Original article

Factors Associated With Knowledge and Control of Arterial Hypertension in the Canary Islands

María C. Rodríguez Pérez,[a] Antonio Cabrera de León,[a,b,*] Raquel M. Morales Torres,[c] Santiago Domínguez Coello,[a] José J. Alemán Sánchez,[a] Buenaventura Brito Díaz,[a] Ana González Hernández,[a] and Delia Almeida González[d]

[a] Unidad de Investigación, Gerencia de Atención Primaria, Hospital Universitario Ntra. Sra. de La Candelaria, Santa Cruz de Tenerife, Spain
[b] Área de Medicina Preventiva y Salud Pública, Universidad de La Laguna, Santa Cruz de Tenerife, Spain
[c] Servicio de Medicina Preventiva, Hospital Universitario Ntra. Sra. de La Candelaria, Santa Cruz de Tenerife, Spain
[d] Unidad de Inmunología, Hospital Universitario Ntra. Sra. de La Candelaria, Santa Cruz de Tenerife, Spain

A B S T R A C T

Introduction and objectives: To analyze the factors associated with knowledge and control of hypertension in the adult population of the Canary Islands (18-75 years).
Methods: We recruited a random sample of the general population aged ≥18 years. Hypertension was defined as systolic/diastolic blood pressure ≥140/90 mmHg or known hypertension (self-declared, or controlled hypertension <140/90 mmHg). The bivariate association of known and controlled hypertension with age, sex, anthropometry, serum lipids, medication, and lifestyle was corroborated by adjusting a multivariate logistic model.
Results: We included 6675 participants. The prevalence of hypertension was higher in men (40% vs 31%, *P*<.001), who also had a lower frequency of treated and controlled hypertension. Female sex (*P*<.001), age ≥55 years (*P*<.001), obesity (*P*<.001), and diabetes (*P*<.001) were associated with known hypertension. The modifiable factors that, in spite of treatment, increased the risk of poor control of hypertension were alcohol consumption (>30 g/day, odds ratio [OR]=2.4, *P*<.001; >15-≤30 g/day, OR=2, *P*=.009; >5-≤15, g/day, OR=1.83, *P*=.004), obesity (body mass index ≥30, OR=2, *P*=.003; >24.9-<30, OR=1.7, *P*=.024), serum cholesterol >250 mg/dL (OR=1.6, *P*=.006) and elevated heart rate (>80 bpm, OR=1.45, *P*=.045; >70-≤80 bpm, OR=1.36, *P*=.038).
Conclusions: The awareness of hypertension increases with frequent use of the health system and with factors associated with known hypertension: female sex, age, underlying health problems. The modifiable factors associated with poor control of known hypertension are alcohol consumption, obesity, elevated heart rate, and hypercholesterolemia.

© 2011 Sociedad Española de Cardiología. Published by Elsevier España, S.L. All rights reserved.

Factores asociados al conocimiento y el control de la hipertensión arterial en Canarias

R E S U M E N

Introducción y objetivos: Analizar los factores asociados al conocimiento y el control de la hipertensión arterial en la población adulta de Canarias.
Métodos: Se reclutó aleatoriamente una muestra de población general adulta (18-75 años). Se consideró hipertensión la presión arterial sistólica/diastólica ≥ 140/90 mmHg; hipertensión conocida, la declaración de padecerla e hipertensión controlada, valores < 140/90 mmHg. La asociación bivariable del conocimiento y el control de la hipertensión con edad, sexo, antropometría, lípidos séricos y estilo de vida se ajustó posteriormente por edad y sexo en un modelo logístico multivariable.
Resultados: Se incluyó a 6.675 participantes. Entre los varones hay mayor prevalencia de hipertensión (el 40 frente al 31%; p < 0,001), pero menos frecuencia de tratamiento y control. El sexo femenino (p < 0,001), la edad ≥ 55 años (p < 0,001), la obesidad (p < 0,001) y la diabetes mellitus (p < 0,001) se asocian directamente con la hipertensión conocida. Los factores modificables que, pese al tratamiento, incrementaban el riesgo de mal control son consumo de alcohol (*odds ratio* [OR] = 2,4 si alcohol > 30 g/día [p < 0,001]; OR = 2 si 15 < alcohol ≤ 30 g/día [p = 0,009]; OR = 1,83 si 5 < alcohol ≤ 15 g/día [p = 0,004]), obesidad (OR = 2 si índice masa corporal ≥ 30 [p = 0,003]; OR = 1,7 si 24,9 < índice masa corporal < 30 [p = 0,024]), colesterol sérico > 250 mg/dl (OR = 1,6; p = 0,006) y frecuencia cardiaca elevada (OR = 1,45 si frecuencia > 80 lat/min [p = 0,045]; OR = 1,36 si 70 < frecuencia ≤ 80 lat/min [p = 0,038]).

* Corresponding author: Unidad de Investigación de Atención Primaria, Hospital Universitario Ntra. Sra. de La Candelaria, Ctra. de El Rosario 145, 38010 Santa Cruz de Tenerife, Spain.
E-mail address: acableo@gobiernodecanarias.org (A. Cabrera de León).

