

Prevalence and determinants of obesity in Spanish children and young people

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Prevalence estimates of obesity in a national random sample of Spanish children and young people are presented in this paper, defined by age- and sex-specific BMI national reference standards for the 85th percentile (overweight) and 97th percentile (obesity), as well as by Cole *et al.* criteria. A random sample of 3534 people, aged 2–24 years, was interviewed between 1998 and 2000. The study protocol included personal data, data on education and socioeconomic status (SES) for the family, dietary assessment, anthropometric measurements and physical activity. The prevalence of obesity was 13.9% (95% CI 12.7, 15.1) considering Spanish reference standards as cut-offs. Obesity was significantly higher in boys (15.6%) than in girls (12%). The highest values were observed between 6 and 13 years of age. Using Cole's cut-offs, the estimated prevalence of obesity was 6.3% (95% CI 5.4, 7.5) with a similar pattern to that previously described by sex. Regarding sociodemographic factors, sex, age group, region, size of locality of residence, mother's level of education and family SES level were significant predictors for obesity in children and adolescents under 14 years. Among young people, the main sociodemographic predictors for obesity were geographical region and family SES level. Odds ratio for obesity was 1.27 for those with a more frequent consumption of buns, cakes and snacks, and 1.71 for those with more frequent consumption of sugared drinks. Adequate consumption of fruit and vegetables, usually having breakfast and regular sports practice had a protective effect. The available data show that obesity in Spain is a public health issue given its magnitude and increasing trends. Among Spanish children and young people, those at prepubertal age, particularly boys, can be identified as a group at higher risk for overweight and obesity, particularly children from lower SES families.

Children: Adolescents: Obesity: Overweight: Prevalence: Determinants: Population study

Obesity has been recognized as a public health problem in developed countries. In particular, obesity in childhood and adolescents is a major concern. Physical and psychosocial problems are among the short-term adverse effects and associated risks from obesity in the early stages of life (World Health Organization, 2000). Longitudinal studies suggest that obesity after 3 years of age is associated in the long term with a greater risk of obesity in adults, increased morbidity and mortality, persistence of associated metabolic disorders, as well as increased risk for CVD and some types of cancer (Powers *et al.* 1997; Freedman *et al.* 1999; World Health Organization, 2000).

Considering the limitations in the available data, it seems more likely that obese children will be obese adults in comparison with normal weight children, although paradoxically most obese adults at the present time were not obese children. Obesity in the second decade of life is a predictive factor for adult obesity (Vanhalo *et al.* 1998; Guo & Chumlea, 1999; Wabitsch, 2000).

Changes in environmental factors, such as dietary habits and a sedentary life-style, and their interaction on genetic susceptibility have been described as causes for the rise in the

prevalence of obesity over the last decades (Maffeis *et al.* 1998; Maffeis, 2000). School years and adolescence are crucial stages for the development of healthy eating habits and other life-styles that persist in later life (Birch & Fisher, 1998).

In the 1980s, the PAIDOS'85 study estimated the prevalence of obesity on a national random sample of Spanish children (Bueno, 1985). Since then, several studies in Spain have contributed estimates on local and regional samples or limited age groups based on measured body weight and height. The Cuenca study estimated the prevalence of obesity among 307 children aged 9–12 years in this Spanish city in 1992 who were followed-up for 6 years (Martínez Vizcaíno *et al.* 2002). Other authors have reported data on local and regional samples of school-aged children and convenience samples of adolescents from several cities in the country (Rios *et al.* 1999; Moreno *et al.* 2000; Garces *et al.* 2005).

In the present paper, the prevalence of obesity and determinant factors are described on a Spanish national sample of children and young people aged 2–24 years, the enKid Study, based on measured body weight and height.

Population and methods

The enKid Study is a cross-sectional study carried out on a national random sample of the Spanish population aged 2–24 years. Sampling procedures and response rates have been described elsewhere (Serra-Majem & Aranceta Bartrina, 2000; Serra-Majem *et al.* 2003). The study protocol considered date of birth, sex, level of education of the mother and father, socioeconomic status (SES) data for the family, birth weight and infant feeding practices. Dietary intake was assessed by means of a 24 h recall and a quantitative food frequency questionnaire. In 25% of the sample a second 24 h recall was collected. In order to avoid seasonal and weekly variations, dietary recalls were scattered throughout the year, including all days of the week. Information was collected during a personal interview at the home of the interviewee, in the presence of the mother or person responsible for the family diet in children under 13 years of age.

