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Overweight in schoolchildren and nutrient intake

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Abstract

Introduction: According to the World Health Organization (WHO), one of the most serious health problems of the 21st century is childhood obesity. In 2016, more than 400 million children and adolescents between the age of 5 and 19 were overweight or obese. The aim of this study is to evaluate the consumption, habits and dietary practices of schoolchildren who suffer from malnutrition due to overweight or obesity.

Methods: descriptive, correlational and prospective study using a quantitative approach. The sample size was 82 girls and boys who met the inclusion criteria between 8 and 14 years of a public institution of basic education in Barranquilla.

Results: schoolchildren of both sexes had a high prevalence of obesity, particularly in the female group (76.44%). A dietary interview using the frequency of food consumption method showed a moderate consumption of fruits and vegetables, as well as a high consumption of sugary drinks, fried foods, cookies and sweets, and a low intake of water. Regarding eating habits and practices, it was reported that a high percentage of schoolchildren receive diets and purchase cookies, ice cream, sugary drink or juices and salty snacks.

Discussion: a a study revealed in 56 schoolchildren evaluated the prevalence of overweight of Spanish schoolchildren according to sex, thus showing a higher prevalence of overweight in girls (21.9%) than in boys, (10.1%) while the prevalence go obesity was higher in boys (24.5%) than in girls (9.7%). A systematic analysis reported in a population of children and adults from 1980 to 2013, finding a prevalence of overweight and obesity in boys (26.3% and 9.4%, respectively) and girls (27.3% and 8.3%). Our study presents excessive figures related to obesity mainly in schoolgirls (76.44%).

Conclusion: Our data show a relationship between the prevalence of overweight and obesity and poor consumption and eating habits and practices.

Keywords: nutrient intake, overweight, obesity, schoolchildren.

I. INTRODUCTION

Obesity and overweight have proved to be troublesome health phenomena in this century. The most significant problem with obesity and overweight is that they co-occur or lead to chronic and costly non-communicable diseases (NCDs) such as diabetes, heart disease, asthma, and cancer. Sadly, adolescent and adulthood obesity is likely to begin during early childhood. Obesity, overweight, and related NCDs have increased health burdens on health care systems in both the developed and developing world. Reports by the World Health Organization (WHO) (2018a) indicate that NCDs that develop due to childhood obesity account for more than 71% of total global deaths.[1] The UNICEF/WHO/World Bank Group Joint Child Malnutrition