Conclusiones: El conocimiento de la hipertensión aumenta con la frecuentación del sistema sanitario y los factores asociados a ello: sexo femenino, edad y sufrir problemas de salud. Los factores modificables que incrementan el mal control de la hipertensión conocida son: consumo de alcohol, obesidad, frecuencia cardiaca elevada e hipercolesterolemia.

Abbreviations

BP: blood pressure
HR: heart rate
HT: hypertension
OR: odds ratio

INTRODUCTION

Although there has been a worldwide trend of decreasing blood pressure (BP) in the last 30 years,[1] hypertension (HT) still affects almost 40% of adults in developed countries and is increasing in developing countries.[2] There are substantial intercontinental differences, as countries such as the United States and Canada have a lower prevalence of HT than Europe,[3] possibly due to more intensive primary prevention measures.[4] Although control of HT has improved, less than half of those who are aware of their condition maintain their BP under control.[5,6] Hypertensive patients have twice the risk of experiencing a cardiac event and HT is associated with 35% of arteriosclerotic events[7] and almost 60% of deaths due to cardiovascular causes in individuals aged over 50 years.[8] Multiple factors have an impact on the poor control of HT: health insurance coverage, unawareness of the problem, poor adherence to treatment, inappropriate prescriptions, therapeutic inertia, and unhealthy lifestyles.[5,9]

In Spain, at the end of the last century the prevalence of HT was 38% among individuals aged over 20 years[10]; data from the first decade of the current century placed the figure at 47% for men and 39% for women between 35 and 74 years of age,[11] thereby confirming the increase compared to previous decades.[12] Although mortality due to ischemic heart disease in Spain is relatively low, the population of the Canary Islands has rates close to those of Nordic and central European countries.[13] The influence of HT on these figures might be important, as the prevalence in the Canary Islands (50% among men and 42% among women aged 35 to 74 years) stands above that of other Spanish regions.[11] However, in this century, studies have not been published on control of HT in the population of the Canary Islands. The objective of this study was to analyze the factors associated with awareness and control of HT in the general adult population of the Canary Islands.

METHODS

This was a cross-sectional study of patients enrolled in the Canary Islands Cardiovascular, Diabetes, and Cancer (CDC) Study. The design of this study and its preliminary results have already been published.[14] In summary, participants were randomly selected from the general adult population of the Canary Islands (aged 18 to 75 years); a participation of 70% was achieved and 6729 participants were recruited between January 2000 and December 2005. For the present analysis, 54 subjects with missing data were excluded. In a first participant visit, fasting blood samples were drawn and the individuals underwent a physical examination. Weight, height, heart rate (HR), abdominal and pelvic circumference, and BP were recorded. BP was measured using a previously calibrated mercury sphygmomanometer, with the subject seated and having been at rest for 5 min. Two measurements were taken and their average was used for the study. In addition, individuals filled out the CDC questionnaire on lifestyle (see www.cdcdecanarias.org). The dietary questions have been validated.[15]

HT was defined as systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg or affirmation of previous diagnosis of HT (known HT). Poorly controlled HT was defined as known HT with systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg. Normal-high BP was taken to be BP between 130 and 139 mmHg or diastolic BP between 85 and 89 mmHg. This determination was based on data obtained in the interview on treatment (diet and drugs) and type of antihypertensive medication and the regimen prescribed by the physician. Therapeutic adherence was established when the individual stated taking the medication daily. Monotherapy was noted when the antihypertensive medication included only 1 group of drugs.

With regard to other factors of cardiovascular risk, patients with diabetes were those who reported having the condition and were receiving pharmacologic treatment and those with fasting blood glucose levels >125 mg/dL. Obesity was defined as a body mass index (BMI) ≥30 and overweight individuals as those with a BMI ≥25 but ≤29.9; abdominal obesity was defined using the abdomen/height ratio.[16] In addition, the lipid profile was determined: total cholesterol, high-density lipoprotein cholesterol (HDL-c), and triglycerides.

Physical activity was measured in total daily metabolic equivalents, consumed both in occupational activities and during leisure time and at rest. Social class was analyzed according to the income, crowding, and education index obtained from the equation (family income, in quintiles)+(3×level of education)+(2×household crowding index). This index has been validated and acts as a continuous quantitative variable that indicates higher social class with higher value.[17] Smoking habit was also obtained as self-declared, and exsmokers were excluded from the group of nonsmokers. The dietary variables analyzed were alcohol consumption (g/week), average sodium intake (mg/day), and coffee consumption (g/day).

Statistical Analysis

The results for continuous variables were expressed as mean (standard deviation) while categorical variables were expressed as relative frequency and 95% confidence intervals (95%CI). The Student t test was used to compare means, while the χ^2 test was used to compare proportions. The general prevalence was adjusted directly, taking as standard the age of the European population after classifying the individuals into 5-year age groups.

