Parental dietary intake predicts fruit consumption among preschool children

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Graphical Abstract

Highlights

• *The frequency of fruit consumption among preschool children reflects parental consumption frequency, independent of sociodemographic variables.*
• *The frequency of vegetable consumption among children is correlated with the number of meals consumed at school.*
• *Banana, apple, and orange were the most frequently consumed fruits by both parents and children.*
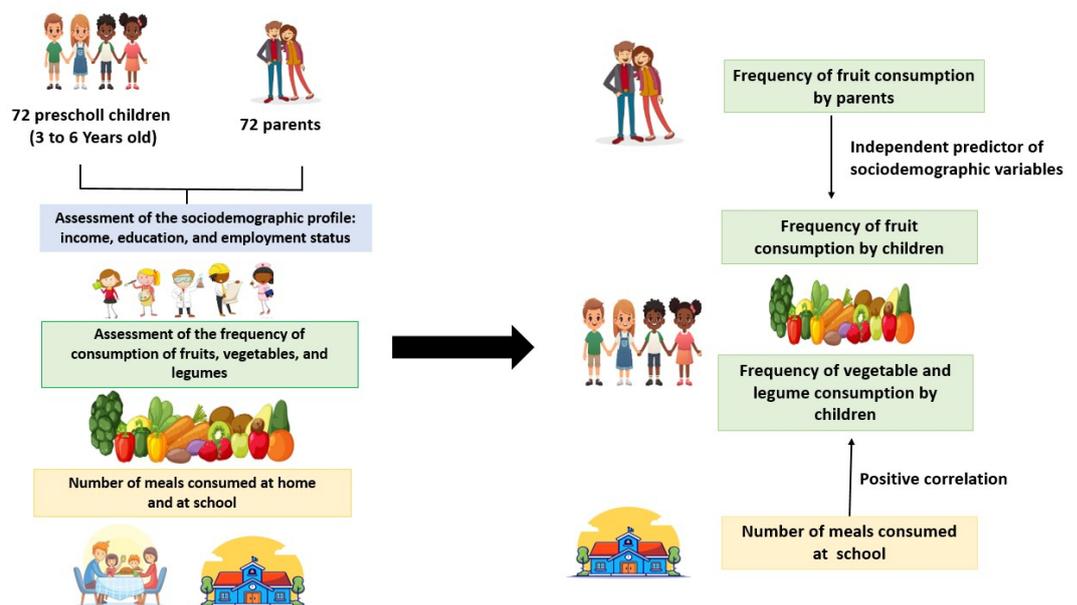
Abstract

The promotion of adequate and healthy eating in childhood constitutes a central strategy of public health policies, with schools representing a privileged setting for the formation of dietary habits. During the preschool period, eating behavior is strongly influenced by the family and school environments, particularly with regard to the consumption of fruits, vegetables, and legumes. This study aimed to identify the determining factors associated with the consumption of these foods among preschool children enrolled in a public school in the municipality of São Paulo, SP, Brazil. This was a cross-sectional study conducted with 72 preschool children and their respective parents. Dietary intake was assessed using an adapted food frequency questionnaire, and sociodemographic characteristics were obtained through a structured questionnaire. The fruits most frequently consumed by the children were banana, apple, and orange, with patterns similar to those observed among parents, whereas foods such as kiwi, escarole, and watercress showed low intake in both groups. A positive association was observed between children's consumption of fruits, vegetables, and legumes and parental consumption, regardless of sociodemographic characteristics, as well as an association with the number of meals consumed in the school environment. It is concluded that both the family and school environments exert a direct influence on preschoolers' eating habits, reinforcing the need for food and nutrition education actions aimed at expanding dietary variety from the earliest years of life.

Keywords: Fruits. Vegetables. Legumes. Preschool Child. Food Consumption.

INTRODUCTION

The pursuit of guaranteeing health and food as human and citizenship rights, with an emphasis on the promotion of adequate and healthy eating, has stimulated the formulation and implementation of public policies. In Brazil, the National Food and Nutrition Policy (Política Nacional de Alimentação e Nutrição – PNAN)[1] represents a landmark of this commitment and has supported the development of strategies and actions such as the elaboration of dietary guidelines, programs, guidance for the organization of services, and the promotion of adequate and healthy eating in different settings. In many of these actions, as well as in other initiatives, food and nutrition education has been recognized as a fundamental strategy for the promotion of healthy and adequate eating, and schools have been identified as a privileged setting for health promotion due to their potential to foster critical thinking and autonomy among all members of the school community[2].

