Original article

Prevalence of General Obesity and Abdominal Obesity in the Spanish Adult Population (Aged 25–64 Years) 2014–2015: The ENPE Study

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A B S T R A C T

Introduction and objectives: According to the 2013 analysis of the Institute of Health Metrics, high body mass index values are the most important risk factor for disease in Spain. Consequently, we describe the prevalence of total obesity and abdominal obesity in the Spanish adult population (25–64 years) for 2014-2015.

Methods: The sample was taken from the ENPE study, a cross-sectional study with a representative sample of the noninstitutionalized population (n = 6800) carried out between May 2014 and May 2015. This analysis refers to the population between age 25 and 64 years (n = 3966). The anthropometric measurements were performed by trained observers at participants' homes according to standard international protocols. Body mass index ≥ 25 was defined as overweight and ≥ 30 as obesity. Abdominal obesity was classified as waist > 102 cm in men and > 88 cm in women.

Results: The estimated prevalence of overweight in the Spanish adult population (25–64 years) was 39.3% 95% confidence interval [95%CI], 35.7%-42.9%). The prevalence of general obesity was 21.6% (95%CI, 19.0%-24.2%) and, more specifically, was 22.8% (95%CI, 20.6%-25.0%) among men and 20.5% (95%CI, 18.5%-22.5%) among women, and rose with age. The prevalence of abdominal obesity was estimated at 33.4% (95%CI, 31.1%-35.7%) and was higher among women (43.3%; 95%CI, 41.1%-45.8%) than among men (23.3%; 95%CI, 20.9%-25.5%), and also rose with age.

Conclusions: The prevalence of general obesity and abdominal obesity in Spain is high, although the distribution differs according to autonomous community. A comparison with earlier data reveals a considerable increase in overweight, indicating the need for routine monitoring and comprehensive initiatives.

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Prevalencia de obesidad general y obesidad abdominal en la población adulta española (25–64 años) 2014–2015: estudio ENPE

R E S U M E N

Introducción y objetivos: Según el análisis de 2013 del *Institute of Health Metrics*, valores elevados de índice de masa corporal son el primer factor de riesgo de carga de enfermedad en España. Con base en este punto de interés, se describe la prevalencia de obesidad total y obesidad abdominal en la población adulta española (25-64 años) en 2014-2015.

Métodos: La muestra procede del estudio ENPE, estudio transversal en muestra representativa de la población no institucionalizada (n = 6.800), realizado entre mayo de 2014 y mayo de 2015. Este análisis se refiere a población entre 25 y 64 años (n = 3.966). Observadores entrenados realizaron las mediciones antropométricas en los domicilios según protocolos internacionales estandarizados. Se consideró sobrepeso valores de índice de masa corporal ≥ 25 y obesidad, índice de masa corporal ≥ 30. La obesidad abdominal se tipificó para valores de cintura > 102 cm en varones y > 88 cm en mujeres.

Resultados: La prevalencia de sobrepeso estimada en la población adulta española (25–64 años) es del 39,3 (intervalo de confianza del 95% [IC95%], 35,7-42,9); la de obesidad general, del 21,6 (IC95%, 19,0-24,2), el 22,8 (IC95%, 20,6-25,0) entre los varones y el 20,5 (IC95%, 18,5-22,5) entre las

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mujeres, y aumenta con la edad. La prevalencia de obesidad abdominal se estima en el 33,4% (IC95%, 31,1-35,7%), mayor entre las mujeres (el 43,3%; IC95%, 41,1-45,8%) que entre los varones (el 23,3%; IC95%, 20,9-25,5%), y también aumenta con la edad.

Conclusiones: Las prevalencias de obesidad general y obesidad abdominal en España son altas, aunque con distribución desigual por comunidades autónomas. La comparación con datos precedentes plantea un aumento importante de la sobrecarga ponderal, lo que indica la necesidad de vigilancia sistemática y acciones integradas.

Abbreviations

AO: abdominal obesity
BMI: body mass index
WC: waist circumference
WHO: World Health Organization
WHR: waist-to-hip ratio
WHtR: waist-to-height ratio

INTRODUCTION

The large overall rise in obesity is one of the most difficult public health challenges faced by current society, a situation that not only affects higher income countries, but is also worsening in countries with low and middle income levels.[1] According to the World Health Organization (WHO), the world prevalence of obesity (body mass index [BMI] ≥ 30) has almost doubled between 1980 and 2014. Around the world, overweight and obesity are associated with more deaths than low weight.[1]

High BMI and abdominal obesity (AO) values are known to be associated with all-cause mortality,[2,3] morbidity,[4] and disability, and consequently with years of life characterized by deteriorated health and low quality of life,[5] a situation that has led to mounting health costs.[6] Obesity is a risk factor for diseases such as type 2 diabetes mellitus (DM), cardiovascular disease, and some types of cancer.[1,7,8]

Although premature morbidity and mortality due to cardiovascular disease in industrialized nations have dropped considerably in the last 40 years, this trend could be slowed or even reversed by the increase in obesity and type 2 DM. This rise in overweight and obesity among adults may be predictive of a potential continual increase in morbidity and mortality in upcoming decades.[1,9,10]

According to a report prepared with 2013 data by the Institute for Health Metrics and Evaluation on the disease burden attributable to the main 15 risk factors, expressed as a percentage of disability-adjusted life years, the risks associated with a high BMI and an improper dietary profile are ranked first and second in the analysis performed for Spain.[11,12]

Some authors report that the prevalence of obesity is possibly now holding steady.[13] However, a disparity has been observed in data from the adult population in different European countries, and rising trends continue to be reported among adults in some studies.[13,14]

The high prevalence of overweight makes constant monitoring necessary to improve strategies against obesity in Spain. In 2013, the WHO adopted the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020, which set a target to halt the rise in obesity between 2010 and 2025.[15]

Earlier studies have published obesity estimates in the Spanish adult population based on self-reported data,[16] but this type of information tends to underestimate the prevalence[17] because participants tend to underestimate their weight and overestimate their height when stating these parameters. The earliest population data based on adult weight and height measurements come from local and regional studies conducted in the 1990s. The SEEDO (Spanish Society for the Study of Obesity) study[18] performed the first estimate for all of Spain, using the analysis of a dataset composed of regional studies available from random population samples that followed comparable procedures. These data were updated years later in the DORICA study.[19] Between 2008 and 2010, the ENRICA study[20] provided estimates for adults using anthropometric data from a country-wide population sample.

