

## HYPERTENSIVE PATIENTS AND RISK FACTORS RELATED TO PHYSICAL ACTIVITY AND NUTRITION

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### ABSTRACT

The aim of this study was to identify the cardiovascular risk factors related to physical activity and/or nutrition of hypertensive patients (n=99) seen at a public health care center of a large city in the southeastern part of Brazil. These factors included, diabetes *mellitus* (36.4% of patients, more frequent in women), dyslipidemia (38.4%, with no gender differences) and overweight/obesity (83.1% with Body Mass Index (BMI) higher than 24.9 Kg/m<sup>2</sup>, more frequent in women). The mean BMI was 29.2 Kg/m<sup>2</sup> (± 5.5); significantly higher among women. All these factors are related to the dysmetabolic syndrome and the risk can be prevented or controlled with interventions involving physical activity and nutrition.

**Descriptors:** Hypertension. Risk factors. Behavior. Nutrition. Motor activity.

### RESUMO

*O objetivo deste estudo foi caracterizar os fatores de risco cardiovascular relacionados à atividade física e/ou nutrição de pacientes hipertensos (n=99) atendidos em um centro de saúde de uma grande cidade na região sudeste do Brasil. Os fatores incluíram dislipidemia (38,4%; sem diferença entre os sexos), diabetes mellitus (36,4%; mais freqüente entre mulheres) e sobrepeso/obesidade (83,1%). O Índice de Massa Corpórea foi 29,2 (± 5,5) Kg/m<sup>2</sup>; significativamente mais elevado entre as mulheres. Todos esses fatores são relacionados à síndrome metabólica e podem ser prevenidos ou controlados por meio de intervenções envolvendo atividade física e nutrição.*

**Descritores:** Hipertensão. Fatores de risco. Comportamento. Nutrição. Atividade motora.

**Título:** Pacientes hipertensos e fatores de risco relacionados ao exercício físico e nutrição.

### RESUMEN

*El objetivo de este estudio fue caracterizar los factores de riesgo cardiovascular relacionados a la actividad física y/o nutrición de pacientes hipertensos (n=99) atendidos en un centro de salud de un gran centro urbano de la región sudeste de Brasil. Los factores fueron: dislipidemia (38,4%; sin diferencia entre los sexos), diabetes mellitus (36,4%; más frecuente entre mujeres) y sobrepeso/obesidad (83,1%). El promedio del Índice de Masa Corpórea fue 29,2 (± 5,5) Kg/m<sup>2</sup>; significativamente mayor entre mujeres. Todos estos factores están relacionados con la ocurrencia del síndrome metabólico y pueden cambiarse a través de intervenciones que apunten a la actividad física y a la nutrición.*

**Descriptores:** Hipertensión. Factores de riesgo. Conducta. Nutrición. Actividad motora.

**Título:** Pacientes hipertensos y factores de riesgo relacionados al ejercicio físico y a la nutrición.

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## 1 INTRODUCTION

Nowadays, heart failure (HF) is one of the main public health problems worldwide<sup>(1)</sup>. In the United States of America, HF affects approximately five million individuals, with a mortality rate of 300,000 per year<sup>(2)</sup>. In Brazil, approximately 400,000 cases are diagnosed annually<sup>(3)</sup>, with a 25% mortality rate over a 5-year period<sup>(4)</sup>.

One of the most common causes of HF is hypertension, which is a highly prevalent condition, acting on the heart and triggering the development of left ventricular hypertrophy. This condition involves a mechanism which is extremely important in the complex process of cardiac remodeling in HF<sup>(5,6)</sup>.

The period from the development of hypertension up to clinical manifestation of HF varies, since individual responses to injury vary tremendously; but it is agreed that level of tension, age, sex and length of exposure to co-morbidities (such as high cholesterol level, obesity and diabetes *mellitus*), as well as the degree of compliance with treatment are all important factors in the prognosis of hypertension and its consequences<sup>(6)</sup>.

Hypertension is a complex syndrome involving various interconnected factors. The interaction of these multiple conditions intensifies the effects of each one resulting in an increased severity of the hypertension and damage to certain organs. Obesity-related insulin resistance contributes to the development or worsening of dyslipidemia, type 2-diabetes and even hypertension. In fact, it has been demonstrated that the combination of hypertension and diabetes increases the risk of both micro and macrovascular complications, as well as the risk of retinopathy, renal disease, peripheral and cerebral vascular disease, coronary disease, HF and cardiac death<sup>(7)</sup>.

