ORIGINAL ARTICLES

Prevalence of Obesity, Diabetes, Hypertension, Hypercholesterolemia, and Metabolic Syndrome in Over 50-Year-Olds in Sanlucar de Barrameda, Spain

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Introduction and objectives. The Spanish province of Cadiz has some of the poorest socioeconomic conditions and the highest cardiovascular morbidity and mortality rates in the country. The aim of this study was to investigate the prevalence of cardiovascular risk factors in the adult population of the city of Sanlucar de Barrameda in Cadiz.

Methods. This cross-sectional population-based study involved 858 randomly selected individuals aged 50-75 years. Age- and sex-adjusted prevalences of the main cardiovascular risk factors were obtained.

Results. The mean age of the study population was 61.5 years and 53.6% were women. Overall, 46% of men and 61.7% of women were illiterate; 23.7% and 7.9%, respectively, were current smokers; 30.9% and 44.8% had a sedentary lifestyle; 54% and 55.9% were obese; 29.4% and 26.1% had diabetes; 45% and 52.4% had hypertension; 40.9% and 45.1% had hypercholesterolemia; and 58.8% and 57% had metabolic syndrome as defined by NCEP/ATP-III criteria. The prevalence of all cardiovascular risk factors, except smoking, increased with age. Significant inverse associations were observed between educational level and obesity in men and between educational level and diabetes and metabolic syndrome in women.

Conclusions. The prevalence of cardiovascular risk factors in individuals aged 50-75 years in Sanlucar de Barrameda was extremely high. The prevalences of obesity, diabetes, and metabolic syndrome were among the highest ever reported in Spain. A very low educational level may underlie these adverse findings.

Key words: *Obesity. Diabetes. Hypertension. Hypercholesterolemia. Metabolic syndrome.*

Prevalencia de obesidad, diabetes, hipertensión, hipercolesterolemia y síndrome metabólico en adultos mayores de 50 años de Sanlúcar de Barrameda

Introducción y objetivos. Cádiz es una de las provincias con los marcadores socioeconómicos más desfavorables y la mayor morbimortalidad cardiovascular de España. Se estudia la prevalencia de los factores de riesgo cardiovascular en la población adulta de Sanlúcar de Barrameda.

Métodos. Estudio poblacional con selección aleatoria de una muestra representativa constituida por 858 individuos con edades entre 50 y 75 años. Descripción de la prevalencia de los factores de riesgo cardiovascular principales ajustada por edad y sexo.

Resultados. La media de edad de los pacientes era 61,5 años, con un 53,6% de mujeres. La prevalencia de sujetos sin estudios en varones y mujeres fue del 46 y el 61,7%; de tabaquismo activo, el 23,7 y el 7,9%; de sedentarismo, el 30,9 y el 44,8%; de obesidad, el 54 y el 55,9%; de diabetes, el 29,4 y el 26,1%; de hipertensión, el 45 y el 52,4%; de hipercolesterolemia, el 40,9 y el 45,1%, y de síndrome metabólico (NCEP/ATP-III), el 58,8 y el 57%. Con excepción del tabaquismo, la prevalencia de todos los factores de riesgo aumentó con la edad. Se aprecia una asociación significativa e inversa del nivel de estudios con la obesidad en varones, y con la diabetes y el síndrome metabólico en mujeres.

Conclusiones. La prevalencia de los factores de riesgo cardiovascular en adultos de 50 a 75 años de Sanlúcar de Barrameda es extraordinariamente elevada. Las prevalencias de obesidad, diabetes y síndrome metabólico se encuentran entre las más elevadas de las que se ha comunicado hasta el momento en España. Un nivel de estudios muy bajo puede estar en relación con un perfil de riesgo tan elevado.

Palabras clave: *Obesidad. Diabetes. Hipertensión. Hipercolesterolemia. Síndrome metabólico.*

The researchers involved in the Sanlucar Study are given at the end.

