

Original

Two methods to determine the prevalence of overweight and obesity in 8-9 year-old-children in Seville, Spain

I. Cerrillo, M.^a S. Fernández-Pachón, M.^a de los Á. Ortega, E. Valero, F. M. Martín*, I. Jáuregui-Lobera and G. Berná*

Molecular Biology and Biochemistry Engineering Department. Pablo de Olavide University. Seville. Spain.

**CIBER de Diabetes y Enfermedades Metabólicas.*

Abstract

Objective: The prevalence of overweight and obesity in Spanish children has increased considerably in the last decades. Obesity has been recognized as a public health problem in developed countries because its association with increased risk for several pathologies. Obesity in children and, specifically, in adolescents, is a major concern. Actually, in Spain, the prevalence rates of childhood overweight and obesity are among the highest in European countries. The objective of this study was to measure the prevalence of overweight and obesity in children from Seville.

Method: A cross-sectional study was performed on 990 children, aged 8-9 years old (51.5% 8-year old and 48.5% 9-year old). Overweight and obesity were defined according to two methods: Spanish standards, applying the criterion of BMI-specific percentiles for age and sex, and the international standards established by Cole et al. (IOTF).

Results: A high prevalence of overweight (11%) and obesity (22%) was observed. The prevalence of obesity as well as the prevalence of overall excess weight was significantly higher in 9-year old children (28% and 41%, respectively) than in 8-year old children (17% and 27%, respectively).

Conclusion: The prevalence of overweight and obesity among Sevillian school children is high, and increases in the studied range of age.

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Key words: *Overweight. Obesity. Children. Risk factors. Methodology.*

DOS MÉTODOS PARA DETERMINAR LA PREVALENCIA DE SOBREPESO Y OBESIDAD EN NIÑOS DE 8 A 9 AÑOS DE SEVILLA, ESPAÑA

Resumen

Objetivo: La prevalencia de sobrepeso y obesidad infantil ha aumentado durante las últimas décadas en España. La obesidad se ha convertido en un problema de salud pública en los países desarrollados por su influencia en el aumento del riesgo de padecer ciertos tipos de enfermedades. Este problema se manifiesta especialmente en escolares y adolescentes. En España, este aumento de la prevalencia de sobrepeso y obesidad infantil le ha hecho llegar a ocupar una de las primeras posiciones en las tasas de sobrepeso y obesidad europeas. El objetivo de este estudio es determinar la prevalencia de sobrepeso y obesidad en niños sevillanos.

Método: Se realizó un estudio epidemiológico transversal en 990 niños de edades comprendidas entre 8 y 9 años (51,5% de 8 años y 48,5% de 9 años). Se definió el sobrepeso y la obesidad según dos métodos: los estándares españoles, usando como criterio los puntos de corte del IMC correspondientes a percentiles específicos por edad y sexo, y los estándares internacionales establecidos por Cole y cols. (IOTF).

Resultados: Se ha observado una prevalencia alta de sobrepeso (11%) y obesidad (22%). Tanto la prevalencia de obesidad como de la carga ponderal total han sido significativamente superiores en niños de 9 años (28% y 41%, respectivamente) que en niños de 8 años de edad (17% y 27%, respectivamente).

Conclusiones: La prevalencia de sobrepeso y obesidad en niños escolares de una población de Sevilla es alta, y aumenta especialmente en el rango de edad estudiado.

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Palabras clave: *Sobrepeso. Obesidad. Infancia. Factores de riesgo. Metodología.*

Correspondence: Ignacio Jáuregui-Lobera.
Molecular Biology and Biochemistry Engineering Department.
Pablo de Olavide University.
Ctra. de Utrera, km. 1.
41013 Seville. Spain.
E-mail: ijl@tcasevilla.com / igjl@upo.es

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Abbreviations

WHO: World Health Organization.

M: Mean.

BMI: Body Mass Index.

IOTF: International Obesity Task Force.

CI: Confidence interval.

SPSS: Statistical Package for the Social Sciences.

NAOS: Strategy for Nutrition, Physical Activity and the Prevention of Obesity.

