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Socioeconomic status, screen time, and time spent at school, and children's food consumption

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Abstract *The present study aimed to evaluate the association of sociodemographic factors and lifestyle with the consumption of in natura or minimally processed (INMP) foods, ultra-processed foods (UPFs), and fruits and vegetables. This was a cross-sectional study conducted with 403 children, aged 4 to 7 years, from a retrospective cohort. Sociodemographic and lifestyle variables were investigated using a sociodemographic questionnaire. Food consumption was assessed by three food records. Bivariate and multivariate linear regression analyses were used to analyze associations. Children with lower income had a higher consumption of INMP foods and a lower consumption of UPFs. A shorter time spent at school was associated with a lower consumption of INMP foods and a higher consumption of UPFs. Children with more screen time and less educated parents consumed less fruits and vegetables. Unfavorable sociodemographic factors were associated with a better profile of food consumption according to the level of processing, except for fruits and vegetables. The longer time spent at school and a shorter screen time contributed to a healthier diet.*

Key words *Child Nutrition, Sedentary behavior, Food consumption, Socioeconomic factors, Industrialized foods*

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Introduction

Food consumption among Brazilian children has been characterized by a lack of fruits and vegetables and a high consumption of ultra-processed foods (UPFs) in their diets[1,2]. This consumption profile constitutes a risk for the development of obesity and Chronic Noncommunicable Diseases (NCD) during childhood[3,4]. Given the potentially negative effects of an inadequate diet during childhood, it is also important to investigate factors associated with food consumption in order to generate information that can provide more precise evidence to defend the need for the elaboration of health protection and promotion strategies.

The processing employed in the production of foods can be divided into the following four categories: *in natura* foods, minimally processed foods, processed foods, and ultra-processed foods. The *in natura* foods are those obtained from nature without being altered by industries. The minimally processed foods are those that passed through processes of cleaning, milling, and freezing but have no addition of salt, sugar, oil, or other such substances, which is different from the processed foods that have had their composition altered with the addition of salt or sugar to increase their expiration time. The ultra-processed foods are those that contain a greater alteration in their natural characteristics, including soft drinks and stuffed cookies, for example[5].

Upon studying the factors associated with children's food consumption, the socioeconomic aspects have been reported as important determinants in the knowledge and understanding of healthy eating habits. In a study conducted with mothers who are less educated and have lower household incomes, the consumption of industrialized products by the children was significantly higher[6]. According to Valmórbida *et al.*[7], a more highly educated father was associated with the consumption of fruits, and each additional year of study increased the probability of the children consuming a portion of fruit by approximately 4%. By contrast, a study conducted by Sparrenberger *et al.*[8] showed that older children and children of more highly educated mothers presented a greater consumption of UPFs.

In addition to the socioeconomic factors, aspects related to the lifestyle of the children, such as the habit of remaining seated for longer periods of time, less opportunity for physical activity in the school environment, the lack of opportunity for free time to play, and excessive screen time have been more and more present in the routines of children and adolescents. This leads to the substitution of active activity time, in addition to providing changes in the eating standards with the increase in the consumption of UPFs and a diminishing of traditional foods in one's diet[9-11]. One national school-based study, conducted with adolescents from public and private schools, showed a greater intake of UPFs among those who spent more time in front of screens[12]. Studies conducted with children on this theme are less common. One study with children, aged 2 to 9 years, from São Paulo, observed that the greater screen time was associated with a lesser adherence to UPF standards[13].

The school environment also represents a factor that can be associated with food consumption, since it is an opportune space to conduct nutritional education activities. However, some studies show the need to raise the awareness of parents regarding healthy choices and the consequences of consuming UPFs, as well as the regulation of the sale and advertising of unhealthy foods in school cafeterias[11]. By contrast, providing school meals can offer a source of healthier foods in a child's diet[14].

Therefore, considering that the food consumption is a multifactorial phenomenon and that it can produce short and long-term consequences to children's health, the aim of this study was to evaluate the association of sociodemographic factors, time spent at school, and lifestyle with the consumption of fruits, vegetables, INMP foods, and UPFs and by children, aged 4 to 7 years.

Methods

This was a cross-sectional study carried out with children, aged 4 to 7 years, conducted in 2016. The children were born in a single maternity hospital in Viçosa, Brazil, and were followed up by the Lactation Support Program (PROLAC, in Portuguese), an Extension Program from the Federal University of Viçosa (UFV). PROLAC operates in the maternity hospital in partnership with the Human Milk Bank of the city. This program seeks to promote breastfeeding with advice given to postpartum mothers and nutritional follow-up provided on a monthly basis during the first year of the child's life. All of the information referent to this follow-up is registered in the Program's medical records[15,16].

