Anthropometric Indices and Cardiovascular Risk: Spanish Perspectives

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Abstract

In Spain, several studies have examined the importance of cardiovascular risk factors; however, DORICA was the first to analyze the role of each of them individually, thus revealing how much each risk factor contributes to cardiovascular morbidity and mortality.

In terms of weight, 40.12% of men and 48.87% of women were classified as normal according to their BMI; 13.2% of men and 17.5% of women were classified as obese. As for cholesterol, 57.3% of men and 53% of women had levels greater than 200 mg/dl, 23% of men and 17.95% of women had LDL-cholesterol levels higher than 160 mg/dl, whereas 15% of men and 6% of women had HDL-cholesterol levels below 40 mg/dl. Hypertriglyceridemia (>150 mg/dl) was detected in 28% of men and 13% of women. Systolic blood pressure was greater than 140 mmHg in 30% of men and in 21% of women; diastolic pressure was higher than 90 mmHg in 23.2% of men and in 13.6% of women. Baseline blood sugar levels were above 126 mg/dl in 11.2% of men and in 7.2% of women aged more than 55; the prevalence of diabetes in this age group was 5.3% and 2.4%, respectively. Smokers accounted for 39% of the study population, and this proportion was higher in men (48.1% of the population compared with 30.2% women).

The prevalence of metabolic syndrome was 10.87% overall (12.15% in men and 9.9% in women). The number of participants with at least 1 major cardiovascular risk factor (arterial hypertension, dyslipidemia, diabetes) was higher in participants with a BMI >27 than in those whose BMI was normal. In terms of waist circumference, 25% of those individuals with risk factors (>102 cm in men and >88 cm women) presented at least 1 major cardiovascular risk factor ($\chi^2 = 56.970$; $P < 0.001$). Receiver operating characteristic (ROC) curves were used to compare the sensitivity and specificity of the different anthropometric indicators and estimate the presence of cardiovascular risk factors associated with obesity.

The individual importance of each cardiovascular risk factor in our setting was evaluated by calculating the attributable risk fraction. The attributable fraction for arterial hypertension was 26.7% for men and 22.9% for women. The prevalence of hypercholesterolemia was 20.7% for men and 18.2% for women, with an attributable fraction of 15.7% and 12.7%, respectively. The prevalence of obesity was 13.2% for men and 17.5% for women, with an attributable fraction of 4% and 5%, respectively. Smoking was third in men, with an attributable fraction of 13.13%, and fourth in women, with an attributable fraction of 3.71%.

Introduction

Circulatory diseases are the leading cause of mortality in Spain, accounting for 36% of all deaths. An analysis of mortality patterns in Europe reveals an east-west trend, with the highest rates observed in Eastern Europe. Spain has one of the lowest mortality rates among developed countries [1].

In recent years, the number of deaths due to cerebrovascular disease has fallen considerably, and ischemic heart disease has become the leading cause of cardiovascular death in Spain. However, this number of deaths due to this condition is falling as a result of recent community interventions aimed at reducing risk factors and improving diagnosis, quality of emergency care, and treatment.

Cardiovascular disease is the third cause of years of potential life lost, the leading reason for admission to hospital, and one of the main reasons for disability and failing health.

Coronary ischemic disease is more common in men and mainly affects adults aged 45 to 74 years. Forecasts on cardiovascular disease carried out in Spain reveal that, despite the reduction in mortality rates for cardiovascular disease, the number of persons affected by this condition will increase in the coming years, mainly due to increased longevity of the population and better diagnosis and treatment.

Epidemiology of cardiovascular disease

Cardiovascular disease is the leading cause of mortality in developed countries, accounting for 36% of deaths by any cause. The next most common causes of death in our setting are cancer (25%), respiratory disease (12%), and digestive disease (5%).