THAO: Childhood obesity prevention program from *Thao* Foundation.

PONCE: Prevalence of Obesity Among Children in Ceuta.

Introduction

According to the World Health Organization (WHO), 1.6 billion people are overweight and 400 million of them are obese. Moreover, WHO estimates that by 2015 there will be 2.3 billion adult people with overweight and more than 700 million with obesity.¹ Overweight and obesity are considered a serious health problem worldwide and obesity has been recognized as a public health problem in developed countries, because it is associated with increased risk for several pathologies, such as cardiovascular disease,² type II diabetes³, arthrosis⁴ and some types of cancer,⁵ among others.

In particular, obesity in childhood and adolescence is a major health concern.^{6,7} Health consequences of weight excess for children are not as evident as for adults, however childhood obesity has been associated with pathologies, such as the metabolic syndrome⁸ and cardiovascular disease.⁹ Moreover, longitudinal studies focused on children after three years of age suggest that obesity is associated with a greater risk of obesity in adolescence and adulthood.^{10,11}

In Spain, the prevalence of childhood overweight and obesity has increased in the last decades. Regarding the rates of childhood overweight and obesity, they are increasing dramatically, ranking this country among the highest with respect to the European rates of these pathologies.^{10,12,13} There are some recent cross-sectional studies aimed to determine the prevalence of overweight and obesity in Spanish children, the most important finding being that both overweight and obesity prevalence are alarmingly high in all studied regions.¹⁴⁻¹⁶

In the South of Spain, different previous studies have considered Andalusia as one of the Spanish regions with the highest obesity rates. Therefore, the aim of this study was to measure the prevalence of overweight and obesity in a childhood population from Alcalá de Guadaíra (a Sevillian city in Andalusia, Spain), with a range of age, which has been considered as having an increased risk of overweight and obesity following the Spanish *enKid* study data.

Material and methods

Participants

This is a cross-sectional study carried out on 990 students, aged between 8 (51.5%) and 9 (48.5%) years old ($M = 8.5 \pm 0.5$), from 6 public primary schools of Alcalá de Guadaíra (Seville, Spain). The sample comprises approximately 97% of the total population of this range of age in that city. Regarding sex, 53% were boys and 47% girls. The study was approved by the directors of the included schools, and all parents provided written informed consent. Neither parent refusal to contribute to the study nor children unwillingness to participate was found.

Procedure

Trained researchers performed the different measures by means of standard procedures. Weight (kg) was measured with a digital balance using calibrated digital scales to the nearest 100 g (Model 780, Seca, Germany). Height (m) was measured using a Seca stadiometer to the nearest 1 mm (Model 220, Seca, Germany). Body Mass Index (BMI) was calculated ($\text{weight}/\text{height}^2$), and overweight and obesity rates were determined using the value of BMI-specific percentiles for age and sex in the reference population¹⁷, considering the cut-off points of 85th and 97th for overweight and obesity respectively. Also, the international standards established by Cole et al. (IOTF)¹⁸ were applied. The IOTF-definitions of overweight and obesity are based on age and gender-specific cut off-points.

Statistical analyses

Results are expressed as means and standard deviation, or as number of subjects (n) and percentages, when appropriate. Mean comparisons were performed by means of the Student's *t*-test. The distributions of both overweight and obesity, considering sex and age, were assessed by means of χ^2 -test. Confidence intervals were fixed at 95% and the level of significance for acceptance was fixed at $p < 0.05$. A Bland-Altman plot was performed to analyze the agreement between the Cole and Hernández criteria as well as the comparison method of Passing-Bablok. Statistical analyses were performed using SPSS, v 15.0 (SPSS Inc., Chicago, IL, USA) and MedCalc Software v 11.6 (Mariakerke, Belgium).