The data collection began by selecting the medical records from PROLAC that contained the information necessary to locate the children and the date of birth compatible with the ages of 4 to 7 years at the time of the study. This study counted on 669 medical records to recruit the children. After conducting the search for the children at their homes, 176 children were not located due to a change of address, 75 because the parents were unwilling to participate or did not conclude all of the stages of the study, eight had health problems that hindered their participation, and seven were excluded as they did not provide data regarding food consumption. Thus, 266 (39,8%) were excluded and the final sample included 403 children.

A semi-structured questionnaire was applied to investigate the sociodemographic variables of the 4 to 7-year-old children, including sex and age of the child (4 to 5 years and 6 to 7 years), the father's level of education (<8 years; between 9 and 11 years; and ≥12 years of study), the mother's level of education (<8 years; between 9 and 11 years; and ≥12 years of study), the mother's job (yes or no), and the per capita household income categorized in income terciles. As regards the investigation of the children's lifestyles, such as screen time (television, computer, and video game) in hours/day, time for active play (hours/day), and time spent at school (hours/day), our study used a questionnaire adapted from an instrument drafted by Andaki[17]. The children with 2 hours or more in front of the television, computers, or video games were considered as excessive screen time[18]. As no other cut-off point was established for the time of active play (running, playing soccer, riding a bike, for example) and time spent at school, these variables were categorized according to their medians in the sample, as follows: <2 hours and ≥2 hours for time of active play and <5 hours and ≥5 hours for time spent at school.

The children's food consumption was evaluated by means of a food record. The mothers were asked to fill out three food records, on non-consecutive days of the week, including one day of the weekend. All of the foods and quantities consumed were registered in home measurements, as were the times and locations of the meals. The mothers were explained how to fill out the records and received written advice. It was possible to use the food record method because there were no illiterate mothers participating in the study. Due to the fact that the children spent at least one period of the day, or in some cases, the entire day at the school or daycare center, a form was delivered to register the food consumed in these locations by the workers responsible for the distribution of the food, who also received due orientation. To reduce bias when filling out the forms, the records were revised by the nutritionists, together with the legal guardian.

The food records were analyzed with the Dietpro®, version 5.1, software, preferably based on the Brazilian Table of Food Components (TACO, in Portuguese), the Nutritional Composition Tables of Foods Consumed in Brazil from the Brazilian Institute of Geography and Statistics (IBGE, in Portuguese), and food labels, when necessary. Faced with the unavailability of food in Brazilian tables, the American table was used (United States Department of Agriculture - USDA). The quantities in grams or milliliters, kilocalories (kcal) of the foods, and the total energy value of the diet, considering the average of the three records for each child.

The foods were grouped according to the NOVA classification[3] in INMP foods, processed foods, and UPFs. The percentage of caloric contribution of the food groups was calculated in relation to the total energy value (TEV) of the child's diet. The percentage of contribution of INMP foods and UPFs was used in the analysis in a continuous manner. The groups of fruits and vegetables in grams was also quantified and expressed by 1,000 calories in order to adjust the consumption by the total energy of the diet, which was also used in the analyses in a continuous manner.

The statistical analyses were conducted using the Stata 14.0 software, with a 5% significance level. To characterize the sample, the sociodemographic variables and lifestyles of the children were presented in simple and absolute frequencies. The averages of food consumption were compared according to the sociodemographic factors and lifestyles, using the Student's t test or analysis of variance (ANOVA).

For the analysis of the association of sociodemographic factors and lifestyles (independent/explicative variables) of the children with the consumption of INMP foods, fruits and vegetables, and UPFs, bivariate and multivariate linear regression models were used to calculate the Beta coefficient with a 95% confidence interval (95%CI).

The dependent variables were the percentage of caloric contribution of the INMP foods and UPFs, as well as the consumption of fruits and vegetables in grams, all analyzed in a continuous manner.

After the bivariate analyses were created, three models of adjusted linear regression (Adjusted Model 1: variables associated with the consumption of INMP foods; Adjusted Model 2: variables associated with the consumption of fruits and vegetables; Adjusted Model 3: variables associated with the consumption of UPFs). The explicative variables included in the adjusted models were those that presented a p-value≤0.100 in the bivariate linear regression analyses.

This study was approved by the UFV Ethics Committee for Research with Human Beings (Of. reference number 892476/2014). The children participated in this study only after the Free and Informed Consent Form had been signed by their parents or guardians.

Results

This study evaluated 403 children, aged 4 to 7 years, of which 55.1% were male. The majority of the children presented a screen time of more than 2 hours (66.5%), a time for active play of less than 2 hours (59.5%), and spent a half day at school (76.8%). The complete characterization of the children as regards the sociodemographic variables of the family are described in Table 1.