The complexity of the manifestation and development of hypertension, as well as the severity of its consequences, points to the need for a comprehensive approach in relation to the treatment of the hypertensive patient. The biological and the psychosocial characterization of such patients is crucial. Hypertension and the phenomenon of insulin resistance are both closely related to unhealthy habits involving physical activity and nutrition. However, in order to estimate the beneficial value of intervention, it is necessary to identify the

frequency of the risk factor in patients and ascertain the relationship between these factors and the presence of specific behaviors.

The present study was designed to identify the cardiovascular risk factors related to physical activity and/or nutrition in hypertensive patients (n=99) seen at a public health care center of a large city in the southeastern part of Brazil. These factors included obesity, diabetes *mellitus* and dyslipidemia, all directly or indirectly related to eating habits and physical activity. The nature of these conditions in a given population may provide subsidies for the design of specific intervention, as well as a more accurate evaluation of the actions implemented.

## 2 MATERIALS AND METHODS

This cross-sectional descriptive study involved the collection of data on the frequency and distribution of health-related variables in a specific population, at a single point in time<sup>(8)</sup>.

### 2.1 Setting and subjects

Data were obtained at the *Vista Alegre* Public Health Center in the southern part of the city of *Campinas, São Paulo*, a large urban center with some one million inhabitants in the southeastern part of Brazil. This health care center serves only patients living in the surrounding area basically of the lower class. The study included subjects over 18 years of age with a medical diagnosis of hypertension. These individuals were enrolled in the specific health care program for hypertensive and diabetic patients (the HIPERDIA program, developed by the Brazilian Government). All patients involved in the study signed the Informed Consent Form and the study was approved by the local ethics committees.

### 2.2 Sampling procedure

Probabilistic sampling was used for the selection of a random sample from the finite population of 494 hypertensive patients enrolled in the HIPERDIA program. Systematic sampling was used, with every fifth element of the population selected after random determination of the starting point within the first five elements. Ninety-

nine patients were selected, an increase over the estimated minimum sample size of 81 established by the method for a finite population of this size in descriptive studies involving categorical variables<sup>(9)</sup>.

### 2.3 Data collection

Semi-structured interviews were used to gather sociodemographic information (age, gender, schooling, marital status, living arrangements, work situation, monthly income). Data referring to clinical condition was gathered through chart analyses (duration of hypertensive condition and presence of co-morbidities, especially diabetes *mellitus* and dyslipidemia). Biophysiological evaluation identified anthropometrical indicators of obesity based on the recommendation of the International Obesity Task Force<sup>(10)</sup> for the classification of Body Mass Index (BMI): **healthy** (BMI from 18.5 to 24.9 Kg/m<sup>2</sup>); **overweight** (BMI from 25.0 and 29.9 Kg/m<sup>2</sup>); **obesity class I** (BMI from 30.0 up to 34.9 Kg/m<sup>2</sup>); **obesity class II** (BMI from 35 to 39.9 Kg/m<sup>2</sup>); and **obesity class III** (BMI equal or superior to 40.0 Kg/m<sup>2</sup>). Three experts with experience in cardiology evaluated the content validity of the instrument. A pilot study

with 19 patients led to a few improvements of the instrument.

### 2.4 Data analysis

Data were initially recorded on an Excel spreadsheet (Windows 98) and analysed using the Chi-square test (or Fisher's exact test) and the Mann-Whitney test in the *Statistical Analysis System* – SAS software, version 8.02.

## 3 RESULTS

The participants were predominantly female (68.7%), with a mean age of 61.3 years (SD=11.1) (ranging from 35.0 to 91.6 years of age). Most were married or had consensual living arrangements (87.1% vs 61.8% for men and women respectively, p=0.011 in Chi-square analysis). The sample involved patients with an average of 2.3 years of schooling (SD=2.7) and included a large number of illiterates (36.1%). Only 24.5% of the subjects were professionally active. The reported monthly income was US\$ 104 (SD= US\$ 28) with women earning less than men (US\$ 64 [SD= US\$ 64] vs US\$ 206 [SD= US\$184]; p = 0.0001 in Mann-Whitney analysis) (Table 1).