The term "school feeding" has also been used to refer to the set of meals provided by the National School Feeding Program (Programa Nacional de Alimentação Escolar – PNAE). Thus, school feeding constitutes a relevant dietary practice in Brazilian public schools. Eating at school occurs alongside other practices that shape the school environment, configuring experiences and processes that influence the construction of children's eating habits and identities. The PNAE aims to contribute to students' biopsychosocial development, academic performance, and the formation of healthy eating habits through food and nutrition education actions and the provision of meals that meet their nutritional needs during their time at schoo[3,4].

Adequate food and nutrition in childhood represent the foundation for survival, growth, and child development, with repercussions in later stages of life. For these reasons, they are a priority on national and international public health and child protection agendas and are included among the targets of the Sustainable Development Goals. However, globally, at least one in every three children under 5 years of age is affected by one or more forms of malnutrition, including undernutrition, overweight, and micronutrient deficiencies. Although the nutritional status of children worldwide has improved, many still do not have adequate food and nutrition, especially those who are most vulnerable: the youngest, the poorest, and those affected by humanitarian crises[5].

Optimal growth and development of children depend on the provision of a supportive environment, particularly during their formative years, specifically the first six years of life. Caregivers, who may also include teachers, and parents in particular, play a full-time role in influencing a child's behavior. Eating behavior is highly complex and is affected by a variety of factors, including the physical environment, the social environment, and individual characteristics[6].

Food selectivity (FS) is characterized by food refusal, low appetite, and lack of interest in food. It is a typical behavior during the preschool phase; however, when present in unfavorable family environments, it may intensify and persist into adolescence. In order to minimize the consequences of poor diet promoted by selectivity, the active participation of parents and caregivers (such as teachers) is essential in identifying the characteristic signs and symptoms of FS. Early intervention prevents the consequences of nutritional deficiencies and enables adequate growth and development, thereby ensuring a better prognosis[7].

Brazil has undergone a clear process of nutritional transition, characterized by a marked increase in the prevalence of overweight across different stages of the life course, without the eradication of undernutrition and other nutritional deficiencies. Children and adolescents are biologically more vulnerable to these conditions and therefore serve as important indicators of nutritional disorders in the population. This group has also exhibited low consumption of fruits, vegetables, and legumes, along with a high intake of ultra-processed foods[8].

In light of the above, understanding the eating habits of these children is essential for adapting school menus, making them more attractive and nutritious, and thereby contributing to the formation of healthy eating habits from an early age. Thus, the analysis of dietary intake among preschool children not only helps improve food practices within the school environment but also provides valuable insights for public health policies aimed at promoting the well-being of future generations. Accordingly, the hypothesis of this study is that family and school factors, particularly parental consumption of these foods and the occurrence of meals in the school environment, are positively associated with the consumption of fruits, vegetables, and legumes by preschool children. Therefore, this study aimed to identify family-related factors influencing the consumption of fruits, vegetables, and legumes among preschool children attending a public school in the municipality of São Paulo, SP, Brazil.

METHODS

Study design

This was a cross-sectional and observational study.

Study setting and participants

The study was conducted within the municipal education network of the city of São Paulo, SP, Brazil, at a public early childhood education school located in the western zone of the city. The selection of the school was based on criteria such as the socioeconomic diversity of the students and the institution's availability and willingness to participate in the study. During an in-person meeting, the research objectives and procedures were presented to the parents of the children, who were invited to participate.

Sample size was determined by convenience, according to parents' availability to respond to the study questionnaires and their attendance at the in-person meeting. At the time of data collection, a total of 148 children were enrolled in early childhood education at the school. Exclusion criteria for data analysis included children diagnosed with behavioral disorders, such as autism spectrum disorder, and genetic syndromes, such as Down syndrome, as reported by parents, since these conditions may compromise dietary intake due to extreme food selectivity. Thus, the final sample consisted of 72 preschool children aged 3 to 6 years and their respective parents.

Data collection

Data collection took place between March and June 2024 and consisted of administering questionnaires to parents or legal guardians during their presence at the school on the day of parent meetings with the principal and teachers. The questionnaires were self-administered under the supervision of the researchers.

Children's habitual dietary intake was assessed using a food frequency questionnaire (FFQ) previously validated for preschool children[9]. Response options included seven categories of consumption frequency: never; less than once per month; 1 to 3 times per month; once per week; 2 to 4 times per week; once per day; and 2 or more times per day[9]. The original FFQ includes 57 food items distributed across food groups; however, to optimize data collection for this study, the questionnaire was adapted to assess only the consumption of fruits (13 items), vegetables (8 items), and legumes (12 items). The same questionnaire was applied to parents to assess their dietary consumption frequency,

allowing for comparative analyses between children and parents.

