ORIGINAL

Classification of blood pressure with JNC-7 criteria in spanish working population: influence of age, sex, social class and tobacco consumption

Clasificación de la presión arterial con criterios JNC-7 en la población laboral española: influencia de la edad, el sexo, la clase social y el consumo de tabaco

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Abstract

Introduction: The Hypertension is a major health problem and is considered the leading cause of death in the world. The aim of this study was to determine the influence of sociodemographic variables and tobacco consumption on the prevalence of arterial hypertension in a large group of Spanish workers.

Material and methods: Descriptive and cross-sectional study in 418,343 Spanish workers to determine the prevalence of blood pressure values using the JNC7 criteria by linking them to sociodemographic variables and tobacco consumption.

Results: The prevalence of Hypertension is 20.7% (27% in men and 11.9% in women). The variable that most influences the onset of Hypertension is age with an Odds ratio of 3.77 (95% CI 3.71-3.84), also sex and social class show influence, while tobacco consumption as a mild protective factor.

Conclusions: The prevalence of Hypertension in the working population increases with age and in the lowest social classes being the far higher values in men. It is therefore necessary to implement campaigns.

Keywords: Blood pressure, hypertension, sociodemographic variables, tobacco.

Resumen

Introducción: La hipertensión arterial es un importante problema de salud y se considera la primera causa de muerte en el mundo. El objetivo de este estudio fue determinar la influencia de las variables sociodemográficas y del consumo de tabaco en la prevalencia de hipertensión arterial en un amplio grupo de trabajadores españoles.

Material y métodos: Estudio descriptivo y transversal en 418.343 trabajadores españoles para determinar la prevalencia de los valores de presión arterial según los criterios del JNC7 relacionándolos con las variables sociodemográficas y el consumo de tabaco.

Resultados: La prevalencia de hipertensión es del 20,7% (27% en hombres y 11,9% en mujeres). La variable que más influye en la aparición de la hipertensión es la edad con una Odds ratio de 3,77 (IC 95% 3,71-3,84), también el sexo y la clase social muestran influencia, mientras que el consumo de tabaco como factor protector leve.

Conclusiones: La prevalencia de hipertensión en la población trabajadora aumenta con la edad y en las clases sociales más bajas siendo los valores muy superiores en los hombres. Por tanto, es necesario poner en marcha campañas de prevención, detección y tratamiento de la hipertensión arterial dirigidas a la población.

Palabras clave: Presión arterial, hipertensión, variables sociodemográficas, tabaco.

Introduction

The World Health Organization recognizes high blood pressure (HTA) as one of the major health problems and the leading cause of death in the world, with more than 9 million new diagnoses each year. It therefore considers it a global public health crisis with a prevalence of approximately 25% of adults, associated with a decline in life expectancy of 10-15 years[1].

The American Heart Association values Hypertension as the highest percentage risk factor for cardiovascular disease, constituting 40.6%, above smoking (13.7%), non-cardiac-healthy diet (13.2%), sedentary life (11.9%) and hyperglycemia (8.8%)[2].

It is the chronic disease most often treated by health professionals[3]. It is increasing in association with an aging population and an increase in obesity[4]. The greatest risk is its silent character, it is not perceived by the patient and only shows evident symptoms when it has already produced damage. From there the importance of realizing a periodic control in young people and, especially in adults as the age increases. The delay in diagnosis favors poor control and an increase in cardiovascular risk[5].

The aim of this study is to estimate the prevalence of blood pressure values, stratifying them by applying the criteria of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7)[6] and relating them to clinical, social and demographic variables in the Spanish working population.

Materials and methods

Study design and setting.

A retrospective and transversal study is carried out on 418,343 workers from different Spanish geographical areas and belonging to different productive sectors during the period from January 2019 to June 2020. The workers were selected among those who attended the periodic occupational medical examinations. The flow chart is shown in **figure 1**.

Figure 1: Study participant flowchart.
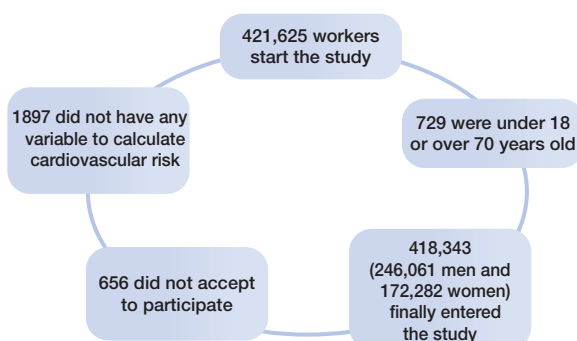
1.1 Inclusión criteria
- Age between 18 and 70 years old.
- Be an active worker
- Agree to participate in the study.

