

## DIETARY PATTERNS AND PHYSICAL ACTIVITY LEVEL IN SCHOOL ADOLESCENTS

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### ABSTRACT

This is a cross-sectional and analytical study that identified nutritional status, dietary patterns and physical activity level in 276 adolescents aged 14 to 17 years old. Nutritional status was assessed by Body Mass Index and Waist Circumference measurement. To assess consumption and eating habits, a questionnaire adapted from the 2009 National School-Based Student Health Survey was applied. Physical activity level was classified in accordance with the International Physical Activity Questionnaire. Eutrophic individuals accounted for 89% of this population, and 27.2% was at risk for cardiovascular diseases. Four dietary patterns were identified: healthy; ultra-processed; cafeteria; school environment. The healthy pattern comprehended 62.5% of healthy adolescents with excessive body mass and 56.2% of adolescents with cardiovascular risk. Most of them presented a physical activity level that poses lower risk for cardiovascular diseases, regardless of dietary patterns. However, data provided in the construction of dietary patterns and inactivity reinforce the perception that this population may be susceptible to cardiovascular disease in adulthood, if current practices are maintained.

**Keywords:** : Nutritional status. Food consumption. Eating behavior. Adolescent.

### INTRODUCTION

Adolescence is a critical phase of major physical and psychological changes that occur over a short period. It is also a transitory and decisive stage in the consolidation of eating habits and lifestyles that will have future consequences<sup>(1)</sup>. Important physical and psychic changes, caused by biological transformations, induce the consumption of highly caloric foods, which produce a sensation of pleasure and psychological compensation. It is also a time of low labor productivity and extensive periods of introspection and withdrawal in individual spaces, where most activities demand low energy consumption<sup>(2)</sup>.

Changes in the lifestyle of adolescents may cause different types of nutritional disorders, posing greater risk for the development of chronic diseases, including obesity, regardless of genetic influences<sup>(1)</sup>.

Transformations occurred in dietary patterns in recent decades, such as increased consumption of simple sugars, processed foods

and insufficient intake of fruits and vegetables, contribute directly to body weight gain. Progressive reduction of physical activity, coupled with longer time spent on low-intensity leisure activities, also plays an important role in adolescents gaining weight<sup>(3)</sup>.

Physical inactivity and unhealthy dietary patterns make up a set of modifiable risk factors, which influence the onset of noncommunicable diseases<sup>(4)</sup> and can be influenced by the school environment. In this context, the National School Feeding Program [*Programa Nacional de Alimentação Escolar*] (PNAE) introduced the mandatory work of nutritionists in the school experience, seeing to make such professionals work both in research and in promoting the students' health.

Recent advances in nutritional epidemiology have promoted transcendence in research. Instead of focusing on a single behavior (diet or physical activity) and its linear relationship with the risks of developing noncommunicable diseases, a new approach focuses on the lifestyle pattern, in a more comprehensive and dynamic

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way<sup>(5)</sup>. The objectives of this study were to identify nutritional status and cardiovascular risk, dietary patterns, inactivity and physical activity level, and the coexistence of these factors in school adolescents from an education institution in the Northwest of Rio Grande do Sul, to be used in future health interventions.

## METHODOLOGY

This is a cross-sectional, observational and analytical study with 276 male and female school adolescents, aged 14 to 17 years and 11 months old, who eat at least one meal a day at school. It was conducted in the facilities of Farroupilha Federal Institute, Campus Santo Augusto, in the municipality of Santo Augusto/RS, in November 2015.

The following variables were investigated: gender; age; nutritional status resulting from the Body Mass Index (BMI) assessment; cardiovascular risk, according to the Waist Circumference (WC) assessment; food consumption; physical activity and inactivity level.

To classify nutritional status, as per BMI, the WHO/2006 z-score reference tables<sup>(6)</sup> were used. In the nutritional assessment of WC, the classification method proposed by Taylor<sup>(7)</sup> was adopted, taking into account that there is still no single internationally accepted reference for use in adolescents<sup>(8)</sup>.

In the assessment of frequency and weekly consumption of foods, the methodology proposed by the National School-Based Student Health Survey [*Pesquisa Nacional de Saúde Escolar*] (PeNSE) was employed. Foods were grouped into healthy and unhealthy consumption markers, considering consumption equal to or greater than five days a week as borderline to identify dietary patterns. In the construction of a dietary pattern, the weekly frequency of consumption of healthy and unhealthy food markers between each other was considered<sup>(9)</sup>.