The most frequent types of cardiovascular disease are ischemic heart disease (31%) and cerebrovascular disease (29%). In both, the underlying lesion is atherosclerotic plaque, and cardiovascular risk factors play a major role in its formation. In the category of ischemic heart disease, acute myocardial infarction accounts for 60% of cases, whereas in cerebrovascular

disease, cerebral hemorrhage accounts for 19% of cases, ischemic attack for 16%, and unknown causes for 65%.

In Spain, cardiovascular mortality has recently been falling by approximately 2.4% annually. This value is mainly the result of the decreased incidence of cerebrovascular disease (3.2% annually compared with 0.6% annually for ischemic heart disease). Nevertheless, this decrease is accompanied by an increase in the absolute number of deaths from these causes brought about by aging of the population.

Men account for 55% of all deaths from cardiovascular disease. However, cardiovascular conditions cause a greater number of deaths among women; therefore, gross cardiovascular mortality is greater for women, both in the general population and in the different age groups, except for the oldest group (>84 years). Therefore, women have a lower cardiovascular risk than men, but greater proportional cardiovascular mortality.

Cardiovascular disease is the leading cause of death overall: the gross cardiovascular mortality rate is 355/100,000 for women and 309/100,000 for men. These figures vary by age group: 1,000/100,000 in individuals aged over 70 years, falling significantly among those aged 40 to 70 years (the second most common cause of death after cancer in this group).

There are considerable differences in cardiovascular mortality in the different Spanish autonomous communities. Those with the greatest incidence are Andalusia, Murcia, Community of Valencia, Balearic Islands and Canary Islands; those with the lowest rates are Madrid, Castile-Leon, Navarre, and La Rioja. This distribution is somewhat paradoxical, as the areas with the highest rates are in the Mediterranean, thus pointing to the possibility of exogenous dietary and socioeconomic factors (some of them unknown) that could be more common in these areas [2].

In comparison with other developed countries, mortality from cardiovascular disease in Spain is considerably lower than in central and northern Europe and the United States. This could be due to the positive influence of the Mediterranean diet on cardiovascular factors.

Cardiovascular Risk Factors

There is sufficient evidence that independent cardiovascular risk factors—smoking, arterial hypertension, hypercholesterolemia (especially high levels of low-density lipoprotein [LDL] cholesterol), and diabetes mellitus—are common in the population and are the direct cause of ischemic heart disease [3,4].

Classic epidemiology studies show that hypercholesterolemia and arterial hypertension are important risk factors for ischemic heart disease. For cerebrovascular disease, only hypertension has been observed to be a risk factor, whereas hypercholesterolemia has not. Epidemiology studies conclude that the total cholesterol/high-density lipoprotein (HDL) cholesterol ratio is the best indicator of the effect of lipid metabolism on the risk of coronary disease.

Other cardiovascular risk factors include family history,

sedentary lifestyle, socioeconomic level, depression, race, obesity, hypertriglyceridemia, glucose intolerance, elevated levels of homocysteine and apolipoprotein B, or electrocardiographic abnormalities consistent with left ventricular hypertrophy. Hypertriglyceridemia, lipoprotein and homocysteine abnormalities, and some clotting factors are considered conditional risk factors [5]. Others, such as obesity or sedentary lifestyle, are considered predisposing risk factors, as they play a role in the onset of the main or conditional risk factors [6].

Although the relation between obesity and coronary disease is not clear, a positive association has been found between the risk of coronary disease and body mass index (BMI) greater than 18.5. This association is more marked in nonsmokers.

A greater risk has been reported in people with mainly central obesity. Since BMI does not provide information on body fat distribution, different indicators have been proposed for this purpose, such as the waist-to-hip ratio, the waist-to-height ratio, or waist circumference.

The results of the MONICA Study and the Seven Countries Study provide standardized and comparable information on the outcome of risk factors for coronary heart disease in different European countries during the last few decades. Around 1995, the highest rates of cholesterolemia were observed in central Europe and the lowest rates in southern Europe, specifically in Catalonia. There were no differences in blood pressure between the north and the south.

