

## Obesity Prevalence

# Prevalence of general and abdominal obesity in the adult population of Spain, 2008–2010: the ENRICA study

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Received 12 August 2011; revised 14 October 2011; accepted 2 November 2011

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### Summary

This is the first study to report the prevalence of general obesity and abdominal obesity (AO) in the adult population of Spain based on measurements of weight, height and waist circumference. The data are taken from the ENRICA study, a cross-sectional study carried out between June 2008 and October 2010 in 12,883 individuals representative of the non-institutionalized population on Spain aged 18 years and older. Anthropometry was performed under standardized conditions in the households by trained interviewers. Overweight was considered as body mass index (BMI) 25–29.9 kg m<sup>-2</sup>, and obesity as BMI ≥ 30 kg m<sup>-2</sup>. AO was defined as waist circumference >102 cm in men and >88 cm in women. The prevalence of obesity was 22.9% (24.4% in men and 21.4% in women). About 36% of adults had AO (32% of men and 39% of women). The frequency of obesity and of AO increased with age and affected, respectively, 35 and 62% of persons aged 65 and over. The frequency of obesity and AO decreased with increasing educational level. For example, 29% of women with primary education or less had obesity vs. only 11% of those with university studies. The prevalence of obesity was very high in the Canary Islands and in the south of Spain.

**Keywords:** Abdominal obesity, obesity, prevalence, Spain.

**obesity reviews** (2012) **13**, 388–392

## Introduction

Although there is evidence that the obesity epidemic is levelling off in some populations (1), the prevalence of excess weight remains high in many countries of the world. To date, information on the frequency of obesity in adults in Spain has come from self-reported data on weight and height (2), while the frequency of abdominal obesity (AO) is unknown. Anthropometric measurements are available only in certain population subgroups, such as older adults (3,4), and in regional or local studies (5). This is the first study to report the prevalence of obesity and AO in the adult population of Spain based on measurements of weight, height and waist circumference.

## Materials and methods

The data were taken from the Study on Nutrition and Cardiovascular Risk in Spain (ENRICA), whose methods have been reported elsewhere (6). In brief, this is a cross-sectional study carried out between June 2008 and October 2010 in 12,883 persons representative of the non-institutionalized population of Spain aged 18 years and older. Participants were selected by stratified cluster sampling. First, the sample was stratified by province and size of municipality. Second, clusters were selected randomly in two stages: municipalities and census sections. Finally, the households within each section were selected by random telephone dialling; subjects in the households were selected

proportionally to the sex and age distribution of the Spanish population. Data collection included a health questionnaire, samples of blood and urine, physical examination and dietary history. The final response rate in the study was 51%.

Weight, height and waist circumference were measured twice in each subject by trained staff under standardized conditions (6). These measurements were performed using electronic scales (model Seca 841: Seca Deutschland, Hamburg, Germany, precision to 0.1 kg), portable extendable stadiometers (model Ka We 44 444Seca) and flexible, inelastic belt-type tapes. Body mass index (BMI) was calculated as weight in kilograms divided by squared height in metres. Overweight was considered as BMI 25–29.9 kg m<sup>-2</sup>, and obesity as BMI ≥ 30 kg m<sup>-2</sup>. Moreover, within the obesity range, a BMI 35–39.9 kg m<sup>-2</sup> corresponded to type II obesity, and a BMI ≥ 40 kg m<sup>-2</sup> to morbid obesity. AO was defined as waist circumference >102 cm in men and >88 cm in women. Subjects were classified into three groups by educational level: low (primary or less education), medium (secondary education) and high (university education).

Analyses were conducted with the individuals with complete information on the variables of interest (12,036 individuals for BMI, and 12,111 for waist circumference). The prevalence of overweight, obesity and AO, with its 95% confidence interval, was calculated by sex and age groups. Moreover, the age-adjusted prevalence of obesity and AO by educational level and region of residence was calculated by the direct method using the ENRICA participants as the standard population. A Chi-square test was used to assess the linear trend in the prevalence of obesity and AO across educational level. The analyses took into account the complex sample design and were performed with the survey procedure in STATA v.11.1: Science Plus Group, Groningen, The Netherlands.

