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ORIGINAL

Trends in food consumption of schoolchildren from 2nd to 5th grade: a panel data analysis

Tendências no consumo alimentar de escolares do 2º ao 5º ano: uma análise de dados em painel

Luciana Jeremias PEREIRA[1] 0000-0002-4214-549X
Patrícia de Fragas HINNIG[1] 0000-0002-9348-8513
Patrícia Faria DI PIETRO[1] 0000-0003-1343-5049
Maria Alice Altenburg de ASSIS[1] 0000-0002-5383-3714
Francilene Gracieli Kunradi VIEIRA[1] 0000-0003-4211-9133

ABSTRACT

Objective

To identify trends in food consumption among schoolchildren (2nd-5th grades) from public schools in the city of *Florianópolis*, Brazil, in a period of three years.

Methods

Three cross-sectional surveys were carried out in 2013 (n=1,942), 2014 (n=1,989) and 2015 (n=2,418). Dietary intake data were obtained using the Web-Based Food Intake and Physical Activity of Schoolchildren questionnaire. Food items were aggregated to eight food groups. Kruskal-Wallis heterogeneity and trend tests were used to analyze the differences and trends among the mean intake frequency of food groups.

[1] Universidade Federal de Santa Catarina, Departamento de Nutrição, Programa de Pós-Graduação em Nutrição. *Campus* Universitário, Trindade, 88040-900, Florianópolis, SC, Brasil. Correspondence to: PF HINNIG. E-mail: <phinnig@yahoo.com.br>.

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Results

There were trends to decrease the mean intake frequency of sweets in the total sample (2013: 0.72±0.91; 2014: 0.68±0.87; 2015: 0.67±0.89, *p*=0.03) which was determined by children between 7-9 years old (2013: 0.69±0.88; 2014: 0.64±0.85; 2015: 0.62±0.87, *p*=0.02), and boys (2013: 0.75±0.90; 2014: 0.70±0.86; 2015: 0.68±0.88, p=0.03). Younger children also tended to increase the mean intake frequency of fruits and vegetables (2013: 1.03±1.35; 2014: 1.16±1.45; 2015: 1.17±1.41, *p*=0.03) and those aged ten-12 years decreased their intake of dairy products (2013: 1.32±1.25; 2014: 1.23±1.18; 2015: 1.20±1.20, *p*=0.05).

Conclusion

The results suggest positive trends for younger children, with an increased consumption of fruits and vegetables in both sexes and decreased consumption of sweets for boys. Older children reduced their consumption of dairy products over the three-year period of this study.

Keywords: Child. Food consumption. Nutritional surveillance.

RESUMO

Objetivo

Este estudo buscou identificar tendências no consumo alimentar de escolares do 2º ao 5º ano de escolas públicas do município de Florianópolis durante três anos.

Métodos

Três pesquisas transversais foram conduzidas em 2013 (n=1.942), 2014 (n=1.989) e 2015 (n=2.418). Dados de consumo alimentar foram obtidos com a aplicação do questionário de avaliação de consumo alimentar e atividade física. Os itens alimentares foram classificados em oito grupos. Utilizaram-se os testes Kruskal-Wallis de heterogeneidade e de tendência para analisar as diferenças e tendências entre as médias de frequência de consumo dos grupos alimentares.

Resultados

Verificou-se uma tendência de redução da média de frequência de consumo de doces para a amostra total (2013: 0,72±0,91; 2014: 0,68±0,87; 2015: 0,67±0,89, p=0,03), que foi determinada pelos escolares de 7 a 9 anos (2013: 0,69±0,88; 2014: 0,64±0,85; 2015: 0,62±0,87, p=0,02) e do sexo masculino (2013: 0,75±0,90; 2014: 0,70±0,86; 2015: 0,68±0,88, p=0,03). Escolares mais novos também tenderam a aumentar o consumo de frutas, verduras e legumes (2013: 1,03±1,35; 2014: 1,16±1,45; 2015: 1,17±1,41, p=0,03), e os de 10 a 12 anos diminuíram laticínios (2013: 1,32±1,25; 2014: 1,23±1,18; 2015: 1,20±1,20, p=0,05).

Conclusão

Os resultados sugerem tendências positivas para escolares mais novos, com o aumento do consumo de frutas, verduras e legumes em ambos os sexos e redução de doces para os meninos. Escolares mais velhos reduziram laticínios nos três anos de seguimento.

Palavras-chave: *Criança. Consumo de alimentos. Vigilância nutricional.*

INTRODUCTION

The study of the food consumption of school-age children has become relevant for nutritional epidemiology due to its relationship with overweight and the greater chance of this condition to remain in adulthood [1,2].

In Brazil, one of the commitments of the *Political Nacional de Alimentação e Nutrição* (PNAN, National Food and Nutrition Policy) is the continuous and systematic monitoring of the population's food and nutritional situation [3]. Periodic food consumption data allows researchers to know the main changes and temporal trends, to identify eating behaviors which could be harmful to the health of the population, to monitor the effectiveness of interventions and to subsidize public policies [4].