For statistical analysis purposes, FFQ consumption frequencies were converted into numerical values, corresponding to consumption scores, according to the method proposed by Fornés et al. (2002)[10]. The following formula was applied: Annual consumption score = $(1/365) \times [(a + b)/2]$

In this equation, "a" and "b" represent the number of days corresponding to each consumption frequency over a one-year period. For example, a frequency of 1 to 3 times per month corresponds to a = 12 (consumption once per month over 12 months) and b = 36 (consumption three times per month over 12 months). For frequencies of once or more per day, the score was considered equal to 1. The scores assigned to each consumption frequency were as follows: never = 0; less than once per month = 0.016; 1 to 3 times per month = 0.065; once per week = 0.142; 2 to 4 times per week = 0.427; once per day = 1; and 2 or more times per day = 1.

Subsequently, for statistical analysis, the mean consumption score for each food group was calculated, generating specific scores for fruit, vegetable, and legume consumption. The mean consumption score reflects the average frequency of intake, corresponding to the number of days per year for each food group.

A sociodemographic questionnaire was also administered, including information on parents' age, child's sex, child's date of birth, parents' educational level, caregiver's employment status, and household income. Questions regarding children's meals were also included, specifically the number of meals consumed at home and the number of meals consumed at school.

Ethical considerations

All participating parents signed an informed consent form and completed the research questionnaires. After parental consent, the study was presented to the children in the classroom using age-appropriate language, so that they could provide assent to participate. The study was approved by the Research Ethics Committee of Centro Universitário São Camilo, under protocol number 3.925.583.

Statistical analysis

Statistical analyses were performed using the JAMOVI software, with a significance level set at p < 0.05. Normality of variable distributions was as-

sessed using the Shapiro–Wilk test. Numerical variables are presented as mean ± standard deviation, and categorical variables as absolute and relative frequencies. Pearson and Spearman correlation tests were applied to parametric and nonparametric numerical variables, respectively. To identify factors associated with fruit, vegetable, and legume consumption scores (dependent variables), three multiple linear regression models were constructed, considering parental consumption score, parental educational level, and the number of meals consumed at home and at school as predictors (independent variables). The models were tested to meet the required statistical assumptions: absence of autocorrelation among residuals, assessed by the Durbin–Watson test (DW = 1.5–2.5); homoscedasticity, evaluated using Q–Q plots; and absence of multicollinearity, assessed by the Variance Inflation Factor (VIF > 0.8). All assumptions were confirmed prior to interpretation of the final models.

RESULTS

The sociodemographic profile of the sample is presented in Table 1.

Table 1 - Sociodemographic profile of preschool children and their parents and/or guardians. São Paulo, SP, Brazil, 2024.

	Mean	SD
Children		
Child age (years)	4.6	± 0.6
Fruit consumption score	0.203	± 0.216
Legume consumption score	0.0854	± 0.091
Vegetable consumption score	0.0684	± 0.102
Number of meals consumed at home	2.87	± 0.102
Number of meals consumed at school	3.15	± 0.102
Parents		
Caregiver age (years)	35.3	± 9.5
Fruit consumption score	0.275	± 0.244
Legume consumption score	0.171	± 0.162
Vegetable consumption score	1.07	± 1.10
	n	**%**
Child sex		
Female	31	43.1
Male	41	56.9
Caregiver sex		
Female	53	73.6
Male	19	26.4
Caregiver education		
Illiterate	0	0.0
Elementary school I completed	9	12.5
Fundamental 2 completo	7	9.7
Elementary school II completed	33	45.8
High school completed	22	30.6
Not reported	1	1.4
Household income		
Yes	54	75.0
No	18	25.0
Work outside the home		
Less than 1 minimum wage	7	9.7
1–2 minimum wages	36	50.0
3–5 minimum wages	22	30.6
6–8 minimum wages	5	6.9
9–10 minimum wages	1	1.4
More than 10 minimum wages	1	1.4

Note: At the time of data collection, the Brazilian minimum wage corresponded to BRL 1,412.00.

The frequency of consumption of vegetables/ legumes and fruits by children and parents/ guardians is presented in Tables 2 and 3, respectively.

Table 2 - Percentage (%) of frequency of consumption of vegetables by children and their parents and/ or guardians. São Paulo, 2024.