Most population studies use waist circumference (WC) to estimate the prevalence of AO, an indicator that could overestimate and underestimate the risk of tall and short individuals, respectively, because height is not taken into consideration.[21] One proposed alternative is the waist-to-height ratio (WHtR), which has been found to be a good indicator of abdominal adiposity, similar to WC. Some meta-analyses and systematic reviews support its use as a better predictor of cardiovascular risk factors.[22-25] In 2011, Bergman et al[26] proposed the use of a body adiposity index as a direct estimator of the percentage of total adiposity.

The aim of our study was to describe the prevalences of overall obesity and AO in a representative sample of the Spanish population aged 25 to 64 years in 2014-2015 and to analyze the distribution of various indicators of body adiposity.

METHODS

All data were taken from the ENPE study (Spanish acronym for the Nutritional Study of the Spanish Population), a cross-sectional observational study designed to collect recent data on consumer dietary habits, anthropometric data, and physical activity in the noninstitutionalized Spanish population older than 3 years. The study was carried out in a representative probabilistic sample (n = 6800) selected by a random multistep procedure, performed in 3 phases, with stratification of the units from the first step (census sections) according to autonomous community. A second step considered the primary residences within each census unit, using a random selection procedure. Likewise, individuals were selected from each home, with controlled quotas and proportional allotments according to the population density by age bracket (3-8 years, 9-18 years, 19-64 years, and > 65 years), sex, and municipality size, using the population census published by the National Institute of Statistics (January 2014). The scope of the study included all residents whose primary residence was in Spain.

Pregnant women were excluded from the study. Additionally, the anthropometric measurements excluded persons who

were unable to remain standing, were missing an arm or leg, or were immobilized with plaster splints that could not be removed.

The sample was recruited using a field procedure based on random routes. The data were collected between May 2014 and May 2015 by face-to-face interviews at the home of each participant. SIGMA DOS, a company that conducts population studies, coordinated the sample design and handled the logistics of the fieldwork.

The final sample included 6800 individuals, 3966 of them aged 25 to 64 years, which provided a margin of error of 1.62%. The participation of 400 individuals per autonomous community was ensured (sample error, 4.89%).

Anthropometric Measurements

All individual anthropometric measurements were taken by well-trained professional interviewers who participated in specific training seminars developed by the study authors. Standard international procedures[27] were followed after prior testing in a pilot study. The measurements were performed with participants in the standing position, barefoot, and with lightweight clothing. Height was measured in centimeters using a Seca 213 portable stadiometer (Seca GmbH & Co. Kg.; Hamburg, Germany) (range, 0-200 cm; precision, 0.1 cm). Body weight was obtained using calibrated Seca 803 digital scales (range, 0.1-150 kg; precision, 0.1 kg). Waist circumference was measured at the midpoint between the last costal margin and the iliac crest, and the hip circumference was measured horizontally around the largest circumference on the buttocks. Both circumferences were measured 3 times with a Seca 201 nonstretch measuring tape (range, 0-150 cm; precision, 0.1 cm). The BMI was calculated as weight (kg) divided by the square of the height (m). In addition, the waist-to-hip ratio (WHR) was calculated as WC (cm)/hip circumference (cm). The WHtR was calculated as WC (cm)/height (cm). The body adiposity index was calculated as proposed by Bergman et al[26]: hip circumference (cm)/(height [m])$^{1.5}$ – 18. Quality controls showed that intraobserver- and interobserver-related measurement errors were less than 1% for all anthropometric parameters reported, values well below those considered acceptable.[28]

Overweight was defined as BMI $\geq$ 25 and obesity as BMI $\geq$ 30. Additionally, the criteria proposed by the SEEDO were used for weight typing based on BMI value into the following categories: underweight (BMI < 18.5), normal weight (BMI = 18.5-24.9), overweight I (BMI = 25.0-26.9), overweight II (BMI = 27.0-29.9), obesity I (BMI = 30.0-34.9), obesity II (BMI = 35.0-39.9), obesity III (BMI = 40.0-49.9), and obesity IV (BMI $\geq$ 50)[29]. Abdominal obesity was defined as WC > 102 cm in men and > 88 cm in women, according to the WHO criteria.[30] Using the WHR, AO was defined as values > 0.90 in men and > 0.85 in women.[30] According to the WHtR, AO was defined as values > 0.5[24] and also using the criterion that proposes WHtR values > 0.55.[31]

Data Analysis

The analysis was done using all participants aged 25 to 64 years who had full information for the variables of interest (3801 for BMI and 3842 for waist and hip circumferences). The prevalence of obesity and AO was calculated with the respective 95% confidence interval (95%CI) according to age bracket and sex. Confidence intervals were calculated by applying bootstrap techniques,[32] based on 1000 samples. The prevalence rates for age-adjusted overweight and obesity were calculated for each autonomous community using a direct method, with the

Spanish distribution population taken as a standard population. The sample was weighted according to the Spanish population distribution. The Kruskall-Wallis nonparametric test was used to compare mean values by age bracket, and the chi-squared test and the z-test were used to compare the prevalence rate according to age and sex. The analysis took the complex design of the sample into consideration and was performed using IBM SPSS v. 19.0.