In the country, there are no official sources of periodic food consumption data for children aged between seven and 12 years. Monitoring this population is important because it is a crucial stage in establishing eating habits [5].

There are few studies addressing temporal trends in the food consumption of schoolchildren [6], and so are studies that have evaluated the influence of age, sex and nutritional status on these trends. Considering that population means can mask important differences between subpopulations, it is possible that changes in food consumption do not occur uniformly between boys and girls of different ages with or without overweight.

Cross-sectional studies conducted with Brazilian children have identified dietary patterns composed of traditional foods consumed in Brazil (rice, beans, flour, tubers, cereals, meat, fruits, vegetables and legumes) and patterns with the presence of sweets, sandwich cookies, chips, snacks, soft drinks and fast food [7,8]. The stability of consumption of traditional foods in the Brazilian diet, from childhood to adolescence was observed in a longitudinal study conducted with schoolchildren from the city of *Florianópolis*, Brazil, between 2007 and 2012 [7].

International studies with data from periodic surveys of children have shown a tendency towards a reduction in the consumption of cereals in Greece, of dairy products in the United States and in European countries, and an increase in the consumption of fast foods in China. Positive trends in reducing the consumption of sugary drinks in the United States, trends of declining consumption of sweets and increasing consumption of fruits and vegetables in the Nordic countries [9-12] have also been identified.

In the city of *Florianópolis* (*Santa Catarina* State), researchers designed the *Consumo Alimentar e Atividade Física de Escolares* (CAAFE, Food Consumption and Physical Activity of Schoolchildren), a health surveillance system, which was developed aimed at providing periodic information on two behaviors intrinsically related to the development of overweight in children – food consumption and physical activities [13].

In this context, the objective of this study was to identify trends in the food consumption of schoolchildren in the city of *Florianópolis*, Brazil, monitored by the CAAFE in the years 2013-2015, stratified by sex, age group and weight status.

METHODS

A panel study conducted with students from the 2nd to the 5th grade of the public-school system of the city of *Florianópolis*, Brazil, monitored between August 2013 and September 2015.

The sampling method was probabilistic by clusters in each grade. All schools (primary sample units) with students from the 2nd to the 5th grade and with computerized classroom were eligible (34 in 2013 – 92% –, 34 in 2014 – 94.4% –, 35 in 2015 – 97.2%). School grades were considered secondary sample units, with a random selection of four classes from each school, one of each grade.

The sample size was calculated each year, based on the expected prevalence of overweight children – between 30-40%, ±3 percentage points of margin of error for the prevalence estimate and a 95% confidence level [14]. Due to the cluster sampling methodology, the sample size was multiplied by 1.5 and with an extra 30% added for possible losses and refusals, resulting in a minimum sample size of 1,804 in 2013, 1,809 in 2014 and 1,811 in 2015.

The following inclusion criteria were considered: students enrolled in the grades of interest, who were present on the day of data collection, signed the Informed Consent Term, and not having any physical or mental problems reported by the teacher that prevented the child's participation. The final sample comprised 7,053 students (2,159 in 2013; 2,230 in 2014 and 2,664 in 2015).

Data on name, date of birth, sex, shift and school grade were made available by schools themselves. Age was calculated in years and categorized (seven-nine and ten-12 years old). Family income was estimated from the average census sector income of the school location area according to data from the *Instituto Brasileiro de Geografia e Estatística* (IBGE, Brazilian Institute of Geography and Statistics) and categorized in tertiles [15].

One day's data on food consumption were obtained using the *Consumo Alimentar e Atividade Física de Escolares* (WebCAAFE, Web-Based Food Intake and Physical Activity of Schoolchildren) questionnaire, a qualitative questionnaire based on the frequencies of food consumption, based on a self-report from the previous day, and composed of three sections: identification, food consumption, and physical activities and sedentary behaviors. Details about the instrument have been described in other studies [16-19].

The food consumption section contains six chronologically ordered meals (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack), each one is illustrated by 32 icons representing different kinds of foods [16]. At each meal, the students were instructed to select the food consumed on the previous day among the 32 options presented.

This section was submitted to two validation studies conducted with schoolchildren from the city of *Florianópolis*, in the state of *Santa Catarina* (Brazil) and *Feira de Santana*, in the state of *Bahia* (Brazil), through the direct observation of school meals from the previous day as a reference method. Schoolchildren from *Florianópolis* showed a mean score of 43.0% of correct answers, 29.0% of intrusions and 28.0% of omissions. Schoolchildren from *Feira de Santana* presented 81.4% matches, 7.1% intrusions and 16.2% omissions [17,18].

The application of WebCAAFE was carried out in the computerized rooms of the schools. Previous explanations about answering the questionnaire were provided to the schoolchildren. The application of the questionnaire took place from Monday to Friday, allowing to obtain consumption data on four weekdays and one weekend day (Sunday) or holidays, and the day where the questionnaire was answered differed between the students. This strategy was used to obtain the daily variability of food consumption (Sunday to Thursday), allowing an analysis at group level. Due to the reason that there are no classes on weekends, it was not possible to obtain data for Fridays and Saturdays.