	Children							Parents						
	≥2 times/ day (%)	1 time/ day (%)	2–4 times/ week (%)	1 time/ week (%)	1–3 times/ month (%)	<1 time/ month (%)	Never or almost never (%)	≥2 times/ day (%)	1 time/ day (%)	2–4 times/ week (%)	1 time/ week (%)	1–3 times/ month (%)	<1 time/ month (%)	Never or almost never (%)
Legumes														
Carrot	10.0	15.0	25.0	20.0	15.0	10.0	5.0	10.0	15.0	20.0	25.0	12.0	8.0	10.0
Beetroot	8.0	12.0	20.0	18.0	20.0	12.0	10.0	7.0	10.0	28.0	18.0	10.0	12.0	15.0
Zucchini	5.0	8.0	25.0	12.0	17.0	18.0	15.0	5.0	10.0	17.0	15.0	18.0	15.0	20.0
Broccoli	1.4	1.4	9.6	11.0	27	15.2	34.4	4.1	2.7	26	16.4	27.4	12.4	11.0
Pumpkin	1.4	6.8	4.1	4.1	19.2	21.9	42.5	0.0	1.4	13.9	9.7	27.9	29	18.1
Eggplant	1.4	2.7	1.4	4.1	4.1	13.7	72.6	6.4	1.4	6.4	4.2	19.5	16.8	45.3
Chayote	3.8	2.1	9.3	1.4	15,7	18.9	48.8	2.8	4.2	18.1	11.1	18.1	18.1	27.6
Gilo	0.0	0.0	0.0	0.0	0.0	10.9	89.1	0.0	1.4	4.2	2.8	5.6	8.3	77.7
Cucumber	1.4	2.8	6.9	5.6	15.3	13.5	54.5	4.2	2.8	23.6	11.1	33.3	8.3	16.7
Cucumber	0.0	2.8	1.4	1.4	2.8	9.6	82.0	2.8	4.2	9.7	6.9	22.7	8.3	45.4
Tomato	12.5	5.6	27.8	8.3	8.3	12.5	25.0	12.5	13.9	41.3	9.7	13.9	0.0	8.7
Vagem	1.4	4.2	4.2	1.4	6.9	9.6	72.3	0.0	6.9	13.9	4.6	12.5	12.5	49.6
Vegetables														
Swiss chard	0.0	0.0	0.0	2.7	1.4	12.3	83.6	0.0	1.4	4,1	8.2	13.7	11.0	61.6
Watercress	0.0	0.0	0.0	1.4	4.0	12,3	82.3	1.4	1.4	8.2	5.5	12.3	16.4	54.8
Lettuce	2.7	2.7	15.1	9.6	17.8	13.7	38.4	9.6	17.8	34.2	17.8	11.0	7.8	1.8
Chicory	1.4	1.4	1.4	1.4	2.7	4.1	87.6	0.0	4.1	5.5	4.1	9.6	8.2	68.5
Collard greens	0.0	1.4	8.4	5.9	11.0	8.5	64.8	1.4	1.4	24.7	16.7	22.9	13.7	19.2
Escarole	1.6	0.0	1.4	0.0	1.6	11.6	83.8	0.0	1.4	2,7	4.1	12.7	9.2	69.9
Spinach	1.6	2.7	0.0	0.0	1.6	13.3	80.8	0.0	1.4	5.5	5.5	11.0	6.8	69.8
Arugula	1.4	2.9	1.4	1.4	4.5	8.7	79.7	1.4	8.2	12.3	2.7	11.0	8.6	55.8

The comparative analysis of legume consumption between children and their parents revealed similar patterns for certain legumes and differences for others (Table 2). Carrot emerged as one of the most frequently consumed legumes in both groups, with 25% of parents and 25% of children reporting consumption at least once per day. However, this pattern was not consistent across all legumes (Table 2).

Regarding fruit consumption (Table 3), certain fruits were consumed more frequently. Banana stood out as one of the most commonly consumed fruits, with 20.8% of children reporting consumption two or more times per day and 22.3% consuming it two to four times per week. A similarly high consumption pattern was observed among parents, with 19.4% reporting banana consumption two or more times per day and 38.9% consuming it two to four times per week, suggesting a strong influence of adult dietary behavior on children's intake. Mango also showed high consumption, with 19.4% of children consuming it two or more times per day and 25.0% of parents and/or guardians reporting consumption two to four times per week.

