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ORIGINAL ARTICLE

Overweight and obesity prevalence estimates in a population from Zaragoza by using different growth references☆

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KEYWORDS
Overweight;
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Body mass index;
Growth standards

Abstract
Objectives: To investigate the prevalence of overweight and obesity among our pediatric population and observe whether the use of different growth references for classification produces significant differences.
Material and methods: A total of 35,824 boys and girls aged between 2 and 14 years were included. Body mass index (BMI) was used to calculate the prevalence of overweight–obesity by age and sex. Prevalence was obtained by using a set of national references (Hernández standards) and the references of World Health Organization (WHO standards). Prevalences were compared for each age and sex subset, as well as with the percentage of patients who had an overweight–obesity diagnosis in the clinical record.
Results: The overall prevalence of overweight–obesity among children aged 2–14 years was 17.0% (95% CI, 16.1–18.0%) according to the Hernández standards vs 30.8% (95% CI, 29.9–31.7%) according to WHO standards (10.1% vs 12.2% obese, and 6.9% vs 18.6% overweight). It was significantly higher in boys, by both standards, due to the higher prevalence of obesity. By using the Hernández standards the prevalence was significantly lower than by using WHO standards for all ages and for both sexes. A low percentage of patients were found to have an obesity–overweight diagnosis in the clinical record (from 3% to 22% at the ages of 2 and 14 years, respectively).

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Conclusions: The prevalence of overweight–obesity in our population is high, especially among boys. Using Hernández standards leads to an under-estimation of the problem, especially because it detects less overweight patients; thus, we recommend using the WHO standards in our daily practice. The low number of overweight–obesity diagnoses in the clinical records might reflect that there is little awareness of the problem by the professionals.

PALABRAS CLAVE
Sobrepeso;
Obesidad;
Prevalencia;
Infancia;
Índice masa corporal;
Estándares crecimiento

Estimación de la prevalencia de sobrepeso y obesidad infantil en un sector sanitario de Zaragoza utilizando diferentes estándares de crecimiento

Resumen
Objetivos: Conocer la prevalencia de sobrepeso y obesidad en nuestro medio y objetivar si hay diferencias significativas al utilizar los estándares de crecimiento de Hernández o los de la Organización Mundial de la Salud (OMS).
Material y métodos: el 35824 niñas y niños de 2 a 14 años. Para determinar las prevalencias, mediante ambos estándares (Hernández y OMS), se utilizó el índice de masa corporal. Se compararon y se analizaron las diferencias de prevalencias por edad y sexo y con el porcentaje de pacientes que tenían registrado algún diagnóstico de obesidad-sobrepeso en la historia clínica.
Resultados: La prevalencia global de sobrepeso-obesidad de 2 a 14 años fue del 17,0% (IC del 95%, 16,1%-18,0%) según estándares de Hernández y del 30,8% (IC del 95%, 29,9%-31,7%) según estándares OMS (obesidad 10,1% y 12,2%, sobrepeso 6,9% y 18,6%, respectivamente). Fue significativamente mayor en varones, según ambos estándares, debido a la mayor prevalencia de obesidad. Con los estándares de Hernández se obtuvieron prevalencias significativamente menores que con los de OMS, en todas las edades y en ambos sexos. Detectamos un bajo porcentaje de registro del diagnóstico (del 3 al 22% a los 2 y 14 años, respectivamente).
Conclusiones: En nuestra población, la prevalencia de sobrepeso-obesidad es alta y es mayor en varones. La utilización de los estándares de Hernández infravalora la sobrecarga ponderal, sobre todo porque detecta menos pacientes con sobrepeso, por lo que creemos que sería preferible incorporar los estándares de OMS de forma sistemática a la práctica diaria. El escaso registro del diagnóstico de sobrepeso-obesidad en la historia clínica podría reflejar una escasa percepción del problema por parte de los profesionales.

Introduction

Childhood obesity has increased in recent decades to epidemic proportions across the world.[1–3] In Spain, its prevalence varies in relation to the time and place in which studies have been performed, and to the reference standards used. In the Enkid study,[4] the overall prevalence of excess weight (overweight and obesity) was 26% in a population aged 0–24 years using the Hernández standards. A study conducted in Navarre[5] on a sample that included all children 0–14 years of age in that autonomous community found an overall prevalence of excess weight of 28% using the standards and criteria established by the World Health Organization (WHO).[6] Recently, a study with data from 18 European countries that used the International Obesity Task Force reference reported an excess weight prevalence of 32.3% for 4-year-old children in Spain, the highest in all of Europe.[7]

Obesity is a risk factor for other diseases, and has a high morbidity and mortality in adulthood associated to elevated health care costs. A high body mass index (BMI) in childhood and adolescence is associated with a higher percentage of body fat and is a risk factor for coronary heart disease.[8] Spain's Ministry of Health has promoted the NAOS strategy,[9] one of whose objectives is the early diagnosis and epidemiological control of this disease.

