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Prevalence of childhood obesity in Spain and its relation with socioeconomic status and health behaviors: Population-based cross-sectional study

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ABSTRACT

Objectives: This study aims to assess the current state of childhood overweight and obesity in Spain, and its relationship with socioeconomic status and health-related behaviors.
Methods: Population-based cross-sectional observational study, based on the 2017 National Health Survey in minors in Spain. This study included all children surveyed who were aged 1–14 years. Childhood obesity was estimated from the *z*-score of the body mass index.
Results: The study included 4882 children aged 1–14 years (mean 7.5). The prevalence of obesity was 18.6% (95% confidence interval [CI] 18.5–18.7), while 13.5% (95% CI 13.4–13.6) were overweight. These figures represent over a million children in Spain who are obese and nearly 750,000 who are overweight. A north–south geographic gradient was apparent, with higher prevalence of unhealthy body weight in southern Spain. Factors associated with childhood obesity were low socioeconomic status, poor diet and sedentarism, among others.
Conclusions: Childhood overweight in Spain is strongly associated with socioeconomic status and other factors such as diet and sedentarism. Multidisciplinary public health interventions are needed to reduce this serious health problem in children.

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Prevalencia de la obesidad infantil en España y su relación con el nivel socioeconómico y los hábitos de salud: un estudio transversal de base poblacional

Palabras clave:
Obesidad pediátrica
Sobrepeso
Factores socioeconómicos
Hábitos dietéticos
Pediatría

RESUMEN

Objetivos: Este estudio pretende evaluar el estado actual del sobrepeso y la obesidad infantil en España, y su relación con el estatus socioeconómico y las conductas relacionadas con la salud.
Métodos: Estudio observacional transversal de base poblacional, basado en la Encuesta Nacional de Salud en menores 2017 en España. En este estudio se incluyen todos los niños encuestados con edades comprendidas entre uno y 14 años. La obesidad infantil se estimó a partir de la puntuación *z* del índice de masa corporal.

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Resultados: El estudio incluyó 4.882 niños de uno a 14 años (media: 7,5). La prevalencia de obesidad fue del 18,6% (intervalo de confianza [IC] del 95%: 18,5-18,7), mientras que el 13,5% (IC del 95%: 13,4-13,6) tenía sobrepeso. Estas cifras representan más de un millón de niños obesos en España y casi 750.000 con sobrepeso. Se observará un gradiente geográfico norte-sur, con una mayor prevalencia de obesidad o sobrepeso. Los factores asociados a la obesidad infantil fueron el bajo nivel socioeconómico, la mala alimentación y el sedentarismo, entre otros.

Conclusiones: El sobrepeso infantil en España está fuertemente asociado al estatus socioeconómico y a otros factores como la dieta y el sedentarismo. Son necesarias intervenciones multidisciplinares de salud pública para reducir este grave problema de salud infantil.

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Introduction

In recent decades, the prevalence of obesity has increased significantly worldwide.[1] In 2017, 2.4 million deaths and 70.7 million disability-adjusted life years in women, and 2.3 million deaths and 77.0 million disability-adjusted life years in men were attributed to high body mass index (BMI).[2] In the USA, obesity has doubled in children and tripled in adolescents over the past three decades, becoming a serious public health problem.[3] Trends across different countries are heterogeneous, with the growth in obesity stabilizing in high-income countries and accelerating in more disadvantaged areas such as some Asian countries.[4] Estimates in Spain show that two thirds of the adult population and one third of children are overweight or obese.[5,6] As in neighboring countries, the general rates of childhood obesity in the Spanish region of Catalonia indicate a very slight decrease in the last decade.[6]

The quality of child nutrition is strongly marked by socioeconomic status. Decades ago, low socioeconomic level was associated with poor growth and malnutrition, but this trend has now reversed, with low-income populations standing out as the most disadvantaged and the most affected by the global obesity epidemic.[7] Reduced physical activity and sedentarism are known determinants of childhood obesity,[8] as are other classic factors such as diet[9] and the intake of sugary drinks.[10] A meta-analysis of behavioral and nutritional factors in children[11] showed that having more than four sugary drinks a week increased the risk of obesity by 24%; watching more than two hours of television a day increased it by 42%, and inadequate sleep by 26%. In the opposite direction, this systematic review reported that having breakfast or performing regular physical activity reduced the risk by 34% and 30%, respectively.