Estimate Annual Report in 2019 on levels and trends in child malnutrition reports that ~5.9% or 40.1 million children worldwide under 5 years presented excessive weight (overweight or obesity).[2] According to the Food and Agriculture Organization of the United Nations (FAO) and the Pan American Health Organization, obesity and overweight have increased throughout Latin America and the Caribbean with a greater impact on women and an upward trend in boys and girls.[3] Overweight and obesity are a worldwide epidemic that affects ~33% of children and adolescents.[4] Prevalence is higher in high-income countries, although the annual rate of increase is higher in low-income and middle-income countries.[5] The WHO has proposed the body mass index (BMI) as a parameter for the diagnosis of overweight and obesity because it shows a correlation with total adiposity and a strong epidemiological correlation with morbidity and mortality associated with obesity in adults. The BMI is a predictor of cardiovascular risk in children.[6] As per the most recent study providing global trends in BMI based on body weight and height data from 128.9 million children, adolescents, and adults, the prevalence of obesity increased in all countries between 1975 and 2016. The BMI is useful for diagnosis in clinical practice.[7] In children, overweight is defined as a BMI for age and sex between P85 and P97 and obesity as a BMI for age and sex greater than P97.[8] The WHO defines malnutrition as follows: "Deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients." [9] In most cases, obesity is attributed to a nutritional imbalance because of increased calorie intake, which leads to the storage of excess energy as fat tissue.[10] The 2014 study KiGGS (Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland), based on surveys of children and adolescents, the strongest risk factors for childhood overweight were parental obesity, low socioeconomic status, migration history, and high birth weight.[11] The excessive screen time (TV, computers, phones, and tablets), in addition to the limited availability of safe and accessible spaces (parks) and sports facilities, are factors that contribute to obesogenic environment. These conditions particularly affect cities and children with less spending power.[12] The likelihood of obesity is between three and four times higher in children with at least one obese parent[13]. In addition to the possible conditioning genetic factors, the most relevant influence is eating habits and lifestyles at home. There is evidence that communicative parents who establish strong affective bonds with their children are associated with lower childhood obesity rates as are families who eat at least one meal a day together[14]. Pregnancy weight, a high or low birth weight, or the absence of breastfeeding are predictors during infancy of an increased risk of childhood obesity.[13,15] Obesity is related to multiple psychosocial problems, low school performance, lower labor productivity in adulthood, and fewer employment opportunities, increasing the possibility of suffering discrimination, stigmatization and bullying.[16] Children and adolescents living in more favorable socio-economic environments, rather than more disadvantaged environments, benefit more from interventions for preventing and treating childhood obesity.[17] The so-called "nutritional transition" has attributed considerable changes in consumption habits of processed foods with a high content of sugars, salt, fats, and sugary, and "energy" drinks in the face of the progressive abandonment of healthier diets and the low consumption of fresh foods, vegetables, and fruits. This transition occurs from food production to consumption, including marketing and advertising, in a food system that favors an environment in which these processed foods and sugary drinks are available at home, educational environments, leisure spaces, shops, and restaurants; sometimes, at more affordable prices (cheap calories) compared to healthier and more nutritious food. This is agreed with the trend toward higher rates of childhood obesity in lower-income households; however, obesity rates stabilize or decrease in higher-income households.[12] Overweight and obesity are associated with health problems; affected children are at a greater risk of cardiovascular diseases, endocrine disruptions, skin disorders, swelling of feet and ankles, respiratory conditions, and musculoskeletal disorders, digestive, psychological, and sleep problems.[18,19] In almost all regions of Colombia, the problem of childhood obesity is present. In 24 official educational institutions in Bogotá, 22.1% of schoolchildren between 9 and 17 years of age were overweight and 6.2% presented abdominal obesity.[20] There is evidence that overweight children become obese adults with an increased risk of metabolic syndrome and other associated pathologies such as hypertension, dyslipidemia, and heart disease, resulting in decreased life expectancy. [21, 22] The aim of this study is to evaluate the consumption, habits, and eating practices of schoolchildren suffering from malnutrition because of excess (overweight or obesity).

Current epidemiology of childhood obesity

The global prevalence of obesity in children and adolescents increased at an alarming rate from 0.7% to 5.6% in boys and from 0.9% to 7.8% in girls between 1975 and 2016.[7] In a continuous anthropometric analysis of BMI in a population of 51,505 children, the fastest weight gain was reported to be between 2 and 6 years old, and 90% of children who were obese at 3 years old were overweight or obese in the adolescent years. [23] In 2016, European countries reported populations of children aged 7–13 years old with a high prevalence of overweight (>30%) and obesity (>10%). The prevalence of overweight was as follows: Greece, 37.3%; Italy, 36.8%; Malta, 36.7%; Andorra, 35.8%; Israel, 35%; Spain, 34.1%; Cyprus, 33.1%; Portugal, 32.4%; United Kingdom, 31.1%; Ireland, 31%; and France, 30%. Moreover, the high levels of obesity prevalence were reported: Greece, 13.8%; Malta, 13.4%; Andorra, 12.8%; Italy, 12.5%; Cyprus, 12.2%; Israel, 11.9%; Turkey, 11.5%; Hungary, 11.1%; Croatia, 10.9 %; Spain, 10.8%; Bulgaria, 10.8%; Portugal, 10.4%; and United Kingdom, 10.2%. The most recent estimates of overweight and obesity prevalence among Latin American children under the age of 20 are 21.7% and 7.4%, respectively.[24] As per UNICEF, the WHO, and the World Bank, the prevalence of overweight and obesity in Latin America in children under 5 years of age in 2019 is 7% in the Caribbean, 6.9% in Central America, and 7.9% in South America. [25]

Applicability of anthropometric indicators for the timely detection of obesity in children

BMI or Quetelet index. The BMI or Quetelet index is the quotient that is attributed to dividing the body weight (in kilograms) by the square of the body height (in square meters). Currently, several expert committees recommend using the BMI-for-age indicator to assess overweight and obesity in children and adolescents. [26, 27–31] The BMI—and changes in BMI—during childhood are associated with risk factors for the subsequent development of coronary heart disease and other chronic diseases.[32–35] Cohort studies by Baker *et al.*[36] demonstrated that having a high BMI is indicative of being overweight or obese between 7 and 13 years and increases the risk of developing coronary heart disease in adulthood. Several studies performed in pediatric populations associate overweight and obesity, represented by the BMI, with metabolic disorders such as impaired fasting glucose and insulin resistance, high blood pressure, and dyslipidemias characterized by hypertriglyceridemia, hypercholesterolemia, low and very low-density lipoproteins increased, and low levels of high-density lipoproteins.[37–39]

