Anthropometric Measurements and Nutritional Status in Elementary School Students: An Observational Study

Antropometria e Consumo Alimentar em Alunos do Ensino Fundamental: Um Estudo Observacional

Mediciones Antropométricas y Estado Nutricional en Estudiantes de Educación Primaria: Un Estudio Observacional

RESUMO

Objetivo: avaliar o estado nutricional (dados antropométricos e consumo alimentar) de crianças/adolescentes de uma escola pública do município de Canoas/RS, Brasil. **Métodos:** estudo observacional (n=341), com 2 cortes transversais e uma coorte prospectiva (n=66). Os parâmetros seguiram o Protocolo SISVAN do Ministério da Saúde/Brasil. As comparações foram realizadas pelo Teste do Qui-Quadrado de Pearson e McNemar-Bowker (p<0,05). **Resultados:** houve um equilíbrio entre os períodos analisados para excesso de peso (2021-2: 44,4% e 2022-1: 45,7%) e, particularmente, a obesidade (2021-2: 27,5% e 2022-1: 24,6%). A magreza também mostrou similaridade entre 2021-2 e 2022-1, com 2,1% versus 3,0%, respectivamente. **Conclusão:** pouco mais da metade (52,5%) encontrava-se no estado nutricional "eutrófico" e não houve alterações desse cenário entre os períodos avaliados. No inquérito de 2022-1 houve maior consumo de alimentos ultra processados do que em 2021-2 e que pode estar associado à volta presencial das aulas.

DESCRITORES: crianças; adolescentes; escola; IMC; estado nutricional.

ABSTRACT

Objective: To assess the nutritional status (anthropometric data and dietary intake) of children and adolescents from a public school in the municipality of Canoas, Rio Grande do Sul, Brazil. **Methods:** Observational study (n=341), consisting of two cross-sectional assessments and one prospective cohort (n=66). All parameters followed the SISVAN Protocol of the Brazilian Ministry of Health. Comparisons were performed using Pearson's Chi-Square test and the McNemar-Bowker test (p<0.05). **Results:** There was relative stability between the periods analyzed regarding excess weight (2021-2: 44.4% and 2022-1: 45.7%) and, specifically, obesity (2021-2: 27.5% and 2022-1: 24.6%). Thinness also showed a similar distribution between 2021-2 and 2022-1 (2.1% versus 3.0%, respectively). **Conclusion:** Slightly more than half of the participants (52.5%) were classified as "eutrophic", and no relevant changes were observed across the evaluated periods. However, in the 2022-1 assessment there was a higher intake of ultra-processed foods compared to 2021-2, which may be associated with the resumption of in-person schooling.

DESCRIPTORS: children; adolescents; school; BMI; nutritional status.

RESUMEN

Objetivo: Evaluar el estado nutricional (datos antropométricos y consumo alimentario) de niños y adolescentes de una escuela pública del municipio de Canoas, Rio Grande do Sul, Brasil. **Métodos:** Estudio observacional (n=341), compuesto por dos cortes transversales y una cohorte prospectiva (n=66). Los parámetros siguieron el Protocolo SISVAN del Ministerio de Salud de Brasil. Las comparaciones se realizaron mediante la prueba Chi-cuadrado de Pearson y la prueba de McNemar-Bowker (p<0,05). **Resultados:** Se observó estabilidad entre los períodos analizados en relación con el exceso de peso (2021-2: 44,4% y 2022-1: 45,7%) y, particularmente, con la obesidad (2021-2: 27,5% y 2022-1: 24,6%). La delgadez también mostró valores similares entre 2021-2 y 2022-1 (2,1% frente a 3,0%, respectivamente). **Conclusión:** Algo más de la mitad de los participantes (52,5%) se encontraban en estado nutricional "eutrófico", sin modificaciones relevantes entre los períodos evaluados. En el relevamiento de 2022-1 se observó un mayor consumo de alimentos ultraprocesados respecto a 2021-2, lo que podría estar asociado al retorno presencial a las aulas.