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ABBREVIATIONS

ABPM: ambulatory blood pressure monitoring
BMI: body mass index
DBP: diastolic blood pressure
SBP: systolic blood pressure
SMBP: self-monitored blood pressure

INTRODUCTION

Cardiovascular disease continues to be the leading cause of morbidity and mortality among adults in Spain. It is estimated that new coronary and cerebrovascular events occur at a rate of 250-450 per 100 000 individuals per year.[1] The distribution of mortality due to cardiovascular disease is not uniform throughout Spain and an accentuated north-south gradient has been confirmed. Three provinces of the Andalusian community (Cadiz, Huelva, and Seville) carry one third of the excess all-cause mortality in the whole of Spain,[2] despite comprising only 8% of the Spanish population. The highest mortality rates due to ischemic heart disease are also concentrated in the south, in the Canary Islands and in Cadiz, Malaga, and Seville.[3] Geographic differences related to socioeconomic and educational levels, the prevalence of cardiovascular risk factors and, to a lesser extent nowadays, the quality and accessibility of health care are factors that may explain this asymmetry.

Detailed and current knowledge of these variables is essential in order to plan prevention and intervention policies for at-risk groups. Over recent years, numerous cross-sectional studies and meta-analyses have been performed that have provided general information on the prevalence of cardiovascular risk factors in different geographical areas.[4] Unfortunately, generation of this information is neither stable nor updated and lacks data from specific areas where the cardiovascular morbidity and mortality impact is very high.

We present the results of a population-based study whose aim was to investigate the prevalence of the main cardiovascular risk factors in the adult population of the city of Sanlucar de Barrameda, Cadiz, Spain.

METHODS

The Sanlucar Study

The Sanlucar Study is a population-based prospective study designed with a 2-fold objective: to establish the prevalence of the main cardiovascular risk factors in the adult population of the city of Sanlucar de Barrameda, results of which are presented in this manuscript, and to contribute information on the role of the metabolic syndrome as an independent cardiovascular risk factor in the development of atherosclerotic events, comparing 2 cohorts of individuals with and without the metabolic syndrome after a follow-up of 5 years, this work still in progress. The Sanlucar Study was carried out by the Internal Medicine Service of the Hospital Virgen del Camino of Sanlucar de Barrameda (Cadiz), and commenced in July 2006. The current analysis was performed after finalizing the inclusion period in February 2007. Thus, it is a cross-sectional, descriptive, population-based study to establish the prevalence of cardiovascular risk factors in the adult population of the city of Sanlucar de Barrameda.

Study Population and Calculation of Sample Size

Sanlucar de Barrameda is a coastal city of the province of Cadiz with a census population in 2005 of 63 509 residents, almost all Caucasian. The target population was made up of individuals between the ages of 50 and 75 years and registered in the municipality. This list, provided by the city hall in December 2005, included a total of 14 018 residents. After taking a random sample of this population, one person was appointed to contact the selected individuals by telephone to invite them to participate in the study. Those who accepted were included after an interview by the physician investigator in the outpatient unit of the hospital and after obtaining informed consent. All individuals were given a clinical report with the results of the physical examination and the laboratory tests.

The sample size of the Sanlucar Study was calculated using the age-adjusted annual incidence rate of coronary and cerebrovascular disease described in Spain,[1] and an estimation of the relative risk of cardiovascular events attributable to the metabolic syndrome.[5,6] An incidence rate of cardiovascular events in the population aged over 50 years of 2.8% was selected, and the relative risk attributable to the metabolic syndrome was 2.75%.

Determining a confidence interval of 95% and a statistical power of 80%, a sample size of 760 cases was calculated, which was increased by 10% to cover losses.

Inclusion and Exclusion Criteria

The individuals selected had to meet the following inclusion criteria: resident in Sanlucar de Barrameda and be listed on the municipal census, be between 50 and 75 years of age, and provide informed consent. Persons diagnosed with severe, life-threatening diseases were excluded. Other exclusion criteria were: documented diagnosis of malignant neoplasia; creatinine clearance <30 mL/min/1.73 m^2 (MDRD-4 formula)[7]; Child stage B or C cirrhosis, cardiac or respiratory failure of any grade, as well as connective tissue disease, neurodegenerative disease or infection with HIV.

