

Factors associated with the consumption of fruits and vegetables by schoolchildren: a comparative analysis between 2007 and 2012

Fatores associados ao consumo de frutas e de vegetais por escolares: uma análise comparativa entre 2007 e 2012

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ABSTRACT

Objective

Perform comparative analysis of adequate consumption of fruits and vegetables and their associated factors in schoolchildren.

Methods

Probabilistic samples representative of students of both sexes, 7 to 14 years old, from public and private schools in *Florianópolis*, SC were investigated in cross-sectional studies in 2007 (n=2,836) and 2012 (n=2,506). The

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exposure variables were: sex, age, family income *per capita*, mother's education and school system. The outcome variable (fruit and vegetable consumption) was collected using the third validated version of the previous day's food questionnaire. Using the Chi-Square test, exposure variables with a p -value <0.20 were eligible for analysis using crude and adjusted multiple logistic regression models. Exposure variables with $p < 0.05$ were considered to be associated with the consumption of fruits and vegetables.

Results

There were no significant differences in the adequate consumption between 2007 and 2012. While in 2007 the *per capita* family income was the only exposure variable associated, in 2012 only a mother with complete higher education was a protective factor for the adequate consumption of fruits and vegetables.

Conclusion

Despite governmental strategies to stimulate the consumption of fruits and vegetables in Brazil, their results are still not perceptible, requiring more time for an evaluation of effectiveness.

Keywords: Child. Cross-sectional studies. Food consumption. Fruit. Vegetables.

RESUMO

Objetivo

Realizar análise comparativa do consumo adequado de frutas e de vegetais e seus fatores associados em escolares.

Métodos

Em estudos transversais de 2007 ($n=2.836$) e de 2012 ($n=2.506$), foram investigadas amostras probabilísticas representativas de escolares de ambos os sexos, com idade entre 7 e 14 anos, pertencentes a escolas públicas e privadas de Florianópolis, SC. As variáveis de exposição foram: sexo, idade, renda familiar *per capita*, escolaridade da mãe e sistema escolar. A variável de desfecho (consumo de frutas e de vegetais) foi coletada por meio da terceira versão validada do questionário alimentar do dia anterior. A partir do teste de *chi-quadrado*, as variáveis de exposição com valor de $p < 0,20$ foram elegíveis para análise por meio de modelos bruto e ajustado de regressão logística múltipla. Enquanto isso, as que apresentaram valor de $p < 0,05$ foram consideradas associadas ao consumo de frutas e de vegetais.

Resultados

Não houve diferenças significativas no consumo adequado entre 2007 e 2012. Enquanto em 2007 a renda familiar *per capita* era a única variável de exposição associada, em 2012 apenas a escolaridade da mãe, com ensino superior completo, foi fator protetor para o consumo adequado de frutas e de vegetais.

Conclusão

Apesar das estratégias governamentais para estimular o consumo de frutas e de vegetais no Brasil, seus resultados ainda não são perceptíveis, exigindo mais tempo para uma avaliação de eficácia.

Palavras-chave: Criança. Estudos transversais. Consumo de alimentos. Frutas. Verduras.

INTRODUCTION

According to the World Health Organization (WHO), Fruits and Vegetables (FV) are essential components of healthy eating. This food group is a source of vitamins and minerals, dietary fibers and a number of beneficial substances such as plant sterols, flavonoids and other kinds of antioxidants. The low consumption of these foods is among the five main risk factors for the occurrence of Chronic Noncommunicable Diseases (CNCD). It is estimated that by 2018, 5.2 million deaths worldwide have been attributed to inadequate consumption of FV [1].

The World Health Organization recommends for the general population the minimum consumption of 400 grams of FV per day, or the equivalent of five servings [1]. However, different

countries have specific intake recommendations for FV, and in Brazil. The second edition of the Brazilian Population Food Guide, published in 2014, does not define servings or amounts of consumption for food groups, it continues to stimulate the intake of FV by recommending, in the Ten Steps to Adequate and Healthy Eating section, the widespread consumption of *in natura* or minimally processed food [2].