Physical activity level and inactivity time were verified by applying the International Physical Activity Questionnaire (IPAQ), in its short version. The questionnaire obtains final scores by assessing duration of physical activity

or physical exercise in minutes-day, and frequency measured in days-week<sup>(10)</sup>.

In the statistical data analysis, descriptive measures were used, such as mean and standard deviation. Student's t test obtained the difference between means of inactivity time. For qualitative variables, the chi-squared test was used in bivariate analyses. As for dietary pattern classification, a factorial analysis was applied, before the cluster analysis that indicated the number of groups. Seventeen participants (6.2%) were classified into two patterns in the statistical analysis used for pattern classification. Thus, they were excluded from the bivariate analysis.

In the statistical tests, a 5% level of significance was considered. All statistical analyses were performed using the SPSS software, v.23 (Statistical Package for Social Sciences).

The conduction of the study was authorized by the senior management of the institution. It complied with the ethical principles contained in the Declaration of Helsinki (2008) and in national legislation. The research project was approved by the Research Ethics Committee of the Regional University of Northwestern Rio Grande do Sul [*Universidade Regional do Noroeste do Estado do Rio Grande do Sul*], under opinion No. 1.080.735/2015.

## RESULTS AND E DISCUSSION

The study participants were 276 students aged 14 to 17 years old (mean of 15.91±0.77), being 132 (47.83%) males and 144 (52.17%) females. A prevalence of 9.1% for overweight was found, as well as 27.2% for cardiovascular risk. Pearson's chi-squared test revealed an association of  $p < 0.006$  between BMI and WC ( $p < 0.001$ ) and between cardiovascular risk and males.

Increased circumference and overweight values differ from the values found by the Cardiovascular Risk Study in Adolescents [*Estudo de Riscos Cardiovasculares em Adolescentes*] (ERICA), carried out in Brazil, which found a prevalence of 12.6% for increased waist circumference and 24.6% for overweight. Despite methodological differences in the studies, both found a higher

prevalence of overweight and increased circumference in the male population<sup>(11)</sup>.

A previous study reported that nearly 80% of the adolescents, aged 11 to 15 years old, combined multiple risk factors for obesity development, and 50% of them accumulated at least three risk behaviors, such as not complying with two or more dietary guidelines, and being sedentary<sup>(12)</sup>.

Sedentary behaviors may contribute and have a cumulative effect on the development of overweight and obesity<sup>(4)</sup>. The rates of sedentarism and occasional activity found are worrisome (27.7%), so are inactivity means, since other studies affirm that physical activity level in this age group is a strong predictor of activity in adulthood<sup>(10)</sup>.

Many universal behavioral patterns related to physical activity and diet have been reported, as well as some with local or unique characteristics<sup>(13)</sup>. About dietary patterns, differences in food consumption, including between Brazilian regions, have been reported<sup>(14)</sup>.

The statistical analysis found four food consumption patterns, a number that is similar to those of other studies<sup>(15)</sup>. The first pattern, called **healthy**, comprehends 46.3% of the population, of which 55.5% are female. This pattern is characterized by regular consumption of vegetables and beans, and low consumption of soda, sausages and snacks.

The second pattern is the one with more mixed dietary characteristics. It accounts for 22.8% of the population and is characterized by balanced consumption between unhealthy markers, provided by the cafeteria, and healthy markers, provided in school meals<sup>(4)</sup>. Of the total of individuals classified in the **school environment** pattern, 55.6% (35) are female.

The third pattern comprehends 13% of the population, characterized by low consumption of healthy food markers and high consumption of unhealthy food markers, especially ultra-processed foods, rich in sugars and fats, such as soda, snacks and crisps<sup>(16)</sup>. Of the total of individuals classified in the **ultra-processed** pattern, 63.9% are males.