Clinical and Laboratory Data Collection Protocol

The following variables were recorded: age, sex, education level (4 categories: no schooling, primary education, vocational training or secondary education, and university studies); smoking (current smoker—smokers at inclusion and ex-smokers for less than 1 year, and non-smoker—those who had never smoked and ex-smokers for more than 1 year); alcohol consumption (non-drinkers, drinkers of 1 or 2 units per day, and drinkers of more than 2 units per day); sedentary lifestyle (walk less than 30 min daily on 5 days per week); documented diagnosis of type 2 diabetes mellitus (1997 ADA definition),[8] high blood pressure (Seventh Report of the Joint National Committee),[9] and hypercholesterolemia (low-density lipoprotein cholesterol [LDL-C] value >190 mg/dL or receiving treatment with statins) or receiving treatment for these conditions, and a first degree family history of early cardiovascular disease (men under 55 years and women under 65 years).

After an overnight fast, venous blood samples were taken to determine plasma levels of: glucose (enzymatic oxidation), creatinine (spectrophotometry), total cholesterol (enzymatic hydrolysis, colorimetry), high-density lipoprotein cholesterol (HDL-C) (beta lipoprotein specific antibodies, spectrophotometry), triglycerides (enzymatic hydrolysis, colorimetry), and uric acid (enzymatic oxidation), using an ILAB-600 analyzer. The LDL-C was calculated using the Friedewald formula.[10]

Blood pressure was measured with an OMRON 705CP automatic blood pressure monitor, using an arm cuff with a 12×40 cm bladder in obese patients with an arm circumference >35 cm. Blood pressure was measured in the outpatient office during the course of a clinical interview after the participant had been seated for 5 min. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) recorded were the mean of 3 consecutive readings with a difference in the SBP <10 mm Hg. The individuals with undiagnosed hypertension, but with a mean clinical blood pressure >140/90 mm Hg were offered confirmation via self-monitored blood pressure (SMBP) if the clinical SBP was 140-149 mm Hg or ambulatory blood pressure monitoring (ABPM) if the clinical SBP was >150 mm Hg. For the SMBP the individuals were instructed to perform 3 readings daily (before the 3 main meals and after resting, seated at the table, for at least 5 min) on 5 consecutive days, to obtain a total of 15 readings. Representative SBP and DBP values were the mean of 13 readings, after excluding the first and last readings. The 24 hour ABPM was carried out with a BR-102 blood pressure recorder (Schiller AG, Baar, Switzerland), taking daytime readings every 20 min until 22:00 and night-time readings every 30 min until 7:00. Representative values for SBP and DBP were the means of the 24 h readings. The body mass index (BMI) was calculated by dividing the weight (in kilos) by the square of the height (in meters). The waist circumference was measured using a semi-rigid measuring tape, with the individual in decubitus, at the point midway between the last rib and the upper border of the iliac crest. Obesity was considered to be a BMI ≥30 and overweight, a BMI ≥27. In individuals with undiagnosed diabetes, a new diagnosis of diabetes was considered to be a plasma glucose >126 mg/dL and elevated fasting plasma glucose, a blood glucose >100 and <126 mg/dL; a new diagnosis of hypertension was considered to be a reading of ≥135/85 mm Hg by SMBP or ABPM in individuals with previously undiagnosed hypertension, and a new diagnosis of hypercholesterolemia was an LDL-C level ≥190 mg/dL in individuals with previously undiagnosed hypercholesterolemia. For the diagnosis of the metabolic syndrome the modified NCEP/ATP-III definition was used.[11]

Statistical Analysis

The normality of the quantitative variables was confirmed using the Kolmogorov-Smirnov test. For the description of the continuous variables the mean (standard deviation), or the median in the case of non-normal distribution, was used. The quantitative variables with a non-normal distribution were transformed into their respective natural logarithms. The qualitative variables are expressed as a proportion and 95% confidence interval. For the bivariate analysis of parametric variables the difference of means test (Student *t* test) was used and for comparison of proportions the χ^2 test. Logistic regression analysis with the variable to be analyzed was performed to assess, from the odds ratio (OR), the relationship between educational level and each of the cardiovascular risk factors, differentiating by sex. In all cases the variables smoking, alcohol, a sedentary lifestyle, and age were included as control variables, in order to consider their potential confounding effect. For this analysis, the educational level was transformed into a dichotomous variable "no schooling" and "some schooling" (including primary education, secondary education, vocational training, and university studies). A *P* value less than .05 was considered significant. The analysis were performed with SPSS, version 11.0.