Specific questionnaires were designed to collect data on smoking habits and alcohol use. Physical activity was assessed by means of a detailed frequency questionnaire, including weekdays and weekends. Usual physical activity in school, method of going to and from school, sport club activities as well as leisure-time physical activity and sports practice were considered in the questionnaire.

Anthropometric measurements

The following measurements were assessed: body weight, height, BMI (weight/height²), waist and hip circumference, waist: hip ratio and diameter of the elbow. The measurements were taken in underwear, no socks, at the home of the interviewee using electrical scales to the nearest 100 g. Height was measured using a Kawe stadiometer to the nearest 1 mm. Circumferences were measured with inextensible metric tapes

according to standardized protocol (Lohman *et al.* 1988) to the nearest 1 mm.

Overweight and obesity were defined using as criteria the value of BMI-specific percentiles for age and sex in the reference population (Hernández *et al.* 1988). Cut-off for overweight was 85th percentile and for obesity the 97th percentile (Rolland-Cachera *et al.* 2001). Overweight and obesity were also defined according to the criteria suggested by Cole *et al.* (2000), recommended by the International Obesity Task Force.

Fieldwork was carried out by 43 dietitian experts who followed a training period and standardization of criteria before beginning the work (1998–2000).

The association between obesity and determinant factors considered was analysed through multiple binomial logistic regression, following a step-wise method. Different models were fitted for children under 14 years and young people. Adjusted odds ratios (OR) and 95% CI are presented for both age groups. The data were analysed using SPSS (version 12.0; SPSS Inc., Chicago, IL, USA).

Results

Table 1 shows prevalence and 95% CI estimates by age group and sex using Spanish reference standards and Cole *et al.* cut-offs. The prevalence of obesity for this age group in Spain was estimated at 13.9% (95% CI 12.7, 15.1) and 12.4% for overweight, considering Spanish reference standards as cut-offs. Altogether, overweight and obesity involve 26.3% (95% CI 24.8, 27.8) of the sample. Obesity was significantly higher in boys (15.6%) than in girls (12%). The highest values were observed between 6 and 13 years of age. Using Cole's cut-offs, the estimated prevalence of obesity was 6.3% (95% CI 5.4, 7.5) with a similar pattern to that previously

Table 1. Prevalence of obesity in Spanish children and young population (2–24 years) by age group and sex (the enKid Study) according to the Spanish reference standards (85th and 97th percentiles)* and using the criteria suggested by Cole *et al.*†

Age group	Sex	n	Spanish reference standards*		Cole <i>et al.</i> definition†	
			Obesity (BMI ≥ 97th percentile) % (95% CI)	Total overweight (BMI ≥ 85th percentile) % (95% CI)	Obesity % (95% CI)	Total overweight % (95% CI)
2–5 years	Total	385	11.1 (7.9, 14.3)	21.0 (16.8, 25.2)	10.4 (7.8, 13.8)	27.0 (22.0, 32.6)
	Boys	195	10.8 (6.4, 15.2)	20.1 (14.4, 25.8)	8.3 (5.9, 11.5)	21.9 (16.0, 29.2)
	Girls	190	11.5 (6.8, 16.2)	21.9 (15.8, 28.0)	12.7 (8.1, 19.4)	32.6 (24.9, 41.3)
6–9 years	Total	423	15.9 (12.4, 19.4)	30.4 (26.0, 34.8)	10.4 (7.3, 14.7)	35.2 (29.9, 40.8)
	Boys	211	21.7 (16.1, 27.3)	37.7 (31.1, 44.3)	12.1 (7.3, 19.4)	37.9 (31.2, 45.0)
	Girls	212	9.8 (5.8, 13.8)	22.9 (17.2, 28.6)	8.6 (5.1, 14.1)	32.4 (24.7, 41.1)
10–13 years	Total	567	16.6 (13.5, 19.7)	31.2 (27.3, 35.1)	4.7 (3.5, 6.2)	27.1 (24.1, 30.3)
	Boys	281	21.9 (17.0, 26.8)	41.9 (36.1, 47.7)	6.6 (5.1, 8.5)	32.8 (29.1, 36.7)
	Girls	286	10.9 (7.2, 14.6)	20.0 (15.3, 24.7)	2.6 (1.7, 3.9)	21.0 (18.1, 24.3)
14–17 years	Total	682	12.5 (10.0, 15.0)	21.8 (18.7, 24.9)	6.5 (4.9, 9.0)	21.9 (18.5, 25.9)
	Boys	337	15.8 (11.9, 19.7)	26.2 (21.5, 30.9)	10.0 (6.8, 14.4)	30.7 (26.2, 35.6)
	Girls	345	9.1 (6.0, 12.2)	17.1 (13.1, 21.1)	2.8 (1.9, 4.2)	12.7 (9.3, 17.2)
18–24 years	Total	1477	13.7 (11.9, 15.5)	26.9 (24.6, 29.2)	4.0 (2.3, 5.5)	19.9 (16.8, 23.3)
	Boys	605	12.6 (9.9, 15.3)	27.5 (23.9, 31.1)	5.9 (4.2, 8.4)	27.4 (23.7, 31.4)
	Girls	872	14.9 (12.5, 17.3)	26.2 (23.3, 29.1)	2.0 (1.5, 2.8)	11.9 (9.9, 14.2)
Total	Total	3534	13.9 (12.7, 15.1)	26.3 (24.8, 27.8)	6.3 (5.4, 7.5)	24.4 (22.3, 26.6)
	Boys	1629	15.6 (13.8, 17.4)	29.9 (27.7, 32.1)	7.9 (6.6, 9.6)	29.5 (27.1, 31.9)
	Girls	1905	12.0 (10.5, 13.5)	22.5 (20.6, 24.4)	4.6 (3.4, 6.2)	19.0 (16.2, 22.2)

