ALADINO 2019

BRIEF REPORT

SURVEILLANCE STUDY ON NUTRITION, PHYSICAL ACTIVITY, CHILD DEVELOPMENT AND OBESITY

September 2020

INDEX

1. Introduction

Childhood obesity is one of the main public health problems in Europe and it is associated, along with overweight, to numerous health complications in adulthood, such as diabetes and cardiovascular diseases. In response, after the WHO European Ministerial Conference on Counteracting Obesity in 2006, the WHO European Childhood Obesity Surveillance Initiative (COSI Euro WHO) was established (1). COSI is a harmonized surveillance system that measures trends in overweight and obesity among schoolchildren in order to monitor the progression of the epidemic and so as to allow intercountry comparisons. Thus, COSI helps to improve the knowledge of the problem and the evaluation of the executed policies and measures.

The Spanish Agency for Food Safety and Nutrition (AESAN, for its initials in Spanish), through the Nutrition and Obesity Study Observatory, started the childhood obesity surveillance in Spain within the Spanish strategy for nutrition, physical activity and prevention of obesity (NAOS, for its initials in Spanish) and the Sustainable Development Goals 2030. Thus, Spain participates in the COSI initiative through the "ALADINO Surveillance Study on Nutrition, Physical Activity, Child Development and Obesity" that the AESAN has periodically carried out since 2011.

Since the first edition of ALADINO study in 2011, the magnitude of the childhood obesity problem in Spain was revealed, with 26.2% and 18.3% overweight and obesity prevalence respectively in schoolchildren from 6 to 9 years old. Subsequently, the ALADINO 2013 study (7 and 8-year-old schoolchildren) showed a stabilization with a downward trend in overweight and obesity prevalence. The ALADINO 2015 study (schoolchildren from 6 to 9 years old) showed a reduction in the overweight prevalence (23.2%), while obesity remained stable (18.1%) (2).

The data collected in the ALADINO 2019 Study allow us to know the overweight and obesity childhood prevalence in Spain in 2019 and to analyze their evolution in the last 4 years.

2. Study design and sample size

Study design:

ALADINO 2019 is an epidemiological study with a descriptive cross-sectional design of Spanish schoolchildren aged 6–9 years old. Anthropometric data and other obesity risk factors were collected using questionnaires translated from COSI Euro WHO models into Spanish and co-official languages. Both design and methodology have been developed in accordance with COSI's protocols and recommendations (3).

Sample design:

The sampling method used was a multi-stage cluster sampling with stratification of primary stage units (schools). Stratification criteria were the Autonomous Community (19 territorial strata: 17 autonomous communities, Ceuta and Melilla) and the habitat corresponding to the municipalities where the schools are located (4 habitat strata: ≤10,000 residents, excluding ≤2,000 residents; 10,001-100,000 residents; 100,001-500,000 residents. and >500,000 residents.) (4).

Four age groups were also considered (6.0 to 6.9; 7.0 to 7.9; 8.0 to 8.9; 9.0 to 9.9 years). As a result, the sampling frame was made up of students from 1st to 4th year of primary education in public or private schools from all the Autonomous Communities (5).

The sampling allocation by Autonomous Community, and by habitat stratum in each Autonomous Community, was proportional to the number of schools in each stratum. A three-stage cluster sampling was performed: 1st) selection of first stage units (school) by strictly random sampling in each stratum, 2nd) selection of second stage units (classrooms of each course/school) by simple random sampling with equal probability and 3rd) selection of sample elements (schoolchildren aged 6 to 9), which were determined by the center and classroom selection. In the third stage, subsampling was not used, and all schoolchildren present on the day of the visit from each classroom selected who had the consent signed by their parents/guardians for the measurements were included.

Sample size:

276 schools (of the 432 contacted) have been studied, being the final sample size **16,665 schoolchildren** (Table 1). In addition to the basal sample (11,200 schoolchildren from 170 schools), 5,465 schoolchildren from 106 schools from six autonomous communities (Andalucía, Canarias, Cantabria, Murcia, País Vasco y La Rioja) were also enrolled to obtain an enlarged sample representative of their respective territories. The analysis section indicates weighting factors applied to maintain the representativeness of the total sample.

Table 1.- Total sample included in the study by sex and age groups

	Boys		Girls		Total	
	n	%	n	%	n	%
6 years	2,054	12.3	2,024	12.1	4,078	24.5
7 years	2,254	13.5	2,033	12.2	4,287	25.7
8 years	2,257	13.6	2,193	13.2	4,450	26.7
9 years	1,948	11.7	1,902	11.4	3,850	23.1
Total	**8,513**	**51.1**	**8,152**	**48.9**	**16,665**	**100**

n-number of valid cases

Fieldwork:

Visits to the schools started in October 2019 and were completed in December 2019, before the beginning of Christmas.