Studies analyzing the dose-response effect between cardiovascular risk factors and ischemic heart disease have revealed that the impact of arterial hypertension and hypercholesterolemia is gradual both in northern Europe and in southern Europe with respect to Mediterranean countries for cholesterol levels of 200 mg/dL. The absolute risk was 3 times greater in northern Europe for blood pressure levels of 140 mmHg.

The MONICA study revealed that blood cholesterol levels and blood pressure have decreased during the last decade, although during this time, there has been a considerable increase in mean BMI and in the prevalence of obesity.

As for risk factors that can be controlled, including arterial hypertension and smoking, comparative cost-effectiveness analyses carried out to date indicate that strategies aimed at healthy eating habits are more important than strategies based on drugs to reduce blood cholesterol levels [7,8].

Prognostic factors for cardiovascular and atherosclerotic disease

As it is well known the main factors associated with the development and outcome of cardiovascular disease are as follows:

Risk factors for cardiovascular disease

Parameters used to stratify risk:

- Systolic and diastolic blood pressure (Grade 1-3)

- Men aged > 55 years
- Women aged > 65 years
- Smoking
- Total cholesterol > 6.5 mmol/L (250 mg/dL).
- Diabetes
- Family history of premature cardiovascular disease

Other factors that negatively affect prognosis:

- Low HDL cholesterol
- High LDL cholesterol
- Microalbuminuria in diabetes
- Carbohydrate intolerance
- Obesity
- Sedentary lifestyle
- High fibrinogen
- High-risk socioeconomic group
- High-risk ethnic group
- High-risk geographic region

Target organ lesion:

- Left ventricular hypertrophy diagnosed by electrocardiogram or echocardiography
- Proteinuria, mild increase in plasma creatinine concentration (1.2-2 mg/dL), or both.
- Echographic or radiologic signs of the presence of atherosclerotic plaque in the carotid, iliac, or femoral arteries, or in the aorta.
- Focal or generalized stenosis of retinal arteries.

Associated clinical disorders:

- Cerebrovascular disease: Cerebrovascular accident, cerebral hemorrhage, or transient ischemic attack.
- Heart disease: Myocardial infarction, angina, coronary revascularization, or congestive heart failure.
- Kidney disease: Diabetic kidney disease or kidney failure (plasma creatinine concentration >2 mg/dL).
- Vascular disease: Dissecting aneurysm or symptomatic artery disease.
- Advanced hypertensive retinal disease: Hemorrhage, exudates, or papillary edema.

The problem to calculate cardiovascular global and individual risk

Tables based on data from the two main studies on overall cardiovascular risk—Framingham and Score—can be used to calculate cardiovascular risk. The different models for this

calculation provide specific information on the risk of having a coronary or cerebrovascular episode during the next five years.

The importance of establishing cardiovascular risk lies in awareness of the need for intervention depending on the level of risk and implementation of an intervention. As the intervention should be as cost-effective as possible, it is important to prioritize therapeutic decisions in patients classed as having a high cardiovascular risk [9].

The most widely used calculation models express risk as the probability (percentage) of experiencing a cardiovascular episode in the next 10 years. Risk is classified as follows:

- a. High risk: patients with clinically demonstrated atherosclerotic disease, patients with a calculated risk greater than 20%, and patients with type 2 diabetes.
- b. Moderate risk: patients with risk factors and a cardiovascular risk calculated to be between 10% and 20%.
- c. Low risk: patients with a cardiovascular risk calculated to be below 10%.

Spanish perspective from recent studies (Tables 1, 2, 3 and 4)

The DORICA (Dislipemia, Obesidad y Riesgo Cardiovascular [Dyslipidemia, Obesity, and Cardiovascular Risk]) Study [10] was carried out by a Spanish working group analyzing obesity and cardiovascular risk. One of the reasons this expert panel was established was the need for reliable data from the Spanish population in terms of the prevalence of different cardiovascular risk factors and their association with eating habits and with anthropometric data in terms of obesity. So, the interest was focused:

- To ascertain the prevalence of cardiovascular risk factors in the Spanish population.
- To analyze the impact of obesity on cardiovascular risk factors.
- To propose a quantitative or qualitative model for estimation of cardiovascular risk factors in our setting using other models.
- To calculate the fraction of attributable risk for each of the risk factors analyzed with respect to the Spanish population.