The BMI is considered a good indicator of excess weight, both for clinical and epidemiological purposes, and makes it possible to compare results between studies. Yet, currently there is controversy surrounding which of the child growth standards should be used and which cutoff points applied for diagnosing obesity and overweight.[10] The WHO standards have already been accepted and incorporated into clinical practise in 125 countries,[11] and constitute the only published standard based on a longitudinal study of the growth of healthy children that had been born to healthy mothers who did not smoke and that had received optimal nutrition (breastfed for a minimum of 4 months).

In Spain, there is no set standard that is uniformly used to monitor the growth of children in the different autonomous communities. However, the clinical practise guideline for the prevention and treatment of obesity in children and

adolescents (Guía de Práctica Clínica sobre la Prevención y el Tratamiento de la Obesidad Infantojuvenil [GPCOI]), published in 2009, recommends the use of the Hernández standards of 1988 because they were established prior to the increase in the prevalence of obesity in our country.[12]

Since childhood obesity is a growing problem in Spain and it would be useful to have updated data on its prevalence, the aim of this study was to estimate the prevalence of overweight and obesity in our health district, compare our results with those obtained in other areas, and determine how the results differ depending on the growth standards used to determine normal weight (Hernández and WHO).

Materials and methods

The initial sample comprised 37,118 patients aged 2–14 years from health district II (Sector II) in Zaragoza, which amounts to 88% of the population of this age group included in the SALUD registry for district II in Zaragoza (41,970 patients) as of December 31, 2012, when the data were collected. Based on data from the Instituto Nacional de Estadística (National Statistics Institute), our health district serves one-fourth of the total 164,556 children in this age group in Aragón. After cleaning the data set, all children with incomplete or contradictory data were excluded from the study, a total of 1294, which accounted for 3% of the total initial sample. The final sample included 35,824 patients, 51.5% of whom were male and 48.5% female.

We collected the data on patients from the electronic medical record database used in Aragón (OMI-AP) and included every patient in our district whose weight and height had been documented at any time up to December 31, 2012. In 50% of the patients the weight and height had been documented within the last year, in 90% within the last 3 years, and in a negligible percentage more than five years before. These data are usually recorded during health checkups.

We collected data for the following variables from the medical records: sex, date of birth, most recent weight and height, and whether a diagnosis of overweight or obesity had ever been documented. The collected data were used to calculate the age in days and the BMI for each patient, as well as their corresponding growth percentiles based on the WHO and the Hernández standards. Since the Hernández tables were developed on the basis of 6-month intervals, we used linear estimations for each month within those intervals.

Then, we classified patients into normal weight, overweight, or obesity based on the criteria applied by the GPCOI (Hernández standards: overweight 90th–97th percentile; obesity >97th percentile) and on the WHO criteria (WHO standards: overweight 85th–95th percentile; obesity >97th percentile), calculating the 95% confidence intervals (95% CI). Since the WHO recommends using the 85th percentile as the cutoff point for overweight, as opposed to the 90th percentile recommended by the GPCOI, we estimated the same prevalence rates using the 85th percentile of the Hernández standards as the cutoff point for overweight. We use the term ''excess weight'' to refer to patients that have either overweight or obesity.

We used the chi square test to compare the prevalence rates.

Results

Table 1 shows the prevalence of overweight and of obesity by age and sex based on each of the applied standards. The overall prevalence of excess weight for ages 2–14 years was 17.0% (95% CI, 16.1–18.0%) based on the Hernández standards and 30.8% (95% CI, 29.9–31.7%) based on the WHO standards, while the prevalence rates of obesity were 10.1% and 12.2%, and for overweight 6.9% and 18.6%, respectively.

This table also shows that the prevalence rates of excess weight were greater when using the WHO standards than when using the Hernández standards, a difference found in every age group and both sexes and that was statistically significant; this was also seen in the overweight prevalence rates. The differences remained even when we used the 85th, rather than the 90th, percentile of the Hernández standards, which resulted in a prevalence of overweight of 11.3% in boys (95% CI, 9.9–12.7%) and of 10.0% in girls (95% CI, 8.6–11.4%). When it came to obesity, we only observed statistically significant differences until 8 years and then at 14 years of age, but at 14 years the prevalence of obesity was significantly greater when using the Hernández standards, reversing the trend observed in all other age groups.