To estimate the risk of different variables associated with awareness of HT, a group of patients with HT was defined and an initial logistic regression model was set up with known HT as the dependent variable (yes or no) and its association with sex, age, and other variables of interest from the bivariate analysis was explored. This procedure was repeated in a second logistic model, in which participants with known and treated HT were selected, and the dependent variable was taken to be controlled HT (yes or no). The fit was performed with the "backstep" method and Wald

criterion, evaluating goodness of fit with the Hosmer-Lemeshow test and discriminatory capacity with the area under the ROC curve, and comparing the final models with the results if they fit with the "enter" method. Both methods gave similar results in the predictive variables that were significant, with slight variations in the size of the coefficients but not in their order; odds ratios (OR) and 95%CIs were calculated, obtained with the "backstep" method. The modeling also explored the interaction between sex and the variables that had shown association only with men and women. The statistics package SPSS 19.0 was used for the analysis.

RESULTS

The crude prevalence of HT was 35.7%, and the standardized prevalence 38.2%. Table 1 shows the prevalence of HT according to sex, as well as degree of awareness, treatment, and control. Prevalence was lower in women ($P<.001$), both for HT and for normal-high BP. However, the proportion with known HT was higher among women, $>70\%$ vs $<60\%$ in men ($P<.001$). Awareness of the condition was significantly greater ($P<.001$) in those aged ≥ 55 years (70.6%) compared to younger individuals (61.6%). Moreover, almost half the women with known HT had good control compared to only a third of men ($P<.001$). Also significant was the difference in known HT untreated pharmacologically (23% in women compared to 36% in men; $P<.001$).

Table 2 shows the differences between people with known and unknown HT. Both men and women with known HT were older, more obese, and had lower BP (only diastolic BP in the case of men), higher prevalence of diabetes, lower HDL-c levels, and a lower dietary sodium intake. In contrast, HR was only lower in women and daily energy expenditure was lower in men.

Subjects with known HT with controlled BP differed from those with poor control (Table 3) in that they were younger and less obese, with a more favorable biochemical profile and worse therapeutic adherence. In addition, men with controlled BP had lower HR and lower alcohol consumption than uncontrolled individuals. For their part, women with controlled HT were more physically active, of a higher social class, and had higher coffee and tobacco consumption than their uncontrolled counterparts.

Table 4 shows the logistic regression model with the factors finally retained for their association with known HT (usage of the health system, diabetes mellitus, and obesity) and the risk of poor control of HT for several factors in the multivariate analysis: the risk of poor control associated with alcohol was significant for consumption greater than 5 g/day (OR=1.8, $P<.004$) and increased with increasing consumption until reaching OR=2.4 for consumption >30 g/day ($P<.001$). Likewise, the risk of poor control increased with increasing overweight (OR=1.7, $P=.043$) up to obesity (OR=2, $P<.003$) and the risk also increased when HR exceeded 70 bpm, with an OR of 1.5 for HR>80 bpm ($P=.045$). Finally, hypercholesterolemia >250 mg/dL was also associated with poor control of HT (OR=1.6; $P=.0006$). The 2 nonmodifiable factors that were also retained in this logistic regression analysis for their association with poor control were male sex (OR=1.88; 95%CI, 1.51-2.33; $P<.001$) and age (OR=1.05 per year; 95%CI, 1.04-1.06; $P<.001$).

DISCUSSION

Our results confirm that HT is far from being considered a well controlled or treated disease in the Canary Islands. The high prevalence is coupled with a lower percentage of individuals who are aware of their disease and an even lower percentage who have achieved good control of BP. There is still a high percentage of individuals who, although aware that they are hypertensive, do not follow pharmacological treatment and the great majority of those who are on treatment are on monotherapy regimens. Alcohol consumption, obesity, high HR, and hypercholesterolemia are the main modifiable risk factors that we found associated with poor control of known HT.

Comparison with studies performed in the Canary Islands at the end of the 20th century showed that the prevalence of HT has not increased but unawareness of the disease persists.[18,19] In contrast, although hardly 40% of those aware of their condition have good control, this percentage has increased notably and is 4-fold greater than the figures at the end of the last century.[19] These 2 circumstances taken together suggest that we have not improved screening for the disease although treatment has improved. Those who were aware of their HT were those with more factors that would favor usage of medical services (age, obesity, diabetes mellitus), thereby facilitating detection of the disease. In countries such as the United States, whose healthcare system is not public, it has been found that factors related to accessibility and frequency of use of healthcare services are the ones that increase awareness

Table 1
Prevalence of Hypertension in Men and Women Percentage With Known, Treated, and Controlled Hypertension

	Men (n=2890)	Women (n=3785)	P
Prevalence			
Confirmed hypertension[a]	39.9 (38.1-41.7)	31.4 (29.9-32.9)	<.001
Percentages			
Normal-high BP (SBP 130-139 and DBP 85-90 mmHg)[b]	27.5 (25.9-29.1)	19.1 (17.8-20.4)	<.001
Known hypertension (previously diagnosed)[c]	58.1 (54.9-60.7)	72.1 (65.6-78.3)	<.001
Controlled hypertension[d]	33.6 (29.9-37.2)	46.1 (42.7-49.5)	<.001
Hypertension controlled and treated pharmacologically[c]	30.6 (26-35.2)	40.7 (36.8-44.7)	.001
Hypertension not treated pharmacologically[d]	35.9 (32.2-39.5)	23 (20.2-25.8)	<.001
Hypertension treated in monotherapy[e]	94.5 (92.3-96.7)	90.8 (88.5-93.1)	.065
Hypertension with good therapeutic adherence[e]	53.7 (49.9-57.5)	64.5 (61.3-67.7)	<.001