Once they had received an information letter and signed the informed consent, the parents or caregivers of schoolchildren in the selected classrooms completed a family questionnaire. The school responsible also completed a school environment questionnaire. School children's anthropometric variables (weight, size, waist and hip circumference) were measured by trained personnel, under standardized conditions with calibrated equipment.

Data were anonymized for further processing.

Study variables:

Anthropometric variables measured in schoolchildren:
Weight, height, waist and hip circumference.

Family questionnaire:

- Parent's weight and height (self-reported data).
- Eating habits: breakfast and weekly food consumption frequency.
- Physical activity: extracurricular sports activities, intense physical activity, sedentary lifestyle, availability of screens in the bedroom.
- Average sleep times.
- Family socioeconomic situation.
- History of the first year of life: average weight at birth and breastfeeding.

School environment questionnaire:
Free availability of water, fruit and vegetables; dining options; availability of sports facilities and physical activity.

Analysis:

The valid final sample deviates from the proportional allocation by including the enlarged sub-samples in certain Autonomous Communities. For this reason, weighting factors by sex, age and Autonomous Communities have been applied in the estimation process. In addition, bootstrapping techniques have been applied to the calculation of 95% confidence intervals (95% CI).

Quantitative variables are expressed as means and standard deviations (SD), while qualitative variables are reported as percentages and confidence intervals. Comparisons were made using the following statistical tests: Chi-square test to verify the association between qualitative variables, Z-test to compare proportions, with Bonferroni's correction to adjust the significance values in multiple comparisons, and for quantitative variables the t-test was used, adjusting the p-values by correcting Bonferroni for multiple samples. Significant differences have been considered when $p<0.05$.

Ethic committee approval:

The ALADINO 2019 study (including the enlargements of the six autonomous communities) has obtained the approval of the Ethical Committee of Clinical Research of the *Hospital Clínico San Carlos* in Madrid (Spain).

3. Main Results

3.1. Prevalence of overweight and obesity by sex and age according to WHO growth standards.

The ALADINO 2019 study shows that the **prevalence of overweight is 23.3% and the prevalence of obesity is 17.3%** in schoolchildren aged 6 to 9 in Spain, according to WHO growth standards. Within obesity, 4.2% schoolchildren have **severe obesity.**

By sex, the prevalence of overweight is higher in girls than in boys (24.7% vs 21.9%; $p<0.05$). However, the prevalence of both obesity and severe obesity are higher in boys than in girls (19.4% vs 15.0%; $p<0.05$ and 6.0% vs 2.4%; $p<0.05$, respectively) (Tables 2-3, Figures 1-2).

By age group, the prevalence of overweight in boys is higher in the 9-year-old group compared to the younger age groups, whereas the prevalence of obesity increases in 7-year-old boys, stabilizing after that age. In girls, the prevalence of overweight does not change with age, while obesity increases until the age of 8.

The **prevalence of central obesity** is 22.6% in the total sample, with no differences between boys (22.4%) and girls (22.9%).

Table 2.- Prevalence of body mass index categories according to WHO growth standards for the whole sample and by sex						
Body mass index categories	Boys		Girls		Total	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Underweight	1.1	(0.9-1.3)	0.8	(0.5-0.9)	0.9	(0.8-1.0)
Normal weight	57.6	(56.5-58.6)	59.5	(58.4-60.6)	58.5	(57.7-59.2)
Overweight	**21.9**	(21.0-22.9)	**24.7**	(23.8-25.7)	**23.3**	(22.6-24.1)
Obesity	**19.4**	(18.6-20.2)	**15.0**	(14.2-15.8)	**17.3**	(16.8-17.8)
TOTAL	**100**	-	**100**	-	**100**	-
Severe obesity	6.0	(5.5-6.5)	2.4	(2.0-2.8)	4.2	(3.9-4.5)
Excess weight	41.3	(40.3-42.3)	39.7	(38.6-40.7)	40.6	(39.8-41.3)
Central obesity	22.4	(21.5-23.3)	22.9	(21.9-23.9)	22.6	(22.0-23.2)