As regards the food consumption, the average TEV of the children's diet was of 1,535.5±366.0 kcal/day, with 38% resulting from UPFs, 5% from processed foods, and 46% from INMP foods. The ingestion of fruits and vegetables was of 130.3 (±107.0) grams.

Lower average percentages of the consumption of INMP foods among children, aged 6 to 7 years, were observed in the third tercile of the household per capita income, with a greater screen time and less time at school ($p<0.05$). As regards the consumption of fruits and vegetables, the lower averages were of children, aged 6 to 7 years, with a less educated father, a greater screen time, and with less time at school ($p<0.05$). By contrast, the percentage of UPF consumption was greater among children, aged 6 to 7 years, in the higher terciles of income, greater screen time, and less time at school ($p<0.05$). These results are shown in Table 2.

The bivariate analysis among the sociodemographic and lifestyle variables and the children's food consumption are shown in Table 3. After the multivariate analysis, adjusted for the child's age, household income, screen time, and time spent at school, the first tercile (β: 3.74; 95%CI: 0.41; 7.07) and second tercile (β: 3.62; 95%CI: 0.47; 6.77) of per capita household income were associated with the increase in the percentage of INMP foods in the children's diets. The less time spent as school was associated with a reduction in the consumption of INMP foods (β: -3.88; 95%CI: -7.02; -0.74) (Table 4).

In the model adjusted for the consumption of fruits and vegetables (controlled by the age of the child, the mother's and father's level of educa-

Table 1. Characterization of the sample according to the sociodemographic characteristics and lifestyle. Viçosa, Minas Gerais, 2016.

Variables	% (n)
Sex	
Male	55.1 (222)
Female	44.9 (181)
Child's age	
4 to 5 years	44.4 (179)
6 to 7 years	55.6 (224)
Mother's level of education	
≥12 years of study	15.3 (61)
9 to 11 years of study	50.6 (202)
≤8 years of study	34.1 (136)
Mother's age	
≥30 years	60.5 (243)
<30 years	39.5 (159)
Father's level of education	
≥12 years of study	13.3 (49)
9 to 11 years of study	36.4 (134)
≤8 years of study	50.3 (185)
Father's age	
≥30 years	80.3 (306)
<30 years	19.7 (75)
Mother's job	
No	29.4 (118)
Yes	70.6 (283)
Per capita household income	
1st tercile (40.6 to 255.0 reais)	33.4 (133)
2nd tercile (260.0 to 500.0 reais)	38.7 (154)
3rd tercile (510.0 to 7,500.0 reais)	27.9 (111)
Screen time	
<2 hours	33.5 (134)
≥2 hours	66.5 (266)
Time for active play	
<2 hours	59.5 (238)
≥2 hours	40.5 (162)
Time spent at school	
≤5 hours	76.8 (302)
>5 hours	23.2 (91)

Source: Authors.

Table 2. Average consumption of in natura or minimally processed or ultra-processed foods (%) and of fruits and vegetables (g/1000 kcal). according to sociodemographic characteristics and lifestyle. Viçosa, Minas Gerais. 2016.

Sociodemographic variables	% In natura or min. processed foods	p value	Fruits and Vegetables (g/1000 kcal)	p value	%UPF	p value
	Average		Average		Average	
Sex						
Male	46.3	0.910	86.3	0.660	37.9	0.931
Female	46.2		83.4		38.0	
Child's age						
4 to 5 years	47.9	0.017	92.5	0.039	35.8	0.006
6 to 7 years	44.9		79.0		39.7	
Mothers level of education						
≥12 years of study	45.2	0.115	99.1	0.195	41.3	0.051
9 to 11 years of study	45.3		81.2		38.3	
≤8 years of study	48.1		84.2		36.0	
Mother's age						
≥30 years	46.1	0.805	82.8	0.371	38.7	0.185
<30 years	46.4		88.8		36.8	
Father's level of education						
≥12 years of study	44.7	0.585	111.9	0.009	40.6	0.219
9 to 11 years of study	46.9		81.7		39.0	
≤8 years of study	46.2		81.7		37.1	
Father's age						
≥30 years	46.3	0.794	84.8	0.548	38.4	0.637
<30 years	45.9		89.9		37.5	
Mother's job						
No	47.0	0.465	91.2	0.241	35.9	0.068
Yes	46.0		82.8		38.8	
Per capita household income						
1st tercile (40.6 to 255.0 reais)	47.5	0.044	90.5	0.297	34.9	0.001
2nd tercile (260.0 to 500.0 reais)	47.1		78.8		37.8	
3rd tercile (510.0 to 7.500.0 reais)	43.8		86.6		41.5	
Variables of lifestyle						
Screen time						
<2 hours	48.6	0.009	95.2	0.029	35.3	0.008
≥2 hours	45.1		80.1		39.3	
Time for active play						
<2 hours	45.7	0.299	80.9	0.104	38.7	0.213
≥2 hours	47.0		91.7		36.9	
Time spent at school						
≤5 hours	45.3	0.005	81.0	0.024	38.9	0.03
>5 hours	49.6		98.7		35.3	