BP, blood pressure; DPB, diastolic blood pressure; SBP, systolic blood pressure.
The variables are expressed as percentages (95% confidence intervals).
  [a] Relative to general population: SBP$\geq$140/DBP$\geq$90 mmHg or previously diagnosed hypertension or antihypertensive treatment.
  [b] Relative to population without hypertension.
  [c] Relative to population with confirmed hypertension.
  [d] Relative to population with known hypertension.
  [e] Relative to population with hypertension receiving pharmacological therapy; monotherapy refers to antihypertensive drugs that contain a single therapeutic group.

Table 2
Distribution of Factors Associated With Awareness of Hypertension by Sex

	Men			Women		
	Known hypertension (n=667)	Unknown hypertension (n=477)	P	Known hypertension (n=859)	Unknown hypertension (n=328)	P
Age, years	50.6±11.1	46.8±11.7	<.001	52.5±10.4	51±10.9	.028
Systolic pressure, mmHg	141.2±18.6	142.2±14	.298	138.4±19.9	143.1±13	<.001
Diastolic pressure, mmHg	88.6±10.6	90.2±8	.005	84.8±10.9	87.6±7.3	<.001
Abdomen/height ratio	0.59± 0.06	0.57±0.07	<.001	0.61±0.08	0.59±0.07	<.001
BMI	29.8±4.2	28.7±4	<.001	31.2±5.6	30±5.2	.001
Heart rate, bpm	73.2±11.1	73.3±11.5	.878	74.5±10.5	76.2±10.8	.012
Total cholesterol, mg/dL	211.8±41.1	216.5±40.4	.055	215.7±40.1	220.9±40.4	.051
Triglycerides,[a] mg/dL	4.9±0.5	5±0.5	.281	4.8±0.5	4.8±0.5	.349
LDL-c, mg/dL	134.7±36.2	137.3±35.7	.241	137.6±35.7	139.8±33.1	.328
HDL-c, mg/dL	44.8±12	47.8±14.7	<.001	51.4±12.3	53.6±12.8	.006
Blood glucose,[a] mg/dL	109.6±34.7	105.9±34.5	.008	105.8±35.1	99.7±22.8	<.001
Diabetes mellitus	23.8 (20.6-27)	13.6 (10.5-16.7)	<.001	23.9 (21-26.8)	11.3 (7.9-14.7)	<.001
Coffee,[a] g/day	35.4±34.5	38.3±35.1	.207	36.7±36.4	38.3±35.8	.281
Alcohol,[b] g/week	138.5±215	153.5±249.5	.144	17.1±47.3	11.1±42.4	.039
Sodium, mg/day	1379.6±279.6	1455.6±292.1	<.001	1020.8±170.7	1055.8±160.5	.011
Total daily MET	34.5±10.3	36.1±11.2	.015	31.9±5.9	32.3±6	.286
Social class	12.8±3.4	13.1±3.5	.119	12.2±2.9	12.3±2.9	.602
Smokers	24.3 (21-27.6)	28.3 (24.3-32.3)	.131	11.5 (9.4-13.6)	8.2 (5.2-11.2)	.098

BMI, body mass index; HDL-c, high-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol; MET, metabolic equivalent.
Continuous variables are expressed as mean±standard deviation while categorical variables are expressed as percentages (95% confidence intervals).
[a] Log transformed for analysis.
[b] For the analysis of alcohol, a nonparametric test (Mann-Whitney U test) was used.

Table 3
Distribution of Factors Associated With Control of Known Hypertension by Sex