Other factors associated with obesity have also been identified, such as a nationality different from the country of residence[12] and lower educational attainment in the parents. Using screens, watching television, sleep duration, and performing physical activity also have an influence on childhood obesity.

Although globally, childhood obesity continues to increase[1] studies from the past decade in a few of the more developed countries show that rates are stabilizing.[6] However, it is difficult to predict the trends in the coming years, as the COVID 19 pandemic may constitute an unprecedented blow to efforts aimed at promoting a healthy body weight.[13] Reducing childhood obesity would equate to an investment in population health, since half of these children will be obese in adolescence and 80% in adulthood, increasing the incidence of cardiovascular risk factors in adults.[14]

Currently, the largest study in carried out in Spain is that by De Bont et al.,[6] while its analysis of trends from 2006 to 2010 is of great interest, its scope was limited to a single Spanish region (Catalonia). Other population-based studies at the national level have instead focused on the adult population.[15]

The aim of the present study was to estimate the prevalence of overweight and obesity in children in Spain as well as to study the possible sociodemographic and medical associations related to obesity.

Material and methods

This was a population-based cross-sectional observational study, conducted using data from the latest national health survey in minors in Spain (ENSME2017). Data were provided by the National Institute of Statistics (INE 2021).[16] The survey used a three-stage sampling strategy, stratified by size of municipality. The population-based survey covered the whole territory of Spain and took place from October 2016 to October 2017 (INE 2017).

This study included all children surveyed who were aged 1 to 14 years. The exclusion criteria were not having data on dietary variables or other explanatory variables, weight or height, and extreme *z*-scores for the body mass index (BMI) (1st or 99th percentiles). Details of survey methodology are published online (https://www.ine.es/metodologia/t15/t153041917.pdf).

The BMI of the included children was calculated from their weight and height. The outcome variable was calculated from the BMI *z*-score, according to the Spanish pediatric population tables presented by Carrascosa et al.[17] Malnutrition was defined as a *z*-score of less than −2.00; normal weight, from −2.00 to 0.99; overweight, from 1.00 to 1.99; and obesity, 2.00 or higher. The analysis was performed by grouping 'obese' against 'non-obese'.

In addition, the analysis considered different explanatory variables from the survey. Sociodemographic characteristics were: age, sex, autonomous community of residence, size of the municipality of residence, children's country of birth, parents' occupational social class (Annex 1), relationship of the informant with the minor, educational level of the informant, and employment status of the informant. Behavioral variables comprised: levels of physical activity, exposure to tobacco smoke, daily hours of sleep, and tooth brushing habits. Health-related factors were: self-perceived health, chronic allergy, asthma, diabetes, epilepsy, behavioral disorder, mental disorders, injuries or accidents, autism spectrum disorder, and having limitations due to health problems in the previous six months. Health services data were also collected: time since the last visit to the pediatrician or specialist; visit to the psychologist, speech therapist or nurse in the last year; hospital admission, day hospital or visit to the emergency room in the last year; and use of radiography, CT, ultrasound, and MRI in the last year. Diet-related factors were: frequency of intake of fresh fruit, dairy products, vegetables, sweets, sugary soft drinks, fast food, snacks, and natural juices, as well as adherence to a particular diet. Household variables were: number of adults; number of minors; number of bedrooms; net monthly household income; odors; poor water quality; street cleanliness; pollution; green areas; and problems with external noise, animal disturbances, or crime or vandalism.

Patient and public involvement

No patient involved

Statistical analysis

A descriptive analysis of all the data was performed by calculating frequencies for categorical variables, and minimum, maximum, mean and standard deviation values for the quantitative ones.

Factors associated with the presence of obesity were analyzed using contingency tables, applying Fisher's exact test for categorical variables, and the Mann–Whitney *U* test for comparing the means for quantitative variables.

The magnitude of associations between explanatory variables and the presence of obesity was estimated by fitting multivariable Poisson models with robust variance. Results were expressed as prevalence ratios (PR) and 95% confidence intervals (CIs). A stepwise variable selection procedure was performed based on the Akaike Information Criterion, taking into account the possible multicollinearity of the variables. Goodness-of-fit indicators were calculated, such as the likelihood ratio test (LRT) and a model calibration test.[18] To obtain representative estimates of the Spanish population, we accounted for complex sampling features by using the elevation factor of the survey divided by its mean as a weighting factor, obtaining weights centered on its mean. Statistical analysis was performed using R software (v.4.0.2).