Source: Authors.

tion, and hours spent at school), the children of les educated parents (≤8 years of study: β:-32.17; 95%CI: -55.02; -9.329, and 11 years of study: β: -28.45; 95%CI: -51.20; -5.70) and those children with a greater screen time presented a lower consumption of fruits and vegetables (β:-17.33; 95%CI: -31.77; -2.89) (Table 4).

The lowest tercile of per capita household income was associated with a reduction in UPF consumption in the children's diets (β: -4.94; 95%CI: -9.06; -0.81) in the multiple analysis adjusted for the child's age, the mother's level of education, the mother's job, household income, screen time, and hours spent at school. Further-

Table 3. Linear regression coefficient of the association of sociodemographic characteristics and lifestyle of the children with the percentage consumption of in natura or minimally processed and ultra-processed foods (%) and of fruits and vegetables (g/1000 kcal). Viçosa, Minas Gerais, 2016.

Sociodemographic variables	%In natura or min. processed foods	p-value	Fruits and vegetables (g/1000 kcal)	p-value	%UPF	p-value
Sex						
Male	Ref		Ref		Ref	
Female	-0.15 (-2.65; 2.34)	0.901	-2.88 (-15.78; 10.00)	0.66	0.12 (-2.65; 2.90)	0.931
Child's age						
4 to 5 years	Ref		Ref		Ref	
6 to 7 years	-3.04 (-5.53; -0.55)	0.017	-13.53 (-26.36; -0.69)	0.039	3.85 (1.10; 6.60)	0.006
Mother's level of education						
≥12 years of study	Ref		Ref		Ref	
9 to 11 years of study	0.09 (-3.54; 3.74)	0.958	-17.18 (-35.99; 1.63)	0.073	-2.92 (-6.95; 1.11)	0.155
≤8 years of study	2.87 (-0.978; 6.71)	0.143	-14.87 (-34.71; 4.96)	0.141	-5.20 (-9.44; -0.94)	0.017
Mother's age						
≥30 years	Ref		Ref		Ref	
<30 years	0.32 (-2.22; 2.87)	0.805	5.98 (-7.14; 19.09)	0.371	-1.91 (-4.73; 0.92)	0.185
Father's level of education						
≥12 years of study	Ref		Ref		Ref	
9 to 11 years of study	2.20 (-1.99; 6.40)	0.302	-30.19 (-51.23; -9.16)	0.005	-1.57 (-6.19; 3.06)	0.506
≤8 years of study	1.51 (-2.51; 5.55)	0.460	-30.24 (-50.48; -9.99)	0.004	-3.52 (-7.98; 0.93)	0.121
Father's age						
≥30 years	Ref		Ref		Ref	
<30 years	-0.43 (-3.64; 2.78)	0.794	5.03 (-11.43; 21.50)	0.548	-0.85 (-4.40; 2.69)	0.637
Mother's job						
No	Ref		Ref		Ref	
Yes	-1.02 (-3.76; 1.72)	0.465	-8.42 (-22.51; 5.67)	0.241	2.82 (-0.21; 5.84)	0.068
Per capita household income						
3rd tercile (510.0 to 7500.0 reais)	Ref		Ref		Ref	
2nd tercile (260.0 to 500.0 reais)	3.31 (0.21; 6.41)	0.036	-7.78 (-23.68; 8.12)	0.336	-3.70 (-7.11; -0.29)	0.034
1st tercile (40.6 to 255.0 reais)	3.77 (0.57; 6.97)	0.021	3.96 (-12.46; 20.38)	0.635	-6.50(-10.02; -2.98)	<0.001
Variables of lifestyle						
Screen time						
<2 hours	Ref		Ref		Ref	
≥2 hours	-3.48 (-6.11; -0.85)	0.01	-15.12 (-28.72; -1.53)	0.029	4.00 (1.05; 6.88)	0.008
Time for active play						
≥2 hours	Ref		Ref		Ref	
<2 hours	-1.35 (-3.89; 1.20)	0.299	-10.87 (-23.97; 2.23)	0.104	1.79 (-1.03; 4.61)	0.213
Time spent at school						
>5 hours	Ref		Ref		Ref	
≤5 hours	-4.29 (-7.27; -1.31)	0.005	-17.66 (-32.97; -2.35)	0.024	3.64 (0.35; 6.93)	0.03

Source: Authors.

more, the less time spent at school was associated with the increase in UPF consumption (β: 3.66; 95%CI: 0.11; 7.15) (Table 4).