	Men			Women		
	Controlled hypertension (n=219)	Uncontrolled hypertension (n=433)	P	Controlled hypertension (n=387)	Uncontrolled hypertension (n=452)	P
Age, years	48±11.3	51.8±10.8	<.001	49±11.3	55.2±8.4	<.001
Systolic pressure, mmHg	123.6±9.5	150.1±15.4	<.001	122.6±10.5	152±15.6	<.001
Diastolic pressure, mmHg	79.1±7.5	93.4±8.4	<.001	76.9±7.4	91.5±8.7	<.001
Abdomen/height ratio	0.58±0.08	0.61±0.06	.001	0.60±0.08	0.62±0.07	<.001
BMI	28.9±4.2	30.3±4.2	<.001	30.6±5.4	31.2±5.7	.002
Heart rate, bpm	71.6±10.1	73.9±11.4	.014	74±9.7	74.9±11.1	.204
Total cholesterol, mg/dL	204.7±41.6	215.3±40.5	.002	211.1±39	220±40.6	.001
Triglycerides[a], mg/dL	149.9±102.6	175.4±119.2	.002	131.1±82.3	140.3±75.6	.009
LDL-c, mg/dL	130.1±36.8	137.2±35.8	.019	134.4±35.2	140.5±35.9	.015
HDL-c, mg/dL	44.7±9.7	44.8±13	.929	51±12	51.7±12.6	.374
Blood glucose,[a] mg/dL	103.2±26.3	112.9±37.9	<.001	102.6±34.9	108.7±35.1	.002
Diabetes mellitus	21.5 (16.1-26.9)	25.4 (21.3-29.5)	.266	22.2 (17.8-26.6)	25.2 (21.2-29.2)	.309
Coffee,[a] g/day	37±33	34.3±35.6	.258	41.3±40.6	33.1±32.4	.010
Alcohol,[b] g/week	101.5±143.8	157.7±241.7	<.001	9.2±25.4	12.7±52.8	.202
Sodium,[b] mg/day	1483.6±869.8	1534.5±889.1	.401	1377.1±872	1232.8±710.7	.078
Total daily MET	34.2±9.8	34.7±10.6	.632	32.4±6.8	31.4±5.1	.015
Social class	12.8±3.5	12.8±3.3	.989	12.5±3.1	11.9±2.7	.006
Smokers	23.3 (17.7-28.9)	25 (20.9-29.1)	.631	18.6 (14.7-22.5)	5.8 (3.6-8)	<.001
Good therapeutic adherence	47.5 (40.9-54.1)	56.9 (52.2-61.6)	.024	55.9 (50.9-60.8)	72 (67.9-76.1)	<.001

BMI, body mass index; HDL-c, high-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol; MET, metabolic equivalent.
Continuous variables are expressed as mean±standard deviation while categorical variables are expressed as percentages (95% confidence intervals).
[a] Log transformed for analysis.
[b] For the analysis of alcohol, a nonparametric test (Mann-Whitney U test) was used.

Table 4
Factors Associated With Awareness of Hypertension and Poor Control

	OR (95%CI)	P
Factors associated with known hypertension[a]		
Visit to the physician 1 or more times a month (reference: never)	11.28 (3.80-33.42)	<.001
Visit to the physician every 2 or 3 months	12.67 (4.43-36.27)	<.001
Visit to the physician 2 or 3 times a year	4.74 (1.69-13.29)	.003
Visit to the physician every 2 or 3 years	2.69 (0.92-7.87)	.070
Visit to the physician more than 3 years earlier	2.76 (0.87-8.73)	.084
Diabetes mellitus	1.81 (1.33-2.46)	<.001
Obesity (BMI$\geq$30) (reference: BMI<25)	1.76 (1.25-2.47)	.001
Overweight (BMI$\geq$25-29.9)	1.76 (1.24-2.50)	.002
Modifiable factors associated with poor control of hypertension despite therapy[b]		
Alcohol>30 g/day (reference: abstention)	2.40 (1.41-4.06)	.001
15 g/day<alcohol $\leq$30 g/day	2 (1.19-3.36)	.009
5 g/day<alcohol $\leq$15 g/day	1.83 (1.21-2.77)	.004
Obesity (BMI$\geq$30) (reference: BMI<25)	2 (1.28-3.14)	.003
Overweight (BMI$\geq$25-29.9)	1.70 (1.07-2.70)	.024
Total serum cholesterol > 250 mg/dL	1.60 (1.14-2.25)	.006
Heart rate>80 bpm (reference: $\leq$70 bpm)	1.45 (1.01-2.08)	.045
70 bpm<heart rate $\leq$80 bpm	1.36 (1.02-1.81)	.038

95%CI, 95% confidence interval; BMI, body mass index; OR, odds ratio.
Independent variables entered into both models as continuous quantitative ones (age, waist circumference, social class, physical activity, and sodium intake), ordinal ones (alcohol consumption, heart rate, body mass index, and frequency of visits to the physician), or dichotomic categoric ones (sex, cholesterol >250 mg/dL, diabetes mellitus, smoking, antihypertensive monotherapy, and good therapeutic adherence).
  [a] n=1986 (after excluding 345 subjects with missing values). Hosmer-Lemeshow: χ^2=7.52; P=.46. Area under curve=0.71 (95%CI, 0.69-0.78).
  [b] n=1464 (after excluding 63 subjects with known hypertension but without treatment). Hosmer-Lemeshow: χ^2=8; P=.43. Area under curve=0.67 (95%CI, 0.64-0.70).

of HT.[20] In addition, those who were aware of being hypertensive had lower BP and lower sodium intake, both attributable to treatment and health recommendations. And, as is habitual, awareness of HT as well as its control and treatment were greater among women,[5,20] who generally use the health services more than men.[21] It would seem appropriate to improve opportunistic screening in primary health care, particularly among young men. Public health policies should promote the identification of hypertensive patients and intensification of BP control.[22]

