Prevalence of Main Cardiovascular Risk Factors in Women From Biscay

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Introduction and objectives. The aim of this study was to analyze the prevalence of principal cardiovascular risk factors in the female population from Biscay (northern Spain).

Patients and method. We selected a random representative sample of 1,317 women aged between 16 and 65 years from this province. For each participant we recorded the following parameters: weight and height, physical activity, smoking, blood pressure, glycemia, total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol.

Results. A total of 1,100 women (mean age 39.83 ± 14 years) participated. Regarding physical activity, 31.9% of the women had a sedentary lifestyle and 48.4% did not exercise during leisure time. The prevalence of smoking was 31.9%. We found a mean body mass index of 24.9 ± 4.6 kg/m^2, and 42.4% of the women were overweight. The prevalence of hypertension was 13.1%, hypertension being defined as a mean systolic blood pressure ≥ 160 mmHg, diastolic blood pressure ≥ 95 mmHg, current antihypertensive treatment, or any combination of these criteria. When a cutoff value of ≥ 140/90 mmHg was used, the prevalence increased to 26.7%. Total cholesterol values were ≥ 240 mg/dl in 26.2%, triglyceride levels were ≥ 200 mg/dl in 2.6%, LDL-cholesterol was ≥ 160 mg/dl in 26.8%, and HDL-cholesterol values were < 45 mg/dl in 12.2%. The prevalence of hyperglycemia was 3.3%.

Conclusions. The prevalences of main cardiovascular risk factors were similar to those in other Spanish studies. Except for smoking, the rest of these risk factors increased with age. Long-term measures should be adopted to modify dietary habits and lifestyles to obtain improvements in the cardiovascular risk profile.

Key words: *Epidemiology. Risk factors. Women.*

Full English text available at: www.revespcardiol.org

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Received 14 May 2002.
Accepted for publication 14 May 2003.

Prevalencia de los principales factores de riesgo cardiovascular en mujeres de Vizcaya

Introducción y objetivos. Analizar la prevalencia de los principales factores de riesgo cardiovascular en mujeres de Vizcaya.

Pacientes y método. Seleccionamos una muestra de 1.317 mujeres con edades comprendidas entre 16-65 años, ambas inclusive, representativa de la población femenina de Vizcaya. Se determinaron el peso y la talla, la actividad física, el hábito tabáquico, la presión arterial, la glucemia, el colesterol total, los triglicéridos, y el colesterol unido a lipoproteínas de alta densidad (cHDL) y de baja densidad (cLDL). Todas las pruebas se realizaron durante el año 1993.

Resultados. Acudieron al estudio 1.100 mujeres, con una edad media de 39,83 ±14 años. El 31,9% de las mujeres realizaban una actividad habitual sedentaria y el 48,4% no hacían ningún ejercicio físico en el tiempo libre. La prevalencia de consumo de tabaco fue del 31,9%. El valor medio del índice de masa corporal (IMC) se estableció en 24,9 ± 4,6 kg/m^2 y el 42,4% de las mujeres tenían un exceso de peso. La prevalencia de hipertensión arterial fue del 13,1%, porcentaje en el que se incluyó a las mujeres con una presión arterial sistólica (PAS) ≥ 160 mmHg y/o diastólica (PAD) ≥ 95 mmHg o que estuvieran tomando medicación antihipertensiva. Al considerar unos valores de PAS y PAD ≥ 140/90 mmHg, la prevalencia ascendió al 26,7%. El 26,2% presentó valores de colesterol total ≥ 240 mg/dl; el 2,6% triglicéridos ≥ 200 mg/dl; el 26,8% cLDL ≥ 160 mg/dl y el 12,2% cHDL < 45 mg/dl. La prevalencia de hiperglucemia fue del 3,3%.

Conclusiones. La prevalencia de factores de riesgo es similar a la obtenida en otros estudios españoles y se ha observado que todos ellos, excepto el tabaquismo, aumentan con la edad. Consideramos necesario adoptar medidas encaminadas a modificar a largo plazo los hábitos dietéticos y los estilos de vida, para conseguir una mejora del perfil de riesgo cardiovascular.

Palabras clave: *Epidemiología. Factores de riesgo. Mujeres.*

ABBREVIATIONS

BMI: body mass index.
ATH: arterial hypertension.
SBP: systolic blood pressure.
DBP: diastolic blood pressure.
TC: total cholesterol.
TG: triglyceride.