*Hernández *et al.* (1988).

†Cole *et al.* (2000).

described by sex (7.9% boys; 4.6% girls) and age groups. Overweight and obesity according to Cole's criteria affected 24.4% of the sample (95% CI 22.3, 26.6).

Table 2 shows predictors of obesity in Spanish children and adolescents in the enKid Study. Regarding sociodemographic factors, sex, age group, region, size of locality of residence, mother's level of education and family SES level were significant predictors for obesity in children and adolescents under 14 years. Prevalence OR for obesity was 1.95 (95% CI 1.14, 2.46) in boys in relation to girls. OR was 1.47 (95% CI 1.14, 1.88) for the age group 6–9 years in relation to the younger ones. The highest prevalence of obesity and overweight was observed in the Canary Islands (OR = 2.69) and southern regions (OR = 1.78), in both sexes. Among children and adolescents under 14 years, the prevalence of obesity was higher in those living in towns and cities compared with children living in rural areas (OR = 1.19).

The prevalence of obesity was higher in boys whose parents had low education, especially if the mother had a low cultural level. OR for prevalence of obesity was 1.25 (95% CI 1.03, 1.67). Occupation of the mother did not enter in the model. The prevalence of obesity was higher in boys and girls from low-SES families (OR = 1.27) compared with higher SES.

Among young people, the main sociodemographic predictors for obesity were geographical region, with an OR of 1.15 (95% CI 0.83, 1.47) for the Canary Islands in relation to the central region of the country, and family SES level. OR for obesity in girls was 0.98 (95% CI 0.79, 1.99) in relation to boys in this age group.

For children under 6 years, weight at birth and breastfeeding practices also entered into the model. Prevalence of obesity was significantly higher among children who recorded birth weights over 3500g in comparison with those who recorded a birth weight below 2500g. Children who were breastfed for 3 months or more showed a lower prevalence of obesity than those who were not breastfed.

At a second step, life-styles regarding dietary practices and physical activity were included as predictors in the model, adjusted for age, sex, geographical region, mother's educational level and family SES level. Regular breakfast consumption, inadequate consumption of buns, cakes, snacks and sugared drinks and consumption of fruit and vegetables were entered into the model, as well as time spent on sedentary activities such as television watching, computer use or video games, and frequency of practising sport.

Likelihood of being obese was higher among those with more frequent usual consumption of buns, cakes, snacks (OR = 1.27) and sugared drinks (OR=1.71; 95% CI 1.26, 2.54). Adequate consumption of fruit and vegetables had a protective effect. For those who usually had less than two portions of fruit and vegetables OR was 2.12 (95% CI 1.60, 3.02) compared with those having five or more. Having breakfast usually had a protective effect as well (OR = 0.73).

