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Food insecurity and socioeconomic, food and nutrition profile of schoolchildren living in urban and rural areas of *Picos, Piauí*

Insegurança alimentar e perfil socioeconômico, alimentar e nutricional de escolares de áreas urbana e rural do município de Picos, Piauí

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ABSTRACT

Objective

This study aimed to determine the prevalence of food insecurity among schoolchildren living in urban and rural areas of *Picos, Piauí* associated with the socioeconomic profile of families and their food intake and nutritional status.

Methods

Study participants were families with children aged 7-10 years enrolled in municipal schools, totaling 342 families/schoolchildren. The study was conducted at school facilities through interviews with mothers - or guardians - using a questionnaire based on the Brazilian Food Insecurity Scale and socioeconomic variables and food frequency questionnaire. The nutritional status of children was assessed using the following indexes: weight/age, height/age and body mass index/age.

Results

The prevalence of food insecurity was high and similar for rural and urban areas, 84.3% and 83.3%, respectively. In general, lower income and consumption of untreated water was associated with greater frequency of food

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insecurity ($p \leq 0.01$). In urban areas, higher percentage of food insecurity was associated to lower educational levels ($p \leq 0.05$). Dietary intake and nutritional status of schoolchildren were not associated with food insecurity condition of families.

Conclusion

The percentage of families at food insecurity, as well as the food consumption and nutritional status of schoolchildren were similar between urban and rural areas, characterized as a homogeneous population in terms of socioeconomic conditions.

Indexing terms: Food consumption. Food security. Nutritional status. Socioeconomic indicators.

RESUMO

Objetivo

Determinar a prevalência de insegurança alimentar em famílias com escolares de áreas urbana e rural do município de Picos, Piauí, relacionando-a com o perfil socioeconômico das famílias, com o consumo alimentar e o estado nutricional dos escolares.

Métodos

Participaram do estudo famílias com escolares entre 7 e 10 anos matriculados na rede municipal de ensino, totalizando 342 famílias/escolares. O estudo foi conduzido na própria escola, mediante entrevista com as mães ou responsáveis, utilizando-se questionários baseados na Escala Brasileira de Insegurança Alimentar e variáveis socioeconômicas das famílias e de frequência alimentar dos escolares. O estado nutricional dos escolares foi avaliado quanto aos índices: peso/ idade, altura/idade e índice de massa corporal/idade.

Resultados

A prevalência de insegurança alimentar foi elevada e similar para as áreas rural e urbana: 84,3% e 83,3% respectivamente. No geral, a menor renda familiar e o consumo de água sem tratamento estiveram associados à maior frequência de insegurança alimentar ($p \leq 0,01$). Na área urbana, observa-se um maior percentual de insegurança alimentar para os menores níveis de escolaridade ($p \leq 0,05$). O consumo alimentar e o perfil nutricional dos escolares não estiveram associados à condição de insegurança alimentar de suas famílias.

Conclusão

O percentual de famílias em insegurança alimentar bem como o perfil de consumo alimentar e nutricional dos escolares foram similares entre as áreas urbana e rural, caracterizando-se como uma população homogênea quanto às condições socioeconômicas.

Termos de indexação: *Consumo de alimentos. Segurança alimentar e nutricional. Estado nutricional. Indicadores socioeconômicos.*

INTRODUCTION

Food and nutrition security is defined as "the everyone's right to regular and permanent access to quality food in sufficient quantity, without compromising access to other essential needs based on health-promoting food practices that respect cultural diversity and are socially, economically and environmentally sustainable"[1] (p.15). This condition must be ensured in a context of full access to other fundamental rights such as education, housing, health and social welfare within an autonomous and sustainable development process based on the exercise of ethical and culturally acceptable labor activity[2].

Food insecurity can be measured through food and nutrition surveillance, food intake surveys and local information systems. Food insecurity also involves important psychosocial components such the concern or uncertainty of whether or not there will be food next month[3].

The *Escala Brasileira de Insegurança Alimentar* (EBIA, Brazilian Food Insecurity Scale) is a quantitative instrument widely used to estimate the prevalence of various levels of food

insecurity in groups or populations at risk at local, regional or national levels[4]. Children are the population group most vulnerable to food insecurity, since the nutritional consequences are more immediate and serious, and also because, when a child has nutritional problems due to dietary deficiency, it could be inferred that adults in the household have been feeding insufficiently for some period of time[5].

From the nutritional point of view, there is no doubt about the importance of proper nutrition to ensure growth and development, especially during childhood, and in adulthood, proper nutrition plays the role of promoting and maintaining health and well-being. When submitted to severe dietary restrictions, children are exposed to nutritional deficiencies and exhibit poor growth conditions, contributing to increased vulnerability to infections and deficiencies in the maturation of the nervous system and mental and intellectual development, causing morphological and functional imbalances which, depending on intensity and duration, may be irreversible[6].

Few studies have addressed the association between food insecurity and place of residence[7-9]. Some studies have provided explanations for spatial variations and access to food, and reported that residents in urban areas have greater access to goods and services essential for health maintenance than residents of rural areas[10]. However, in a study conducted in the state of *Amazonas*, the forms of food insecurity showed a trend of lower prevalence in rural areas (68.7%) when compared with urban area of *Manaus* (AM), (89.1%), especially the severe form of food insecurity, with 28.2% in rural areas compared to 44.6% in urban areas[11].

In this context, the aim of this study was to determine the prevalence of food insecurity among schoolchildren living in urban and rural areas of *Picos* (PI), relating it to the socioeconomic profile of families, as well as the food consumption and nutritional status of schoolchildren.

METHODS

This is a cross-sectional study including families with children aged 7-10 years. The sample size was calculated based on the universe of 4,398 children in the age group of interest enrolled in 64 municipal schools in urban and rural areas of *Picos* (PI), adopting a significance level of 95% for a prevalence of 20% of moderate and severe food insecurity, average value found for the state of *Piauí*[12], with a sampling error of ± 4.5% (Epi-Info version 6.04b), taking into account a loss of approximately 20%, totaling 342 students/families with sample representativeness for the municipality. This municipality has population of 73,414 inhabitants and area of 534.715 km^2 and is located 330 km away from the state capital[13].

Municipal schools were selected according to areas enclosed by the Department of Education of *Picos* (PI). For data collection, students' parents were called and those who agreed to participate in the study signed the Informed Consent Form. The study was approved by the Ethics Committee on Human Research of the *Universidade Federal do Piauí* (nº 0176.0.045.000-08). The team of interviewers was previously trained for the application of questionnaires and data collection was carried out from August 2009 to February 2010. Initially, the socioeconomic questionnaire was applied to parents or guardians, containing variables such as family income, living conditions (sewage service, garbage collection, access to treated water, etc.), educational level and participation in government income transfer programs.

Perception of food insecurity was assessed by interviewing parents or guardians using a questionnaire based on the EBIA, which consists of 15 closed questions (yes or no) on food insufficiency experience in the last three months at various levels of intensity, ranging from the concern that food may be lacking until the experience of spending a whole day without eating. Of the 15 questions, seven refer to family members under 18 years of age. Each affirmative

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response to the food insecurity questionnaire scores 1 point, and the sum is the scale score, ranging from 0 to 15 points as follows: security 0; mild insecurity 1-5 points; moderate insecurity 6-10 points and severe insecurity 11-15 points in families with children under 18 years of age[14].

The Food Frequency Questionnaire was also applied to parents or guardians as an interview, assessing the consumption of 54 foods, divided into the following groups: cereals, pasta, legumes, fruits, eggs, vegetables, roots and tubers, meats, dairy products, sweets and fats. The consumption frequency was classified as "rarely", "less than once a month", "from one to three times a month," "once a week", "from two to four times a week", "once a day", "two or more times a day. "Rarely" was defined as occasional consumption or no consumption[15].

To assess the nutritional status, weight and height were measured by trained Nutrition students. For weight, Tanita digital scale (*São Paulo*, Brazil) with capacity of up to 150 kg and 100 g precision was used, and children were weighed barefoot and with minimal clothing. Height was measured with the use of measuring tape adhered to wall without footers and a wooden square, according to recommendations of Lohman *et al.*[16]. For this measure, the tape was attached to the wall and children were placed upright, barefoot, with upper limbs along the body and heels, back and head touching the wall. Children were classified according to their nutritional status as recommended by World Health Organization (WHO)[17], using the Height/Age (H/A), Weight/Age (W/A) and Body Mass Index/Age (BMI/A) *ratios*. Children with Z-scores greater than 2.0 above the median of the reference population were considered obese; overweight with Z-score greater than 1.0 above the median of the reference population and low weight those with Z-scores 2.0 below the median of the reference population. Children with Z-scores below 2.0 were considered with growth deficit.

For analysis of the anthropometric data, the Anthro-Plus software version 3.2.2 was used. To verify the existence of association between place of residence according to food insecurity (outcome variable) and socioeconomic and anthropometric variables and dietary intake (independent variables), the Chi-square test was used, adopting significance level of $p \leq 0.05$. The Epi Info software version 6.04b was used for analyses.

RESULTS

Figure 1 shows that the prevalence of food insecurity was high and similar for rural and urban areas (84.3% and 83.3%, respectively), and moderate and severe food insecurity values were 38 9% and 38.2%, respectively.

Table 1 shows that for the entire sample (n=342), in families with lower income, there is a higher prevalence of food insecurity ($p \leq 0.01$), with similar behavior among families living in rural and urban areas. Regarding the educational level of the family head, there is a higher percentage of food insecurity for the lowest educational levels, especially illiterates, only in the urban area ($p \leq 0.05$).

Consumption of treated water was associated with lower frequency of food

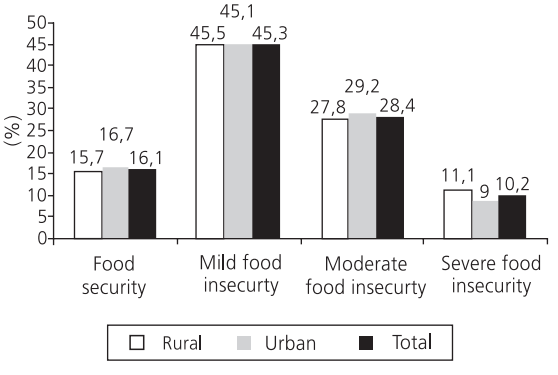

Figure 1. Food insecurity classification of schoolchildren living in urban and rural areas of the city of *Picos* (PI), 2009.

Note: $p<0.05$.

Table 1. Food insecurity classification according to the socioeconomic characteristics and housing conditions of families with schoolchildren living in urban and rural areas of the city of *Picos* (PI), 2009.

Variables	Total			Rural			Urban		
	n=342	FS %	FI %	n=198	FS %	FI %	n=144	FS %	FI %
Gender of family head									
Male	160	15.6	84.4	91	15.4	84.6	69	15.9	84.1
Female	182	16.5	83.5	107	15.9	84.1	75	17.3	82.7
Income		**			†			†	
<1 MW	231	12.6	87.4	142	12.7	87.3	89	12.4	87.6
≥1 MW	111	23.4	76.6	56	23.2	76.8	55	23.6	76.4
Income transfer programs									
Yes	274	15.3	84.7	160	14.4	85.6	114	16.7	83.3
No	68	19.1	80.9	37	21.6	78.4	31	16.1	83.9
Educational level of family head								*	
Illiterate	78	10.3	89.7	56	14.3	85.7	22	0.0	100.0
Incomplete elementary school	192	16.7	83.3	110	17.3	82.7	82	15.9	84.1
Full high school or more	72	20.8	79.2	32	12.5	87.5	40	27.5	72.5
Type of housing								*	
Masonry	286	15.0	85.0	160	15.6	84.4	126	14.3	85.7
Other type	56	21.4	78.6	38	15.8	84.2	18	33.3	66.7
Garbage collection									
Public	281	16.4	83.6	155	16.1	83.9	126	16.7	83.3
Other	60	15.0	85.0	42	14.3	85.7	18	16.7	83.3
Water supply									
Public network	248	17.3	82.7	111	17.1	82.9	137	17.5	82.5
Other system	94	12.8	87.2	87	13.8	86.2	07	0.0	100.0
Water consumption		***			**			**	
Treated, bottled and boiled	104	28.8	71.2	55	27.3	72.7	49	30.6	69.4
Tap water	238	10.5	89.5	143	11.2	88.8	95	9.5	90.5
Sewage system								†	
Public network	90	18.9	81.1	43	11.6	88.4	47	25.5	74.5
Other system	252	15.1	84.9	155	16.8	83.2	97	12.4	87.6

Note: †$p \leq 0.10$; *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.

FS: Food Security; FI: Food Insecurity; MV: Minimun Wage.

insecurity, unlike households that consume untreated water in both rural and urban areas ($p \leq 0.01$). Regarding the type of housing in the urban area, the lowest percentage of food insecurity occurred in households with worst construction conditions (mud, canvas and other materials), which seems a contradictory situation, probably due to the small number of households in this condition (16%).

Most of the families receive financial resources from government income transfer programs, with more than 80% of families living in urban and rural areas of *Picos* (PI) receiving these resources.