INTRODUCTION

Cardiovascular disease is the leading cause of death in Spain. In 1997, it was responsible for 37.51% of all deaths (32.1% in males and 43.5% in women).[1] Currently, the best way of predicting the appearance of cardiovascular disease is by detecting habits or characteristics (risk factors) which are known to be associated with an increased likelihood of developing these diseases. Habits and characteristics such as high blood pressure, obesity, smoking, diabetes and lipid concentrations are classic cardiovascular risk factors, as shown by their association with increased risk of cardiovascular disease.[2,3]

The aim of this study was to analyze the prevalence of the principal cardiovascular risk factors in the female population from Biscay (Northern Spain). The study was carried out in women because cardiovascular risk factors have not been widely studied in this population, and gaps in our knowledge remain, both in terms of diagnosis and treatment. Women also have specific characteristics which influence cardiovascular risk factors, particularly in relation to hormonal evolution.

PATIENTS AND METHODS

The study sample consisted of 1317 women aged between 16 and 65 years. The study sample was selected in such a way as to take into account the population distribution across urban, coastal and rural areas, and by age group. The population centers included in the study were: Bilbao, Baracaldo, Getxo, Ermua, Bermeo, Ondarroa, Plencia, Carranza, Gernika, Markina, Igorre, Zalla, Durango and Munguía. The sample was selected using the Biscay population census and was designed to be representative of the female population aged 16 to 65 years. The sample was selected using random sampling, so that each sampling unit in the census had the same probability of being selected. The Biscay Department of Social Welfare provided support in the sample selection procedure.

Women selected to participate were sent a letter describing the study's characteristics and aims, and inviting them to participate. Information on the place, date and time for the study interview was also included, together with a phone number they could contact with any questions or requests for additional information. Where possible, a follow-up phone call was made to all candidates to inform them about the study and invite them to participate. Study interviews were performed in the health center closest to the participant's home, and were carried out by two physicians and two nurses who had been previously trained. This team administered all of the surveys, took all blood samples and performed the biological and anthropometric measurements. The study was carried out in 1993.

The following interventions were used for all participants:

1. Questionnaire on physical activity during usual activities. This questionnaire was used to collect information on the type of work or other activities performed regularly. Participants were classified in one of 3 categories: usual activities involve spending most of the day sitting; usual activities involve spending most of the day standing, and usual activities involve carrying loads and moving around frequently.

2. Questionnaire on physical activity performed during leisure time. This questionnaire also allowed us to classify participants into one of 3 categories: those who did not do any sport or physical activity; those who did moderate physical activity (long walks or bike journeys at least once a week); and those who performed intense physical activity (gym, jogging, etc.) at least twice a week.

3. Questionnaire on smoking. Participants were classified as nonsmokers, ex-smokers or regular smokers.

Physical exploration

1. Weight and height were obtained to calculate the BMI (kg/m^2). A SECA balance (model 713) was used to weigh patients while wearing outdoor clothing (without jacket or overcoat) and without shoes. Reference BMI values used were: <20 kg/m^2, underweight; 20 –24.9 kg/m^2, optimal weight; 25 –29.9 kg/m^2, overweight, and ≥30 kg/m^2, obese.

2. Blood pressure was measured on two occasions following World Health Organization (WHO) recommendations. When the two measurements gave different values, the arithmetic mean was recorded. The limit for high blood pressure (HBP) was established at 160/95 mm Hg, although a second cut-point of 140/90 mm Hg was used to take the VI Joint National Committee criteria into account.[4]

Analytic data

Blood samples were obtained from all study participants by venipuncture after they had abstained from eating or drinking for 12 h. Total cholesterol (TC) was

TABLE 1. **Sample distribution by age groups**

Age (years)	16-25 (n=223)	26-35 (n=256)	36-45 (n=204)	46-55 (n=218)	56-65 (n=199)	Total (n=1100)
Smoking habit						
Nonsmoker	75 (33.6)	87 (34.6)	112 (54.9)	187 (85.8)	192 (96.5)	565 (59.4)
Ex-smoker	23 (10.3)	31 (12.1)	28 (13.7)	12 (5.5)	2 (1)	96 (8.7)
Smoker	125 (56.1)	138 (53.9)	64 (31.4)	19 (8.7)	5 (2.5)	351 (31.9)
BMI, kg/m^2						
<20	55 (24.8)	27 (10.7)	18 (9)	4 (1.8)	3 (1.5)	107 (9.8)
20-24.9	135 (60.8)	166 (65.9)	98 (49)	72 (33.2)	48 (24.5)	519 (47.7)
25-29.9	29 (13.1)	46 (18.3)	63 (31.5)	92 (42.4)	85 (43.4)	315 (29)
≥30	3 (1.4)	13 (5.2)	21 (10.5)	49 (22.6)	60 (30.6)	146 (13.4)
Blood pressure, mm Hg						
DBP	71.3±8.6	72.6±9.3	76.7±11.1	84.3±11.9	88.1±12.3	78.3±12.5
SBP	112.9±12.6	112.6±12.3	120.8±8.1	134.2±21.2	146.9±21.5	124.8±21.8

