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# Epidemiological characterization of some variables related to lifestyle and cardiovascular risk factors in hypertensive patients

Rodolfo Vega Candelario[1]✉, MD; Junior Vega Jiménez[2], MD; and Ulises M. Jiménez Jiménez[1], MD

[1] Department of Cardiology, Hospital General Docente Roberto Rodríguez Fernández. Morón, Ciego de Ávila, Cuba.
[2] Department of Internal Medicine, Hospital Militar Docente Dr. Mario Muñoz Monroy. Matanzas, Cuba.

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**Acronyms**
**BP:** Blood pressure
**HBP:** High blood pressure
**OR:** Odds ratio

✉ *R Vega Candelario*
*Edif. 10, Apto. 11. Microdistrito Norte. Morón, Ciego de Ávila, Cuba.*
*E-mail address:*
*rvc_50@infomed.sld.cu*

## ABSTRACT

*Introduction:* The high blood pressure (HBP) is a frequent reason for consultation in health services and it is one of the most common diseases that affects adult individuals in all parts of the world. Its epidemiological characterization is very important to prevent risks.

*Objectives:* To determine the prevalence of HBP, its strength of association with some epidemiological and lifestyle variables, and its percentage population attributable risk.

*Method:* A retrospective analytical observational epidemiological research (cases and controls) was conducted to determine the strength of association of some variables related to HBP in the population of 15 or more years of age.

*Results:* The punctual prevalence rate of high blood pressure was $111.5 \times 10^3$. Caucasian patients predominated, in the age group between 45-59 years, without sex differences. The most prevalent modifiable risk factors were the ingestion of salt, the consumption of coffee, the non-practice of physical exercise and the habit of smoking. The highest percentage population attributable risk figures corresponded to the ingestion of salt, the non-practice of physical exercise and obesity.

*Conclusions:* The overweight, obesity, increased consumption of salt, little or no practice of physical exercise, excessive consumption of coffee, smoking, personal pathological history of diabetes mellitus, regardless of type, and family history of high blood pressure showed a causal association with HBP and, therefore, with the risk of suffering some of its complications, mainly cardio-cerebrovascular and renal.

*Keywords:* Essential hypertension, Descriptive epidemiology, Risk factors

## *Caracterización epidemiológica de algunas variables relacionadas con el estilo de vida y los factores de riesgo cardiovascular en pacientes hipertensos*

## RESUMEN

*Introducción: La hipertensión arterial (HTA) es motivo de consulta frecuente en los servicios de salud y es una de las enfermedades más comunes que afecta a individuos adultos en todas partes del mundo. Su caracterización epidemiológica es muy importante para prevenir riesgos.*

*Objetivo: Determinar la prevalencia de HTA, su fuerza de asociación con algunas*

*variables epidemiológicas y del estilo de vida, y su riesgo atribuible poblacional porcentual.*

*Método: Se realizó una investigación epidemiológica observacional analítica retrospectiva (casos y controles) para determinar la fuerza de asociación de algunas variables relacionadas con la HTA en la población de 15 o más años de edad.*

*Resultados: La tasa de prevalencia puntual de hipertensión arterial fue de 111.5 × $10^3$. Predominaron los pacientes blancos, del grupo de edad entre 45-59 años, sin diferencias de sexo. Los factores de riesgo modificables de mayor prevalencia fueron la ingestión de sal, el consumo de café, la no práctica de ejercicio físico y el hábito de fumar. Las mayores cifras de riesgo atribuible poblacional porcentual correspondieron a la ingestión de sal, la no práctica de ejercicio físico y la obesidad.*

*Conclusiones: El sobrepeso, la obesidad, el mayor consumo de sal, la poca o ninguna práctica de ejercicio físico, el consumo excesivo de café, el hábito de fumar, los antecedentes patológicos personales de diabetes mellitus, independientemente al tipo, y los antecedentes familiares de hipertensión arterial mostraron una asociación causal con la HTA y, por consiguiente, con el riesgo de padecer alguna de sus complicaciones, principalmente cardio-cerebrovasculares y renales.*

