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Systolic Blood Pressure and Its Determinants: Study in a Population Attending Pharmacies in a Portuguese Coastal City

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***Abstract*—**Hypertension is a common condition causing cardio and cerebrovascular complications. Portugal has one of the highest mortality rates from stroke and a high prevalence of hypertension. Systolic Blood Pressure (SBP) is an important risk factor for cardiovascular events (myocardial infarction and stroke) and premature mortality, particularly in the elderly population. The present study aims to estimate the prevalence of hypertension in a Portuguese population living in a coastal city and to identify some of its determinants (namely gender, age, the body mass index and physical activity frequency).

A total of 91 adults who attended three pharmacies of a coastal city in the center of Portugal, between May and August of 2013 were evaluated. Attendants who reported to have diabetes or taking antihypertensive drugs in the 2 previous weeks were excluded from the study. Sociodemographic factors, BMI, habits of exercise and BP were assessed. Hypertension was defined as blood pressure ≥140/90 mmHg.

The majority of the studied population was constituted by women (75.8%), with a mean age of 54.2±1.6 years old, married or living in civil union and that had completed secondary school or had higher education (40%). They presented a mean BMI of 26.2±4.76 Kg/m^{2}, and were sedentary. The mean BP was 127.0±17.77mmHg- 74.69 ± 9.53. In this population we found 4.3% of people with hypertension and 16.1% with normal high blood pressure.

Men exhibit a tendency to present higher systolic blood pressure values than women. Of all the factors considered, SBP values also tended to be higher with age and higher BMI values.

Despite the fact that the mean values of SBP did not present values higher than 140 mmHg we must be concerned because the studied population is undiagnosed for hypertension.

Although this is a preliminary study, it might be a prelude to the upcoming research about the underlying factors responsible for the occurrence of SBP.

***Keywords*—** Hypertension, age, exercise, obesity, gender.

I. Introduction

HYPERTENSION is the most important risk factor for cardiovascular and cerebrovascular disease, particularly morbidity and mortality myocardial infarction and stroke, which are major causes of throughout the world [1]-[3]. In 2008, the global prevalence of hypertension in adults aged ≥25 years was 40%, despite having fallen between 1980 and 2008 [4], [5].

For the last 30 years, Portugal has been among the countries with the highest mean blood pressure (BP) levels [6], [7]. In 2008, the prevalence of hypertension (or use of antihypertensive medication) in adults aged ≥25 years was estimated at 41.9% (46.5% in men and 37.4% in women) [8].

Elevated resting BP is an established predictor of cardiovascular morbidity and mortality and it is one of the components of total cardiovascular risk in SCORE charts [9], [10]. There is also a growing body of evidence that systolic blood pressure plays a major role in cardiovascular morbidity and mortality. This is even more important when isolated systolic hypertension is considered [11]. Isolated systolic hypertension (ISH) is defined as elevated systolic pressure (>140 mmHg) in conjunction with normal diastolic blood pressure (<90 mmHg). The pathophysiology of isolated systolic hypertension seems to be related to thickening and hardening of the arterial walls [12]. Although some studies add other factors such as an increase in cardiac output [12], or reduction in arterial elasticity with the resulting increase in peripheral vascular resistance [13], which may also be the consequence of a decrease in the lumen area of the vascular bed.

Knowledge of the population's BP levels and characterization of the incidence and prevalence of hypertension and associated mortality is important for planning, implementation and evaluation of public health measures.

The present study was undertaken to estimate the prevalence of hypertension in a Portuguese population living in a coastal city, evaluate the systolic blood pressure (SBP) of that population and identify some of its determinants (namely gender, age, the body mass index and frequency of physical activity).

II. Materials and Methods

A. Settings and Study Design

This study was conducted between May and August of 2013. The sample consists of subjects of both genders, aged between 18 and 82 years old, who attended any of 3 pharmacies in the city of Figueira da Foz (a coastal city in the center of Portugal) and agreed to collaborate in the study. Subjects who reported to have diabetes or reporting the use of antihypertensive drugs in the previous 2 weeks were excluded from data analysis.

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A total of 91 individuals gave informed consent to participate in the present study.

B. Studied Variables

Sociodemographic variables*: age (age-groups used: 18-39, 40-54, 55-64 and ≥ 65 years-old), gender and marital status.* Education was recorded as illiterate, between four and nine years of education, completed secondary school and completed a higher education degree.