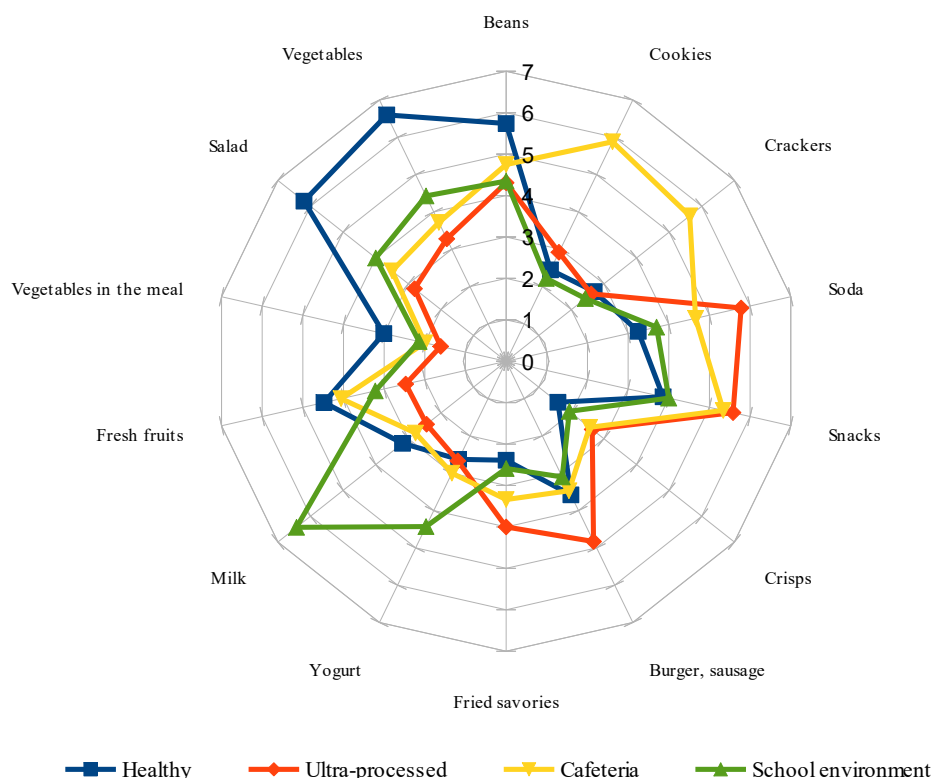
The fourth pattern comprehends 11.6% of the population. It is characterized by low consumption of healthy food markers and high

consumption of unhealthy food markers, especially snacks, cookies, crackers and sausages<sup>(9)</sup>. Of the total of individuals classified in the **cafeteria** pattern, 53.1% are male.

When it comes to differences between genders, females have greater representativeness in the **healthy** pattern and in the **school environment** pattern, with higher frequencies as to consumption of healthy markers in relation to the other two patterns. Males present greater representativeness in the **ultra-processed** and **cafeteria** patterns, considered less healthy. These trends in food consumption patterns, differentiated by gender, are common findings in other studies<sup>(4)</sup>.

Except for individuals who maintain a healthier dietary pattern, the participants showed a frequent pattern of consumption of both unhealthy food markers and healthy food markers, which other authors have called a mixed pattern<sup>(4)</sup>. These results may mean that healthy eating habits, common in children, are being gradually replaced in adolescence by less healthy habits. The adolescents would be in a moment of dietary and nutritional transition<sup>(3)</sup> that stimulates the adoption of a dietary model based on their preferences and social relations<sup>(16)</sup>.

In this sense, food availability in the school environment seems to affect consumption in the population differently. The supply of healthy food markers in school meals, for instance, appears to favor the habitual consumption of the **healthy** pattern and the **school environment** pattern. This positive influence of healthy food supply in school meals has already been observed in other studies<sup>(17)</sup>. On the other hand, the **ultra-processed** and **cafeteria** patterns, characterized mainly by high frequency of consumption of unhealthy food markers, may be having their consumption influenced by the high availability of these foods in the cafeteria. Among the patterns, **school environment** seems to be the most affected by the existence of a dual profile of food availability at the education place. The representation of the consumption of dietary patterns found is shown in figure 1.



**Figure 1.** Dietary patterns constructed according to the combination of food consumption frequency. Santo Augusto, RS, 2015

To verify correlations between the consumption patterns and nutritional status found in the population, the data were combined and are presented in Table 1. Most individuals, with excessive weight and cardiovascular risk, present a dietary pattern considered as **healthy**. Although the healthy pattern typifies a better eating behavior, this group comprehends the highest percentages relative to overweight and

cardiovascular risk, which can be understood as an attempt by these subjects to seek a healthier life. Some studies suggest that, consciously or unconsciously, individuals try to make up for inappropriate behaviors by adopting other healthy behaviors<sup>(15)</sup>. Moreover, adolescents easily identify a healthy diet by high consumption of vegetables and fruits<sup>(16)</sup>.

