



## Relationship of breakfast with the level of physical activity and anthropometric variables in primary school children

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### Abstract

**Background:** the aim of the study was to assess the association between breakfast and the level of physical activity and different anthropometric variables in children attending primary school.

**Methods:** we performed a cross-sectional study ( $n = 248$ ; age,  $10.25 \pm 1.45$  years). We obtained the items to assess breakfast from the KIDMED questionnaire on the adherence to the Mediterranean diet. We assessed physical activity by means of the Spanish version of the Physical Activity Questionnaire for Children (PAQ-C) and calculated the body mass index with the Quetelet equation.

**Results:** 10.5% of the schoolchildren did not eat breakfast routinely, and children that skipped breakfast were older ( $p < 0.013$ ), taller ( $p < 0.005$ ) and had lower levels of physical activity ( $p < 0.001$ ). We found a significant tendency toward an increased BMI in those that consumed industrial baked goods at breakfast ( $p < 0.058$ ). We found significant proportions of boys and girls that ate this type of food at breakfast (77.6% versus 80.9%). A higher proportion of boys ate breakfast compared to girls ( $p < 0.021$ ). In the female subgroup, girls that had breakfast habitually were significantly younger ( $p < 0.022$ ), of shorter stature ( $p < 0.034$ ) and had a higher level of physical activity ( $p < 0.006$ ). The logistic regression analysis revealed that eating breakfast ( $p < 0.015$ ), consuming dairy at breakfast ( $p < 0.001$ ) and consuming cereal ( $p < 0.005$ ) were associated with a higher level of physical activity.

**Conclusions:** based on these findings, health professionals and educators in the public school system should cooperate with parents to prioritise interventions to promote and maintain healthy breakfast habits in primary school children.

#### Key words:

- Anthropometry
- Breakfast
- Children
- Physical activity

### Resumen

## Relación del desayuno con el nivel de actividad física y variables antropométricas en escolares de primaria

**Fundamentos:** el objetivo fue analizar la relación del desayuno con el nivel de actividad física y variables antropométricas en escolares de Educación Primaria.

**Métodos:** estudio transversal ( $n = 248$ ;  $10,25 \pm 1,45$  años). Los ítems del desayuno fueron extraídos mediante el test de adhesión a la dieta mediterránea KIDMED. La actividad física (AF) se evaluó a través del Physical Activity Questionnaire in Spanish Children (PAQ-C) y para el cálculo del índice de masa corporal (IMC) se empleó el índice de Quetelet.

**Resultados:** el 10,5% de los escolares no desayuna habitualmente, obteniendo estos escolares mayores promedios en edad ( $p < 0,013$ ), talla ( $p < 0,005$ ) y menor nivel de AF ( $p < 0,001$ ). Se observó una tendencia significativa a una mayor puntuación en el IMC para aquellos que desayunan bollería industrial ( $p < 0,058$ ). Tanto varones como mujeres obtuvieron porcentajes similares en consumir este tipo de alimento (77,6 frente a 80,9%). Los varones obtuvieron una mayor prevalencia en desayunar que las mujeres ( $p < 0,021$ ). En mujeres, aquellas que desayunan habitualmente presentaron significativamente menor edad ( $p < 0,022$ ), talla ( $p < 0,034$ ) y mayor nivel de AF ( $p < 0,006$ ). El análisis de regresión logística reflejó que la ingesta de desayuno ( $p < 0,015$ ), tomar un lácteo ( $p < 0,001$ ) y cereal ( $p < 0,005$ ) se asocia con un nivel mayor de AF.

**Conclusiones:** sobre la base de estos resultados, se pone de manifiesto que los profesionales de la salud pública y educativa en cooperación con los padres deben priorizar las acciones que motiven a los escolares de Educación Primaria a mantener un hábito del desayuno saludable.