Values are number (percentage) or mean±standard deviation. BMI indicates body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure; n, number of women.

analyzed using the cholesterol esterase, cholesterol oxidase and peroxidase method; triglycerides (TG) using the lipase, GK, GPO and peroxidase method; glucose using the GOD and POD method; high-density lipoprotein cholesterol (HDL-C) using the same method as for TC, after precipitating very low-density lipoprotein cholesterol (VLDL-C) and low density lipoprotein cholesterol (LDL-C) via addition of phosphotungstic acid and magnesium ions. cLDL was estimated with the Friedewald formula:

$$\text{LDL-c= CT-HDL-C-TG/5}$$

which is valid for TG values below 300 mg/dL. Samples were analyzed in the IEPEVC Biochemical Laboratory, and quality control was applied using the laboratory´s internal standards and by following the guidelines of the WHO Reference Laboratory in Prague.[5] Values were categorized as follows:

– Hypercholesterolemia: CT≥240 mg/dL; borderline values, 200-239 mg/dL; desirable values, CT<200 mg/dL.

– Hypertriglyceridemia: TG≥200 mg/dL; borderline values, 150-99 mg/dL; desirable values, TG<150 mg/dL.

– Low HDL-C:≤35 mg/dL; borderline values, 36-44 mg/dL; desirable values, HDL-C≥45 mg/dL.

– High LDL-C:≥160 mg/dL; borderline values, 130-159 mg/dL; desirable values, LDL-C<130 mg/dL.

– Hyperglucemia: glucose >120 mg/dL; borderline values, 111-119 mg/dL; desirable values, glucose≤110 mg/dL.

Statistical analysis

Data were stored in Dbase IV and statistical analyses were carried out in with the SPSS program running on a personal computer. For qualitative variables, absolute and relative frequencies were calculated, while means and standard deviations were calculated for quantitative variables. χ^2 was used for bivariate analyses when expected values were ≥5, and Yates' correction was applied as necessary.

RESULTS

The response rate was 83.7%, and the mean age of participants was 39.83±14 years. Women who were invited to participate in the study but did not do so were evenly distributed across age groups, so that the final sample was representative of the overall population by age in the Biscay region. The sample distribution by age is shown in Table 1.

Table 2 shows the sample distribution according to the amount of physical activity performed during usual activities and leisure time. Only 7.1% of the women included performed intense physical activity during their usual activities, and of those 51.3% were aged between 36 and 55 years. Almost half of the women studied (48.4%) did not perform any physical activity during their free time; 37.1% performed moderate

TABLE 2. **Sample distribution by usual physical activity and physical activity performed during leisure time**

	Usual	Leisure time
Physical activity		
None	349 (31.9)	528 (48.4)
Moderate	667 (61.0)	404 (37.1)
Intense	78 (7.1)	158 (14.5)
Total	1094 (100)	1090 (100)

Values are absolute numbers followed by percentages (in parentheses).

TABLE 3. **Total cholesterol, triglycerides, HDL-C, LDL-C, and glucose. Prevalence of lipid alterations and hyperglucemia by age**

Age (years)	16-25	26-35	36-45	46-55	56-65	Total
TC, mg/dL ($\bar{X}$±SD)	188.1±34.0	200.0±34.2	216.7±38.4	235.0±46.3	244.5±48.0	216.2±45.5
TC≥240 mg/dL, n (%)	15 (7.5)	24 (10.1)	46 (23.8)	79 (38.5)	106 (54.6)	270 (26.2)
TG, mg/dL (($\bar{X}$±SD)	71.5±29.1	73.4±36.3	77.8±39.6	94.3±52.4	109.4±57.6	84.9±46.3
TG≥200 mg/dL, n (%)	0 (0.0)	2 (0.8)	4 (2.1)	6 (3.0)	15 (7.7)	27 (2.6)
HDL-C, mg/dL (($\bar{X}$±SD)	60.4±13.0	60.5±13.5	60.3±13.2	61.6±13.8	59.1±13.9	60.4±13.6
HDL-C≤35 mg/dL, n (%)	2 (1.1)	6 (2.8)	1 (0.6)	2 (1.1)	2 (1.1)	13 (1.4)
LDL-C, mg/dL (($\bar{X}$±SD)	113.6±33.1	124.9±31.9	141.0±35.8	153±42.7	164.2±42.6	138.9±41.5
LDL-C≥160 mg/dL, n (%)	23 (12.2)	24 (11.0)	46 (25.6)	70 (37.2)	91 (51.7)	254 (26.8)
Glucose, mg/dL (($\bar{X}$±SD)	85.8±20.4	84.3±12.1	88.1±19.4	90.2±16.4	96.7±30.2	88.9±0.7
Glucose≥120 mg/dL, n (%)	3 (1.5)	3 (1.3)	3 (1.6)	6 (2.9)	19 (9.9)	34 (3.3)