Data of the study were collected from epidemiology studies on nutrition and risk factors using random samples that were representative of the populations of the autonomous regions of Andalusia, Balearic Islands, Canary Islands, Catalonia, Galicia, Madrid, Murcia, Basque Country, and Valencia during the period 1990 and 2000. A multistage random sampling procedure was followed in all cases with stratification by age, gender, and residence, in proportion with population density. Data were collected by qualified health care staff that was trained according to the requirements of the study protocol.

Table 1: Distribution of Anthropometric Parameters and systolic/Diastolic blood pressure by age.

AGE GROUP	LIPID PARAMETER	MEAN	SD	95% CI	25th	50th Percentiles	75th
25-34	Weight (Kg)	75,11 ^a	10,89	74,63-75,59	67,20	74,00	82,00
	Height (cm)	173,51 ^a	676	173,22-173,81	169	173,00	178,00
	BMI (kg/m ²)	24,91 ^a	3,27	24,76-25,05	22,75	24,54	26,85
	Waist (cm)	87,15 ^a	8,66	86,62-87,68	80,50	86,50	93,00
	Waist/Hip ratio	0,89 ^a	0,06	0,89-0,89	0,85	0,89	0,93
	SBP (mmHg)	126,24 ^a	13,58	125,49-126,98	118,00	125,00	135,00
	DBP(mmHg)50th	76,98 ^a	10,07	76,43-77,53	70,00	76,00	84,00
35-44	Weight (Kg)	76,26	11,40	75,72-76,80	69,00	75,00	83,00
	Height (cm)	171,09	6,63	170,77-171,40	166,87	171,00	175,50
	BMI (kg/m ²)	26,01	3,41	25,85-26,17	23,78	25,83	28,01
	Waist (cm)	91,16	9,78	90,52-91,80	84,00	91,50	96,50
	Waist/Hip ratio	0,91	0,06	0,91-0,92	0,88	0,91	0,95
	SBP (mmHg)	127,85	14,85	126,97-128,72	120,00	127,50	137,00
	DBP (mmHg)	79,85	11,37	79,18-80,51	71,00	80,00	88,00
45-54	Weight (Kg)	76,38	11,58	75,78-76,98	69,00	75,00	83,00
	Height (cm)	169,00	7,09	168,63-169,37	164,00	169,00	173,91
	BMI (kg/m ²)	26,71	3,62	26,52-26,89	24,52	26,46	28,86
	Waist (cm)	94,46	9,72	93,77-95,15	88,40	94,00	100,00
	Waist/Hip ratio	0,94	0,06	0,94-0,95	0,90	0,94	0,99
	SBP (mmHg)	133,11	15,35	132,11-134,12	120,00	130,00	144,50
	DBP (mmHg)	83,11	12,05	82,32-83,90	75,00	83,50	90,00
55-64	Weight (Kg)	75,82	10,82	75,20-76,45	69,10	75,50	82,00
	Height (cm)	167,15	6,86	166,76-167,55	163,00	167,50	172,00
	BMI (kg/m ²)	27,10	3,48	26,90-27,30	24,92	26,57	29,34
	Waist (cm)	96,85	8,93	96,14-97,56	91,50	97,00	102,30
	Waist/Hip ratio	0,96	0,06	0,96-0,96	0,92	0,97	1,00
	SBP (mmHg)	139,44	18,20	138,11-140,77	128,00	139,50	150,00
	DBP (mmHg)	84,62	11,01	83,82-85,42	78,00	85,00	90,00

Table 2: Lipid Profile by Age Group.