#### Palabras clave:

- Actividad física
- Antropometría
- Desayuno
- Niños

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## INTRODUCTION

Nutrition is the most important extrinsic determinant of growth during childhood.<sup>1</sup> At the physiological level, the organism needs energy and nutrients,<sup>2</sup> especially after long hours of fasting,<sup>3</sup> as the gradual decline of insulin and glucose levels—among other metabolic changes—during a prolonged fast may elicit mental and physical fatigue.<sup>4</sup>

The first meal of the day breaks this fast and is thus referred to as breakfast. It has been identified as the meal from which the organism absorbs the most nutrients.<sup>5</sup> Therefore, eating breakfast may be key to be able to adequately carry out physical and mental activities during the school day.<sup>6</sup> However, recently developed lifestyles have led to changes in the traditional distribution of nutrient consumption, modifying breakfast habits, and the recurrence of these new habits may lead to nutritional imbalance.<sup>7,8</sup>

There is a large amount of data from six nationwide dietary surveys related to recommendations on breakfast dietary patterns,<sup>9</sup> but there is a dearth of scientific data on what constitutes a highly nutritional breakfast.<sup>10</sup> It seems reasonable that for this meal to be healthy, it needs to include foods with the best possible nutritional profile so that overall dietary intake follows a healthier pattern.<sup>11</sup> Some studies suggest that a balanced breakfast should include at least 20% to 25% of the daily recommended energy intake,<sup>12</sup> one food from each food group, and portions that are appropriate for the individual's weight, height and sex.<sup>5</sup>

The dietary guidelines published in Spain suggest that the dietary quality of breakfast could improve considerably.<sup>13</sup> Furthermore, research shows that the differences between school-aged children do not involve the composition of breakfast as much as whether this meal is consumed or skipped.<sup>3</sup> The age group corresponding to the highest proportion of children that consume breakfast is the 7 to 9 years group<sup>14</sup>; after which there is a progressive decline in the quality of breakfast as age increases.<sup>15</sup>

Some studies show that female individuals are more likely to have breakfast in all age groups,<sup>14</sup> but others have reported a higher quality of breakfast in male individuals<sup>16</sup> and others have not found any association between sex and breakfast.<sup>17</sup> This disagreement also extends to the average proportion of individuals that skip breakfast, which ranges from 65%<sup>14</sup> to 75% in Portuguese children.<sup>18</sup> Breakfast, like other meals eaten through the day, is often influenced by cultural factors that result in dietary habits that are not healthy.<sup>7,19</sup>

Numerous studies have found an association between consumption of an adequately nutritious breakfast and improved academic performance<sup>11</sup> and mental health.<sup>20</sup> It has also been associated with the prevention of chronic diseases in adulthood (diabetes, cancer, cardiovascular diseases)<sup>6</sup> and type 2 diabetes<sup>2</sup> as well as a decreased risk of excess weight.<sup>21</sup>

This is one of the most extensively studied aspects in relation to breakfast.<sup>22</sup> A study conducted in Cyprus in children found that those who ate breakfast regularly had lower body mass indices (BMIs), weight circumferences, percentages of body fat and fasting blood glucose levels compared to children who skipped breakfast,<sup>23</sup> as skipping breakfast combined with the prolonged nocturnal fast leads to higher levels of circulating insulin in response to the consumption of foods later in the day, which can lead to increased fat storage and weight gain.<sup>7</sup> A cross-cultural study found a strong association between these variables that was independent from socioeconomic and cultural differences between the different countries it included.<sup>24</sup> However, several cross-sectional studies have not found a significant association between breakfast and body composition.<sup>25</sup>

Another of the aspects linked to breakfast is the level of physical activity (PA), which is an important and well-known factor in healthy lifestyles.<sup>8,26</sup> In its Dietary Guidelines, the Sociedad Española de Nutrición Comunitaria (Spanish Society of Community-Based Nutrition, SENC) recommends a minimum of 1 hour of physical activity a day (walking

10 000 steps during the day)<sup>13</sup> as part of a healthy diet. Some studies suggest that skipping breakfast is associated with low levels of PA.<sup>27</sup> However, cross-sectional and longitudinal studies that used objective measures of physical PA did not find an association between having breakfast and the level of physical activity.<sup>25</sup>

Based on this background, the current scientific literature is not conclusive as regards the association of breakfast with other healthy lifestyle habits in different stages of life.<sup>28</sup> Thus, we designed our study to analyse the association of breakfast with the level of PA and different anthropometric variables in primary education students.