Fig. 1 shows that based on the WHO standard, the prevalence of excess weight is significantly greater in boys than in girls at 6 years of age, and again starting at age 10 years. The prevalence of obesity is higher in boys at 6 years of age and from 8 years onward. However, we found no differences in the prevalence of overweight between the sexes, that is, the differences between the sexes in the prevalence of excess weight were mostly due to the greater prevalence of obesity in boys. Although we have not represented it graphically, the same was observed when the Hernández standards were applied.

Fig. 2 shows the prevalence of excess weight by age group and sex for each of the 2 studied reference standards, and it is apparent that the prevalence rates of excess weight were significantly higher for all ages and both sexes when applying the WHO standards rather than the Hernández standards. This prevalence increased gradually until 9 years of age in girls and 11 years of age in boys, reaching 39.6% and 43.9% by the WHO standards, and proceeded to decrease gradually until reaching 23.6 and 29.7%, respectively, at 14 years of age.

Fig. 2 also presents the percentage of patients with a documented ICPC code (T82-obesity, T83-overweight) in the medical records of the OMI-AP, which ranged between 0.5% at age 2 years and 7% at 14 years, corresponding to only 3–22% of the total number of patients that had excess weight at these ages when applying the ''gold standard'' of the WHO growth reference.

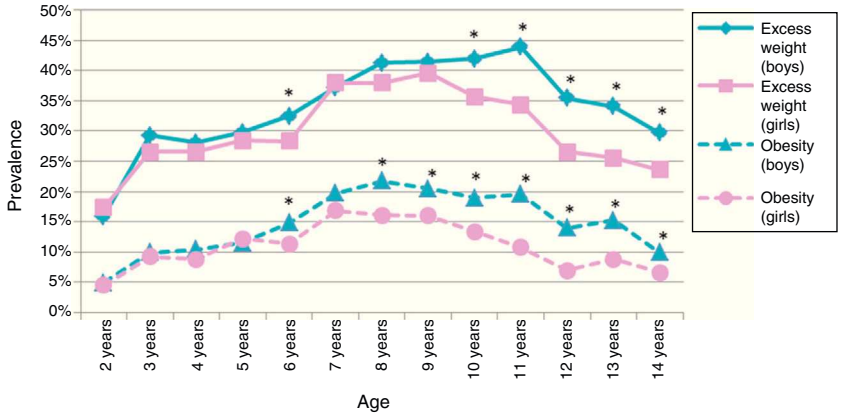
Discussion

The overweight and obesity prevalence rates obtained in this study are consistent with those found in several other Spanish[4,13,14] and European[7] regions, confirming the considerable magnitude of the problem. We used the WHO standards because of their international applicability and

Table 1 Prevalence of overweight and obesity by sex and age, based on the WHO and Hernández standards.