AGE GROUP	LIPID PARAMETER	MEAN	SD	95% CI	25th	50th Percentiles	75th
25-34	Total cholesterol (mg/dL)	192,97 ^a	35,77	188,80-197,13	169,00	191,00	216,94
	cLDL (mg/dL)	121,20 ^a	32,99	116,86-125,53	97,00	119,94	143,00
	cHDL (mg/dL)	52,15	12,28	50,71-53,48	44,09	51,00	58,00
	Triglycerides (mg/dL)	119,14 ^b	69,10	111,09-127,18	76,86	107,28	144,75
	Glucemia (mg/dL)	91,81	11,00	90,34-93,28	85,06	92,00	98,00
35-44	Total cholesterol(mg/dL)	211,8	43,31	206,75-217,21	181,59	212,96	238,95
	cLDL (mg/dL)	136,2	38,03	131,48-141,96	109,00	137,00	159,23
	cHDL (mg/dL)	51,76	14,03	50,05-53,46	43,00	49,21	61,00
	Triglycerides (mg/dL)	142,78	130,67	126,98-158,58	78,12	120,00	158,08
	Glucemia (mg/dL)	96,75	21,28	93,77-99,73	86,84	94,00	102,00
45-54	Total cholesterol (mg/dL)	215,54	36,52	212,12-222,96	196,00	221,00	241,00
	cLDL (mg/dL)	143,26	36,38	138,03-148,49	118,00	145,02	162,48

	cHDL (mg/dL)	50,40	12,99	48,71-52,09	42,00	48,00	57,00
	Triglycerides (mg/dL)	132,18	74,85	122,46-141,89	77,00	116,82	168,11
	Glucemia (mg/dL)	101,41	26,11	97,53-105,29	90,00	97,86	105,00
55-64	Total cholesterol (mg/dL)	217,54	36,52	212,12-222,96	196,00	221,00	241,00
	cLDL (mg/dL)	141,96	31,08	136,76-147,16	125,00	147,80	163,00
	cHDL (mg/dL)	52,36	16,08	49,96-54,75	42,02	50,00	60,99
	Triglycerides (mg/dL)	141,41	86,04	128,62-154,20	94,33	118,58	165,29
	Glucemia (mg/dL)	104,11	27,67	99,56-108,66	89,00	97,00	107,00

Table 3: Prevalence of Cardiovascular risk factors in the Spanish population.

	MEN		WOMEN	
RISK FACTOR	Prevalence (95%CI)	Attributable fraction (%)	Prevalence (95%CI)	Attributable fraction (%)
Hypercholesterolemia				
> 200 mg/dL	57,3%(56,96-57,64)	34	53%(52,68-53,32)	30
> 240 mg/dL	20,7%(52,68-53,32)	16	18,21%(17,99-18,43)	13
Hypertension				
>140/90 mmHg	36,4%(35,55-37,24)	27	24,8%(24,36-25,24)	23
Diabetes	5,3%(4,92-5,68)	6	2,4%(2,03-2,77)	3
Smoking	48,1%(47,57-48,63)	13,1	30,2%(29,64-30,76)	4
Obesity	13,2%(13,09-13,31)	4	17,5%(17,28-17,72)	5

Table 4: Sociodemographic Characteristics.

AGE GROUP	MEN	WOMEN
25-34	35,0	32,5
35-44	27,5	28,4
45-54	21,3	23,9
55-64	16,2	15,3
EDUCATIONAL LEVEL		
LOW	23,17	28,46
MEDIUM	40,81	43,85
HIGH	36,02	27,69
SOCIOECONOMIC LEVEL		
LOW	22,96	27,25
MEDIUM	66,03	66,08
HIGH	11,02	6,67
AREA OF RESIDENCE		
< 10.000 inhabitants	12,09	11,81
10.000-100.000 inhabitants	31,81	31,98
> 100.000 inhabitants	56,11	56,14
REGION		
North	11,73	11,66
Northwest	6,78	6,89
Center	25,98	26,14
Northeast	18,80	18,68
East	14,64	14,67
South	22,03	21,93

The study included the healthy adult non institutionalized population between the ages of 25 and 64 years (n = 14,616; 6796 men and 7820 women). The sample was stratified by autonomous region, age group, and gender, and was adjusted and weighted for data analysis in accordance with the intercensal population estimate for Spain in 1998.