## MATERIALS AND Y METHODS

### Study design

We conducted a cross-sectional ex post facto study in a sample of children enrolled in 2 public primary education schools (ages 8-12 years) in an urban area of a city in the Region of Murcia (Spain). Before initiating the study, we held meetings with the school administrators to inform them about the study protocol and request their informed consent for the participation of the schoolchildren. We also obtained the informed consent of the parents of the participants. We excluded from the study any students for whom we did not obtain informed consent.

The sample included 248 students (107 male [43.1%] and 141 female [56.9%]; age mean  $\pm$  standard deviation: 10.25  $\pm$  1.45 years) selected at random. We took measures to protect personal data, safeguarding the rights, safety and wellbeing of participants. All the schoolchildren participated voluntarily, in adherence with the ethical principles for research established in the Declaration of Helsinki (2013).

Weight was measured with a digital scale accurate to 100 g (TANITA TBF 300A, USA) and height with a stadiometer accurate to 1 mm (SECA A800, USA) by level I certified personnel following the International Standards for Anthropometric Assessment

protocol, and we established nutritional status based on the body mass index.

We obtained the items that assessed breakfast from the KIDMED questionnaire on the adherence to the Mediterranean diet.<sup>29</sup> They are four dichotomous questions that must be answered in the affirmative or negative (yes/no) exploring whether breakfast is or not eaten and the habitual consumption of dairy products, cereal or industrial baked goods at breakfast.

We evaluated the level of physical activity by means of the physical Activity Questionnaire for Children (PAQ-C), which assesses the physical activity of a child over the past 7 days. We summarised the results of this questionnaire by calculating the mean.<sup>30</sup>

### Data analysis

We assessed the normality and homogeneity of variance of the distributions by means of the Kolmogorov-Smirnov and Levene tests, respectively. Since we found that part of the observed values followed a normal distribution, we decided to use parametric tests. We calculated *p*-values (*t* test for independent samples) to assess for the presence of statistically significant differences. We used the Pearson  $\chi^2$  test with residual analysis to analyse categorical variables. All the analyses were performed for the overall sample and stratified by sex. We also performed a logistic regression analysis to study the association between each item referred to breakfast and the different anthropometric measures as well as the level of PA. We performed the analyses with the statistical package SPSS version 24.0.

## RESULTS

Of the 248 schoolchildren (43.1% male), 10.5% usually skipped breakfast; these students had a higher mean age ( $p < 0.013$ ) and height ( $p < 0.005$ ) and lower level of PA ( $p < 0.001$ ) and exhibited a tendency toward a greater weight ( $p < 0.056$ ). In the female subset, we found that girls that ate

breakfast were significantly younger ( $p < 0.022$ ) and taller ( $p < 0.034$ ) and had a higher level of physical activity ( $p < 0.006$ ). On the other hand, we found that a higher proportion of boys ate breakfast compared to girls (93.5% versus 86.5%;  $p < 0.021$ ) (Table 1).

In the total sample ( $p < 0.001$ ) and the female subgroup ( $p < 0.001$ ), consumption of at least 1 dairy product at breakfast was associated with a higher level of PA. Girls that did not consume dairy were significantly older than those that did ( $p < 0.022$ ). In addition, boys that did not consume dairy exhibited a significant tendency toward a lower level of PA ( $p < 0.053$ ) (Table 2).

In the overall sample ( $p < 0.003$ ) and the male subset ( $p < 0.017$ ) we found that consumption of cereal or dairy at breakfast was associated with significant differences in the level of PA. In girls, we also found a tendency toward a lower level of PA in association with not having any cereal for breakfast ( $p < 0.054$ ) (Table 3).