In contrast, fruits such as pineapple and guava showed lower consumption among children. In the case of guava, 31.1% of children and 25.0% of parents reported never or almost never consuming this fruit, indicating that although intake was also low among adults, it was slightly higher compared with children. It is noteworthy that the guava harvest season occurs mainly between March and May, which coincides with the data collection period of this study. This difference may suggest that the availability or acceptance of these fruits within the household does not directly translate into children's consumption, or that children may be more selective regarding certain flavors and textures (Table 3).

Table 3 - Fruit consumption (%) among preschool children and their parents/guardians. São Paulo, SP, Brazil, 2024.

	Children							Parents						
	≥2 times/ day (%)	1 time/ day (%)	2–4 times/ week (%)	1 time/ week (%)	1–3 times/ month (%)	<1 time/ month (%)	Never or almost never (%)	≥2 times/ day (%)	1 time/ day (%)	2–4 times/ week (%)	1 time/ week (%)	1–3 times/ month (%)	<1 time/ month (%)	Never or almost never (%)
Pineapple	1.4	2.8	15.3	12.5	18.1	27.6	22.3	1.4	2.8	15.3	12.5	18.1	27.6	22.3
Avocado	4.2	6.6	9.3	4.2	13.8	23.8	38.1	5.6	5.6	14.4	9.7	22.5	26.4	15.8
Banana	20.8	11.1	22.3	5.6	12.4	9.7	18.1	19.4	6.9	38.9	12.5	9.7	8.4	4.2
Guava	4.6	10.1	8.7	13.7	13.7	18.1	31.1	4.6	1.4	16.7	9.5	22.2	20.6	25.0
Kiwi	6.9	0.0	8.3	5.6	15.3	13.9	50.0	2.8	2.8	9.7	4.2	25.0	16.6	38.9
Orange	13,5	13.5	24.8	9,3	18.8	16.3	3.8	15,3	8.3	29.2	9.7	23.6	5.5	8.4
Tangerine	14.1	4.2	19.3	10.1	11.9	19.3	21.1	9.7	8.3	27.8	8.3	23.6	12.6	9.7
Papaya	8.9	6.8	16.9	7.9	10.9	10.9	37.7	8.9	6.8	16.9	7.9	10.9	10.9	37.7
Mango	19.4	4.2	12.6	16.3	16.3	16.3	14.9	8.5	2.8	25.0	16.9	27.8	12.1	6.9
Apple	13.5	9.7	25.0	14.9	12.3	17.9	6.7	8.5	5.6	18.3	11.3	28.2	7.0	21.1
Melon	8.3	4.2	12.5	11.1	13.9	19.4	30.6	9.9	8.5	23.9	7.0	19.7	12.7	18.3
Watermelon	13.9	5.6	25.0	16.7	12.4	11.1	15.3	8.9	4.2	26.8	18.3	23.9	8.0	9.9
Strawberry	11.1	4.2	22.2	8.3	15.3	20.8	18.1	7.0	5.6	19.7	9.9	32.5	15.5	9.8
Grape	19.4	4.2	27.8	15.3	6.9	13.9	12.5	9.9	5.6	29.5	15.5	28.2	8.5	2.8
Pear	11.1	1.4	15.7	16.7	9.7	17.7	27.7	8.5	5.6	18.3	11.3	28.2	7.0	21.1

Most popular fruits, such as orange and apple, showed relatively high consumption frequencies among both children and parents. For example, 24.8% and 25.0% of children consumed orange and apple, respectively, two to four times per week, indicating good acceptance of these fruits. A similar pattern was observed among adults, with 29.2% reporting orange consumption and 18.3% apple consumption at the same frequency (Table 3). The similarity in these figures suggests that these fruits may be more easily incorporated into family dietary routines and, therefore, consumed more regularly by all household members.

Conversely, kiwi emerged as one of the least consumed fruits among both children and parents. This finding may be related to the relatively higher cost of this fruit compared with others, as well as its harvest season, which at the time of data collection was just beginning, limiting its availability. Another possible contributing factor is a preference for more familiar and less acidic flavors, which are characteristic of kiwi.

The results of the correlations between children's and parents' consumption scores are presented in Table 4. Children's fruit consumption scores showed a positive and significant correlation with vegetable consumption ($r = 0.310$, $p < 0.01$) and legume consumption ($r = 0.472$, $p < 0.001$), suggesting an association among different types of foods consumed. In addition, children's fruit consumption was strongly correlated with parental fruit consumption ($r = 0.528$, $p < 0.001$), indicating a potential influence of family dietary habits.

