

ORIGINAL ARTICLE

Relationship between food consumption, nutritional status and school performance



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Abstract

Introduction: Adequate feeding during childhood and adolescence is extremely important, due to its act directly on physical and cognitive development.

Objective: To verify the relationship between dietary intake and nutritional status with school performance.

Methods: It is an observational, quantitative and cross-sectional study of 134 students aged 9 to 11 years. The nutritional status was measured using the Body Mass Index by age and gender, and food consumption was assessed through the 3-day Dietary Recall. For the knowledge of the school performance, the report cards of 2016 were consulted. A questionnaire was used to collect data regarding the marital status.

Results: Regarding nutritional status, 59,7% of the students presented eutrophy, 18,7% overweight, 15,6% obesity and 6,0% underweight. The consumption of calcium ($p < 0,001$) and iron ($p < 0,001$) were significantly below the values recommended by the Dietary Reference Intakes. Obese children consumed significantly more lipids ($p = 0,026$) and calories ($p = 0,003$) than the other students. The participation of ultra processed foods represented 35.50% of the total energy value, with a positive correlation between their consumption and the amount of calories consumed ($p = 0,022$) and inverse correlation with zinc intake ($p = 0,007$).

Conclusion: There was no significant association between dietary intake and nutritional status with school performance, but it was found that the marital status of the parents was associated with student performance, the children of married parents had a higher educational achievement than the children of separated parents.

Keywords: food consumption, nutritional status, nutritional deficiencies.

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■ INTRODUCTION

Child feeding has lately arisen great interest among researchers. Since this stage of life is a period of growth and formation of alimentary habits. Adequate nutrition during this period of life guarantees physical growth and mental development, while serves as a preventive factor for some diseases¹.

The context in which a child is inserted influences eating habits, mainly through the availability of food at home, as well as stipulated rules for eating practices. In addition, parents tend to have their feeding behavior shown in their children, and a child who is exposed to inadequate food can follow it during adult life^{2,3}.

From the age of 10 the transition to adolescence begins, this period is characterized by intense changes of growth and development in a short period of time, nutritional status during this phase is extremely important, especially because it is a time with increased nutritional needs⁴.

Brazil is facing a defining moment of nutritional transition, in which the overweight and obesity prevalence exceeds malnutrition⁵, and food consumption is based on a great intake of foods high in fat and sugar and poor in nutrients^{6,7}. Changes in the nutritional profile reveal a low quality of children and adolescents feeding, often exceeding the recommended energy sport, but with nutritional deficiencies in terms of micronutrients. Among the inadequacies of food consumption, iron and zinc deficiency are more prominent². Eating habits are directly related to nutritional status and to the linear growth of children and adolescents in school age⁸.

Nutritional status and nutrient intake have significant effects on school performance and are related to cerebral function and memory capacity⁹. Malnutrition has serious long-term consequences¹⁰ and it may have negative impact on the cognitive development of schoolchildren^{11,12}, who demonstrate a lower level of learning and development when compared to other students with adequate nutrient intake¹³.

Likewise, overweight, in addition to being a risk factor for health, is related to growth disorders, leading to difficulties in motor performance, low school performance and attention deficit¹⁴. One of the factors that contributes to overweight is the early introduction of ultraprocessed foods in the diet, which negatively affect health, since these foods are rich in fat, sugar, sodium and they have high energy density¹⁵. The imbalance of nutritional intake is one of the possible mechanisms for an association between overweight and school performance, since both excess and nutrient deficiency can cause changes in cerebral functions. The deficits of some specific nutrients, such as iron, can cause difficult concentration on studies¹⁶, and the psychosocial factors involved, such as low self-esteem, leading to absenteeism and consequent worsening in school performance¹⁷.

In addition, parents' participation in children's school life may be an important factor that helps to boost the students' performance¹⁸, because when there are stimulus and motivation in family environment, there is also a better chance for the students to be more involved in classroom activities¹⁹.

Thus, the present study aimed to analyze the relationship between dietary intake and nutritional status with school performance in a sample of public schools in a city of Rio Grande do Sul, Brazil.

■ METHODS

This is an observational, quantitative and cross-sectional study carried out with schoolchildren enrolled in the 4th year of elementary school from ten public schools in one city in Rio Grande do Sul, Brazil. The sample was for convenience, composed of schoolchildren of both sexes, aged between 9 and 11 years old.