TC indicates total cholesterol; TG, triglycerides; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; $\bar{X}$, mean; SD, standard deviation.

physical activity, of whom 64.1% were aged over 35, and; 14.5% of the overall sample performed some form of intense physical activity in their free-time. 56% of those performing intense physical activity in their free time were aged under 35 and only 12% were aged between 56 and 65.

Fifty nine % of the sample were nonsmokers, 8.7% were ex-smokers and 31.9% were regular smokers. In the latter group, 42.7% smoked 1-10 cigarettes per day, 43.9% smoked 11-20 cigarettes per day, and 13.4% smoked over 20 cigarettes per day. Table 1 shows the distribution of the overall sample by age-group and the relationship with smoking. Seventy five % of smokers were under 35 years of age and only 1.4% were aged over 55.

The mean BMI for the overall sample was 24.9±4.6 kg/m^2. Minimum and maximum values were 16.2 kg/m^2 and 47.3 kg/m^2, respectively, with a range of 31.1 kg/m^2. Table 1 shows the sample distribution by BMI and age group, with women being classified as underweight (9.8%), optimum weight (47.7%), overweight (29.0%) and obese (13.4%).

The mean systolic blood pressure (SBP) was 124.8±21.8 mm Hg, with maximum and minimum values of 205 mm Hg and 75 mm Hg, respectively. Mean diastolic blood pressure (DBP) was 78.3±12.5 mm Hg (maximum and minimum values of 128 mm Hg and 35 mm Hg, respectively). Both types of pressure increased with age, as shown in Table 1. The prevalence of AHT, using a cut-off point of 160/95 mm Hg, was 13.1%. Using a cut-off point of 140/90 mm Hg gave a prevalence of 26.7%.

Table 3 shows the means and standard deviations for the analytic variables, for the sample as a whole and by age-group. There was a statistically significant increase in TC, TG and LDL-C values with age (P<.0001). No statistically significant association was found between HDL-C values and age. Prevalence of hypercholesterolemia (CT ≥ 240 mg/dL) in the overall sample was 26.2%, and 63.1% of the women who participated had TC≥200 mg/dL. The prevalence of hypercholesterolemia, hypertriglyceridemia, LDL-C≥160 mg/dL and hyperglycemia also increased steadily with age. With respect to HDL-C, only 1.4% of the overall sample had values of ≤ 35 mg/dL, while 87.8% had values of ≥45 mg/dL, although no variations were found with age (Table 3).

DISCUSSION

In this study, sample selection was limited to women of working age because of economic and time constraints, although this meant that the study also focused on a sector of the female population in which disease and illness are likely to have the greatest socio-economic impact.

The youngest age group (16-25 years) included the highest percentage of women with a sedentary lifestyle, both in terms of activity performed during usual activities and in free-time. This might be explained by the fact that most of the respondents in this group were students who would spend a considerable amount of time sitting down. Another explanation could be that the increase of illness with age leads to an increase in medical advice recommending an active lifestyle, which in turn leads to an increase in moderate physical activities. As found in a previous study in women in Toledo,[6] a sedentary lifestyle was the most prevalent risk factor among the women of Biscay.

Thirty two % of the study participants smoked regularly, and 8.7% were ex–smokers. These figures are higher than those reported by Segura et al[7] in women aged 25-74 years in Castilla-La Mancha (13.7%), and by Mosquera et al[8] in women aged 16-77 in La Rioja (25.7%), but they are similar to those reported by Tormo et al[9] in women aged 18-65 in Murcia (29.6%). As in the majority of studies performed in the 1990s,[7-12] we found that smoking was most prevalent in younger women, with 75% of smokers being aged under 35 and only 1.4% over 55.

The higher prevalence of smokers amongst younger women is noteworthy, and will almost certainly have an impact on the incidence of problems related with this risk factor in the future.