Waist-to-height ratio (WHtR). The WHtRis a simple and effective anthropometric index of abdominal obesity across different ages, sex, and ethnic groups that has demonstrated a close relationship with morbidity and mortality. The WHtR has a clearer relationship with mortality compared to the BMI and not only detects central obesity and adverse cardiometabolic risk in overweight/obese children but also in children with normal weight identifying those without such risk conditions, which has implications for pediatric primary care practice. The WHtR indicates the pathophysiological role of intra-abdominal body fat distribution in determining cardiometabolic risk factors. Intra-abdominal body fat is related to metabolic syndrome independently of age, sex, and ethnic origin. This indicator is complementary to BMI. [40] Recent studies on children and adolescents highlight the use of a single cut-off point of 0.50 for WHtR **.**[41]

II. METHODS

A descriptive, correlational, and prospective study with a quantitative approach was performed between February and July 2019 at a basic public education institution in Barranquilla. The study was performed by students of the nursing program of the Universidad Simón Bolívar in Barranquilla and their research advisor. The study population was 200 students enrolled between the fifth and eighth year of basic education in morning sessions. The sample size was 82 female and male volunteer schoolchildren who met the inclusion criteria: school-age children between 8 and 14 years old (with previous parental or guardian consent and children assent), of Colombian citizenship, enrolled in the school and attending classes regularly, with no clinical picture, and classified as normal as per the anthropometric evaluation expressed in units of standard deviations (SD): age-appropriate height (height/age) ≥ −1, BMI/age, age-appropriate BMI/age (≥ −1 to ≤ +1) overweight: BMI/age (> +1 and ≤ +2 SD) or obesity. BMI/age (above of the score line +2 SD, in the age group of 5 to 17 years old). [42] Furthermore, 118 schoolchildren were excluded from the study because they did not

meet the indicated inclusion criteria. For anthropometric assessment, children were weighed on a calibrated Seca mechanical scale (Seca, Hamburg, Germany) resting on the ground with a sensitivity of 100 g that was permanently calibrated with a standard weight. The girls/boys of the study were weighed barefoot with minimal clothing. Furthermore, height was measured with a stadiometer of the same brand with an accuracy of ±1 mm. Height measurement was performed with the subject standing.[43] Anthropometric measurements were considered by expert nursing and nutrition personnel after training, thus complying with the requirements established in the practical guide for physical measurements[44]. A form prepared by us was used to record the following variables: date of birth, chronological age, sex, weight, height, and BMI. Chronological age was estimated considering the difference between the date of the anthropometric evaluation and the date of birth. As per this information, the database and the anthropometric-nutritional classification were collected, thereby obtaining the anthropometric-nutritional diagnosis: Normal, Overweight or Obesity for each schoolchild. The variables of weight and height were then combined to construct the BMI; moreover, the values obtained were interpreted according to the WHO child growth patterns, which were adopted for school-age children and adolescents (5–19 years) by the Resolution 2465 of 2016 of Bogotá of the **Ministry of Health and Social Protection of Colombia**[42].

The study considered the norms that regulate human research according to the **Resolution 008430 of 1993 of the Ministry of Health and Social Protection of Colombia**. This study was considered to be of minimal risk and complied with the scientific, technical, and administrative norms of the research department that governs these; No. 00002 of March 15, 2011 of the Universidad Simón Bolívar [45, 46], as well as the international ethics standards established by the WHO for human research and the Declaration of Helsinki (ratified by the 29th World Medical Assembly, Tokyo 1995). [47] Data were recorded in a spreadsheet from Microsoft Excel 2013, Statistical Package for Social Sciences, 22.0 (SPSS, Chicago, IL, USA) was applied. For statistical analysis, data were used to measure frequency, relative frequency, cumulative frequency and chi square values. Moreover, the results were demonstrated in tables and graphs using descriptive statistics, determining frequencies, distributions, and percentages.