Ethical Considerations

All participants were informed of the study objectives and procedures and gave written consent to participate. The final protocol was approved by the Euskadi Clinical Research Ethics Committee and performed in accordance with the World Medical Association's Declaration of Helsinki for research involving human subjects.[33] The study maintained strict confidentiality of the information provided by all the participants as set forth in Organic Act 15/1999, of December 13, on the protection of personal data in all processes used to record and handle the information obtained. A firm specializing in population studies, SIGMA DOS, is the guarantor and custodian of the information and ensures the absolute confidentiality and secrecy of the data collected.

Table 1

Sample Distribution by Age Bracket, Sex, Educational Level, and Autonomous Community

Characteristics	Total n (%)	Men n (%)	Women n (%)
Age brackets			
25-34 y	809 (20.4)	394 (20.5)	415 (20.3)
35-44 y	1098 (27.7)	525 (27.3)	573 (28.0)
45-54 y	1207 (30.4)	597 (31.1)	610 (29.8)
55-64 y	852 (21.5)	405 (21.1)	447 (21.9)
Total	3966 (100)	1921 (100)	2045 (100)
Educational level			
Less than primary	480 (13.0)	216 (12.1)	264 (13.8)
Primary	1117 (30.2)	568 (31.9)	549 (28.7)
Secondary	1251 (33.8)	619 (34.8)	632 (33.0)
Higher education	848 (22.9)	378 (21.2)	470 (24.5)
Autonomous Community			
Andalusia	256 (6.5)	119 (6.2)	137 (6.7)
Aragon	228 (5.7)	118 (6.1)	110 (5.4)
Principality of Asturias	243 (6.1)	110 (5.7)	133 (6.5)
Balearic Islands	254 (6.4)	127 (6.6)	127 (6.2)
Canary Islands	248 (6.3)	120 (6.2)	128 (6.3)
Cantabria	246 (6.2)	121 (6.3)	125 (6.1)
Castile-La Mancha	214 (5.4)	99 (5.2)	115 (5.6)
Castille and León	214 (5.4)	105 (5.5)	109 (5.3)
Catalonia	240 (6.1)	116 (6.0)	124 (6.1)
Extremadura	223 (5.6)	122 (6.4)	101 (4.9)
Galicia	213 (5.4)	103 (5.4)	110 (5.4)
Community of Madrid	230 (5.8)	108 (5.6)	122 (6.0)
Chartered Community of Navarre	238 (6.0)	115 (6.0)	123 (6.0)
Basque Country	244 (6.2)	108 (5.6)	136 (6.7)
Region of Murcia	233 (5.9)	116 (6.0)	117 (5.7)
La Rioja	221 (5.6)	113 (5.9)	108 (5.3)
Valencian Community	221 (5.6)	101 (5.3)	120 (5.9)

Table 2

Weight, Height, Body Mass Index, Bbody Adiposity Index, Waist and Hip Circumferences, and Waist-to-hip Ratio and Waist-to-height Ratio Indexes in Men and Women According to Age Bracket

Indicators	Age 25 to 34 y		Age 35 to 44 y		Age 45 to 54 y		Age 55 to 64 y	
	n	Mean (95%CI)	n	Mean (95%CI)	n	Mean (95%CI)	n	Mean (95%CI)
Men								
Weight, kg	382	80.3[a] (78.8-81.8)	509	82.6 (81.3-83.9)	579	81.6 (80.5-82.7)	393	82.0 (80.7-83.3)
Height, cm	382	175.7[b] (174.9-176.4)	509	174.7 (174.1-175.3)	579	172.6 (172.0-173.2)	393	169.9 (169.2-170.5)
BMI	382	25.8[b] (25.4-26.3)	509	27.1 (26.8-27.5)	579	27.3 (27.0-27.7)	393	28.4 (27.9-28.8)
BAI, %	382	24.1[b] (23.6-24.6)	509	25.4 (25.0-25.9)	579	26.4 (26.0-26.9)	393	28.5 (28.0-29.0)
Waist circumference, cm	386	88.7[b] (87.4-90.0)	515	93.7 (92.5-94.9)	585	96.1 (95.0-97.1)	397	99.7 (98.5-100.9)
Hip circumference, cm	386	97.8[b] (96.7-98.9)	515	100.5 (99.5-101.6)	585	101.1 (100.2-102.0)	397	103.5 (102.4-104.5)
WHR	386	0.91[b] (0.90-0.92)	515	0.93 (0.93-0.94)	585	0.95 (0.94-0.96)	397	0.97 (0.96-0.97)
WHtR	382	0.51[b] (0.50-0.51)	509	0.54 (0.53-0.54)	579	0.56 (0.55-0.56)	393	0.59 (0.58-0.59)
Women								
Weight, kg	394	63.5[b] (62.1-64.9)	543	67.7 (66.4-69.0)	577	67.5 (66.5-68.6)	424	70.6 (69.4-71.7)
Height, cm	394	162.2[b] (161.5-162.9)	543	162.1 (161.5-162.7)	577	160.8 (160.2-161.3)	424	158.6 (158.0-159.1)
BMI	394	24.5[b] (24.0-25.0)	543	25.5 (25.1-26.0)	577	26.0 (25.6-26.4)	424	28.1 (27.6-28.6)
BAI, %	394	29.3[b] (28.7-29.9)	543	30.4 (29.8-31.0)	577	31.5 (31.0-32.1)	424	34.6 (34.0-35.3)
Waist circumference, cm	398	79.9[b] (78.6-81.3)	549	84.4 (83.2-85.7)	584	86.3 (85.2-87.4)	428	91.8 (90.4-93.2)
Hip circumference, cm	398	97.9[b] (96.7-99.1)	549	100.1 (99.0-101.1)	584	101.0 (100.1-102.0)	428	104.9 (103.8-106.1)
WHR	398	0.82[b] (0.81-0.82)	549	0.84 (0.84-0.85)	584	0.85 (0.85-0.86)	428	0.87 (0.87-0.88)
WHtR	394	0.49[b] (0.48-0.50)	543	0.52 (0.51-0.53)	577	0.54 (0.53-0.54)	424	0.58 (0.57-0.59)

95%CI, 95% confidence interval; BAI, body adiposity index; BMI, body mass index; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio.
[a] Kruskall-Wallis nonparametric test, $P < .05$.
[b] $P < .001$.