DESCRIPTORES: niños; adolescentes; escuela; IMC; estado nutricional.

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INTRODUCTION

The Reference Framework for Food and Nutrition Education (EAN) for Public Policies, developed in 2012, has been considered a fundamental strategy for the prevention and control of contemporary food and nutrition problems[1]. Among its main points is its contribution to the prevention and control of chronic noncommunicable diseases, especially in school settings.

Unlike overweight and obesity, and more serious from an immediate point of view, social vulnerability and food insecurity are associated with hunger and malnutrition, including among children and adolescents[2] . This scenario disrespects the *basic* human condition, that is, the very existence and minimum dignity of survival. Furthermore, child malnutrition leads to delayed physical and cognitive development[3]. While hunger and malnutrition are socially devastating, today's diet is largely based on processed and ultra-processed foods, and food choices, when possible, revolve around what is "most palatable," "most satisfying," and, mistakenly, "cheapest," as opposed to what is nutritionally healthy. The consequence of these choices and the lack of regular physical activity[4] leads to overweight and obesity, and with it, cardiometabolic diseases[5]. This scenario is widespread among the Brazilian and global population, including children and adolescents[6].

Given that public schools tend to have a predominance of socially vulnerable and low-income students, it is imperative that EAN clarify the idea that "healthy eating does not have to be expensive, but rather a matter of choice." This view should be widely promoted in schools[1]. In Brazil, the Ministry of Health has implemented SISVAN (Food and Nutrition Surveillance System)[7] as an important tool for population diagnosis and decision-making with regard to improving the quality of care for the population and promoting health: *"Valuing nutritional status assessment is essential to improving health care and promotion"*[7]. Thus, there is consensus on the importance of monitoring the nutritional status of children and adolescents. Therefore, a temporal analysis of the parameters that reflect the nutritional status of children and adolescents is imperative and should contribute to the analysis of deficiencies within a school community, supported by the Health at School Program and EAN. As social and economic characteristics differ greatly across Brazil and are based on local aspects, we applied this study to a public school in a municipality in the metropolitan region of Porto Alegre/RS. Thus, the objective of this study is to assess the nutritional status (anthropometric data and food consumption) of children and adolescents in a public school in the municipality of Canoas/RS.

METHODS

This research followed ethical guidelines in accordance with RDC 466/2012 and was submitted to and approved by the Research Ethics Committee of LaSalle University (protocol 5.724.310, approved on 10/26/2022). It is an observational study composed of two cross-sections (2021-1 and 2022-1) and, within this period, a cohort was formed by volunteers who were evaluated in both periods for anthropometric changes and food consumption. Thus, all students in grades 1 to 7 nd 8th (n=350) of the afternoon shift at Arthur Pereira de Vargas Municipal Elementary School, Canoas/RS, were part of the study.

Outcomes of Interest

According to SISVAN guidelines[7] , for children considered to be under 10 years of age, the anthropometric indices used are: (i) BMI percentile or Z-score, (ii) body weight for age, and (iii) height for age. For adolescents, considered to be aged ≥ 10 years and < 20 years, BMI percentile or Z-score and height for age should be used.

The anthropometric measurements of the study population from 2021-2 and 2022-1 were collected through the

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School Health Program (PSE), Municipal Health Secretariat of Canoas/RS (SMS), in partnership with the Integrative Project of the Faculty of Nutrition of LaSalle University, and tabulated in an Excel spreadsheet as a database. Consumption markers were collected at the same time. The analysis and classification of anthropometric and food consumption markers strictly followed the SIVAN Protocol.

All collections were carried out on Wednesday afternoons. This information guides the SIVAN Food Consumption survey, as it refers to "the previous day."