1. Anthropometric Variables

The body mass index (BMI) was calculated as the weight (kg) divided by the square of the height (in m^2).

Different classes of BMI were considered*: underweight* <18,5 Kg/m2; *normal*: 18.5-24.99 Kg/m2; *overweight*: 25-29.99 Kg/m2; *obesity*: 30≥39.99 Kg/m2 [14].

The small number of underweight participants in this study made it impossible accurate inferences about this group. Therefore, this category was considered together with normal weight.

2. Blood Pressure Measurements

The right brachial BP was measured with the subject in a seated position using a "professional aneroid sphygmomanometer" MDF ® instruments. After a 5-min rest, BP was measured twice; 1 min apart, and a third measurement was performed if the difference between the first two was more than 10 mmHg for SBP or DBP. The mean of the two measurements or the mean of the last two measurements (when three measurements were taken) were used for analysis. BP was classified according to a Portuguese regulatory norm [15] (as shown in Table I). The small number of optimal blood pressure participants in this study made accurate inferences about this group impossible. Consequently, this category was considered together with normal blood pressure.

TABLE I
CLASSIFICATION OF BLOOD PRESSURE ACCORDING TO A PORTUGUESE REGULATORY NORM [15]

Blood Pressure	Systolic Blood pressure (SBP) (mm Hg)	Diastolic bood pressure (DBP) (mm Hg)
Optimal	≤ 120	≤ 80
Normal	120-129	80-84
Normal high	130-139	85-89
Hypertension	≥140	≥90

3. Habits of Exercise

A self-reported questionnaire was used to collect the information on the subjects about how frequently they exercise. The possible answers from which they could choose were "never"; "occasionally" and "regularly".

a) Statistical Analysis

All statistical analyses were performed using SPSS software (ver. 22, 2013). The variables were expressed as mean± standard deviation (SD), the median, minimum and maximum. The differences in the SBP means were compared by gender, classes of age, BMI and physical exercise by a *t*-test of independent samples or an analysis of variance with Bonferroni *post-hoc* tests, as appropriate. The differences in the age and BMI means were compared by SBP by an analysis of variance with Bonferroni *post-hoc* tests. The significance level was set at 5% ($p \leq 0.05$).

III. RESULTS AND DISCUSSION

A total of 91 individuals of both sexes were examined, stratified by gender and age as defined in the sampling process. The questionnaires were distributed equally among the three pharmacies.

A. Characteristics of the Sample

Of those surveyed, 24.2% were male and 75.8% female. The age of the subjects ranged between 20 and 82 years, with a mean age of 54.2±1.6 years old, approximately equally distributed within the age group considered. Of the total sample, 67.8% were married or living in civil union. 40 % of this population had either completed secondary school or had a degree in higher education.

The studied sample presented a BMI of 26.2±4.76 $Kg/m^{2.}$ Considering the differences of BMI between genders, 33% of the men were overweight versus 39.1% of the women. The prevalence of obesity (BMI >30) was 11.5% in men and 17% in women.

The mean of three measurements was used to assess systolic and diastolic blood pressure values. SBP ranged between 90.0 mm Hg and 170 mmHg, with a mean of 127.0 mmHg (standard deviation 17.77). DBP varied between 56.0 mmHg and 93.0 mmHg, with a mean of 74.69 mmHg (standard deviation 9.53). Among the 91 subjects, 4.3% had hypertension and 16.1% had normal high blood pressure.

Overall, this population reported very low physical activity levels (48.3%).

B. Systolic Blood Pressure and Risk Factors

For analysis of risk factors for isolated systolic hypertension, the following variables were tested: age, gender, body mass index and physical activity (Fig. 1).

Men presented a tendency to have higher SBP when compared with women (Fig. 1 (a)).

Despite the fact that means SBP values were lower than 140 mmHg, several subjects who denied having hypertension or taking antihypertensive drugs actually presented SBP values, which fit into the criteria for hypertension. This is worrying as there is a degree of under diagnosis in this population. In untreated men, the risk of cardiovascular disease, myocardial infarction, stroke, and cardiovascular death increases progressively across clinical categories of systolic blood pressure (<120, 120 to 129, 130 to 139, and ≥140 mm Hg), without evidence of a threshold or a J-shaped association [16].

