Relationship Between Metabolic Syndrome and Ischemic Heart Disease Mortality in Spain

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Morbidity and mortality due to ischemic heart disease (IHD) is subject to wide geographic variation both between and within countries. The aim of this study was to determine whether geographic variations exist in the prevalence of metabolic syndrome in the Spanish working population or in its relationship with IHD mortality. We analyzed clinical and laboratory data obtained during health check-ups carried out in Spanish workers (n=17 837) during 2003.

The prevalence of metabolic syndrome was 17% in men and 6.5% in women. However, there was a heterogeneous distribution across the different regions studied. The prevalence in southern and western regions (eg, in men: 22.15% in Extremadura and 20.6% in Galicia) was double that observed in central and northern zones (eg, in the País Vasco and Castilla y León). This research indicates that there is a significant association between IHD mortality and the prevalence of metabolic syndrome in workers from different Spanish regions.

Key words: Metabolic syndrome. Ischemic heart disease. Mortality.

INTRODUCTION

Recent years have seen the publication of studies investigating the prevalence of metabolic syndrome (MS) in different parts of Spain.1-3 However, their results cannot be easily compared owing to the type of samples selected and the different methods used in each.

Metabolic syndrome is a risk factor for diabetes mellitus and ischemic heart disease (IHD).4,5 The existence of geographic heterogeneity with respect to cardiovascular disease-related mortality and morbidity between and even within countries is well known.4 The aim of the present work was to describe the distribution of the prevalence of MS in the working population of Spain, and to determine whether any relationship exists between this distribution and IHD mortality rates.

METHODS

Study sample

This study involved a cross-sectional, epidemiological investigation of Spanish workers...
recruited during health check-ups performed by the prevention services of FREMAP in the year 2003. The initial sample included 118,138 workers, of which 17,837 (13,768 men and 4,069 women) were eligible for inclusion. After eliminating those initial subjects with computer-illegible data, the sample size was 69,860 patients. Of the remainder, those with all the variables required to make a diagnosis of MS were finally selected. All these subjects were between 25 and 64 years of age. The most important limiting variable for making this final selection of workers was the high density lipoprotein cholesterol (HDL-C) concentration; this datum was only available for one quarter of the initial population. An analysis was made of the randomness of the presence or absence of high density lipoprotein data, which showed the missing data were random and uniformly distributed across the provinces included in the study.

The mean values of the variables studied (Table 1) for the sample of workers included in and excluded from the study were compared after dividing them in terms of the presence or absence of HDL-C data, and glucose and triglyceride data, both in general and by sex. No significant differences were detected. The methods used in the collection of physical examination data and for the collection of samples for biochemical analysis are described elsewhere.7,8

**Statistical Analysis**

Continuous variables were described in terms of the mean, standard deviation, and median. Dichotomous variables were described in terms of proportions. Standardized estimates of proportions were recorded along with their 95% confidence intervals (95% CI). The adjustment of prevalences and means was undertaken using a standard European population for the age range 25-64 years, with subdivisions by decades as in previous analyses. Standardized statistical information was prepared for each region and province (in this case for men only), excluding those for which a sample of <100 workers was available. For the provincial level analysis a total of 13,305 workers was available. Adjusted confidence intervals were obtained by calculating the variance for each stratification of proportions, later adjusting for the weight of each of the groups used in the stratification procedure. The IHD-related mortality rates adjusted for sex and age for each province were obtained from the Centro Nacional de Epidemiología (National Epidemiology Center).9 The association between the prevalence of MS and IHD-related mortality was determined by calculating the Spearman non-parametric rho coefficient.

**RESULTS**

Table 1 shows the characteristics of the workers studied. The men showed high values for all the variables studied except HDL-C. The raw prevalence of MS was 13.4% (15.9% in men and 5.2% in women).

Table 2 shows the prevalence of MS in each region according to sex and age; significant differences were seen between men and women (P<.05) in all regions. The maximum prevalence of MS was seen among men in Extremadura (22.15%; 95% CI, 21.7-22.5) and Galicia (20.6%; 95% CI, 20.2-20.9), and in women in Castilla-La Mancha (10.4%; 95% CI, 10.1-10.6) and Extremadura (9.1%; 95% CI, 8.1-10.2). Both sexes showed low prevalences in the País Vasco and Castilla-León. Figure 1 shows the significant positive correlation between the provincial figures for IHD-related mortality, adjusted for age and sex, and the standardized prevalence of MS (R=0.414; P=.04).
in other risk factors and eventually increased IHD-related morbidity and mortality. This would appear to be borne out by recently published data that show the south of Spain to be losing its position as one of the areas of Europe with the lowest IHD-related mortality; in fact the area now has higher values than the rest of Europe.