The low consumption of FV by children and adolescents seems to be common in both developed and developing countries [3-5], although there is a trend of lower consumption in less developed regions, directly reflecting the cultural, socioeconomic and agricultural conditions of these populations [6]. Accompanying the international scenario, the consumption of FV in Brazil is also below the recommendations for this age group [7-12].

Lack of exposure to food, food availability at home, education, family income, advertising, the type of food consumed in school, and level of knowledge about nutrition have been associated with the consumption of FV by children and adolescents [3,8,13,14]. A study carried out in 2007, with 2,836 children and adolescents, aged 7 to 14, living in the city of *Florianópolis* (Brazil), found that only 4.8% had adequate consumption of FV, and the associated variables were the school system, the mother's educational level and the *per capita* family income being that, after the adjustment, only the *per capita* family income maintained the association [15].

Considering that, after 2007, the Brazilian government expanded its strategies to reinforce adequate and healthy eating as a human right, with emphasis on the implementation of the *Sistema Nacional de Segurança Alimentar e Nutricional* (National System of Food and Nutrition Security) in 2006, changes in the legislation of the *Programa Nacional de Alimentação Escolar* (National School Nutrition Program) in 2009 and the creation of the *Política Nacional de Segurança Alimentar e Nutricional* (National Policy on Food and Nutrition Security) in 2010, this article aims to perform a comparative analysis of the adequate consumption of FV, and its associated factors in schoolchildren aged 7 to 14 years old between 2007 and 2012 [16-18].

METHODS

Data from two cross-sectional studies with the same design that investigated the adequacy of the consumption of FV and the associated factors in probabilistic samples of 7 to 14 year-old schoolchildren from both private and public schools in *Florianópolis* were analyzed. These data were collected in 2007/2008 (1st wave) and in 2012/2013 (2nd wave). The studies were funded by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq, National Council for Scientific and Technological Development) (Protocol n. 402322/2005-3 and Protocol n. 483955/2011-6) and approved by the Research Ethics Committee (Protocol n. 028/2006 and 120341/2012). All children and adolescents consented orally to the data collection, and their parents or guardians signed the Informed Consent Form.

A detailed description of the methods used to determine the sample size as well as the sampling of the two studies have been described in previous publications [15,19-22]. In the 2007 study, the sample size was based on the prevalence of obesity of 10% for children from 7 to 10 years-old, and 17% for children from 11 to 14 years-old, with a margin of error of two percentages, a design effect of 1.3 and a study power of 80%, resulting in a sample size of 2,800 students. Adding a random loss of 10%, a total of 3,100 students should be investigated.

The final sample effectively included for the year 2007 was composed of 2,836 students. In the 2012 study, to estimate the sample size, the initial parameters were: the total number of students

aged 7 to 14 years-old ($n=45.247$) in the city; an expected overweight/obesity prevalence of 38%; a sample error of 3.5 percent (two-tailed) and a confidence interval of 95%, estimating a total of 727 students would be necessary. Considering a delineation effect of 1.8 and the stratification by age group (7-10 and 11-14 years-old), the total sample size would be 2,618 students to be evaluated.

Adding 10% to this value for possible losses or refusals, a total of 2,880 students should be investigated. Considering these parameters, the largest sample size required to test associations (considering an exposure prevalence of 5%) was lower than the sample size obtained "from" the prevalence estimate ($n=2,880$), even after an increase in the number of schoolchildren for provisioning eventual losses/refusals and an adjustment for confounding factors. In this article, for the year 2012, the final sample investigated was composed of 2,506 students.

The selection of the samples occurred in two steps in both waves of the research. In the first stage, the schools were stratified according to their region in the city and by school system. The schools in each geographic stratum were randomly selected, with a probability proportional to the size of the stratum. In the 1st wave (2007), 17 elementary schools (11 public and 6 private) were selected from the 87 schools in the municipality. In the year 2012, 30 schools (20 publics and 10 privates), including the same 17 schools of the year 2007 were selected. In the second stage, the students were randomly selected by age group, with equal probability, in each of the selected schools. The analyzes to estimate the prevalence and the associated factors considered both the effect of the design and the sampling plan.

The exposure variables investigated in this article were biological (child's sex and age) and socioeconomic (*per capita* family income, the mother's educational level and the school system). Sex, age and school system were collected from lists provided by the schools. The *per capita* family income, and the educational level of the mother were collected through a self-administered questionnaire sent to their parents or guardians.