RESULTS

From July 2006 until February 2007, 1174 individuals were invited to participate in the study; 273 (23.2%) refused to participate, 37 (3.1%) were excluded (19 for malignant neoplasms, 7 for neurodegenerative disease, 4 for chronic heart failure, 4 for chronic respiratory insufficiency, 4 for advanced chronic renal failure, 3 for cirrhosis, and 3 for connective tissue disorders) and 6 were not located. The total number of valid cases finally

TABLE 1. **Characteristics of the Sample**

	Total	Men	Women	*P*
Patients, n (%)	858	398 (46.4)	460 (53.6)	
Age, mean (SD), y	61.5 (6.8)	61.9 (6.8)	61.1 (6.7)	NS
Educational level				
No schooling	54.5 (51.1-57.9)	46 (41-51)	61.7 (57.1-66.2)	<.001
Primary	39 (35.8-42.4)	43.4 (38.5-48.5)	35.2 (30.9-39.8)	
Secondary	4.4 (3.2-6)	7.2 (4.9-10.3)	2.0 (0.9-3.7)	
University studies	2.1 (1.2-3.3)	3.4 (1.9-5.8)	1.1 (0.4-2.5)	
Smokers	15.2 (12.8-17.7)	23.7 (19.5-28.1)	7.9 (5.5-10.7)	<.001
Drinkers >2 u/day	12.1 (10-14.5)	25.5 (21.2-30)	0.7 (0.1-1.9)	<.001
Sedentary lifestyle	38.3 (35.1-41.7)	30.9 (26.4-35.7)	44.8 (40.2-49.5)	<.001
Obesity (BMI)				
Mean (SD)	30.9 (4.7)	30.4 (4)	31.3 (5.2)	NS
≥27	79.8 (77-82.5)	79.6 (75.4-83.5)	80 (76-83.6)	NS
≥30	55 (51.6-58.4)	54 (49-59)	55.9 (51.2-60.5)	NS
Diabetes				
Diagnosed	23.3 (20.5-26.3)	23.4 (19.3-27.8)	23.3 (19.5-27.4)	NS
Undiagnosed	4.3 (3.1-5.9)	6 (3.9-8.8)	3.2 (1.8-5.3)	.015
Total	27.6 (24.7-30.7)	29.4 (25.0-34.1)	26.1 (22.1-30.4)	NS
High fasting blood glucose	28.5 (25.6-31.6)	29.1 (24.7-33.9)	28 (24.0-32.4)	NS
Hypertension				
Diagnosed	44.6 (41.3-48)	39.4 (34.6-44.4)	49.1 (44.5-53.8)	.003
Undiagnosed	4.3 (3.1-5.9)	5.5 (3.5-8.2)	3.3 (1.8-5.3)	NS
Total	49 (45.6-52.4)	45 (40-50)	52.4 (47.7-57)	.018
Hypercholesterolemia				
Diagnosed	37.2 (33.9-40.5)	34.4 (29.8-39.3)	39.6 (35.1-44.2)	NS
Undiagnosed	6.5 (5-8.4)	6.5 (4.3-9.4)	6.5 (4.4-9.2)	NS
Total	43.7 (40.4-47.1)	40.9 (36.1-46)	45.1 (40.4-49.7)	NS
Metabolic syndrome	57.8 (54.4-61.1)	58.8 (53.8-63.7)	57 (52.3-61.5)	NS
Waist circumference	77.2 (74.2-79.9)	68.3 (63.5-72.9)	84.8 (81.2-87.9)	<.001
Blood pressure	83.2 (80.5-85.7)	85.7 (81.8-89)	81.1 (77.2-84.6)	.044
Glucose	56.2 (52.8-59.5)	58.5 (53.5-63.4)	54.1 (49.5-58.8)	NS
Triglycerides	35.4 (32.2-38.7)	41.2 (36.3-46.2)	30.4 (26.3-34.9)	.001
HDL-C	16.1 (13.7-18.7)	14.8 (11.5-18.7)	17.2 (13.8-20.9)	NS

BMI indicates body mass index; HDL-C, high-density lipoprotein cholesterol.
Values are expressed as a percentage and 95% confidence interval or mean (standard deviation) (SD).

included was 858 (73.1%). The mean age and sex proportion of the sample (46.4% men with a mean age of 61.9 years and 53.6% women with a mean age of 61.1 years) did not differ significantly from the target population (48.6% men with a mean age of 61.1 years and 51.4% women with a mean age of 61.6 years).