OR for the prevalence of obesity was 1.68 (95% CI 1.18, 2.88) for boys and girls who spent more than 2h daily watching television in comparison with those who spent less time. Regular sports practice had a protective effect (OR = 0.64).

Among young people (14–24 years), the prevalence of obesity was higher in smokers than non-smokers, in boys and girls alike. Frequent consumption of buns, snacks and sugared drinks were entered as predictors in the model,

adjusted for sex, age, geographical region and family SES level. Higher consumption of fruit and vegetables and regular sports practice had a protective effect in young Spanish people.

Discussion

The enKid Study, to our knowledge, is the first cross-sectional study carried out on a national random sample of Spanish children and young people, including subjects from a wide age range (2–24 years) and individual measured body weight and height following a standardized protocol. The study design, the different questionnaires used and adequate training of field-work staff were carefully designed in order to ensure reliable and valid data. Quality control mechanisms were established both at the preparatory stage and during data collection.

In this study, different prevalence rates were obtained depending on the criteria used to define overweight and obesity. According to Spanish standards, the average prevalence of obesity in this age group of Spanish people is 13.9% (Serra-Majem *et al.* 2003). However, when using Cole *et al.* criteria, the global estimate is half of this figure (6.3%). Nevertheless, overweight and obesity follow a similar distribution pattern by age group, sex and other sociodemographic characteristics when using either criteria. This fact raises the issue for the need to clarify the most suitable criteria to define obesity when comparing data, both for international comparison purposes and when looking for trends within the same population (Flegal *et al.* 2001).

In the Cuenca study, a city in central Spain, Martínez Vizcaíno *et al.* (2002) reported prevalence for overweight of 26.6% and for obesity of 3.9% in a sample of 9–12-year-old children according to Cole *et al.*'s criteria, but no significant differences by sex. These figures are consistent with the estimates for the whole country in the enKid Study when using the same criteria for this age group, 22.45% for overweight and 4.7% for obesity. However, it is interesting to note that in the enKid Study significant differences in the prevalence of obesity across regions were identified. Furthermore, geographical region was a predictor for obesity, as well as sex, with an OR of 1.95 for boys compared with girls.

The follow-up of the Cuenca study estimated a relative risk of 2.9 (95% CI 2.21, 4.04) for overweight children at baseline to be overweight or obese after a 6-year follow-up. Prevalence trends for overweight and obesity were also analysed by Moreno *et al.* (2000) in the region of Aragon, in the centre-east of the country, in school-aged children between 1985 and 1995. They reported a steady increase in the prevalence of overweight, particularly in boys. Furthermore, obese children in 1985 were more obese in 1995.

In the Child and Adolescent Trial for Cardiovascular Health in the USA, Dwyer *et al.* (1998) investigated predictors for obesity among 9–11-year-olds during a 2-year follow-up. Being obese at baseline, study site, race and male sex were predictors of obesity in this study.

Comparison of results in the enKid Study and data from a population study carried out in the mid-1980s, the PAIDOS study, show an increasing trend for obesity in Spain comparable to that reported in other countries such as France or Switzerland (Deheeger *et al.* 2002).

Table 2. Prevalence odds ratios for obesity by sociodemographic and lifestyle factors in the enKid Study