The dietary intake of students for the total sample (Figure 2) showed no statistically significant difference with respect to food insecurity, the same occurring for rural and urban areas (data not shown).

Considering the foods analyzed, it was observed that the most consumed foods are cereals, sugars and fats. Roots, eggs, miscellaneous (ice cream, soft drinks, processed juices) and vegetables in this order are among

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Table 2. Nutritional profile of schoolchildren according to the food insecurity classification and place of residence, *Picos* (PI), 2009.

Anthropometric variables	Total			Rural			Urban		
	n=342	FS %	FI %	n=198	FS %	FI %	n=144	FS %	FI %
*BMI/age**									
Low weight	14	3.6	4.2	7	3.2	3.6	7	4.2	5.0
Normal weight	289	85.5	84.3	168	87.1	84.4	121	83.3	84.2
Overweight	39	10.9	11.5	23	9.7	12.0	16	12.5	10.8
*Weight/age**									
Weight deficit	21	9.1	5.9	11	9.7	5.0	10	8.3	7.1
Normal weight	307	90.9	94.1	180	90.3	95.0	127	91.7	92.9
*Height/age**									
Height deficit	14 (4.1)	5.5	3.8	7	3.2	3.6	7	8.3	4.2
Normal height	328 (95.9)	94.5	96.2	191	96.8	96.4	137	91.7	95.8

Note: *$p<0.05$.

FS: Food Security; FI: Food Insecurity; BMI: Body Mass Index.

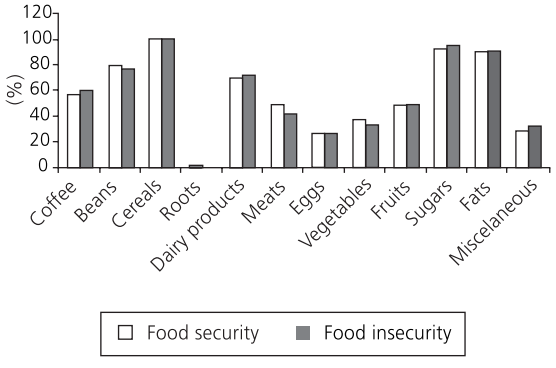

Figure 2. Food consumed by schoolchildren (n=342) at least once a day, according to food insecurity. *Picos* (PI), 2009.

Note: $p<0.05$.

the less consumed foods by schoolchildren. Among the protein sources, beans and dairy products are more consumed than meats and eggs. High consumption of coffee and beans was observed, exceeding 56% and 75%, respectively. However, less than 50% of children consume fruits and vegetables at least once a day. Regarding the study outcome, children at food security consume a little more meat and vegetables than children at food insecurity, although without significant differences.

Table 2 shows that there was no statistical difference for anthropometric indicators of schoolchildren living in rural and urban areas, either when associated with food insecurity, probably due to the low prevalence of anthropometric deficit with values between 6.4% and 4.1%.

DISCUSSION

In the present study, no difference was observed in the prevalence of food insecurity among families with children living in urban and rural areas of *Picos* (PI). However, the percentages of the most severe forms of food insecurity were higher than the average for families with children under 18 years of age in the state of *Piauí*, which was 10.6% for moderate food insecurity and 6.9% for severe food insecurity in the urban area, and 15.9 and 10.7% in rural areas. Similarly, moderate and severe food insecurity was higher than the average found for children aged 4 to 7 and 8 to10 years, of 26.9% and 18.8%, respectively, in the state of *Piauí*[12].

According to the 2004-2009 National Household Survey[12], in northern and northeastern Brazil, severe food insecurity showed higher proportions in the rural area, while in southern and Midwestern Brazil, the inverse occurred, where severe food insecurity was detected in higher proportions in urban areas. Yuyama *et al.*[11]

found that families living in the urban area of *Manaus* (AM) had higher prevalence of food insecurity compared to those living in rural areas. In a study conducted by the United States Departament of Agriculture, highest prevalence of food insecurity was detected in large cities and in rural areas[17], since individual perception of food insecurity and socioeconomic indicators play an important role, regardless of place of residence, whether rural or urban[9].

Similarity in the prevalence of food insecurity of families living in urban and rural areas of *Picos* (PI) with income less than 1 minimum wage (87.3 to 87.6%), near 85.4%, was observed, which corroborates the results by Yuyama *et al.*[11] for families living in the urban area of *Manaus* (AM) with income less than 1 minimum wage.

In the present study, low income and low educational level of the family head were associated with higher prevalence of food insecurity. According to Sales-Costa *et al.*[18], income and education are determinants of food insecurity, since low family income and educational level significantly contribute to increasing food insecurity, as well as the availability of treated water and sewage system, since they are associated with the provision of basic public services.

In a study conducted in *Duque de Caxias* (RJ), sanitary conditions were not associated with perception of food insecurity; however, the consumption of treated water was positively associated with food security[18], which result is similar to the present study, in which the consumption of treated, bottled or boiled water, whether in urban or rural areas, was decisive and significantly higher ($p \leq 0.01$) among families in food security.

Government income transfer programs were not able to influence the income of these families, and most of them have monthly income less than one minimum wage. According to the 2004 National Household Survey[12], levels of food insecurity - mild, moderate or severe - affected 66% of families with at least one beneficiary of government income transfer programs, and the authors claim that there is a relevant contribution of income transfer programs to reduced inequality, poverty alleviation and improvement of social conditions of the population. However, according to Anschau *et al.*[19], the high prevalence of food insecurity among beneficiaries of income transfer programs as compared to non-beneficiaries of the same social stratum indicates the need for better understanding the circumstances that characterize the lives of those families.

Regarding food consumption in *Picos* (PI), vegetables and meats were the most sensitive to food insecurity in urban or rural areas, although without statistical significance. Different result was observed by Yuyama *et al.*[11] in the Amazon region, where rural riverside families consume more grains, fruits, vegetables, roots, oil and meat than families living in urban areas. According to Segall-Côrrea[3] and Panigassi *et al.*[20], as food insecurity conditions are more severe, the consumption of fruits, vegetables, meats, and dairy products is lower, and this behavior is uniform in all Brazilian regions, except for the Amazon region, where hunting, fishing and collection of regional fruits increase the food availability.

In a study by D'Innocenzo *et al*.[21] with children aged 4-11 years, it was observed that dietary patterns of children are dependent on the socioeconomic conditions of their families, and the adoption of healthier food items is associated with higher socioeconomic status, because the lower the socioeconomic level, the more fried foods, sweets, snacks and soft drinks/artificial juice and less fruits, legumes, vegetables, fish and cereals are consumed by children. Moreover, Triches & Giugliane[22] highlight that there is a recent and excessive marketing of a variety of foods high in energy and fat, affordable and available to schoolchildren. On the other hand, foods such as vegetables and fruits with less energy and more nutritional value are increasingly lacking in children's diets.

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The study by Conceição *et al.*[23] with children aged 9-16 years enrolled in private and public schools in the state of *Maranhão* also found high consumption of sugar and sweets (69.4%) and oils and fats (65.6%); however, the consumption of this food group by schoolchildren evaluated here was even higher, with more than 89.0% consuming oils and fats and 92.0% consuming sugars and sweets at least once a day.

Similar results were obtained by Antunes *et al.*[24], in which children under 3 years at food insecurity showed high consumption of coffee, being higher among children with the most severe forms of food insecurity. Antunes *et al*.[24] also observed that the consumption of fruits, vegetables, and dairy products was below recommendations for children in situation of food security or insecurity.

It is noteworthy that some foods cannot be consumed due to various reasons such as unpleasant taste, difficulty of finding food; difficulty in eating; price; not having the habit or time to eat[25], moreover, one should take into account the limitations of methodologies for measuring food consumption in line with food insecurity[8].

The population of students living in rural or urban areas of *Picos* (PI) was fairly homogeneous regarding anthropometry, with similarities in the forms of malnutrition (deficits and excesses) for most students, despite the condition of food insecurity largely shown by the families of these children. Segall-Corrêa[3] explained that the anthropometric measure is an important indicator of nutritional status; however, it assesses food insecurity indirectly, and eventually obtains normal values for weight, height and Body Mass Index (BMI) in families in situation of food insecurity. Accordingly, Oliveira *et al.*[26] reported that in populations with high levels of poverty, low Human Development Index and high prevalence of food insecurity, the exclusive use of anthropometric indicators may reveal a situation apparently quite more favorable than reality.

Some studies suggest a relationship between obesity and food insecurity and claim that food insecurity does not increase the chances of being overweight in childhood; however, they may increase in adulthood[27] and others that suggest an association between malnutrition and food insecurity[7] discuss that these relationships are directly related to differences in dietary patterns that may exist among children in conditions of food insecurity, as many high-calorie foods cost less than healthier ones.

According to Oliveira & Lima Filho[28] malnutrition and obesity often coincide in families with food and nutrition insecurity, causing the average amplitude of BMI of families increase according to food insecurity, considering that food security levels positively impact anthropometric indexes.

The study by Pellegrini *et al.*[29] with schoolchildren aged 10-17 years enrolled in public schools in the states of *Santa Catarina* and *Rio Grande do Sul* showed higher percentage of normal weight children (82.3%) and lower percentage of overweight students (6.7%) in urban areas, with 11.0 - 11.7% of malnourished children living in rural and urban areas, with no statistical difference for this nutritional status among students of different places of residence. This result is quite similar to that found in the present study, in which schoolchildren living in rural areas showed nutritional status similar to those living in urban areas.

Among the limitations of this study, there is the possibility of one-off factors or short-term view of the Food and Nutrition Security by the interviewee and the subjective aspects of the applied scale. The sample is only representative for students and not necessarily for the urban and rural areas. In populations of less developed regions and small and medium-sized cities, complex conditions such as the perception of food insecurity may be uniform across different socioeconomic strata.

CONCLUSION

The prevalence of food insecurity was similar between urban and rural areas in the city of *Picos* (PI). Among associated factors, low family income and consumption of untreated water contributed to the higher percentage of families in conditions of food insecurity.

Dietary intake and nutritional status of schoolchildren were not associated with the condition of food insecurity among students. Further studies should be carried out to better characterize the population at food insecurity, taking into account the constant changes in the socioeconomic and environmental conditions, food habit and lifestyle of the population, and the development and implementation of public policies in the field of food and nutrition.

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CONTRIBUTORS

JS AQUINO conducted the collection and interpretation of data, drafting of the manuscript. LAS SIQUEIRA-DE-ANDRADE conducted the statistical analysis and critical revision of the manuscript. PEB ALENCAR DA SILVA conducted the collection and tabulation of data. AP SILVA conducted the collection and tabulation of data. CRS VIEIRA conducted the collection and tabulation of data. drafting of the manuscript. PIC LIRA conducted the statistical analysis, drafting and critical revision of the manuscript.

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Overweight in *Goiás' quilombola* students and food insecurity in their families[1]

Excesso de peso de estudantes quilombolas de Goiás e a insegurança alimentar em suas famílias

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ABSTRACT

Objective

To characterize the nutritional status of *quilombola* students and determine the food security status of their households.

Methods

This is a cross-sectional study with students aged six to nineteen years from *quilombola* communities in twelve municipalities of *Goiás* categorized by age, gender, school location (urban/rural), and nutritional status based on the World Health Organization's height-for-age and body mass index for-age charts. The Brazilian Food Insecurity Scale was used for measuring food (in)security in their families. Descriptive and association analyses were conducted using the Chi-square test at a significance level of 5% ($p<0.05$).

Results

In a sample of 226 students, overweight (17.2%) was more common than malnutrition (1.3%), especially in students attending urban schools (28.2%) ($p<0.05$). Most (75.2%) *quilombola* families experienced food insecurity, especially mild.

Conclusion

The apparent contradiction of excess weight and food insecurity occurring simultaneously indicates the need of revising the study instruments and the causal network that identify poverty.

Indexing terms: African continental ascestry. Food security. Nutritional status. School feeding.

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RESUMO

Objetivo

Caracterizar o estado nutricional de estudantes quilombolas e a segurança alimentar nos seus domicílios.

Métodos

Estudo transversal com estudantes na faixa etária de 6 a 19 anos, de comunidades quilombolas de 12 municípios goianos, categorizados quanto à idade; ao sexo; à localização da escola em que estavam matriculados, e ao estado nutricional, classificado segundo os critérios do World Health Organization *para os parâmetros estatura para idade e índice de massa corporal para idade. Por meio da Escala Brasileira de Medida de Insegurança Alimentar, foi estudada a (in)segurança alimentar das famílias dos respectivos alunos. Realizaram-se análises descritivas e de associação utilizando-se o Qui-quadrado com significância estatística quando p-valor<0,05.*

Resultados

Em amostra de 226 estudantes, observou-se maior frequência de excesso de peso (17,2%) em comparação à desnutrição (1,3%), com maior ocorrência entre os alunos matriculados nas escolas da zona urbana (28,2%) (p<0,05). A insegurança alimentar esteve presente em 75,2% das famílias quilombolas, sendo a insegurança alimentar leve a mais frequente.

Conclusão

A aparente contradição da ocorrência simultânea de excesso de peso e insegurança alimentar aponta para a necessidade de que sejam revistos os instrumentos de estudo, bem como a rede de causalidade que identifica a pobreza e o excesso de peso.