RESULTS

Table 1 describes the study group by sex, age, educational level, and autonomous community. Valid anthropometric data were available for 3801 participants (1863 men and 1938 women), which accounted for 95.8% of the participating sample (96.9% of men and 94.7% of women). Weight was significantly higher in men aged 25 to 34 years and the following age bracket of 35 to 44 years, whereas among women, it increased significantly as they grew older. Height gradually dropped with age in both men and women (Table 2). The mean BMI for the Spanish adult population was 26.7 (BMI = 27.2 in men and BMI = 26.1 in women) and increased significantly with age, similar to body adiposity index, which showed lower mean values than BMI in men, but higher mean values than BMI in women in all age brackets. Waist and hip circumferences showed mean values that were significantly higher with age in both men and women, as seen with WHR and WHtR (Figure 1).

The prevalence of overweight (BMI, 25.0-29.9) estimated in the Spanish adult population aged 25 to 64 years was 39.3% (95%CI, 35.7%-42.9%), and was higher in men (46.5%; 95%CI, 43.9%-49.1%) than in women (32.1%; 95%CI, 29.9%-34.3%). The overall prevalence of obesity (BMI ≥ 30) was estimated at 21.6% (95%CI, 19.0%-24.2%), and was also higher in men (22.8%; 95%CI, 20.6%-25.0%) than in women (20.5%; 95%CI, 18.5%-22.5%) (Table 3). Both overweight and obesity were significantly higher with age in men and women, and in all age brackets analyzed, both rates were significantly higher in men than in women. The global prevalence of overweight was 60.9% (95%CI, 57.3%-64.5%) among the Spanish adult population aged 25 to 64 years, 69.3% (95%CI, 66.7%-71.9%) among men, and 52.6% (95%CI, 50.4%-54.8%) among women. The prevalence of BMI values ≥ 35 was estimated at 5.2% (95%CI, 3.9%-6.5%) and 6.9% (95%CI, 4.8%-9.0%) in the age bracket of 55 to 64 years.

When considering the age-adjusted prevalence rates, the highest obesity rate was estimated to be in the Principality of Asturias (25.7%; 95%CI, 20.1%-31.8%) and in Galicia (24.9%; 95%CI, 18.7%-30.6%), followed by Andalusia (24.4%; 95%CI, 18.7%-30.0%), whereas the lowest rates were observed in the Balearic Islands (10.5%; 95%CI, 6.9%-14.2%), Catalonia (15.5%; 95%CI, 10.4%-20.4%), and the Basque Country (16.8%; 95%CI, 12.9%-21.6%) (Figure 2).

The prevalence of AO, defined using the cutoff points proposed by the WHO for WC (men, > 102 cm; women, > 88 cm), was estimated to be 33.4% (95%CI, 31.1%-35.7%) and was higher in women (43.3%; 95%CI, 41.1%-45.8%) than in men (23.3%; 95%CI, 20.9%-25.5%). These figures were much higher when the criterion used was WHR (men, > 0.9; women, > 0.85), being 64.5% (95%CI, 62.4%-66.6%). Figures were also higher when using the strict cutoff point of WHtR > 0.5, namely 69.7% (95%CI, 67.6%-71.8%). When the cut-off point was WHtR > 0.55, however, the estimate was 44.4% (95%CI, 42.1%-46.5%) (Table 4).

A total of 49.5% of persons classified with AO based on WC had BMI ≥ 30, and 40.5% had values consistent with overweight (25.0 and 29.9). This distribution pattern was similar to that observed when AO was defined as WHtR > 0.55: 43.2% with BMI ≥ 30 and 46.6% with BMI 25.0 to 29.9. However, when the criterion used to define AO was WHR, 28.1% of persons classified with AO had BMI ≥ 30, 44.4% had BMI 25.0 to 29.9, and 27.5% had BMI < 25 (Table 5).