Anthropometric classification of nutritional status for girls and boys 5 and 17 years old, according to the indicator and cut-off point BMI-for-age (BMI/A). Resolution No. 00002465 of June 2016. [42]

Indicator	Cut-off point (SD)	Anthropometric classification	Type of use
Body Mass Index according to age (BMI/A)	> +3	Obesity	Population
	> +2 to < +3	Overweight	
	> +1 to < +2	Risk of overweight	
	< +1	Not applicable (Verify with W/H)	

For the group of children and adolescents from 5 to 17 years old, the indicators (BMI/A) and height-for-age (H/A) should be used at both individual and population levels. To estimate results obtained using the WHtR indicator, the following cut-off points for pediatric age were considered in the schoolchildren studied in relation to the nutritional category.[48-50]

Men. Overweight: WHtR greater than 0.48. Obesity: WHtR greater than 0.51

Women. Overweight: WHtR greater than 0.47. Obesity: WHtR greater than 0.50

Dietary Assessment

Two interviews were conducted with schoolchildren by a nutrition professional based on methods to evaluate the frequency of food consumption. The first questionnaire on consumption and eating habits and practices in schoolchildren was validated by others. [51] The questionnaire included 28 questions and 5

thematic sections (frequency of consumption, culinary skills, eating habits, expenses at school, and knowledge) in the following order: culinary skills with six questions, food consumption frequency with 12 questions, eating habits with seven questions, and expenses at school with four questions. A second food frequency questionnaire registering daily and weekly consumption was performed. Foods were separated into seven groups as per their content of carbohydrates, proteins, and fats.[51] This frequency method enabled determining the daily consumption and the portion size of fruits, vegetables, fish, red meat, cured meat, pasta, cereals, legumes, milk and derivatives, fried foods, soft drinks, cakes, cookies/cakes/sweets, or chocolates under the following categories: three or more times a day, two times a day, once a day, 4–6 times a week, 2–3 times a week, once 1 week, and occasional or never.[52]

III. Results

Table # 1 Sex in relationship with the BMI (Sex/BMI)

Sex	Normal		Overweight		Obesity	
	N	%	N	%	N	%
F	3	12.72	2	10.84	34	76.44
M	7	16.73	5	14.68	31	68.59

Chi-Square Test P-value 0.7525 is greater than 0.05

Source: Data register

Analysis: When analyzing sex in relationship with the BMI, it became evident that sex had no influence on the BMI values obtained (P-value: 0.7525). Both female and male groups had a higher prevalence of obesity, especially in the female group (76.44%).

Table # 2 Age in relationship with the BMI (Age/BMI)

Age Group	Normal		Risk of Overweight		Overweight		Obesity	
N	%	N	%	N	%	N	%	
8 yr. – 10 yr.	6	16.57	0	0	0	0	15	83.4
10 yr. – 12 yr.	1	3.89	2	7.84	4	13.89	25	74.38
12 yr. – 14 yr.	1	4.84	2	5.72	4	12.23	22	77.21

Chi-Square Test P-value 0.0003 is less than 0.05

Source: Data register

Analysis: Regarding the relationship between age and the BMI, it became evident that age influenced the values obtained (P-value: 0.0003). The age group of 10–12 year presented a prevalence of overweight and obesity of 13.89% and 74.38% respectively, and the age group of 12– 14 year presented a prevalence of overweight and obesity of 12.23% and 77.21%, respectively.

Table # 3 Sex in relationship with the WHtR indicator (Sex/WHtR)

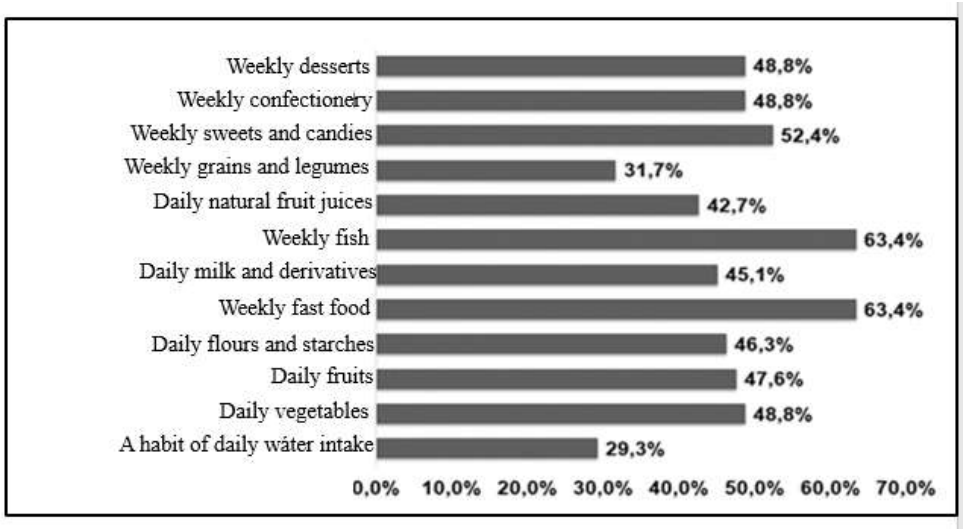
Sex	Normal		Overweight		Obesity	
	N	%	N	%	N	%
F	21	61.89	10	23.79	3	14.32
M	28	54.68	18	28.77	2	16.55