The outcome variable – the consumption of FV – was collected through the 3rd version of the Previous Day's Food Intake Questionnaire (PDFQ-3), which is characterized as a 24 hour recall-type questionnaire, illustrated and structured to qualitatively evaluate the food consumption of schoolchildren [19]. In the PDFQ-3, all the six meals were ordered chronologically (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack). The food or food groups of each meal sought to respect the Brazilian eating habits, and each meal contained the same 21 foods or food groups, which were selected considering the eating patterns of the students, the availability of food, the menus provided by the National School Nutrition Program and some precepts extracted from the 1st edition of the Brazilian Population Food Guide [19]. The PDFQ-3 was validated by comparison with the direct observation of the food consumed in the previous day by students from 6 to 11 years-old. The results of these studies demonstrated a high sensitivity and specificity for most food items, indicating that the instrument is valid for assessing the previous day's food intake of schoolchildren [19].

In both waves, data collection of food consumption occurred between August and July, avoiding that the interference of seasonality in the results. The application of the PDFQ-3 was carried out in the classrooms, with the presence of the respective teachers, when initially the students were informed that they would have to remember everything they ate the day before to fill out the questionnaire. The questionnaires with the names of the students were delivered by the research team, who clarified any doubts the students had.

The exposure variables were sex (female and male), age group (7 to 9, and 10 to 14 years-old), school system (public and private), the mother's educational level (never attended school or attended but did not complete elementary school, attended but did not complete high school or complete high school education, and complete higher education), *per capita* family income (quartiles in BRL). Specifically in relation to the *per capita* family income, due to the income gap between the two analyzed waves, the income intervals in each of the quartiles were different in each wave. Thus, in 2007, the quartiles were (in BRL): 1st quartile (≤ 540.00); 2nd quartile (540.01 to 1,000.00); 3rd quartile (1,000.01 to 2,000.00); 4th quartile ($> 2,000.00$). In 2012, the quartiles were (in BRL): 1st quartile (≤ 600.00); 2nd quartile (600.01 to 1,250.00); 3rd quartile (1,250.01 to 2,400.00); 4th quartile ($> 2,400.00$).

The outcome variable was the adequate consumption of FV. As the PDFQ-3 had not been designed to obtain information on frequencies and quantities, the determination of the adequate consumption of FV was performed as follows: it was considered adequate when the intake of FV was equal to or greater than five times per day, and inadequate when the intake of FV occurred less than five times a day, in an adaptation based on the recommendation of consumption of FV, according to the WHO [1].

Furthermore, for a descriptive analysis, fruit consumption alone was adequate when equal to or greater than twice a day, while vegetable consumption was considered adequate when equal to or greater than three times a day [15].

A database was created in the EpiData[®] software version 3.2, and verified by trained data entry operators [23]. Data consistency and amplitude were checked automatically, and were analyzed using Stata[®] software version 13.0 [24].

A descriptive analysis was conducted to show the distribution of the population according to biological, socioeconomic and adequate consumption of fruits, vegetables and FV variables. The results of this analysis were presented in frequency distribution tables comparing the two waves. Pearson's Chi-Square (χ^2) test was also used to verify the existence of significant differences ($p < 0.05$) between the results of the two waves.

In the inferential analysis, the Chi-Square test (χ^2) was used to verify the existence of significant differences between the categories of exposure variables (gender, age group, school system, mother's education and family income *per capita*) in relation to the outcome variable (adequate VF consumption). All exposure variables with $p < 0.20$ in χ^2 were included for analysis using a multiple logistic regression models. The prevalence ratios were estimated together with the respective gross and adjusted Confidence Intervals of 95% (CI:95%). Exposure variables with a p -value ≥ 0.20 in the crude analysis were excluded from the adjusted analysis. The design effect was taken into account in all analyzes using the SVY command, which analyzes data from complex samples. Associations with a p -value < 0.05 were considered significant.