*Palabras clave: Hipertensión esencial, Epidemiología descriptiva, Factores de riesgo*

## INTRODUCTION

The high blood pressure (HBP) is a frequent reason for consultation in health services and it is one of the most common diseases that affects adult individuals worldwide[1]. It represents itself a syndrome, a disease, and also an established risk factor for other diseases, mainly ischemic heart disease, heart failure, cerebrovascular disease, kidney failure, and peripheral vascular and retinal disease [1,2].

Noncommunicable chronic diseases are currently the leading cause of death in all regions of the world, with the exception of sub-Saharan Africa. Out of the 35 million deaths in 2015 due to noncommunicable chronic diseases, 80% took place in developing countries[2-4]. In the United States of America, the National Health and Nutrition Examination Survey (NHANES), after a survey carried out between 1999 and 2004, found a prevalence of HBP of 60% in the people polled between 60 and 69 years of age, which increased to 72% for those from 70 to 79, and 77% for those over 80[2]. In that country, the number of people affected by HBP is around 50 million[5] and some 60000 deaths are reported every year directly due to the HBP[6]. In addition, the INTERHEART study found that HBP is an independent risk factor for acute myocardial infarction among elderly people[6].

Cuba is a developing country, with health indicators similar to those of developed countries. With a population of 11.6 million people and an accelerated aging of its population, in 2020 it will become the oldest country in Latin America. It is estimated that at that time, the Cuban elderly will represent 25% of the total population[7,8].

The prevention of HBP is the most important, universal and less expensive health measure. The control of blood pressure (BP) is therefore a challenge for all countries and it should be a priority of the health, population and government institutions. The proper risk perception of the HBP requires executing a population strategy with measures of education and promotion aimed at decreasing the average BP and control of other associated risk factors, primarily the lack of physical exercise, inadequate levels of blood lipids, high salt intake, smoking, alcoholism and obesity, which can be achieved through actions aimed at lifestyle changes. On the other hand, an individual strategy is necessary to detect and control individuals who, due to being exposed to high levels of one or more of the aforementioned risk factors, have HBP or a high probability of suffering from it[9,10].

In recent decades, there has been a marked interest in finding related data and the epidemiology of the HBP[11-19], for this reason, we decided to develop this research with the objective of determining the prevalence of HBP, its strength association with some epidemiological variables and lifestyle, and the percentage population attributable risk of each one of them, in order to contribute to the fulfillment

of the Program of Prevention, Diagnosis, Evaluation and Control of this condition and to the future projections of the Ministry of Public Health.

## METHOD

### Population and study design

An epidemiological observational analytical research was carried out, where 102 patients with HBP (cases) were selected by a simple random method, out of the 915 over 15 years of age attended in the cardiology department of the Hospital Provincial Docente Roberto Rodríguez Fernández of Morón, Ciego de Ávila, Cuba, during the year 2017.

For each case to have a matched control by the sex and age group, there were chosen, by systematic random sampling (table of random numbers), 102 patients (controls) without HBP or other cardiovascular disease that required follow-up by cardiology.

### Variables

The HBP considered for the systolic BP was 140 mmHg or more or and for diastolic BP 90 mmHg or more, both figures inclusive, according to the recommendations of national[1] and foreign[5] guidelines. Risk, to the measure that reflects the probability of an occurrence or damage to health, illness or death[20]; and risk factor, to the detectable feature, condition or circumstance in an individual or group of people and the environment, associated with an increased probability of developing a disease or deviation from health[20].