Chi-Square Test P-value 0.3977 is greater than 0.05

Source: Data register

Analysis: When relating sex to the WHtR indicator, it became evident that sex had no influence on the WHtR values obtained (P-value: 0.3977). However, the results demonstrate a normal classification with a trend toward overweight and obesity in female and male groups.

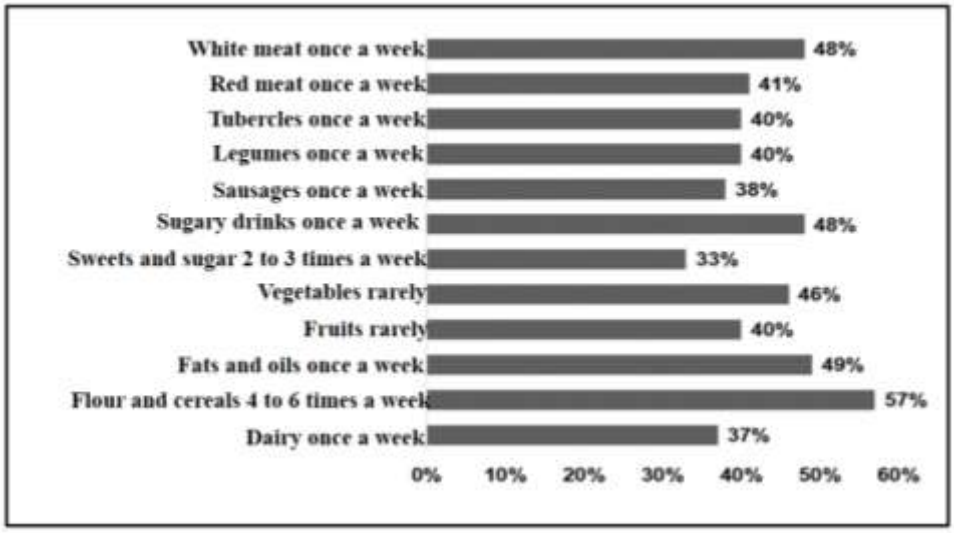
Graph #1 Daily and weekly food consumption in schoolchildren studied using the interview method.



Source: Data register from the interview on food consumption using the frequency method

Analysis: In the interview of eating habits and practices applied to the studied schoolchildren, a high weekly consumption of sweets, cookies, candies, fast foods, and others (52.4%) was observed, in addition to fish (63.4%) and fast foods (63.4%). An average daily consumption of vegetables, fruits and dairy was between 45.1% and 48.8%. Moreover, a low daily intake of liquid (water) and a low weekly intake of grains and legumes, 29.3% and 31.7%, respectively, was observed.

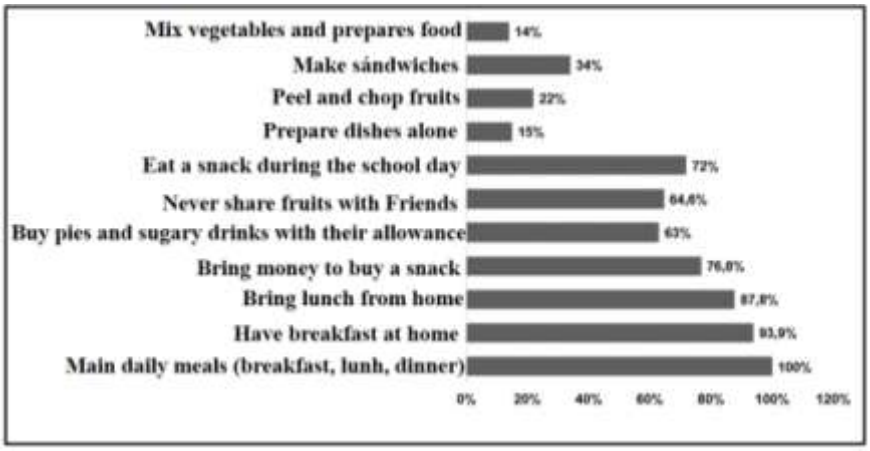
Graph #2. Food consumption according to the food frequency method in the schoolchildren studied.