RESULTS

In the two waves analyzed, there was a predominance of female schoolchildren (2007: 52.1%, 2012: 54.0%; $p > 0.05$), aged 10 to 14 years (2007: 67.9%, 2012: 54.3%; $p < 0.01$), studying in the public school system (2007: 75.3%, 2012: 65.3%; $p < 0.01$) and mothers with complete high school education (2007: 32.8%, 2012: 32.4%; $p > 0.05$). The sex and the mother's educational level variables did not present significant differences between the two collection periods. However, in 2012, the prevalence of schoolchildren in the age group of 7 to 9, and of students enrolled in schools was significantly higher than in 2007 (Table 1).

There was also a statistically significant difference in the *per capita* family income between the two collection periods. In 2007, there was a higher prevalence of schoolchildren in the lowest income quartile (29.8%) and, in 2012, a higher prevalence in the second highest quartile of family income (26.0%) (Table 1).

In the analysis of the adequacy of the consumption of FV, it was identified a greater adequacy for fruits in both waves (Table 2). In 2007, 543 schoolchildren (19.2%) showed adequate levels of fruit consumption, while in 2012, 527 (21.0%) of students showed adequate levels. In the analysis of the adequacy of the individual consumption of FV, and the combined consumption of FV, both in 2007 and in 2012, the values were around 5.0%. Regarding the variables shown in Table 2, no statistically significant differences were identified between their 2007 and 2012 results.

Table 3 presents the gross and adjusted prevalence ratios for the association between the exposure variables and the appropriate consumption of FV for the 2007 and 2012 surveys. In the gross analysis, the private school system, a mother with a college degree and a higher *per capita* income were positively associated with adequate consumption of FV in 2012.

Table 1. Characteristics of schoolchildren aged 7-14 in the city of Florianópolis (SC), Brazil, 2007/2012.

Study variables	Year						p-value
	2007			2012			
	N	%	CI 95%	N	%	CI 95%	
Sex							
Female	1478	52.1	50.1-53.8	1354	54.0	52.1-56.0	0.142
Male	1358	47.9	46.1-49.8	1152	46.0	44.0-47.9	
Age (years)							
7-9	909	32.1	30.2-33.7	1146	45.7	43.8-47.7	<0.001
10-14	1924	67.9	66.3-69.7	1360	54.3	52.3-56.2	
School system							
Public	2135	75.3	73.8-76.9	1637	65.3	63.4-67.1	<0.001
Private	701	24.7	23.0-26.2	869	34.7	32.8-36.5	
Mother's educational level							
IES	692	25.2	23.6-26.9	624	25.8	24.0-27.5	0.974
CES	545	19.9	18.4-21.4	486	20.0	18.5-21.7	
CHS	899	32.8	31.1-34.6	786	32.4	30.6-34.3	
CHE	605	22.1	20.5-23.6	529	21.8	20.2-23.5	
Per capita family income (BRL)							
1 st quartile	722	29.8	27.6-32.0	521	24.3	22.5-26.1	<0.001
2 nd quartile	529	21.8	20.2-23.4	528	24.6	22.8-26.4	
3 rd quartile	580	23.9	22.2-25.6	559	26.0	24.2-27.9	
4 th quartile	592	24.5	22.6-26.2	538	25.1	23.2-26.9	

Note: CES: Complete Elementary School or incomplete high school; CHE: Complete Higher Education; CHS: Complete High School or incomplete higher education; CI: Confidence Interval; IES: Incomplete Elementary School or never attended school.

Table 2. Adequacy of fruit and vegetable consumption among schoolchildren aged 7-14 in the city of Florianópolis (SC), Brazil, 2007/2012.

Food group	Year						p-value
	2007			2012			
	N	%	CI 95%	N	%	CI 95%	
Fruits	543	19.2	15.5-22.8	527	21.0	19.4-22.7	0.086
Vegetables	144	5.1	4.1-6.1	135	5.3	4.5-6.3	0.513
Fruits and vegetables	135	4.8	3.7-5.9	136	5.4	4.6-6.4	0.255

Note: CI: Confidence Interval.

In the adjusted analysis, the strength of association of all exposure variables was lost. It should be noted that the mother's educational level was the only exposure variable that maintained a statistically significant association, showing that a mother with a higher education degree was the only protective factor for the adequate consumption of FV among schoolchildren (Table 3).