## Results

Mean BMI in Spanish adults was 26.9 kg m<sup>-2</sup> (27.4 in men and 26.3 in women), and it increased with age (Table 1). The prevalence of overweight was 39.4% (46.4% in men and 32.5% in women), and the prevalence of obesity was 22.9% (24.4% in men and 21.4% in women). The frequency of overweight and obesity increased with age and was higher in men than in women, except for those aged 65 years and older where obesity was more frequent in women (Table 1). The prevalence of type II obesity was 4.2% (95% CI 3.8–4.6%); the corresponding figure was 3.8% (95% CI 3.2–4.4%) in men and 4.5% (95% CI 3.1–5.1%) in women. As regards morbid obesity, the prevalence was 1.2% (95% CI 1.0–1.5%) in the total study sample, 0.6% (95% CI 0.4–0.9%) in men and 1.8% (95% CI 1.4–2.2%) in women. The available sample size does not allow obtaining precise prevalence estimates of these obesity subgroups by age.

The prevalence of AO was 35.5% (31.7% in men and 39.2% in women). At each age, the prevalence of AO was higher in women than in men, and it reached 50.9% of men and 69.7% of women aged 65 and over (Table 2).

Figure 1 shows the age-adjusted prevalence of obesity and AO in men and women by educational level. The frequency of obesity and AO decreased with increasing educational level in each sex (*P* for trend < 0.01 in all cases). This social gradient is especially notable for obesity in women, so that 29% of women with primary education or less had obesity vs. only 11% of those with university education.

Finally, the age-adjusted prevalence of obesity and AO was very high in the Canary Islands and in the south of Spain (Fig. 2). The absolute difference between the regions with highest and lowest prevalence of obesity is 16% in men and 12% in women. For AO, the absolute differences between regions are even greater (range of 20% in men and 39% in women) (Fig. 2).

|             | <i>n</i> | Body mass index<br>Mean (95% CI) | Overweight*<br>% (95% CI) | General obesity*<br>% (95% CI) |
|-------------|----------|----------------------------------|---------------------------|--------------------------------|
| Total       | 12,036   | 26.9 (26.7–27.0)                 | 39.4 (38.2–40.5)          | 22.9 (21.9–23.8)               |
| 18–44 years | 6,018    | 25.5 (25.4–25.7)                 | 33.4 (31.8–34.9)          | 15.0 (13.7–16.2)               |
| 45–64 years | 3,580    | 27.9 (27.7–28.0)                 | 44.9 (42.9–47.0)          | 27.8 (26.0–29.7)               |
| ≥65 years   | 2,438    | 28.8 (28.6–29.0)                 | 46.0 (43.5–48.4)          | 35.0 (32.6–37.4)               |
| Men         | 5,957    | 27.4 (27.3–27.6)                 | 46.4 (44.6–48.1)          | 24.4 (23.0–25.8)               |
| 18–44 years | 3,127    | 26.5 (26.3–26.7)                 | 41.5 (39.0–43.9)          | 18.6 (16.7–20.5)               |
| 45–64 years | 1,782    | 28.4 (28.2–28.6)                 | 51.9 (48.9–54.8)          | 30.9 (28.2–33.6)               |
| ≥65 years   | 1,048    | 28.4 (28.1–28.7)                 | 51.7 (47.8–55.6)          | 30.6 (27.3–33.9)               |
| Women       | 6,080    | 26.3 (26.2–26.5)                 | 32.5 (31.1–33.9)          | 21.4 (20.0–22.7)               |
| 18–44 years | 2,891    | 24.4 (24.2–24.7)                 | 24.6 (22.8–26.4)          | 11.1 (9.7–12.5)                |
| 45–64 years | 1,798    | 27.3 (27.0–27.6)                 | 38.0 (35.3–40.8)          | 24.7 (22.3–27.3)               |
| ≥65 years   | 1,390    | 29.1 (28.7–29.4)                 | 41.7 (38.6–44.8)          | 38.3 (34.0–41.6)               |

**Table 1** Body mass index and prevalence of overweight and general obesity in the adult population of Spain in 2008–2010, by sex and age

\*Overweight: BMI 25–29.9 kg m<sup>-2</sup>; general obesity: BMI ≥ 30 kg m<sup>-2</sup>. CI, confidence interval.