Ethics approval statement

This study is exempt from institutional review board review because ethical approval is not required in Spain for performing analysis with anonymized data provided by the National Statistics Institute.

Results

There were 6297 eligible households (with at least one minor); of these, 6016 minors were included (response rate of 97%). The reasons for no inclusion were: 133 due to refusal to participate, 56 due to absence and 2 due to disability.[16] Of the 6106 children included in the ENSE2017 for minors, the following were excluded from the analysis: 207 children under 1 year of age, for not presenting values in the dietary variables; 733 children for missing values in weight or height; 180 children for missing data on some of the explanatory variables; and 104 children for presenting extreme values for the *z*-score (less than the 1st percentile, *z*-score < −4.3 or greater than the 99th percentile, *z*-score > 12.2). The final analyzed sample was 4882 children.

The mean age of the sample was 7.5 years (SD 4.1); 51.2% were male, 94.3% were born in Spain, and 7.3% lived in households with a net income of less than EUR 800 per month. Regarding health status, 6.1% reported fair, poor, or very poor self-perceived health, 12.2% had chronic allergy, 6.3% asthma, and 5.5 some physical limitation in the previous six months. In terms of the use of health services, 29.6% had visited the pediatrician in the previous month, and 8.3% had seen a specialist. In the year prior to the survey, 5.9% had visited a psychologist, 3.5% had been admitted to hospital, and 37.3% had visited the emergency room. Behavioral data showed sedentarism in 20.5% of respondents, while 6.3% never brushed their teeth or did so occasionally, and 6.4% had some daily exposure to tobacco smoke. Regarding diet, 5.7% consumed less than one serving of fresh fruit a week, 7.6% ate vegetables less than once a week, and 1.7% had dairy less than once a week. On the other hand, 44.2% ate sweets at least once a day, while 5.8% had sugary soft drinks, 2.8% fast food, and 1.8% salty snacks on a daily basis. About 30.1% never consumed natural juices, and 2.8% followed some diet. As far as household characteristics, 14.9% lived in dwellings with two bedrooms or less, 29.1% reported problems with external noise, and 28.8% poor access to green space (Table S1).

In 2017, 32.1% of children aged 1–14 years were above the norms for a healthy weight; prevalence of obesity was approximately 18.6% (95% CI 18.5–18.7) and overweight 13.5% (95% CI 13.4–13.6). These figures represent a total of 1,027,466 children with obesity and 744,940 children with overweight in Spain in 2017.

Table 1 shows the most noteworthy associations between explanatory variables and childhood obesity; results of the complete analysis are in Table S1. A higher prevalence of obesity was observed in younger versus older children (20.5% at 1–2 years compared to 11.3% at 11–14 years), in more disadvantaged versus more advantaged social classes (25.0% in class VI compared to 13.3% in class I), and in children from households with less versus more income (31.9% from households with less than EUR 800 net monthly income compared to 7.4% from households with more than EUR 3600 monthly income). Obesity was also more prevalent in children who had visited their pediatrician more recently (21.7% in the last month compared to 11.9% in more than a year) and in those who reported less frequent visits to a specialist (25.1% never compared to 17.9% in the last month) or a psychologist (19.1% with no visit in the previous year compared to 11.7% with a visit). Other factors associated with obesity were less physical activity (24.1% sedentary versus 15.4% with physical activity several times a week), more exposure to tobacco smoke (30.6% more than 1 h/day compared to 18.1% never or almost never), lower consumption of vegetables and greens (21.8% 1–2 servings/week compared to 18.0% 1 or more serving/day), greater consumption of sugary soft drinks (25.3% 1 or more a day vs. 15.1% 1–2 a week), lower consumption of natural juices (21.4% less than once a week vs. 14.5% more than once a day), and adherence to some diet (31.6% vs. 18.3%).