The 32 food items were classified into eight food groups, according to their nutritional properties, similarity of ingredients and previous groupings using WebCAAFE [17-19]: (1) Dairy products: milk, coffee with milk, yogurt and cheese; (2) Cereals: bread/cookies, cakes, manioc flour, maize/potato, pasta/lasagna, porridge, rice, breakfast cereal and cheese bread; (3) Beans: beans; (4) Meat, eggs and seafood: meat/poultry, egg, fish/seafood; (5) Fruits and vegetables (F&Vs): fruits, green leafy, vegetables, and vegetable soup; (6) Pizzas, hamburgers, hot dogs, processed and fried foods: instant pasta, French fries, sausages, packaged snacks, chicken nuggets, fried snacks/hamburgers/pizzas/hot dogs; (7) Sweets: chocolate/candies/lollipops/ice cream/cakes with icing and cream cookies; (8) Sugary drinks: chocolate milk, juices and soft drinks.

Weight and height measurements were performed using standardized procedures. Weight was measured on a portable digital scale, Marte® PP 180 model, with a maximum capacity of 180 (kg) and precision of 100 (g). For height, a Alturexata® stadiometer with a precision of one millimeter

(mm) was used. The measurements were carried out once, on the same day the schoolchildren answered the WebCAAFE questionnaire. The Body Mass Index (BMI) was converted into a Z-score (by age and sex) according to the World Health Organization references [20]. Weight status was categorized as non-overweight (under and normal weight children; Z-score <+1.0) or overweight (including obese children; Z-score ≥+1.0).

For statistical analysis, 704 students were excluded because they had a total frequency of consumption equal to or less than three food items, or greater than three standard deviations times the square root of the mean [7]. To describe the qualitative variables, the absolute and relative frequency were used, and Pearson's Chi-Square test was applied to verify differences between different years. The normality of the quantitative variables was verified using the Shapiro-Wilk test. Even though data distribution was asymmetrical, the use of means was considered more adequate, since food consumption is episodic. For food groups that showed a trend in the mean frequency of consumption, the Kruskal-Wallis trend test was used. When no trend was observed, the Kruskal-Wallis test and the Mann-Whitney post-test were applied. The analyzes were performed on the total sample and stratified by age, sex and weight status. The Stata 13.0 software [21] was used, and a significance level of $p<0.05$.

This study was approved by the Human Research Ethics Committee of the *Universidade Federal de Santa Catarina* (Federal University of Santa Catarina) (Opinion Numbers: 108.386 and 1.410.381).

RESULTS

A total of 6,349 schoolchildren participated in the study (1,942 in 2013; 1,989 in 2014 and 2,418 in 2015). A higher proportion of students aged seven to nine years was monitored during the three-year period, with a higher percentage in 2014 (61.89%) ($p<0.001$). The proportion of students that studied in the afternoon was similar between 2014 and 2015, while there were no children studying full time in 2013 ($p<0.001$). The prevalence of overweight was higher in 2014 (37.46%), compared to the other years (32.29% in 2013 and 34.66% in 2015, $p<0.001$). More students reported their food consumption on a school day (versus a non-school day) ($p<0.001$), with a higher percentage of students reporting non-school days in 2014 (26.40%). There was a lower representation of students from the third tertile of income in 2015 (30.27%) ($p=0.04$) (Table 1).

In general, there was a reduction in the mean frequency of cereal consumption from 2013 to 2014 (Mean±SD – 2013: 3.53±1.76 and 2014: 3.38±1.72, $p=0.01$) and a trend of reduction in the consumption of sweets throughout the years (2013: 0.72±0.91; 2014: 0.68±0.87; 2015: 0.67±0.89, $p=0.03$). A stratified analysis of the group of cereals was performed, dividing them into (a) bread/cookies, cakes, porridge, breakfast cereals and cheese bread (a typical Brazilian food), and (b) manioc flour, maize/potato, pasta/lasagna and rice, but no significant differences were observed for the subgroups (data not shown). For the rest of the food groups, food consumption remained stable during the period (Table 2).

Schoolchildren aged seven to nine years showed a tendency to increase the mean frequency of consumption of fruits & vegetables (F&Vs) (2013: 1.03±1.35; 2014: 1.16±1.45; 2015: 1.17±1.41, $p=0.03$) and a reduction in the consumption of sweets (2013: 0.69±0.88; 2014: 0.64±0.85; 2015: 0.62±0.87, $p=0.02$). For students aged ten to 12 years, there was a tendency to reduce the mean frequency of consumption of dairy products (2013: 1.32±1.25; 2014: 1.23±1.18; 2015: 1.20±1.20, $p=0.05$) and a reduction in cereal consumption from 2013 to 2014 (2013: 3.68±1.67; 2014: 3.35±1.64, $p<0.001$) (Tables 3 and 4).

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Table 1. Sociodemographic characteristics, weight status and self-reporting of food consumption of schoolchildren from the city of *Florianópolis* (SC), Brazil, in 2013, 2014, and 2015.