Positive correlations were also observed between children's legume consumption and vegetable consumption ($r = 0.597$, $p < 0.001$), as well as with parental vegetable consumption ($r = 0.243$, $p < 0.05$) and legume consumption ($r = 0.322$, $p < 0.01$). The number of meals consumed at school showed a positive correlation with children's vegetable ($r = 0.311$, $p < 0.01$) and legume consumption ($r = 0.280$, $p < 0.05$), whereas the number of meals consumed at home was not significantly correlated with dietary consumption scores.

Table 4 - Correlations (r and rho) between fruit, vegetable, and legume consumption scores of children and their parents. São Paulo, SP, Brazil, 2024.

	Child fruit con-sumption score	Child vegetable con-sumption score	Child legume con-sumption score	Parental fruit con-sumption score	Parental vegeta-ble con-sumption score	Parental legu-me con-sump-tion score
Child fruit con-sumption score						
Child vegetable con-sump-tion score	0.310**					
Child legume con-sump-tion score	0.472***	0.597***				
Parental fruit con-sump-tion score	0.528***	0.010	0.126			
Parental vegetable con-sumption score	0.278*	0.132	0.243*	0.459***		
Parental legume con-sumption score	0.322**	0.072	0.192	0.644***	0.650***	
Number of meals consu-med at home by the child	−0.069	−0.094	−0.047	0.001	0.042	0.039
Number of meals consu-med at school by the child	0.144	0.311**	0.280*	0.143	0.123	0.165

Note: *p < 0.05; **p < 0.01; ***p < 0.001.

Multiple linear regression Model 1 revealed a significant association between children's fruit consumption score and parental/guardian consumption score, after adjustment for educational level, household income, and the number of meals consumed at home and at school. No significant associations were observed between children's vegetable and legume consumption scores and the investigated variables (Table 5).

Table 5 - Multiple linear regression models to determine fruit, legume, and vegetable consumption scores among preschool children. São Paulo, SP, Brazil, 2024.

Model 1			95% CI			
Dependent variable – Children's fruit consumption score	**B**	**Standard error**	**Lower**	**Upper**	**t**	**p**
Parents' fruit consumption score	0.705	0.075	0.554	0.856	9.385	<0.001
Parents' educational level						
Elementary School I	−0.012	0.158	−0.329	0.304	−0.079	0.937
Elementary School II	0.062	0.159	−0.257	0.382	0.391	0.698
High School	0.036	0.150	−0.265	0.337	0.240	0.811
Higher Education	−0.017	0.150	−0.319	0.284	−0.116	0.908
Income						
1 to 2 minimum wages	0.023	0.063	−0.104	0.149	0.364	0.717
3 to 5 minimum wages	0.048	0.069	−0.091	0.187	0.695	0.490
6 to 8 minimum wages	−0.049	0.094	−0.239	0.139	−0.531	0.598
9 to 10 minimum wages	0.134	0.157	−0.179	0.449	0.858	0.394
More than 10 minimum wages	0.321	0.163	−0.005	0.646	1.972	0.054
Number of meals at school	0.004	0.019	−0.033	0.042	0.237	0.814
Number of meals at home	−0.017	0.014	−0.045	0.012	−1.140	0.258
Model 2			95% CI			
Dependent variable – Children's vegetable consumption score	**B**	**Standard error**	**Lower**	**Upper**	**t**	**p**
Parental legume consumption score	1.400	0.074	-0.149	0.149	0.002	0.999
Parental education						
Elementary school I	7.460	0.107	-0.215	0.216	0.007	0.994
Elementary school II	0.027	0.108	-0.189	0.243	0.249	0.804
High school	0.048	0.101	-0.156	0.251	0.469	0.641
High school	0.054	0.102	-0.150	0.258	0.531	0.597