The mean BMI for the sample was 24.9 kg/m^2, value close to the upper limit of the normal range. The WHO MONICA[13] study provided comparative data on obesity in women aged 36-65 in different European countries. In that study, prevalence ranged from 41% in Malta to 10% in Denmark. In the present study, the prevalence of obesity among women aged 36-65 was 21.2%, which would place it in an intermediate position compared to the countries included in the WHO study. Our study also confirmed the association between weight gain and age found previously.[8,14]

Mean SBP in the present study (124.8 mm Hg) was very similar to that found by Tormo et al[9] in women in Murcia aged 18-65 (123.3 mm Hg), and lower than that observed in Castilla-La Mancha[7] (131.4 mm Hg) and La Rioja[8] (136.5 mm Hg). Nevertheless, women included in the Castilla-La Mancha study were aged 25-74 and those in the La Rioja study were aged 16-77, which might explain the differences. Mean DBP values in the present study (78.3 mm Hg) were similar to those found in other studies in Spain.

We found a statistically significant association between blood pressure and age, with both SBP and DBP increasing with age, and a particularly sharp rise in the prevalence of high blood pressure over the age of 45. The increase in arterial hypertension with age is particularly noticeable in the case of SBP.

Mean SBP and DBP values in women aged 36-65 were 132 and 83 mm Hg, respectively. This compares with SBP and DBP values of 118-145 mm Hg and 75-93 mm Hg for women of the same age from 22 countries included in the WHO MONICA[13] study. Thus, our sample would occupy an intermediate position in the table.

Hypertension is more prevalent in males in the Biscay region than in women. Santayana (Cross-Sectional Epidemiological Study of Peripheral Occlusive Arterial Disease and its Risk Factors in the Basque Autonomous Community. Doctoral thesis. Universidad del País Vasco, 1988) and Izquierdo (Cross-Sectional Epidemiological Study of Peripheral Venous Insufficiency and its Risk Factors in the Basque Autonomous Community. Doctoral thesis. Universidad del País Vasco, 1989) detected a prevalence of AHT in males which was almost double that of women. The minimum age in these studies was 25 years, compared to 16 years in the women included in our study, and this may explain some of the differences, together with the differences due to gender.

TC values in the present study were higher than those found in a similar study by Tormo et al[9] in Murcia (216 vs 187 mg/dL), while HDL-C values were similar to those found in studies performed in other autonomous regions in Spain, with values ranging between 52.5 and 67.1 mg/dL.[7,9,11,15]

Unlike TC, LDL-C and TG, all of which clearly increase with age, HDL-C values and the prevalence of low HDL-C values were independent of age, a finding which reflects previously published results.[16] As expected, considerable differences were observed in the prevalence of dyslipidemia in women aged over and under 55. Hypertriglyceridemia (TG≥200 mg/dL), for example, was 5 times more prevalent in the older age group, and hypercholesterolemia (TC≥240 mg/dL) and LDL-C≥160 mg/dL were almost three times more prevalent.

Cholesterol levels were slightly higher in our sample than those found by Santayana and Izquierdo in males in Biscay (216.2±45.5 mg/dL in women vs 211.2±42 mg/dL in men). TG levels were higher in men (104.1±66.7 vs 84.93+46.3 mg/dL in men and women, respectively), but HDL-C levels were higher in women (60.4±13.6 vs 45.6±12.3 mg/dL in men). Several epidemiological studies[16,17] have also found similar or slightly higher TC values in women, higher TG levels in men, and higher HDL-C levels in women.

In the WHO MONICA study,[13] cholesterol levels ranged between 162.38 and 243.58 mg/dL. In our study, women aged 36-65 had an average TC value of 231 mg/dL, which would place them in the higher part of the table.

Limitations of the study

Responses to the questionnaire on physical activity and smoking could not be verified and are therefore open to the usual margin of error existing in any subjective response. In this type of questionnaire, factors unobserved by the interviewer may influence responses. The use of different criteria to define hypercholesterolemia, hypertriglyceridemia, arterial hypertension etc., as well as the different age ranges in different epidemiological studies, make it difficult to compare results across studies.

CONCLUSIONS

The prevalence of the risk factors studied here is similar to that found in other Spanish regions. Given the increasing prevalence of some of the cardiovascular risk factors studied (obesity, hypertension and dyslipidemia) with age, primary prevention of these risk factors should be implemented from an early age, particularly by encouraging a heart healthy diet and exercise.

The fact that smoking has been viewed as socially acceptable, and a lack of awareness of its dangers, has led to an increase in the number of young women

smokers. This should be fighted using interventional programs to provide information and health education to reduce the number of young people who begin smoking and to reduce the number of current smokers.

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