Source: Data register from the interview on food consumption using the frequency method

Analysis: In the schoolchildren's dietary interview on food consumption in which the frequency method was applied, a weekly prevalence of 57% was observed in the consumption of flour and cereals, followed by saturated fats (49%) and white fish and sugary drinks (48%), and a low consumption of dairy products (37%).

Graph #3 Eating habits and practices in the studied schoolchildren.



Source: Data register from the interview on food consumption using the frequency method

Analysis: In the interview on eating habits and practices with the studied schoolchildren, 100% of the children complied with the three primary daily meals (breakfast, lunch, and dinner), 93.9% of them demonstrated that they ate breakfast at home, whereas 87.8% brought lunch from their homes, 76.8% brought money to buy snacks, and 63% used this money to buy fried pies and/or sugary drinks. However, 72% had a snack during their school day and a lower percentage had mixed vegetables and prepared food (14%) or cooks (15%) for themselves.

IV. DISCUSSION

The study was performed with 82 schoolchildren between the ages of 8 and 14 who attended a public educational institution in Barranquilla. Of the total number of students studied, 47.56% were girls and 52.43% were boys with an average age of 9 years. The results of the studies allowed us to analyze the relationship between overweight or obesity and food consumption in schoolchildren. United States and Mexico have been considered the two countries with the highest frequency of overweight and obesity. In United States, 19.6% of children between 6 and 11 years old are overweight and 18.1% of children between 12 and 19 years are old. In Mexico, one in three adolescent men or women is overweight or obese [53]. In Colombia, the last Encuesta Nacional de la Situación Nutricional 2015 (National Survey on the Nutritional Situation 2015)[54] reported a prevalence of excess weight of 6.3% in children under 5 years old, 24.4% in schoolchildren, and 17.9% in adolescents. Furthermore, excess weight in schoolchildren increased from 18.8% to 24.4% between 2010 and 2015.

The study by Herazo-Beltrán *et al*. (2019)[55] demonstrated that in the Colombian Caribbean region, excess weight is more frequent in children. These results are unlike a study performed in school children from 24 educational institutions in Bogotá, thus determining the relationship between nutritional status and BMI in a population of children and adolescents. In this study, boys presented higher values of weight, height, and waist circumference, while girls presented higher values in the BMI and higher prevalence of being overweight. [20] These results are in agreement with those obtained in this study. In a recent study in a Brazilian city with children and adolescents between 6 and 18 years old, a prevalence of overweight was observed (17.3%). Moreover, prevalence in adolescent women and men was (18% and 15.3 %), respectively, and prevalence of obesity was (12.5% and 18.9%) in women and men, respectively. Furthermore, in public schools, being overweight is more common in women, while obesity is more common in men.[6] These results are unlike our study in which the schoolchildren from a public institution presented a prevalence of obesity of (76.44% and 68.59%) in the male and female groups, respectively. These results surpassed those obtained in the classification of overweight in female (13.89%) and male (12.23%) groups. The study by De Piero *et al.* (2014), [56] evaluated the prevalence of overweight and obesity in a sample of Spanish schoolchildren as per sex, thus showing a higher prevalence of overweight in girls (21.9%) than in boys (10.1%) while the prevalence of obesity was higher in boys (24.5%) than in girls (9.7%). These results are unlike our study, as the results for obesity (76.44%) were above the results reported by Piero *et al.*[56], particularly in the female group, and the prevalence of overweight was greater in boys (14.68%) than in girls (10.84%). The study by Vieira *et al.* (2018) [57], evaluated 257 children of which (55.2%) were girls and (44.8%) were boys with an average age of 6 years. The prevalence of excess weight (24.9%) was higher in all indicators of abdominal adiposity in the overweight children. Our study included a similar number of children (47.56%) for girls and (52.43%) for boys, although the prevalence of overweight (14.68%) was lower than that in the study by Viera *et al.*[58], Ng *et al.* (2014) [24], demonstrated a prevalence of overweight and obesity of (26.3% and 9.4%) for boys and (27.3% and 8.3%) for girls, respectively. These results differ from our study as the observed prevalence of obesity in girls (76.44%) surpass them. In a study performed by Milasinovic *et al.* (2019) [58] ,with a population of 1,480 children between 9 and 13 years , the anthropometric evaluation of the BMI according to age and sex showed overweight in (19.51%) of the girls and (23.8%) of the boys according to the WHO, (14.46%) of the girls and (17.80%) of the boys according to the Centers for Disease Control and Prevention (CDC), and 16.37% of the girls and (22.89%) of the boys according to the IOTF (International Obesity Task Force). In terms of obesity, researchers observed a prevalence of (17.14%) children as per WHO and (14.59%) children as per CDC. These results are similar to those of our study in which boys showed a higher prevalence of overweight (14.68%) compared to girls (10.84%).