Tables 1, 2, and 3 show the demographic, clinical, and analytical data of the study sample, and the prevalence of cardiovascular risk factors according to age and sex. Table 4 compares the prevalences of the cardiovascular risk factors between the group of persons with no schooling and the group that had some schooling.

Alcohol, Smoking, Physical Activity, and Educational Level

Significantly more men were active smokers and drank more than 2 units per day (Table 1), with a tendency to decrease in the oldest age groups (Table 3). The prevalence of a sedentary lifestyle was high, more than one third of cases, predominantly among the women and increasing progressively with age (Tables 1 and 3).

The most notable result in the sample group was a very low level of education, as 61.7% of the women and 46% of the men admitted to not having completed primary studies and not being able to read or write. Just 10.6% of the men and 3.1% of the women had had the opportunity to study at the secondary or university level. By deciles of age, a significant decrease in illiteracy was seen in the youngest group. This reduction was seen in both sexes, though less marked among the women (Tables 1 and 3). In the bivariate analysis, the group of individuals with no schooling had a significantly higher percentage of obesity, diabetes, hypertension and the metabolic syndrome. The only predominant risk factor in individuals with some schooling was active smoking (Table 4).

TABLE 2. **Biochemical Parameters and Blood Pressure by Sex**

	Total	Men	Women	*P*
Patients, n (%)	858	398 (46.4)	460 (53.6)	
Waist circumference, cm	104.4 (12.5)	108.2 (11.1)	101.1 (12.7)	<.001
Systolic blood pressure, mm Hg	144.5 (20.7)	147.5 (20)	142 (21)	<.001
Diastolic blood pressure, mm Hg	80 (10.3)	80.2 (10.3)	79.7 (10.3)	NS
Heart rate, bpm	78.9 (12.3)	79.1 (13.2)	78.7 (11.4)	NS
Glucose, mg/dL	113 (39.8)	113.5 (35.8)	112.6 (43)	NS
Total cholesterol, mg/dL	231.9 (44.1)	224.7 (44.6)	238.2 (42.8)	<.001
LDL-C, mg/dL	146.1 (37.2)	142 (37.4)	149.6 (36.7)	.003
HDL-C, mg/dL	57.4 (13.5)	52.2 (12.1)	61.9 (13)	<.001
Triglycerides, median, mg/dL	124.5	160.8	135.3	
Neperian logarithm		4.9 (0.57)	4.79 (0.46)	.002
Uric acid, mg/dL	4.4 (1.5)	5.2 (1.5)	3.7 (1.2)	<.001

HDL-C indicates high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.
The values are expressed as mean (standard deviation).

TABLE 3. **Prevalence of Cardiovascular Risk Factors According to Deciles of Age and Sex**

	Men			Women		
Age, y	50-59	60-69	70-75	50-59	60-69	70-75
Patients, n (%)	162 (40.7)	166 (41.7)	70 (17.6)	208 (45.2)	181 (39.3)	71 (15.4)
Educational level						
No schooling	33.8	54.3	54.4[a]	53.1	64.8	78.9[b]
Primary	50.3	37.7	41.2	43	32.4	19.7
Secondary	10.8	5.6	2.9	2.4	1.7	1.4
University studies	5.1	2.5	1.5	1.4	1.1	0
Smoker	26.5	21.1	18.6	9.7	8.9	0[c]
Drinker >2 u/d	26.5	25.3	18.6	0	1.7	0
Sedentary lifestyle	30.9	29.5	34.3	42.3	43.6	54.9
BMI ≥30	51.9	54.2	58.6	50	59.7	63.4
Type 2 diabetes mellitus						
Diagnosed	16	29.5	25.7[d]	13.9	28.7	36.6[b]
Total	23.5	33.7	32.9	16.3	32.6	38.0[b]
High fasting blood glucose	29	27.7	32.8	25	33.7	22.5[e]
Hypertension						
Diagnosed	28.4	45.8	50[a]	37.5	54.7	69.0[b]
Total	34.6	50.6	55.7[a]	41.3	56.4	74.6[b]
Hypercholesterolemia						
Diagnosed	34	34.3	35.7	29.3	47	50.7[b]
Total	53.7	50	52.9	54.3	67.4	63.4[e]
Metabolic syndrome	54.9	56.6	72.9[d]	42.3	69.6	67.6[b]