The study revealed a significant association of SBP with age as shown in Fig. 1 (b). SBP was higher in the group of those ≥65 years old (136.43 ± 15.99 mmHg) and lower in the 18-40 age group (116.0 ± 15.23 mmHg). The values of SBP were higher in those 55 or older.

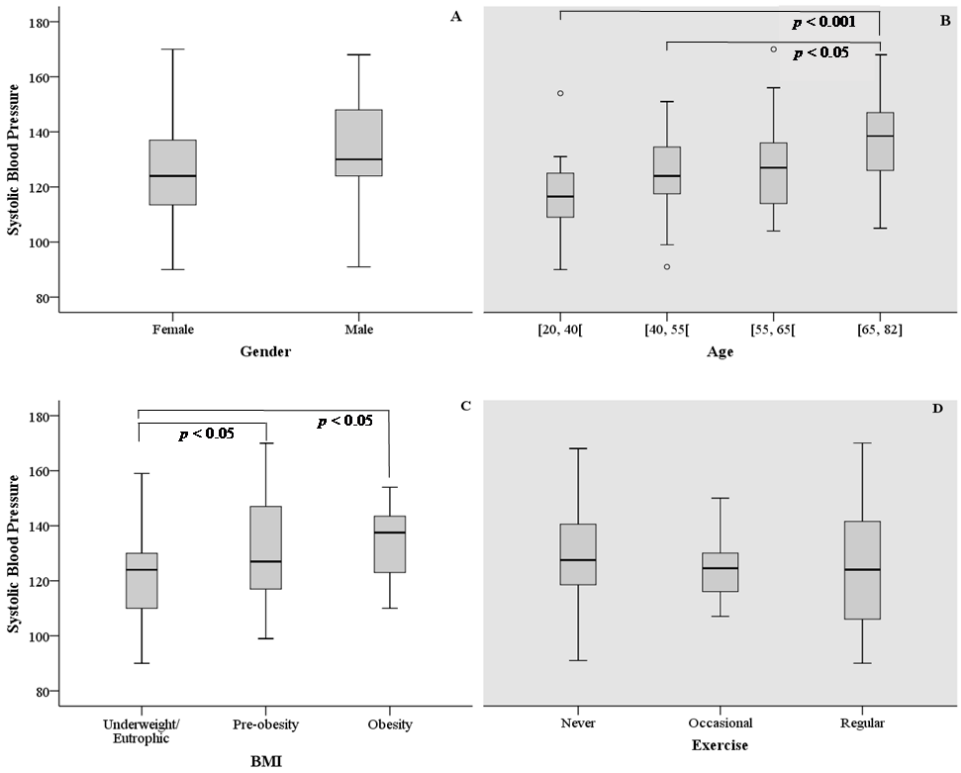

Fig. 1 Risk factors for elevated systolic blood pressure: (a) Variation of SBP with gender, (b) Variation of SBP with age, (c) Variation of SBP with BMI, (d) Variation of SBP with exercise

A statistically significant difference ($P = 0.005$) is observed when comparing the SBP of pre-obese group and the SBP of obese group with SBP presented by the eutrophic group (Fig. 1 (c)). Both pre-obese and obese patients tended to have higher SBP levels.

SBP did not seem to vary with an increasing level exercise (Fig. 1 (d)). Although the SBP was higher in the sedentary group (129.48±16.8 mmHg) as compared to those who practiced exercise occasionally or regularly (123.48±12.8 mmHg), this difference was not statistically significant ($P = 0.326$).

IV. Conclusions

In Portugal, cerebrovascular disease, the outcome most strongly associated with hypertension, is the main cause of death and disability. The prevalence of hypertension among Portuguese adults remained stable in the past decade, but awareness, treatment and control of hypertension improved significantly. This study intended to evaluate the BP in a Portuguese population attending pharmacies in a coastal city of the center of Portugal. In this population, we found that 4.3% presented hypertension and 16.1% had normal high blood pressure. Considering the importance of SBP in thickening and hardening of the arterial walls, we evaluated the SBP according several factors. Older subjects and those with higher BMI levels were shown to have higher SBP levels.

Despite the fact that there are several limitations in this study, it emphasizes the need for further research to document the impact of modifiable risk factors of SBP to fully understand its etiological factors and allow for a better prevention and control of hypertension.

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