Data collection and management

The anthropometric measurements of height and weight, clinical and analytical, have been made by the health personnel of the different occupational health units participating in the study, after homogenizing the measurement techniques.

To measure the weight (expressed in kilograms) and the height (expressed in cm), a scale/height meter was used: model SECA 700 with capacity for 200 kg and 50 gram divisions, which has an added telescopic height meter SECA 220 with millimetric division and 60-200 cm interval. The BMI is calculated by dividing the weight by the height in meters squared.

The abdominal waist perimeter was measured in cm with a measuring tape: SECA model 20, with 1-200 cm interval and millimetric division. For evaluation, the person is placed in a standing position, feet together and trunk upright, abdomen relaxed and upper extremities hanging on both sides of the body. The measuring tape is placed parallel to the floor at the level of the last floating rib.

The blood pressure was examined in supine position with a calibrated OMRON M3 automatic sphygmomanometer and after 10 minutes of rest. Three determinations were made at one-minute intervals, obtaining the mean value of the three. Blood pressure was classified according to criteria JNC-7.

The blood samples were obtained by peripheral venipuncture after 12 hours of fasting and were sent to the reference laboratories where they were processed within a maximum time of 48-72 hours. Glycaemia, total cholesterol and triglycerides were determined by automated enzymatic methods, expressing the values in mg/dl. HDL is calculated by precipitation with dextran-sulphate Cl2Mg, and values are expressed in mg/dl. The LDL is estimated by means of the Friedewald formula (provided that the triglycerides are lower than 400 mg/dl) and is expressed in mg/dl.

Friedewald formula: LDL-c= Total cholesterol–HDL-c–triglycerides/5

A smoker is a person who has regularly consumed at least 1 cigarette/day (or the equivalent in other types of consumption) in the last month, or has stopped smoking less than a year ago.

The social class is determined from the 2011 National Classification of Occupations (CNO-11), based on the proposal of the group of social determinants of the

Spanish Society of Epidemiology [7]. It is classified into 3 categories: Class I. Directors/managers, university professionals, athletes and artists. Class II. Intermediate occupations and self-employed workers without employees. Class III. Unskilled workers.

Statistical analysis

A descriptive analysis of the categorical variables is carried out, calculating the frequency and distribution of responses for each of them. For quantitative variables, the mean and standard deviation are calculated, and for qualitative variables the percentage is calculated. The bivariate association analysis is carried out by means of the test of chi 2 (with correction of the exact Fisher statistic when conditions require it) and the Student t for independent samples. For multivariate analysis, binary logistic regression with Wald's method has been used, with the calculation of Odds ratios and the Hosmer-Lemeshow goodness-of-fit test is performed. The statistical analysis is carried out with the program SPSS 27.0 with the accepted statistical significance level of 0.05.

Ethics statement

Approval for the study was obtained from Balearic Islands Health Area Clinical Research Ethics Committee (institutional review board approval number: IB 4383/20). The study was designed in accordance with the ethical guidelines of the Declaration of Helsinki. All participants sign written informed consent documents before participating in the study.

Study participant flowchart is shown in **figure 1**.

Results

Our sample corresponds to a male-dominated population, average age 39-40 years, overweight, average blood pressure within normal values and discreetly high total cholesterol figures.

All the studied parameters, anthropometric (height, weight, BMI and waist circumference), clinical (blood pressure) and analytical (lipid profile and glycaemia) present more unfavorable average values in males, with statistically significant differences. In both sexes, the most frequent age group is 30-49 years old and the predominant social class is III. One third of the participants in our study are smokers, being equally distributed in both genders. **Table I**.

The prevalence of blood pressure values according to JNC7 classification in both sex is shown in **figure 2**.

Figure 2: Prevalence of blood pressure values according to JNC7 classification by sex (in percentage).
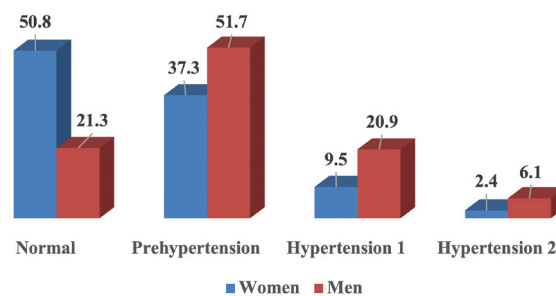

Table I: Sociodemographic, anthropometric, clinical and analytical characteristics of the sample.