**Table 1** – Sociodemographic profile. Campinas (SP), 2002/2003.

	Female (n=68)			Male (n=31)			Total (n=99)		
	n (%)	Mean (SD)	Median (Range)	n (%)	Mean (SD)	Median (Range)	n (%)	Mean (SD)	Median (Range)
<b>Marital Status</b>									
With partner	42 (61.8)*			27 (87.1)*			68 (68.7)		
Without partner	26 (38.2)			4 (12.9)			31 (31.3)		
<b>Age (years)</b>		60.2 (11.0)	61.1 (35-85.6)		63.9 (11.2)	63.3 (48.3-91.6)		61.3 (11.1)	61.5 (35-91.6)
<b>Schooling (years)</b> (n=97)		2.1 (2.8)	1 (0-12)		2.8 (2.6)	2 (0-10)		2.3 (2.7)	1.0 (0-12)
<b>Individual income (US\$)</b> (n=98)		64** (64)	80 (0-260)		206** (184)	140 (0-760)		104 (128)	80 (0-760)
<b>Family income (US\$)</b> (n=82)		232 (192)	160 (0-840)		328 (224)	288 (80-920)		264 (200)	200 (0-920)
<b>Length of hypertension<sup>f</sup> diagnosis (years)</b> (n=98)		13.2 (10.1)	10 (1-42)		10.6 (6.6)	10 (1.5-27)		12.4 (9.1)	10.0 (1-42)

**Source:** Direct search: Piovesana, Paula de Moura. Data collection from chart analyses and interview. Campinas (SP), 2002/2003.

**Legend:** SD: standard deviation.

\* p=0.011(chi-square); \*\* p=0.0001 (Mann-Whitney)

The mean period since the diagnosis of hypertension was 12.4 years (SD=9.2) (Table 1). Co-morbidities included bronchitis/asthma/emphysema (9.1%); *angina pectoris* (5.4%); myocardial infarction (4.0%); Chagas disease (3.0%) and renal failure (1.0%). A history of smoking was reported by 34.4% of the patients, either as a

previous habit (28/34) or as a current one (6/34). Current smokers reported an average of 46.5 years (SD=18.7) and the former smokers reported an average of 22.9 years (SD=16.1). Current and/or former heavy alcohol consumption was also reported by 30.3%.

**Table 2** – Distribution of the Risk Factors related to nutrition and physical activity. Campinas (SP), 2002/2003.

	Female		Male		Total	
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
<b>Diabetes mellitus</b>	30 (44.1) *		6 (19.5) *		36 (36.4)	
<b>Dislipidemia</b>	27 (39.7)		11 (35.6)		38 (38.4)	
<b>Obesity (n=83)</b>	50 (87.7) **		19 (65.5) **		69 (83.1)	
<b>BMI</b>		30.1 (± 5.9) ***		27.1 (± 3.9) ***		29.2 (± 5.5)

**Source:** Direct search: Piovesana, Paula de Moura. Data collection from chart analyses and biophysiological evaluation. Campinas (SP), 2002/2003.

**Legend:** SD: standard deviation; \* p<0.05 (chi-square); \*\* p=0.000 (chi-square); \*\*\* p<0.05 (Mann-Whitney).

The three risk factors of dyslipidemia, diabetes *mellitus*, and overweight/obesity were investigated in all participants. Dyslipidemia was registered for 38.4% of the subjects, while diabetes *mellitus* was observed in 36.4% of the individuals, especially in women (44.1%, vs 19.5%; for men and women respectively; p=0.018 in Chi-square analysis). Obesity (or overweight) was the most prevalent risk factor. Among the 83 subjects with BMI data recorded, 69 (83.1%) had a BMI greater than 25.0 Kg/m<sup>2</sup>; the mean BMI was 29.2 Kg/m<sup>2</sup> (SD= 5.5), with a range of 17.5 to 53.0 Kg/m<sup>2</sup>. The BMI was higher for women than for men (30.1 [SD= 5.9] vs 27.1 [SD= 3.9] respectively; p=0.0125 in Mann-Whitney analysis) (Table 2).