Termos de indexação: *Grupo com ancestrais do continente africano. Segurança alimentar e nutricional. Estado nutricional. Alimentação escolar.*

INTRODUCTION

The remaining *quilombolas* are considered ethnic/racial groups according to self-attribution criteria and have a history of their own[1]. A close bond with the land is one of the most striking *quilombola* characteristics, with mostly subsistence agriculture being the main economic activity. A small part of the farm products is sold at very low prices, generating low income for the families[2-4].

Studies have found that *quilombola* communities have poor basic sanitation, characterized by frequent water shortages and no garbage collection or sewerage. In addition to these vulnerabilities, low education level and illiteracy are common, and access to primary health care services is difficult, compromising *quilombola* health, characterized by nutritional deficiencies, malnutrition, and chronic Noncommunicable Diseases (NCD)[2,3,5-7].

Although *quilombola* children aged less than five years are often malnourished[2,8], some are overweight. *Quilombola* individuals aged more than seventeen years have frequencies of overweight and NCD, such as high blood pressure, of 41.9% and 41.6%, respectively[9].

Economic changes in rural communities, such as wage labor, retirement pensions, and access to welfare programs such as *Bolsa Família*, may change food habits because they enable the acquisition of processed foods at urban grocery stores instead of those grown in the community, which may increase the intake of processed and high-fat foods. Such transitions and exposure to the urban environment may explain the changes in the nutritional profile of the *quilombola* population[10,11]. *Quilombola* youth frequently move to cities because their communities lack high schools, so they move to cities to continue their education and find work, losing touch with their cultural and social center[12-14].

Studies on the nutritional status and health profile of *quilombola* children aged more than five years and adolescents are few. Their nutritional profile is concerning because 7.5% of

the population aged eleven or more years consume fewer than three meals a day, and 32.5% of children aged three to eleven years have a maximum of three meals a day[2].

It is plausible to assume that the causal network of the nutritional status of *quilombola* communities has changed given their usually difficult access to food and resultant hunger, characterizing a situation of food insecurity in these families[2,15]. The availability of affordable energy-dense foods may be a factor that explains this paradigm shift[16-18].

Given the need to expand the discussion about food (in)security and its relationships with the nutritional status-related epidemiologic landscape, the objective of this study was to characterize the nutritional status of *quilombola* students and food (in)security in their households.

METHODS

This cross-sectional study was conducted from March to August 2012 in 12 municipalities in *Goiás* with *quilombola* communities recognized by the *Fundação Cultural Palmares*[19], selected according to the local leaders' interest in participating in the study.

The study target population was estimated based on the 2011 school census[20] and consisted of male and female *quilombola* children aged six to nine years and adolescents aged ten to nineteen years enrolled in municipal and state elementary, middle, and high schools. Since the study universe was diverse, all schools with *quilombola* students were visited. The local *quilombola* leader helped to determine the schools with *quilombola* students by examining the enrollment forms.

Ninety-one schools had *quilombola* students, but twelve (13.2%) were not included because of their remoteness (n=4) or absence of a teacher or another person in charge (n=4), being closed and/or abandoned (n=2), and not having enough time to conduct the study (n=2). Therefore, the study population consisted of 2,413 *quilombola* students from 79 schools.

Students were randomly selected at each school taking into account an error estimate of 6%, a Confidence Interval of 95% (95%CI), and a desired proportion of 50% since there is no data on the percentage of *quilombola* children and adolescents at nutritional risk. The sample was defined in 175 students with an extra 30% to compensate for losses[21], thereby totaling 226 *quilombola* students considering a loss by refusal. The sample size was given by calculating sampling weights to maintain proportionality with the *quilombola* students in each municipality[22].

The field team consisted of properly trained dieticians who collected sociodemographic data, such as age, gender, and school location (rural/urban), anthropometric data (weight and height), and Food Security (FS) and Food Insecurity (FI) data of the students' families.

Anthropometric assessment included measuring weight (kg) and height (cm) as recommended by the World Health Organization (WHO)[23], using a solar digital scale with a capacity of 150 kg and accuracy of 0.1 kg of the brand Tanita, and compact stadiometer of the brand Seca with a total length of 210 cm and accuracy of 0.1 cm. Nutritional status was also classified as recommended by the WHO according to height-for-age and Body Mass Index (BMI)-for age Z-scores[24].

The *Escala Brasileira de Insegurança Alimentar* (EBIA, Brazilian food Insecurity Scale) was used for assessing food (in)security in the households, classifying it as follows: (1) mild food insecurity - poor diet and family concerned with running out of food soon; (2) moderate food insecurity - quantitative food restriction in the household; (3) severe food insecurity - food deficit and even hunger among the family's adults and/or children[25]. Although this instrument was developed for assessing traditional populations, changes were not proposed because the instrument is validated and has already been used

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in Brazilian *quilombola* surveys and other studies[2,25-27].

The software Stata version 12.0® treated the data, and the WHO's program AnthroPlus version 1.0.4® assessed the participants' nutritional profile. The Chi-square test measured the association between the study variables and the food security indicator of the *quilombola* students with a significance level of α<5.0% (p<0.05).

The study "*Food, health, and quality of life of* quilombola *schoolchildren from* Goiás" upon which the present study is based was approved by the Research Ethics Committee of the *Universidade Federal de Goiás* under Protocol number 263/2011, and all participants signed an Informed Consent Form before entering the study.

RESULTS

The mean age and standard deviation of the 226 study students was 10.5±3.3 years, 51.8% (n=117) were females, and 52.2% (n=118) were enrolled in urban schools. Only three adolescents were stunted, and another three students (1.3%), two children (66.7%) and one adolescent (33.3%), were underweight. Thirty-nine (17.2%) participants were overweight (overweight or obese). Table 1 shows the *quilombola* student profiles.

A total of 214 families were interviewed to collect food access information, classifying the household as food secure or insecure. The number of families is smaller than the number of participants because some households had more than one participant. Food insecurity was found in 160 (75.2%) households, most of which were mildly (45.1%) and moderately (21.6%) food insecure (Table 2).

The following groups had similar percentages of food insecurity: females (74.4%), males (76.1%), children (73.1%), adolescents (77.0%), students from rural schools (78.7%), and students from urban schools (72.0%). Table 3

Table 1. Profile of *quilombola* students attending public schools. *Goiás,* Brazil, 2012 (n=226).

Characteristics	Age group			
	6 to 9 years		10 to 19 years	
	n	%	n	%
Gender				
Female	55	47.0	62	53.0
Male	49	45.4	60	55.0
Height-for-age				
Low height-for-age	0	0.0	3	100.0
Appropriate height-for-age	104	46.6	119	53.4
BMI-for-age				
Underweight	2	66.7	1	33.3
Normal weight	84	45.7	100	54.3
Overweight	18	46.2	21	53.8
Location				
Rural	56	51.9	52	48.1
Urban	48	40.7	70	59.3

Note: BMI: Body Mass Index.

Table 2. Food (in)security distribution in *quilombola* students' households. *Goiás*, Brazil, 2012 (n=214).

Characteristics	n	%	95%CI
Food (in)security			
Food security	54	24.8	19.0 - 30.6
Mild food insecurity	96	45.1	38.4 - 51.8
Moderate food insecurity	46	21.6	16.1 - 27.1
Severe food insecurity	18	8.5	4.8 - 12.2

Note: 95%CI: Confidence Interval of 95%.

Table 3. Food security/insecurity frequency by the sociodemographic variables of *quilombola* children and adolescents. *Goiás,* Brazil, 2012 (n=226).

Characteristics	Food (in)security				p[1]
	Food security		Food insecurity		
	n	%	n	%	
Gender					
Female	30	25.6	87	74.4	0.497
Male	26	23.9	83	76.1	
Age					
6 to 9 years	28	26.9	76	73.1	0.242
10 to 19 years	28	23.0	94	77.0	
School location					
Rural	23	21.3	85	78.7	0.069
Urban	33	28.0	85	72.0	

Note: [1]Chi-square test.

Table 4. Nutritional status distribution of quilombola children and adolescents by sociodemographic and food security/insecurity variables. *Goiás,* Brazil, 2012 (n=226).

Characteristics	Food (in)security				p[1]
	Not overweight		Overweight		
	n	%	n	%	
Gender					
Female	94	80.4	23	19.7	0.294
Male	93	85.3	16	14.7	
Age					
6 to 9 years	86	82.7	18	17.3	0.888
10 to 19 years	101	82.8	21	17.2	
School location					
Rural	103	95.4	5	4.6	0.000
Urban	84	71.8	33	28.2	
Food (in)security					
Food security	45	80.4	11	19.6	0.690
Food insecurity	142	83.6	28	16.5	

Note: [1]Chi-square test.

shows that these sociodemographic variables were not associated with food insecurity (p>0.05).

Most (19.6%) overweight children and adolescents lived in food secure households. Excess weight was more frequent among girls (19.7%) than boys (14.7%) but the difference was not significant (p>0.05). There was a statistically significant association (p<0.05) between school location (urban/rural) and the students' nutritional status: 28.2% of the children attending urban schools were overweight (Table 4).

DISCUSSION

Stunting was found in only three adolescents, no children were affected. Adolescents were also more likely to be overweight or obese than children. Moreover, the frequency of food insecurity for the study sample was high.

The small number of studies on the nutritional status of *quilombola* children aged six to nineteen years limits the discussion of the results, justifying comparison with other population groups with similar sociocultural trajectory.

The increasing prevalence of overweight has already been observed in other specific populations, such as *Xavante* in *Mato Grosso*, with an overweight prevalence of 27.5% in adolescents[28], and in *Alto Xingu* where the adolescents' BMI was higher than the country's average BMI, also suggesting a high frequency of overweight[29]. The nutritional profile of students from public schools in *Juiz de Fora* (MG) with a mean age of 10.8 years was also similar to that of the present sample given that 7.5% and 10.4% of the women were overweight and obese, respectively, and 13.5% and 7.6% of the men were overweight and obese, respectively[30].

The 2008/2009 Family Budget Survey found that more than 30% of Brazilian children aged five to nine years and roughly 20% of Brazilian adolescents were overweight[31]. The *Pesquisa Nacional de Saúde do Escolar* (PeNSE, National Schoolchild Health Survey) found that 23% of the students aged 11 to 19 years attending public and private schools in Brazilian capitals were overweight[32].

An association was found between nutritional status and school location (urban/rural) as most overweight students attended urban schools. A study of adolescents aged 10 to 17 years attending public schools found that those living in urban areas were 75% more likely to be overweight than those living in rural areas[33]. Although the present study did not investigate where the sample lived, the fact that they studied in urban schools may have facilitated access to processed foods, uncommon in rural areas, a factor that may promote weight gain.

The proximity between *quilombola* communities and roads going to large cities may impact the socioeconomic, and consequently, the behavioral aspects of this population. In other words, greater proximity to cities may change the eating habits of *quilombola* communities, justifying the increase in the prevalence of overweight in this population. New fields of work, such as tourism, wage labor, and ease of distributing agricultural products lead communities near roads to adopt a new pattern

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of subsistence, characterized by smaller involvement with subsistent farming and greater access to foods common in urban areas. These pieces of evidence may be indicative of nutritional transition in this population and thereby, higher food insecurity[3,10,11,34].

The impact of this change on the subsistence model was observed by ecological farmers from *Paraná*. They believe that purchased foods are important because their production does not meet all their nutritional requirements, but they know that purchased foods have a negative impact on their health. Some farmers also wanted to buy processed foods, such as sweets, bouillon cubes, soft drinks, and others, regardless of their unhealthiness[35].

Although the frequency of overweight was high, the number of food insecure families was also high. This result reaffirms the evidence found by some studies regarding the broken paradigm that food insecurity is a synonym of malnutrition, introducing a new concept where hunger is associated with overweight[16-18]. However, nutritional status was not associated with food insecurity in the study *quilombola* families.

The identified food insecurity confirms the vulnerable situation of *quilombola* families[2,3,5-7] and corroborates a study of *quilombolas* in *Tocantins* that found percentages of mild and moderate food insecurity of 85.1% and 70.2%, respectively[15].

The frequency of food insecurity in *quilombola* families and the nutritional profile of the study children and adolescents are concerning and deserve the attention of public policies. The *Programa Nacional de Alimentação Escolar* (PNAE, National School Food Program) is an example of the students' right to appropriate food, that is, food quality and amount that meet their nutritional requirements while at school, especially its teaching nature[36]. However, in practice the recommendations of the program are distorted since schools in some *quilombola* communities served foods alien to the local food habits[3].

One of *Programa Nacional de Alimentação Escolar*'s principles is the respect for local food habits. The traditional practices that are part of a healthy food culture must be considered along with the guideline of buying diverse, locally produced foods[36].

In 2009 *Programa Nacional de Alimentação Escolar* determined that schools should purchase foods from family farms, which is a way of providing better quality meals to the students and food and nutrition security to the farmers, improving everyone's quality of life. Schools should also prefer foods produced by *quilombola* farmers[36]. However, the percentage of Brazilian municipalities that buy food from family farms is still small (47.4%), especially in the Midwest region (35.3%)[37].