**Table 2** Waist circumference and prevalence of abdominal obesity in the adult population of Spain in 2008–2010, by sex and age

|             | <i>n</i> | Waist circumference<br>Mean (95% CI) | Abdominal obesity<br>% (95% CI) |
|-------------|----------|--------------------------------------|---------------------------------|
| Total       | 12,111   | 90.7 (90.4–91.2)                     | 35.5 (34.3–36.7)                |
| 18–44 years | 6,045    | 86.0 (85.4–86.5)                     | 20.4 (19.0–21.8)                |
| 45–64 years | 3,610    | 94.0 (93.4–94.6)                     | 43.0 (41.0–45.0)                |
| ≥65 years   | 2,456    | 97.9 (97.3–98.5)                     | 61.6 (59.2–64.1)                |
| Men         | 6,007    | 96.4 (95.9–96.8)                     | 31.7 (30.1–33.6)                |
| 18–44 years | 3,155    | 92.1 (91.4–92.8)                     | 19.8 (17.7–21.9)                |
| 45–64 years | 1,797    | 100.0 (99.5–100.6)                   | 41.4 (38.6–44.2)                |
| ≥65 years   | 1,055    | 102.8 (102.0–103.5)                  | 50.9 (47.4–54.4)                |
| Women       | 6,105    | 85.3 (84.9–85.8)                     | 39.2 (37.6–40.8)                |
| 18–44 years | 2,891    | 79.3 (78.7–79.8)                     | 21.1 (19.2–22.9)                |
| 45–64 years | 1,813    | 88.0 (87.4–88.7)                     | 44.6 (41.8–47.4)                |
| ≥65 years   | 1,401    | 94.2 (93.5–95.0)                     | 69.7 (66.5–72.9)                |

Abdominal obesity: Waist circumference > 102 cm in men and > 88 cm in women.

CI, confidence interval.

## Discussion

Around 39% of the adult population in Spain is overweight, and 23% have obesity. As regards the prevalence of overweight, the estimate in the ENRICA study is similar to 37.6% obtained in the European Health Interview Survey in Spain (EHISE), which collected self-reported weight and height on over 20,000 persons aged ≥18 years in 2009 (7). In contrast, the prevalence of obesity in the ENRICA study is higher than in the EHISE, which was 16% (7). Interview surveys usually underestimate the prevalence of obesity because reported weight is lower, and reported-height is higher, than the actual ones, particularly among the obese. For instance, while the prevalence of morbid obesity in the ENRICA study was 1.2%, it was only 0.6% using self-reported data in the National Health Interview Survey in 2006–2007 (8).

Among individuals aged 35–74 years, a pooled analysis of regional and local studies across 10 regions in Spain over the last decade estimated that the prevalence of obesity was 29% in each sex (5). The range in the prevalence of obesity across regions was 22–38% in men and 20–36% in women. Like in the ENRICA study, the frequency of obesity in this pooled analysis was higher in the Canary Islands and in Southern Spain (5).

The prevalence of obesity in Spain is lower than in the United States of America (USA), where 34% of the population aged 20 and over were obese in 2008 (9). In Europe, there is some variability in the prevalence of obesity; our results are similar to those of England, with 23% of obesity in those aged 16 and over in 2009 (10), or of Finland, where 21% of men and 24% of women aged 30 and over were obese in 2000 (11). However, the prevalence of

obesity in Spain is much higher than that of Portugal in 2003–2005, where 14% of the population aged 18–64 was obese (12).