DISCUSSION

The ENPE study estimated prevalences of overweight of 39.3% and general obesity of 21.6% in the Spanish adult population aged 25 to 64 years. These data are consistent with the estimates obtained in the ENRICA study for 2008-2010,[20] a study which estimated a prevalence of 22.9% for obesity in the Spanish population older than 18 years. In contrast, a significant rise in overweight was observed in the Spanish adult population compared with the data reported by the DORICA study in 2003,[19] which estimated prevalences of obesity of 15.5% and
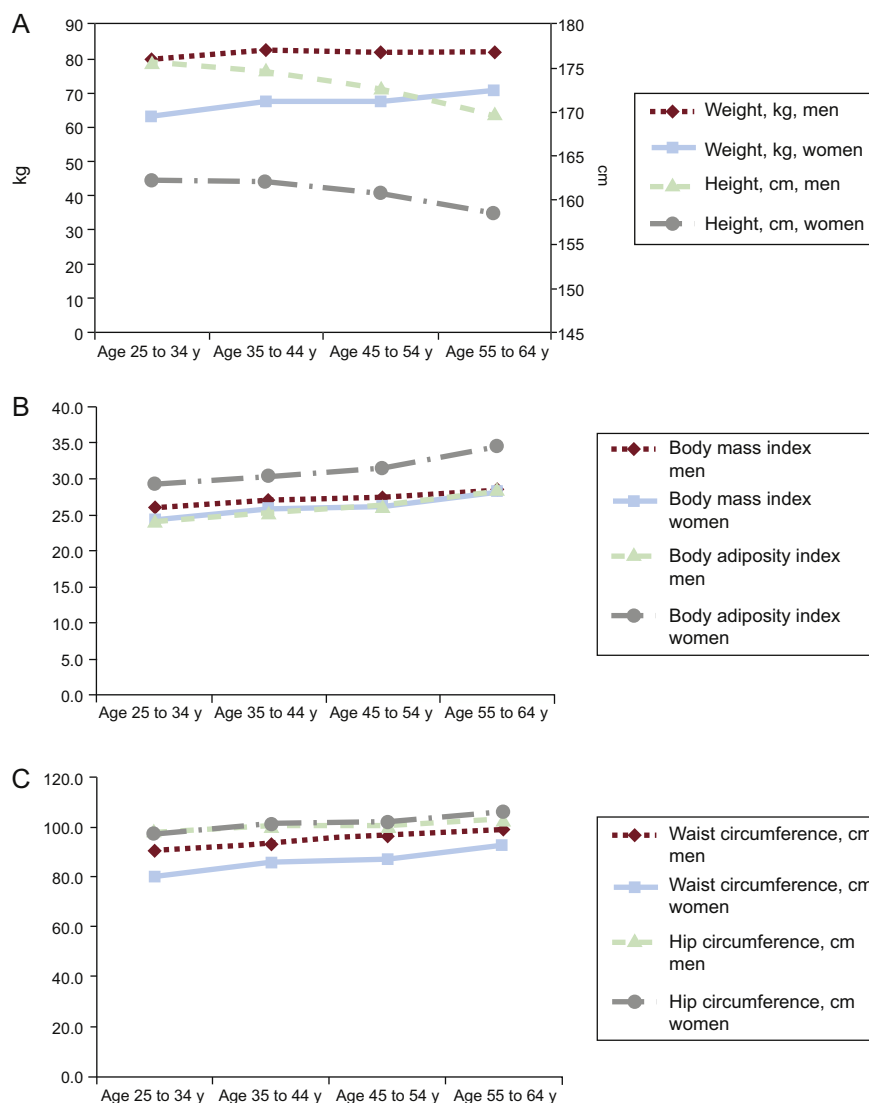
Figure 1. Trend with age in mean height and weight (A), body mass index and body adiposity index (B), and waist and hip circumferences (C) of men and women.

overweight (BMI, 25.0-29.9) of 39.2% in the population aged 25 to 64 years.

Like the ENRICA and the ENPE studies, the DORICA study observed an upward trend in overweight and obesity rates with age. However, the ENPE study estimated significantly higher obesity rates in men than women, whereas the opposite trend was seen in the DORICA study, revealing a change in the distribution pattern. The ENRICA study also observed higher rates in men than in women in all age brackets except women older than 65 years, a bracket not included in this ENPE study analysis. The latest Health Survey (ENSA) data[34] also indicate this trend, although the ENSA study estimated the prevalence of overweight and obesity from self-reported data rather than individual height and weight measurements. Likewise, the last decade has seen an increase in obesity among men in other countries, such as Finland[14] and Portugal.[35]

The prevalence of obesity in the adult population in Spain is lower than the rates estimated for the United States, a country where the prevalence of obesity (BMI ≥ 30) in the population older than 20 years (2011-2012)[36] is 35.1%, although the authors of this analysis point out that these rates are now steady, with no

significant changes between 2003-2004 and 2011-2012 in that country.

The highest prevalence rates of obesity in adult populations are estimated to be found in countries located in the Middle East and the Persian Gulf.[37,38] In countries such as Saudi Arabia, the prevalence of obesity is 50.4% among women aged 25 to 64 years (2005) and 31.5% among men. In Mexico,[39] the prevalence of obesity is estimated at 37.5% (2012) among women aged 20 years or older and 26.5% among men, whereas in New Zealand (2013-2014),[37] it is estimated at 30.2% of women and 29.6% of men. In Europe, 2013 data for the United Kingdom[37,40] indicate a prevalence of obesity among women aged 16 years or older at 28.3% (26% among men) and 2008-2011 data for Germany[41] indicate 23.9% among women and 23.2% among men aged 18 to 79 years.

The DORICA study[19] observed a trend toward higher obesity prevalence levels toward the south, with the highest estimates seen in the Canary Islands, Andalusia and the Region of Murcia, and the lowest in Catalonia and the Basque Country. Studies in other population groups, such as the enKid study,[42] conducted in a population aged 2 to 24 years, have seen a similar distribution

Table 3

Weight Classification of the Spanish Population Aged 25 to 64 Years (2014-2015) According to Age Bracket and Sex