**Table 1.** Dietary pattern of school adolescents at cardiovascular risk and overweight. Santo Augusto, RS,

Factor	Pattern				Total** n(%)
	Healthy	Ultra-processed	Cafeteria	School Environment	
	n (%)	n (%)	n (%)	n (%)	
Card. risk <sup>*(a)</sup>	41 (56.2)	10 (13.7)	8 (11.0)	14 (22.2)	73 (28.2)
Overweight <sup>(b)</sup>	15 (62.5)	1 (4.2)	3 (12.5)	5 (20.8)	24 (9.3)

\*% at cardiovascular risk compared to the total number of participants who consumed products five days or more in the last seven days; \*\*% of the total in relation to the number of study participants; (a) assessed by Waist Circumference; (b) assessed by Body Mass Index.

Sedentarism or occasional physical activity accounted for 27.17% of the total population, and different profiles of physical activity levels, especially among gender-related profiles, were

found. Pearson's chi-squared test revealed an association of  $p < 0.013$  between physical activity and males.

The study also investigated daily time of

inactivity during a school day and a non-school day to perceive variations on days with or without school routine. It was found that the average time spent sitting on a school day was 653.33 minutes (ten hours and 53 minutes). The average time spent sitting on a non-school day was 511.14 minutes (8 hours and 31 minutes). A European study had already found an average of nine hours spent on sedentary activities, in adolescents, during waking state<sup>(1)</sup>. Prolonged time of daily inactivity among the adolescents is worrisome, since a growing body of evidence shows that sitting time may be more predictive of weight and health status than time spent on

physical activity<sup>(13)</sup>.

In order to verify associations between physical inactivity and nutritional status, the classifications obtained from BMI and WC were combined with the average time spent sitting during a school day and a non-school day. Physical inactivity, as one of the two components in the caloric balance equation, is a real cause of positive caloric balance, that is, obesity<sup>(18)</sup>. The lowest means of daily inactivity on a school and a non-school day, according to the BMI assessment, were found in low-weight individuals (Table 2).

**Table 2.** Physical inactivity on a school day and a non-school day in relation to BMI classification. Santo Augusto, RS, 2015.

Inactivity (minutes)	Low weight Mean±SD	Eutrophic Mean±SD	Overweight Mean±SD
School day	*	656.9 ± 147.0	610.0 ± 156.2
Non-school day	440.0 ± 69.3	510.6 ± 210.9	524.8 ± 223.4

\* For low weight, inactivity is constant, so it was omitted

Assessing daily time of inactivity in individuals with or without cardiovascular risk, it can be seen that risk-free ones have lower means of inactivity during non-school day, and individuals at risk have lower

means on school days. Previous study found association between inactive time on days without labor activities and metabolic risk associated with abdominal fat<sup>(1)</sup>. Results are displayed in table 3.

**Table 3.** Physical inactivity on a school day and a non-school day in relation to cardiovascular risk. Santo Augusto, RS, 2015

Inactivity (minutes)	No cardiovascular risk Mean±SD	Cardiovascular risk Mean±SD	Total	P
School day	662.76 ± 145.22	628.07 ± 151.66	653.33 ± 147.55	0.08
Non-school day	498.38 ± 205.80	545.33 ± 221.09	511.14 ± 210.70	0.10

p considering Student's t test

To verify associations between behaviors related to physical activity level or sedentarism, classified according to their degree of protective factor for cardiovascular diseases and dietary patterns, the data were combined and are presented in Table 4.

Regardless of dietary pattern, most individuals presented a physical activity level that poses lower risk for the development of cardiovascular diseases. However, the rate of 25.8% of individuals with healthy dietary patterns, with a physical activity level that poses higher risk, is curious, for being contradictory behaviors. Nevertheless, several studies have reported that the grouping of a sedentary lifestyle combination with healthy diet might occur<sup>(19)</sup>.

Despite this perception, the association between dietary patterns and physical activity levels revealed that healthier dietary patterns also included most of more active individuals, whereas the ultra-processed pattern comprehends the largest number of more sedentary individuals. These results confirm a trend towards the synergy of behaviors in this population and reinforce the perception that healthier life choices can be part of the adolescents' routine, if the environment becomes even more favorable to the adoption of these practices. Previous studies have shown that positive environmental changes, as long as they influence interpersonal determinants of a behavior, can induce a similar change in relation to other behavior, as a synergistic effect<sup>(20)</sup>.