Data were collected from September to December 2016. Participants in the study were those who signed the Term of Assent and whose parents or guardians signed the Informed Consent Term (TCLE). Students who refused to complete some stage of the survey and those whose parents did not fill or partially completed the instruments used for data collection were excluded from the study. In a universe of 176 students, 134 participated in the study. The project was approved by the Ethics in Research Committee (COEP) of the University of Vale do Taquari - Univates, according to Resolution CNS 466/2012, under number 1,708,395.

For weight measurement, a Plenna® brand digital scale was used, with an accuracy of 100 grams and a maximum capacity of 150 kg. The student was placed in an orthostatic position (upright posture, feet together and with upper limbs extended along the body), barefoot and with the least possible clothing, being positioned in the center of the equipment. The height was measured using a Sanny Profissional® brand portable stadiometer with a precision of 0.1cm and a maximum extension of two meters, fixed to the wall. The student was barefoot, leaning against the stadiometer, with his head held high and unprotected, staring at a fixed point at eye level²⁰.

Age was obtained from the date of birth informed by the school board. To evaluate the nutritional status, the anthropometric index Body Mass Index (BMI) by age and sex was used. Their values were expressed in z-score, as recommended by the World Health Organization²¹. The diagnosis of nutritional status was performed using WHO AnthroPlus® software, version 1.0.4²².

For the analysis of the food consumption of schoolchildren, the Food Recall was used, carried out in 3 non-consecutive days, one of the evaluations referring to the weekend and the other two being performed on weekdays. Reminders were applied by the researcher during a previously scheduled interview and food images were used so that each student could indicate with greater precision the amount consumed, reducing the chances of errors in the portions reports²³.

The obtained data were calculated using the software Dietwin®, version 2969, year 2008. Through this, the average of daily consumption of energy, carbohydrate, lipid, protein, calcium, iron and zinc was verified for further comparison with the Dietary Reference Intakes (DRIs) recommended values²⁴. Through the information of the searched students, it was possible to

calculate the average consumption of ultraprocessed foodstuffs in percentage of calories in comparison to the total energetic value. The definition of ultraprocessed foods was performed according to the Food Guide for Brazilian Population²⁵.

Verification of school performance was done based on 2016 report cards. According to the school standard, students were evaluated through concepts according to

the school performance level in the areas of languages, mathematics, humanities and natural sciences, and the possible results in each area are exemplified in Chart 1. In order to make it possible to analyze the average school performance in the school year, the concepts were replaced by grades, considering the highest value equivalent to each concept (Chart 1).

Concept	Lowest equivalent grade	Highest equivalent grade
Insufficient	0.00	5.00
Regular	5.10	6.00
Good	6.10	7.50
Very good	7.51	9.00
Excellent	9.10	10.00

Chart 1: School concepts and their equivalent grades

Source: authors, 2017

In this way, it became possible to calculate the quarterly arithmetic average per student, including the sum of the four evaluated areas. After obtaining the three quarterly averages, the same procedure was performed in order to calculate the final average school performance in the year. For statistical analysis purposes, annual school performance averages were categorized again into concepts.

Data on the parents' marital status have been obtained through a structured questionnaire, filled out by the parents of the students, which was categorized into five variables (single, married, separated / divorced, widowed or other).

The data has been analyzed in the Statistical Package for the Social Sciences (SPSS), version 22.0. The level of significance was set at 5% ($p < 0.05$). Exact Fischer and t-student tests were used, correlation analyzes were also performed, and non-parametric Kruskal-Wallis and Mann-Whitney statistical tests were applied.

RESULTS

The students' age average was 10.2 ± 0.5 years, in which 50% ($n = 67$) were female. Regarding nutritional status, 59.7% ($n = 80$) of the sample presented a diagnosis of eutrophy, 18.7% ($n = 25$) of overweight, 15.6% ($n = 21$) of obesity and 6, 0% ($n = 8$) were underweight. There was no significant difference in age between boys and girls ($p = 0.291$), nor significant association between sexes and nutritional status ($p = 0.408$).

It was observed that students had an average calories consumption of 1430.9 ± 340.8 per day and the daily calcium and iron intake was significantly lower than the recommended intake ($p = 0.000$). For the other nutrients, there was no significant difference to the recommendation (Table 1).