Results

A total sample of 990 school children, with a mean age of 8.5 ± 0.5 , participated in this study. Mean weights and mean heights were 34.9 ± 8.7 kg and 135.6 ± 6.0 cm, respectively. Mean BMI was 18.3 ± 3.7 . Table I shows

Table I
Anthropometric characteristics of Sevillian children

	Total (n = 990)	Boys (n = 523)	Girls (n = 467)	P
Weight (kg)	34.9 ± 8.7	34.9 ± 9.0	34.9 ± 8.3	0.955
Height (cm)	135.6 ± 6.0	135.9 ± 6.1	135.3 ± 5.9	0.141
BMI (kg/m ²)	18.3 ± 3.7	18.2 ± 3.7	18.4 ± 3.78	0.397

Values are expressed by mean ± standard deviation.
P-values for comparisons between boys and girls (Student's *t* test).

the results of the anthropometric measurements for total population as well as for boys and girls separately. There were not significant differences neither considering BMI nor taking into account weights and heights, proved by Student's *t* test ($t = 0.056$; $p = 0.955$ for weight between boys and girls; $t = 1.472$; $p = 0.141$ for height between boys and girls and $t = 0.848$; $p = 0.397$ for BMI between boys and girls).

Table II shows the prevalence of overweight and obesity in the total population. Values were 11.3 % and 22.1 % respectively, for Hernández criteria, and 22.1 % and 14.2 % respectively, for Cole criteria. This distribution shows significant differences between the two applied criteria as it is proved by the χ^2 -test ($\chi^2 = 50.361$; $df = 2$; $p < 0.0001$). Considering overweight, there exists a difference of 10.8%, and post-hoc test revealed its significance (95% CI = 7.54-14.05; $\chi^2 = 40.73$; $p = 0.0001$). With respect to obesity the difference between the two criteria was 7.90%. Again, post-hoc test revealed the significance of that difference (95% CI = 4.51-11.27; $\chi^2 = 20.26$; $p < 0.0001$). In case of overweight and obesity considered together the prevalence was 33.4 % and 36.4 %, for Hernández and Cole respectively. In this case the difference (3%) was not significant (95% CI = -1.2-7.18; $\chi^2 = 1.83$; $p = 0.176$).

Prevalence of overweight (BMI $\geq 85^{\text{th}}$ percentile < 97th), obesity (BMI $\geq 97^{\text{th}}$ percentile) and total overweight (BMI $\geq 85^{\text{th}}$ percentile) are shown in tables III and IV with data distributed by gender and age, respectively. There were not statistical differences by gender with respect to overweight, obesity and total excess of weight, proved by the χ^2 -test ($\chi^2 = 0.441$; $p = 0.506$ for overweight prevalence; $\chi^2 = 2.618$; $p = 0.106$ for

Table II
Overweight and obesity prevalence in total population
(n: %)

	Hernández	Cole
Overweight BMI $\geq 85^{\text{th}}$ percentile < 97 th	112 (11.3)	219 (22.1)
Obesity BMI $\geq 97^{\text{th}}$ percentile	219 (22.1)	141 (14.2)
Overweight + Obesity BMI $\geq 85^{\text{th}}$ percentile	331 (33.4)	360 (36.4)

$\chi^2 = 50.361$; $df = 2$; $p < 0.0001$.

Table III
Overweight, obesity, and excess weight prevalence (%)
in boys and girls

	Gender		P
	Boys (n = 523)	Girls (n = 467)	
Overweight BMI $\geq 85^{\text{th}}$ percentile < 97 th	10	12	0.506
Obesity BMI $\geq 97^{\text{th}}$ percentile	23	21	0.106
Overweight + Obesity BMI $\geq 85^{\text{th}}$ percentile	33	33	0.296

P-values for comparisons between boys and girls (χ^2 test).

Table IV
Overweight, obesity, and excess weight prevalence (%)
in 8-9 year-old children

	Age		P
	8 years (n = 506)	9 years (n = 484)	
Overweight BMI $\geq 85^{\text{th}}$ percentile < 97 th	10	13	0.248
Obesity BMI $\geq 97^{\text{th}}$ percentile	17	28	0.001
Overweight + Obesity BMI $\geq 85^{\text{th}}$ percentile	27	41	0.001

P-values for comparisons between aged 8 and 9 years (χ^2 test).

obesity prevalence; and $\chi^2 = 1.091$; $p = 0.296$ for prevalence of total excess weight).