Fig. 1 shows a map of Spain along with the estimated prevalence of childhood obesity in each autonomous region. A north-south gradient is apparent, with higher prevalence in southern regions. Table 2 shows the childhood obesity prevalence ratios estimated using the multivariable Poisson model. A significantly higher adjusted prevalence was observed in the 3–5-year-olds (PR 2.05) compared to the 11–14 age group; in the Canary Islands (PR 3.81), Andalusia (PR 3.54), Murcia (PR 3.49) and Catalonia (PR 3.22) compared to Cantabria; and in sedentary children (PR 1.32) compared to those who took part in physical activity several times a week. Compared to children who never consumed sweets, the prevalence of obesity was about twice as high in children who had them regularly (1–2 times/week, PR 1.87; 3 times/week, PR 2.16; 4–6 times/week, PR 2.14; and ≥1 times/day, PR 2.03). Children with monthly household income of less than EUR 800 were also at higher risk compared to those with a monthly income over EUR 3600 (PR 3.63). Finally, obesity was associated with a lower frequency of visits to the pediatrician (PR 1.54), not having an X-ray in the last year (PR 1.45), not having chronic allergy (PR 1.49), and having asthma (PR 1.62).

Discussion

This work shows a high prevalence of overweight (13.5%) and obesity (18.6%) in children in Spain in 2017, representing nearly 750,000 children aged 1–14 years who were overweight, and more than 1 million who were obese. The variable with the largest association with childhood obesity was socioeconomic status. Prevalence of childhood obesity was 3.6 times higher in households with monthly incomes of less than EUR 800 compared to households with incomes more than EUR 3600.

International data on the prevalence of childhood obesity show a stabilization worldwide and even a decrease in countries with more

Table 1
Prevalence of obesity according to explanatory variables.

	Total		Non-obese[a]		Obese		*p* value
	n	% (column)	*n*	% (row)	*n*	% (row)	
Age							
1–2	553	11.3%	440	79.5%	113	20.5%	<0.001
3–5	947	19.4%	692	73.1%	255	26.9%	
6–10	1873	38.4%	1503	80.3%	370	19.7%	
11–14	1509	30.9%	1337	88.7%	171	11.3%	
Occupational social class[b]							
I	693	14.2%	600	86.7%	92	13.3%	<0.001
II	423	8.7%	361	85.3%	62	14.7%	
III	926	19.0%	780	84.2%	146	15.8%	
IV	598	12.3%	495	82.8%	103	17.2%	
V	1342	27.5%	1038	77.4%	303	22.6%	
VI	575	11.8%	431	75.0%	144	25.0%	
NS/NC	326	6.7%	267	81.8%	59	18.2%	
Monthly household income (EUR)							
<800	358	7.3%	244	68.1%	114	31.9%	<0.001
800–1050	364	7.5%	280	76.9%	84	23.1%	
1050–1550	757	15.5%	606	80.0%	151	20.0%	
1550–2200	751	15.4%	621	82.7%	129	17.3%	
2200–3600	1028	21.1%	858	83.5%	170	16.5%	
>3600	265	5.4%	246	92.6%	20	7.4%	
NA	1360	27.9%	1118	82.2%	242	17.8%	
Chronic allergy							
No	4286	87.8%	3463	80.8%	824	19.2%	0.005
Yes	596	12.2%	510	85.6%	86	14.4%	
Asthma							
No	4576	93.7%	3742	81.8%	834	18.2%	0.004
Yes	306	6.3%	230	75.3%	76	24.7%	
Last visit to pediatrician							
<1 month	1447	29.6%	1133	78.3%	314	21.7%	<0.001
1–12 months	2900	59.4%	2368	81.6%	532	18.4%	
>1 year or never	535	11.0%	471	88.1%	63	11.9%	
Last visit to specialist							
<1 month	405	8.3%	332	82.1%	72	17.9%	<0.001
1–12 months	1611	33.0%	1357	84.2%	254	15.8%	
>1 year	1502	30.8%	1262	84.0%	240	16.0%	
Never	1364	27.9%	1021	74.9%	343	25.1%	
Visit to psychologist in previous year							
No	4595	94.1%	3719	80.9%	876	19.1%	0.002
Yes	287	5.9%	253	88.3%	34	11.7%	
X-ray in the previous year							
No	4039	82.7%	3243	80.3%	796	19.7%	<0.001
Yes	843	17.3%	729	86.5%	114	13.5%	
Physical activity							
Sedentary	999	20.5%	759	75.9%	241	24.1%	<0.001
Occasional	1184	24.2%	939	79.3%	245	20.7%	
Several times/month	1286	26.3%	1080	84.0%	206	16.0%	
Several times/week	1413	28.9%	1195	84.6%	218	15.4%	
Exposure to tobacco smoke							
Almost never/never	4573	93.7%	3743	81.9%	830	18.1%	0.001
<1 h/day	198	4.1%	152	76.9%	46	23.1%	
>1 h/day	111	2.3%	77	69.4%	34	30.6%	
Intake of vegetables and greens							
≥1 serving/day	1499	30.7%	1228	82.0%	270	18.0%	0.001
4–6 servings/week	1229	25.2%	997	81.1%	232	18.9%	
3 servings/week	994	20.4%	836	84.1%	159	15.9%	
1–2 servings/week	786	16.1%	615	78.2%	171	21.8%	
<1 serving/week	213	4.4%	179	84.1%	34	15.9%	
Never	158	3.2%	115	72.5%	44	27.5%	
Intake of sugary soft drinks							
≥1 serving/day	282	5.8%	211	74.7%	71	25.3%	0.005
4–6 servings/week	114	2.3%	90	79.5%	23	20.5%	
3 servings/week	224	4.6%	177	79.1%	47	20.9%	
1–2 servings/week	882	18.1%	749	84.9%	133	15.1%	
<1 serving/week	1098	22.5%	895	81.6%	202	18.4%	