When we compared the consumption versus lack of consumption of industrial baked goods for breakfast (Table 4), we found that the BMI was significantly greater ( $p < 0.058$ ) in children that consumed these products at breakfast. We found that high proportions of boys and girls consumed these products for breakfast (77.6% versus 80.9%).

Lastly, Table 5 presents the results of the logistic regression analysis performed to assess the dependent variable of eating breakfast. Eating breakfast (odds ratio [OR]= 3.3; 95% confidence interval [95 CI]: 1.2 to 8.7;  $p < 0.015$ ), consuming dairy (OR = 4.9; 95 CI: 2.0 to 11.6;  $p < 0.001$ ) and consuming cereal (OR = 2.69; 95 CI: 1.3 to 5.3;  $p < 0.005$ ) were associated with a higher level of physical activity.

## DISCUSSION

The aim of our study was to analyse the association of breakfast with the level of physical activity and various anthropometric variables in primary

**Table 1.** Analysis of the presence or absence of breakfast by age, height, weight, BMI and PA

		Eats breakfast (mean $\pm$ SD)	Skips breakfast (n = 222; 89.5%)	p
Total sample		(N = 222; 89.5%)	(N = 26; 10.5%)	
	Age (years)	10.17 $\pm$ 1.43	10.92 $\pm$ 1.46	0.013*
	Height (cm)	144.93 $\pm$ 10.45	150.96 $\pm$ 9.39	0.005*
	Weight (kg)	41.14 $\pm$ 11.13	45.51 $\pm$ 9.80	0.056
	BMI	19.26 $\pm$ 3.73	19.78 $\pm$ 4.18	0.467
	Total AP	2.31 $\pm$ 0.51	1.95 $\pm$ 0.43	0.001**
Male		(N = 100; 93.5%)*	(N = 7; 6.5%)	
	Age (years)	10.24 $\pm$ 1.39	10.85 $\pm$ 1.95	0.273
	Height (cm)	144.91 $\pm$ 9.68	151.71 $\pm$ 11.44	0.078
	Weight (kg)	40.66 $\pm$ 9.58	46.28 $\pm$ 10.92	0.140
	BMI	19.22 $\pm$ 3.52	19.95 $\pm$ 3.24	0.597
	Total AP	2.32 $\pm$ 0.49	2.00 $\pm$ 0.24	0.092
Female		(N = 122; 86.5%)	(N = 19; 13.5%)	
	Age (years)	10.11 $\pm$ 1.47	10.94 $\pm$ 1.31	0.022*
	Height (cm)	144.95 $\pm$ 11.07	150.68 $\pm$ 8.87	0.034*
	Weight (kg)	41.54 $\pm$ 12.28	45.23 $\pm$ 9.67	0.213
	BMI	19.29 $\pm$ 3.91	19.76 $\pm$ 3.02	0.614
	Total AP	2.29 $\pm$ 0.52	1.93 $\pm$ 0.48	0.006*

**BMI:** body mass index; **PA:** physical activity; **SD:** standard deviation.

The asterisks mark the variables that differed significantly between the sexes (\*)  $p < 0.05$ ; (\*\*)  $p < 0.0001$ . Student t test and Pearson  $\chi^2$  test.

**Table 2. Comparison of the inclusion or lack of dairy in breakfast by age, height, weight, BMI and PA**

		Has dairy at breakfast (mean ± SD)	No dairy at breakfast (mean ± SD)	<i>p</i>
Total sample		(N = 210; 84.7%)	(N = 38; 15.3%)	
	Age (years)	10.20 ± 1.45	10.50 ± 1.46	0.251
	Height (cm)	145.25 ± 10.51	147.31 ± 10.30	0.265
	Weight (kg)	41.60 ± 11.06	41.59 ± 11.20	0.994
	BMI	19.46 ± 3.52	18.53 ± 4.35	0.149
	Total AP	2.32 ± 0.50	1.98 ± 0.49	0.001**
Male		(N = 90; 84.1%)	(N = 17; 15.9%)	
	Age (years)	10.33 ± 1.43	10.00 ± 1.45	0.382
	Height (cm)	145.45 ± 10.06	144.82 ± 9.18	0.810
	Weight (kg)	41.64 ± 10.05	37.77 ± 7.12	0.133
	BMI	19.52 ± 3.56	17.95 ± 2.84	0.089
	Total AP	2.34 ± 0.47	2.09 ± 0.51	0.053
Female		(N = 120; 85.1%)	(N = 21; 14.9%)	
	Age (years)	10.10 ± 1.47	10.90 ± 1.37	0.022*
	Height (cm)	145.10 ± 10.48	149.33 ± 10.92	0.103
	Weight (kg)	41.57 ± 11.80	44.68 ± 13.01	0.275
	BMI	19.41 ± 3.50	19.00 ± 5.29	0.644
	Total AP	2.31 ± 0.52	1.88 ± 0.46	0.001**