However, both obesity and excess weight were significantly higher in the 9 year old children (28% and 41%, respectively) than in the 8 year old children (17% and 27%, respectively). ($\chi^2 = 10.963$; $p = 0.001$ and $\chi^2 = 10.517$; $p = 0.001$, respectively).

In order to analyze the agreement between the two applied criteria the Bland Altman plot was performed as it is shown in figure 1. As a result, the high correla-

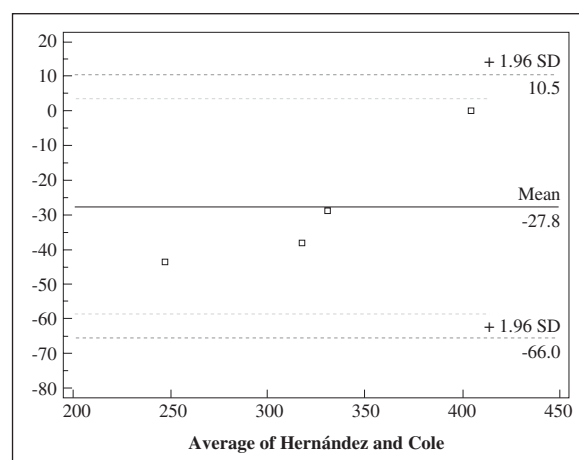


Fig. 1.—Bland-Altman plot.

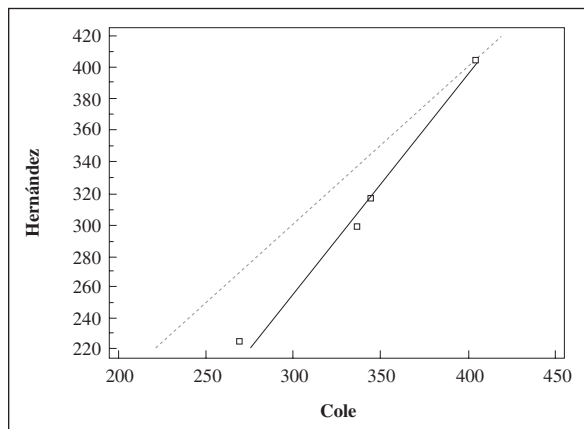


Fig. 2.—Passing-Bablok regression.

tion between the two criteria determining the prevalence rates of overweight + obesity allow us to conclude that there is a good agreement between these two criteria. Figure 2 (Passing-Bablok regression) shows that differences between the two methods assessing overweight and obesity separately tend to disappear when excess weight is considered as a unique parameter. Cusum test for linearity reveals no significant deviation from linearity ($p > 0.10$).

Discussion

This study shows a high prevalence of overweight and obesity among children, confirming values previously obtained by other analyses undertaken in different Spanish regions, such as the *enKid* study.¹⁹ According to the *enKid* study carried out on children and young Spanish people, the highest overweight and obesity total prevalence was observed from ages between 6-9 and between 10-13 years old, with total overweight and obesity rates of 30% and 31%, respectively.¹⁹ The students participating in the current study were between 8 and 9 years old, thus, they were within the age range that the *enKid* data identified as having an increased risk of overweight and obesity.

In other recent studies, the values obtained for overall overweight and obesity prevalence in children were 30% in Cuenca (children between 9-10 years old),¹⁴ 32% in Basque Country (children between 7-10 years old),¹⁵ 26% in Canary Islands (children between 12-14 years old),²⁰ 28% in Balearic Islands (children between 12-17 years old),²¹ 39% in Galicia (children between 10-12 years old)¹⁶ and 32% in Navarra (children 8 years old)¹¹. Despite methodological differences (range of age, procedure to collect data, etc.), the figures of prevalence of the current study with respect to overweight and obesity (33%) are higher than those of other studies as, for example, Cuenca (22% overweight and 8% obesity), Basque Country (28% overweight and 4% obesity), Canary Islands (12% overweight and 14% obesity), Balearic Islands (17%

overweight and 11% obesity) and Navarra (25% overweight and 7% obesity). Nevertheless, the prevalence shown in this study is lower than the prevalence reported in Galicia (30% overweight and 9% obesity).