There was determined the association strength of the following variables (independent) with the HBP that was considered the dependent variable:

- Practice of physical exercise: Practice time, type and frequency of physical exercise. It was considered as none, frequent or systematic, depending on the physical activity performed: 1) walking less than 100 meters a day, 2) between 100-500 meters plus another type of exercise at least once a week and 3) daily walk more than 500 meters and to perform other physical exercise at least three times a week.
- Smoking habit: Amount of daily cigarettes or cigars and exposure time.
- Coffee intake: Amount of cups of coffee consumed daily and exposure time.
- Alcohol intake: Quantity consumed, frequency and exposure time. In men it should be limited to less than 1 ounce of ethanol (20 ml) per day; in women and in people underweight, less than 15 ml per day. The daily equivalent can be: 12 ounces (350 ml) of beer or 5 ounces (150 ml) of wine or 2 ounces (50 ml) of rum[1,5,9].
- Salt intake: Amount consumed daily and exposure time. It should not exceed 6 grams/day, the daily equivalent is one teaspoon of dessert[5,9].
- The nutritional status according to the body mass index was performed taking into account the recommendations by Jiménez Acosta *et al*[21]. The patients were classified as: low weight (≤18,5 kg/m$^2$), normal weight (18,5 - 24,9 kg/m$^2$), overweight (25,0 - 29,9 kg/m$^2$) and obese (≥30 kg/m$^2$).
- Personal pathological history of diabetes mellitus, type and time of treatment.
- A familiar pathological background of HBP.

### Statistical processing

The information collecting technique used was the survey, which was prepared according to the objectives proposed in the research. The instrument was validated in a test applied to 163 subjects for verifying its reliability, previous preparation of the instruction of completion. The survey was conducted in the cardiology consultation of the aforementioned institution.

The data processing was computational, for which a database in SPSS 15.0 was created. Descriptive statistical methods were applied to perform the frequency distribution of the data in the nominal scale, and their interpretation; as well as inferential statistics to test the hypothesis. The percentage analysis enabled the quantitative processing of the data provided by the applied instrument.

The punctual prevalence rate, the odds ratio or cross-products and percentage population attributable risk were calculated, as recommended by Lao *et al*[22].

The results are presented through contingency tables, estimating the confidence interval for 95% by the Haldane method or logarithmic transformation[22].

## Ethical issues

The ethical recommendations were fulfilled when using any method for obtaining information. When applying the surveys in the cardiology consultation, the informed consent of the patients was taken into account.

## RESULTS

Out of the 915 patients of 15 years of age or more, who attended the cardiology consultation in 2017, 102 were hypertensive, representing a punctual prevalence rate of $111.5 \times 10^3$. Half (50%) were female and generally, the age group from 45 to 59 years (47.6%) and white skin (73.5%) predominated. All cases and controls came from the urban area.

In **table 1** are exposed the differences in odds between cases and controls according to the physical exercise in relation to HBP, where a causal association is observed while less is the exercise performed, the practice time and the type of exercise. Moreover, systematic physical activity, prolonged practice time and greater intensity of exercise do not show a relationship or represent protective factors.

Something similar happens with the smoking habit (**Table 2, supplementary material**), because the lower the amount of daily cigarettes or cigars, and the exposure time to that harmful habit, the greater the protection in relation to HBP.

Regarding the coffee and alcohol intake (non-tabulated data), a non-significant causal association was found, depending on the quantity, frequency and time of exposure to the factor. The lower the coffee and alcohol consumed, the less likely it was