Database Processing

The data were organized in Excel spreadsheets in order to unify the nomenclature of BMI percentile and body weight/age diagnoses. Afterwards, a "name by name" check of both collections (2021-2 and 2022-1) was performed to represent the student cohort. Thus, 341 children/adolescents were evaluated, with 70 girls and 72 boys in 2021-2; in 2022-1, there were 99 girls and 100 boys. Of this group, 66 children were evaluated on both occasions

Body weight was measured using a P200M digital scale (Líder, Araçatuba, SP), and height was measured using a portable stadiometer (Avanutri, Rio de Janeiro, RJ). The measurement protocol followed the recommendations of SISVAN (2008). Briefly, for body weight, the child/adolescent was asked to wear only a T-shirt and remove their shoes, respecting the wishes of those being evaluated. The children stood on the scale with their feet together, looking straight ahead (Frankfurt plane), arms at their sides, and their body weight was recorded. Next, the children/adolescents stood at the base of the stadiometer with their heels against the back and their feet close together at a 45° angle. The Frankfurt plane was then checked, and the stadiometer rod was lowered to the top of the head to measure height. When applicable, participants were asked to undo any hairstyles or hair arrangements that could interfere with height measurement. Individual interviews were conducted to assess food consumption. After each question was asked, if the child/adolescent showed hesitation in answering, only in these cases did the interviewers provide examples related to the question in question. This practice was adopted to minimize potential bias or prompting of answers.

As the variables of interest, body weight and height, as well as food consumption markers, do not follow a classic pattern of normality, there was no interpolation for missing information, especially in the study cohort.

Statistical Analysis

Continuous variables with normal distribution, tested by Shapiro-Wilk, were described as mean ± standard deviation. Categorical variables were described as absolute and relative frequencies. Comparisons were made according to the type of variable and number of groups formed: Pearson's Chi-Square test for categorical variables, with independent samples, and McNemar-Bowker to assess changes in the cohort (paired samples in the two analysis periods). Statistical analysis was performed using the *Statistical Package for Social Sciences* (SPSS) 20.0 program, and a statistical significance level of $p<0.05$ was accepted.

RESULTS

A total of 341 children/adolescents were evaluated, of which 70 were girls and 72 were boys in 2021-2; in 2022-1, there were 99 girls and 100 boys. Of this group, 66 children were evaluated on both occasions.

Overall, 45.2% (154 of 341 students) were "overweight" (overweight or obese). Considering only "obesity," it totaled 25.8% of cases (88 students out of a total of 341). Comparing the two periods, there was a balance between them for overweight (2021-2 with 44.4% and 2022-1 with 45.7%) and obesity (2021-2: 27.5% and 2022-1: 24.6%). At the other extreme, thinness also showed similarity between the prevalences of 2021-2 and 2022-1, with 2.1% *versus* 3.0%, respectively. Thus, considering all students, only 52.5% of them show adequate nutritional status (eutrophy), assessed by BMI percentile, with no distinction between girls and boys. Interestingly, in 2022-1 there was a higher prevalence of "severe obesity" compared to 2021-2, both in girls and boys, although the absolute frequency was relatively low (Table 1).

Table 1 – Distribution of "BMI percentile" in the periods studied

	2021-2	2022-1	Total	Qui-Quadrado Pearson
	Frequency n (%)	Frequency n (%)	Frequency n (%)	p-valor
Girls				
Thinness	1 (1,4)	5 (5,1)	6 (3,6)	0,117
Eutrophication	38 (54,3)	57 (57,6)	95 (56,2)	
Overweight	12 (17,1)	18 (18,2)	30 (17,8)	
Obesity	19 (27,1)	15 (15,2)	34 (20,1)	
Severe obesity	0 (0,0)	4 (4,0)	4 (2,4)	
Total	70	99	169	