Characteristics	2013 (n=1,942)		2014 (n=1,989)		2015 (n=2,418)		p^c
	n	%	n	%	n	%	
Age (years)							
7 to 9	1,146	59.01	1,231	61.89	1,341	55.46	<0.001
10 to 12	796	40.99	758	38.11	1,077	44.54	
Sex							
Boys	992	51.08	985	49.52	1,235	51.08	0.520
Girls	950	48.92	1,004	50.48	1,183	48.92	
School period							
Morning	956	49.23	901	45.30	1,108	45.82	<0.001
Afternoon	986	50.77	1,022	51.38	1,243	51.41	
Full-time	0		66	3.32	67	2.77	
Weight status[a] (BMI)							
Non-overweight	1,315	67.71	1,244	62.54	1,580	65.34	<0.001
Overweight	627	32.29	745	37.46	838	34.66	
Day of the week reported							
Non-school days	340	17.51	525	26.40	523	21.63	<0.001
School days	1,602	82.49	1,464	73.60	1,895	78.37	
Tertiles of income[b]							
1° tertile (lowest)	693	35.68	701	35.24	843	34.86	0.040
2° tertile	607	31.26	625	31.42	843	34.86	
3° tertile	642	33.06	663	33.33	732	30.27	

Note: [a]Onis *et al*. [20]; [b]Income based on the average census sector income of the school located area; [c]Pearson's Chi-squared test; n: Absolute frequency; %: Relative frequency.
BMI: Body Mass Index.

Table 2. Trends in the mean intake frequency of each of the food groups of schoolchildren from the city of *Florianópolis* (SC), Brazil, in 2013, 2014, and 2015.

Food groups	2013		2014		2015		*p*
	Mean	SD	Mean	SD	Mean	SD	
Dairy products	1.24	1.29	1.16	1.20	1.16	1.20	0.35[a]
Cereals	3.53[c]	1.76	3.38[c]	1.72	3.40	1.73	0.01[a]
Beans	0.80	0.81	0.76	0.79	0.80	0.82	0.26[a]
Meat, eggs and seafood	1.10	0.93	1.04	0.93	1.10	0.94	0.08[a]
Fruits and vegetables	1.04	1.30	1.13	1.39	1.12	1.35	0.19[a]
Pizza, hamburger, hot dog, processed and fried food	1.07	1.28	1.04	1.23	1.01	1.22	0.24[b]
Sweets	0.72	0.91	0.68	0.87	0.67	0.89	0.03[b]
Sugary drinks	1.55	1.41	1.47	1.32	1.58	1.39	0.06[a]

Note: [a]Kruskal-Wallis test; [b]Kruskal-Wallis trend test; [c]Significant for Mann-Whitney post-test.
SD: Standard Deviation.

Boys reduced the mean frequency of cereal consumption in 2014 and 2015 when compared to 2013 (2013: 3.43±1.78; 2014: 3.24±1.71; 2015: 3.25±1.77, p<0.001). There was also a tendency to reduce the consumption of sweets for boys (2013: 0.75±0.90; 2014: 0.70±0.86; 2015: 0.68±0.88, p=0,03) (Tables 3 and 4).

From 2013 to 2014, overweight students showed a reduction in the mean frequency of consumption of cereals (2013: 3.53±1.69; 2014: 3.29±1.70, p<0.001), of meats, eggs and seafood (2013: 1.19±0.97; 2014: 1.03±0.88, p=0.03), and an increase in consumption of sugary drinks from 2014 to 2015 (2014: 1.41±1.28; 2015: 1.61±1.39, p=0.02) (Tables 3 and 4).

Table 3. Trends in the mean intake frequency of dairy products, cereals, beans, meat, eggs, seafood and fruits and vegetables of schoolchildren from the city of *Florianópolis* (SC), Brazil, in 2013, 2014, and 2015, according to their age, sex and weight status.

Characteristics	Dairy products		Cereals		Beans		Meat, eggs and seafood		Fruits and vegetables	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)										
7 to 9										
2013	1.18	1.32	3.43	1.81	0.81	0.82	1.05	0.96	1.03**	1.35
2014	1.12	1.21	3.40	1.77	0.79	0.81	1.01	0.97	1.16**	1.45
2015	1.13	1.21	3.31	1.75	0.81	0.84	1.04	0.97	1.17**	1.41
10 to 12										
2013	1.32**	1.25	3.68*a	1.67	0.78	0.80	1.17	0.89	1.05	1.23
2014	1.23**	1.18	3.35*a	1.64	0.72	0.77	1.09	0.86	1.09	1.30
2015	1.20**	1.20	3.52*	1.70	0.80	0.80	1.17	0.89	1.05	1.27
Sex										
Girls										
2013	1.29	1.32	3.64	1.74	0.81	0.81	1.11	0.89	1.23	1.45
2014	1.23	1.22	3.52	1.71	0.75	0.78	1.03	0.91	1.28	1.43
2015	1.25	1.22	3.56	1.67	0.80	0.79	1.08	0.90	1.28	1.41
Boys										
2013	1.19	1.27	3.43*ab	1.78	0.79	0.81	1.08	0.97	0.85	1.11
2014	1.09	1.18	3.24*a	1.71	0.77	0.81	1.05	0.95	0.97	1.34
2015	1.08	1.18	3.25*b	1.77	0.81	0.85	1.12	0.97	0.96	1.27
Weight status (BMI)										
Non-overweight										
2013	1.25	1.30	3.53	1.79	0.80	0.81	1.06	0.91	1.03	1.30
2014	1.18	1.22	3.44	1.72	0.78	0.80	1.05	0.95	1.11	1.37
2015	1.19	1.21	3.46	1.76	0.84	0.85	1.11	0.96	1.11	1.33
Overweight										
2013	1.21	1.29	3.53*a	1.69	0.79	0.82	1.19*a	0.97	1.05	1.30
2014	1.13	1.17	3.29*a	1.70	0.74	0.77	1.03*a	0.88	1.16	1.44
2015	1.11	1.18	3.32*	1.68	0.74	0.76	1.08*	0.91	1.14	1.39