	Boys	Girls	Both	Overweight (WHO)				Overweight (Hernández)			
	n	*n*	*N*	Boys		Girls		Boys		Girls	
				%	95% CI	%	95% CI	%	95% CI	%	95% CI
2 years	1898	1846	3744	11.0	6.5–15.0%	12.8	8.4–16.9%	2.7	−2.7–6.2%	2.5	−3.0–6.0%
3 years	1250	1202	2452	19.4	14.2–24.1%	17.3	11.9–22.2%	6.0	0.0–10.7%	4.5	−2.0–9.1%
4 years	1821	1693	3514	17.7	13.4–21.7%	17.7	13.2–21.9%	5.7	0.8–9.7%	5.1	−0.1–9.2%
5 years	816	781	1597	18.3	11.7–24.1%	16.3	9.4–22.3%	5.6	−2.1–11.2%	4.4	−4.0–9.7%
6 years	2994	2676	5670	17.6	14.3–20.8%	17.0	13.4–20.3%	5.5	1.8–8.7%	5.0	0.9–8.3%
7 years	746	700	1446	17.6	10.7–23.7%	21.1	14.2–27.4%	7.9	0.2–13.9%	7.9	−0.2–14.1%
8 years	1602	1469	3071	19.5	15.0–23.8%	21.9	17.2–26.3%	7.6	2.5–11.9%	8.4	3.1–12.9%
9 years	927	889	1816	20.9	14.9–26.4%	23.6	17.6–29.1%	9.5	2.8–15.0%	9.2	2.4–14.9%
10 years	1008	1014	2022	23.0	17.4–28.2%	22.3	16.6–27.5%	10.6	4.3–16.0%	8.9	2.4–14.2%
11 years	1438	1333	2771	24.3	19.7–28.7%	23.6	18.7–28.1%	11.5	6.4–16.1%	9.4	3.9–14.1%
12 years	951	862	1813	21.5	15.6–26.8%	19.6	13.3–25.3%	10.1	3.5–15.6%	8.4	1.3–14.0%
13 years	903	783	1686	18.8	12.7–24.4%	16.7	10.0–22.7%	8.7	1.9–14.3%	7.9	0.4–13.8%
14 years	2090	2132	4222	19.8	15.8–23.5%	17.0	13.0–20.7%	9.7	5.3–13.5%	7.1	2.7–10.9%
2–14 years	18,444	17,380	35,824	18.7	17.4–20.0%	18.5	17.1–19.8%	7.4	6.0–8.7%	6.4	4.9–7.8
	Boys	Girls	Both	Obesity (WHO)				Obesity (Hernández)			
	n	*n*	*N*	Boys		Girls		Boys		Girls	
				%	95% CI	%	95% CI	%	95% CI	%	95% CI
2 years	1898	1846	3744	4.9	0.0–8.7%	4.5	0.0–8.4%	2.8	−2.5–6.4%	2.4	−3.3–5.8%
3 years	1250	1202	2452	9.9	4.3–14.8%	9.2	3.4–14.2%	5.8	−0.2–10.5%	4.5	−2.0–9.1%
4 years	1821	1693	3514	10.4	5.8–14.5%	8.9	4.0–13.1%	7.2	2.4–11.2%	4.6	−0.7–8.6%
5 years	816	781	1597	11.5	4.5–17.4%	12.2	5.1–18.2%	8.1	0.8–13.9%	7.8	0.3–13.7%
6 years	2994	2676	5670	14.9	11.4–18.1%	11.4	7.7–14.8%	9.6	6.0–12.8%	6.3	2.4–9.7%
7 years	746	700	1446	19.7	12.9–25.8%	16.9	9.7–23.2%	12.2	4.9–18.4%	11.6	4.0–17.9%
8 years	1602	1469	3071	21.7	17.2–25.9%	16.1	11.2–20.5%	17.3	12.7–21.6%	12.9	7.8–17.4%
9 years	927	889	1816	20.5	14.5–26.0%	16.0	9.6–21.6%	17.7	11.5–23.2%	15.0	8.5–20.6%
10 years	1008	1014	2022	18.9	13.1–24.2%	13.4	7.3–18.8%	18.1	12.2–23.4%	12.9	6.8–18.3%
11 years	1438	1333	2771	19.5	14.7–24.0%	10.8	5.4–15.5%	18.0	13.1–22.5%	11.9	6.6–16.7%
12 years	951	862	1813	14.0	7.7–19.5%	7.0	0.5–12.6%	14.9	8.7–20.4%	9.5	2.6–15.3%
13 years	903	783	1686	15.3	8.9–20.9%	8.8	1.4–14.8%	17.4	11.1–23.0%	10.9	3.7–16.9%
14 years	2090	2132	4222	9.9	5.6–13.7%	6.6	2.2–10.4%	12.9	8.7–16.7%	9.8	5.5–13.5%
2–14 years	18,444	17,380	35,824	14.0	12.6–15.3%	10.3	8.9–11.7%	11.7	10.3–13.0%	8.5	7.0–9.9%

95% CI, 95% confidence interval.



*Significant differences between Hernández and WHO ($p < 0.001$) in both sexes and all ages

Figure 1 Prevalence of overall excess weight and obesity by sex and age group based on WHO growth standards.

their methodological quality. The study did not include children younger than 2 years because there is no consensus on the ideal BMI for this age group.[15]