The present results indicate a significant relationship between IHD-related mortality in workers and the frequency of MS in the different provinces. Unfortunately, the results refer to an association between cardiovascular risk in 2003 and IHD-related mortality in 2002. Sadly, data for the preceding 10 years on the prevalence of MS are unavailable – such

### DISCUSSION

The prevalence of MS was found to be similar to that published for other samples of Spanish workers. However, its distribution was not homogeneous across regions. In addition, it correlated with IHD-related mortality. The southern regions of the country showed a greater prevalence of MS, reaching up to twice that seen in the center and north. This north-south/southwest pattern agrees with that described by other authors for hypertension, diabetes, and obesity in Spain, both in adults and children. The presence of MS might be determined by the greater prevalence of overweight in these regions, which would also lead to an increase in other risk factors and eventually increased IHD-related morbidity and mortality. This would appear to be borne out by recently published data that show the south of Spain to be losing its position as one of the areas of Europe with the lowest IHD-related mortality; in fact the area now has higher values than the rest of Europe.

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### TABLE 2. Prevalence of Metabolic Syndrome (MS) Adjusted by Age and Sex for Each Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Men No.</th>
<th>MS, % (95% CI)</th>
<th>Women No.</th>
<th>MS, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andalucia</td>
<td>2268</td>
<td>15.2 (14.9-15.4)</td>
<td>677</td>
<td>6.5 (6.3-6.7)</td>
</tr>
<tr>
<td>Aragón</td>
<td>480</td>
<td>14.5 (14.1-15)</td>
<td>158</td>
<td>7.9 (7.6-8.2)</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>2741</td>
<td>17.8 (17.5-18)</td>
<td>1164</td>
<td>10.4 (10.1-10.6)</td>
</tr>
<tr>
<td>Castilla-León</td>
<td>1578</td>
<td>14.3 (14-14.5)</td>
<td>527</td>
<td>4 (3.9-4.1)</td>
</tr>
<tr>
<td>Cataluña</td>
<td>987</td>
<td>18.6 (18.1-19)</td>
<td>249</td>
<td>7.3 (7.1-7.6)</td>
</tr>
<tr>
<td>Extremadura</td>
<td>563</td>
<td>23.7 (22.7-24.6)</td>
<td>107</td>
<td>9.1 (8.1-10.2)</td>
</tr>
<tr>
<td>Galicia</td>
<td>2492</td>
<td>20.6 (20.2-20.9)</td>
<td>505</td>
<td>6.2 (6-6.4)</td>
</tr>
<tr>
<td>Madrid</td>
<td>232</td>
<td>15.5 (14.7-16.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>País Vasco</td>
<td>1272</td>
<td>13.7 (13.5-14)</td>
<td>333</td>
<td>5.8 (5.5-6)</td>
</tr>
<tr>
<td>Levante</td>
<td>945</td>
<td>17.3 (16.8-17.7)</td>
<td>248</td>
<td>10.5 (9.9-11.1)</td>
</tr>
<tr>
<td>Raw total</td>
<td>13 693</td>
<td>16.9 (16.7-17)</td>
<td>4069</td>
<td>6.5 (6.4-6.7)</td>
</tr>
<tr>
<td>Standardized total</td>
<td>13 693</td>
<td>16.9 (16.7-17)</td>
<td>4069</td>
<td>6.5 (6.4-6.7)</td>
</tr>
</tbody>
</table>

### Figure

Association between prevalence of metabolic syndrome (MS) in Spanish provinces (%) and mortality related to ischemic heart disease.
information would be very useful for establishing the relationship between MS and current IHD-mortality. However, those data that do exist suggest that the prevalence of cardiovascular risk factors has not diminished in recent years. In addition, the same geographical differences as detected in the present work have been previously reported.

The present work suffers from a number of limitations. No other factors (e.g., socioeconomic factors, physical activity, diet, use of tobacco) that might have influenced the results were controlled. Further, the selection of the provinces was neither random nor weighted; rather, those that could supply information for >100 workers were included. The present results could, however, allow one to design new studies to determine the influence of genetic or acquired (dietetic, physical activity, etc) factors on MS in the different regions. Knowledge of these differences is important for deciding upon the best preventive strategy to be followed in each area.

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REFERENCES