The *Programa de Aquisição de Alimentos* (PAA, Food Acquisition Program) also aims to promote farmer food and nutrition security and school meals of higher quality by purchasing foods from family farms and donating the foods to schools[38]. However, these programs require farmers to own the land, but land ownership is not very common in *quilombola* communities[11,13].

Given the nutritional status profile of the study *quilombola* students and the importance of public policies that aim to improve their quality of life, one must investigate the obstacles that must be overcome for implementing and ensuring the effectiveness of these policies for the proposition to actually improve the quality of life of individuals living in *quilombola* communities.

CONCLUSION

The simultaneous presence of overweight and food insecurity raises questions regarding new life and consumption habits, and even about today's poverty profile in Brazil. Therefore we suggest new studies to expand the discussion about this apparent paradigm shift.

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CONTRIBUTORS

The authors participated in all study and manuscript stages: conception, design, proposition of ideas, critical analysis, and writing.

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Factors associated with the consumption of fruits and vegetables in schoolchildren aged 7 to 14 years of *Florianópolis,* South of Brazil[1]

Fatores associados ao consumo de frutas, legumes e verduras em escolares de 7 a 14 anos do município de Florianópolis

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ABSTRACT

Objective

To estimate the prevalence of the fruit and vegetable intake of schoolchildren aged 7 to 14 years from *Florianópolis*, *Santa Catarina*, Brazil, and analyze the associated factors.

Methods

This cross-sectional study analyzed food intake, socioeconomic, and biological data of 2,836 schoolchildren. The Chi-square test analyzed the dependent (fruit and vegetable intake) and independent variables; the latter with *p*-value <0.20 were selected for logistic regression analysis. The level of significance was $p<0.05$.

Results

Only 4.8% of the sample had adequate fruit and vegetable intake. The variables associated with adequate fruit and vegetable intake were school ownership status (private *versus* public), mother's education level, and family income per member. After adjustment only family income *per capita* remained associated with fruit and vegetable intake.

Conclusion

The fruit and vegetable intake of schoolchildren aged 7 to 14 years from *Florianópolis, Santa Catarina,* Brazil, is inadequate.

Indexing terms: Adolescent. Child. Food consumption. Fruit. Vegetables.

[1] Article based on the master's thesis of CR GALEGO intitled "*Fatores associados ao consumo de frutas, legumes e verduras em escolares de 7 a 14 anos do município de Florianópolis, Santa Catarina*". Universidade Federal de Santa Catarina; 2010.

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RESUMO

Objetivo

Estimar a prevalência e analisar os fatores associados ao consumo de frutas, legumes e verduras em escolares de 7 a 14 anos de idade do município de Florianópolis, Santa Catarina.

Métodos

Estudo transversal com amostra probabilística de 2 836 escolares. Foram analisadas variáveis de consumo alimentar, biológicas e socioeconômicas. Foi aplicado teste Qui-quadrado entre as variáveis independentes e dependentes (consumo de frutas, legumes e verduras), sendo aquelas com valor de p<0,20 incluídas na análise de regressão logística. O nível de significância adotado foi de p<0,05.

Resultados

O consumo adequado de frutas, legumes e verduras foi verificado em 4,8% da amostra. As variáveis associadas com o consumo adequado de frutas, legumes e verduras foram o tipo de escola, nível de escolaridade da mãe e renda familiar per capita*. Após o ajuste, apenas a renda familiar* per capita *manteve a associação.*

Conclusão

Verificou-se que o consumo de frutas, legumes e verduras por escolares de 7 a 14 anos de idade residentes no município de Florianópolis encontra-se abaixo das recomendações.

Termos de indexação: *Adolescente. Criança. Consumo de alimentos. Frutas. Verduras.*

INTRODUCTION

Both developed and developing countries consider that low Fruit and Vegetable (FV) intake increases the risk of chronic Non-Communicable Diseases (NCD)[1,2]. The literature provides evidence that adequate FV intake protects against the risk of NCD, such as diabetes *Mellitus* type 2, cardiovascular diseases, dyslipidemia, chronic respiratory diseases, hypertension, and some types of cancer[3]. NCD are the main global cause of mortality and disability. The World Health Organization (WHO) estimates that NCD kill 36 million people annually. In 2007 NCD accounted for 72% of the deaths in Brazil[4].

Inadequate fruit and vegetable intake in children and adolescents has been evidenced by Brazilian[5-8] and foreign studies[9,10].

The *Pesquisa Nacional de Saúde do Escolar* (PeNSE, National Schoolchild Health Survey) conducted in 2009 by the *Instituto Brasileiro de Geografia e Estatística* (IBGE, Brazilian Institute of Geography and Statistics) surveyed 60,973 students aged 13 to 15 years, attending public and private schools throughout the country, and also found low FV intake[11]. A total of 34.3% of the ninth graders attending private schools and 30.4% of those attending public schools had consumed vegetables on five days of the study week. Fruits had been consumed five days a week or more by 31.5% of the schoolchildren[11].

The 2012 *Pesquisa Nacional de Saúde do Escolar* surveyed 109,104 students aged 13 to 15 years and again found low FV intake: 43.4% and 30.2% of the schoolchildren consumed vegetables and fruits, respectively, weekly[12].

In *Santa Catarina,* Costa *et al*.[6] studied 4,964 schoolchildren aged 6 to 10 years and found that only 2.7% of the sample had adequate FV intake (>5 times a day), and that 26.6% had not consumed any FV on the study day.

In *Florianópolis* (SC), Costa *et al*.[7] studied 4,168 children aged 7 to 10 years to assess dietary changes after a five-year period (2002 and 2007) and found that the FV intake of children attending public and private schools decreased significantly by 22.9% and 27.8%, respectively, going from 90.1% in 2002 to 69.5% in 2007 for the former and from 94.1% in 2002 to 67.9% in 2007 for the latter.

The growing prevalence of obesity in children and adolescents[13-15] emphasizes the

importance of promoting a healthy lifestyle, including higher FV intake[9]. The nutritional basis behind the recommendation of higher FV intake is the possibility of FV replacing low-nutrient, energy-dense foods, such as refined grains and sugar, basic ingredients in processed and fast foods. In addition to their contribution to energy balance, they may also provide nutrients that benefit general health significantly[16].

The "Brazilian Food Guide" published in 2006 by the Ministry of Health recommends 3 servings of fruits and 3 servings of vegetables a day to prevent NCD[17]. The WHO[18] recommends a minimum FV intake of 400 grams a day. Global strategies to promote health and encourage higher FV intake began in the early 1990s; one such strategy is the 5-a-Day Program, which recommends 5 FV servings a day[19,20].

The World Health Organization encourages high FV intake to protect and promote health and healthy food habits, improving quality of life and decreasing NCD risk[1]. Knowledge about the importance of FV intake is critical, since childhood habits may persist throughout adulthood[6].

Given the scarcity of studies on the FV intake of children and adolescents, the objective of this study was to estimate the prevalence and analyze the factors associated with FV intake in schoolchildren aged 7 to 14 years from *Florianópolis* (SC).

METHODS

This cross-sectional study investigated a probabilistic sample of schoolchildren aged 7 to 14 years attending private and public schools in *Florianópolis* (SC). Data were collected 2007. The study was sponsored by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq - National Council for Scientific and Technological Development) (Process number 402322/2005-3).

The methods used for determining sample size and sampling are described elsewhere[13]. In summary, sample size was based on a prevalence of obesity of 10% for children aged 7 to 10 years[21] and of 17% for children aged 11 to 14 years[22], an error margin of 2%, and a design effect of 1.3, resulting in a sample size of 2,800 schoolchildren, 1,100 seven- to ten-year-olds and 1,700 eleven- to fourteen-year-olds. Considering a sample loss of 10%, the final sample should include 3,100 schoolchildren aged 7 to 14 years. Sampling consisted of two stages. In the first stage, the schools in *Florianópolis* (SC) were stratified by location (North, South, East, downtown, and continent) and ownership status (public or private). Schools in each geographical stratum were selected randomly, with probability proportional to stratum size. Thus, 11 public and 6 private schools were selected from the 87 schools in the municipality, 33 private and 54 public. In the second stage, the schoolchildren were randomly selected by age group, with equal probability, in each of the selected schools. The analyses to estimate prevalence and associated factors considered both the design effect and sampling plan. A total of 2,863 schoolchildren were surveyed. Children aged less than seven years (n=15) and more than fourteen years (n=12) were excluded, resulting in a sample size of 2,836 (99%) schoolchildren.

The study collected biological (gender, age, weight, and height), socioeconomic (family income, mother's education level, and school ownership status), and food intake (FV intake) data.

Gender, age, and school ownership status were collected from the lists provided by the schools, which were included in the questionnaire by a data pre-collection team. Socioeconomic data, such as family income and mother's education level, were collected by a self-administered questionnaire sent to the children's parents or guardians.

Anthropometric data were collected by trained anthropometrists as recommended by the WHO[23] and Lohman *et al*.[24]. This procedure allowed assessment of intra- and interpersonal measurement differences by calculating the Technical Error of Measurement (TEM)[25].

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Body weight was measured by the electronic scale Marte® model PP 180 (*Marte Balanças e Aparelhos de Precisão* Ltda, *São Paulo*, Brazil), with a capacity of 180 kg and accuracy of 50 grams. Height was measured by the stadiometer Alturexata® (Alturexata Ltda, *Belo Horizonte*, Brazil), with an accuracy of 1 mm.

The nutritional status of the schoolchildren was given by Body Mass Index (BMI) - for-age and gender, according to Cole *et al.*[26], as proposed by the International Obesity Task Force. BMI was calculated by dividing the weight in kilograms by the square of the height in meters. The children were then grouped into two groups: not overweight/obese and overweight/obese.

The independent variables were age group (children aged 7 to 9 years, adolescents aged 10 to 14 years); gender (male, female); mother's education level (never attended school or incomplete elementary school; complete elementary school or incomplete high school; complete high school or incomplete higher education; and complete higher education); family income per member (quartiles in *reais*); and school ownership status (private, public).

The *Questionário Alimentar do Dia Anterior* (QUADA, Previous Day Food Questionnaire)[27] questionnaire collected the foods consumed on the preceding day by the children. This 24-hour recall is validated and structured to assess the food intake of schoolchildren on a single day. The instrument layout and protocol were developed by dieticians, educators, and artists, taking into account age-related cognitive skills and ease of administration. The meals, foods, and food groups listed in the questionnaire are based on the dietary habits of these age groups, on the foods in the *Programa Nacional de Alimentação Escolar* (PNAE, National School Food Program's) menu, and those in the "Brazilian Food Guide"[27,17].

The questionnaire contains the illustration of 21 foods in four A4 paper sheets, structured into six daily meals (breakfast, morning snack, lunch, afternoon snack, supper, and bedtime snack). This allows identifying the proportion of schoolchildren who ate the 21 foods in the six meals of the preceding day, which can be assessed qualitatively by determining the nutritional profile represented by the different nutrient sources in each food group[27].

The students were informed that they would have to recall everything they ate the day before to fill out the questionnaire. Therefore, the team repeatedly mentioned the day before, and informed the students of meal times. The questionnaires with the students' names were given to the students by the research team and their teachers, who clarified eventual doubts discreetly to avoid distracting others. After the instruments were handed out, each having banners describing each meal and drawings of the foods according to the questionnaire, the research team read the following questions to the students: What did you eat yesterday? For breakfast? For the morning snack? For lunch? For the afternoon snack? For supper? For the bedtime snack? After each question, the students were asked to look carefully at the foods and circle those that they had consumed in that meal. The students were also told that if they had not had that particular meal, they should not circle any food; and that they should circle FV if they had consumed preparations containing FV.

The outcome variable was FV intake determined by QUADA and grouped as follows: adequate when intake was equal to or higher than five times a day and inadequate when intake was less than five times a day, as recommended by the 5-a-Day Program[19,20]. FV intake by the study sample was analyzed as follows: fruit intake; vegetable intake; and FV intake. Fruit intake was adequate when equal to or greater than two times a day, and vegetable intake was adequate when equal to or greater than three times a day.

A database was created in the software EpiData 3.2 and fully checked by trained data entry operators. Consistency and amplitude were checked automatically.

The data were treated by the software Stata version 9.0. The distribution of the population

by socioeconomic and biological variables is described statistically by frequency distribution tables. The Chi-square test (χ^2) measured the association between the independent (gender, age, family income *per capita*, mother's education level, and school ownership status) and dependent (FV intake) variables. All variables with $p<0.20$ in the χ^2 were included in unconditional multiple regression analysis. The prevalence *ratios* were estimated along with their respective crude and adjusted 95% Confidence Intervals (95% CI). The Mann-Whitney test compared FV intake between the overweight/obese and non-overweight/obese groups.

The design effect was taken into account in all analysis by using Stata's svy command, which analyzes data from complex samples. Associations with *p*-value <0.05 were considered significant.

The study protocol was approved by the Human Research Ethics Committee of the *Universidade Federal de Santa Catarina* (nº 028/2006). The subjects were included in the study after their parents or guardians signed an Informed Consent Form.