Table 3.- Prevalence of body mass index categories according to WHO growth standards for the national sample and by sex and age								
	6-year-old		7-year-old		8-year-old		9-year-old	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total								
Underweight	0.6	(0.3-0.9)	0.9	(0.7-1.2)	1.0	(0.7-1.3)	1.2	(0.9-1.5)
Normal weight	64.1	(62.6-65.6)	59.6	(58.1-61.0)	56.8	(55.4-58.2)	54.0	(52.3-55.6)
Overweight	**21.9**	(20.7-23.2)	**22.7**	(21.4-23.9)	**22.8**	(21.6-24.2)	**25.6**	(24.3-27.0)
Obesity	**13.4**	(12.3-14.6)	**16.8**	(15.5-18.2)	**19.4**	(18.0-20.7)	**19.2**	(17.9-20.4)
Severe obesity	4.6	(3.9-5.2)	4.8	(4.2-5.5)	4.4	(3.8-5.0)	3.2	(2.7-3.7)
Excess weight	35.3	(34.0-36.7)	39.5	(38.0-41.2)	42.2	(40.7-43.6)	44.8	(43.2-46.4)
Central obesity	22.7	(21.4-24.0)	20.4	(19.1-21.6)	23.2	(21.9-24.5)	24.1	(22.8-25.3)
Boys								
Underweight	0.7	(0.4-1.2)	1.1	(0.8-1.5)	1.1	(0.7-1.5)	1.4	(1.0-2.0)
Normal weight	64.1	(62.0-66.2)	59.6	(57.8-61.4)	56.5	(54.4-58.3)	50.7	(48.6-52.8)
Overweight	**20.6**	(18.7-22.5)	**20.2**	(18.5-21.9)	**21.2**	(19.5-23.0)	**25.5**	(23.5-27.7)
Obesity	**14.6**	(12.7-16.5)	**19.1**	(17.4-20.8)	**21.2**	(19.5-23.0)	**22.4**	(20.4-24.6)
Severe obesity	6.3	(5.4-7.3)	6.3	(5.3-7.4)	6.3	(5.4-7.2)	5.2	(4.3-6.2)
Excess weight	35.2	(33.0-37.2)	39.3	(37.3-41.5)	42.4	(40.6-44.2)	47.9	(45.8-50.1)
Central obesity	21.1	(19.2-22.9)	19.9	(18.2-21.8)	23.2	(21.5-25.1)	25.1	(23.3-26.9)
Girls								
Underweight	0.3	(0.1-0.6)	0.7	(0.4-1.0)	0.9	(0.5-1.4)	1.0	(0.4-1.7)
Normal weight	64.1	(61.9-66.2)	59.7	(57.5-61.7)	57.2	(55.2-59.3)	57.5	(55.1-59.8)
Overweight	**23.3**	(21.6-25.1)	**25.3**	(23.5-27.3)	**24.5**	(22.7-26.2)	**25.7**	(23.7-27.8)
Obesity	**12.3**	(10.5-14.0)	**14.3**	(12.5-16.3)	**17.4**	(15.6-19.1)	**15.8**	(13.8-17.9)
Severe obesity	2.8	(2.1-3.7)	3.3	(2.5-4.1)	2.3	(1.7-3.0)	1.0	(0.5-1.5)
Excess weight	35.6	(33.6-37.7)	39.6	(37.6-41.7)	41.9	(39.9-44.4)	41.5	(39.3-43.8)
Central obesity	24.5	(22.7-26.4)	20.9	(19.1-22.9)	23.2	(21.3-25.0)	22.9	(21.0-24.8)

Figure 1. Prevalence of body mass index categories according to WHO growth standards by sex