Sociodemographic factors	Odds ratio (95% CI)		
	2–13-year-olds	14–24-year-olds	14–24-year-olds
Age (years)			
2–5	1.00	–	1.00
6–9	1.47 (1.14, 1.88)	–	0.95 (0.69, 1.31)
10–13	1.37 (1.05, 1.77)	–	1.01 (0.83, 1.42)
14–17	1.0	1.0	0.64 (0.37, 0.88)
18–24	1.07 (0.82, 1.53)		
Mother's educational level			
Low	1.25 (1.03, 1.67)	1.00	2.12 (1.60, 3.02)
Medium	1.14 (0.83, 1.58)	1.06 (0.85, 2.25)	1.00
High	1.00	0.79 (0.38, 1.73)	
Family SES			
Low	1.27 (1.06, 1.71)	1.12 (0.81, 1.86)	1.00
Medium	1.15 (0.84, 1.68)	1.09 (0.88, 2.31)	0.75 (0.44, 1.86)
High	1.00	1.00	1.27 (1.05, 2.31)
Region			
Center	1.00	1.00	1.00
Northeast	0.74 (0.37, 0.93)	0.52 (0.39, 0.83)	1.00 (0.69, 1.44)
North	1.02 (0.72, 1.89)	0.73 (0.43, 0.89)	1.34 (1.07, 1.85)
South	1.78 (1.10, 3.31)	0.95 (0.54, 1.26)	
East	0.80 (0.59, 1.91)	0.73 (0.40, 1.09)	
Canary Islands	2.69 (1.49, 7.62)	1.15 (0.83, 1.47)	
Locality size*			
< 10 000	1.00	1.00	1.00
10 000–50 000	0.90 (0.65, 1.08)	1.00 (0.60, 1.48)	0.86 (0.55, 1.16)
50 000–350 000	1.08 (0.87, 1.80)	0.82 (0.42, 1.19)	1.39 (1.04, 2.14)
> 350 000	1.19 (1.07, 2.28)	0.99 (0.60, 1.24)	
Birth weight			
< 2500 g	0.73 (0.46, 0.94)		1.00
2500–3500 g	0.68 (0.42, 0.92)		0.86 (0.46, 1.87)
> 3500 g	1.00		0.64 (0.38, 0.95)
Breastfeeding†			
No	1.00		1.00
1–3 months	0.68 (0.32, 1.21)		0.99 (0.63, 1.49)
≥ 3 months	0.57 (0.36, 0.97)		0.84 (0.33, 1.05)
Life-style factors			
Regular breakfast consumption			
No			
Sometimes			
Yes			
Fruit and vegetable consumption			
< 2 portions/d			
≥ 4 portions/d			
Regular consumption of buns and snacks			
< 1 portion/week			
1–4 portions/week			
≥ 5 portions/week			
Sugared drinks consumption			
< 1 portion/week			
1–4 portions/week			
≥ 5 portions/week			
Time spent watching television daily			
< 1 h			
1–2 h			
>2 h			
Regular sport practice			
No			
1–2 times/week			
≥ 3 times/week			

SES, socioeconomic status.

*Number of inhabitants.

†Fitted for children under 6 years of age.

The estimated prevalence of obesity in the enKid Study is among the highest rates in European countries, as shown by data gathered by the expert group on childhood obesity of the International Obesity Task Force (Lobstein *et al.* 2004). It is noteworthy that the southern European countries in the Mediterranean region are those showing the highest figures along with the UK and the USA, compared with northern European countries, particularly Scandinavian countries.

Different studies have investigated sociodemographic, lifestyle and environmental determinant factors for obesity among children. No breastfed infants have been reported to be more likely to be obese children (Hediger *et al.* 2001; Arenz *et al.* 2004). A sedentary lifestyle, particularly spending more than 3 h a day watching television (Gortmaker *et al.* 1996), a high consumption of sugared drinks and fruit juices (Ludwig *et al.* 2001), a high fat intake (Livingstone, 2000) and inadequate consumption of fruit and vegetables (Epstein *et al.* 2001) have all been identified as determinant factors for obesity. This was the case in the enKid Study as well.

Results from the Health Behaviour in School-aged Children study, supported by WHO and carried out periodically in eleven countries around the world, highlight two key facts. On the one hand, reported consumption of fruits and vegetables in Spanish children and adolescents is among the lowest in Europe. On the other hand, physical activity and sports practice are also among the lowest in Spain, while children and young people in Scandinavian countries are more active (Currie *et al.* 2004). Results from the Pro Children study, a cross-sectional study performed in 10–12-year-old children in nine European countries, show a similar pattern for the consumption of fruit and vegetables (Yngve *et al.* 2005).

Available data show that obesity in Spain is a public health issue for its magnitude and increasing trends. Among Spanish children and young people, those at prepubertal age, particularly boys, can be identified as a group at higher risk for overweight and obesity, especially children from lower SES families.

Inspired by the WHO Global Strategy on Nutrition and Physical Activity (World Health Organization, 2004), the Spanish Ministry of Health launched the National Strategy for Nutrition, Physical Activity and Obesity with the aim of planning monitoring and prevention actions to face the problem in the country (Agencia Española de Seguridad Alimentaria, 2005). Establishing a monitoring system with comparable data at a national level, which is useful for international comparisons as well as identifying key determinant factors, particularly those which can be modified, is desirable when planning such preventive policies.

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