Table 1: Comparison of food consumption and reference values of DRIs (2011)

Food consumption	Reference values	Average	Standart Deviation	p
Carbohydrate (%)	45% a 65	51.28%	7.34%	NS
Protein (%)	10% a 30	16.73%	3.87%	NS
Lipids (%)	25% a 35	31.97%	6.03%	NS
Calcium (mg)	1300	384.10	232.76	$p \leq 0.001$
Zinc (mg)	8	7.68	3.90	0.348
Iron (mg)	8	6.92	2.54	$p \leq 0.001$

Legend: Student's t-test. NS - not significant.

It was observed that obese schoolchildren consume significantly more lipids ($p = 0.026$) and calories ($p = 0.003$) in comparison to the other students. The other nutrients did not present significant differences when compared to the nutritional status classification (Table 2).

Ultraprocessed food represents $35.50 \pm 13.76\%$ of the total calories ingested. There was a positive correlation between the consumption of this food and the amount of calories ($p = 0.022$) and the inverse correlation with zinc consumption ($p = 0.007$) (Table 3).

School performance with a regular concept was

verified in 5.2% ($n = 7$) of the studied population, good in 33.6% ($n = 45$), very good in 41.8% ($n = 56$), excellent in 19, 4% ($n = 26$) and none of the students had insufficient school performance. There was no significant difference between food intake and school performance classifications (Table 4).

It was verified that there was no significant association between school performance and nutritional status ($p = 0.532$). Regarding the parents marital status, it was observed that good academic performance was significantly associated with the separated parents, and the excellent school performance was related to married parents ($p = 0.038$) (Table 5).

Table 2: Association between food consumption variables and nutritional status classifications

Food consumption	Nutritional Status	N	Average	Standart Devation	p
Carbohydrate (%)	Underweight	8	52.7	5.8	0.056
	Eutrophia	80	52.5	7.3	
	Overweight	25	50.4	6.9	
	Obesity	21	47.2	7.4	
Protein (%)	Underweight	8	16.0	2.2	0.968
	Eutrophia	80	16.7	4.0	
	Overweight	25	16.6	3.6	
	Obesity	21	17.2	4.2	
Lipid (%)	Underweight	8	31.4	6.1	0.026
	Eutrophia	80	30.7	5.4	
	Overweight	25	33.0	6.5	
	Obesity	21	35.6	6.5	
Calcium (mg)	Underweight	8	377.1	357.4	0,326
	Eutrophia	80	370.4	226.0	
	Overweight	25	373.3	229.3	
	Obesity	21	451.7	211.9	
Iron (mg)	Underweight	8	7.2	3.8	0.135
	Eutrophia	80	6.6	2.5	
	Overweight	25	6.8	2.0	
	Obesity	21	8.0	2.3	
Zinc (mg)	Underweight	8	7.2	3.9	0.446
	Eutrophia	80	7.6	4.2	
	Overweight	25	7.2	3.0	
	Obesity	21	8.7	3.7	
Ultraprocessed (%)	Underweight	8	35.52	15.85	0.879
	Eutrophia	80	35.91	13.44	
	Overweight	25	33.75	12.97	
	Obesity	21	36.01	15.84	
Total calories	Underweight	8	1296.7	429.1	0.003
	Eutrophia	80	1378.0	302.8	
	Overweight	25	1436.9	371.7	
	Obesity	21	1676.6	313.4	

Non-parametric Kruskal-Wallis test.

Table 3: Correlation of the variables calcium, iron, zinc and calories with ultraprocessed food

Food Consumption	Ultraprocessed food	p
	R	
Calcium (mg)	-0.042	0.627
Iron (mg)	-0.124	0.154
Zinc (mg)	-0.233	0.007
Calories	0.197	0.022

Correlation analysis

Table 4: Association between food consumption variables and school performance classifications