[a]*P*<.01 for comparison of the prevalence of risk factors according to the age of the men.
[b]*P*<.001 for comparison of the prevalence of risk factors according to the age of the women.
[c]*P*<.05 for comparison of the prevalence of risk factors according to the age of the women.
[d]*P*<.05 for comparison of the prevalence of risk factors according to the age of the men.
[e]*P*<.01 for comparison of the prevalence of risk factors according to the age of the women.
The values are expressed as a percentage.

Taking into consideration the unfavorable results in the level of education and the notable differences found according to gender, the analysis of the relationship between the educational level and the presence of cardiovascular risk factors was studied in more depth. The OR of the risk factors was calculated, comparing the group with no schooling to the group with some schooling (Table 5) separately for men and women. Statistically significant differences were detected for obesity in the men and diabetes and the metabolic syndrome in the women; in all cases the risk was higher in the persons with no schooling (Table 5). In absolute terms, the risk of having any cardiovascular risk was higher in the group with no schooling, except in the case of hypercholesterolemia in the men, in whom this tended to predominate in the group with some schooling, although without reaching statistical significance.

TABLE 4. **Prevalence of Cardiovascular Risk Factors According to Level of Education**

	No Schooling	Some Studies	*P*
Patients, n (%)	468 (54.5)	390 (45.5)	
Age, mean (SD), y	62.6 (6.6)	60 (6.7)	<.001
Women	61.3 (56.7-65.8)	45.6 (40.6-50.7)	<.001
Active smoker	11.1 (8.4-14.3)	18.5 (14.7-22.7)	<.001
Drinker >2 u/day	11.5 (8.8-14.8)	13.2 (9.9-16.8)	NS
Sedentary lifestyle	40.7 (36.1-45.2)	35.9 (31.1-40.9)	NS
BMI ≥27	82.8 (79.2-86.2)	76.6 (72.1-80.8)	.015
BMI ≥30	58.5 (53.9-63.1)	51.8 (46.7-56.9)	.031
Diabetes			
Diagnosed	25.7 (21.7-29.9)	20.3 (16.4-24.6)	.04
Undiagnosed	7.3 (5.1-10.0)	3.3 (1.8-5.6)	.017
Total	31.1 (27.0-35.6)	22.9 (18.7-27.3)	.005
Hypertension			
Diagnosed	47.4 (42.8-52.1)	41.1 (36.1-46.1)	.04
Undiagnosed	14.5 (11.5-18.1)	15.9 (12.4-19.9)	NS
Total	55.0 (50.3-59.5)	50.3 (45.2-55.3)	NS
Hypercholesterolemia			
Diagnosed	38.7 (34.2-43.3)	35.2 (30.4-40.1)	NS
Undiagnosed	10.3 (7.7-13.4)	9.7 (7.0-13.1)	NS
Total	45.0 (40.5-49.7)	41.4 (36.4-46.3)	NS
Metabolic syndrome			
NCEP/ATP-III	61.1 (56.5-65.6)	53.9 (48.8-58.9)	.021

The values are expressed as a percentage and 95% confidence interval.

Obesity and the Metabolic Syndrome

Obesity and the metabolic syndrome were the most prevalent variables, together with the low educational level (Table 1). An important additional characteristic was that the obesity found was predominantly abdominal. Among the individuals with a BMI ≥27, 84.5% of the men had a waist circumference >102 cm and 95.4% of the women >88 cm. Among those with a BMI <27, 21% of the men and 51.1% of the women also had a high waist circumference.