Model 3		95% CI					
Dependent variable – Children's fruit consumption score	**B**	**Standard error**	**Lower**	**Upper**		**t**	**p**
Income							
1 to 2 minimum wages	-0.022	0.043	-0.108	0.063		-0.526	0.601
3 to 5 minimum wages	-0.042	0.047	-0.136	0.051		-0.911	0.367
6 to 8 minimum wages	-0.085	0.063	-0.212	0.042		-1.344	0.184
9 to 10 minimum wages	0.021	0.108	-0.190	0.233		0.202	0.840
More than 10 minimum wages	0.039	0.012	-0.177	0.257		0.367	0.715
Number of meals at school	0.015	0.012	-0.011	0.041		1.181	0.243
Number of meals at ho	-0.010	0.009	-0.029	0.009		-1.048	0.299
Model 4		95% CI					
Dependent variable – Children's vegetable consumption score	**B**	**Standard error**	**Lower**	**Upper**		**t**	**p**
Parents' vegetable consumption score	0,004	0.012	-0.021	0.284		0.318	0.752
Parents' educational level							
Elementary School I	0,013	0.120	-0.227	0.254		0.108	0.914
Elementary School II	-0,004	0.121	-0.246	0.239		-0.029	0.977
High School	-0,003	0.113	-0.231	0v224		-0.030	0.977
Higher Education	-0,003	0.114	-0.231	0.225		-0.029	0.977
Income							
1 to 2 minimum wages	0,010	0.048	-0.086	0.106		0.212	0.833
3 to 5 minimum wages	-0,017	0.052	-0.121	0.087		-0.333	0.740
6 to 8 minimum wages	0,091	0.071	-0.051	0.234		1.284	0.204
9 to 10 minimum wages	-0,002	0.118	-0.239	0.234		-0.0186	0.985
More than 10 minimum wages	0,004	0.122	-0.202	0.289		0.353	0.726
Number of meals at school	0,027	0.014	-9.830	0.056		1.936	0.058
Number of meals at home	-0,014	0.011	-0.037	0.007		-1.358	

DISCUSSION

One of the most important findings of the present study refers to the association observed between children's fruit consumption scores and parental fruit consumption scores, regardless of household income and educational level. These results reinforce the influence of family dietary patterns on children's diets, highlighting the role of food education through modeling of family food choices and the formation of healthy eating habits[11].

Nutrition in early childhood is a critical factor in child development and contributes substantially to the health–disease process, as the maintenance of healthy eating habits supports children's physical, physiological, and cognitive growth, extending these benefits throughout the life course[12]. It is during this stage that the process of eating behavior formation begins, generating dietary habits characterized by a set of food-related practices and choices[13]. Promoting healthy eating in early childhood not only meets immediate nutritional needs but also plays a preventive role, contributing to long-term health outcomes[14].

Eating habits may be understood as neurological routines that enable the performance of a series of activities or learning tools. These habits are constructed during childhood and are mirrored in the behavior of individuals within the child's surrounding environment[13]. Therefore, family involvement is of paramount importance in encouraging healthy eating from early childhood[12].

Knowledge and exposure to different foods are essential for acquiring a varied diet. In general, children tend to choose foods that are frequently offered to them and show a preference for those that are readily available at home, as these are the foods to which they are most routinely exposed[15].

Another relevant finding of the present study was the low consumption of leafy vegetables by both children and their parents/guardians. This result may be related to multiple family and environmental factors, such as poorly consolidated eating habits for this food group, lower sensory acceptance by children (e.g., bitter taste and texture), as well as issues related to accessibility and cost. In urban areas, the availability of fresh leafy vegetables may be limited by restricted access to local markets and street fairs, greater reliance on food

outlets with limited offerings, and seasonal price fluctuations, disproportionately affecting lower-income families. Moreover, although the school environment represents a strategic setting for offering these foods, children's actual acceptance depends on preparation methods, repeated exposure, and alignment with encouragement in the family environment. Thus, the low consumption observed suggests that, beyond availability, integrated strategies between schools and families are needed to promote repeated exposure, attractive preparation, and the valuation of leafy vegetables in daily diets[16].

The family environment can be considered a key determinant in shaping children's eating habits and lifestyle. It is believed that the family context contributes to food preferences, rejections, and consumption patterns, as children learn not only through their own experiences but also by observing others. The family context is a space for sharing affection, care, and cultural patterns, and it is through intersubjectivity that psychological processes and individual characteristics are constructed[17].

Regarding fruit consumption, the most popular fruits, such as banana, orange, and apple, were consumed more frequently by both children and their parents. Banana consumption exemplifies this pattern, with 20.8% of children and 19.4% of parents reporting consumption two or more times per day. In contrast, fruits such as pineapple, guava, and kiwi showed lower consumption, particularly among children, which may reflect lower acceptance of these flavors or their reduced presence in family dietary routines.

Fruits are essential components of children's diets, as they provide relevant amounts of vitamins, minerals, fiber, and water[18]. The Brazilian National Survey on Child Nutrition (ENANI-2019)[19], conducted with 14,558 children under five years of age, indicated that approximately 27.4% of children aged 24 to 59 months did not consume fruits and vegetables on the day prior to the survey. Several studies have demonstrated that a high proportion of children in different regions worldwide fail to meet the recommended daily intake of fruits and vegetables[20,21,22]. In Brazil, low fruit consumption among children has been associated with dysfunctional family contexts, low social support, and moderate to severe food insecurity[23].