An analysis of variables must be included:

- Socio-demographic
 1. Age group: 25-34 years, 35-44 years, 45-54 years, 55-64 years.
 2. Gender: man, woman.
 3. Marital status: single, married, divorced-separated, widowed.
 4. Educational level: low, medium, high.
 5. Social class: low, middle, high.
 6. Area of residence: <10,000 inhabitants, 10,000-100,000 inhabitants, >100,000 inhabitants.
 7. Region.
- Lifestyle
 1. Eating habits: The analysis of eating habits was made using the 24-hour recall method (2 or 3 nonconsecutive days) or diet diaries on 3 nonconsecutive days [11].
 2. Smoking: smoker, ex-smoker, nonsmoker.
 3. Physical activity: very low, low, medium, high, very high.
 4. Exercise (sport): yes, no.
 5. Frequency of exercise (sport).
 6. Alcohol: yes, no.
 7. Sleep.
- Anthropometry
 1. Weight
 2. Height
 3. BMI
 4. Waist and hip circumferences
 5. Systolic and diastolic blood pressure: in the dominant arm with two separate sequential measurements. Blood pressure was considered the mean of the two readings. Arterial hypertension was considered as systolic pressure >140 mmHg, diastolic pressure >90 mmHg, or both.
 6. Waist-to-hip ratio
 7. Waist-to-height ratio
 8. Obesity: calculated as BMI >30
- Biochemistry
 1. Baseline blood sugar

2. Total cholesterol: <200 mg/dl (desirable), 200-239 mg/dl, >240 mg/dl (high).
3. LDL cholesterol: <100 mg/dl, 100-129 mg/dl (desirable), 130-159 mg/dl, 160-189 mg/dl (high), >190 mg/dl.
4. HDL cholesterol: <40 mg/dl (low), 40-59 mg/dl (normal), >60 mg/dl.
5. Triglycerides: <150 mg/dl, 150-199 mg/dl (high), 200-499 mg/dl, >500mg/dl.
- Other

Metabolic syndrome: defined as a fulfilling 3 or more of the following:

- Abdominal obesity: waist circumference >102 cm for men or >88 cm for women
- Blood pressure >130/85 mmHg.
- Baseline blood sugar >110 mg/dl.
- Hypertriglyceridemia >150 mg/dl.
- HDL-cholesterol < 40mg/dl for men or <50 mg/dl for women
- Measurement of anthropometric variables
 - Weight was determined in kilograms with a tolerance of ± 100 g. Height was measured in centimeters with a tolerance of ± 0.5 cm.
 - The BMI was used for the ponderal index. This divides body weight in kilograms by the square of height in meters (body weight [kg]/height [m²]). Participants were classified as normal weight if the BMI was between 18.5 and 24.9, overweight grade I if the BMI was between 25 and 26.9, overweight grade II if the BMI was between 27 and 29.9, obese type I if BMI was between 30 and 34.9, obese type II if BMI was between 35 and 39.9, obese type III or morbidly obese if BMI was above 40, and obese type IV or extremely obese if the BMI was above 50.

Methodological considerations including as follows:

- The statistical analysis was performed using SPSS and Stata. Proportions were estimated using 95% confidence intervals.
- Quantitative variables were expressed as the mean and standard deviation (SD). Statistical significance was set at $P < 0.05$.
- Analysis of variance was performed to compare the mean between groups; the χ^2 was performed to compare proportions.
- The fraction of risk attributable to each factor was calculated to evaluate the individual importance of each factor in our setting.