**Table 1.** Distribution of cases and controls according to variables related to the practice of physical exercise.

| Variables | Cases | Controls | OR | CI 95% | Interpretation |
|---|---|---|---|---|---|
| Practice of physical exercise | | | | | |
| None | 30 | 25 | 1.77 | 3.79 - 0.83 | p>0.05 (Causal) |
| Frequent | 51 | 46 | 1.64 | 3.22 - 0.84 | p>0.05 (Causal) |
| Systematic | 21 | 31 | 1.00 | – | – |
| Practice time of physical exercise | | | | | |
| None | 30 | 25 | 1.34 | 2.53 - 0.71 | p>0.05 (Causal) |
| Less than 1 year | 6 | 3 | 2.24 | 8.61 - 0.58 | p>0.05 (Causal) |
| 1 – 5 years | 8 | 9 | 1.00 | 2.68 - 0.37 | p>0.05 (No association) |
| More than 5 years | 58 | 65 | 1.00 | – | – |
| Type of physical exercise | | | | | |
| None | 30 | 25 | 1.33 | 3.71 - 0.48 | p>0.05 (Causal) |
| Light | 35 | 31 | 1.25 | 3.41 - 0.46 | p>0.05 (Causal) |
| Moderate | 28 | 36 | 0.86 | 2.36 - 0.32 | p>0.05 (Protection) |
| Intense | 9 | 10 | 1.00 | – | – |
| Practice frequency of physical exercise | | | | | |
| None | 30 | 25 | 1.57 | 3.04 - 0.81 | p>0.05 (Causal) |
| Daily | 42 | 55 | 1.00 | – | – |
| 2–5 days a week | 22 | 18 | 1.60 | 3.33 - 0.77 | p>0.05 (Causal) |
| Once a week | 8 | 4 | 2.62 | 8.79 - 0.78 | p>0.05 (Causal) |

CI, confidence interval; OR, odds ratio

to suffer from HBP.

There is also a non-significant causal association with HBP among salt consumers in relation to those who do not consume it, as well as with the prolonged time of use (**Table 3, supplementary material**); because the bigger the amount and time (in years) the bigger the chances of suffering from HBP.

The patients with low weight (**Table 4**) had a non-significant association of protection in relation to HBP (OR 0.88; CI 7.14-0.11); instead, in overweight (OR 2.09; CI 3.98 - 1.10) and obese (OR 3.00; CI 7.60-1.18) the relationship was causal.

Those with diabetes mellitus (OR 3.62; CI 8.34-1.57; p<0.05), regardless of whether they are insulin-dependent (OR 4.82; CI 20.38-1.14; p<0.05) or not (OR 3.2; CI 8.36-1.24; p<0.05) are more likely to suffer from HBP (**Table 5**). This probability also increases the longer the time of evolution of the disease. Something similar happens with hypercholesterolemia (non-tabulated data) because suffering from it had a significant causal association with the presence of HBP (OR 2.83; CI 95% 6.19-1.29; p<0.05). This type of association was also found with the family pathological history of HBP (OR 3.00; CI 95% 5.31-1.70; p <0.05) and the presence of the disease (**Table 6**).

In (**Table 7**) are exposed the prevalence rate and percentage population attributable risk of modifiable risk factors, in the total of patients who received treatment in the period shown above, where the

**Table 4.** Distribution of cases and controls according to nutritional status.

| Variables | Cases | Controls | OR | CI 95% | Interpretation |
|---|---|---|---|---|---|
| Low weight | 1 | 2 | 0.88 | 7.14 - 0.11 | p>0.05 (Protection) |
| Normal weight | 21 | 37 | 1.00 | – | – |
| Overweight | 63 | 53 | 2.09 | 3.98 - 1.10 | p<0.05 (Causal) |
| Obese | 17 | 10 | 3.00 | 7.60 - 1.18 | p<0.05 (Causal) |
| Total | 102 | 102 | – | – | – |

CI, confidence interval; OR, odds ratio

**Table 5.** Distribution of cases and controls according to variables related to diabetes mellitus.

| Variables | Cases | Controls | OR | CI 95% | Interpretation |
|---|---|---|---|---|---|
| Diabetes Mellitus | | | | | |
| Yes | 24 | 8 | 3.62 | 8.34 - 1.57 | p<0.05 (Causal) |
| No | 78 | 94 | 1.00 | – | – |
| Type of diabetes mellitus | | | | | |
| None | 78 | 94 | 1.00 | – | – |
| Insulin-dependent | 8 | 2 | 4.82 | 20.38 - 1.14 | p<0.05 (Causal) |
| Non-insulin-dependent | 16 | 6 | 3.21 | 8.36 - 1.24 | p<0.05 (Causal) |
| Time of treatment | | | | | |
| None | 78 | 94 | 1.00 | – | – |
| Less than 1 year | 4 | 6 | 0.80 | 2.77 - 0.23 | p>0.05 (Protection) |
| 1 - 5 years | 11 | 1 | 13.26 | 74.60 - 2.36 | p<0.05 (Causal) |
| More than 5 years | 9 | 1 | 10.85 | 62.28 - 1.89 | p<0.05 (Causal) |