Note: *Significant for Kruskal-Wallis test; **Significant for Kruskal-Wallis trend test; [a]Significant difference in Mann-Whitney Post-test between 2013 and 2014; [b]Significant difference in Mann-Whitney Post-test between 2013 and 2015; [c]Significant difference in Mann-Whitney Post-test between 2014 and 2015.
BMI: Body Mass Index; SD: Standard Deviation.

Table 4. Trends in the mean intake frequency of pizzas, hamburgers, hot dogs, processed and fried foods, sweets and sugary drinks of schoolchildren from the city of *Florianópolis* (SC), Brazil, in 2013, 2014, and 2015, according to their age, sex and weight status.

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Characteristics	Pizzas, hamburgers, hot dogs, processed and fried foods		Sweets		Sugary drinks	
	Mean	SD	Mean	SD	Mean	SD
Age (years)						
7 to 9						
2013	1.11	1.33	0.69**	0.88	1.41	1.35
2014	1.05	1.28	0.64**	0.85	1.35	1.29
2015	1.05	1.27	0.62**	0.87	1.49	1.40
10 to 12						
2013	1.00	1.20	0.77	0.94	1.74	1.47
2014	1.02	1.15	0.73	0.90	1.66	1.33
2015	0.96	1.16	0.73	0.92	1.69	1.36

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Table 4. Trends in the mean intake frequency of pizzas, hamburgers, hot dogs, processed and fried foods, sweets and sugary drinks of schoolchildren from the city of *Florianópolis* (SC), Brazil, in 2013, 2014, and 2015, according to their age, sex and weight status.

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Characteristics	Pizzas, hamburgers, hot dogs, processed and fried foods		Sweets		Sugary drinks	
	Mean	SD	Mean	SD	Mean	SD
Sex						
Girls						
2013	0.95	1.17	0.69	0.91	1.59	1.43
2014	0.91	1.17	0.65	0.88	1.59	1.35
2015	0.86	1.11	0.66	0.90	1.67	1.38
Boys						
2013	1.18	1.37	0.75**	0.90	1.51*§	1.39
2014	1.17	1.28	0.70**	0.86	1.35*§	1.27
2015	1.16	1.30	0.68**	0.88	1.49*§	1.39
Weight status (BMI)						
Non-overweight						
2013	1.08	1.29	0.76	0.91	1.55	1.42
2014	1.05	1.24	0.71	0.90	1.51	1.34
2015	1.03	1.23	0.72	0.91	1.57	1.39
Overweight						
2013	1.03	1.25	0.64	0.90	1.54*	1.39
2014	1.02	1.22	0.61	0.82	1.41*c	1.28
2015	0.98	1.21	0.57	0.84	1.61*c	1.39

Note: *Significant for Kruskal-Wallis test; **Significant for Kruskal-Wallis trend test; [a]Significant difference in Mann-Whitney Post-test between 2013 and 2014; [b]Significant difference in Mann-Whitney Post-test between 2013 and 2015; [c]Significant difference in Mann-Whitney Post-test between 2014 and 2015; [§]Not significant for Mann-Whitney Post-test.

BMI: Body Mass Index; SD:Standard Deviation.

DISCUSSION

The objective with this study, conducted with students from the city of *Florianópolis*, was to identify trends in the mean frequency of the consumption of food groups in three consecutive years. There was a tendency towards a reduction in the consumption of sweets between the three years of this study, and a reduction in cereals between 2013 and 2014. Stratified analyzes identified a tendency towards an increase in the consumption of F&V and a reduction in sweets among schoolchildren aged seven to nine, and a tendency towards the reduction of consumption of dairy products for those aged ten to 12 years. The reduction in cereal consumption occurred for older and overweight schoolchildren from 2013 to 2014 and for boys in 2014 and 2015, compared to 2013. Boys also tended to reduce their consumption of sweets. There was also a reduction in meat and seafood for overweight students in the first two years and an increase in sugary drinks from 2014 to 2015.