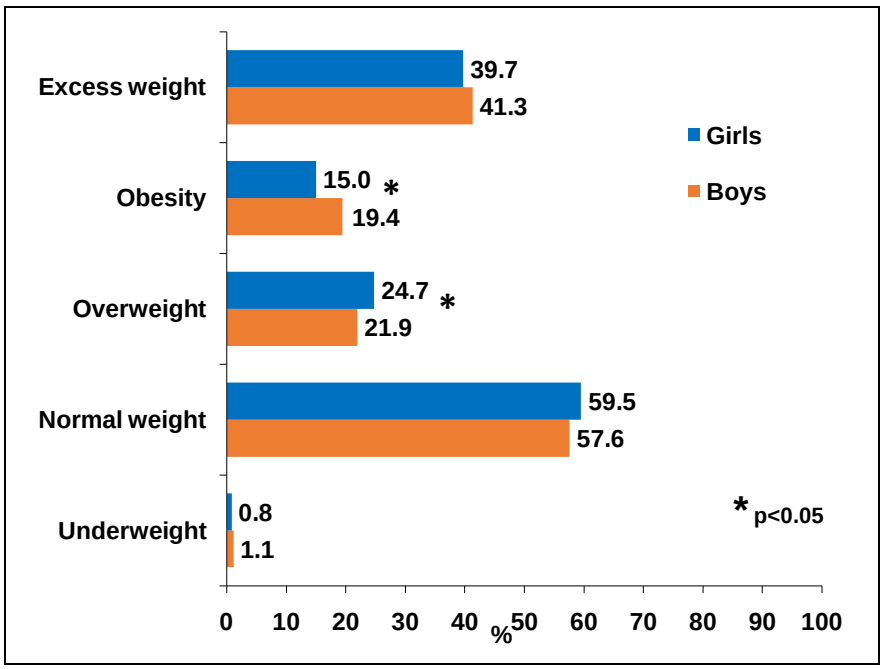
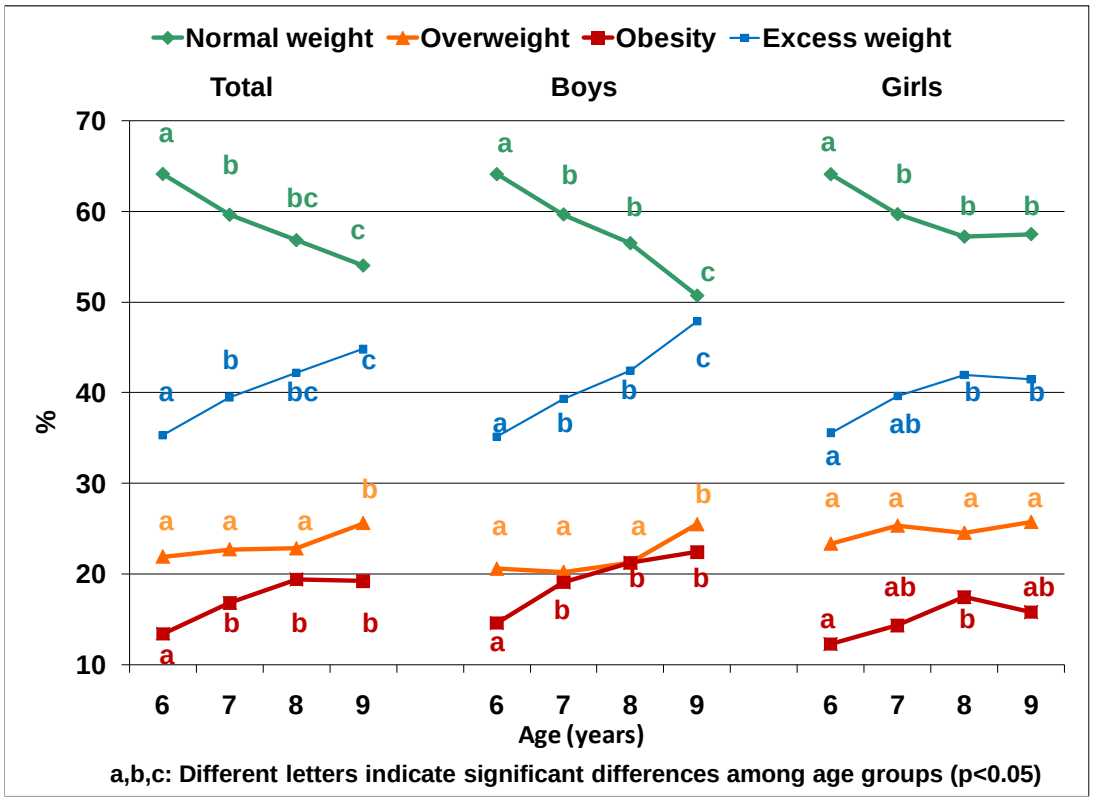


Figure 2. Prevalence of body mass index categories according to WHO growth standards by sex and age



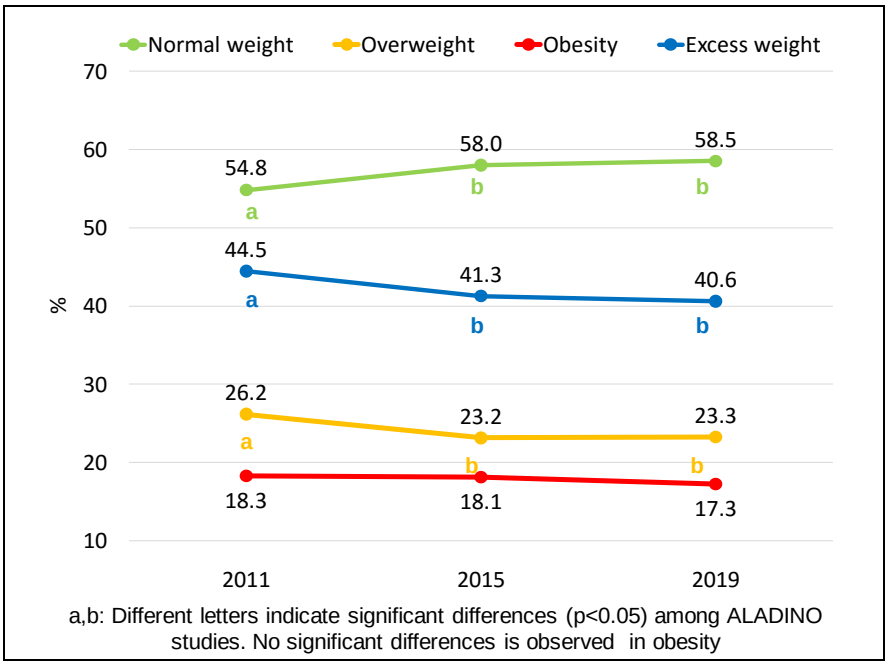
3.2. Trends in overweight and obesity prevalence among schoolchildren aged 6–9 between ALADINO 2011 study and ALADINO 2019 study

Data show that from 2011 to 2019 there has been a significant decrease in excess body weight (overweight and obesity) (-3.9%) and overweight (-2.9%). Moreover, the decrease in the prevalence of obesity was close to being statistically significant and the prevalence of normal weight children increased significantly (3.7%).