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Boys				
Thinness	2 (2,8)	1 (1,0)	3 (1,7)	0,502
Eutrophy	38 (52,8)	45 (45,0)	83 (48,3)	
Overweight	12 (16,7)	24 (24,0)	36 (20,9)	
Obesity	19 (26,4)	26 (26,0)	45 (26,2)	
Severe obesity	1 (1,4)	4 (4,0)	5 (2,9)	
Total	72	100	172	
All Students				
Thinness	3 (2,1)	6 (3,0)	9 (2,6)	0,207
Eutrophy	76 (53,5)	102 (51,3)	178 (52,2)	
Overweight	24 (16,9)	42 (21,1)	66 (19,4)	
Obesity	38 (26,8)	41 (20,6)	79 (23,2)	
Severe obesity	1 (0,7)	8 (4,0)	9 (2,6)	
Total	142	199	341	

BMI percentile classification according to the Ministry of Health(7) . BMI: Body Mass Index. The differences between semesters, within each stratification (girls, boys, and total) were tested using Pearson's chi-square test and a significance level of 5% ($p<0.05$).

Considering the cohort of 66 students, i.e., those who were assessed in both periods, there were no relevant changes [p(girls)=0.601; p(boys)=0.440] over time. However, considering an individual clinical view, we observed that of the 21 "eutrophic" girls in 2021-2, three of them were assessed as "thin" in 2022-1. Furthermore, of the 8 girls with "obesity," two of them went to "severe obesity" in 2022-1. For boys, the picture was better: one boy with "thinness" migrated to "eutrophy," and two who were "overweight" were classified as "eutrophic." Finally, of the nine boys classified as "obese" in 2021-1, five regressed to "overweight" and three were classified as "eutrophic."

Table 2 – Monitoring of the "BMI percentile" of a cohort of students from 2021-2 to 2022-1

		2021-2 – n (%)	2022-1 – n (%)				
			Thin	Normal weight	Overweight	Obesity	Severe obesity
Girls (n=34)	Thinness						
	Normal weight	21 (61,8)	**3 (8,8)****	17 (50,0)	**1 (2,9)****		
	Overweight	5 (14,7)		**1 (2,9)***	4 (11,8)		
	Obesity	8 (23,5)				6 (17,6)	2 (5,9)**
	Severe obesity						
Boys (n=32)	Thinness	1 (3,1)		**1 (3,1)***			
	Normal weight	17 (53,1)		15 (46,9)	**2 (6,3)****		
	Overweight	4 (12,5)		**2 (6,3)***	2 (6,3)		
	Obesity	9 (28,1)		**3 (9,4)***	**5 (15,6)***	1 (3,1)	
	Severe obesity	1 (3,1)				1 (3,1)	
Total (n=66)	Thinness	1 (1,5)		1 (1,5)			
	Normal weight	38 (57,6)	3 (4,5)	32 (48,5)	3 (4,5)		
	Overweight	9 (13,6)		1 (1,5)	6 (9,1)	2 (3,0)	
	Obesity	17 (25,8)			3 (4,5)	11 (16,7)	3 (4,5)
	Severe obesity	1 (1,5)				1 (1,5)	

BMI percentile classification according to the Ministry of Health(7). The differences between the semesters, within each stratification (total, girls, and boys) were checked using the McNemar-Bowker test and a significance level of 5% ($p<0.05$). Thus, p(girls)=0.601; p(boys)=0.444; p(total)=0.525. ** migration to "worsening health" and * migration to "improving health".

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Another important nutritional status marker for children up to 9 years of age (complete) is body weight for age (Table 3). Thus, it can be observed that there were no consistent changes between the classifications of this marker. However, Table 4 shows the change in children over time, and of 10 children with "high weight for age," five of them were reclassified as "appropriate weight for age" in 2022-1.

