men) and ≤ 88 cm (women).

In this study there was a positive association between hypertension and age: in women, mean SBP increased progressively with increasing age; in men, this increase occurred throughout the entire age group, from 18 to 64, decreasing at older ages. Mean DBP increased in both genders up to 54 years; beyond this age it kept stable in women and declined in men. However, mean SBP and DPB were lower among the females than among the males, except in the ≥65 age group. The positive association between age and hypertension is well known in the literature<sup>1,16,28,29</sup>.

Concerning the question about the use of antihypertensive drugs, it is suspected that there may have been response bias. More than half (54.5%) of subjects that reported taking medication at the right times and dosages had high blood pressure. As the interviews were conducted in the basic health unit, and as the interviewers were the employees of these units, respondents may have been afraid of saying that they did

not take their medication properly and, as a result, lose their registration with the PSF and/or their access to distribution of free medicine. Lessa and Fonseca<sup>30</sup>, in a study with subjects belonging to lower social strata in Salvador, said that frequent visits to the clinic do not seem to be regarded as an important factor in controlling hypertension, but distribution of free medicine is. Moreover, among those who adhere to treatment, the percentage of controlled patients was low.

In Formiga, 85.3% of the patients with uncontrolled BP had previous knowledge of their hypertensive condition. In studies carried out in Brazil, similar rates were found by Freitas et al. in Catanduva, SP, (77.0% in 1998). In Formiga, 67.3% of the patients with known hypertension reported taking hypertensive medication regularly, a considerably high rate compared with that found in Pelotas, RS, (32.0%) by Piccini et al.<sup>7</sup> in 1992 and in Piracicaba, SP, (10.0%) by Ayres<sup>27</sup> in 1988.

Although the hypertension prevalence found in Formiga MG (32.7%) was high compared with that reported by regional studies already published<sup>10</sup>, the socioeconomic and demographic characteristics of the population registered with the PSF was similar to those described in other studies using the general population<sup>5,7,25</sup>.

In conclusion, hypertension prevalence in Formiga is a major public health problem, and local health care services should pay special attention to this disease and emphasize detection and control measures. With respect to educational campaigns and support groups for the hypertensive, it is necessary to underscore the importance of adherence to drug treatment and follow-up visits, in addition to encouraging the institution of programs that promote physical activity and weight control.

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