The greatest risk of poor control of HT occurs in those who report a high alcohol intake, although the risk was already significant for intakes as low as 5 to 15 g/day. Given the cross-sectional design, we cannot establish cause-effect relationships, but our results agree with those of prospective studies in which alcohol consumption increases the risk of having HT.[23] This is a factor whose cardiovascular impact is subject to lengthy debate about whether moderate alcohol consumption (generally associated with high HDL-c) is beneficial and about the damage caused by the onset and poor control of HT. For the general population, the debate probably cannot be settled without comparing benefits and harm in a controlled clinical trial.[24] In hypertensive patients, however, the current level of evidence prompts most scientific societies to recommend limiting alcohol consumption.[25,26]

The association we have found between overweight-obesity and poor control of HT has been well established, and the mechanisms are known.[27] Clearly, the high prevalence of obesity in the Canary Islands contributes to the poor control of HT.[11] In contrast, the multivariate analysis did not confirm the effect of physical activity detected in women with the bivariate analysis, perhaps because we did not assess exercise during leisure time but rather total daily energy consumption. Although the beneficial effect of physical exercise has been shown for BP and for control of HT, thanks to decreased systemic vascular resistance,[28] there are epidemiological studies in which this association is not detected,[29] whether because of the way in which physical activity is measured or the presence of some confounding factor.

High HR maintained its association with poor control of HT, even after adjustment for factors with an impact on HR, such as beta-blockers and others such as smoking and physical exercise. This association is known and it has been reported that an increase of 10 bpm can increase BP by up to 10 mmHg.[30] HR is being given increasing prominence as an independent risk factor, as it predicts both the onset of HT and cardiovascular mortality,[31] although it has not been included in the clinical guidelines.[32]

The fact that hypercholesterolemia emerged as a factor for poor control of HT, even after adjusting for consumption of lipid-lowering agents such as statins, has also been reported before.[33,34] It does not seem that this is merely because of the coexistence of several risk factors in the same subject, as the logistic regression model adjusted for most of them. Although it is impossible to discard a certain influence of residual confounding factors, the observation more probably reflects the association between HT and atherosclerosis favored by hypercholesterolemia.

The use of antihypertensive medication, which was more frequent among women, shows a substantial percentage of known hypertensive patients who were not being treated with drugs, 29.5% on average. Even so, this figure is an improvement on the 53% reported in the Canary Islands 10 years earlier,[19] and is less than the 38% recently reported in some regions.[35] By countries, this proportion of untreated HT is similar to that published in the United States[5] and Spain,[36] but greater than the 20% reported for France.[20] Almost all hypertensive patients in pharmacological treatment were in monotherapy, which has been attributed to inertia in physicians' approach to therapy and is considered an obstacle for control of HT in articles that declare a conflict of interest.[37,38] We did not detect any association between mono-therapy and poor control, and as such, we are in agreement with other studies that have not shown the superiority of combined therapy compared to monotherapy.[20] In contrast, adherence of

patients to treatment, always conducive to good control,[21] showed an inverse relationship in our study, but this can be attributed to a greater effort on the part of patients who did not manage to control their HT and this is not comparable in a cross-sectional study such as ours. In any case, the association disappeared in the multivariate analysis.

Although sodium is a necessary nutrient, the direct relationship between sodium intake and HT has led to recommendations of intakes between 1200 and 1500 mg/day,[39] a limit exceeded by the men in our study. Sodium intake was significantly lower in those who were aware of their HT, but we did not find an association between sodium intake and control of HT. Although we estimated intake using a validated questionnaire,[15] this method often underestimates sodium intake in aspects such as added salt for preservation and cooking. However, other studies that have quantified sodium intake through urinary excretion of sodium also did not find significant differences.[40]

The bivariate association of smoking habit, coffee, and social class with good control of HT in women can be explained by their 6-year difference in age compared to women who did not manage to control HT. In fact, these associations disappeared in the multivariate model after adjustment for age. Prevalence, awareness, and control of HT have been reported previously for the whole of Spain in the population aged more than 60 years.[41] Our study, limited to the Canary Islands, analyzed a much younger population (18-75 years) but the results are in agreement for known HT: usage of the health system, obesity, and diabetes mellitus. In contrast, perhaps because our study mainly included the active population, we detected factors associated with poor control of HT that were not confirmed in elderly Spaniards: obesity, alcohol, cholesterol, and HR.

The main limitation of our study is its cross-sectional design, which precludes inferences of causality. To this, we should add the fact that, as in any population-based study, many of the data analyzed were based on self-reported values, which may introduce bias, particularly in statements about therapeutic adherence given that in addition to possible recall biases there is also the possible desire for approval. Moreover, we cannot vouch for the reliability of registry-based studies in aspects such as diagnosis and treatments. On the other hand, the strength of the study lies in the fact that it analyzed the largest adult sample in the Canary Islands. This sample was selected in such a way as to ensure that it was representative, providing a better view of the reality in the region than would be obtained with a study conducted exclusively in patients.

CONCLUSIONS

We conclude that in the population of the Canary Islands, where the prevalence of HT is among the highest in Spain, it is still necessary to increase the percentage of individuals who are aware of their disease. Compared with previous decades, control has improved, but there is still a high percentage of individuals who do not follow pharmacological treatment despite knowing that they are hypertensive. Those with lower usage of the healthcare system are less aware of their disease; they tend to be younger, male, and do not have any underlying health problems. Opportunistic screening efforts should be greater in these individuals. Alcohol consumption, obesity, high HR, and hypercholesterolemia are the main modifiable risk factors associated with poor control of HT.