Food consumption	Concept	N	Average	Standart Deviation	p
Carbohydrate (%)	Regular	7	47.2	8.9	0.330
	Good	45	52.2	8.6	
	Very Good	56	51.3	6.0	
	Excellent	26	50.7	7.0	
Protein (%)	Regular	7	15.3	3.9	0.253
	Good	45	16.0	3.3	
	Very Good	56	17.4	4.2	
	Excellent	26	16.9	4.0	
Lipids (%)	Regular	7	37.5	6.9	0.109
	Good	45	31.8	7.1	
	Very Good	56	31.2	5.0	
	Excellent	26	32.4	5.2	
Calcium (mg)	Regular	7	409.7	218.2	0.919
	Good	45	387.5	235.3	
	Very Good	56	366.2	220.2	
	Excellent	26	409.9	266.6	
Iron (mg)	Regular	7	6.6	1.8	0.914
	Good	45	7.1	2.8	
	Very Good	56	6.7	2.2	
	Excellent	26	7.2	3.0	
Zinc (mg)	Regular	7	5.6	4.0	0.230
	Good	45	7.8	3.9	
	Very Good	56	8.0	3.9	
	Excellent	26	7.3	3.9	
Ultraprocessed (%)	Regular	7	36.31	16.07	0.406
	Good	45	38.39	14.66	
	Very Good	56	33.09	13.11	
	Excellent	26	35.48	12.66	
Calories	Regular	7	1597.4	394.1	0.052
	Good	45	1459.9	383.6	
	Very Good	56	1354.9	306.8	
	Excellent	26	1499.7	295.8	

Non-parametric Kruskal-Wallis test.

Table 5: Association between food consumption variables and school performance classifications

		School Performance								p
		Regular		Good		Very good		Excelent		
		n	%	n	%	N	%	n	%	
Nutricional Status	Underweight	-	-	3	37.5	2	25.0	3	37.5	0.532
	Eutrophia	3	3.8	28	35.0	32	40.0	17	21.3	
	Overweight	1	4.0	7	28.0	14	56.0	3	12.0	
	Obesity	3	14.3	7	33.3	8	38.1	3	14.3	
Parents Marital Status	Single	-	-	5	27.8	11	61.1	2	11.1	0.038
	Married	7	7.4	27	28.7	37	39.4	23	24.5	
	Separated	-	-	13	65.0	6	30.0	1	5.0	
	Widow	-	-	-	-	2	100.0	-	-	

Fischer's exact test

DISCUSSION

The nutritional profile of the studied population presented higher indexes of overweight and obesity than malnutrition. The National School Health Survey (PENSE)²⁶, carried out among students aged 13 to 17 years old who were regularly attending public and private schools throughout the National Territory, observed a low weight in 3.1% of schoolchildren, while overweight was found in 23.7% of cases and obesity in 7.8%. The values found in PENSE²⁶ showed little variation between the female and the male sex, corroborating the data from this study, where no significant difference in nutritional status between boys and girls was found.

Souza *et al.*²⁷, who evaluated children and adolescents between 4 and 19 years old in schools in a city in the state of Rio Grande do Sul, found similar numbers, being 1.9% underweight, 18.9% overweight and 11.4% of obesity, the highest proportion of overweight was found among girls and the highest proportion of obesity among boys. Similar results were also observed in adolescents between 10 and 15 years old in the state of Paraná, where the observed percentage of overweight was 17.53%, obesity 13.64%, and low weight only among females in 3.06% of cases²⁸.

The nutritional transition of the Brazilian population was verified in the Family Budgets Survey (POF), which observed the increase in the prevalence of obesity and reduction of low weight in the population between 10 and 19 years old, in which it was observed, in 2002-2003²⁹, 15.1% of boys with overweight and 3.0% with obesity, among the girls the result was 16.7% of overweight and 4.11% of obesity. In 2008-2009³⁰ there was an increase in both overweight and obesity, with 19.4% of overweight and 4.0% of obesity among boys, while among girls it was observed 21.7% of overweight and 5.9% of obesity. In conjunction with the increase in the prevalence of overweight, there was a reduction in cases of malnutrition. In 2002-2003²⁹, boys presented 4.3% and girls 5.3% of weight deficiency. In 2008-2009³⁰, these values decreased to 3.0% among boys and 3.7% among girls. The reduction of low weight cases and greater number of people with overweight and obesity, which characterizes the nutritional transition of the population, was also verified in the present study.