Table 1 (*Continued*)

	Total		Non-obese[a]		Obese		*p* value
	n	% (column)	*n*	% (row)	*n*	% (row)	
Never	2280	46.7%	1847	81.0%	433	19.0%	
Natural juice							
≥1 serving/day	709	14.5%	606	85.5%	103	14.5%	0.010
4–6 servings/week	418	8.6%	350	83.8%	68	16.2%	
3 servings/week	567	11.6%	462	81.4%	105	18.6%	
1–2 servings/week	959	19.6%	781	81.5%	177	18.5%	
<1 serving/week	756	15.5%	594	78.6%	162	21.4%	
Never	1470	30.1%	1176	80.0%	294	20.0%	
Adherence to some diet							
No	4745	97.2%	3879	81.7%	866	18.3%	<0.001
Yes	137	2.8%	94	68.4%	43	31.6%	

[a] Non-obese group: underweight, normal weight, overweight.
[b] Occupational social class: I. managers of ≥10 employees/II. Managers < 10 employees/III. Intermediate occupations and self-employed/IV. Skilled technical worker/V. Skilled worker in the primary sector/VI. Unskilled worker/NA: not available.

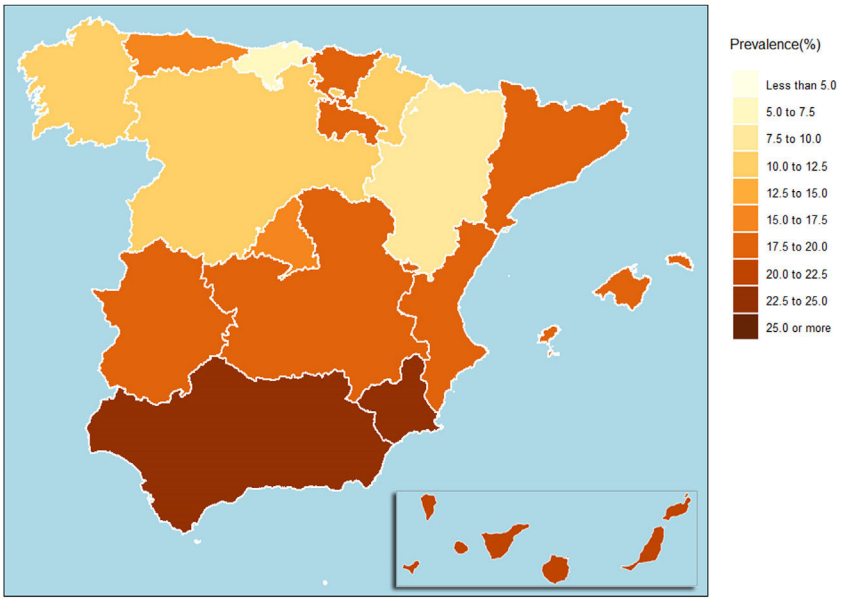

Fig. 1. Prevalence of obesity in children aged 1–14 years in Spain in 2017, by autonomous region.