	All		25-34 y		35-44 y		45-54 y		55-64 y	
	n	Prevalence (95%CI)	n	Prevalence (95%CI)	n	Prevalence (95%CI)	n	Prevalence (95%CI)	n	Prevalence (95%CI)
Total										
Underweight (BMI < 18.5)	50	1.2 (0.5-1.9)	20	2.8 (1.5-4.19)	15	1.3 (0.4-2.2)	11	0.8 (0.1-1.5)	4	0.2 (0.1-0.3)
Normal weight (BMI 18.5-24.9)	1502	37.8 (34.0-41.6)	402	51.0 (47.2-54.8)	462	42.3 (38.9-45.7)	435	35.7 (32.6-38.8)	203	23.1 (19.9-26.3)
Overweight I (BMI 25.0-26.9)	668	18.1 (15.2-21.0)	133	19.8 (16.9-22.7)	186	17.2 (14.7-19.7)	208	18.8 (16.4-21.2)	141	16.9 (14.1-19.7)
Overweight II (BMI 27.0-29.9)	787	21.2 (18.5-23.9)	134	14.3 (11.6-17.0)	195	19.7 (16.9-22.5)	270	23.4 (20.6-26.2)	188	26.3 (23.0-29.6)
Overweight (BMI 25.0-29.9)	1455	39.3 (35.7-42.9)	267	34.1 (30.5-37.7)	381	36.9 (33.6-40.2)	478	42.2 (39.1-45.3)	329	43.2 (39.4-47.0)[*]
Obesity I (BMI 3.0-34.9)	594	16.5 (14.4-18.6)	62	7.4 (5.3-9.5)	152	13.8 (11.2-16.4)	190	17.6 (15.1-20.1)	190	26.6 (23.3-29.9)
Obesity II (BMI 35.0-39.9)	149	3.6 (2.3-4.9)	20	3.2 (1.9-4.5)	36	3.6 (2.3-4.9)	37	2.9 (1.7-4.1)	56	4.9 (2.8-7.0)
Obesity III (BMI 40.0-49.9)	43	1.4 (0.4-2.4)	10	1.5 (0.5-2.5)	14	1.9 (1.1-2.7)	5	0.5 (0.0-1.0)	14	1.6 (0.6-2.6)
Obesity IV (BMI ≥ 50)	8	0.2 (0.0-0.4)	1	0.1 (0.0-0.2)	2	0.2 (0.0-0.5)	2	0.3 (0.0-0.6)	3	0.4 (0.1-0.7)
Obesity (BMI ≥ 30)	794	21.6 (19.0-24.2)	93	12.2 (9.6-14.8)	204	19.5 (16.7-22.3)	234	21.4 (18.7-24.1)	263	33.4 (29.7-37.1)[*]
Men										
Underweight (BMI < 18.5)	14	0.5 (0.1-1.0)	4	0.3 (0.0-0.67)	3	0.8 (0.0-1.6)	6	0.7 (0.1-1.3)	1	0
Normal weight (BMI 18.5-24.9)	594	30.2 (27.8-32.6)	176	42.3 (36.5-48.1)	167	32.3 (27.6-36.8)	167	27.2 (23.0-31.4)	84	20.1 (15.5-24.7)
Overweight I (BMI 25.0-26.9)	371	21.5 (19.5-23.5)	77	24.7 (19.9-29.5)	106	21.0 (17.0-25.0)	113	20.2 (16.6-23.8)	75	21.4 (17.2-25.6)
Overweight II (BMI 27.0-29.9)	451	25.0 (22.8-27.2)	80	20.1 (15.8-24.4)	125	26.0 (21.8-30.2)	153	28.2 (24.0-32.4)	93	23.6 (18.6-28.6)
Overweight (BMI 25.0-29.9)	822	46.5 (43.9-49.1)	157	44.4 (38.8-50.0)	231	46.8 (41.8-51.8)	266	48.4 (43.8-53.0)	168	44.9 (39.1-50.7)
Obesity I (BMI 30.0-34.9)	324	17.9 (15.8-20.0)	34	8.7 (5.3-12.1)	83	14.5 (10.5-18.5)	110	20.2 (16.2-24.2)	97	27.6 (22.4-32.8)
Obesity II (BMI 35.0-39.9)	77	3.7 (2.6-4.8)	6	2.2 (0.6-3.8)	22	4.4 (2.2-6.6)	21	2.5 (1.3-3.7)	28	6.2 (3.8-8.6)
Obesity III (BMI 40.0-49.9)	16	0.9 (0.4-1.4)	5	1.6 (0.2-3.0)	5	1.0 (0.2-1.8)	3	0.7 (0.1-1.3)	3	0.5 (0.1-0.9)
Obesity IV (BMI ≥ 50)	3	0.3 (0.1-0.5)	1	0.3 (0.1-0.5)	0	0	1	0.4 (0.2-0.6)	1	0.5 (0.1-0.9)
Obesity (BMI ≥ 30)	420	22.8 (20.6-25.0)	46	12.7 (8.9-16.5)	110	20.0 (15.6-24.4)	135	23.7 (19.5-27.9)	129	35.0 (29.2-40.8)[*]
Women										
Underweight (BMI < 18.5)	36	2.0 (1.3-2.7)	16	5.2 (2.8-7.6)	12	1.7 (0.3-3.1)	5	1.0 (0.2-1.8)	3	0.5 (0.0-1.1)
Normal weight (BMI 18.5-24.9)	902	45.4 (43.0-47.8)	226	59.2 (53.8-64.6)	295	53.0 (48.2-57.8)	268	44.8 (40.2-49.4)	119	25.7 (20.9-30.5)
Overweight I (BMI 25.0-26.9)	297	14.7 (13.0-16.4)	56	15.2 (11.6-18.8)	80	13.2 (10.0-16.4)	95	17.2 (14.0-20.4)	66	13.1 (9.3-16.9)
Overweight II (BMI 27.0-29.9)	336	17.4 (15.5-19.3)	54	9.0 (5.6-12.4)	70	13.2 (10.0-16.4)	117	18.2 (14.8-21.6)	95	28.6 (24.2-33.0)
Overweight (BMI 25.0-29.9)	633	32.1 (29.9-34.3)	110	24.3 (19.5-29.1)	150	26.3 (22.1-30.5)	212	35.4 (31.2-39.6)	161	41.6 (36.6-46.6)[*]
Obesity I (BMI 30.0-34.9)	270	15.1 (13.3-16.9)	28	5.9 (3.1-8.7)	69	13.2 (9.8-16.6)	80	14.8 (11.6-18.0)	93	25.7 (21.3-30.1)
Obesity II (BMI 35.0-39.9)	72	3.4 (2.5-4.3)	14	4.1 (1.9-6.3)	14	2.7 (1.1-4.3)	16	3.4 (1.8-5.0)	28	3.6 (0.8-6.4)
Obesity III (BMI 40.0-49.9)	27	1.8 (1.2-2.4)	5	1.3 (0.1-2.5)	9	2.7 (1.5-3.9)	2	0.4 (0.0-0.8)	11	2.7 (1.1-4.3)
Obesity IV (BMI ≥ 50)	5	0.24 (0.10-0.50)	0	0	2	0.40 (0.10-0.70)	1	0.20 (0.00-0.04)	2	0.20 (0.00-0.40)
Obesity (BMI ≥ 30)	374	20.5 (18.5-22.5)	44	11.4 (7.8-15.0)	94	19.0 (15.2-22.8)	98	18.8 (15.2-22.4)	143	32.1 (26.9-37.3)[*]

95%CI, 95% confidence interval; BMI, body mass index.