The increased prevalence of overweight and obesity is a reflection of excessive energy consumption, in conjunction with significant nutritional deficiencies in terms of micronutrients². Nutritional deficiencies were observed in this study, since calcium intake was far below the limits recommended by DRIs²⁴, as well as a study carried out in São Paulo by Assumpção *et al.*³¹, which verified calcium deficiency, with a consumption average of 618.2 mg per day in a sample of 10-19 year-old teenagers. In the study of Ribas *et al.*³² carried out in Paraná among 8-12 year-old schoolchildren, the observed average intake of calcium was 552.19mg among boys and 475.54mg among girls. When evaluating the food intake of Brazilian adolescents between 12 and 13 years old, Souza *et al.*³³ verified that calcium is one of the micronutrients that presents a higher inadequate prevalence, reaching more than 95% of deficiency among

12-17 year-old teenagers of public schools throughout the National Territory. Over 90% of 7-9 year old children who participated in the Albuquerque survey *et al.*³⁴ in Ceará showed insufficient consumption of milk and dairy products, which are important sources of calcium in the diet.

Calcium is an essential nutrient for the body, which acts on maintaining bone mass, as well as preventing fractures and osteoporosis throughout life³¹, and may also be related to school performance³⁵. Adolescence is considered a critical period, since in this period of life there is the peak bone mass, where more than half of the skeleton is established. The deficiency of this nutrient in the studied age group becomes very worrying, since it is a phase of transition between childhood and adolescence, and the insufficient consumption of calcium at this moment can cause irreversible consequences for adult life³⁶. The inadequate consumption of iron in the sample of the studied population was also verified, a similar result to the study carried out in Maranhão by Pereira *et al.*³⁷, where they have found that 23.1% of the sample of adolescents between 10 and 19 years old consumed iron under the recommended amount and Souza *et al.*³³, who evaluated adolescents between 12 and 17 years of age in the National Territory and found inappropriate values of iron in 0.6% of boys and 2.5% of girls.

The reduction of body's iron storage may be related to stature disabilities, malnutrition or obesity in varying degrees³⁸, impairment of the immune system, difficulty in concentration and reduction of physical capacity^{39,40}. After long periods of iron negative assessment, deficiency may lead to iron deficiency anemia, but even before anemia manifests itself, mild iron deficiency in the body can cause adverse effects on development^{38,39}. Iron content in feed may be related to the increase in consumption of ultraprocessed foods, as verified by Louzada *et al.*⁴¹, who observed that the participation of these foods in the diet was inversely and significantly associated with the consumption of iron, evidencing the disadvantage of ultraprocessed food, which may contribute to the development of nutritional deficiencies.

The dietary intake of zinc and macronutrients (carbohydrates, proteins and lipids) was in accordance with the values recommended by DRIs²⁴. In the study by Souza *et al.*³³, with Brazilian adolescents between 12 and 17 years old, the percentage of macronutrients and zinc was also in agreement with the reference values, differing from the result found by Vaz-Tostes *et al.*⁴², who performed a research in Espírito Santo, in which the adequacy of macronutrient consumption was observed, however, the dietary intake of zinc was inadequate among 2-6 year-old children, reaching 4.33 mg of daily intake.

This mineral plays a very important role in children's and teenagers' health, acting directly on physical growth, sexual development, immune system and cognitive ability. Zinc deficiency present in early adolescence may slow the growth and affect learning ability. Therefore, it is necessary to evaluate the food consumption in these stages of life, to avoid losses due to its deficiency. It is important to be aware of this age group because, due to the growth rates, zinc needs may be higher in this period^{43,44}.

It was found that obese schoolchildren consumed significantly more lipids and total calories than the others. A study carried out in Ceará, among 7-9 year-old students, has found different results, since there were no significant differences in the food consumption of students with obesity. However, the sample evaluated showed inadequate consumption of some food groups (fruits, vegetables and milk and dairy products), besides the high frequency of physical inactivity and sedentary habits in this population, which may be related to the frequency of obesity found at that study³⁴.

In this study, the impact of physical activity on nutritional status was not considered, but regular exercise practice may be effective in improving childhood obesity indicators⁴⁵, and when combined with healthy diet, may help to reduce psychological problems caused by discrimination for being overweight, which can cause depression and even social isolation⁴⁶.