ACKNOWLEDGMENTS

FUNDING

CONFLICTS OF INTEREST

None declared.

REFERENCES

1. Danaei G, Finucane MM, Lin JK, Singh GM, Paciorek CJ, Cowan MJ, et al. National, regional and global trends in systolic blood pressure since 1980: systematic analysis of health examination surveys and epidemiological studies with 786 country-years and 5.4 million participants. Lancet. 2011;6736:62036–43.
2. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK. Global burden of hypertension: analysis of worldwide data. Lancet. 2005;365:217–23.
3. Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense HW, Joffres M, et al. Hypertension prevalence and blood pressure levels in 6 european countries, Canada and the Unites States. JAMA. 2003;289:2363–9.
4. Fields LE, Burt VL, Cutler JA, Hughes J, Roccella EJ, Sorlie P. The burden of adult hypertension in the Unites States 1999 to 2000 a rising tide Hypertension. 2004;44:398–404.
5. Centers for Disease Control and Prevention (CDC). Vital signs: prevalence, treatment, and control of hypertension—United States, 1999-2005 and 2005-2008. MMWR Morb Mortal Wkly Rep. 2011;60:103–8.
6. Llisterri Caro JL, Rodríguez Roca GC, Alonso Moreno FJ, Banegas Banegas JR, González-Segura Alsina D, Lou Arnal S, et al. Control de la presión arterial en la población hipertensa española atendida en atención primaria. Estudio PRESCAP 2006. Med Clin (Barc). 2008;130:681–7.
7. Cifkova R. The burden of hypertension and inadequate control in populations. J Hypertens. 2006;24:807–9.
8. Graciani A, Zuluaga-Zuluaga MC, Banegas JR, León-Muñoz LM, De la Cruz JJ, Rodríguez-Artalejo F. Mortalidad cardiovascular atribuible a la presión arterial elevada en la población española de 50 años o más. Med Clin (Barc). 2008; 131:125–9.
9. Coca A. Evolución del control de la hipertensión arterial en atención primaria en España. Resultados del estudio Controlpress 2003. Hipertensión. 2005;22:5–14.
10. Gabriel R, Alonso M, Segura A, Tormo MJ, Artiago LM, Banegas JR, et al. Prevalencia, distribución y variabilidad geográfica de los principales factores de riesgo cardiovascular en España. Análisis agrupado de datos individuales de estudios epidemiológicos poblacionales: estudio ERICE. Rev Esp Cardiol. 2008;61:1030–40.
11. Grau M, Elosua R, Cabrera de León A, Guembe MJ, Baena-Díez JM, Vega T, et al. Factores de riesgo cardiovascular en España en la primera década del siglo XXI: análisis agrupado con datos individuales de 11 estudios de base poblacional, estudio DARIOS. Rev Esp Cardiol. 2011;64:295–304.
12. Basterra-Gortari FJ, Bes-Rastrollo M, Seguí-Gómez M, Forga L, Martínez JA, Martínez-González MA. Tendencias de la obesidad, diabetes mellitus, hipertensión e hipercolesterolemia en España (1997-2003). Med Clin (Barc). 2007;129:405–8.
13. Müller-Nordhorn J, Binting S, Roll S, Willich SN. An update on regional variation in cardiovascular mortality within Europe. Eur Heart J. 2008;29:1316–26.
14. Cabrera de León A, Rodríguez Pérez MC, Almeida González D, Domínguez Coello S, Aguirre Jaime A, Brito Díaz B, et al. Presentación de la cohorte "CDC Canarias": objetivos, diseño y resultados preliminares. Rev Esp Salud Pública. 2008;82: 519–34.
15. Aguirre-Jaime A, Cabrera de León A, Domínguez Coello S, Borges Álamo C, Carrillo Fernández L, Gavilán Batista JC, et al. Validación de un cuestionario de frecuencia de consumo de alimentos adaptado para el estudio y seguimiento de la población adulta de las islas canarias. Rev Esp Salud Pública. 2008;82: 509–18.
16. Rodríguez Pérez MD, Cabrera de León A, Aguirre-Jaime A, Domínguez Coello S, Brito Díaz B, Almeida González D, et al. El cociente perímetro abdominal/estatura como índice antropométrico de riesgo cardiovascular y de diabetes. Med Clin (Barc). 2010;134:386–91.
17. Cabrera de León A, Rodríguez Pérez MC, Domínguez Coello S, Rodríguez Díaz C, Rodríguez Álvarez C, Aguirre Jaime A; grupo CDC. Validación del modelo REI para medir la clase social en población adulta. Rev Esp Salud Pública. 2009;83:231–42.
18. Rodríguez Pérez JC, Calonge Ramírez S, Bichara Antonios G. Prevalencia de los factores de riesgo de cardiopatía isquémica en la isla de Lanzarote. Med Clin (Barc). 1993;101:45–50.
19. De Pablos-Velasco P, Martínez-Martín FJ, Rodríguez Pérez F, Urioste LM, García Robles R. Prevalence, awareness, treatment and control of hipertensión in a Canarian population. Relationship with glucose tolerance categories. The Guía Study. J Hypertens. 2002;20:1965–71.
20. Wagner A, Sadoun A, Dallongeville J, Ferrièrs J, Amouyel, Ruidavets JB. High blood pressure prevalence and control in a middle-aged French population and their associated factors: the MONA LISA study. J Hypertens. 2011;29:43–50.