Table 3 – Distribution of "Body Weight by Age" in the Periods Studied – Children Aged 5 to 9 Years Old

	2021-2	2022-1	Total	Pearson Chi-Square
	Frequency n (%)	Frequency n (%)	Frequency n (%)	p-value
Girls				
Adequate for age	10 (58,8)	28 (82,4)	38 (74,5)	0,069
High for age	7 (41,2)	6 (17,6)	13 (25,5)	
Total	17	34	51	
Boys				
Age-appropriate	27 (73,0)	33 (68,8)	60 (70,6)	0,672
High for age	10 (27,0)	15 (31,3)	25 (29,4)	
Total	37	48	85	
All Students				
Age-appropriate	37 (68,5)	61 (74,4)	98 (72,1)	0,455
High for age	17 (31,5)	21 (25,6)	38 (27,9)	
Total	54	82	136	

Classification of "Body Weight by Age" for children up to 9 years of age, according to the Ministry of Health(7) . The differences between the semesters, within each stratification (girls, boys, and total) were tested using Pearson's chi-square test, with a significance level of 5% ($p<0.05$).

Table 4 – Monitoring of "Body Weight by Age" in a Cohort of Students from 2021-2 to 2022-1 – Children Aged Between 5 and 9 Years Old

	2021-2 – n (%)		2022-1 – n (%)	
			Adequate for age	High for age
Girls (n=9)	Adequate for age	7 (77,8)	6 (66,7)	1 (11,1)**
	High for age	2 (22,2)	1 (11,1)*	1 (11,1)
Boys (n=17)	Age-appropriate	9 (52,9)	8 (47,1)	1 (5,9)**
	High for age	8 (47,1)	4 (23,5)*	4 (23,5)
Total (n=26)	Adequate for age	16 (61,5)	14 (53,8)	2 (7,7)**
	High for age	10 (38,5)	5 (19,2)*	5 (19,2)

Classification of "Body Weight by Age" for children up to 9 years of age, according to the Ministry of Health(7) . The differences between the semesters, within each stratification (girls, boys, and total) were tested using Pearson's chi-square test, with a significance level of 5% ($p<0.05$).

In relation to height for age, there were no cases outside the expected values recommended by the Brazilian Ministry of Health[7] .

Table 5 presents the questions on food consumption recommended by the SISVAN Protocol of the Brazilian Ministry of Health (BRAZIL). Regarding food consumption, the survey has three questions involving healthy foods (Q3, Q4, and Q5) and four questions involving industrialized and ultra-processed foods (Q6, Q7, Q8, and Q9). Thus, we highlight that, in 2021-2, 50.7% of children/adolescents had not consumed any type of fresh fruit, while 72.1% had consumed sweetened beverages, always considering the day before the survey

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(24-hour recall). In 2022-1, the picture is slightly worse for processed and ultra-processed foods: 56.5% consumed hamburgers or sausages, 75.3% had consumed sweetened beverages, 64.6% consumed instant noodles, and 67.7% consumed some type of filled cookie or candy.