RESULTS

Of the 2,836 study schoolchildren, 1,478 (52.1%) were females, and 2,315 (75.3%) attended public schools. A total of 899 (32.8%) mothers had completed high school or some higher education. The family income per member of 722 (29.8%) schoolchildren was in the first quartile (≤540.00 *reais*) (Table 1). The mean age and standard deviation of the children was 11.3±2.2 years, the minimum age was 7 years and the maximum, 14 years. According to BMI, 2232 (78.0%) schoolchildren were not overweight/obese and 629 (22.0%) were overweight/obese.

Nearly everyone (n=2,700, 95.2%) had inadequate FV intake (<5 times a day). Moreover, 990 (34.9%) students reported not having eaten FV the day before. Fruits and vegetables were not

Table 1. Absolute and percentage distribution of the study schoolchildren aged 7-14 (n=2,836) by independent variables. *Florianopolis* (SC), Brazil, 2007.

Variables	n	%
Gender		
Female	1,478	52.1
Male	1,358	47.9
School ownership status		
Public	2,135	75.3
Private	701	24.7
Age (years)		
Children (7-9)	909	32.09
Adolescents (10-14)	1,924	67.91
Mother´s education level		
IES	692	25.2
CES	545	19.9
CHS	899	32.8
CHE	605	22.1
Family income per capita *(reals)*		
1st quartile (≤540.00)	722	29.8
2nd quartile (540.01 to 1,000.00)	529	21.8
3rd quartile (1,000.01 to 2,000.00)	580	23.9
4th quartile (<2,000.00)	592	24.5

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

Table 2. Absolute and percentage distribution, Confidence Interval of 95% (95%CI), mean, and Standard Deviation (SD) of adequate Fruit and Vegetable (FV) intake by students aged 7-14 years (n=2,836) by food group. *Florianopolis* (SC), Brazil, 2007.

Food groups	Adequate intake		95%CI	Mean		SD
	n	%				
Fruits	543	19.2	15.5 - 22.8	0.8	±	1.0
Vegetables	144	5.1	4.1 - 6.1	0.7	±	1.0
FV	135	4.8	3.7 - 5.9	1.5	±	1.6

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consumed by 1,531 (54.0%) and 1,602 (56.5%) schoolchildren, respectively.

Only 135 (4.8%) schoolchildren had adequate FV intake (95%CI=3.7-5.9%). FV, fruits, and vegetables were consumed a mean of 0.8±1.0, 0.7±1.0, and 1.5±1.6 times a day, respectively (Table 2).

The fruit (p=0.220), vegetable (p=0.25), and FV (p=0.250) intakes of overweight/obese and non-overweight/obese children did not differ. The medians for fruit and vegetable intakes were zero, regardless of nutritional status. On the other hand, the median FV intake was 1 in both groups.

Table 3 shows the crude and adjusted prevalence ratios of the study associations. The variables associated with adequate FV intake were school ownership status, mother's education level, and family income per member. The mother's education level was positively associated with FV intake in the intermediate education level strata (complete high school or incomplete higher education, p=0.027; complete elementary school or incomplete high school, p=0.04).

Variables with p<0.20 (school ownership status, mother's education level, and family income per member) were included in the adjusted analysis model. After adjustment, the only variable associated with outcome was family income per member (Table 3).

DISCUSSION

The study found that only 4.8% of the schoolchildren had adequate FV intake. This finding is concerning and indicates the need of creating and reassessing strategies that focus on a healthier diet for this population.

Table 3. Distribution of prevalence, Prevalence *Ratio* (PR), crude and adjusted Confidence Interval of 95% (95% CI), and *p*-value of the association between adequate fruit and vegetable intake and the independent variables of schoolchildren aged 7-14. *Florianopolis* (SC), Brazil, 2007.

Variables	% (95%CI)	Crude		Adjusted*	
		PR (95%CI)	*p*-value	PR (95%CI)	*p*-value
Gender					
Male	5.0 (3.0 -7.0)	1			
Female	4.5 (3.4-5.7)	0.90 (0.5-1.5)	0.670	-	-
School ownership status					
Public	4.3 (3.1-5.4)	1			
Private	6.3 (3.0-9.6)	1.50 (0.8-2.5)	0.126	-	-
Age (years)					
7-9	4.7 (2.8-6.7)	1			
10-14	4.7 (3.2-6.3)	1.00 (0.5-1.8)	0.337	-	-
Mother's education level					
CHE	6.5 (4.3-8.6)	1			
CHS	4.3 (2.8-5.9)	0.66 (0.4-0.9)	0.027	-	-
CES	4.0 (2.8-5.3)	0.61 (0.3-0.9)	0.040	-	-
IES	4.9 (2.8-5.3)	0.75 (0.4-1.4)	0.350	-	-
Family income per capita *(reais)*					
4th quartile (<2000.00)	6.9 (4.3-9.6)	1		1	
3rd quartile (1000.01-2000.00)	3.5 (1.9-5.0)	0.48 (0.2-0.8)	0.019	0.48 (0.2-0.8)	0.019
2nd quartile (540.01-1000.00)	3.2 (2.3-4.2)	0.45 (0.2-0.7)	0.007	0.45 (0.2-0.7)	0.007
1st quartile (≤540.00)	5.4 (2.7-8.1)	0.77 (0.7-1.4)	0.382	0.77 (0.7-1.4)	0.382

Note: *The adjusted analysis contains the variables with *p*-values <0.20.

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

Low fruit and vegetable intake in schoolchildren was also found by another Brazilian cross-sectional study of 390 adolescents aged 10 to 17 years conducted by Toral *et al*.[28] in *Piracicaba* (SP), which reported that roughly 28% of the adolescents did not reach the minimum intake of 3 servings of fruits and 3 servings of vegetables a day, as recommended by the Brazilian Ministry of Health's "Brazilian Food Guide"[17].

In agreement with these data, a study conducted by Costa *et al*.[6] in 8 municipalities of *Santa Catarina* with 4,964 schoolchildren aged 6 to 10 years found that FV were consumed a mean of 1.5 times/day; that only 2.7% of the sample had adequate FV intake (≥5 times per day); and that 26.6% had not consumed FV the day before.

Low fruit and vegetable intake was also found by Assis *et al*.[5] when they studied the food intake of 1,232 schoolchildren aged 7 to 10 years from *Florianópolis* (SC): 27.2% consumed fruits three times a day, 5.5% consumed vegetables two times a day, and 15% consumed FV five times a day.

Riediger *et al*.[9] studied 18,524 Canadian adolescents aged 12 to 19 years and found that almost 60% of them consumed FV less than five times a day.

Likewise, Pérez-Lizaur *et al*.[10] found that only 11.0% of 327 Mexican children aged 7 to 10 years consumed fruits three or more times a day, indicating low FV intake, and that girls consumed more FV than boys (15.2% and 6.7%, respectively).

The fruit and vegetable intake of the study overweight/obese and non-overweight/obese groups did not differ. Fagundes *et al*.[29] studied 218 children and adolescents aged 6 to 14 years from *Parelheiros*, a neighborhood in the municipality of *São Paulo*, and found that the obese, followed by the overweight, had the lowest FV intakes.

Hassapidou *et al*.[30] studied 512 Greek adolescents aged 11 to 14 years and found that overweight/obese adolescents adhered more to the Western diet and less to the traditional Mediterranean diet than normal weight adolescents. Overweight/obese adolescents consumed less fruits ($p<0.001$), leaf vegetables ($p<0.001$), and non-leaf vegetables ($p<0.001$) than normal weight adolescents.

In the present study, mother's education level and family income by member were associated with FV intake.

The association between parents' education level and FV intake was also found by other studies[9,31]. Godoy *et al*.[31] studied 437 male and female adolescents from the neighborhood of *Butantã*, municipality of *São Paulo*, aged 12 to 19 years and found that FV intake increased with the education level of the family head. The authors concluded that higher education level leads to better food-related knowledge, increasing food variety and promoting higher FV intake. Additionally, the present study found that adolescents in the fourth quartile of family income per member consumed significantly more FV than those in other quartiles.

A study of 18,524 Canadian adolescents aged 12 to 19 years found that family income was significantly associated with FV intake ($p<0.001$), and that higher parents' education level was associated with higher FV intake frequency ($p<0.001$)[9].

Similarly, Kristjansdottir *et al*.[32] studied 1,179 Icelandic adolescents and found that the parents' socioeconomic level was positively associated with the FV intake of boys ($p=0.04$) but not of girls ($p=0.43$), and with the fruit intake of girls ($p<0.01$) but not of boys ($p=0.25$).

Toral *et al*.[28] studied 390 adolescents aged 10 to 17 years from *São Paulo* but did not find differences in FV intake by gender.

Instituto Brasileiro de Geografia e Estatística 2009 PeNSE survey of 60,973 students aged 13 to 15 years found that vegetable intake was not affected by gender (31.3% for females and 31.2% for males); in state capitals and the Federal

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District, 31.5% of the sample consumed fruits five or more days a week, regardless of gender[8].

A study with Canadian adolescents aged 12 to 19 years found that the percentage of girls (31%) who consumed fruits two to four times a day was significantly higher than that of boys (26%) ($p<0.05$). The percentage of girls (41%) who consumed FV five to ten times a day was also significantly higher than that of boys (35%) ($p<0.05$)[9].

The present study did not find association between age and outcome, contrary to a Canadian study of adolescents aged 12 to 19 years that found significantly different fruit ($p<0.05$) and FV ($p<0.001$) intakes between two age groups[9].

One of the study limitations was the use of FV intake frequency (times per day), considering adequate an intake frequency equal to or greater than five times a day. As mentioned earlier, the Brazilian Ministry of Health[17] and the WHO[18] recommend intake in grams and number of servings, respectively. Thus, this methodological strategy may have over- or underestimated FV intake. However, other studies have used 'FV intake frequency (times per day)' as proxy of 'number of FV servings per day'[5-7].

Another limitation regards the use of QUADA to investigate FV intake, a questionnaire based on the 24-hour recall[27]. The present study used the questionnaire for assessing a single food intake day of the schoolchildren, which may estimate a day's FV intake accurately, but not the habitual FV intake. However, single-day assessment has been proven adequate and is often preferred by some studies, especially those that involve large, complex samples[6,7,23,33].

CONCLUSION

Schoolchildren aged 7 to 14 years from the municipality of *Florianópolis* (SC) do not meet the FV intake recommended by the 5-a-Day Program. Of the study variables, only family income *per capita* was associated with FV intake.

More knowledge is needed about the FV intake of children and adolescents and its associated factors, which can then be used for guiding and implementing local health policies that encourage FV intake, promoting healthy eating practices and consequently, preventing NCD.

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CONTRIBUTORS

CR GALEGO analyzed and interpreted the results and wrote the manuscript. GL D'AVILA wrote and reviewed the manuscript. FAG VASCONCELOS conceived the study, and structured and reviewed the manuscript.

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ORIGINAL | *ORIGINAL*

Regional food dishes in the Brazilian National School Food Program: Acceptability and nutritional composition

Preparações regionais no Programa Nacional de Alimentação Escolar: aceitabilidade e composição nutricional

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ABSTRACT

Objective

The objective of this study was to evaluate the nutritional composition and describe the acceptability of regional culinary dishes served to students from public schools of rural and urban areas.

Methods

Ten Brazilian regional dishes were evaluated for acceptability and nutritional composition. The survey was conducted in schools located in rural and urban areas of two cities in the state of *São Paulo*. Dish acceptability was evaluated using leftover analysis and a 5-point facial hedonic scale. The adherence index was calculated and used as an indirect measure of acceptance, and the nutritional composition was calculated based on the technical files of each dish.

Results

A total of 2,384 students from 20 schools participated in the study and 1,174 tasted and evaluated the dishes. The test using the 5-point facial hedonic scale demonstrated that five dishes (*Caldo verde* soup, persimmon

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jelly, chicken with okra, puréed cornmeal with spinach, and arugula pizza) had an acceptability rate above 85.0%. The mean adherence indices were 57.3% and 55.6% in urban and rural environments, respectively. Analysis of the nutritional composition of regional dishes indicates that these dishes can partially meet macronutrient recommendations.

Conclusion

The tested dishes can become part of school menus as they were accepted or partly accepted by the students regardless of school location, whether rural or urban. The cultural heritage is an important resource for the food sovereignty of a country and should be constantly encouraged.

Indexing terms: Food habits. Nutrition programs and policies. Public policies. School food.

RESUMO

Objetivo

Avaliar a composição nutricional e descrever a aceitabilidade de preparações regionais servidas aos estudantes de escolas públicas de áreas rurais e urbanas.

Métodos

Dez preparações regionais brasileiras foram avaliadas quanto à aceitabilidade e à composição nutricional. A pesquisa foi realizada em escolas localizadas em áreas rurais e urbanas de duas cidades no estado de São Paulo. A aceitabilidade dos alimentos foi avaliada por meio da análise de restos e da escala hedônica facial de 5 pontos. O índice de adesão foi calculado e utilizado como medida indireta da aceitação. A composição nutricional foi calculada com base nas fichas técnicas de cada prato.