A critical analysis to action

In terms of weight, 40.12% of men and 48.87% of women were classified as normal according to their BMI; 13.2% of men and 17.5% of women were classed as obese. Prevalence increased with age and was significantly higher in women aged more than 45 years [12].

As for cholesterol, 57.3% of men and 53% of women had levels greater than 200 mg/dl, 23% of men and 17.95% of women had LDL-cholesterol levels higher than 160 mg/dl, whereas 15% of men and 6% of women had HDL-cholesterol levels below 40 mg/dl. Hypertriglyceridemia (>150 mg/dl) was detected in 28% of men and 13% of women [13].

Systolic blood pressure was greater than 140 mmHg in 30% of men and in 21% of women; diastolic pressure was higher than 90 mmHg in 23.2% of men and in 13.6% of women. The prevalence of arterial hypertension increased with age in both sexes, with a greater prevalence in men up to 54 years, after which age it leveled off.

Baseline blood sugar levels were above 126 mg/dl in 11.2% of men and in 7.2% of women aged more than 55; the prevalence of diabetes in this age group was 5.3% and 2.4%, respectively.

Smokers accounted for 39% of the study population, and this proportion was higher in men (48.1% of the population compared with 30.2% women).

Significantly higher values were observed in BMI and hip circumference as arterial hypertension worsened; thus, participants classed as grade II-IV had a mean BMI value of 27.2 and a hip circumference of 94.5 cm. Similarly, mean values for total cholesterol, LDL-cholesterol, and triglycerides increased significantly with BMI in both men and women.

The prevalence of metabolic syndrome was 10.87% overall (12.15% in men and 9.9% in women). The number of participants with at least 1 major cardiovascular risk factor (arterial hypertension, dyslipidemia, diabetes) was higher in participants with a BMI >27 than in those whose BMI was normal. In terms of waist circumference, 25% of those individuals with risk factors (>102 cm in men and >88 cm women) presented at least 1 major cardiovascular risk factor ($\chi^2 = 56.970$; $P < 0.001$).

Receiver operating characteristic (ROC) curves were used to compare the sensitivity and specificity of the different anthropometric indicators and estimate the presence of cardiovascular risk factors associated with obesity. The conclusion was that waist circumference, with an area under the curve of 0.7499 in men and 0.7080 in women, was the variable with the most significant results, followed by waist-to-hip ratio (0.7502 and 0.7163, respectively).

The individual importance of each cardiovascular risk factor in our setting was evaluated by calculating the attributable risk fraction, using data from the Framingham study as a comparison as follows: $PAR = [P (RR-1) / (1+P (RR-1))] \times 100$, where PAR is the population-attributable risk, P the prevalence of the risk factor, and RR the relative risk estimated for the risk factor in the Framingham study.

The prevalence of arterial hypertension was 36.4% in men, 24.8% in women; therefore, the attributable fraction for arterial hypertension was 26.7% for men and 22.9% for women. The prevalence of hypercholesterolemia was 20.7% for men and 18.2% for women, with an attributable fraction of 15.7% and

12.7%, respectively. The prevalence of obesity was 13.2% for men and 17.5% for women, with an attributable fraction of 4% and 5%, respectively. Smoking was third in men, with an attributable fraction of 13.13%, and fourth in women, with an attributable fraction of 3.71%.

Towards the future

The recent studies showed that the greater the number of risk factors, the greater the risk of suffering from a cardiovascular disease, although specificity and sensitivity for each of them independently were low.

Although the population samples used in the DORICA study were cross-sectional and from different studies, we observed that, after adjustment and weighting of sample data, estimations can be made on a representative spectrum of the Spanish population from different regions. Therefore, the data collected in each of the autonomous communities can be considered as representative.

The main limitations of different studies lie in the absence of data on the presence of coronary disease or other specific cardiovascular conditions. Given that most studies in Spain are also affected by this limitation, data on mortality and cardiovascular disease are being collected in the different autonomous communities, as is the case with the IBERICA study.