Studies conducted by Meneses *et al.*⁴⁷, in the state of Tocantins, among children aged 5 to 10 years old, and Steil and Poll⁴⁸, in the city of Candelária, RS, with students between 9 and 11 years old, did not observe differences of food consumption among nutritional status classifications. The divergent results can be explained by the fact that obesity is a multifactorial disease⁴⁹, which transcends the results of caloric intake, and may be related not only to food consumption but also to breastfeeding early termination, with inadequate introduction of complementary feeding², family environment, genetic, socioeconomic factors and regular practice of physical activity⁵⁰.

In the sample of the studied population, more than a third of the energy value came from ultraprocessed food. It was observed the negative impact of this kind of intake on the nutritional quality of food, since the higher the consumption, the higher the caloric density found, evidencing its contribution to the number of overweight and obese children. This condition may cause serious health problems in children and adolescents, such as diabetes and cardiovascular diseases⁵¹.

There was also a correlation between the higher consumption of ultraprocessed food and the lower consumption of zinc. Similar data has been found by Louzada *et al.*⁵², who evaluated the food consumption of 30 thousand Brazilians over 10 years old, and observed that the consumption of ultraprocessed food represented 30% of the total energy value, also confirming the association between its consumption and the prevalence of overweight and obesity in this population.

In Pelotas, RS, it was observed that children under 2 years old had 19.7% of consumption of ultraprocessed food in the diet, and children over 2 years old consumed 36.1%, demonstrating the early introduction of this food in the children's diet and increasing its intake with aging progress¹⁵. When evaluating the food consumption of Brazilians over 10 years old, Louzada *et al.*⁴¹ observed that the intake of ultraprocessed food represented 21.5% of the total calories, while at the same time they also observed a relationship between the higher consumption of ultraprocessed food and lower zinc content in the diet.

Another study, conducted in Canada, has found higher values for consumption of ultraprocessed food,

reaching 47.7% of the total energy value in general population. An inverse relationship was also observed between the consumption of this kind of food and the intake of zinc, reinforcing the findings in the present study⁵³.

In United States, the consumption of ultraprocessed food is also high, reaching 57.9% of the energy value⁵⁴. Through these studies, it can be observed lower consumption of ultraprocessed food in Brazil, when compared to other countries. One possible explanation for this fact is that in Brazil some types of ultraprocessed food have a high cost when compared to other groups, which suggests an economic advantage of replacing ultraprocessed food with homemade meals⁵⁵.

There was no statistically significant association between dietary intake and nutritional status with school performance in the sample of the studied population. These results were also found in Rio de Janeiro, in a study carried out among students from 6th to 9th grade, in which there was also no association between diet and nutritional status with school grades⁹. Santana *et al.*⁵⁶, in a systematic review, also did not observe sufficient evidence to support the direct link between food consumption and poor school performance of schoolchildren.

Different results were found in the study by Correa-Burrows *et al.*⁵⁷, conducted in Chile, which evaluated the relationship between dietary intake and school performance in 16-year-old teenagers and showed that food with a high energy density were associated with a reduction in schoolchildren performance. In another study, carried out in the same place, with a 3 year-old population, it was also observed an association between feeding and school performance, where students who ate less healthy snacks were more likely to fail at school⁵⁸. In Korea, Kim *et al.*³⁵ evaluated 12-18 years-old adolescents and found that school achievement worsened in those who consumed ultraprocessed food more than 7 times a week.

In India, Rashmi *et al.*¹⁰ carried out a study with a population between 5 and 14 years-old and observed that malnutrition was a factor related to lower school performance. While Rossini *et al.*⁵⁹, in RS, verified the correlation between students' grades and nutritional status in schoolchildren aged 7 to 10 years old, observing that students with low weight presented higher marks than the others.

In some studies, it was observed that overweight and obesity were directly related to school performance. Phrashiah *et al.*⁶⁰ evaluated the relation between nutritional status and school performance in Kenya, and found out that the nutritional status classification in 11-15 years old adolescents influenced school performance, mainly through low involvement of overweight student in the activities proposed in the classroom.

In the United States, Carey *et al.*⁶¹ found out that gain weight among children and adolescents aged 10 to 17 was associated with lower school performance, mainly promoting absenteeism, school year repetition and less involvement in school activities. The gain weight associated with lower school performance was also verified in a study conducted in the state of Minas Gerais, among 9-11 year-old students, enrolled on the 4th year of

elementary public school¹⁶, and also in Portugal, in a study involving adolescents aged 12 to 18 years old⁶².