The reduction in cereal consumption from 2013 to 2014 for the total sample repeats the situation found in a study carried out between 2002 and 2007 with schoolchildren from the city of *Florianópolis*, Brazil, of the same age group and from the public school system [6]. In the present study, the decline in cereal consumption was driven, in large part, by students aged ten to 12 years, male and overweight. In a 14-year follow-up study carried out with Greek children, a decline in cereal consumption was observed for children with a mean age of seven years, of both sexes, regardless of nutritional status [9]. In fact, the results of this study are in line with the literature regarding the decrease in the participation of food of this group in the diet of the Brazilian population [22]. In

the present study, the reduction occurred only from 2013 to 2014, and, in 2015, the consumption remained stable.

Schoolchildren aged seven to nine showed positive food profiles when they presented trends of reducing the consumption of sweets and increasing the consumption of F&V. Costa *et al.* [6] also observed a reduction in the consumption of sweets between 2002 and 2007, however, with regard to an increased consumption of F&V, the results were opposite. Possibly, the findings in this study may reflect measures that have been strengthened over the years, such as the actions of food and nutrition education carried out periodically in schools in the region and encouraged by the *Programa Nacional de Alimentação Escolar* (National School Feeding Program) [23]. However, it should be considered that students aged ten to 12 years are also targets of these actions, but their food consumption has not changed. Adolescents tend to have greater autonomy and are more susceptible to external influences that can have a negative impact on their eating behaviors [24].

Studies suggest that girls tend to have a healthier eating behavior, when compared to boys [25,26]. In fact, the results in the present study show that the mean frequency of consumption of sweets by girls was lower than that of boys in the three-year follow-up period. In view of this difference found in consumption between the sexes, which corroborates with other studies in the literature, food and nutrition education actions should direct their interventions considering these characteristics.

These results also demonstrate that schoolchildren aged ten to 12 years showed a tendency to reduce their consumption of dairy products, which is in line with the secular trends found in a review study [27]. The consumption of dairy products has decreased in the last decade, being below dietary recommendations and with a tendency to decline even further with the coming of age. Milk consumption is generally associated with childhood and is less appreciated by adolescents who tend to substitute it for other drinks such as soft drinks [27,28].

Due to the changes found in the prevalence of overweight during the years, it was considered relevant by the researchers of this study to examine the consumption of food groups in relation to their weight status. As overweight increased in 2013 and 2014, there was a decrease in the consumption of foods labeled as healthy eating items, such as cereals and meat, eggs and seafood. This decrease when reporting the frequency of consumption may have been the result of a bias in social desirability (underreporting). Another explanation for the reduction in the consumption of meat, eggs and seafood would be the increase in the consumption of processed meats, which contribute to the development of overweight, but which were not reflected in the results due to the group analysis. In a 16-years follow-up study with Australian children, stability in the consumption of red meat and seafood was identified, but an increase in the consumption of processed meat was also observed during the period [29].

Overweight children also increased the consumption of sugary drinks from 2014 to 2015. The decrease in the consumption of sugary drinks among children has been demonstrated in the literature [12], however, data in this study show that this specific population has an unfavorable eating behavior, even in the face of the ban on the sale of these foods at schools. Studies have shown that household availability, the eating behavior of parents and the socioeconomic level of the family are determinants of the consumption of sugary drinks [12,26]. This indicates that, in addition to public policies directed at schools, educational actions must be directed to the family environment.

Among the limitations of the present study, it is highlighted that the evaluation of food consumption was based on the report of only one day, which may not be a fair representation of the usual intake, but it is pertinent to emphasize that the objective was to cover different days of the week, including a day of the weekend in order to observe the variation at group level. Because of this, the conclusions generated by these analyzes must be interpreted at the population level. In addition, the quantity or portions of food were not measured, as the WebCAAFE questionnaire was defined to obtain the frequency of consumption, in view of the children's insufficient cognitive capacity for quantitative reporting [30]. It is also important to note that, during the collections, no data were obtained regarding the socioeconomic condition of the child's family and the mean income of the area where schools were located was considered as a proxy for this parameter – thus, the researchers chose not to stratify the analyzes by this variable. In addition, although there is evidence in the literature suggesting differences in the nutritional quality of food consumption between days of the week and weekends, it was decided not to stratify by this variable, as no significant trends of increase or decrease in the consumption of foods commonly consumed on weekends, such as sugary drinks, pizza, hamburgers, hot dogs, fried foods and processed foods were found [31,32].

The evaluated trends were the results of three consecutive years and this time may not have been enough to capture the influences that geographical, environmental, social and economic factors cause in the food consumption of the population. Studies involving a longer period between investigations have identified important changes in the food consumption of children in several countries [9-12,25,33,34]. Since this study was carried out in public schools, caution is necessary in generalizing the results for students from private schools.

These findings are relevant considering the lack of studies addressing food consumption trends among Brazilian children aged seven to 12 years. Most studies carried out in Brazil with the target population describe consumption at a single point in time. The panel analysis used is a positive feature, as it consists of repeated cross-sectional surveys that allow researchers to monitor and understand of the dynamics of changes in food consumption. Other strengths were the representative sample size of the population, the use of an online questionnaire validated for the age group and data collection during the same time of the year, allowing comparability of findings.