Table 3. Distribution of prevalence, gross and adjusted prevalence *ratios*, and the *p*-value of the association between the adequate consumption of fruits and vegetables, and the exposure variables of schoolchildren aged 7-14 in the city of Florianópolis (SC), Brazil, 2007-2012.

Variables	2007							
	%	CI 95%	Gross			Adjusted*		
			PR	CI 95%	<i>p</i> -value	PR	CI 95%	<i>p</i> -value
Sex								
Female	5.0	3.0-7.0	1	-	-	-	-	-
Male	4.5	3.4-5.7	0.90	0.5-1.5	0.670	-	-	-
Age (years)								
7-9	4.7	2.8-6.7	1	-	-	-	-	-
10-14	4.7	3.2-6.3	1.00	0.5-1.8	0.126	-	-	-
School system								
Public	4.3	3.1-5.4	1	-	-	-	-	-
Private	6.3	3.0-9.6	1.50	0.8-2.5	0.337	-	-	-
Mother's educational level								
CHE	6.5	4.3-8.6	1	-	-	-	-	-
CHS	4.3	2.8-5.9	0.66	0.4-0.9	0.027	-	-	-
CES	4.0	2.8-5.3	0.61	0.3-0.9	0.040	-	-	-
IES	4.9	2.8-5.3	0.75	0.4-1.4	0.350	-	-	-
Per capita family income (BRL)								
1 st quartile	6.9	4.3-9.6	1	-	-	1	-	-
2 nd quartile	3.5	1.9-5.0	0.48	0.2-0.8	0.019	0.48	0.2-0.8	0.019
3 rd quartile	3.2	2.3-4.2	0.45	0.2-0.7	0.007	0.45	0.2-0.7	0.007
4 th quartile	5.4	2.7-8.1	0.77	0.7-1.4	0.382	0.77	0.7-1.4	0.382
Variables	2012							
	%	IC95%	Gross			Adjusted*		
			PR	CI 95%	<i>p</i> -value	PR	CI 95%	<i>p</i> -value
Sex								
Female	4.7	3.6-5.8	1	-	-	1	-	-
Male	6.2	4.8-7.6	1.3	0.9-1.9	0.095	1.1	0.7-1.6	0.638
Age (years)								
7 - 9	6.1	4.7-7.5	1	-	-	1	-	-
10 - 14	4.8	3.7-6.0	0.8	0.6-1.1	0.168	0.8	0.5-1.2	0.314
School system								
Public	3.9	2.9-4.8	1	-	-	1	-	-
Private	8.3	6.4-1.0	2.2	1.5-3.1	<0.000	1.6	0.9-2.7	0.095
Mother's educational level								
CHE	7.9	5.9-10.5	1	-	-	1	-	-
CHS	4.6	3.3-6.3	0.6	0.4-0.9	0.012	0.6	0.3-0.9	0.031
CES	4.7	3.1-7.0	0.6	0.4-1.0	0.040	0.5	0.3-0.9	0.020
IES	5.1	3.6-7.1	0.6	0.4-1.0	0.054	0.5	0.3-0.9	0.023
Per capita family income (BRL)								
1 st quartile	8.2	6.1-10.8	1	-	-	1	-	-
2 nd quartile	5.2	3.6-7.3	0.6	0.4-1.0	0.049	0.8	0.5-1.4	0.410
3 rd quartile	3.8	2.4-5.8	0.5	0.3-0.8	0.003	0.7	0.3-1.4	0.291
4 th quartile	3.6	2.3-5.6	0.4	0.3-0.7	0.003	0.7	0.3-1.4	0.268

Note: *Analysis adjusted for variables such as *p*-value <0.20.

CES: Complete Elementary School or incomplete high school; CHE: Complete Higher Education; CI: Confidence interval; CHS: Complete High School or incomplete higher education; IES: Incomplete Elementary School or never attended school; PR: Prevalence *Ratio*.

DISCUSSION

When comparing the results of the two waves, it should be noted that in 2012, the adequacy of individual fruit consumption, individual vegetable consumption, and the combined consumption of FV did not show any significant differences in relation to the values found in 2007.