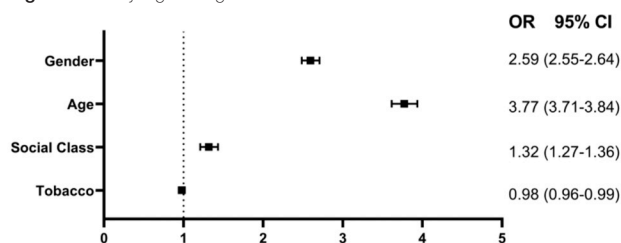|	Women n=172.282 mean (SD)	Men n=246.061 mean (SD)	Total n=418.343 mean (SD)	p-value
Age	39.6 (10.8)	40.6 (11.1)	40.2 (11.0)	<0.0001
Height	161.8 (6.5)	174.6 (7.0)	169.4 (9.3)	<0.0001
Weight	66.2 (14.0)	81.4 (14.7)	75.1 (16.2)	<0.0001
BMI	25.3 (5.2)	26.7 (4.5)	26.1 (4.8)	<0.0001
Waist circumference	74.8 (10.6)	86.2 (11.1)	81.5 (12.2)	<0.0001
Systolic blood pressure	117.4 (15.7)	128.2 (15.5)	123.7 (16.5)	<0.0001
Dyastolic blood pressure	72.6 (10.4)	77.8 (11.0)	75.6 (11.0)	<0.0001
Total cholesterol	190.6 (35.8)	192.6 (38.9)	191.8 (37.7)	<0.0001
HDL-c	56.8 (8.7)	50.3 (8.5)	53.0 (9.1)	<0.0001
LDL-c	116.1 (34.8)	118.0 (36.7)	117.2 (35.9)	<0.0001
Triglycerides	89.1 (46.2)	123.7 (86.4)	109.5 (74.6)	<0.0001
Glycaemia	87.8 (15.1)	93.3 (21.3)	91.0 (19.2)	<0.0001
	Percentage	Percentage	Percentage	p-value
18-29 years	20.7	18.8	19.6	<0.0001
30-39 years	29.7	27.6	28.4	
40-49 years	29.6	30	29.9	
50-59 years	16.8	19.7	18.5	
60-70 years	3.2	3.9	3.6	
Social class I	6.9	4.9	5.7	<0.0001
Social class II	23.4	14.9	18.4	
Social class III	69.7	80.3	75.9	
No Smokers	67.2	66.6	66.9	<0.0001
Smokers	32.8	33.4	33.2	

Table II: Prevalence of blood pressure values with JNC-7 classification according to age, social class and tobacco by sex.

	Women						Men					
		Normal	Prehyper-tension	Hyper-tension 1	Hyper-tension 2			Normal	Prehyper-tension	Hyper-tension 1	Hyper-tension 2	
	n	%	%	%	%	p-value	n	%	%	%	%	p-value
18-29 years	35617	63.8	32.5	3.3	0.4	<0.0001	46215	29.8	56.6	12.2	1.4	<0.0001
30-39 years	51115	61.6	32.6	4.9	0.9		67798	26.5	55.5	15.4	2.6	
40-49 years	51017	46.5	40.1	10.6	2.8		73935	18.8	51.8	22.8	6.6	
50-59 years	28951	29.4	45.0	19.6	6.0		48522	12.1	44.4	31.0	12.5	
60-70 years	5582	18.8	45.2	27.3	8.7		9591	8.7	39.6	36.0	15.7	
Social class I	11894	60.3	32.7	5.8	1.2	<0.0001	11950	22.0	53.9	19.2	4.9	<0.0001
Social class II	40266	53.6	36.5	8.0	1.9		36590	20.0	53.4	20.9	5.7	
Social class III	120122	48.9	38.0	10.3	2.8		197521	21.5	51.3	21.0	6.2	
No Smokers	115727	50.5	37.4	9.6	2.5	<0.0001	163920	21.1	51.8	21.0	6.1	<0.0001
Smokers	56555	51.3	37.1	9.2	2.4		82141	21.7	51.7	20.7	5.9	

The prevalence of arterial hypertension, both together and separately, increases as age increases in both genders. Similarly, its prevalence increases in parallel in men and women as they descend in social class. The prevalence of hypertension is slightly higher in the non-smoking group compared to that of smokers. In all cases the differences show statistical significance. (See **table II**).