**Table 3** – Distribution of the 83 patients according to the Body Mass Index (BMI). Campinas (SP), 2002/2003.

BMI	Female		Male		Total	
	Freq.	%	Freq.	%	Freq.	%
< 20	1	1.7	0	0.0	1	1.2
20 – 24.9	6	10.5	7	26.9	13	15.7
25 – 29.9	25	43.9	12	46.2	37	44.6
30 – 34.9	14	24.6	6	23.1	20	24.1
35 – 39.9	8	14.0	1	3.8	9	10.8
≥ 40	3	5.3	0	0.0	3	3.6
<b>TOTAL</b>	57	100.0	26	100.0	83	100.0

**Source:** Direct search: Piovesana, Paula de Moura. Data collection from biophysiological evaluation. Campinas (SP), 2002/2003.

The distribution of the BMI of these overweight or obese subjects was reported in Table 3, with 44,6% revealing a BMI between 25.0 and 29.9 Kg/m<sup>2</sup>, while for 24,1% it ranges from 30.0 to 34.9, for 10,8% it is between 35.0 and 39.9 Kg/m<sup>2</sup> and for 3,6% it equals or exceeds 40.0 Kg/m<sup>2</sup>.

**Table 4** – Frequency of the risk factors: Diabetes, Dyslipidemia and Obesity, in isolation or in association. Campinas (SP), 2002/2003.

Risk Factor	n	%
<b>None</b>	<b>04</b>	<b>4.8</b>
<b>Isolated factor</b>		
Diabetes	02	2.4
Dyslipidemia	06	7.2
Obesity	28	33.8
Subtotal	36	43.4
<b>Association of 2 Factors</b>		
Diabetes + Dyslipidemia	02	2.4
Obesity + Diabetes	17	20.5
Obesity + Dyslipidemia	14	16.9
Subtotal	33	39.8
<b>Association of 3 Factors</b>		
Obesity + Diabetes + Dyslipidemia	10	12.0
Subtotal	10	12.0
<b>TOTAL</b>	<b>83</b>	<b>100.0</b>

**Source:** Direct search: Piovesana, Paula de Moura. Data collection from chart analyses and biophysiological evaluation. Campinas (SP), 2002/2003.

These three factors of dyslipidemia, diabetes and obesity were also analyzed in relation to the frequency of association. From the 83 patients for which BMI were available, only 4.8% revealed none of the risk factors; 51.8% presented two or three of the conditions, and 43.4% at least one of them. The prevalence of obesity was very high, either in isolation or in association with diabetes and/or dyslipidemia. In this group of patients, few individuals had either diabetes or dyslipidemia in isolation (2.4% and 7.2%, respectively) (Table 4). Of the 16 patients whose BMI was not available, 50.0% presented dyslipidemia and diabetes, and 18.75% presented no associated condition, whereas 18.75% had only dyslipidemia; and 12.5% had only diabetes.

#### 4 DISCUSSION

These data are consistent with a previous study<sup>(11)</sup> reporting a predominance of female hypertensives in an elderly group living in nursing homes. However, international data indicate that sex, age, race and socioeconomic level of hypertensive patients vary tremendously with geographic location, and moreover with the criteria used for the diagnosis of hypertension. The number of methodologically adequate Brazilian studies on the prevalence of hypertension is relatively small, but some of these have indicated a trend toward greater prevalence among men<sup>(12)</sup>. These results are in agreement with classical findings in the literature suggesting that hypertension is more frequent among men up to 45 years of age, although in older groups, the number of hypertensive women is higher<sup>(13)</sup>. The data obtained here seem to confirm this, as the mean age of our population, predominantly female, was over 60.

The low socioeconomic and educational levels observed are coherent with the region where the health care center is located. These conditions are reported to be related to difficulties in access to basic and specialized health care services, and consequently to unfavorable clinical outcomes, a greater prevalence of other risk factors, target organ damage and higher risk for cardiac events<sup>(14,15)</sup>.

The association of diabetes and hypertension increases the level of risk of a hypertensive patient, even in the absence of other risk factors

and target organ damage; moreover, more complex therapy is needed, often requiring combinations of antihypertensive drugs to obtain a better control of arterial blood pressure<sup>(16)</sup>.

Obesity or overweight, the most prevalent factor of risk in this group, with only 19.3% having a BMI below 24.9 Kg/m<sup>2</sup>, is considered to be a public health problem worldwide, and it has increasingly been associated with the development of hypertension. Anthropometrical measures are closely associated not only with tensional levels<sup>(12)</sup>, but also with the development and progression of left ventricular hypertrophy, whether or not hypertension is present.