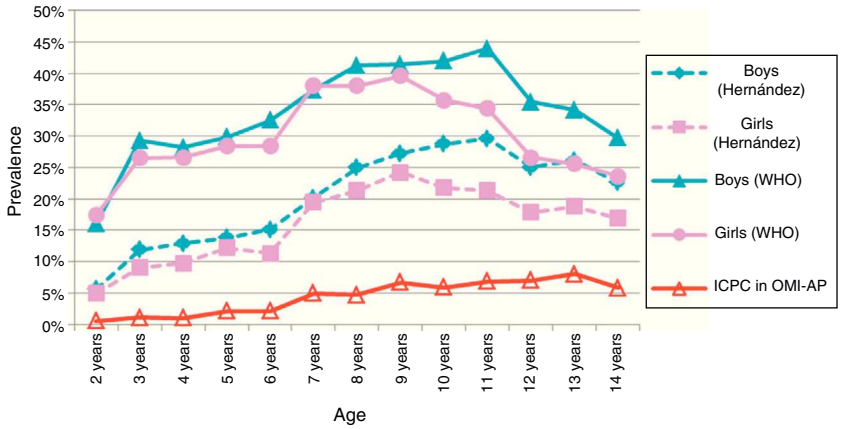
In Spain, the ALADINO study,[16] which used the WHO reference standards, found a prevalence of overweight in children of 26.2% (25.7% in girls and 26.7% in boys) and a prevalence of obesity of 18.3% (15.5% in girls and 20.9% in boys). The data for our health district, very similar to those found in a study in Navarre,[5] are slightly lower than these figures.

Caution must be exercised when making comparisons with other studies, even those that apply the same standards, as we estimated period prevalences rather than point prevalences, although the differences with the results found by other authors with a case selection similar to ours have been insignificant.[13]

Other studies also found an increase in excess weight in boys and girls at 9 and 11 years of age, respectively, and attribute those changes to the normal process of growth. But this may be an important fact, since recent studies have shown that BMI and prepubertal weight gain are good predictors of obesity in adulthood.[17–19]

The higher prevalence of excess weight when the WHO standards are applied has been reported previously by many other authors.[20–23] However, given that those standards were developed based on a sample of children living under optimal nutritional and environmental conditions, and who therefore represent a ''gold standard'' that was previously unavailable, it would be more accurate to say that the Hernández standards recommended by the GPCOI underestimate the overall prevalence of excess weight, mostly because they underestimate overweight. Since overweight precedes obesity, the use of WHO standards would allow a much earlier diagnosis of the problem. Furthermore, the Hernández standards also underestimate obesity up to 8 years of age, although paradoxically they also lead to a higher estimate of the obesity prevalence at 14 years of age in both males and females. These facts have been reported by other authors, who have questioned the use of these standards in the calculation of excess weight, and proposed a reassessment of the cutoff points.[13]

The fact is that cutoff points could be determined accurately if we knew when excess weight becomes a risk factor



Significant differences between Hernandez and WHO ($p < 0.001$) in both sexes and all ages

Figure 2 Prevalence of overall excess weight and obesity by sex, age, and the growth standard used, and percentage of patients with an ICPC code documented in the medical records.

for disease, that is, if we could associate these points to a health-related outcome. Until such a time, it seems appropriate that clinical and epidemiological criteria are used considering that it is likely that greater the risk of disease is the higher the BMI. On the other hand, the GPCOI proposes the use of the 90th percentile of the Hernández standards to diagnose overweight, but also weight loss to below the 85th percentile as a treatment goal. This not only leaves some of the overweight patients undiagnosed, but is also less practical than using a single criterion for both diagnosis and management.

For these reasons, we believe that it would be preferable to use the WHO standards to monitor child growth, although the clinical and epidemiological consequences of their use are still being evaluated. A recent European study[24] underscored the considerable variability in the standards used to monitor child growth in the different countries. Although the sample of this study was not representative of European pediatricians, the participation of Spanish pediatricians was good, and 39% of those who participated reported using the WHO growth charts.

Our study also found a low percentage of patients with a documented diagnosis of overweight or obesity when they actually had excess weight, even when we estimated excess weight based on the GPCOI criteria (Fig. 2). This lack of a documented diagnosis could be due to forgetfulness, an overload of administrative tasks; to a low awareness of excess weight as a problem on the part of professionals; or to both. At any rate, if a problem has not been documented, the interventions performed to address that problem are likely to be minimal or nonexistent.

In addition to the method used for case selection that we already mentioned, another potential source of bias in our study may be that the measurements were taken by different observers with different measuring instruments. We expect that these biases were minimized by the large number of cases and the data cleaning.

Conclusions

In our public health sector, the prevalence of excess weight is high, and it is higher in boys.

Based on our results, the use of the Hernández standards leads to underestimating a problem of epidemic proportions in our setting, so we believe that it would be preferable to incorporate the WHO standards to our routine clinical practise. This would allow the early diagnosis of excess weight, as proposed by the NAOS strategy, and would make it possible to make more reliable comparisons with domestic and international data.

Given the infrequent documentation of overweight and obesity in the medical records, it would be advisable to call on health providers to increase their awareness of this problem.

Conflicts of interest

The authors have no conflicts of interest to declare.

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