CI, confidence interval; OR, odds ratio

**Table 6**. Distribution of cases and controls according to family history of HBP.

| Family history of HBP | Cases | Controls | OR | CI 95% | Interpretation |
|---|---|---|---|---|---|
| Yes | 70 | 43 | 3.00 | 5.31 - 1.70 | p<0.05 (Causal) |
| No | 32 | 59 | 1.00 | – | – |
| Total | 102 | 102 | – | – | – |

HBP, high blood pressure; CI, confidence interval; OR, odds ratio

**Table 7.** Prevalence and population attributable risk of modifiable risk factors.

| Risk factors | Nº of Patients | Prevalence rate x $10^3$ | Percentage PAR |
|---|---|---|---|
| No practice of physical exercise | 290 | 316.9 | 19.77 |
| Smoking | 278 | 303.8 | – |
| Coffee intake | 490 | 535.5 | 5.61 |
| Alcohol intake | 208 | 227.3 | 2.03 |
| Salt intake | 890 | 972.7 | 31.77 |
| Obesity | 89 | 97.3 | 16.67 |

PAR, population attributable risk

most prevalent was salt intake (972.7 × $10^3$; 31.77) followed by coffee intake (535.5 × $10^3$; 5.61), and a sedentary lifestyle (316.9 × $10^3$; 19.77). The attributable risk to the smoking habit was not calculated because it showed protection association with the HBP.

## DISCUSSION

The punctual prevalence rate of HBP calculated is less than the one reported by other national and foreign studies[8,22,23], and also lower than the values specified by the national commission of HBP of the Public Ministry of Health of the Cuban Republic[21] for urban areas (280 × $10^3$), demonstrating that the dispensarization is at the expense of the visible portion of the epidemiological iceberg, regardless of the manifestation form of the disease under the clinical horizon[21]; in addition, hypertensive patients with associated diseases that are dispensed in group III, where the main disease is not HBP, are not included in the cases studied.

Due to the design of this research and the selection of patients, our results regarding sex do not coincide with those published in other national studies (Pérez Caballero *et al*[24] and Dueñas *et al*[25] in the province of Matanzas, and Noval *et al*[26] in the Plaza municipality), who state that before the age of 45 there are more hypertensive men than women, but not after that age, where the frequency of HBP in the female sex is greater. Generally, it is stated that men have a higher BP and a higher frequency of HBP[27]; although in both sexes its frequency increases with age, it appears in earlier stages in men and later in women, especially in the post-climacteric period[6].

The relationship between BP and age is well documented and it is recognized that there is a strong association between aging and the progressive increase of its figures[17-19,24-31], which is explained by the hypertensive endothelial dysfunction added to the atherosclerotic endothelial dysfunction that produces vessel stiffness[29]; that is the reason why the prevalence of the HBP increases with age, and it has shown that after 50 years of age, about 50% of the population suffers from it[5,6,10,11]. Other authors suggest that the risk of developing HBP after 55 years, by who have previously been normotensive, is

about 90%[19,24].

The prevalence of HBP in the urban population is higher than that found in the rural population[2-4]. In Cuba, it affects 30% and 15%, respectively[1,7-9], which coincides with our results. Unlike the skin color, that diverges from the points made by some researchers that found higher prevalence of HBP in patients with black skin[1,] and more tendency to suffer the most severe form of disease progression with vascular complications and death[6,10]. However, our results are similar to those published in other Cuban[8,26] and Latin American[32,33] studies.