[*] Chi-square, P < .001.

pattern in overweight. In the ENPE study, the highest figures were estimated in the Principality of Asturias and in Galicia, followed by Andalusia and the Region of Murcia, whereas the prevalence in the Canary Islands appears to have stabilized at 20.1%. This geographic distribution pattern is similar to that described in the ENRICA study[20] and to those of other recent studies conducted in school children, such as PERSEO,[43] ALADINO,[44] and a study performed by Sánchez-Cruz et al.[45]

The prevalence of AO in the adult population in Spain is high, rises with age, and is higher in women than in men. Different indicators and distinct cutoff points have been proposed to define AO, depending on the result of the disease investigated: DM, cardiovascular disease, or others. The ENRICA study[20] used WC (cutoff points > 102 cm in men and > 88 cm in women) to estimate the prevalence of AO at 35.5%, although it was as high as 43% among persons aged 45 to 64 years and 61.6% among persons aged ≥ 65 years. As in the ENPE study, AO was higher among women than men. The prevalence of AO in adults aged ≥ 20 years was estimated using the same criteria at 54.2% in the United States (2011-2012)[46] and 38% in United Kingdom (2009).[47]

The ROC (receiver operating characteristic) curve-based sensitivity and specificity analysis performed in the DORICA study[48] estimated that the risk of the presence of cardiovascular risk factors for WC values of 80 cm in women and 88 cm in men was comparable to the risk with BMI = 25, and for WC values of 88 cm in women and 98 cm in men, similar to BMI = 30.

Strengths and Limitations

The strengths of the ENPE study include its performance in a representative random sample of the Spanish population, ensuring 400 interviews in each autonomous community and obtaining a sampling error of 4.89%. The procedure to recruit the sample allowed us to achieve the desired sample size, which ensures randomization, as fixed quotas were established in proportion to the distribution of the Spanish population. The estimates were
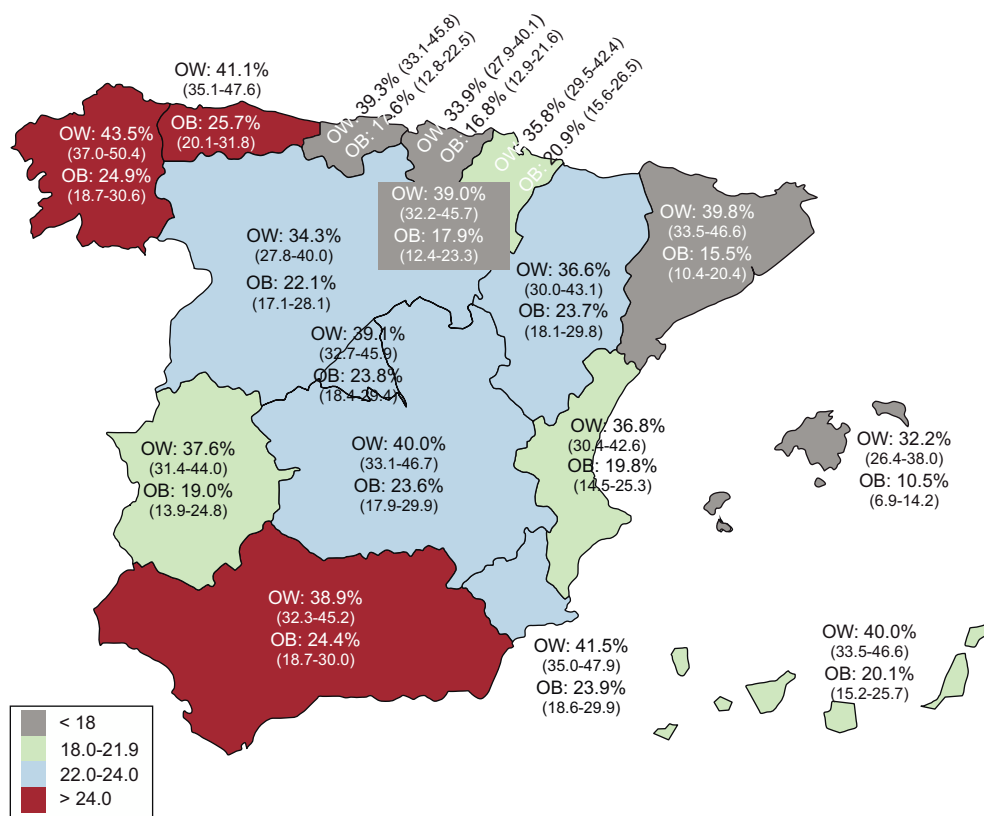
Figure 2. Map of obesity prevalence in the adult population (aged 25-64 years) in Spain. Age-adjusted rates. 95% confidence interval between parentheses. OB, obesity; OW, overweight.

Table 4

Prevalence of Abdominal Obesity Defined According to Different Criteria by Age Bracket and Sex. Spanish Population Aged 25 to 64 Years (2014-2015)