By sex, only the decrease in overweight and the increase in normal weight boys was statistically significant. Similarly to the global results, the decrease in the prevalence of obesity in boys was close to being significant.

A stabilization of all body mass index categories is observed in the 2015-2019 period, without any statistically significant change between them (Figure 3).

Figure 3. Trends in body mass index categories between ALADINO 2011 and ALADINO 2019 Study (total sample)



a,b: Different letters indicate significant differences (p<0.05) among ALADINO studies. No significant differences is observed in obesity

3.3. Parental perception of children's weight status

In the analysis of the parental perception of the weight status of their child compared to the child´s actual weight status according to the WHO standards, it was observed that 69.1% of actual "excess weight" schoolchildren (88.6% with overweight; 42.7% with obesity) were classified as "normal weight" by their parents. In addition, 67.1% of schoolchildren with severe obesity, were perceived as "slightly overweight" by their parents (Table 4).

Table 4.- Parental perception of child's weight status according to WHO standards							
Parental perception	Actual weight status (base on WHO standards)						
	Total	Underweight	Normal weight	Overweight	Obesity	Severe obesity	Excess weight
	%	%	%	%	%	%	%
Underweight	5.7	42.2	8.7	0.7	0.2	0.4	0.5
Normal weight	81.7	**56.7**	90.7	**88.6**	**42.7**	**19.1**	**69.1**
Slightly overweight	11.7	**1.1**	0.5	10.5	52.3	**67.1**	**28.3**
Very overweight	0.9	0.0	0.1	0.2	4.8	13.4	2.1

3.4. Main factors associated with schoolchildren weight excess: eating habits, physical activity patterns, sleeping habits and family socioeconomic characteristics.

3.4.1 Schoolchildren eating habits

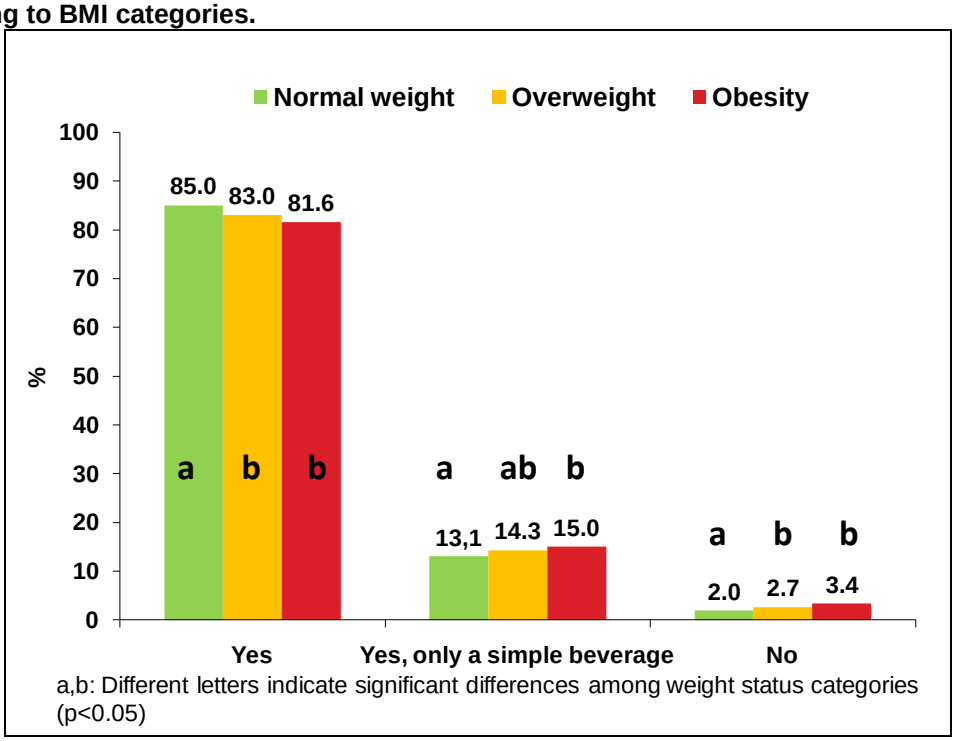
The present study has evaluated different factors related to eating habits which are associated with the schoolchildren weight status. The highlights are as follows:

- Breakfast: according to families, 80.6% of schoolchildren eat something more than just a glass of milk or juice every day or almost every day ([1]). This percentage was significantly higher in schoolchildren with normal weight. In addition, 97.6% of schoolchildren reported having breakfast on the study day. These data are similar to those of ALADINO 2015, although the percentage that reported having had more than just a beverage for breakfast increased (from 81.9% in 2015 to 83.9% in 2019).