Resultados

Participaram do estudo 2 384 estudantes de 20 escolas públicas; destes, 1 174 provaram e avaliaram os pratos. A avaliação por meio da escala hedônica facial de 5 pontos demonstrou que cinco pratos (caldo verde, geleia de caqui, frango com quiabo, angu com espinafre e pizza de rúcula) tiveram um percentual de aceitabilidade acima de 85,0%. O percentual médio de adesão à alimentação escolar foi de 57,3% e 55,6% em escolas urbanas e rurais respectivamente. A análise da composição nutricional das preparações regionais indicou que os pratos testados podem ser fontes de vários micronutrientes e atender parcialmente as recomendações de macronutrientes exigidas pela legislação.

Conclusão

Os pratos testados podem tornar-se parte do cardápio escolar, pois foram aceitos ou parcialmente aceitos pelos alunos, independentemente da localidade da escola. O patrimônio cultural é um recurso importante para a soberania alimentar de um país e deve ser constantemente estimulado.

Termos de Indexação: *Hábitos alimentares. Políticas públicas. Programas e políticas de nutrição e alimentação. Alimentação escolar.*

INTRODUCTION

The development of eating habits starts in pre-school and will reflect directly on children's growth and development[1]. Therefore, being aware of what is offered and how food choices are made during this phase of life are important, since eating habits incorporated in this phase will influence health in adulthood[1,2]. Associated with family and environmental factors, the school has a key role in forming healthy eating habits because in school the child can acquire autonomy over what he or she eats primarily if associated with nutrition education programs[1].

The *Programa Nacional de Alimentação Escolar* (PNAE, National School Food Program) is characterized as one of the longest-lasting public policies in Brazil. It constitutes an important strategy for food and nutrition security, while promoting the "Human Right to Adequate Food"[3,4]. It ensures permanent and continuous

access to quality foods and in adequate quantity without compromising other essential needs.

This policy covers 45.6 million students enrolled in basic education of the public networks of Brazil every day of the year[4]. One goal of the program is to provide free food to students, ensuring at least 20% of the students' daily nutritional needs, with a variety of foods prioritizing the children's dietary adherence and acceptability[5,6]. It also seeks to prioritize respect for eating habits and the regional produce in order to promote local development[5,7]. The incorporation of regional dishes in school menus can contribute to the preservation of the Brazilian food culture, bearing in mind the magnitude of the program.

Therefore, it is possible to unify two major aspects of this program, a healthy and adequate diet with respect to regional habits, mainly because most regional dishes involve fruits and vegetables[8]. Despite the legal requirement that menus of school food programs must meet the local nutritional references, eating habits, food culture, and tradition[7], a significant number of school food menus does not include regional foods, particularly in the country's North and Midwest regions[9]. Additionally, the menus in large Southern capitals contained few regional food items or regional dishes[10].

Appreciation for dietary practices based on local characteristics and traditional foods has increased because the process of globalization is characterized by homogenization and standardization in various orders[11]; however, this appreciation seems to be little explored by states and municipalities. The insertion of regional foods and regional dishes in school food programs can promote the local cultural identity and improve the acceptability of the menus[10].

Acceptability is therefore an important indicator for assessing and deciding whether these preparations should compose the menu of school meals.

Tests of acceptance of meals offered in schools are required by federal law[5] and are important instruments for verifying how the dietary habits and preferences of the students are ensured by the school meals.

Few studies address issues related to school food and food culture, and none directly assesses the acceptance of regional dishes in this environment. In this context the objective of this study was to evaluate the nutritional composition and describe the acceptability of regional dishes served to students in rural and urban areas. These data will essentially contribute to the eating habits of these communities as well as determine which foods should be introduced to the menus in order to enhance regional culture and encourage nutrient intake.

METHODS

This *cross-sectional, descriptive study was conducted* from February to December 2009 and included 20 public schools. The inclusion criteria were: second to fifth graders of either gender aged seven to ten years attending a public school in one of two Brazilian municipalities located in the Southeast region of the country. The schools had no canteens selling food, a factor that demonstrably affects adherence and acceptability of school meals[12].

We used simple random sampling. One hundred students were enrolled for each dish test, which was sufficient considering absences and refusals. These students were selected randomly from the six study schools, three urban and three rural. Sample size determination was based on guidelines in Bartlett *et al.*[13] and calculated using Cochran's[14] method, assuming a 5% alpha level (type I error), a 3% margin of error, and two regions in each municipality: urban and rural[15].

Regional dishes

The following ten regional dishes from the Brazilian Southeast, where the study was conducted, were evaluated in the schools: 1) puréed cornmeal with spinach (cornmeal mixed

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in a blender with water, cooked with spinach); 2) star fruit cake (dish based on wheat flour, egg, milk, or water, oil or margarine, yeast, sugar, and puréed star fruit, decorated with pieces of star fruit); 3) rice pudding with mango (rice cooked in milk and sugar to which mango pieces and cinnamon are added); 4) jackfruit conserve (seedless jackfruit segments with added sugar, water, lemon juice, and spices, such as cloves and cinnamon); 5) arugula pizza (disc of fermented flour dough, sprinkled with tomato sauce and topped with cheese and arugula); 6) green beans and corn flour (stir fried green beans mixed with corn flour); 7) kale with garlic (kale cut into thin strips stir fried with garlic and olive oil); 8) chicken with okra (chicken cooked with seasonings and spices plus okra); 9) *caldo verde* soup (green broth - creamy potato broth to which finely sliced cooked kale, seasonings, and pepperoni are added); 10) persimmon jelly (persimmon pulp mixed in blender and cooked with sugar and lemon juice).

The main ingredients of the selected dishes are present in the guidelines of the regional food guide of the Brazilian Ministry of Health[8] to promote the dissemination of Brazilian fruits and vegetables.

All study dishes were selected based on the results of a survey conducted by the Brazilian Ministry of Health. According to these results, all the chosen dishes were frequently consumed in the Southeast region. The recipes will be part of the second edition of the "Brazilian Regional Food Guide".

Caldo verde soup and arugula pizza were served as complete meals without any supplement. For the other dishes, a vehicle or supplement was served approaching the dishes to the reality of the school food. The dishes puréed cornmeal with spinach, green beans and corn flour, and kale with garlic were offered with rice, beans and meat. Chicken with okra was served with rice and beans. Persimmon jelly was served with cream-cracker biscuit. The other dishes are fruit-based desserts that followed a meal consisting of one kind of cereal, one vegetable, and meat.

These dishes were prepared and tested previously in the Laboratory of Dietetic Techniques of *Universidade de Brasília* to create a detailed technical file containing: ingredients, quantity of each ingredient, yield, and nutritional value and portion (carbohydrates, proteins and lipids). The dishes were also chosen based on highly consumed ingredients in the Southeast[16] at an affordable cost, and all dishes needed to have, on their list of ingredients, at least one fruit or vegetable.

In the school all dishes were prepared by school food handlers. The researchers assisted food handlers during the preparation to make sure they followed the recipe correctly. All the ingredients were weighed using a digital scale.

The portions of food served to each student were standardized. These portions were appropriate to the students' ages and served as customary.

Evaluation of acceptance of regional dishes

The researchers administered the questionnaires, collected data, and assisted the food handlers during food preparation.

Two methods were used to evaluate the acceptance of regional dishes: Leftover analysis and the 5-point facial hedonic scale. These two tests are recommended for this purpose by the Brazilian legislation[7].

Test 1: Leftover analysis

Leftover analysis was based on the method described by Abreu *et al.*[17], by calculating the percentages of rejection and acceptance. The method uses equations 1 and 2 below to find the rejection and acceptance percentages:

(equation 1)

$$\text{Rejection percentage} = \frac{(\text{weight of the meal rejected x } 100)}{\text{weight of distributed meal}}$$

(equation 2)

$$\text{Acceptance percentage} = 100 - \text{Rejection percentage}$$

The weight of the food that has been rejected and left on the plate is considered the rejected meal; the distributed meal is the weight of the meal produced minus that one which was not served to the student. For this test we used a scale with a maximum capacity of 20 kilograms and an accuracy of 10 grams.

Test 2: 5-point facial hedonic scale using a form

The 5-point facial hedonic scale used in the study was described by Lawless & Heymann[18] and da Cunha *et al.*[19]. The mixed 5-point facial hedonic scale[4] with five faces was used, representing the categories: "hated it," "disliked it," "indifferent," "liked it," and "loved it" with the corresponding numbers 1-5. The student was asked to fill in a form indicating the degree of satisfaction regarding the study dish, as recommended by the Brazilian legislation[5]. The categorical scale was dichotomized to calculate the percentage of acceptance. The hedonic scale scores 1, 2, and 3 were grouped together, categorizing this region of the scale as a rejection area, and the scores 4 and 5, regarding the hedonic terms "liked" and "loved", were grouped together, corresponding to the acceptance area of the scale. Then the percentage of students who accepted each dish was calculated and compared with the cut-offs established by the National School Food Program regulation: acceptability ≥85% using the hedonic scale method and ≥90% using the leftover analysis to consider the dish accepted[5,19].

The study dishes were classified into five categories based on the acceptability rate given by the 5-point facial hedonic scale and leftover analysis, as follows: if the acceptability rate ranged from 0 to 19.9% - the students "hated the meal"; 20.0 to 39.9% - "disliked it"; 40.0 to 59.9% -"indifferent"; 60.0 to 79.9% - "liked it"; and 80.0 to 100.0% -"loved it".

Dishes classified as "liked it" and/or "loved it" were deemed accepted by the students.

Dietary adherence by the students to the study dishes was also determined. This datum provides complementary information to the tests of acceptability and leftovers.

Adherence index

The adherence index included a calculation to see how many students ate on the day the dish was served, an indirect measure of acceptance of dishes served as shown in equation 3.

(equation 3)

$$\text{Adherence Index} = \frac{(\text{number of students who consumed the meal x } 100)}{\text{number of students in school}}$$

The researchers tried not to call the attention of the students to the research in order to leave them at ease and not to interfere on the adherence index.

Data analysis

The technical files of the preparations were used for counting the nutrients and energy content of each study dish. The study nutrients were: carbohydrates (g) protein (g), lipids (g), fiber (g), retinol (mcg), ascorbic acid (mg), iron (mg), calcium (mg), magnesium (mg), and zinc (mg). For all nutrients, the adequacy for the study age group was given by the nutritional recommendations of the current program[5], based on the recommendations of the Dietary Recommended Intake[20]. The software Avanutri Online® calculated the nutrients and energy content of the study dishes only. The nutritional composition of the accompaniments was not included in this calculation.

Contingency tables with the outcome accept/reject were prepared to determine

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differences in acceptability and adherence between the school children of urban and rural areas, and the Chi-square test with Yates correction or Fisher's exact test for values lower than five were used.

We calculated the correlation between the acceptability values obtained in the 5-point facial hedonic scale and leftover analysis. For these calculations, we used the intra-class correlation coefficient. The Spearman correlation test investigated the relationship between the adherence results and acceptability measures.

Data were analyzed using the software Statistical Package for the Social Sciences (SPSS) 15.021 and, in all tests, $p<0.05$ was considered significant.

The project was approved by *Universidade Federal de São Paulo*'s Research Ethics Committee under Protocol nº 0307/08 on March 14, 2008, and all parents or children's guardians signed an Informed Consent Form.

RESULTS AND DISCUSSION

A total of 2,384 students from 20 schools participated in the study and of these 1,174 tasted and evaluated the dishes using the 5-point facial hedonic scale.

Table 1 shows the nutritional composition of the study dishes. The dishes provided a diverse amount of essential nutrients for the dietary requirements and nutrition of school children in this age group.

The following four study dishes were served with accompaniments: puréed cornmeal with spinach, green beans and corn flour, kale with garlic, and chicken with okra. They were served with rice and beans. The combination of cereal and legume, most commonly rice and beans, is also part of the Brazilian food tradition. In a study conducted in southeastern Brazil, the combination of rice and beans was the only preparation that appeared weekly in the school menu for five weeks[22]. A household budget survey conducted by the Brazilian government during the years 2008 and 2009 shows that 84.0% of the population consumes rice and 72.8% consumes beans daily[16].

The nutritional content of the preparations was calculated individually, without the addition of accompaniments like: rice, beans, bread, or meats. None of the preparations met the recommendation of at least 300 kcal, 48.8 g of

Table 1. Nutritional composition of the regional dishes without supplements. *Santos* (SP), Brazil, 2010.