Other research projects carried out recently in Spain on the importance of cardiovascular risk factors are MONICA and the National Health Survey, which, despite providing a general vision of the prevalence of cardiovascular disease in Spain, lack the individual anthropometric and biochemistry data necessary to draw a greater number of conclusions.

Some studies have also analyzed the quality of the information in clinical histories in primary care with respect to cardiovascular risk factors. They conclude that there has been a notable improvement in recent years, except in the frequency of recording information on smoking and alcohol.

The DORICA study stresses the need to continue developing programs based on dietary habits, physical exercise, and early detection of risk factors as indispensable approaches to preventing coronary disease [14,15].

Priority actions points for the prevention of cardiovascular disease in Spain

The results of recent studies, together with clinical and epidemiological evidence from previous studies, point to a number of areas that can help prevent cardiovascular disease in Spain.

I. Lifestyle: Insistence by primary care physicians on smoking cessation, a healthy diet, and a minimum of daily physical exercise.

II. Smoking cessation programs: Informing the public of the many adverse effects of smoking on health, completely suppressing direct or indirect advertising that promotes consumption, and ensuring compliance with the law preventing smoking in public places.

III. Healthy diet: Dietary recommendations: consumption of fruit, vegetables, pulses, and cereals; reduction of fatty foods, especially those containing saturated fats, refined sugar, and salt; minimum intake of omega 3, oleic acid, vitamin B, and antioxidants.

Support for companies from the food industry that promote strategies to provide healthy food at lower prices. Control of food advertising and support for campaigns that promote healthy foods.

IV. Physical activity: Promotion of individual and community exercise plans adapted to individual needs and characteristics. Recommendation of a medical check-up and a design of a progressive training program before starting a training program.

V. Early detection and treatment of the main cardiovascular risk factors: Hypercholesterolemia, arterial hypertension, smoking, carbohydrate intolerance, diabetes mellitus, overweight, obesity, and metabolic syndrome.

VI. Assessment of cardiovascular risk on an individual basis: Initiation of strategies that encourage healthy lifestyles in patients with a moderate or high risk. Starting treatment with drugs if a healthy lifestyle does not prove effective at controlling risk factors permanently.

VII. Control of atherosclerotic disease: In patients with signs of ischemic heart disease, peripheral artery disease, or cerebrovascular disease. Cardiovascular risk factors should be treated early, and specific treatment of the cardiovascular disease should be started.

VIII. Avoid alcohol: Never more than two low-proof drinks per day for a man, and half this amount for a woman.

IX. Support from government and the media for health programs: Promoting health in schools and the workplace, with social support for health programs.

X. Promote research on cardiovascular disease: Increase resources for promoting research for scientific societies, so that better results are generated and more reliable therapy designed.

Summary Points

1. Cardiovascular disease is the main cause of death in developed countries. Spain is one of the countries with a lower mortality index.
2. Although the cardiovascular mortality rate is falling in Spain, the total number of deaths will increase due to aging of the population.
3. The importance of the DORICA study lies in the fact that it is the first in Spain to investigate the attributable fraction of each cardiovascular risk factor individually.
4. Cardiovascular risk should be calculated on an individual basis to provide tailored strategies and take full advantage of these strategies.
5. The most important anthropometric values for

subsequent cardiovascular risk were waist diameter and waist-to-height index.

6. Although the total number of deaths from cardiovascular disease is greater in men, the gross mortality rate is higher in women.
7. Obesity is a risk factor with little impact on cardiovascular mortality, although it is significantly associated with other key risk factors, such as arterial hypertension and hyperglycemia.
8. Early detection of risk factors and promotion of a healthy diet and lifestyle are particularly important as cardiovascular risk reduction strategies.
9. Future studies in Spain must determine the association between risk factors and the number of cases affected by coronary disease and cerebrovascular disease, since we currently lack protocols of this type.

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