  Moreover, according to weight status, the percentage of schoolchildren who reported having breakfast on the day of the study was significantly lower in those with overweight and obesity than in normal weight children (normal weight: 98.1%, overweight: 97.3% and obesity: 96.6%; $p<0.05$) (Figure 4).

[1] This data is not comparable to that obtained in 2015 due to a change in the formulation of the question.

Figure 4. Percentage of schoolchildren who report having had breakfast on the study day according to BMI categories.



a,b: Different letters indicate significant differences among weight status categories (p<0.05)

- 82.4% of families reported that schoolchildren usually include milk, 57.5% biscuits, 54.1% bread or toasts, 45.2% breakfast cereals and other cereals, and 20.1% fresh fruit in their breakfast. The percentage of schoolchildren who include milk and biscuits was higher in boys (83.5% and 58.7%) than in girls (81.3% and 56.1% respectively). In contrast, there were fewer boys who include fresh fruit (18.7% in boys and 21.5% in girls). 12.2% of schoolchildren usually include pastries in their breakfast (12.8% boys, 11.6% girls; p<0.05).
- According to weight status, a significantly lower percentage of schoolchildren with obesity include biscuits (53.3%) and fresh fruits (18.1%) in their breakfast, compared to normal weight children (58.4% and 20.6% respectively; p<0.05). Moreover, the percentage of schoolchildren with obesity that include milk was higher than in normal weight children (82.8% vs.81.8%).
- 68.0% of schoolchildren eat fresh fruit every day or almost every day (at least 4 days/week). The percentage was higher in girls than in boys (69.0% vs. 66.9%) and was higher in children with normal weight (69.5%) or overweight (69.3%) than in children with obesity (61.3%) (p<0.05).

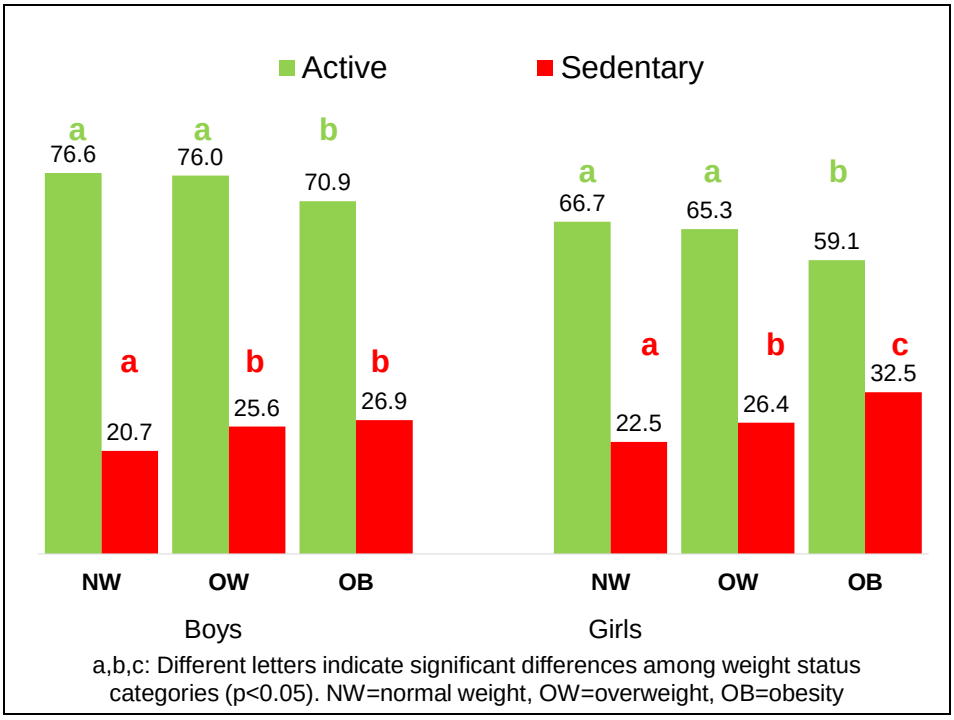
3.4.2 Physical activity patterns in schoolchildren

Regarding the practice of physical activity by schoolchildren reported by their parents, the percentage of boys enrolled in extracurricular sports activities was higher than that of girls (75.9%

vs 72.0%; p<0.05). These data are similar to those observed in the ALADINO 2015 study. According to weight status, the percentage of boys with obesity practicing sports activities outside school hours (71.1%) was also significantly lower than those with overweight (74.2%), and normal weight (75.0%) (p<0.05).