Tabela 5 – Marcadores de Consumo nos Períodos Estudados

	2021-2						2022-1					
	Girls		Boys		Total		Girls		Boys		Total	
	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)
Q1) Do you usually eat your meals while watching TV, using your computer, or using your cell phone?	28 (20,3)	40 (29,0)	22 (15,9)	48 (34,8)	50 (36,2)	88 (63,8)	48 (24,7)	49 (25,3)	31 (16,0)	66 (34,0)	79 (40,7)	115 (59,3)
Q3) Did you eat beans yesterday?	30 (21,6)	38 (27,4)	24 (17,4)	47 (33,8)	54 (38,8)	85 (61,2)	20 (10,4)	76 (39,6)	30 15,6)	66 (34,4)	50 (26,0)	142 (74,0)
Q4) Did you consume fresh fruit yesterday (not including fruit juices)?	29 (20,7)	40 (28,6)	42 (30,0)	29 (20,7)	71 (50,7)**	69 (49,3)	29 (15,1)	67 (34,9)	30 (15,6)	66 (34,4)	59 (30,7)	133 (69,3)
Q5) Did you eat vegetables yesterday (except potatoes, cassava, manioc, sweet potatoes, and yams)?	30 (21,2)	39 (27,7)	40 (28,4)	32 (22,7)	70 (49,6)	71 (50,4)	36 (18,8)	59 (30,9)	35 (18,4)	61 (31,9)	71 (37,2)	120 (62,8)
Q6) Did you eat hamburgers or cold cuts (ham, bologna, salami, sausage, or hot dogs) yesterday?	40 (29,0)	28 (20,3)	45 (32,6)	25 (18,1)	85 (61,6)	53 (38,4)	45 (23,3)	52 (26,9)	39 (20,2)	57 (29,5)	84 (43,5)	109 (56,5)**
Q7) Yesterday, did you consume sweetened beverages (soda, boxed or powdered juice, boxed coconut water, guarana or blackcurrant syrup, fruit juice with sugar)?	18 (12,9)	51 (36,4)	21 (15,0)	50 (35,7)	39 (27,9)	101 (72,1)**	28 (14,4)	69 (35,6)	20 (10,3)	77 (39,7)	48 (24,7)	146 (75,3)**
Q8) Yesterday, did you eat instant noodles, packaged snacks, or savory cookies?	43 (30,7)	25 (17,9)	50 (35,7)	22 (15,7)	93 (66,4)	47 (33,6)	38 (19,8)	59 (30,7)	30 (15,6)	65 (33,9)	68 (35,4)	124 (64,6)**
Q9) Yesterday, did you consume filled cookies, sweets, or candy (candy, lollipops, gum, caramel, jelly beans)?	33 (23,6)	35 (25,0)	38 (27,1)	34 (24,3)	71 (50,7)	69 (49,3)	28 (14,4)	69 (35,4)	35 (17,9)	63 (32,3)	63 (32,3)	132 (67,7)**

** when prevalence > 50%, presenting a worrying health situation. Question "Q2" is presented in the text (section "Results") due to the multiple response configuration.

Regarding the number of meals eaten on the day before the survey, Q2 – Consumption Markers[7,8] , there was a fluctuation for boys (p=0.026), as well as for the total sample (p=0.008). Although the difference was for 4 or more meals per day, the concern lies with 34 children (10.2%) who had eaten only 1 or 2 meals the day before, in both periods analyzed.

DISCUSSION

We assessed the prevalence of nutritional status using BMI percentile, body weight for age, height for age, and food consumption markers in students from 1st to 7th grade at a municipal school in the metropolitan region of Porto Alegre, Rio Grande do Sul. The main findings show that, in the entire sample, just over half (52.5%) are classified as "eutrophic," i.e., healthy. The extremes of BMI percentile were distributed as fol-

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lows: "thinness" with similarity between 2021-2 (2.1%) and 2022-1 (3.0%); overweight: 2021-2 (44.4%) and 2022-1 (45.7%); and, particularly, "obesity": 2021-2 (27.5%) and 2022-1 (24.6%). In all analyses, there was no difference between the sexes. However, the cohort of 66 students showed a trend toward improvement in indicators for boys, especially those who were "obese" in the first assessment (2021-2). Regarding food consumption, the prevalence showed that children/adolescents did not consume healthy foods in favor of industrialized or ultra-processed foods one day before the survey in both periods studied, but with greater prominence in 2022-1.