	Total		25-34 y		35-44 y		45-54 y		55-64 y	
	n (%)	95%CI	n (%)	95%CI	n (%)	95%CI	n (%)	95%CI	n (%)	95%CI
Total										
Abdominal obesity Waist (M > 102 cm; W > 88 cm)	1290 (33.4)	31.1-35.7	147 (18.6)	15.5-21.6	321 (29.5)	26.4-32.7	424 (35.9)	32.4-39.1	398 (48.1)	44.1-51.7
Abdominal obesity by WHR (M > 0.90; W > 0.85)	2334 (64.5)	62.4-66.6	351 (49.7)	45.8-53.9	619 (62.8)	59.4-66.2	757 (69.2)	66.1-72.1	577 (74.2)	71.1-77.5
Abdominal obesity by WHtR ($\geq$ 0.55)	1725 (44.4)	42.1-46.5	177 (23.6)	20.5-27.1	383 (36.0)	32.7-39.3	548 (49.4)	46.2-52.7	527 (66.8)	63.5-69.8
Abdominal obesity by WHtR ($\geq$ 0.50)	2245 (69.7)	67.6-71.8	300 (47.7)	43.9-51.6	548 (62.0)	58.7-65.3	713 (75.6)	72.6-78.4	623 (90.3)	87.9-92.7
Men										
Abdominal obesity Waist (M > 102 cm)	459 (23.3)	20.9-25.5	44 (11.5)	8.0-15.5	117 (20.8)	16.4-25.3	165 (27.5)	23.0-32.5	133 (31.7)	25.7-37.1
Abdominal obesity by WHR (M > 0.90)	1314 (75.9)	73.7-78.1	210 (59.6)	53.9-65.0	357 (74.0)	69.7-78.4	439 (83.0)	79.2-86.7	308 (84.6)	80.7-88.3
Abdominal obesity by WHtR ($\geq$ 0.55)	838 (45.6)	43.2-48.1	84 (22.6)	17.3-27.9	194 (35.9)	31.1-40.8	299 (54.5)	50.1-59.2	261 (67.6)	63.2-71.9
Abdominal obesity by WHtR ($\geq$ 0.50)	1143 (76.4)	74.1-78.5	163 (56.4)	50.7-61.9	285 (66.2)	61.5-70.7	389 (85.5)	81.6-89.3	306 (94.5)	91.5-97.3
Women										
Abdominal obesity Waist (W > 88 cm)	831 (43.3)	41.1-45.8	103 (25.5)	21.1-30.1	204 (38.6)	34.3-43.3	259 (45.0)	40.5-49.5	265 (62.0)	57.1-67.2
Abdominal obesity by WHR (W > 0.85)	990 (53.5)	51.2-56.0	141 (40.1)	35.2-45.2	262 (51.1)	46.6-55.8	318 (54.8)	50.2-59.2	269 (66.4)	61.5-71.3
Abdominal obesity by WHtR ($\geq$ 0.55)	797 (43.3)	41.0-45.9	93 (24.5)	19.8-29.0	189 (36.1)	31.7-40.4	249 (43.8)	39.4-48.2	266 (66.0)	61.2-71.1
Abdominal obesity by WHtR ($\geq$ 0.50)	1041 (63.6)	61.1-65.6	137 (40.2)	34.9-45.2	263 (58.0)	53.4-62.7	324 (65.2)	60.9-69.4	317 (87.1)	82.9-91.1

95%CI, 95% confidence interval; M, men; W, women; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio.

Table 5

Frequency of Abdominal Obesity, Defined by Different Criteria, in Men and Women According to Weight Type Category

Criteria for abdominal obesity	Abdominal obesity		
	Men	Women	Total
	n (%)	n (%)	n (%)
Waist abdominal obesity (M > 102 cm; W > 88 cm)			
Normal weight (BMI 18.5-24.9)	15 (3.5)	92 (12.7)	123 (10.0)
Overweight (BMI 25.0-29.9)	145 (33.4)	319 (43.9)	499 (40.5)
Obesity (BMI ≥ 30)	274 (63.1)	315 (43.3)	608 (49.5)
Abdominal obesity by WHR (M > 0.90; W > 0.85)			
Normal weight (BMI 18.5-24.9)	323 (25.6)	322 (34.3)	645 (27.5)
Overweight (BMI 25.0-29.9)	589 (46.7)	354 (37.7)	943 (44.4)
Obesity (BMI ≥ 30)	349 (27.7)	262 (27.9)	611 (28.1)
Abdominal obesity by WHtR ≥ 0.55			
Normal weight (BMI 18.5-24.9)	67 (8.2)	86 (11.1)	153 (10.3)
Overweight (BMI 25.0-9.9)	386 (47.3)	349 (45.0)	735 (46.6)
Obesity (BMI ≥ 30)	363 (44.5)	340 (43.9)	703 (43.2)
Abdominal obesity by WHtR ≥ 0.50			
Normal weight (BMI 18.5-24.9)	196 (17.7)	209 (20.7)	405 (18.2)
Overweight (BMI 25.0-29.9)	534 (48.2)	456 (45.1)	990 (48.0)
Obesity (BMI ≥ 30)	377 (34.1)	347 (34.3)	724 (33.8)

BMI, body mass index; M, men; W, women; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio.

computed by weighting the sample, and all rates were age-adjusted using the direct method to calculate prevalence by autonomous community. All data were collected by individual measurements of weight, height, and circumferences. In addition, considerable care was taken with the study protocol, with measurement equipment selection and calibration, and with interviewer training, while also establishing quality controls throughout the entire process.

One of the limitations is the cross-sectional design, which allowed prevalence to be estimated as reported in this article, but did not establish causality relationships with other factors.

CONCLUSIONS

The prevalence of general obesity and AO in Spain is high, although its distribution is uneven among the various autonomous communities. A comparison with earlier data reveals a large increase in overweight, which appears to have stabilized, according to recent estimates. This indicates a need for better routine monitoring, especially in high-risk groups, as well as a need to implement general preventive strategies targeting the entire population, and specific health care actions for affected individuals.

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WHAT IS KNOWN ABOUT THE TOPIC?

- According to the 2013 analysis of the Institute of Health Metrics, a high BMI is the first risk factor for disease in Spain.
- There is evidence that WC and WHR are better predictors than BMI of the risk of DM and cardiovascular disease, even independently of BMI.
- The WHO's Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020 has set a target to halt the rise in obesity.

WHAT DOES THIS STUDY ADD?

- This article describes the prevalence of total obesity and AO in a representative sample of the Spanish population aged 25 to 64 years in 2014-2015 and analyzes the distribution of different indicators of body adiposity.
- The results indicate that the prevalence of general obesity and AO in Spain is high, but the distribution is uneven among the various autonomous communities.
- These results reveal a large increase in overweight compared with earlier data for the same age bracket (DORICA, 2003), which appears to have stabilized according to more recent estimates (ENRICA, 2008-2010).

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