Our findings corroborate with other studies that have identified an adequacy of fruit intake over vegetables among children and adolescents in Brazil as well as in other countries. One study, who also used the PDFQ-3 for data collection, and found adequate fruit consumption levels which were almost 5 times higher than that of vegetables among 1,232 schoolchildren aged 7 to 10 years in *Florianópolis* [25]. Also, a Dutch study carried out with 1,105 students in 2003 and with 577 in 2009, which investigated differences in the intake of FV through a self-administered 24h recall questionnaire, also found fruit consumption adequacy levels which were 5.6 times higher than that of vegetables in 2003 and 3.8 times higher in 2009 [26].

When analyzing the prevalence of adequacy in the combined consumption of FV, the values found in our study, referring to the 2012 findings, are significantly lower than those presented in other surveys conducted in Europe. A study by Fischer *et al.*, showed adequate levels in the consumption of FV in the 2003 wave which were 2.2 times higher and, in the 2009 wave, 3.1 times higher than the results of the present study [26]. Authors identified two times the prevalence of adequate consumption of FV among German adolescents when compared to our results [4]. A cross-sectional study with 466 Scottish children aged 4 to 13, with food consumption data directly collected with the children through a questionnaire, resulted in an adequate consumption of FV of 42% [27]. And, a review that compared the consumption of FV among adolescents from 11 countries in the Eastern Mediterranean Region, found adequate consumption levels which were 3.6 times higher than our findings [28]. A study that assessed the dietary intake of 789 Australian 4 to 8 years old children and compared with the recommendations of the Australian Healthy Eating Guide found that there are significant discrepancies between contemporary Australian children's eating patterns and national recommendations and only one child met recommended daily servings for all food groups [29].

Although the aforementioned studies used different parameters from the ones used in this study to determine the adequacy of FV consumption, there seems to be a greater adequacy in the consumption of FV among European children and adolescents compared to the population studied. This difference becomes even more important when one observes that the findings of this study seem to point to stability in the adequate consumption of FV between 2007 and 2012, diverging, for example, from the findings of Vereecken *et al.*, which, through analysis of data from studies involving 448,951 adolescents from 33 countries and regions in Europe and North America, observed an increase in the daily consumption of FV between 2002 and 2010 in most countries [30].

The positive association observed between the adequate consumption of FV and the private school system, a mother with complete higher education, and a higher *per capita* family income was similar to the study by Maranhão *et al.*, who investigated, through home visits, 520 adolescents and adults residing in Brazil [31]. However, in our study, the mother's educational level was the only variable that in the adjusted analysis maintained a statistically significant association, evidencing that a mother with complete higher education was the only protective factor for the adequate consumption of FV between the students. Therefore, a result different from the one found in the 2007 wave, when in the post-adjustment analysis, only the *per capita* family income maintained the association with the outcome.

Although a higher *per capita* family income is a protective factor for the consumption of FV among children and adolescents in our study in the 2012 wave, there was a loss of their strength of association in the adjusted analysis, which differs from the relative findings regarding the wave of 2007. This difference between the waves can be explained by the improvement in the *per capita* income among families, which reflects a change in Brazil since the 2000s, where the Human

Development Index grew more than 10% between 2000 and 2015 and the Gini Index was reduced by almost 10% between 2002 and 2012 [32,33].

In relation to the protective factor of a higher educational level by the mother in the consumption of FV among children and adolescents, studies carried out in different countries have pointed out such evidence [3,4,34,35]. In these studies, this association is explained by the fact that a higher maternal educational level is also associated with a higher income among families, which would result in greater capacity to access quality food. In addition, it is understood that mothers with higher educational levels are more likely to discriminate between what is considered healthy eating and to have a greater ability to promote food education strategies for their children.

Still, Hass and Hartmann, in a study that analyzed, through regression models, data from 3 dietary records of 702 German parents and their children, who *ranged from* 7 to 10 years-old, reinforce that the eating habits of children and adolescents is associated with the family dietary pattern, revealing three determining factors for the consumption of FV: knowledge of different types of FV, preferences for FV and parental consumption of FV [36].