Myocardial hypertrophy is an adaptive response to hemodynamic overload in which the histological precursor involves the enlargement of cardiac myocytes as the result of an increase in the number of ultra-structural cell elements, an increase triggered by the activation of protein synthesis<sup>(17)</sup>. Hypertrophy can be identified directly by an increase in ventricular mass, or indirectly by the evaluation of the diastolic function of the left ventricle (LV). Recent studies have observed altered LV diastolic function and/or increased ventricular mass in obese normotensive subjects<sup>(18,19)</sup>. In the present study however it was not possible to correlate BMI and the rate of ventricular hypertrophy, since highly sensitive echodopplercardiographs were not available for determining this.

Obesity seems to underlie all three of the risk factors considered here (dyslipidemia, diabetes and hypertension). This association with obesity composes the X Syndrome, first described by Reaven in 1988 and currently known as plurimetabolic or dysmetabolic syndrome<sup>(7)</sup>. It seems to be the phenomenon of insulin resistance which underlies this syndrome. This resistance involves a state in which higher than normal concentrations of insulin are required for normal responses, thus resulting in hyperinsulinaemia. When beta-cells fail to secrete the excess insulin needed (because the number of cells or their production has become insufficient), diabetes mellitus type 2 emerges<sup>(7)</sup>. Insulin resistance is thus associated with the development of obesity, as well as with the onset of dyslipidemia and hypertension itself, thus favoring the premature development of other cardiovascular morbidities<sup>(7)</sup>.

Interventions to promote the prevention of obesity or weight reduction, can thus contribute to an improvement of the progression of hypertension.

The benefits of weight reduction in relation to cardiovascular risk are described in a review article<sup>(20)</sup>: 1) among hypertensive patients, a weight loss of 11 Kg seems to produce a 20% decrease in both systolic and diastolic pressure, i.e., a decrease in 1mm systolic and 2mm diastolic pressure for each 1% reduction in body weight; 2) for each 1 kg of weight lost, there is a decrease of 1% in the level of total and LDL-cholesterol levels, as well as of 30% in triglycerides, accompanied by an increase of 1% in HDL level; 3) intentional weight loss also reduces the risks related to diabetes, with a 50% reduction in the risk of developing diabetes for a 5 Kg weight loss, while in type-2 diabetic patients, a 5% weight loss reduces fasting blood glucose level by 15%, and a 10-20% one may be sufficient to control the disease. Another study<sup>(21)</sup> suggests that weight loss is capable of reversing many of the electrocardiographic alterations associated with morbid obesity.

In this context, changes in lifestyle, which combine healthy food habits and the regular practice of physical activity, seem to constitute the cornerstone for interventions designed to prevent or control hypertension, since this condition is generally related to obesity, a condition which can be attenuated by weight reduction.

Exercise contributes to weight reduction by generating a negative energetic balance. Nevertheless, high energy expenditure requires a high level of fitness, so that the individual can engage in high intensity activities for long periods of time. Energy deficits are thus more efficiently created by dieting<sup>(22)</sup>. An increase in the regular practice of physical activity, however, is also important because it results in other benefits. Regular exercise prevents the decline in lipolytic rate and fat oxidation observed among obese patients treated only with dieting, as well as contributing to glucose control by decreasing insulin resistance<sup>(22)</sup>. There are thus obvious advantages for combining exercise and nutrition in the prevention or reversion of obesity and, consequently, hypertension.

## 5 CONCLUSION

The data presented here were collected from a population with a high risk for clinical compli-

cations of hypertension, as a result of their socio-demographic profile and the high prevalence of conditions characterizing the dysmetabolic syndrome (Dyslipidemia, diabetes *mellitus*, obesity and hypertension). The treatment of overweight/obesity for such patients must be one of the priorities, and it deserves special attention. Comprehensive interventions are recommended addressing not only treatment with medication to ameliorate the factors of risk but also, and even more importantly, education aimed to promote a healthy lifestyle. Furthermore, behavioral interventions, both physical and nutritional, must consider the specificities of the group, predominantly women, with a low income and educational level, who are on the verge of becoming elderly. This is a challenge for all those involved in the treatment of such individuals, including nurses, who plays an especially important role in health education.

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