A starting point for discussion concerns the broad concept of health, including that adopted by the SUS[9] , which advocates health not only as the absence of disease, but as a general state of balance between biological, psychological, social, emotional, and intellectual perspectives, resulting in a sense of well-being and quality of life. However, there is a *sine qua non* association that physical proportions, such as BMI, body weight for age, and height for age, are associated with nutritional status and, therefore, constitute partial indicators of health. In this sense, and according to the WHO and UNICEF, malnutrition is a pathological condition caused by deficient or inadequate consumption of calories and/or proteins[10]. Whereas thinness, as a BMI classification for children or adults, is a view of the ratio of body weight to height, i.e., physical rather than nutritional parameters; although, in this case, there is a logical and inherent association that a person classified as "thin" will also be "malnourished." Thus, while other nutritional deficiencies, such as iron, vitamin A, iodine, and other micronutrient deficiencies, require reminders and laboratory tests, malnutrition can be diagnosed through indicators of body weight, height, and age[8]. This diagnosis can prevent serious consequences for the development of children/adolescents that are associated with thinness and malnutrition[11]: immune weakness, growth retardation, impaired intellectual, psychomotor, and brain development, among many other situations. In our study, of the 341 evaluated, we found 9 children/adolescents in a state of thinness and malnutrition.

Although this prevalence is "acceptable" in epidemiological terms, we are dealing with nine children with possible motor and cognitive developmental delays[12]. Evidence shows that the functions most compromised in malnourished children are balance (static and dynamic), sensitivity, language, and trunk-limb coordination, which collectively affect higher cortical functions and neuropsychomotor development[13]. Interestingly, the number of meals consumed by children/adolescents with "thinness" in our study is within an acceptable average (between 3 and 4 meals/day). However, the energy or nutritional content of these meals was not evaluated. We emphasize that the SISVAN instrument consists of the question "What meals did you eat yesterday?" and other questions about nutritional quality, but none of them cover the concept of quantity. Thus, the amount of energy ingested appears to be insufficient to meet the demands of these thin children/adolescents.

In contrast to thinness and malnutrition, the most prevalent cases are those of excess body weight (overweight + obesity). Overall, 45.2% (154 of 341 students) were overweight. Specifically, 25.8% were obese (88 students out of a total of 341). In 2013, the *American Medical Association* (AMA), one of the most influential medical organizations in the world, decided to classify obesity as a disease[14]. However, the AMA received criticism[15] about this decision, mainly because of the way obesity is diagnosed: through BMI. A central point about obesity is the concept itself and its diagnosis. In general terms, obesity is characterized by an imbalance between caloric intake and expenditure, favoring intake, which determines the accumulation of adipose tissue in the body[16]. It can be observed that the definition covers "accumulation of adipose tissue" and body weight does not reflect the amount of "fat mass," therefore, BMI would not be an adequate tool for diagnosing obesity and classifying it as a "disease." However, numerous health organizations, including the WHO, recommend BMI as a tool for the "population-based" diagnosis of obesity and associate it with cardiometabolic "risk factors." Furthermore, for children/adolescents, the standard is to use percentile curves or Z-scores, according to age[7]. Thus, on the one hand, it would be legitimate to say that 25.8% of those evaluated are "sick"—after all, obesity is considered a disease. On the other hand, it would be premature and perhaps psychosocially burdensome to classify them as "sick."

The comparison between the periods studied showed that the prevalences were similar and independent of gender, meaning that, at least within this time frame, the situation remained unchanged. The concern becomes even greater given the finding that overweight children/adolescents are more likely to become obese adults((. Studies have shown that between 50% and 80% of adults with obesity have a history of the same condition in adolescence, leading to the burden of associated diseases[18, 19].

Interestingly, the prevalence rates found in our study are higher than those of the ERICA study, whose results indicate that 8.4% (95% CI 7.9–8.9) of the adolescent population in Brazil is obese[6]. Furthermore, adolescents with this condition showed a higher prevalence of hypertension (28.4%; 95% CI 25.5–31.2) than those who are overweight (15.4%; 95% CI 13.8–17.0) or eutrophic (6.3%; 95% CI 5.6–7.0). In the same study, the southern region led in cases of overweight (18.7%) and obesity (11.1%) when compared to the rest. Our study found 23.2%, which

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is twice as much as the ERICA study. One speculation may be raised due to the COVID-19 pandemic. The ERICA study was published in 2015/2016, in a different scenario compared to 2021/2022.