CONCLUSION

There was a reduction in the consumption of cereals between 2013 and 2014, and a tendency towards a reduction in the consumption of sweets that was determined by schoolchildren aged seven to nine, of male sex. Younger schoolchildren also tended to increase their consumption of F&Vs, and those aged ten to 12 decreased their intake of dairy products. The reduction in the consumption of cereals was driven by schoolchildren aged ten to 12 years, male and overweight. Overweight schoolchildren also reduced their consumption of meat, eggs and seafood from 2013 to 2014 and increased their sugary drinks intake from 2014 to 2015. Periodic data on children's food consumption should be considered in the design of actions based on the promotion of health and prevention of early-onset chronic diseases. Studies with a longer follow-up period and with a longitudinal design are necessary, while they are also suggested to assess the trend in the frequency of consumption of food groups per meal. The use of the CAAFE as a health surveillance system can be a promising proposal for monitoring the health of this population in Brazil.

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CONTRIBUTIONS

LJ PEREIRA contributed to the study conception and design, collection, analysis and interpretation of data, article review and approval of the final version. PF HINNIG contributed to the analysis and interpretation of data, article review and approval of the final version. PF DI PIETRO contributed to article review and approval of the final version. MAA ASSIS contributed to article review and approval of the final version. FGK VIEIRA contributed to the study conception and design, review and approval of the final version.

REFERENCES

1. Abarca-Gómez L, Abdeen ZA, Hamid ZA, Abu-Rmeileh NM, Acosta-Cazares B, Acuin C, *et al.* Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. Lancet. 2017;390(10113):2627-42. http://dx.doi.org/10.1016/S0140-6736(17)32129-3
2. Simmonds M, Llewellyn A, Owen CG, Woolacott N. Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. Obes Rev. 2016;17(2):95-107. http://dx.doi.org/10.1111/obr.12334
3. Henriques P, O'Dwyer G, Dias PC, Barbosa RMS, Burlandy L. Políticas de saúde e de segurança alimentar e nutricional: desafios para o controle da obesidade infantil. Cien Saúde Coletiva. 2018;23(12):4143-52. http://dx.doi.org/10.1590/1413-812320182312.34972016
4. Hoelscher DM, Ranjit N, Pérez A. Surveillance systems to track and evaluate obesity prevention efforts. Annu Rev Public Health. 2017;38:187-214. http://dx.doi.org/10.1146/annurev-publhealth-031816-044537
5. World Health Organization. Report of the Commission on Ending Childhood Obesity. Geneva: Organization; 2016 [cited 2019 Aug 4]. Available from: https://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf?sequence=1
6. Costa FF, Assis MAA, Leal DB, Campos VC, Kupek E, Conde WL. Mudanças no consumo alimentar e atividade física de escolares de Florianópolis, SC, 2002-2007. Rev Saúde Pública. 2012;46(Supl1):117-25. http://dx.doi.org/10.1590/S0034-89102012005000058
7. Leal DB, Assis MAA, Hinnig PF, Schmitt J, Lobo AS, Bellisle F, *et al.* Changes in dietary patterns from childhood to adolescence and associated body adiposity status. Nutrients. 2017;9(10):1098. http://dx.doi:10.3390/nu9101098
8. Rocha NP, Milagres LC, Filgueiras MDS, Suhett LG, Silva MA, Albuquerque FM, *et al.* Association of dietary patterns with excess weight and body adiposity in Brazilian children: the Pase-Brasil Study. Arq Bras Cardiol. 2019;113(1):52-9. http://dx.doi.org/10.5935/abc.20190113
9. Smpokos EA, Linardakis M, Sarri K, Papadaki A, Theodorou AS, Kafatos A. Differences in food consumption according to weight status and physical activity levels among Greek children between 1992/93 and 2006/07. J Hum Nutr Diet. 2013;26(3):259-67. http://dx.doi.org/10.1111/jhn.12004
10. Xue H, Wu Y, Wang X, Wang Y. Time trends in fast food consumption and its association with obesity among children in China. Plos One. 2016;11(3):e0151141. http://dx.doi:10.1371/journal.pone.0151141
11. Fismen A-S, Smith ORF, Torsheim T, Rasmussen M, Pagh TP, Augustine L, *et al.* Trends in food habits and their relation to socioeconomic status among Nordic adolescents 2001/2002-2009/2010. Plos One. 2016;11(2):e0148541. http://dx.doi:10.1371/journal.pone.0148541
12. Bleich SN, Vercammen KA, Koma JW, Li Z. Trends in beverage consumption among children and adults, 2003-2014. Obesity. 2018;26(2):432-41. http://dx.doi.org/10.1002/oby.22056

13. Universidade Federal de Santa Catarina. Sistema de monitoramento do consumo alimentar e atividade física de escolares. Florianópolis: UFSC; 2002 [citado 4 ago 2019]. Disponível em: http://caafe.ufsc.br/portal

14. Leal DB, Assis MAA, González-Chica DA, Costa FF. Trends in adiposity in Brazilian 7-10-year-old schoolchildren: evidence for increasing overweight but not obesity between 2002 and 2007. Ann Hum Biol. 2014;41(3):255-62. http://dx.doi.org/10.3109/03014460.2013.854832