The study by Valle-Leal *et al.* (2016) [59,] children between 6 and 12 years old reported results according to BMI/age: (52%) children were obese and (12%) were non-obese children. Moreover, this study demonstrated a WHtR of >0.5, while (36%) of those classified as obese had a WHtR of <0.5. Furthermore, the study reported a higher prevalence of overweight and obesity in boys of (28.77% and 16.55%), respectively, as per WHtR/sex. In a study by Aparco *et al.* (2016) [60], WHtR/sex was assessed in 824 schoolchildren between 6 and 12 years old. Moreover, (21.6% and 26.4%) of boys presented overweight and obesity, respectively, while (23.7% and 21.4%) of girls presented overweight and obesity, respectively. These results are unlike those reported in our study, where the prevalence of obesity was higher for both girls (76.44%) and boys (68.59%). In their schoolchildren survey on food consumption, Aparco *et al.* (2016) [60], detected a

consumption of 5–7 days a week of fruits (59.6%), vegetables (48.7%), milk (62.2%), and water (67%). From 2 to 4 days, we assessed the consumption of dairy products (55%), fried or saturated fats foods at home (58.3%), soft drinks (30%), cookies (30.2%), and sweets (22.6%). The study revealed a consumption of vegetables (48.8%), fruits (47.6%), sugary drinks and/or soft drinks (48%), fried or saturated fat foods (49%), sweets and cookies (33%), water (29.3 %), and dairy products (between 37% and 45.1%). Our study demonstrated similar results except for the higher water intake and the lower consumption of soft drinks or sodas reported by these researchers [60]. Our data demonstrate that although (93.9%) of schoolchildren report having breakfast at home, (76.8%) brought money from home and (63%) spent their money on pies or other fried foods or sugary drinks. This aligns with the study by Olivares -Cortes S *et al.* (2017) [61], in which (66%) of the studied children stated that they had money to buy food. Cookies, ice cream, drinks or sugary juices, salty snacks, and yogurt were among the most purchased food items. A study by García *et al.* (2019) [61], that included 1025 female and male schoolchildren from Madrid between 7 and 11 years old reported that, according to the BMI/age and sex indicators, (61.27%) of the girls and (65.18%) of the boys were classified as normal, (19.26%) of the girls and (16.39%) of the boys were classified as overweight, and 7.38% of the girls and 7.08% of the boys were classified as obese. In this study, as per the WHtR, (56%) of the girls and (64%) of the boys were classified as normal, (18%) of the girls and (15%) of the boys presented abdominal overweight, and (23%) of the girls and (22%) of the boys presented abdominal obesity. The results from the dietary interview demonstrated that (9.0%) of the schoolchildren did not bring snacks in the morning and revealed the consumption of fruits (45.54%), sodas and sugary drinks (25.79%), cookies (37.13%), and sandwiches (49.97%). However, in our anthropometric nutritional assessment, BMI/age and sex showed lower results in the normal category for girls (12.72%) and boys (16.73%). Our results regarding overweight (10.84%) for girls and (14.68%) for boys were below those reported by Garcia *et al.*[62], however the results we obtained for obesity in both girls (76.44%) and boys (68.59%) were much higher than those reported by the aforementioned study. The results from the dietary interview demonstrated a higher consumption of sugary drinks and/or soft drinks than the one we reported (48%), although similar results were reported in relation to the consumption of desserts and sweets between (52.4% and 48.8%). In our study, although (93.9%) of schoolchildren reported that they ate breakfast at home, (76.8%) brought money from home for a morning snack and (63%) bought pies or other fried preparation with their allowance. These results are unlike the aforementioned study[62], where (9.0%) of the schoolchildren do not bring food to consume in the morning. The study by González *et al*. (2014) [63], based on a nutritional education program, studied female and male schoolchildren between 4 and 10 years old with an average age of 9 years old. As per the BMI/age evaluation, they reported at the beginning of the classification program: (44.6%) normal, (26.3%) overweight, and (24.4%) obese children. These results differ from our study where (12.72%) of girls and (16.73%) of boys were classified as normal. Moreover, our data show a lower percentage of overweight girls (10.84%) and boys (14.68%), as well as a much higher percentage in the obesity group (76.44%) of the girls and (68.59%) of the boys. Moreover, in the study by González *et al.*[63], the dietary interview on the frequency of weekly food consumption (1 time, 2 times/week) reported a consumption of dairy products (30% and 38.6%), fruits (31.8% and 32.6 %), vegetables (59.3% and 19.6%), drinks and juices (31.8% and 36.8%), legumes (37.6% and 24%), fish (38.4% and 13.2%), cookies and sweets (31.6% and 22.2%), and french fries and pizza (48.6% and 9.2%). These results are similar to those of our study regarding the consumption of fruits (47.65%), beverages and juices (48%), legumes (40%), dairy products (between 37% and 45.1%), and sweets and cookies (33%), with the exception of fish and fast foods, such as french fries and pizza, where we reported a high consumption (63.4% and 63.4%). These results agree with our obesity results in girls (76.44%) and boys (68.59%). A study by Muckelbauer *et al.* (2016) [64], reported that the higher consumption of sugary drinks is associated with an increase in the BMI and a higher prevalence of obesity and that the replacement of these beverages by water could prevent overweight, thereby confirming our results. In a study by Rossi *et al.* (2019) [65] , of 3,930 schoolchildren in Brazil, 1,672 (41%) of the total sample consumed low nutritional quality foods, such as soft drinks, fried foods, and processed foods, including french fries, sweets, candy, and stuffed cookies. In addition to showing a positive association with cases of overweight and obesity (20.9%), these results agree with the results from our study in which the high percentages in the female group (76.44%) and the male group (68.59%) are related to the high percentages in the consumption of fast foods (63.4%) and of sugary drinks and/or soft drinks (48%). In the study of the National Survey of School Health (PeNSE) 2012 and 2015 in Brazil, students reported consuming fried foods (13.7%), sweets (41.6%), soft drinks (26.7%), and ultra-processed snacks (31.3%) with a frequency equal to or greater than five days per week. In 2012, 69.9% of the students consumed beans, 43.4% consumed vegetables, and 30.2%