Methodological differences (e.g., Cole or Hernandez methods to determine overweight and obesity) make especially difficult to compare results from different studies. However, previous data indicate that total overweight and obesity prevalence is the most suitable indicator for measuring child overweight and obesity. This is due to its independence of the underlying criteria.²² In addition, when applying the criteria of IOTF, the prevalence of excess weight increases until 36%. With respect to the rates of overweight and obesity, comparing with each other, the method of Cole seems to overestimate overweight (or vice versa underestimate obesity) whilst the method of Hernández seems to overestimate the prevalence of obesity (or vice versa underestimate overweight). Nevertheless, considering the total prevalence of overweight and obesity, both methods seem to be equally useful.

Data also show that obesity and excess weight prevalence were significantly higher in 9 year-old children (28% and 41%, respectively) when compared with 8 year-old children (17% and 27%, respectively). Previous studies in other Spanish regions showed that the highest obesity rates were present in the following age ranges: 7-10,¹⁵ 6-13,¹⁹ and 8.¹¹

In the current study, the overweight prevalence was higher in girls when compared with boys (12% vs 10%), but the prevalence of obesity was higher in boys (23%) than in girls (21%), although these differences were not significant. Thus, the overall overweight and obesity prevalence was the same in both sex (33% in girls and boys). Prevalence rates of obesity found in other studies in both boys and girls have been different, thus their interpretation becoming difficult. For example, in Canary Islands, the overall overweight and obesity prevalence in adolescents was higher in girls when compared with boys (30% vs 23%).²⁰ However, in Cuenca and Basque Country studies, the data obtained showed the opposite. That is, overweight and/or obesity prevalence were higher in boys than in girls.^{14,15} Henriquez Sanchez²⁰ and Aranceta-Bartrina²³ suggest that the majority of the Spanish studies show higher excess of weight prevalence in boys, when compared with girls. However, another studies show the opposite²⁴ and in some cases these studies show no differences between boys and girls with respect to total overweight and obesity prevalence.²⁵

Our data show an alarmingly high prevalence of excess weight in children. The values found in our study are higher than those observed in infants and pre-school children from 18 different countries.²⁶ The study of Cattaneo and colleagues²⁶ found a prevalence of overweight-obesity ranging from 12% in Romania to 32% in Spain. Countries from the Mediterranean region and British islands reported higher rates than those from middle, northern and eastern Europe.²⁶

It must be noted that the current study was conducted in Andalusia, where, together with the Canary Islands, Galicia and Murcia, the *enKid* study identified the highest rates of obesity and overweight in Spain.²³ Other recent studies in our context (South of Spain) have reported an overweight prevalence between 18.3-32.2% and 10.9-26.1% in girls and boys respectively, this referred to 9-17 year-old children and adolescents. With respect to obesity prevalence, these studies have shown a higher prevalence in schoolgirls between 12-13 year-old adolescents (15.1%) than in boys at the same range of age. From 13 years onwards obesity prevalence seems to increase progressively in boys.^{27,28} In a narrower range of age (12-16 year-old adolescents) another study reported 9.7% of participants with a BMI \geq 85th percentile and 7.5% with a BMI \geq 95th percentile.²⁹ Finally in the PONCE study, including children between 6-13 years old, authors found 13.81% for overweight prevalence, 8.75% for obesity prevalence, and 22.57% for excess weight prevalence.³⁰ In the current study, the first data of overweight and obesity prevalence in a childhood population from Seville (Andalusia) have been shown.

Specifically data show high overweight and obesity prevalence in an 8-9 year-old population from Alcalá de Guadaíra (Andalusia). Our results provide information about a range of age that the *enKid* data identified with increased risk for overweight and obesity.¹⁹ Thus, we suggest that greater attention should be paid at this age. This should include the development of interventional strategies and nutritional programs focused on these school-age children. In view of this study, Public Health Authorities should set up and regulate surveillance programs and preventive strategies. As a result of studies like this, the National Health Authorities have focused on the design of nutritional strategies to improve the lifestyles of Spanish school children (i.e., the NAOS strategy and THAO program).

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