**Table 4.** Risk classification for cardiovascular disease, according to physical activity level and dietary pattern. Santo Augusto, RS, 2015

Dietary pattern	Physical activity level that poses lower risk for the development of cardiovascular disease <sup>(a)</sup> n (%)	Physical activity level that poses higher risk for cardiovascular disease <sup>(b)</sup> n (%)
Healthy	95 (74.2)	33 (25.8)
Ultra-processed	24 (66.7)	12 (33.3)
Cafeteria	24 (75.0)	8 (25.0)
School environment	47 (74.6)	16 (25.4)

<sup>(a)</sup> Individuals who exercise regularly<sup>(b)</sup> Individuals who exercise occasionally or are sedentary

### FINAL CONSIDERATIONS

The study found worrisome results in a portion of the population. Although many students have a healthy dietary pattern and are active, a considerable amount consumes unhealthy foods often and has high rates of inactivity, which can lead to future health problems.

About food, the identification of four consumption patterns reinforces the interpretation that the subjects' individual food preferences prevail over environmental influence. Likewise, the high means of physical inactivity on a non-school day point to the perception that personal choices, in leisure time, are determinant for the performance of physical activity, despite changes in routine and in the environment. These results and the behavioral differences between gender indicate that, in this

population, individual preferences and behavioral habits already established prevailed over the environmental factor and that, in the health activities that will be planned from the results found, one must consider that awareness actions targeting health risks at the individual level are as or more important than collective actions for nutritional education or for changing environmental conditions.

An important limitation of this study is its cross-sectional design, which provides evidence for association, but not for cause. Another limitation is the likely bias in the participants' self-reports. Strengths, on the other hand, include careful design, protocol and methodology. The repetition of the study, with the inclusion of new variables of interest, will provide new and important insights about the behavior of the population.

## PADRÕES ALIMENTARES E NÍVEL DE ATIVIDADE FÍSICA EM ADOLESCENTES ESCOLARES

### RESUMO

Estudo transversal e analítico que identificou estado nutricional, padrões alimentares e nível de atividade física em 276 adolescentes, com idade de 14 a 17 anos. O estado nutricional foi avaliado pelo Índice de Massa Corporal e a medida da Circunferência da Cintura. Para avaliar o consumo e as práticas alimentares, foi aplicado um questionário adaptado da Pesquisa Nacional de Saúde do Escolar, de 2009. O nível de atividade física foi classificado de acordo com o International Physical Activity Questionnaire. Encontravam-se eutróficos 89,9% desta população e 27,2% apresentavam risco para doenças cardiovasculares. Foram identificados quatro padrões alimentares: saudável; ultraprocessado; cafeteria; ambiente escolar. Pertenciam ao padrão saudável 62,5% dos adolescentes com excesso de massa corporal e 56,2% dos adolescentes com risco cardiovascular. A maioria encontrava-se no nível de atividade física, que oferece menor risco para doenças cardiovasculares, independente dos padrões alimentares. Contudo, dados fornecidos na construção dos padrões alimentares e de inatividade reforçam a percepção de que esta população pode estar suscetível a doenças cardiovasculares na idade adulta, se mantiver as práticas atuais.

**Palavras-chave:** Estado nutricional. Consumo de alimentos. Comportamento alimentar. Adolescente.

## PATRONES ALIMENTARIOS Y NIVEL DE ACTIVIDAD FÍSICA EN ADOLESCENTES ESCOLARES

### RESUMEN

Estudio transversal y analítico que identificó el estado nutricional, los patrones alimentarios y el nivel de actividad física en 276 adolescentes, con edad de 14 a 17 años. El estado nutricional fue evaluado por el Índice de Masa Corporal y la medida de la Circunferencia de la Cintura. Para evaluar el consumo y las prácticas alimentarias, fue aplicado un cuestionario adaptado de la Investigación Nacional de Salud del Escolar, de 2009. El nivel de actividad física fue clasificado de acuerdo con el *International Physical Activity Questionnaire*. Se encontraba eutrófico el 89,9% de esta población y el 27,2% presentaba riesgo para enfermedades cardiovasculares. Fueron identificados cuatro patrones alimentarios: saludable; ultraprocesado; cafetería; ambiente escolar. Pertenecía al patrón saludable el 62,5% de los adolescentes con exceso de masa corporal y el 56,2% de los adolescentes con riesgo cardiovascular. La mayoría se encontraba en el nivel de actividad física, que ofrece menor riesgo para enfermedades cardiovasculares, independiente de los patrones alimentarios. Sin embargo, datos proporcionados en la construcción de los patrones alimentarios y de inactividad refuerzan la percepción de que esta población puede estar susceptible a enfermedades cardiovasculares en la edad adulta caso se mantengan las prácticas actuales.

**Palabras clave:** Estado nutricional. Consumo de alimentos. Comportamiento alimentario. Adolescente.

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