15. Instituto Brasileiro de Geografia e Estatística. Base de informações do Censo Demográfico 2010: resultados do universo por setor censitário. Rio de Janeiro: Instituto; 2011 [citado 4 ago 2019]. Disponível em: http://www.ipea.gov.br/redeipea/images/pdfs/base_de_informacoess_por_setor_censitario_universo_censo_2010.pdf

16. Costa FF, Schmoelz CP, Davies VF, Di Pietro PF, Kupek E, Assis MAA. Assessment of diet and physical activity of Brazilian schoolchildren: usability testing of a web-based questionnaire. JMIR Res Protoc. 2013;2(2):e31. http://dx.doi:10.2196/resprot.2646

17. Davies VF, Kupek E, Assis MA, Natal S, Di Pietro PF, Baranowski T. Validation of a web-based questionnaire to assess the dietary intake of Brazilian children aged 7-10 years. J Hum Nutr Diet. 2015;28(Suppl1):93-102. http://dx.doi.org/10.1111/jhn.12262

18. Jesus GM, Assis MA, Kupek E. Validity and reproducibility of an internet-based questionnaire (Web-CAAFE) to evaluate the food consumption of students aged 7 to 15 years. Cad Saúde Pública. 2017;33(5):e00163016. http://dx.doi.org/10.1590/0102-311x00163016

19. Kupek E, Assis MAA, Bellisle F, Lobo AS. Validity of WebCAAFE questionnaire for assessment of schoolchildren's dietary compliance with Brazilian Food Guidelines. Public Health Nutr. 2016;19(13):2347-56. http://dx.doi.org/10.1017/S1368980016000732.

20. Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660-7. http://dx.doi:10.2471/BLT.07.043497

21. StataCorp. Stata Statistical Software: release 13. College Station: StataCorp LP; 2013.

22. Martins APB, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Participação crescente de produtos ultraprocessados na dieta brasileira (1987-2009). Rev Saúde Pública. 2013;47(4):656-65. http://dx.doi.org/10.1590/S0034-8910.2013047004968

23. Cervato-Mancuso AM, Vincha KRR, Santiago DA. Educação alimentar e nutricional como prática de intervenção: reflexão e possibilidades de fortalecimento. Physis. 2016;26(1):225-49. http://dx.doi.org/10.1590/S0103-73312016000100013

24. Ong JX, Ullah S, Magarey A, Miller J, Leslie E. Relationship between the home environment and fruit and vegetable consumption in children aged 6-12 years: a systematic review. Public Health Nutr. 2017; 20(3):464-480. http://dx.doi.org/10.1017/S1368980016002883

25. Moraeus L, Lissner L, Olsson L, Sjöberg A. Age and time effects on children's lifestyle and overweight in Sweden. BMC Public Health. 2015;15:355. http://dx.doi.org/10.1186/s12889-015-1635-3.

26. Elinder LS, Heinemans N, Zeebari Z, Patterson E. Longitudinal changes in health behaviours and body weight among Swedish schoolchildren: associations with age, gender and parental education: the SCIP school cohort. BMC Public Health. 2014;14:640. http://dx.doi.org/10.1186/1471-2458-14-640

27. Dror DK, Allen LH. Dairy product intake in children and adolescents in developed countries: trends, nutritional contribution, and a review of association with health outcomes. Nutr Rev. 2014;72(2):68-81. http://dx.doi.org/10.1111/nure.12078

28. Özen AE, Bibiloni MDM, Pons A, Tur JA. Fluid intake from beverages across age groups: a systematic review. J Hum Nutr Diet. 2015;28(5):417-42. http://dx.doi.org/10.1111/jhn.12250

29. Sui Z, Raubenheimer D, Cunningham J, Rangan A. Changes in meat/poultry/fish consumption in Australia: from 1995 to 2011-2012. Nutrients. 2016;8(12):753. http://dx.doi.org/10.3390/nu8120753

30. Foster E, Bradley J. Methodological considerations and future insights for 24-hour dietary recall assessment in children. Nutr Res. 2018;51:1-11. http://dx.doi.org/10.1016/j.nutres.2017.11.001

31. Monteiro LS, Hassan BK, Estima CCP, Souza AM, Verly Junior E, Sichieri R, *et al.* Food consumption according to the days of the week: National Food Survey, 2008-2009. Rev Saúde Pública. 2017;51. http://dx.doi.org/10.11606/s1518-8787.2017051006053

32. Hoffmann DA, Marx JM, Burmeister JM, Musher-Eizenman DR. Friday night is pizza night: a comparison of children's dietary intake and maternal perceptions and feeding goals on weekdays and weekends. Int J Environ Res Public Health. 2018;15(4):720. http://dx.doi.org/10.3390/ijerph15040720.

33. Boylan S, Hardy LL, Drayton BA, Grunseit A, Mihrshahi S. Assessing junk food consumption among Australian children: trends and associated characteristics from a cross-sectional study. BMC Public Health. 2017;17(1):299. http://dx.doi:10.1186/s12889-017-4207-x

34. Dunford EK, Popkin BM. 37 year snacking trends for US children 1977-2014. Pediatr Obes. 2018;13(4):247-55. http://dx.doi:10.1111/ijpo.12220

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