Meanwhile, Orduñez, in several of his publications, has found that in Cuba, in 2005[34], hypertensive with white skin predominated; and in 2008[35] and 2013[36], he did not find significant differences, which means that whites and blacks have the same prevalence of HBP. Also, he suggests that the difference in the frequency of HBP among blacks and whites is much less pronounced in Cuba than in the United States, Bahamas and Puerto Rico[35].

In an attempt to explain these racial differences, several hypotheses have been issued involving genetic alterations, increased vascular hyperactivity and salt sensitivity, as well as reduced activity of the sodium-potassium pump ATPase, abnormalities of co-transporters of sodium-potassium and sodium-lithium, low activity of endogenous vasodilator substances, diets with high salt content, smoking and sociocultural factors[6].

Reducing the salt intake contributes to lower the BP and mortality from strokes and ischemic heart diseases[13].

Moreover, according to some research conducted by the World Health Organization (WHO), it has been demonstrated that physical exercise has a rehabilitating and preventive action in HBP, obesity, hyperlipidemia, diabetes mellitus, stress, cancer, osteoporosis, mental illness, aging, and addictions; however, the hypertensive population resorts more to the use of drugs than to a non-pharmacological solution, that is decisive in the treatment of the disease, such as the practice of physical exercises[12-14].

The aerobic physical exercise is one of the main pillars of the non-pharmacological treatment for hypertensive patients. Sedentary and hypertensive individuals increase three times the risk of developing a heart attack compare to the active hypertensives[11].

The WHO has declared the sedentary lifestyle as a public enemy of humanity, which is associated with chronic noncommunicable diseases, being one of the risk factors of cardiovascular diseases together with HBP, smoking, overweight, lipoprotein disorders, diabetes mellitus and eating disorders[11,21,35]. In order to guarantee an adequate quality of life, men and women must undergo systematic physical training in order to combat the inactivity and sedentary lifestyle caused by modern life.

The excessive consumption of coffee (5 cups or more of coffee per day) and other products rich in caffeine (tea, cola) can cause acute elevations of the BP, thus, it is recommended to restrict their use[37]. On the other hand, in hypertensive patients who consume alcohol, the educational work must be intensified, as HBP *per se* and alcoholism are enhance[5].

Inheritance is of great importance as a factor that predisposes the development of HBP, since the increase of the BP is observed very frequently in people whose parents suffer from HBP[26-29].

Several epidemiological studies corroborate the association between HBP and diabetes mellitus[10,20,38], and other show the frequency of hypertensive who are diabetics and are suffering cardiovascular and cerebrovascular diseases[11-14,39]. The HBP affects twice the diabetic population compared to non-diabetic and its presence is associated with an increase in mortality from coronary heart disease, especially in women. The combination of HBP and diabetes mellitus has important clinical implications, because the first one contributes to the development and progression of chronic complications of the second one[13-19,24].

For all these reasons the epidemiological characterization of all hypertensive patients is important, because of their risk of suffering from a cardiovascular disease, with significant deleterious effects, and disabling in many cases. This characterization favors to direct a systematic monitoring of those with risk factors and unhealthy lifestyles, in order to reduce the incidence of cardiovascular disease and, in the cases that it appears, to do an early diagnosis and apply a timely treatment. That is why, a permanent interrelation among all the levels of attention is essential: primary, secondary and tertiary.

## CONCLUSIONS

The punctual prevalence rate of high blood pressure was $111.5 \times 10^3$. White patients predominated, in the age group between 45 and 59 years of age, without

sex differences. The overweight, obesity, increased salt intake, little or no practice of physical exercise, excessive coffee intake, smoking, personal pathological history of diabetes mellitus, regardless of type, and family history of high blood pressure showed a causal association with HBP and, therefore, with the risk of suffering from some of its complications, mainly cardio-cerebrovascular and renal.

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