The multivariate analysis by means of binary logistic regression establishes as covariates the male sex, the age from 50 years, the tobacco consumption and the social class II-III. The variable that shows greater influence in the appearance of hypertension is age with an Odds ratio of 3.77 (95% CI 3.71-3.84). Gender and social class also influence while tobacco consumption as a mild protective factor. (See **figure 3**).

Figure 3: Binary logistic regression

	OR	95% CI
Gender	2.59	(2.55-2.64)
Age	3.77	(3.71-3.84)
Social Class	1.32	(1.27-1.36)
Tobacco	0.98	(0.96-0.99)

Discussion

Essential hypertension is still the most frequently diagnosed disease among patients who come to the Primary Care outpatient clinic today. Its importance lies in its high prevalence and its association with high cardiovascular and renal morbidity and mortality.

The absence of a clear threshold for the association of blood pressure and risk of cardiovascular events and the existence of lifestyle factors that predispose to hypertension and whose modification is very difficult in practice, despite having been shown to reduce CVD, means that primary prevention continues to be considered as a real possibility that is doubtful and has already been described as utopian in previous studies[8].

In our study the overall prevalence of hypertension is 27% in men and 11.9% in women, data that differs from the study Di@bet.es[9] conducted in the general population with 5,048 people over 18 years, where the overall prevalence of hypertension was 42.6%, however, coincide with our results by gender, with higher figures for men 49.9% than for women 37.1%.

The analysis of the relationship of blood pressure figures with age and gender in our results reveals that they increase with increasing age, with the most unfavorable values in all cases in men, although these differences decrease between genders at ages over 59. Our results coincide with other studies that find an increase in hypertension prevalence with age and male gender[10]. This association between high blood pressure values with age is also observed in various population studies and leads to strict control of patients throughout their lives, but especially with aging[11-13].

The young population is less aware of the idea of illness, so primary prevention activities are complex and not very effective. This task can be developed from the basic units of occupational health in companies that complement the function of primary health care. Previous studies obtain a better result at a higher educational level and social status with greater acceptance of the treatments in case of needing them. In this work, white collars were less likely to suffer from hypertension compared to blue collars[14], which coincides with the results of our study of the worst results in terms of blood pressure in the population of both genders belonging to class III (which corresponds to blue collar workers) than in class I (white collar).

We found no relationship between the higher blood pressure figures and the consumption of tobacco referred to by other authors who defend that tobacco-induced mitochondrial oxidative stress contributes to endothelial dysfunction and the development of hypertension[15].

Cardiovascular diseases are the leading cause of death in our country and also lead to a high degree of disability and health expenditure. Atherosclerosis is a disease with

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a multifactorial cause, so its prevention requires a global approach that takes into account the different risk factors with which it is associated, among which hypertension occupies a prominent place[16]. Outpatient monitoring (MAPA) is by far the best clinical tool for estimating an individual's blood pressure. There is no scientific or clinical justification for ignoring these advantages, so MAPA should be part of the evaluation and follow-up of practically all hypertensive patients and to act in prevention with the advantages that its use implies for both the physician and the patient[17].

Our results show that it is possible to carry out preventive activities in hypertension in the workplace with access to large population samples, as well as interventions from occupational health as has been referred to by other authors with results in controlling hypertension and modifying unhealthy lifestyle habits. These multilevel actions are recommended for large-scale use or inclusion in workplace hypertension control programs[18].

The scope for improvement in the diagnosis and treatment of hypertension among employees in a company is very broad. Effective intervention programs based on epidemiological studies of large samples such as the one presented here are urgently needed and constitute its greatest strength. Among the limitations of our study are the lack of a comparative group of non-working people, the limitation to age groups between 18 and 70 years, and the greater participation of men, which does not allow extrapolating the results to the general population. As this is a population that regularly attends its health check-ups in prevention services, better results could be obtained than in the general population. This could be a source of confusion.

Conclussion

The prevalence of high blood pressure in the working population increases with age and in lower social classes, in both genders. We propose to implement campaigns of prevention, detection and treatment of arterial hypertension directed to the general population, being of special interest the work in primary prevention from the units of labor health and by the doctor of the work.

Interests conflict

The researchers declare that they have no conflict of interest.

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