Our study found 2.6% (9 out of 341 children/adolescents) with severe obesity. As with thinness, the number of cases may be acceptable from an epidemiological point of view. However, these 9 children/adolescents may suffer, in addition to increased cardiometabolic risk, negative social and psychological effects. The feeling of disrespect and "not fitting in" to society ends up causing diseases such as depression, anxiety, and panic attacks[20] in children, adolescents, and adults. In this sense, early intervention on lifestyle and social respect can have a positive impact on adult behavior, with school being a strategic place to work on these issues. According to the Ministry of Health, "The *articulation between School and Primary Health Care is the basis of the Health at School Program (PSE)*"[21]. Furthermore, the PSE advocates for intersectorality between public health and education networks and other social networks, clearly showing that there should be joint actions between the areas of health and education with a single goal: the physical and mental health and educational level of students.

In addition to BMI percentile and weight for age, current eating behavior revolves around problems that obscure the perception and act of eating[22]. Eating in front of screens (cell phone, television, or computer), as well as in noisy places and/or places that offer unlimited food choices, among others, leads to eating without attention and in a hurry[22,23]. Collectively, these behaviors can lead to overeating and weight gain[23]. In fact, our sample showed that 63.8% (2021-2) and 59.3% (2022-1) of participants responded that they "usually eat meals while watching TV, using the computer, or using their cell phone."

Regarding the quality mentioned in the food consumption survey, the population evaluated in our study seems to maintain the eating habits of most Brazilian adolescents[24]: a preference for industrialized and ultra-processed foods over healthy foods, such as fruits, vegetables, natural juices, etc. Although this is a reality, some hypotheses can be raised. The first period evaluated (2021-2) was still under the COVID-19 pandemic, meaning that most, if not all, classes were remote and/or video lessons. In contrast, during the second period evaluated (2022-1), classes were already fully in-person. This change may have encouraged the consumption of "quick" and "more palatable" snacks, including sweets, cookies/biscuits, ready-made juices, and soft drinks. This fact may explain, in part, the worse performance of consumption markers in 2022-1 *versus* 2021-2. Still under the shadow of the COVID-19 pandemic, many parents and guardians returned to their usual workload in 2022-1. It is possible that children/adolescents were left in the care of older siblings, neighbors, relatives, etc. In this scenario, the change in social behavior may have influenced food consumption: children wake up later, do not eat a proper breakfast, and go straight to lunch—skipping a meal.

Health education within the school environment, including knowledge of nutrition (the subject of this research), should be treated as a priority issue and, perhaps, a cross-cutting theme in an educational plan. Triches and Giugliani (2005)[25] showed that obesity was associated with less knowledge of nutrition and less healthy eating practices. The authors described that children with these characteristics (less knowledge about nutrition) were five times more likely to be obese (*Odds Ratio* = 5.3; 95% CI 1.1 – 24.9)[25].

Our study has some limitations. The main one was that it was restricted to the instruments of the SISVAN Protocol. The recall used by SISVAN is a 24-hour survey. The application of other food consumption instruments, such as a habitual recall or food frequency, among others, could infer the quantity and quality of food. Similarly, the assessment of triceps and leg (calf) skinfolds could provide other diagnoses and adequacy indices for better classification of the sample. In this sense, the use of ERICA study procedures seems to largely address these points. Another limitation was the lack of sociodemographic information from guardians and school performance, which limited some associations with nutritional status.

CONCLUSION

A large part of our sample (45%) has cardiometabolic risk, despite their young age. Extreme cases (thinness and severe obesity), although low in prevalence, should not be overlooked. These indices are confirmed by food choices that favor industrialized and ultra-processed foods, according to the survey conducted. In the general context, the sample studied shows higher rates of inadequate nutritional status when compared to the ERICA study, a national reference. Thus, it is urgent to implement public policies in schools that address the topic of "health education," including nutrition, regular physical exercise, and psychosocial aspects.

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