Lotrean and Tuiti, in a cross-sectional survey of 361 school-aged children (11 to 14 years) from Romania, found that fruit consumption was higher among children who reported greater availability of fruit at home, as well as where the eating pattern of the mother was better [37]. The level of mother education too was identified as a important factors associated with their at-home support of fruit and vegetable consumption for their children, in a national representative sample of Polish mothers of children aged 3-10 years (n=1200) [38]. It is highlighted that the influence of socioeconomic status in children's eating behavior was also one of the standout factors in a narrative review study on the theme [39].

Considering the importance of actions to encourage the consumption of FV among schoolchildren and to guide the parents of these students about healthy eating habits, it should be noted that between 2007 and 2012, several governmental actions were implemented for this purpose. In 2009, the Brazilian federal government updated the legislation of the National School Nutrition Program, encouraging the acquisition of diversified types of food, produced locally and preferably through family-based agriculture. Furthermore, it reinforced the importance of food and nutrition education actions that also involve the school community, which includes parents or guardians of children and adolescents who study in school [17].

Also noteworthy are the implementation of the National Policy on Food and Nutrition Security in 2010, and the updating of the National Food and Nutrition Policy in 2011, which reinforced the importance of food and nutrition education, and the provision of healthy food in schools. In 2012, Brazil published the Food and Nutrition Education Reference Framework for Public Policies, which highlights the need to increase articulated actions that enable the incorporation of food, health and nutrition issues in curricula and in schools' pedagogical projects, also reinforcing the involvement of the students' families [18,40,41].

Despite the normative advance of public policies to promote the consumption of FV in the school environment and actions of food and nutritional education for schoolchildren and their families, there is still a low variety of vegetables being offered in schools, and an important issue which is the rejection presented by the children to the vegetables offered, suggesting the need for a greater variation and the insertion of FV in school menus [42,43]. With socioeconomic characteristics different from Brazil, a study developed in the United States of America reinforce that the providing fresh fruits and vegetables is challenging for some schools due to cost, administrative burden, and

concern for food waste. To address these challenges, specific act proposes to allow american federally funded programs to substitute fresh fruits and vegetables with canned, frozen, or pureed versions, a fact that occurred for a long time in Brazil [44].

Returning to the brazilian reality, faced with a scenario of low levels of adequate consumption of FV, the National Food and Nutrition Policy and the Food and Nutrition Education Reference Framework point out, among the main challenges for the implementation of food and nutritional education actions, the difficulty of monitoring and disseminating actions in the school environment; the absence of a common intersectoral agenda; an approach which is limited to technical-scientific information; and insufficient appropriation of cultural and social dimensions as determinants of eating habits [40,41].

Some limitations of the present study need to be pointed out, such as the use of frequency of consumption of FV (times per day), considering a frequency of consumption equal to or greater than five times a day. The WHO recommend the ingestion to be measured in grams and in the number of servings, respectively. Thus, this methodological strategy may have overestimated or underestimated the consumption of FV. The present study used the questionnaire to evaluate a single day of school nutrition, which can estimate a day's intake of FV with precision, but not the usual intake of FV. However, a single day's evaluation has shown to be adequate and has been frequently reported by some studies, particularly those involving robust and complex samples [8,45].

It is important to highlight the strengths of this study, which include an adequate sample size, methodological rigor, regional representativeness and a school-based population. This study provides significant contributions regarding the consumption of FV by schoolchildren and the results can serve as a basis for the development of public policies of eating habits and nutrition, directed to the studied population.

CONCLUSION

The comparison of the results of the two waves did not show any significant changes in the adequacy of fruit and vegetable consumption among schoolchildren, but pointed to changes in the determinants associated with this consumption, which accompanies the findings of other studies and may be justified by changes in the socioeconomic profile of Brazilian families.

Although the quantification of the consumption of FV from a qualitative collection is a limitation of this study, the validation of the instrument used for collection and the methodological rigor in the data analysis give reliability to the results found.

It is pointed out that, even in the face of the strengthening of governmental strategies to stimulate the consumption of FV among schoolchildren in Brazil, their results are still not perceptible, requiring more time for an evaluation of effectiveness. We suggested that nationally based studies of the consumption of FV among Brazilian schoolchildren be carried out, as well as evaluative research that can demonstrate the impact of public policies on this consumption.

CONTRIBUTORS

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