Identifying determinants of school performance is a complex task, since this process is influenced by several variables and is constantly changing, and may involve genetic, socioeconomic, environmental and behavioral factors^{60,63}. The family structure is also a strong determinant factor of learning and school performance⁶⁴, as verified in the results of the present study, where the children of married parents obtained higher educational achievement than the children of separated parents. Costa *et al.*⁶⁵, observed that the encouragement of parents in school routines improved students performance. Parents' participation in the children's school life is essential for the child's development. This importance stems from the interaction in the family environment and the quality of support in school tasks, by encouraging reading, stimulating oral and written expression, relevant aspects for cognitive development¹⁸. In the present study, the majority of the parents presented married marital status, an aspect that may have contributed to the fact that the studied population showed, for the most part, satisfactory school concepts.

It is also important to emphasize that there were no school concepts classified as insufficient, this fact may have contributed to the results found to be, in part, different from those verified in the literature. According to State Law No. 14,705, of June 25, 2015⁶⁶, every schoolchild with learning difficulties has the right to individual support, in a way that allows the student to improve their school performance. This student's support may also have helped to ensure that insufficient concepts were

not verified. The study presented limitations, especially regarding the cross-sectional delineation of the research and the sample of students being from a small number of schools in a city in the state of RS. R24h, used to evaluate food consumption, may have had memory bias on the part of schoolchildren, and the results found reflected food consumption during the period in which it was performed, not observing dietary conditions throughout the school year.

Most of the evaluated schoolchildren presented a diagnosis of eutrophy, however, considerable percentages of overweight and obesity were verified. There was no statistically significant association between dietary intake and nutritional status with school performance. However, the marital status of the parents was associated with the performance of the students and inadequacies were observed in the dietary intake of calcium and iron in the studied age group, as well as the considerable participation of the ultraprocessed food in the diet.

The results of this research further emphasize the importance of adequate food since childhood, since it is one of the factors that act directly in the physical and cognitive development. In addition, it can be observed that family structure is one of the main conditions that contributes to school success. Studies such as this are extremely important in the field of public health, since they show the presence of overweight and obesity in childhood and adolescence, confirming the trend of change in the nutritional profile of the Brazilian population. Considering this scenario, the challenge is to develop efficient education and nutritional monitoring actions in order to control the nutritional transition observed in the population.

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Resumo

Introdução: A alimentação adequada durante a infância e a adolescência é extremamente importante, pois atua diretamente no desenvolvimento físico e cognitivo.

Objetivo: Verificar a relação entre o consumo alimentar e o estado nutricional com o rendimento escolar.

Método: Trata-se de um estudo observacional, quantitativo e transversal, realizado com 134 escolares com idades entre 9 e 11 anos. O estado nutricional foi mensurado por meio do Índice de Massa Corporal por idade e gênero e a avaliação do consumo alimentar foi realizada através do Recordatório Alimentar de 3 dias. Para o conhecimento do rendimento escolar foram consultados os boletins do ano letivo de 2016. Utilizou-se um questionário para coletar dados referentes ao estado civil. Quanto ao estado nutricional, 59,7% dos escolares apresentaram eutrofia, 18,7% sobrepeso, 15,6% obesidade e 6,0% baixo peso.

Resultado: O consumo de cálcio ($p=0,000$) e ferro ($p=0,000$) foram significativamente abaixo dos valores recomendados pela Dietary Reference Intakes. Os escolares com obesidade consumiram significativamente mais lipídios ($p=0,026$) e calorias ($p=0,003$) que os demais estudantes. A participação dos alimentos ultraprocessados representou 35,50% do valor energético total, observando-se correlação positiva entre o seu consumo e a quantidade de calorias da alimentação ($p=0,022$) e correlação inversa com a ingestão de zinco ($p=0,007$).

Conclusão: Não foi encontrada associação significativa entre o consumo alimentar e estado nutricional com o rendimento escolar, porém verificou-se que o estado civil dos pais apresentou associação com o desempenho dos estudantes, os filhos de pais casados tiveram um rendimento escolar superior aos filhos de pais separados.

Palavras-chave: consumo de alimentos, estado nutricional, eficiências nutricionais.

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