The metabolic syndrome was equally represented in men and women and increased progressively with age (Tables 1 and 3). The most prevalent diagnostic criteria for the metabolic syndrome were waist circumference and blood pressure, both predominant in the women, as opposed to triglycerides, which was the most frequent criterion in the men (Table 1).

Diabetes Mellitus

Diabetes and elevated fasting blood glucose, together with obesity, were the risk factors with the highest prevalence, as up to 56.1% of the individuals were diabetic or presented elevated blood glucose values (Table 1). Almost one quarter of the individuals in the sample were known diabetics under treatment by a primary care physician, with no differences between sex. However, the number of cases of unknown diabetes was almost double among the men (Table 1).

Hypertension

In total, 383 (44.6%) persons were known to have hypertension and were receiving therapy. Among the remaining 475, 235 (49.5%), of which 63% were men, presented a mean clinical blood pressure ≥140/90 mm Hg. Only 108 (45.9%) chose to have their measurements confirmed using SMBP (37 cases) or ABPM (71 cases). In 37 of the 71 cases using ABPM, the 24 h mean blood pressure was ≥135/85 mm Hg (22 men and 15 women), and in 26 of the 37 cases using SMBP, the mean blood pressure was also ≥135/85 mm Hg (15 men and 11 women). Thus, the final percentage of hypertensive individuals in the study sample was 49%, with a significantly higher predominance among the women (Table 1).

Hypercholesterolemia

No differences were found between sexes in the prevalence of diagnosed or undiagnosed hypercholesterolemia. An increase in the prevalence related to age was only observed among the women.

DISCUSSION

The prevalence of cardiovascular risk factors found in adults from Sanlucar de Barrameda aged between 50 and 75 years was extremely high. Obesity, diabetes and, consequently, the metabolic syndrome all stand out. Of

TABLE 5. **Odds Ratio (95% Confidence Interval) for the Risk Factors According to Level of Education (Individuals With no Schooling vs Individuals With Some Studies)**

	Obesity	Diabetes	Hypertension	Hypercholesterolemia	Metabolic Syndrome
Men					
Unadjusted	1.5 (1-2.24)[a]	1.2 (0.78-1.84)	1.1 (0.74-1.64)	0.81 (0.54-1.22)	1.06 (0.71-1.58)
Smoking	1.55 (1.03-2.32)[a]	1.11 (0.72-1.72)	1.08 (0.72-1.62)	0.85 (0.57-1.28)	1.08 (0.72-1.62)
Alcohol	1.55 (1.04-2.33)[a]	1.16 (0.75-1.79)	1.1 (0.73-1.64)	0.84 (0.56-1.27)	1.09 (0.73-1.64)
Sedentary lifestyle	1.51 (1-2.45)[a]	1.2 (0.78-1.86)	1.1 (0.74-1.65)	0.81 (0.54-1.22)	1.06 (0.71-1.59)
Age	1.45 (0.96-2.17)	1.1 (0.71-1.72)	0.96 (0.64-1.45)	0.81 (0.54-1.22)	0.95 (0.63-1.44)
All	1.47 (0.97-2.24)	1.03 (0.65-1.61)	0.94 (0.61-1.43)	0.85 (0.56-1.3)	0.95 (0.62-1.45)
Women					
Unadjusted	1.18 (0.81-1.72)	1.96 (1.24-3.09)[b]	1.35 (0.93-1.97)	1.43 (0.98-2.09)	1.71 (1.17-2.5)[b]
Smoking	1.11 (0.76-1.63)	1.86 (1.18-2.95)[b]	1.3 (0.89-1.91)	1.42 (0.97-2.09)	1.62 (1.11-2.39)[a]
Alcohol	1.2 (0.81-1.74)	2 (1.27-3.16)[b]	1.33 (0.91-1.94)	1.43 (0.97-2.09)	1.7 (1.16-2.49)[b]
Sedentary lifestyle	1.13 (0.77-1.67)	1.92 (1.22-3.04)[b]	1.32 (0.9-1.93)	1.42 (0.97-2.08)	1.67 (1.13-2.47)[b]
Age	1.07 (0.72-1.57)	1.65 (1.03-2.64)[a]	1.07 (0.72-1.59)	1.25 (0.84-1.85)	1.45 (0.98-2.15)
All	1.03 (0.69-1.55)	1.62 (1.01-2.62)[a]	1.02 (0.67-1.53)	1.23 (0.83-1.83)	1.4 (0.93-2.1)