	Dishes*									
	1	2	3	4	5	6	7	8	9	10
Portion (g)	121.00	80.00	135.00	85.00	98.00	57.00	35.00	90.00	410.00	15.00
Energy (kcal)	68.02	138.75	129.45	183.19	169.14	90.41	27.60	58.63	222.42	21.32
Carbohydrates (g)	12.29	29.28	28.69	43.18	26.61	15.97	4.00	1.92	28.06	5.25
Proteins (g)	2.77	2.72	2.89	1.69	6.36	1.77	1.20	8.98	8.46	0.05
Lipids (g)	0.86	1.20	0.35	0.41	4.14	2.16	0.76	1.67	8.48	0.01
Fibers (g)	2.00	1.43	0.66	1.81	1.57	3.31	1.00	0.36	3.34	0.76
Vitamin A (μg)	84.45	25.68	26.96	26.20	58.29	25.51	278.96	5.46	239.58	0.01
Vitamin C (mg)	4.12	7.63	4.12	67.69	8.44	4.73	38.43	2.19	78.58	0.15
Calcium (mg)	15.19	23.70	54.28	36.51	75.67	12.62	47.17	16.88	88.66	2.16
Iron (mg)	0.52	0.61	0.22	0.59	0.93	0.80	0.58	0.40	1.58	0.03
Magnesium (mg)	23.63	7.11	12.79	37.40	14.10	23.29	11.32	13.33	35.16	1.07
Zinc (mg)	0.28	0.23	0.43	0.40	0.30	0.38	0.17	0.29	0.50	0.02

Note: *Nutritional composition of the regional dishes without accompaniments and vehicle. Dishes: 1: puréed cornmeal with spinach; 2: star fruit cake; 3: rice pudding with mango; 4: jackfruit conserve; 5: arugula pizza; 6: green beans and corn flour; 7: kale with garlic; 8: chicken with okra; 9: *caldo verde* soup ; 10: persimmon jelly.

carbohydrate, 9.4 g of protein, and 5.4 g of fiber established by the Brazilian federal law for children aged 6 to 10 years in school part-time[7]. Therefore, it is essential to accompany these dishes with other foods, especially foods that complement their nutritional characteristics, i.e., that offer, along with the chicken with okra, a source of carbohydrate and a fruit. Of the ten study dishes, five supplied 100% of the Estimated Average Requirement (EAR) of vitamin C (ascorbic acid). Three other dishes provided at least 50% of the nutritional recommendations (Table 1).

The dishes kale with garlic and *caldo verde* soup provided 100.0% of the students' EAR for vitamin A. Both contain kale, a plant rich in β-carotene, a carotenoid with 100.0% pro-vitamin A activity. Two other dishes, puréed cornmeal with spinach and arugula pizza, provided 84.4% and 58.3%, respectively, of the EAR for vitamin A.

As for minerals, all preparations but persimmon jelly met the magnesium requirement. The calcium, iron, and zinc requirements were not met by any of the preparations.

Figures 1 and 2 show the distribution of percent acceptabilities of regional dishes obtained using the methods 5-point facial hedonic scale and leftover analysis, respectively.

With regard to acceptance by analyzing the 5-point facial hedonic scale, three dishes showed acceptability rate above 85% (chicken with okra, persimmon jelly and *caldo verde* soup) in urban areas. In rural areas, four dishes showed these acceptability levels (puréed corn meal with spinach, arugula pizza, persimmon jelly, and *caldo verde* soup). Three preparations had percent acceptabilities above 90% in the leftover analysis for urban schools (kale with garlic, persimmon jelly, and *caldo verde* soup) and four for rural schools (star fruit cake, arugula pizza, chicken with okra, and persimmon jelly). These results differ from the ones obtained by the hedonic scale.

Consuming an entire meal, leaving no leftovers, and accepting them in terms of preferences and satisfaction are different in nature. Acceptability is a hedonic experience characterized by a definite positive attitude

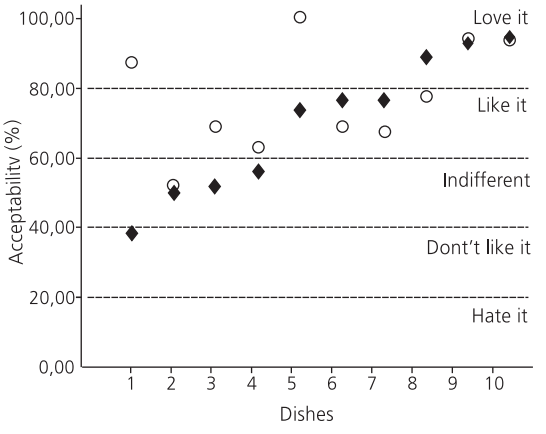

Figure 1. Acceptability rate of regional dishes tested in (˙) urban and (o) rural schools using the 5-point facial hedonic scale. *Santos* (SP), Brazil, 2010.

Note: Dishes: 1: puréed cornmeal with spinach; 2: star fruit cake; 3: rice pudding with mango; 4: jackfruit conserve; 5: arugula pizza; 6: green beans and corn flour; 7: kale with garlic; 8: chicken with okra; 9: *caldo verde* soup; 10: persimmon jelly.

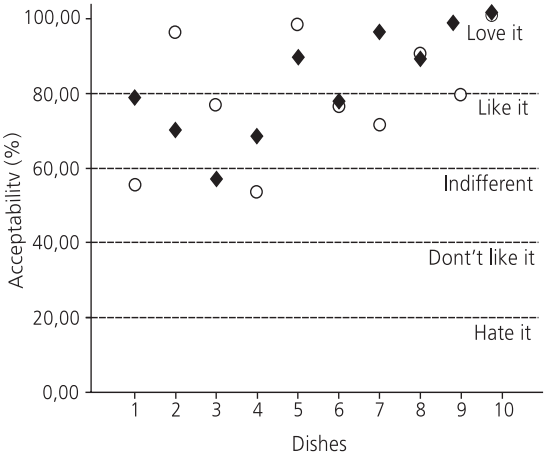

Figure 2. Acceptability rate of regional dishes tested in (˙) urban and (o) rural schools using leftover analysis. *Santos* (SP), Brazil, 2010.

Note: Dishes: 1: puréed corn meal with spinach; 2: star fruit cake; 3: rice pudding with mango; 4: jackfruit conserve; 5: arugula pizza; 6: green beans and corn flour; 7: kale with garlic; 8: chicken with okra; 9: *caldo verde* soup; 10: persimmon jelly.

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towards the object being analyzed and thus can be considered an affective test[25]. Accordingly, preparations with high acceptability rate evaluated by affective tests, but with low acceptability rate evaluated by leftover analysis (like chicken with okra in the urban schools and puréed corn meal and *caldo verde* soup in rural schools) can be included in the menu combined with nutrition education and strategies that reduce food waste, such as appropriate food portions, and that enhance student awareness on this issue.

The acceptabilities measured by the hedonic scale indicate that, with the exception of puréed cornmeal with spinach in urban schools, all dishes had acceptability rate above 50%. Preparations with a porridge consistency, like puréed cornmeal with spinach, are generally associated with infant/elderly food by scholars or understood as a dish culturally designed for dinner[24]. Therefore, these preparations generally have low acceptability and low adherence index in schools, as observed in this study. The other study dishes can become part of school menus, as they were accepted or partly accepted by the students regardless of where the school was situated, whether in rural or urban areas. Acceptance, especially by children, requires time, access, and exposure to a food or preparation. The child needs to get used to the food or dish before accepting it. Thus, the percentages of acceptability can be considered reasonable, since this was the first time these dishes were offered in school meals[25].

Figure 2 shows that 90% of the dishes, both in urban and rural areas, were classified as "liked" and/or "loved" according to leftover analysis. The dishes star fruit cake and rice pudding with mango were classified in rural and urban schools, respectively, as "indifferent." Leftover analysis is an indirect measure of acceptability, since it quantifies the food rejected in relation to the food served. High acceptability scores obtained by this method show not only a positive attitude towards the dishes but also little waste.

Jordanna[26] defines traditional food as 'a product that must be linked to a territory, and it must also be part of a set of traditions, which will necessarily ensure its continuity over time" (p.147). Hence, regional food dishes, from the perspective of tradition, involve sociological, cultural, environmental, and not only nutritional aspects[27]. The insertion (or recovery) of regional dishes in modern food systems requires recovering the self-awareness of the population[27]. In this direction the introduction of regional dishes during childhood can promote consumption of these dishes in the future and consequently, improve the maintenance of food culture.

The perception of those involved with this policy is another factor that can favor the inclusion of regional dishes in school food programs. Members involved with school food programs associate the rescue of regional dishes with a healthy diet[11] since these dishes generally contain fruits, vegetables, and regional products, and do not use processed foods. Brazilian public policies also include the rescue of regional food habits, included in the school food program in the 1970s[28] and maintained to this day by the legislation[5]. This fact reinforces the program's potential as a food security policy helping Brazil to achieve the development goals for the millenium[29].

Table 2 shows acceptability rate according to the hedonic scale and adherence indexes towards the regional dishes in both environments. The dishes puréed cornmeal with spinach (85.71%) and arugula pizza (98.02%) had higher acceptability in rural areas ($p<0.05$), whereas in urban areas the most accepted dishes were persimmon jelly (93.33%) and *caldo verde* soup (93.23%). This difference in acceptance between students of urban and rural areas may be due to a portion of the population having greater access to some dishes. For example, the urban population has greater access to industrialized or

processed foods than the rural population, resulting in higher household availability of these foods[30]. In Brazil, the consumption of pizzas is four times higher in urban areas[16], and due to greater exposure to this type of dish, children from urban areas possibly show less interest towards arugula pizza, leading to greater compliance and acceptance by children from rural schools.

Significant differences were observed in the percent adherences of rural and urban schools for same-dish comparisons (Table 2). However, the region where the school was located did not influence general adherence since the adherence was higher for five dishes in urban schools and for another four dishes in rural areas. From these results it can be inferred that food adherence was not associated with a geographical factor. In both urban and rural environments, the average adherence index was 57.3% and 55.6%, respectively. Other studies found lower rates of adherence in school food programs, like 23.2% in the city of *Chapecó* (SC)[31], 46% in the city of *Piracicaba* (SP)[12] and 33.5% in *Paraíba* State[32]. Sturion *et al.*[12] reported a profile characterizing the type of student that adheres to the program. This profile described them as being nutritionally compromised and coming from a family of lower income and education levels. The justification for this low adherence was attributed to poor management of the program that was conducted in a centralized manner until 1994, when the planning of menus, purchasing of groceries, quality control, and food distribution were countrywide, providing mainly processed foods, generating menu monotony, and not giving enough emphasis to cultural and regional aspects[4,12]. In this context, valuing the cultural aspects of each Brazilian region can contribute significantly to school meal adherence by preparing menus that not only include fruits and vegetables, but are also part of the local dietary habit.

Table 2. Acceptability rate using the hedonic scale and adherence indexes for the regional dishes. *Santos* (SP), Brazil (2010).

Dishes	Site	Acceptance		Rejection/ Indifference		*p*	Eat/Tried the dish		Did not eat/Did not try the dish		*p*
		n	%	n	%		n	%	n	%	
Puréed cornmeal with spinach	Rural	6	85.71	1	14.29	0.03*	7	4.11	163	95.89	<0.001
	Urban	14	38.89	22	61.11		36	44.44	45	55.56	
Star fruit cake	Rural	14	51.85	13	48.15	0.91	27	19.85	109	80.15	<0.001
	Urban	6	50.00	6	50.00		12	70.58	5	29.42	
Rice pudding with mango	Rural	28	68.29	13	31.71	0.08	41	89.13	5	10.87	<0.001
	Urban	72	51.43	68	48.57		140	44.35	146	55.65	
Jackfruit conserve	Rural	10	62.50	6	37.50	0.85	16	13.55	102	86.45	<0.001
	Urban	29	55.77	23	44.23		52	55.91	41	44.09	
Arugula pizza	Rural	99	98.02	2	1.98	<0.001*	101	87.82	14	12.18	0.002
	Urban	24	72.73	9	27.27		33	66.00	17	34.00	
Green beans and corn flour	Rural	64	68.09	30	31.91	0.40	94	89.52	11	10.48	0.390
	Urban	52	75.36	17	24.64		69	41.31	98	58.69	
Kale with garlic	Rural	52	66.67	26	33.33	0.33	78	90.69	8	9.31	0.002
	Urban	49	75.38	16	24.62		65	26.00	185	74.00	
Chicken with okra	Rural	29	76.32	9	23.68	0.24	38	52.05	35	47.95	<0.001
	Urban	61	87.14	9	12.86		70	82.35	15	17.65	
Caldo verde soup	Rural	12	92.31	1	7.69	1.00*	13	20.00	52	80.00	<0.001
	Urban	104	91.23	10	8.77		114	44.35	143	55.65	
Persimmon jelly	Rural	100	92.59	8	7.41	0.99*	108	90.00	12	10.00	0.390
	Urban	56	93.33	4	6.67		60	93.75	4	6.25	

Note: *Fisher's exact test.

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An intra-class correlation coefficient of 0.77 (0.36-0.95) was observed between acceptability according to the 5-point facial hedonic scale and leftover analysis. This result indicates consistency between the methods with regard to acceptability.

Stone & Sidel[25] investigated the validity of sensory methods for measuring whether the results of a particular test are consistent with the facts. In this context, the present study shows the correlation between the test (5-point facial hedonic scale) and the fact (leftover analysis). Therefore, leftover analysis also proved to be an effective method for assessing the acceptability of children to the regional dishes served, although this does not have a hedonic nature, as it has been previously observed by Meiselman & Schutz[33]. The use of an ingestion test to predict the acceptability of a meal showed a positive, highly significant, correlation ($p<0.001$) for salads, pizza and tea. The Brazilian legislation recommends both tests to evaluate acceptability in the school environment[7].