Table 4. Multivariate analysis of the association of sociodemographic characteristics and lifestyle of the children with percentage consumption of in natura or minimally processed and ultra-processed foods (%) and of fruits and vegetables (g/1000 kcal). Viçosa, Minas Gerais, 2016.

Variables	β (95% Confidence Interval)	p-value
Adjusted model 1: % In natura or min. processed foods		
Child's age		
4 to 5 years	Ref	
6 to 7 years	-1.79 (-4.44; 0.85)	0.183
Per capita household income		
3rd tercile (510.0 to 7500.0 reais)	Ref	
2nd tercile (260.0 to 500.0 reais)	3.62 (0.47; 6.77)	0.024
1st tercile (40.6 to 255.0 reais)	3.74 (0.41; 7.07)	0.028
Screen time		
<2 hours	Ref	
≥2 hours	-2.33 (-5.09; 0.44)	0.100
Time spent at school		
>5 hours	Ref	
≤5 hours	-3.88 (-7.02; -0.74)	0.016
Adjusted Model 2: Fruits and Vegetables (grams)		
Child's age		
4 to 5 years	Ref	
6 to 7 years	-8.66 (-22.66; 5.34)	0.225
Mother's level of education		
≥12 years of study	Ref	
9 to 11 years of study	-9.88 (-30.16; 10.44)	0.339
≤8 years of study	-2.81 (-25.12; 19.49)	0.804
Father's level of education		
≥12 years of study	Ref	
9 to 11 years of study	-28.45 (-51.20; -5.70)	0.014
≤8 years of study	-32.17 (-55.02; -9.32)	0.006
Screen time		
<2 hours	Ref	
≥2 hours	-17.33 (-31.77; -2.89)	0.019
Time spent at school		
>5 hours	Ref	
≤5 hours	-12.33 (-28.55; 3.89)	0.136
Adjusted Model 3: %Ultra-processed Foods		
Child's age		
4 to 5 years	Ref	
6 to 7 years	2.68 (-0.25; 5.60)	0.073
Mother's level of education		
≥12 years of study	Ref	
9 to 11 years of study	-1.27 (-5.48; 2.94)	0.533
≤8 years of study	-2.07 (-6.78; 2.65)	0.390
Mother's job		
No	Ref	
Yes	1.63 (-1.66; 4.92)	0.331
Per capita household income		
3rd tercile (510.0 to 7500.0 reais)	Ref	
2nd tercile (260.0 to 500.0 reais)	-3.31 (-6.95; 0.33)	0.074
1st tercile (40.6 to 255.0 reais)	-4.94 (-9.06; -0.81)	0.019
Screen time		
<2 hours	Ref	
≥2 hours	2.32 (-0.74; 5.38)	0.137
Time spent at school		
>5 hours	Ref	
≤5 hours	3.63 (0.11; 7.15)	0.043

Model 1: Adjusted for child's age, per capita household income, screen time, and time spent at school, Model 2: Adjusted for child's age, mother's and father's level of education, screen time, and time spent at school. Model 3: Adjusted for child's age, level of education, and mother's job, per capita household income, screen time, and time spent at school.

Source: Authors.

Discussion

This study demonstrated the association of the socioeconomic status, screen time, and time spent at school with the food consumption profile of children, aged 4 to 7 years. The children with a lower household income presented a lower consumption of UPF and a higher consumption of INMP foods. The less time spent at school was associated with a greater consumption of UPF and a lower consumption of INMP foods. Moreover, children with parents with a lower level of education and more screen time consumed less fruits and vegetables. Our findings indicate the importance of identifying factors associated with the promotion of an adequate and healthy diet during childhood.

In the present study, 38% of the energy resulted from UPFs, and the greater consumption of these foods was among children, aged 6 to 7 years. According to Sparrenberger *et al.*[8], when evaluating the contribution of UPFs in the food consumption of children, aged 2 to 12 years, results showed that 47% of the energy came from UPFs, and the consumption of these foods was greater among school-aged children. One study, conducted with children, aged 6 to 16 years, identified a 69.7% consumption of UPFs. Although the present study presented a lower percentage when compared to other studies, the UPFs should be avoided due to the high levels of sugar, fats, and additives. Moreover, the consumption of these foods is related to an increase in obesity, diabetes, and cardiovascular diseases, for example[19].