21. Bertakis KD, Azari R, Helms LJ, Callahan EJ, Robbins JA. Gender differences in the utilization of health care services. J Fam Pract. 2000;49:147–52.
22. Banegas JR, Jovell A, Abarca B, Aguilar Diosdado M, Aguilera L, Aranda P, et al. Hipertensión arterial y política de salud en España. Med Clin (Barc). 2009;132:222–9.
23. Sesso HD, Cook NR, Buring JE, Manson JE, Gaziano JM. Alcohol consumption and the risk of hypertension in women and men. Hypertension. 2008;50:1080–7.
24. Kloner RA, Rezkalla SH. To drink or not to drink? That is the question. Circulation. 2007;116:1306–17.
25. Khan NA, Hemmelgarn B, Herman RJ, Bell CM, Mahon JL, Leiter LA, et al. The 2009 Canadian Hypertension Education Program recommendations for the management of hypertension: Part 2—therapy. Can J Cardiol. 2009;25:287–98.
26. Goldstein LB, Bushnell CD, Adams RJ, Appel LJ, Braun LT, Chaturvedi S, et al. Guidelines for the primary prevention of stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2011;42:517–84.
27. López-Jiménez F, Cortés-Bergoderi M. Obesidad y corazón. Rev Esp Cardiol. 2011;64:140–9.
28. Fagard RH, Cornelissen VA. Effects of exercise on blood pressure control in hypertensive patients. Eur J Cardiovasc Prev Rehabil. 2007;14:12–7.
29. Casson RI, King WD, Godwin NM, Petrella RJ; Canadian Hypertension Society. Lack of association between activity or fitness and loss of control of hypertension. Can J Cardiol. 2003;19:1485–9.
30. Perret-Guillaume C, Joly L, Benetos A. Heart rate as a risk factor for cardiovascular disease. Prog Cardiovasc Dis. 2009;52:6–10.
31. Palatini P. Heart rate as predictor of outcome. Blood Press Monit. 2008;13:167–8.
32. Mancia G, De Backer G, Dominiczak A, Ciflkova R, Fagard R, Germano G, et al.; ESH-ESC Task Force on the Management of Arterial Hypertension. 2007 ESH-ESC Practice Guidelines for the Management of Arterial Hypertension: ESH-ESC Task Force on the Management of Arterial Hypertension. J Hypertens. 2007;25:1751–62.
33. Journath G, Hellènius ML, Petersson U, Theobald H, Nilsson PM. Sex differences in risk factor control of treated hypertensives: a national primary healthcare-based study in Sweden. Eur J Cardiovasc Prev Rehabil. 2008;15:258–62.
34. Rodríguez-Roca GC, Alonso-Moreno FJ, Barrios V, Llisterri JL, Lou S, Matalí A, et al. Características de la presión arterial en una población dislipémica española asistida en atención primaria. Estudio LIPICAPPA. Rev Esp Cardiol. 2007;60:825–32.
35. Félix-Redondo FJ, Fernández-Bergés D, Fernando Pérez J, Zaro MJ, García A, Lozano L, et al. Prevalencia, detección, tratamiento y grado de control de los factores de riesgo cardiovascular en la población de Extremadura (España). Estudio HERMEX. Aten Primaria. 2011;43:426–34.
36. Baena-Díez JM, Félix FJ, Grau M, Cabrera de León A, Sanz H, Leal M, et al. Tratamiento y control de los factores de riesgo según el riesgo coronario en la población española del estudio DARIOS. Rev Esp Cardiol. 2011;64:766–73.
37. Wald DS, Law M, Morris JK, Bestwick JP, Wald NJ. Combination therapy versus monotherapy in reducing blood pressure: meta-analysis on 11,000 participants from 42 trials. Am J Med. 2009;122:290–300.
38. Márquez-Contreras E, Coca A, De la Figuera M, Divisón JA, Llisterri JL, Sobrino J, et al. Perfil de riesgo cardiovascular de los pacientes con hipertensión arterial no controlada. Estudio Control-Project. Med Clin (Barc). 2007;128:86–91.
39. Barr SI. Reducing dietary sodium intake: the Canadian context. Appl Physiol Nutr Metab. 2010;35:1–8.
40. Staessen JA, Bieniaszewski L, Pardaens K, Petrov V, Thijs L, Fagard R. Life style as a blood pressure determinant. J R Soc Med. 1996;89:484–9.
41. Banegas JR, Rodríguez-Artalejo F, Ruilope LM, Graciani A, Luque M, De la Cruz-Troca JJ, et al. Hypertension magnitude and management in the elderly population of Spain. J Hypertens. 2002;20:2157–64.