consumed fresh fruits; however, in 2015, these percentages reached 60.7% for beans, 37.7% for vegetables, and 32.7% for fresh fruits [66, 67]. Our study revealed a consumption of legumes (40%), vegetables (48.8%), fruits (47.6%), sugary drinks and/or soft drinks (48%), fried preparations or saturated fats (49%), thus indicating a higher consumption of sugary drinks and saturated fats than those reported by the PeNSE study in Brazil (67.68%) and agreed with the high prevalence of obesity in both girls and boys. Gaona-Pineda *et al.* (2018) [68], reported data from the National Health and Nutrition Survey (ENSANUT), Mexico. The aim of the study was to evaluate the weekly food consumption of preschool students, schoolchildren, and adolescents. In a group of 2,597 schoolchildren from an urban area, we observed consumption of fruits (46.2%), vegetables (23.1%), legumes (57.2%), water (86.5%), dairy (66.6%), eggs (48.4%), sweets and desserts (63.6%), sugary cereals (52.4%), and fast foods and snacks (15.8%). The schoolchildren in our study reported a lower consumption of fruits (47.65%), legumes (40%), sweets and cookies (33%), water (29.3%), and dairy products between (37% and 45.1%); however, consumption of fast foods, such as french fries and pizza was remarkably higher (63.4% and 63.4%) respectively. Egg consumption was not reported. The **primary limitation of this study** is that the studied sample was not representative because of a lack of sufficient funding to extend time and sample size.

V. Conclusions

The WHtR indicator proved to be a complementary indicator to BMI to detect overweight or obesity at an early age. This study showed a prevalence of overweight, with a significant obesity classification for both sexes being higher for the female group that was studied. Moreover, the relationship between the prevalence of overweight/obesity and wrong habits, consumption and eating practices was confirmed by our results.

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Competing interests

The authors declare no conflict of interests.

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