economic resources.[5] Our data are in line with previous national health surveys, which have shown a modest decline in prevalence since the peak about 10 years ago.[19]

The international (International Obesity Task Force; IOTF) BMI cut-offs are widely used to estimate the prevalence of child obesity because they make it easier the comparison with other approaches.[20] Previous studies about the prevalence of child obesity in Spanish regions used the BMI-Z score to define the obesity[6,21] since, due to ease of acquisition, the BMI is the most widely used clinical outcome variable. Our results are consistent with those reporting on the pediatric population in Catalonia, where the prevalence of obesity was 17.5% in 2016 and the combined prevalence of overweight and obesity, 39%.[6] The authors of a recent study analyzed data from children aged 2 to 17 years in eight autonomous regions in Spain and found that the prevalence of overweight and obesity decreased from 2005 to 2017 in most regions.[21] Significant geographical differences were observed, with a higher prevalence in southern regions. Further research is needed to know the reasons of these differences. A similar north-south gradient was already observed in a European study, where the southern countries had a higher prevalence,[22] although those authors pointed to the loss of the Mediterranean diet in favor of a westernized one along with a more sedentary lifestyle and lack of physical activity. Notably, southern European countries also generally have a lower economic level compared to northern ones.

The strong association between socioeconomic status and obesity is well known and is consistent with the results published elsewhere[7,23] Occupational social class is closely related to socioeconomic status, so likewise a greater prevalence of obesity was observed in lower occupational social classes,[24] although the magnitude of the association was greater for income level. We were not able to detect an association between parents' country of birth and childhood obesity, as in neighboring European countries.[12] We consider that the migratory flows in Spain may be further in the past than elsewhere, allowing greater social integration. In our population, poor diet, increased consumption of sweets, and sedentary behaviors were associated with childhood obesity. Despite the present study reports a weak significant association between physical activity and obesity, probably due to the way of measuring physical activity, these factors are being tackled in multiple diet and exercise intervention programs that have been shown to be effective when used in combination.[24] Notably, even moderate intake of sweets once or twice a week was associated with nearly double the risk of obesity, compared to never consuming sweets. These data confirm the findings of previous studies,[10] highlighting the importance of diet in overweight or obese children.

Table 2
Prevalence ratios of childhood obesity, multivariable Poisson model with robust variance.

	PR	95% CI	*p* value
Sex			
Female	1.05	(0.91–1.20)	0.539
Age group			
11–14 years	1		
6–10 years	1.67	(1.37–2.03)	<0.001
3–5 years	2.05	(1.65–2.54)	<0.001
1–2 years	1.50	(1.12–2.00)	0.006
Autonomous region of residence			
Cantabria	1		
Canary Islands	3.81	(1.22–11.88)	0.021
Andalusia	3.54	(1.17–10.75)	0.025
Murcia	3.49	(1.14–10.71)	0.029
Catalonia	3.22	(1.06–9.80)	0.039
La Rioja	3.18	(0.99–10.22)	0.052
Ceuta	3.19	(0.97–10.46)	0.056
Castilla-La Mancha	3.00	(0.97–9.28)	0.057
Extremadura	2.98	(0.93–9.58)	0.066
Basque Country	2.85	(0.92–8.79)	0.068
Balearic Islands	2.79	(0.89–8.75)	0.080
Valencian Community	2.68	(0.88–8.19)	0.083
Melilla	2.84	(0.87–9.31)	0.085
Madrid	2.63	(0.86–8.04)	0.090
Asturias	2.58	(0.81–8.120)	0.11
Navarra	2.15	(0.63–7.42)	0.22
Galicia	1.87	(0.58–6.00)	0.30
Castilla y Leon	1.71	(0.53–5.52)	0.37
Aragon	1.40	(0.42–4.65)	0.58
Physical activity			
Several times a week	1		
Several times a month	1.01	(0.81–1.27)	0.91
Occasional activity	1.18	(0.95–1.46)	0.14
Sedentary	1.32	(1.05–1.65)	0.017
Intake of sweets			
Never	1		
<1 serving/week	1.66	(0.98–2.83)	0.061
1–2 servings/week	1.87	(1.17–2.99)	0.009
3 servings/week	2.16	(1.36–3.45)	0.001
4–6 servings/week	2.14	(1.32–3.44)	0.002
≥1 servings/day	2.03	(1.30–3.18)	0.002
Adherence to a diet			
Yes	2.27	(1.69–3.06)	<0.001
Net monthly household income (EUR)			
>3600	1		
2200–3600	1.96	(1.17–3.27)	0.010
1550–2200	2.13	(1.27–3.59)	0.004
1050–1550	2.46	(1.47–4.13)	0.001
800–1050	2.64	(1.55–4.51)	<0.001
<800	3.63	(2.15–6.15)	<0.001
NA	2.09	(1.26–3.47)	0.004
Last visit to pediatrician			
>1 year or never	1		
1–12 months	1.42	(1.06–1.92)	0.021
<1 month	1.54	(1.12–2.10)	0.007
X-ray in previous year			
No	1.45	(1.18–1.79)	<0.001
Chronic allergy			
No	1.49	(1.13–1.98)	0.005
Asthma			
Yes	1.62	(1.26–2.09)	<0.001