Although correlation analyses indicated a positive association between children's consumption of vegetables and legumes and the frequency of meals consumed at school, this relationship did not remain significant in the adjusted regression models. This finding suggests that the association observed in bivariate analyses may be partially explained by confounding factors, such as family consumption patterns, socioeconomic characteristics, or other variables included in the models. Additionally, vegetable and legume consumption tends to show greater variability and lower acceptance among children compared with fruit consumption, which may reduce statistical power to detect independent associations. Another plausible explanation is that, although school meals increase exposure to these foods, actual consumption and acceptance are strongly influenced by family environments and household feeding practices, thereby attenuating the effect of school meals in adjusted models.

Schools can be considered facilitators of food and nutrition education, promoting greater familiarity with fruits and vegetables from early childhood. Therefore, food and nutrition education programs implemented in school settings may play a crucial role[24].

In Brazil, school feeding in public schools is regulated by the National School Feeding Program (Programa Nacional de Alimentação Escolar – PNAE), which plays a central role in shaping healthy eating habits by promoting food and nutrition education and ensuring the regular provision of adequate foods within the school environment. Among its guidelines, the mandatory regular offering of fresh and minimally processed foods stands out, with an emphasis on fruits, vegetables, and legumes in school menus. In schools operating on a part-time basis, a minimum of 280 g per student per week is established, with fruits offered on at least two days and vegetables and legumes on at least three days per week. In full-time schools, the minimum increases to 520 g per student per week, with fruits offered on at least four days and vegetables and legumes on five days per week, reinforcing frequent exposure to these foods in the school environment. It is important to note, however, that this study did not include a qualitative or quantitative analysis of school menus, as this was not the focus of the investigation, which concentrated on children's consumption of fruits and vegetables and the factors associated with this intake[25].

Beyond family dietary habits and exposure to foods at school, other factors such as palatability, children's individual preferences, and the eating environment also influence fruit and vegetable consumption. Therefore, frequent exposure to these foods in school settings may positively impact children's acceptance[25,26].

In early childhood education, food-related experiences can be positive, encouraging balanced and healthy diets. In this context, schools represent an ideal setting for routine health promotion. Educa-

tors play a significant role in children's food acceptance, as eating habits and styles are constructed during childhood and extend into the daily practices of those around them. Children often choose foods that are served frequently, making the integration between school and family essential[15]. This finding is reflected in the present study through the observed relationship between children's consumption of fruits and vegetables, parental consumption, and the frequency of meals at school. This represents a shared process, as family meals constitute a practice that strengthens interpersonal bonds and supports food and nutrition education[27].

A systematic review and meta-analysis including 30 studies and 4,017 children aged 2 to 5 years demonstrated that repeated exposure to vegetables significantly increased acceptance and consumption, reinforcing repeated offering as an effective strategy to improve vegetable intake[28].

A study conducted by Caldwell *et al.* (2018)[29] found that family meal frequency was associated with fruit and vegetable consumption. Preschool-aged children who shared fewer than three family dinners per week were more likely to have low fruit and vegetable intake compared with those who shared family dinners every night.

Given that both the variety and quantity of fresh food consumption, such as fruits and vegetables, are associated with the prevalence of noncommunicable chronic diseases[30], future studies are suggested to evaluate the relationship between intake of these foods and health outcomes among preschool children.

Limitations of the present study include the relatively small sample size, the cross-sectional design, and the use of a retrospective questionnaire to assess dietary intake, which may introduce recall bias, as well as the lack of direct analysis of school menus. Nevertheless, the findings contribute to understanding which fruits and vegetables are more or less accepted by children and may support strategies to stimulate consumption in both family and school settings. This study is also innovative in simultaneously assessing dietary intake in the child–parent dyad. Furthermore, the results may inform future public policies on child nutrition by prioritizing actions that consider the determinants of food preferences within socioeconomic and cultural contexts.

CONCLUSION

In conclusion, the consumption of fruits and vegetables among preschool children is influenced by parental consumption patterns and by meals consumed at school. The importance of the family environment as a determinant of eating habits was confirmed, while also highlighting the need for educational interventions to promote greater dietary diversity among children. The school environment plays a strategic role in this process by complementing family efforts through the foods offered at school. Therefore, this study reinforces that integrated strategies involving families and schools are essential to promote healthy eating habits and to ensure adequate growth and development during early childhood.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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