Concerning the physical activity intensity, the percentage of boys with intense physical activity (≥1 h/day, every day) was higher than that of girls (75.4% vs 65.2%; p<0.05). A slightly higher percentage of girls (25.0% vs. 23.0%; p <0.05) can be considered sedentary (≥3 h/day, every day, of reading, doing homework or screen time) (Figure 5). According to weight status, among those who have obesity (both in girls and boys), there was a significantly lower percentage of active schoolchildren and a higher percentage of sedentary compared to other weight status groups.

Figure 5. Percentage of schoolchildren active (intense physical activity) or sedentary, according to sex and weight status



a,b,c: Different letters indicate significant differences among weight status categories (p<0.05). NW=normal weight, OW=overweight, OB=obesity

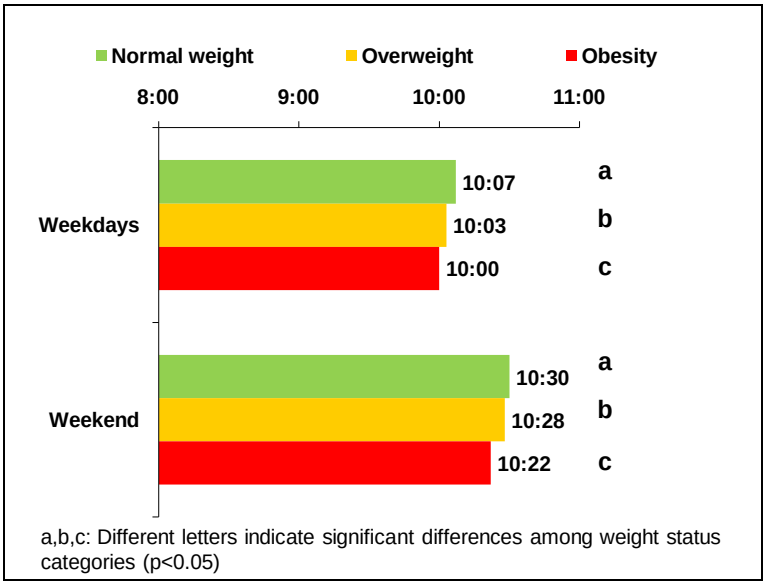
Finally, regarding the availability of screens, 21.6% of schoolchildren had a TV or DVD and 9.9% had a game console in their bedroom. In addition, these percentages were higher in boys and in children with obesity (p<0.05) (Table 5).

Table 5. Percentage of schoolchildren with availability of screen in their bedroom						
	Total (%)	Sex		Weight status		
		Boys (%)	Girls (%)	Normal weight (%)	Overweight (%)	Obesity (%)
Computer	7.2	7.1 a	7.3 a	6.8 a	6.8 a	9.0 b
TV/DVD	21.6	22.4 a	20.7 b	19.2 a	23.1 b	27.7 b
Game console	9.9	14.5 a	4.9 b	9.0 a	9.5 a	13.5 b
a,b,c: Different letters indicate significant differences between sex or among weight status categories (p<0.05).						

3.4.3 Sleeping habits

Sleep duration declared by parents was 10 h:05 min ± 0:37 min on weekdays and 10 h:28 min ± 0:54 min on weekends. The sleep time was slightly lower in children with obesity than in children with overweight or normal weight (Figure 6). This trend has already been observed in previous ALADINO studies.

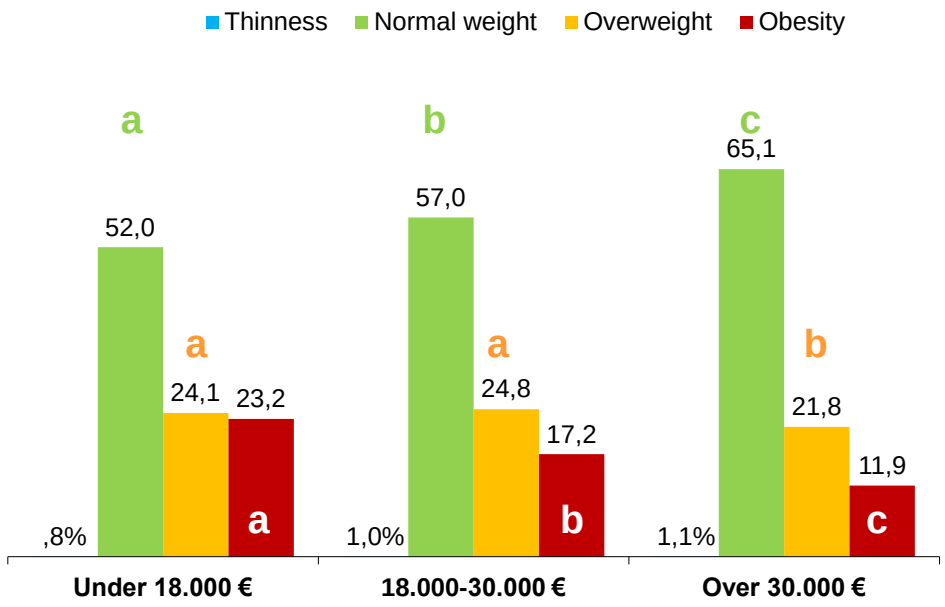
Figure 6. Sleep duration (hours/day) according to schoolchildren weight status