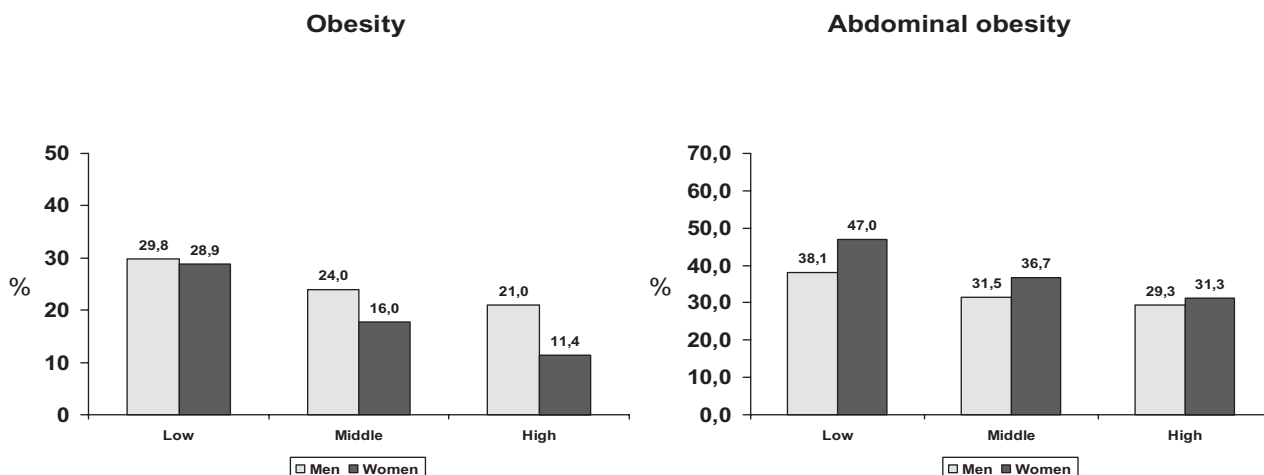
The prevalence of AO in Spain is lower than that in the USA in 2003–2006, where 53% (45 and 61% of men and women, respectively) of persons aged 20 years and older had a waist circumference of risk (13). However, the Spanish prevalence of AO is similar to that of England in 2009, where 38% of adults (32% of men and 44% of women) had a waist circumference of risk (10), and is lower than in Portugal, where 25% of adults had AO (12).

Traditionally, the prevalence of overweight in Spain (with self-reported data) was higher in men, whereas obesity was higher in women (2). However, in both Spain (with self-reported data) and other countries (e.g. USA, Portugal and Finland), the frequency of obesity in the last decade has increased more in men than in women (2,9,11,12). Thus, the current prevalence of obesity in Spain is somewhat higher in men. In contrast, in Spain and various other countries such as the USA (13) or England (10), AO is more frequent in women than in men.

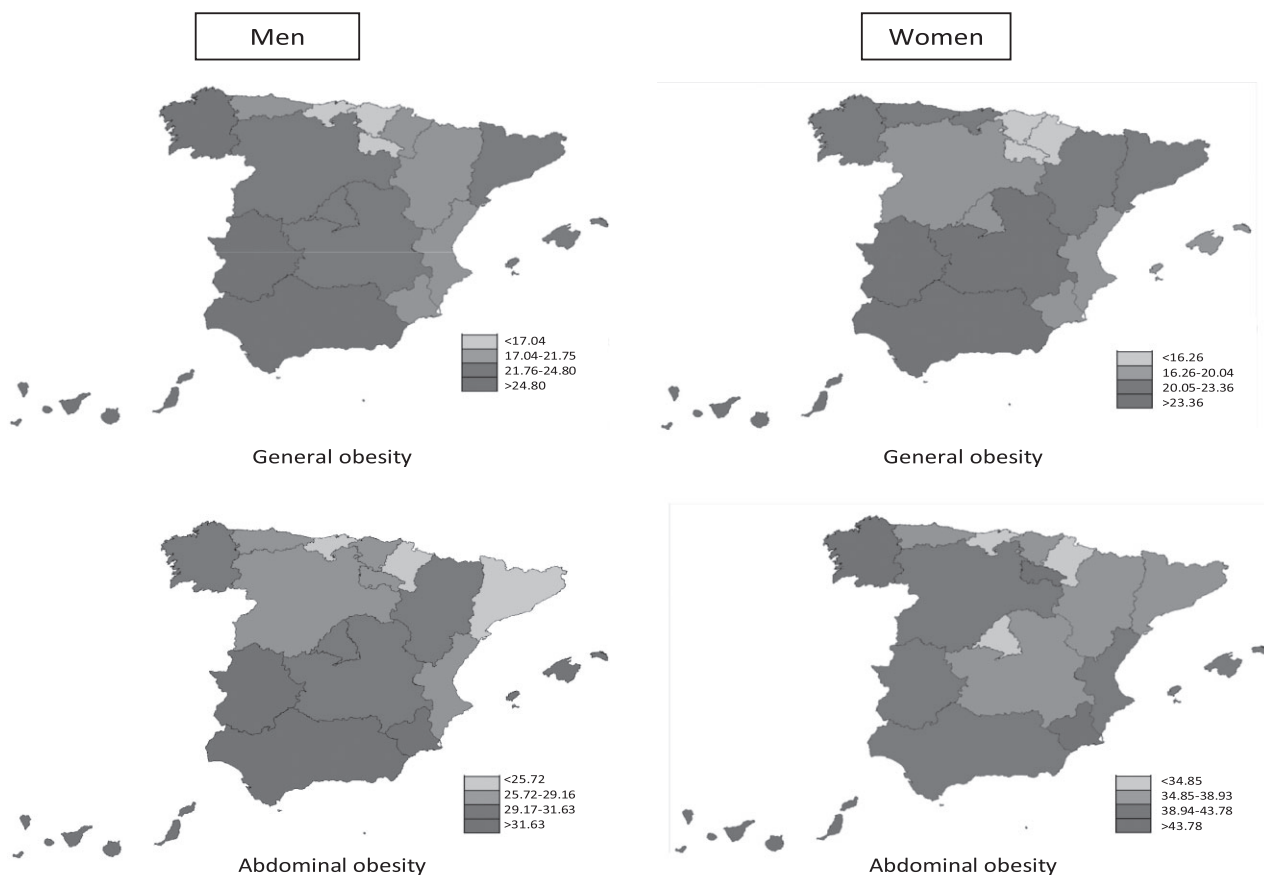
Similar to the USA and other European countries (e.g. Portugal, England and Finland), obesity in Spain shows an inverse socioeconomic gradient. This is consistent with the lower level of leisure-time physical activity and less adherence to the Mediterranean diet in persons with low educational level in Spain (data from the ENRICA study, not shown).