Studies concerning determining factors of food consumption during childhood demonstrate the heavy influence of sociodemographic variables of the parents in the child's eating standards, due to the important role of the family environment in the formation of eating habits during childhood[20,21]. The present study showed an association of the less educated father with the low consumption of fruits and vegetables by the children. Similarly, one study conducted with children, aged 2 to 3 years, also demonstrated the negative influence of the less educated father in the low consumption of fruits and vegetables[5]. By contrast, according to Souza *et al.*[20], children, aged 1 to 6 years, with mother's who have a higher education and a better household income presented a greater adherence to the fruits and vegetables standards. The low level of education of the parents suggests an insufficient understanding of the necessary health care and nutritional recommendations, culminating in the lower supply of foods considered to be healthy for children[7]. Our findings reinforce the importance of also considering the relationship between the father's level of education and the child's eating habits, bearing in mind that the majority of the studies only investigated the maternal influence.

Studies that show the relationship of sociodemographic factors with the consumption of UPFs during childhood are still contradictory. We believe that a poorer socioeconomic status is still a factor that makes the consumption of UPFs difficult, according to that observed in the present study, due to the lack of value and priority of these foods in household incomes. On the other hand, the greater consumption of INMP foods by children in a poorer socioeconomic status, but the lower consumption of fruits and vegetables by these same children, indicates that the diet of these children is most likely based on traditional Brazilian foods, such as rice and beans, but it is still lacking in fruits and vegetables. The high cost of fruits and vegetables may well be a factor to explain why these are less consumed by children whose parents have a lower level of education.

Similarly, the Household Budget Survey (POF, in Portuguese) 2017-2018 illustrates that Brazilians who belong to the lower fourth of income classes consume less UPFs, such as soft drinks and sandwiches; however, they are also among those who least consume fruits and raw salads when compared to the richer income classes. By contrast, the consumption of traditional foods, such as rice and beans, is greater among poorer Brazilians[22].

What stands out is the role of the child´s age, which was related to a worse food consumption profile in older children who consumed less INMP foods, less fruits and vegetables, and more UPFs. The older children have more autonomy in their food preferences and are more vulnerable to environmental influences[23] such as the susceptibility to marketing by food industry, which encourages the consumption of UPFs[24].

The shorter time spent at school was associated with a lower consumption of INMP foods and fruits and vegetables, as well as a greater intake of UPFs. The supply of fruits and vegetables has most likely been greater for the children who stay full-time at school or in daycare centers, especially in public schools where the promotion of healthy eating habits occurs through the National School Meal Program (PNAE, in Portuguese)[25].

In addition, during data collection for the present study, there were reports from mothers

about the incentives on the part of the schools or daycare centers for the consumption of healthy foods at home. One study in Belo Horizonte, Brazil, conducted with 1,357 children, analyzed the consumption of INMP foods and UPFs in schools, of which 46.3% were linked to the Integrated School Program (PEI, in Portuguese), a program similar to the PNAE. This study found that the child's time spent at school, full-time, was a protection factor for healthy eating habits, with a 26% lower consumption of UPFs in the children's diets, including three meals at school, as compared to children who did not eat the school meals[26]. Therefore, these results agree with those of the present study and reinforce the positive impact that the school can have on the promotion of an adequate and healthy diet during childhood.

Sedentary behavior, represented by the greater screen time, implies a greater exposure of the children to the media and to aggressive marketing campaigns from the food industry, predisposing the children to a high consumption of UPFs[27,28].

According to Mallarino *et al.*[24], the children's food preferences undergo major influence from the publicity of food and drinks. This is one of the explanations for the association found in the present study between the greater screen time and the worse food consumption profile, represented by the lower average consumption of INMP foods and fruits and vegetables, and the greater consumption of UPFs by children. The increase in the consumption of UPFs most likely substitutes the consumption of more healthy foods. Moreover, the screen time favors the consumption of obesogenic foods due to their practicality and the distractions that the screens offer, interfering in the hunger and satiety mechanisms, favoring the greater consumption of UPFs[9]. Similar to our results, one study from the National Health Survey (NHS) showed that the habit of watching TV for more than three hours was a risk factor for the consumption of sugary drinks for children under two years of age[29].

In this sense, it is important to limit children's screen time, considering that this sedentary behavior, associated with inadequate eating habits, predisposes children and adolescents to obesity. Our findings also reveal the need for action to encourage the promotion of healthy eating habits and physical activity, geared toward promoting a healthy lifestyle during childhood.