[a]*P*<.05 for the comparison between the group with no schooling and the group with some studies.
[b]*P*<.01 for the comparison between the group with no schooling and the group with some studies.

note, too, was the low educational level, with more than 50% illiteracy, predominantly in women. These prevalences are among the highest in Spain, and to date we have been unable to find a higher prevalence of obesity and the metabolic syndrome in Spain.[12-28] The data on the prevalence of diabetes, together with those of the GUIA Study in the Canary Isles, are also the highest so far reported in Spain.[26]

The extremely high prevalence of overweight and obesity deserves special mention, and it could increase even more in the future due to the progressive increase detected among young persons and adolescents.[29] Furthermore, considering that overweight and obesity are closely linked to the development of the remaining cardiovascular risk factors and that they are independently associated with mortality,[30] the results found in this study are a cause for concern.

Educational Level and Prevalence of Risk Factors

Although the Sanlucar Study was not designed to investigate the causes of the prevalence of cardiovascular risk factors, we believe that the detection of such adverse findings justifies carrying out an additional analysis in order to propose a possible explanation. Since socioeconomic factors, mainly the educational level, are closely linked to the development of cardiovascular risk factors,[31-34] it is plausible that the socioeconomic determinants are significantly affecting the development of risk factors in Sanlucar de Barrameda. In the age segment studied, up to 93.5% of the individuals had no schooling or only primary education (though not specifying whether these studies were in fact completed). By logistic regression analysis, the risk for obesity was 1.5 times higher among men with no schooling, after adjusting for confounding variables. Likewise, the risk for diabetes or the metabolic syndrome was more than 1.6 times higher among women with no schooling. The poor employment situation in Cadiz province is well known, with the highest unemployment rate registered in Spain[35]; Sanlucar de Barrameda ranks fifth in the rate of unemployment among Spanish towns with more than 50 000 inhabitants, registered in 2006 (after Ceuta, Melilla, La Linea de la Concepcion, and Cadiz), and was in first position a few years ago.[35]

Relevance and Practical Applicability of the Results

The Sanlucar Study provides up to date data on the prevalence of the leading cardiovascular risk factors in an area with one of the highest cardiovascular morbidity and mortality rates in Spain. The results of the present study show the need for improvements in health care concerning the detection and prevention of risk factors. The efficiency of these measures would likely be limited if parallel political and social action is not taken to improve school failure, the economy, and unemployment.

Limitations of the Study

As a prevalence analysis, the limitations of the present study include the fact that it focused on one age group and did not cover the entire population, due to the design of the Sanlucar Study. Also, the prevalences of diabetes and hypertension are underestimated. Although no confirmatory readings of fasting blood glucose levels were made in the cases with values ≥126 mg/dL, we consider the real prevalence of diabetes to be underestimated since no oral glucose tolerance testing was performed on the high number of individuals with elevated fasting glucose readings. Hypertension, too, was probably underestimated, as only half of the non-hypertensive individuals with elevated blood pressure carried out SMBP and ABPM. This low percentage of acceptance of SMBP or ABPM was surprising, even though this group of individuals received information regarding the diagnostic and prognostic importance and the potential therapeutic repercussions. Finally, a characteristic that makes a rigorous comparison of results of national epidemiological studies with those of the Sanlucar Study difficult derives from the heterogeneity of the diagnostic criteria, the age groups and the methodology used. This does not significantly affect comparison of the prevalence of obesity or the metabolic syndrome. Regarding diabetes, however, and with the exception of the Canary Islands' GUIA Study, the differences in prevalence found between the Sanlucar Study and the rest of the studies are so marked that they could not be explained by methodological differences alone.

CONCLUSIONS

The prevalence of cardiovascular risk factors in adults aged 50 to 75 years from Sanlucar de Barrameda is extremely high. In particular, the prevalences of obesity, diabetes, and the metabolic syndrome were found to be among the highest so far reported in Spain. A very deficient educational level may be related with these adverse results, thus posing a health care problem of great magnitude that requires considerably increasing corrective and preventive measures.

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