**BMI:** body mass index; **PA:** physical activity; **SD:** standard deviation.

The asterisks mark the variables that differed significantly between the sexes (\*) *p* < 0.05; (\*\*) *p* < 0.0001. Student *t* test.

**Table 3. Comparison of the inclusion or lack of cereal or cereal product in breakfast based on different anthropometric variables and the level of PA**

		Cereal at breakfast (mean ± SD)	No cereal at breakfast (mean ± SD)	<i>p</i>
Total sample		(N = 193; 77.8%)	(N = 55; 22.2%)	
	Age (years)	10.19 ± 1.45	10.45 ± 1.45	0.239
	Height (cm)	145.47 ± 10.54	145.9 ± 10.39	0.786
	Weight (kg)	41.32 ± 10.56	42.58 ± 11.95	0.458
	BMI	19.18 ± 3.50	19.78 ± 4.18	0.290
	Total AP	2.32 ± 0.51	2.09 ± 0.48	0.003*
Male		(N = 83; 77.6%)	(N = 24; 22.4%)	
	Age (years)	10.15 ± 1.46	10.70 ± 1.26	0.077
	Height (cm)	144.83 ± 9.84	147.16 ± 10.07	0.311
	Weight (kg)	40.81 ± 9.80	41.78 ± 9.58	0.668
	BMI	19.27 ± 3.26	19.26 ± 4.26	0.989
	Total AP	2.36 ± 0.46	2.10 ± 0.52	0.017*
Female		(N = 110; 78%)	(N = 31; 22%)	
	Age (years)	10.21 ± 1.46	10.25 ± 1.56	0.895
	Height (cm)	145.83 ± 11.06	144.93 ± 10.69	0.646
	Weight (kg)	41.71 ± 11.54	43.20 ± 13.63	0.543
	BMI	19.12 ± 3.69	20.18 ± 4.14	0.171
	Total AP	2.29 ± 0.54	2.08 ± 0.45	0.054

**BMI:** body mass index; **PA:** physical activity; **SD:** standard deviation.

The asterisks mark the variables that differed significantly between the sexes (\*) *p* < 0.05; (\*\*) *p* < 0.0001. Student *t* test.

**Table 4. Analysis of the inclusion or exclusion of industrial baked goods in breakfast based on different anthropometric variables and the level of PA**

		Industrial baked goods at breakfast (mean ± SD)	No industrial baked goods at breakfast (mean ± SD) (N = 197; 79.4%)	p
Total sample		(N = 51; 20.6%)	(N = 197; 79.4%)	
	Age (years)	10.29 ± 1.48	10.07 ± 1.35	0.347
	Height (cm)	145.62 ± 10.36	145.33 ± 11.08	0.858
	Weight (kg)	41.92 ± 11.04	40.39 ± 11.15	0.380
	BMI	19.52 ± 3.57	18.52 ± 3.94	0.058
	Total AP	2.29 ± 0.50	2.21 ± 0.53	0.324
Male		(N = 28; 22.4%)	(N = 79; 77.6%)	
	Age (years)	10.32 ± 1.44	10.10 ± 1.42	0.549
	Height (cm)	145.72 ± 9.50	144.08 ± 11.25	0.477
	Weight (kg)	41.70 ± 9.68	38.70 ± 9.70	0.184
	BMI	19.52 ± 3.63	18.42 ± 2.86	0.174
	Total AP	2.31 ± 0.46	2.28 ± 0.55	0.775
Female		(N = 27; 19.1%)	(N = 114; 80.9%)	
	Age (years)	10.27 ± 1.51	10.03 ± 1.31	0.460
	Height (cm)	145.56 ± 10.98	146.44 ± 11.02	0.708
	Weight (kg)	42.07 ± 11.98	41.89 ± 12.28	0.943
	BMI	19.53 ± 3.54	18.61 ± 4.76	0.260
	Total AP	2.27 ± 0.53	2.14 ± 0.52	0.273