This study presented some limitations. First, it is important to highlight that there was a 39.8% loss in the retrospective cohort. This situation commonly occurs in cohorts, due to the participants' difficulty to follow the study. Due to the cross-sectional design, it was not possible to infer any causality between the sociodemographic variables, the time spent at school, and the variables of the children's lifestyles and food consumption. Therefore, it is important for the associations found in the present study to be understood as associated factors and not necessarily causes. In this sense, it is necessary to conduct new studies to evaluate the association of sociodemographic factors, time spent at school, and lifestyle with the children's food consumption in a longitudinal manner so as to verify a causal relationship among the variables.

On the other hand, this study also presents strong points. The children's food consumption was evaluated by three food records, one on the weekend, which evaluated the children's eating habits, even during the period in which they were at school. The quantity of evaluated food records also contributed by reducing the intra-individual variability and reflected the children's habitual food intake. Most of the studies that evaluated the consumption of fruits and vegetables by the children, for example, investigated only the frequency of this consumption.

In conclusion, sociodemographic variables, time spent at school, and screen time were associated with the intake of INMP foods, UPFs, and fruits and vegetables. These results indicate that the worse socioeconomic status of the family was associated with the lower consumption of UPFs and the higher consumption of INMP foods, which is positive. Nonetheless, the children of less educated parents consumed less fruits and vegetables, indicating that, although the children in a worse socioeconomic status presented a higher consumption of INMP foods, this consumption is not represented by larger quantities of fruits and vegetables.

The excessive screen time was associated with a worse food consumption profile among children; therefore, these should be encouraged to have a more active lifestyle and to participate in food and nutritional education activities at school, together with the parents, in order to improve children's eating habits, thus preventing obesity and other associated diseases in their current and future lives.

Collaborations

PCA Fonseca and SAV Ribeiro participated in the study conception and design, data analysis and interpretation, writing and final review of the article. RRS Carvalho participated in data interpretation and updating the final version of the article. CS Andreoli participated in the conception and design of the study and data interpretation. JF Novaes and SE Priore participated in the study conception and design, data interpretation and article review. CA Carvalho participated in the analysis and interpretation of data, writing and review of the final version of the manuscript. SCC Franceschini participated in the conception and design of the study and data interpretation and final review of the article.

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References

1. Bortolini GA, Gubert MB, Santos LMP. Consumo alimentar entre crianças brasileiras com idade de 6 a 59 meses. *Cad Saude Publica* 2012; 28(9):1759-1771.
2. Alves MN, Muniz LC, Vieira MFA. Consumo alimentar entre crianças brasileiras de dois a cinco anos de idade: Pesquisa Nacional de Demografia e Saúde (PNDS), 2006. *Cien Saude Colet* 2013; 18(11):3369-3377.
3. Monteiro CA, Cannon G, Levy R, Moubarac JC, Jaime P, Martins AP, Canella D, Louzada M, Parra D, Ricardo C, Calixto G, Machado P, Martins C, Martinez E, Baraldi L, Garzillo J, Sattamini I. NOVA. A estrela brilha. Classificação dos alimentos. *World Nutrition* 2016; 7(1-3):28-40.
4. Rauber F, Campagnolo PD, Hoffman DJ, Vitolo MR. Consumption of ultra-processed food products and its effects on children's lipid profiles: a longitudinal study. *Nutr Metab Cardiovasc Dis* 2015; 25(1):116-122.
5. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Departamento de Atenção Básica. *Guia alimentar para a população brasileira*. 2ª ed. Brasília: MS, 2014.
6. Sotero AM, Cabral PC, Silva GAP. Fatores socioeconômicos, culturais e demográficos maternos associados ao padrão alimentar de lactentes. *Rev Paul Pediatr* 2015; 33(4):445-452.
7. Valmórbida JL, Vitolo MR. Factors associated with low consumption of fruits and vegetables by pre-schoolers of low socio-economic level. *J Pediatr (Rio J)* 2014; 90(5):464-471.
8. Sparrenberger K, Friedrich RR, Schiffner MD, Schuch I, Wagner MB. Ultra-processed food consumption in children from a Basic Health Unit. *J Pediatr (Rio J)* 2015; 91(6):535-542.
9. Oliveira JS, Barufaldi LA, Abreu GA, Leal VS, Brunken GS, Vasconcelos SML, Santos MM, Bloch KV. ERICA: uso de telas e consumo de refeições e petiscos por adolescentes brasileiros. *Rev Saúde Publica* 2016; 50(Supl. 1):7s.
10. Nobre JNP, Santos JN, Santos LR, Guedes SC, Pereira L, Costa JM, Morais RLS. Fatores determinantes no tempo de tela de crianças na primeira infância. *Cien Saude Colet* 2021; 26(3):1127-1136.
11. Costa CS, Flores TR, Wendt A, Neves RG, Assunção, MCF, Santos IS. Comportamento sedentário e consumo de alimentos ultraprocessados entre adolescentes brasileiros: Pesquisa Nacional de Saúde do Escolar (PeNSE), 2015. *Cad Saude Publica* 2018; 34(3):e00021017.
12. Rocha LL, Gratão LHA, Carmo AS, Costa ABP, Cunha CF, Oliveira TRPR, Mendes LL. School Type, Eating Habits, and Screen Time are Associated With Ultra-Processed Food Consumption Among Brazilian Adolescents. *J Academy Nutr Dietetics* 2021; 121(6):1136-1142.
13. Mais LM, Warkentin S, Vega JB, Latorre MRDO, Carmell S, Taddei JAAC. Sociodemographic, anthropometric and behavioural risk factors for ultra-processed food consumption in a sample of 2-9-year-olds in Brazil. *Public Health Nutr* 2018; 21(1):77-86.