Finally, the large geographic variation in the prevalence of obesity and AO in Spain is also a characteristic of the epidemiology of obesity in many countries. The factors that might explain the regional differences in obesity, and specifically the north-south gradient, in Spain are uncertain. Of note, however, is that this geographic pattern has been observed for over 25 years, based on reported weight and height (14). Also, recent regional and local studies have shown this pattern, which also affects other cardiovascular risk factors such as hypertension and hypercholesterolemia (5). This pattern has been traditionally linked to the lower socioeconomic level of the Canary Islands and Southern Spain (14). Lastly, the reduction in physical activity and the worsening dietary habits, which have led to the obesity epidemic over the last decades, may have been more pronounced in Southern Spain than in other regions due to economic and social circumstances (15).

The main strengths of this study are its large size and the use of objective measures of weight, height and waist circumference. One possible limitation is that the response rate was 51%. This rate is somewhat lower than that in the NHANES III carried out in 2007–2008 in the USA (16), but it is among the highest in the health interview and examinations surveys conducted in Europe (17). Moreover, the observed sex, age and educational level structure of the



**Figure 1** Age-adjusted prevalence of general and abdominal obesity by educational level in Spanish men and women, 2008–2010. Chi-square for trend *P* values in general obesity and abdominal obesity was <0.01 in both men and women.



**Figure 2** Regional variation in the age-adjusted prevalence of general obesity and abdominal obesity in Spanish men and women, 2008–2010.

ENRICA study closely resemble the socio-demographic distribution of the Spanish population in 2009 (6). Thus, both the response rate and the sample structure suggest that the ENRICA study is representative of the adult population of Spain.

We conclude that the prevalence of obesity in Spain is very high; there are also important socioeconomic and geographic differences in the frequency of obesity. Both the level and the differences in obesity should be compellingly tackled by appropriate policies.

## Conflict of Interest Statement

No conflict of interest was declared.

## Acknowledgements

The ENRICA study is funded by Sanofi-Aventis. Additional funding is obtained from FIS grants PI09-1626 and PI08-0166, and from the 'Cátedra UAM de Epidemiología y Control del Riesgo Cardiovascular'. The ENRICA study is being run by an independent academic steering committee.

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