3.4.4 Family socioeconomic characteristics

The prevalence of obesity was significantly higher in children from family settings with incomes of less than 18,000€/year compared to those with higher incomes. These data were similar in the ALADINO 2011 and 2015 studies. The percentage of children with overweight was higher in low and middle-income families than in high-income families (Figure 7).

Figure 7. Weight status schoolchildren according the family income



a,b,c: Different letters indicate significant differences among weight status categories (p<0.05)
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3.5. Other factors related to excess weight

Regarding the **first year of life** variables declared by parents, birth weight was higher in children with overweight (3,249 ± 564 g) and obesity (3,319 ± 605 g) than in children with underweight (2,974 ± 653 g) or normal weight (3172 ± 578 g), in both sexes.

The percentage of schoolchildren with obesity who received breastfeeding (77.8%) was significantly lower than that of schoolchildren with overweight (80.9%) or normal-weight (81.2%) (p <0.05).

These results were similar in the previous ALADINO 2011 and 2015 studies.

3.6. School environment

Regarding the **availability of food and beverages** in the school environment, the product with the highest free availability is water (77.5% of schools), followed by fresh fruit (33.4%) and vegetables (15.7 %).

91.5% of the schools have a canteen. Among these, 49.2% have their own kitchen facilities and 48.2% have an external supplier providing the canteen food services.

97.8% of the schools have outside playgrounds and 77.8% have inside play areas (gym). 77.1% of the schools allow pupils to use the playgrounds outside school hours, but only 34.2% of the

schools allow pupils to use inside play areas outside school hours. Finally, 65.0% of the schools organize some sports or physical activities at least once a week outside school hours.

4. Conclusions

Schoolchildren (aged 6 to 9 years) weight status in Spain:

1. In 2019 the prevalence of **overweight and obesity was 23.3% and 17.3%,** respectively.
2. From 2011 to 2019 a decrease in **overweight** (**2.9%,** significant both in the global results and in boys), **obesity** (**1.0%,** close to being significant in the global results as well as in boys) and **excess weight (overweight and obesity) (3.9%)** was observed. The decrease was more pronounced between 2011 and 2015, with a trend towards stabilization in the 2015-2019 period, in which the decrease was not statistically significant.
3. In 2019, the prevalence of **central obesity was 22.6%** in the total sample, with no differences between boys (22.4%) and girls (22.9%).
4. According to sex, **overweight** was significantly **more prevalent in girls** (24.7% girls vs. 21.9% boys), and **obesity** (including severe obesity) was significantly **more prevalent in boys** (Obesity: 19.4% boys vs. 15.0% girls; Severe Obesity: 6.0% boys vs. 2.4% girls).
5. According to age, the prevalence of **overweight in boys was higher in those aged 9** and the prevalence of **obesity was higher in boys aged 7, 8 and 9**, compared to younger age groups. In girls, there were no age differences in overweight, while prevalence of obesity increased from 6 to 8 years.
6. 69,1% of the parents of schoolchildren with excess weight consider the weight of their children as normal (overweight: 88.6%; obesity: 42.7%; severe obesity: 19.1%).

Eating habits, physical activity patterns and sleeping habits:

1. According to families, 80.6% of schoolchildren ate something more than a glass of milk or juice for breakfast every day or almost every day. 97.6% of schoolchildren reported having breakfast on the day of the study, similar to 2015. Both percentages were significantly higher in schoolchildren with normal weight.
2. Children with obesity practiced less physical activity (extracurricular sports activities or intense physical activity more than 1 hour per day everyday), were sedentary more frequently and had screens in their room more frequently than the other schoolchildren.
3. Schoolchildren with overweight and obesity slept less than normal-weight schoolchildren.
4. The prevalence of overweight and obesity was significantly higher in schoolchildren from families with a lower income level compared to those with a higher income.

School environment:

1. In relation to food services, 9 out of 10 schools offered a canteen service, half of which had their own kitchen facilities. Water was offered for free in 3 out 4 schools (77.5%). Also 33.4% of the centers provided fresh fruit for free to schoolchildren, and 15.7% provided free vegetables.
2. Regarding the availability of resources for physical activity, more than 90% of the schools had outdoor recreation areas and approximately 80% indoor gymnasium. Moreover, 8 out of 10 schools allowed pupils to use the playgrounds outside school hours, but only 3 out of 10 schools allowed pupils to use inside play areas.

5. References

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