14. Arqque RGC, Ferreira JCS, Figueiredo. A importância nutricional da merenda escolar para a comunidade. *Res Soc Develop* 2021; 10(14):e111101421852.
15. Magalhães TCA, Vieira SA, Priore SE, Ribeiro AQ, Franceschini SCC, Sant'ana LFR. Fatores associados à dislipidemia em crianças de 4 a 7 anos de idade. *Rev Nutr* 2015; 28(1):17-28.
16. Vieira SA. Magalhães TCA, Ribeiro AQ, Priore SE, Franceschini SCC, Sant'Ana LFR. Influence of Weight Gain Rate on Early Life Nutritional Status and Body Composition of Children. *ScientificWorldJournal* 2014; 2014:616108.
17. Andaki ACR. *Antropometria e nível de atividade física na predição de alterações metabólicas em crianças de 10 anos* [dissertação]. Viçosa: Universidade Federal de Viçosa; 2010.
18. Council on Communications Media. Children, adolescents, and the media. *Pediatrics* 2013; 132:958-961.
19. Andretta V, Siviero J, Mendes KG, Motter FR, Theodoro H. Consumo de alimentos ultraprocessados e fatores associados em uma amostra de base escolar pública no Sul do Brasil. *Cien Saude Colet* 2021; 26(4):1477-1488.
20. Souza RLV, Madruga SW, Santos IS, Barros AJD, Assunção MCF. Padrões alimentares e fatores associados entre crianças de um a seis anos de um município do Sul do Brasil. *Cad Saude Publica* 2013; 29(12):2416-2426.
21. Patrick H, Nicklas TA. A review of family and social determinants of children's eating patterns and diet quality. *J Am Coll Nutr* 2005; 24(2):83-92.
22. Brasil. Ministério do Planejamento, Orçamento e Gestão. *Pesquisa de Orçamentos Familiares 2017-2018: Análise do consumo alimentar pessoal no Brasil*. Rio de Janeiro: IBGE; 2018.
23. Martins AP, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Increased contribution of ultra-processed food products in the Brazilian diet (1987-2009). *Rev Saude Publica* 2013; 47(4):656-665.
24. Mallarino C, Gomez LF, Gonzalez-Zapata L, Cadena Y, Parra DC. Advertising of ultra-processed foods and beverages: children as a vulnerable population. *Rev Saude Publica* 2013; 47(5):1006-1010.
25. Szinwelski NK, Teo CRPA, Souza Gallina L, Grahl F, Filippi C. Implicações do Programa Nacional de Alimentação Escolar (PNAE) na Renda e Organização de Agricultores Familiares. *Rev Bras Polit Publicas* 2015; 5(3):1-23.
26. Bento BMA, Moreira AC, Carmo AS, Santos LC, Horta PM. A higher number of school meals is associated with a less-processed diet. *J Pediatr (Rio J)* 2018; 94(4):404-409.
27. Fraga RS, Silva SLR, Santos LC, Titonele LRO, Carmo AS. The habit of buying foods announced on television increases ultra-processed products intake among schoolchildren. *Cad Saude Publica* 2020; 36(8):e00091419.
28. Alcântara FB, Rodrigues JCS, Silva KK, Santos MC, Silva TM, Berni AL. A influência da mídia e publicidade na alimentação de escolares: o papel da educação alimentar. *Rev Eletr Acervo Saude* 2019; 11(13):e2005.
29. Jaime PC, Prado RR, Malta DC. Influência familiar no consumo de bebidas açucaradas em crianças menores de dois anos. *Rev Saude Publica* 2017; 51(Supl. 1):13s.

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