BMI: body mass index; PA: physical activity; SD: standard deviation.

The asterisks mark the variables that differed significantly between the sexes (\*)  $p < 0.05$ ; (\*\*)  $p < 0.0001$ . Student *t* test.

school children. The binary logistic regression analysis revealed that eating breakfast, consuming dairy and consuming cereal at breakfast were associated with higher levels of PA (Table 5). These findings are consistent with those of previous studies<sup>20,27</sup> that documented an association between eating breakfast and the self-perception of

children of having energy and being fit.<sup>31</sup> This may be because following a night fast, breakfast immediately raises the energy level in the body and mostly restores blood glucose levels to the normal range, increasing glycogen stores in muscle and the liver.<sup>17</sup> Since low levels of carbohydrates result in poorer performance and quicker fatigue during

**Table 5. Association of breakfast consumption with anthropometric variables and physical activity (PA) in primary school children**

	Yes / Has breakfast			Yes / Dairy at breakfast			Yes / Cereal at breakfast			Yes / Industrial baked goods at breakfast		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age (years)	2.160	0.838-5.569	0.111	0.757	0.354-1.599	0.465	0.970	0.516-1.822	0.924	0.716	0.376-1.362	0.308
Sex (male)	0.943	0.591-1.504	0.805	1.017	0.683-1.515	0.936	0.811	0.581-1.133	0.220	1.296	0.912-1.841	0.148
Sex (female)	0.449	0.182-1.112	0.084	1.079	0.538-2.164	0.830	1.026	0.561-1.876	0.934	1.212	0.658-2.266	0.527
Height (cm)	0.894	0.718-1.113	0.317	1.043	0.908-1.207	0.560	1.000	0.880-1.136	0.996	1.058	0.918-1.220	0.433
Weight (kg)	1.141	0.800-1.627	0.466	0.904	0.714-1.139	0.392	1.070	0.871-1.313	0.519	0.855	0.676-1.082	0.193
BMI	0.766	0.337-1.737	0.523	1.392	0.821-2.346	0.215	0.841	0.540-1.309	0.442	1.525	0.897-2.595	0.111
Total PA	3.328	1.264-8.764	0.015*	4.915	2.071-11.639	0.001**	2.696	1.358-5.353	0.005*	1.585	0.812-3.097	0.177

The asterisks mark the variables that differ significantly between the sexes (\*)  $p < 0.05$ ; (\*\*)  $p < 0.0001$ . Binary logistic regression. BMI: body mass index. CI: confidence interval. OR: odds ratio.

physical activity, having breakfast may provide an increased amount of energy that may be needed to engage in more physical activity during the day.<sup>20</sup> In addition, frequent consumption of breakfast has been associated with variables linked to vigorous physical activity, such as cardiorespiratory fitness,<sup>27</sup> independently of potential confounders such as age, BMI, race, depressive symptoms or sleep quality.<sup>32</sup> However, other studies have not found a significant association between breakfast and physical activity.<sup>28</sup> These discrepancies may be due to differences in the methods used to assess physical activity (accelerometer versus questionnaire).