CI: confidence interval; NA: not available; PR: prevalence ratio.
$n = 4882$; N obese children = 866; likelihood ratio test = 260.1 ($p < 0.001$); Calibration test $p = 0.531$.
In bold $p < 0.005$.

More obesity was observed in children who used health services less frequently and who did not perform other health-promoting behaviors, such as tooth brushing. The association between cavities and childhood obesity has been described in other studies.[25] The national health survey does not collect analytical data on vitamin D or hours of sleep, but in other studies obesity has been related to vitamin D deficiency,[26] just as healthy sleeping habits are linked to less obesity in children[27] As in other studies, a higher prevalence of obesity was observed in children with asthma.[28] As in the adult population, cardiovascular risk factors tend to cluster in the same individuals, heightening a single person's risk of developing cardiovascular disease.[29] Along the same lines, a large study in concluded that economic subsidies in more deprived areas, taxes on unhealthy foods, and policies promoting physical activity would be the most effective measures to reduce childhood obesity.[30]

Among the limitations of our study, its cross-sectional design precludes any conclusions about the causal relationship between obesity and associated factors. In addition, other factors associated with obesity may not have been measured in the survey. The self-reported nature of the survey responses could also introduce a risk of recall bias. On the other hand, the definition of obesity using the BMI-Z score may have limitations in children under 2 years of age and may not reflect current conventions. In contrast, the large sample size, and population-based estimates, considering the elevation factor of the survey in a complex sample design, are the major strengths.

This study provides updated, representative data on the pediatric population in Spain in 2017 and describes its most relevant associations. According to these data, as in neighboring countries, in 2017 the prevalence of obesity showed signs of beginning to stabilize, but not evenly throughout the national territory. A National Health Survey in Spain is currently underway and will be published in 2025. This data will allow for analysis and comparison with our current research.

We conclude that the combined prevalence of overweight and obesity in 2017 exceeded 32% of the pediatric population in Spain, representing more than 1.7 million children. Low socioeconomic status and other factors such as poor diet or sedentarism were the main factors associated with childhood obesity. Although the cross-sectional design of this study prevents establishing causality, the study findings allows set very cautious hypotheses about the observed associations to be explored in future studies. Prevalence estimates show geographical disparities, with the southern regions standing out as the most affected. Further research with more specific study objectives is needed to clarify aspects such as the socioeconomic factor or the differences of prevalence between regions.

Strengths and limitations of this study

- The major strengths are large sample size and population-based estimates, taking into account the elevation factor of the survey in a complex sample design.
- The cross-sectional design precludes any conclusions about the causal relationship between obesity and associated factors.
- Other factors associated with obesity may not have been measured in the survey.
- The self-reported nature of the survey responses could also introduce a risk of recall bias.

Authors' contributions

All authors contributed to the design of this study. Jose Antonio Quesada asked for the study data and performed the statistical analysis. All authors contributed to the interpretation of the results.

Francisco Sanchez, Ana Pilar Nso and Jose Antonio Quesada drafted the manuscript. Vicente Bertomeu, Juan Miguel Ruiz and Adriana Lopez revised this manuscript critically. All authors approved the final version of this manuscript.

Ethical considerations

This study is exempt from institutional review board review because ethical approval is not required in Spain for performing analysis with anonymized data provided by the National Statistics Institute.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflict of interests

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.medcli.2024.02.016.

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