Another of the salient findings of our study was the high average proportion of schoolchildren (10.5%) that went to school without having breakfast; which was higher in boys than in girls (93.5% vs. 86.5%); in addition, schoolchildren that skipped breakfast were older, taller, heavier, and had a lower level of physical activity (Table 1). These results suggest that school children that are older and have sedentary habits are more likely to skip breakfast. These findings are similar to those obtained in other studies that analysed schoolchildren that skip breakfast.<sup>27</sup> It has been hypothesised that skipping breakfast causes metabolic and endocrine changes to the foods consumed later in the morning as well as differences in perceived appetite and a compensatory energy intake.<sup>5</sup> It has also been suggested that eating in the morning is more satisfying and can thus reduce the total daily energy intake.<sup>21,22</sup> However, schoolchildren that eat breakfast may have a higher total daily energy intake compared to those that skip it.<sup>27</sup> What needs to be translated into the field of health education is the importance of eating breakfast and maintaining a healthy dietary pattern in childhood, as regular consumption of breakfast has been associated with a healthy weight status in schoolchildren, regardless of sex.<sup>33</sup>

Despite these benefits, there is evidence that as age increases, so does the proportion of schoolchildren that skip breakfast, while the nutritional composition and quality of breakfast also decreases,

with peaks at ages 14 and 18 years.<sup>34</sup> The progressive autonomy that children acquire with age may be one of the factors involved in skipping breakfast at home.<sup>3</sup> This may be due to shifts in food preferences associated with maturational changes.<sup>15</sup> There is evidence that as children near adolescence, the social pressure to conform to certain aesthetic stereotypes may promote habits aimed at weight control, and children may skip breakfast with the aim of decreasing their energy intake.<sup>4</sup> Furthermore, some studies suggest that the habits of schoolchildren may be a reflection of inadequate dietary habits in the household.<sup>7</sup> Along these lines, some studies have described that lack of appetite in the morning or a lack of time to get ready or the rush to make it to school in time are some of the most frequent reasons children skip breakfast.<sup>35</sup>

However, other studies have not found a significant association between breakfast and body composition or sex.<sup>34</sup> In any case, in our study we found that schoolchildren with a greater BMI consumed more processed baked goods at breakfast, with similar proportions in girls and boys (77.6% versus 80.9%) (Table 4). Some authors have termed it “the sweet breakfast”, and the proportion of schoolchildren that consume it can be as high as 40.0%,<sup>36</sup> while the same children, on the other hand, exhibit a low intake of water, protein, dietary fibre, total fat, polyunsaturated fat, beta-carotene and vitamins E and D.<sup>16</sup> The current evidence shows that compared to other meals, consuming breakfast is part of a healthy dietary pattern, with multiple studies corroborating the nutritional and health benefits associated with consumption of a breakfast of adequate size including varied and high-quality foods.<sup>11</sup> Thus, there seems to be universal agreement that breakfast plays an important role in achieving an optimal nutrient profile in the diet.<sup>37,38</sup>

We propose that future research be aimed at overcoming certain limitations, such as restriction to a particular geographical area or a small sample size, and include not only primary school children, but also, and more importantly, adolescents. Fur-

thermore, we assessed the type of breakfast and the level of physical activity based on quantitative self-report instruments, but there are other methods that can be used to assess nutrition and physical activity more objectively. One of the strengths of our study was the assessment of three possible indicators of a healthy lifestyle at early ages, which can help different agents in education to identify health needs in schoolchildren and thus design educational programmes to address these needs and to promote the development of healthy habits through the lifespan.

Based on our findings, we conclude that in school-aged children, consumption of breakfast and a greater dietary quality of this meal are associated with younger age and healthy lifestyle habits, such as higher levels of physical activity. The high percentage of children that habitually skipped breakfast before going to school (10.5%) demonstrates the need of public health and education profes-

sionals to prioritize, in collaboration with the parents, actions to motivate primary education students to develop and maintain the habit of eating breakfast.

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## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare in relation to the preparation and publication of this article.

## ABBREVIATIONS

**BMI:** body mass index • **OR:** odds ratio • **PA:** physical activity • **PAQ-C:** Physical Activity Questionnaire in Spanish Children • **SENC:** Sociedad Española de Nutrición Comunitaria • **95 CI:** 95% confidence interval.

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