Adherence also showed significant intra-class correlation with the methods of assessing acceptability, being 0.83 for the 5-point facial hedonic scale ($p<0.01$) and 0.64 for the leftover analysis ($p<0.05$). This could be explained considering that children tend to eat foods they like, they know, or are used to. Thus, dishes with high adherence also showed high acceptability by both methods (5-point facial hedonic scale and leftover analysis). According to an American study, repeated exposure to food with a fruit and vegetable base increases the chance that children will want to try the dish (adherence). Over time, adherence promotes better acceptance[25]. This finding, similar to that obtained in our study, suggests that adherence and acceptance are correlated measures. However, new studies should be undertaken to better understand their relationship.

CONCLUSION

With the exception of puréed cornmeal with spinach, the study regional dishes presented acceptability rate above 50% as verified by different methods (affective and analytical), both in urban and rural areas. The dishes presented in this study are innovative, have fruits and vegetables in their composition, and were used for the first time in school meals. The use of regional dishes may require time, so it is important to maximize the exposure of students to these preparations associating nutrition education strategies. Thus, these preparations can possibly reach the percentage set by law, and may be part of the school menu continuously.

Analysis of the nutritional composition of the regional dishes indicates that these dishes are sources of several micronutrients, and the macronutrient composition can be consistent with the law regarding the school food program. The importance of dieticians in menu creation is noteworthy since they identify the best time to insert these dishes, considering: ingredients, seasonality, menu complexity, and nutritional composition of the other dishes.

The relationship between acceptability according to the 5-point facial hedonic scale and leftover analysis was identified. We suggest that those responsible for school food programs choose one of these two methods and analyze their results together with the adherence index. The combination of adherence index and acceptability rate can promote a greater understanding of food and dish acceptance.

Brazil is a country made up of many different nationalities and therefore, has great cultural and food diversity. The cultural heritage is an important resource for the food sovereignty of a country and should be constantly encouraged. In this sense, it is important to begin serving these dishes during childhood, contributing to the formation of healthy habits and meeting the requirements of the National School Food Program.

CONTRIBUTORS

DT CUNHA contributed to the study design, data collection, data analysis, interpretation of data

and drafting of the manuscript; HVB GONÇALVES and AFA LIMA contributed to the data collection, data analysis and manuscript writing; PA MARTINS and VV ROSSO contributed for the study design, data analysis, manuscript writing and critical review of the manuscript; E STEDEFELDT contributed to the study design, data analysis, interpretation of data and critical review of manuscript.

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Overweight in Brazilian industry workers: Prevalence and association with demographic and socioeconomic factors and soft drink intake

Excesso de peso em trabalhadores de indústrias no Brasil: prevalência e associação com fatores demográficos, socioeconômicos e consumo de refrigerantes

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ABSTRACT

Objective

To estimate the prevalence of overweight in industry workers and its association with demographic and socioeconomic factors and soft drink intake (including type).

Methods

This is a nationwide cross-sectional cohort survey of "Lifestyle and leisure habits of industry workers" conducted between 2006 and 2008 in 24 Brazilian federate units. The participants answered a previously tested questionnaire and self-reported their weight and height. Statistical analyses consisted of crude and adjusted Poisson regression.

Results

Males and females had overweight prevalences of 45.7% (95%CI=45.1; 46.2) and 28.1% (95%CI=27.4; 28.9) respectively. Older and married individuals and those working in medium-sized and large factories were more likely to be overweight. Males with higher education levels and gross family incomes were also more likely to be overweight, but not females. Finally, men (PR=1.24; 95%CI=1.13; 1.36) and women (PR=1.40;

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95%CI=1.22; 1.61) who consumed diet/light soft drinks were also more likely to be overweight than those who did not consume soft drinks.

Conclusion

More than one-third of the workers were overweight according to their self-reported weight and height, and the prevalence of overweight was higher in males. Demographic and socioeconomic variables and diet/light soft drink intake were associated with overweight. These data may be helpful for the development of actions that reduce the risk of overweight in this population.

Indexing terms: Adults. Obesity. Overweight. Soft drink. Workers.

RESUMO

Objetivo

Estimar a prevalência de excesso de peso e sua associação com fatores demográficos, socioeconômicos e com o consumo e tipo de refrigerante ingerido.

Métodos

Trata-se de um inquérito nacional, de corte transversal, sobre o "Estilo de vida e hábitos de lazer de trabalhadores da indústria", realizado nos anos de 2006 a 2008, em 24 unidades federativas do Brasil. As informações foram obtidas por meio de um questionário previamente testado, inclusive a informação sobre o excesso de peso (autorrelato do peso e da estatura). Regressões de Poisson bruta e ajustada foram realizadas.

Resultados

A prevalência de excesso de peso foi de 45,7% (IC95%=45,1; 46,2) nos homens e 28,1% (IC95%=27,4; 28,9) nas mulheres. Identificou-se que o aumento da idade, ser casado e o tamanho das empresas (médio e grande porte) associaram-se a maiores probabilidades para o excesso de peso. Quanto maior a escolaridade e a renda familiar bruta entre os homens, maior a probabilidade de excesso de peso, tendo sido observada situação contrária entre as mulheres. Homens (RP=1,24; IC95%=1,13; 1,36) e mulheres (RP=1,40; IC95%; 1,22; 1,61) que relataram consumir refrigerantes diet/light também apresentaram maior excesso de peso quando comparados àqueles que relataram não consumir refrigerantes.

Conclusões

Em seus autorrelatos, mais de um terço dos trabalhadores foram classificados com excesso de peso, com maior prevalência entre os homens. Variáveis demográficas, socioeconômicas e consumo de refrigerantes diet/light *se mostraram associados ao excesso de peso. Tais informações podem auxiliar na elaboração de ações direcionadas para redução da probabilidade do excesso de peso nesse grupo.*

Termos de Indexação: *Adultos. Obesidade. Sobrepeso. Refrigerante. Trabalhadores.*

INTRODUCTION

The prevalence of overweight has been increasing as the amount of energy spent working, commuting, and performing house chores decreases[1]. This phenomenon tends to affect specific groups[2], but the current situation is changing, that is, overweight is no longer a risk factor exclusive to high-income individuals[3]. Excess weight is considered one of the main public health problems in developed and developing countries because of its close relationship with numerous health problems[4] and its impact on government funds for the treatment of related diseases[5].

According to the World Health Organization (WHO), approximately 300 million adults were obese in 2005, and this number is expected to rise to 700 million by 2015[6]. From 1980 to 2008, the prevalence of overweight increased 15.4% (n=1,296 million people) in the study countries. In this 28-year period, the number of obese individuals in the United States (56 million), China (42 million), Brazil (20 million), and Mexico (18 million) increased considerably[7].

In Brazil the survey showed that the number of obese individuals never ceases to increase[8]. According to the *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance of Risk and Protective Factors for Chronic Diseases Telephone Survey) conducted in 2012 by the Ministry of Health, the proportion of overweight people increased from 43.2% in 2006 to 51.0% in 2012. During this same period, the percentage of obese individuals increased from 11.6% to 17.1%[9].

Studies have shown that the prevalence of overweight increases with age[10] and marriage[11-13]. Women are also more vulnerable to overweight, especially those with low income and education level[14]. Another important factor that can contribute to the overweight epidemic is the intake of beverages with added sugar, especially soft drinks, given their high added sugar content, low satiety, and incomplete compensation for total energy[15]. Malik *et al.*[16] have found a worldwide increase in soft drink intake and obesity prevalence in the last decades. Adult Brazilians have also increased soft drink intake significantly[17,18].

This study intends to investigate the relationship between demographic and socioeconomic variables and overweight in industry workers, and whether soft drink intake and type are associated with overweight because of excessive advertising encouraging the intake of specific soft drinks to minimize the negative impact of excess intake on health. Therefore, the study intends to estimate the prevalence of overweight in industry workers and its association with demographic and socioeconomic factors and soft drink intake and type.

METHODS

This study is part of a national survey of "Lifestyle and leisure habits of industry workers" conducted by the *Serviço Social da Indústria* (SESI, Social Service for Industry Workers) and the *Núcleo de Pesquisa em Atividade Física e Saúde* (NuPAF, Research Center for Physical Activity and Health) of the *Universidade Federal de Santa Catarina* (UFSC) from 2006 to 2008, which included 24 of the 27 Brazilian federate units. The states *Rio de Janeiro, Piauí*, and *Sergipe* did not participate in the study in a timely manner.

Sample size was based on an overweight prevalence of 45%, sampling error of 3%, 95% confidence interval, and design effect of 1.5. An extra 20% were added to compensate for losses and refusals. The final sample consisted of 52,774 workers recruited in two phases: 1) the workers were stratified according to industry size, given by the number of workers as follows: small (20-99); medium-sized (100-499), and large (≥500); 2) the workers by industry size were also stratified by Brazilian region, subdivisions of a Regional Department. The number of workers by industry size by region was proportional to that found in the reference population. Next, the factories were randomly selected. Each Brazilian region included 10% to 50% of the factories in each size category, according to the number of existing factories and number of workers necessary to compose the sample. Finally, the workers were selected systematically in each selected industry using lists provided by the factories with the workers' names. Further information is available elsewhere[19].

The participants answered a previously validated questionnaire with 58 questions. This study used eleven questions on demographic and socioeconomic aspects and soft drink intake. Chart 1 shows the data collection method and operationalization of the dependent and independent variables.

Initially we used the distribution of relative frequencies with its respective 95% Confidence Intervals (95%CI) to measure the associations between the study variables and overweight. Next, crude and adjusted Poisson regression determined which demographic and socioeconomic variables and soft drink intake and type were associated with overweight. The variables were included in the adjusted model according to the following hierarchic levels: level 1 (age and marital status); level 2 (education level and gross family income); level 3 (industry size

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and location); and level 4 (soft drink intake and type). All analyses were stratified by gender. The significance level was set to 5% ($p<0.05$). The questionnaire was scanned by the software Sphynx. All statistical analyses were performed by the software Stata version 11.

Chart 1. Study Variables in industry workers, Brazil, 2006-2008.

Variables	Answer options	Operational categories
Dependent		
Excess weight	Self-reported measurements: Body weight (kg) Height (m)	Based on BMI: Normal weight ≤24.9 kg/m^2 Overweight ≥25 kg/m^2
Independent		
Regional Department	All study federate units (24), separated by geographic region.	South Southeast Midwest Northeast North
Industry size	Small: 20 to 99 employees; Medium-sized: 100 to 499 employees; Large: 500 or more employees	Small Medium-sized Large
Gender	Male; Female	Male; Female
Age (years)	<30 years 30-39 years 40-49 years ≥50 years	<30 years 30-39 years ≥40 years
Marital status	Single Married or living with partner Widowed Divorced/Separated	Married Other (all other categories)
Education level	Incomplete elementary school Complete elementary school Complete high school Complete higher education	Incomplete elementary school Complete elementary school Complete high school Complete higher education
Gross family income* (*per* month)	Up to 600 *reais* 601 to 1,500 *reais* 1,501 to 3,000 *reais* more than 3,000 *reais*	Up to 600 *reais* 601 to 1,500 *reais* More than 1,500 *reais*
Soft drink intake**	Never 1 day 2 days 3 days 4 days 5 days 6 days 7 days	Never 1 to 3 days 4 to 6 days 7 days
Type of soft drink	Does not consume soft drinks Regular Diet/Light Any	Does not consume soft drinks Regular Diet/Light Any

Note: *Minimum salaries in 2006 (R$350,00); 2007 (R$380,00); 2008 (R$415,00); **Consumption during a regular week.

BMI: Body Mass Index.

The survey was approved by the Research Ethics Committee of the UFSC, Brazil, under Protocol numbers 306/2005 and 009/2007. The SESI, our survey partner, authorized this secondary data analysis.

RESULTS

This survey had a response rate of 90.6% or 47,886 workers. Of these, 490 (1.0%) did not report their gender, and 1,888 (4.0%) did not

Table 1. Prevalences of overweight in industry workers and respective 95% confidence intervals by demographic and socioeconomic variables. Brazil, 2006-2008 (*n*= 45,508).

Variables	N	%	Males			Females		
			N	%	95%CI	N	%	95%CI
			31,956	45.70	45.14; 46.23	13,552	28.12	27.36; 28.88
Age (n=45,344)								
Less than 30 years	21,005	46.33	14,495	34.46	33.69; 35.24	6,510	17.88	16.94; 18.81
30-39 years	14,049	30.98	9,730	52.12	51.13; 53.12	4,319	33.47	32.07; 34.88
40 + years	10,290	22.69	7,611	58.83	57.73; 59.94	2,679	44.30	42.42; 46.19
Marital status (n=45,406)								
Other*	19,908	43.85	12,485	35.46	34.62; 36.30	7,423	23.54	22.58; 24.51
Married	25,498	56.15	19,392	52.26	51.56; 52.96	6,106	33.65	32.46; 34.84
Education level (n=45,422)								
Incomplete elementary school	8,359	18.40	6,836	45.04	43.86; 46.22	1,523	40.38	37.91; 42.84
Complete elementary school	7,068	15.56	5,426	42.94	41.62; 44.25	1,642	31.42	29.17; 33.67
Complete high school	23,345	51.40	15,915	44.21	43.44; 44.98	7,430	26.21	25.21; 27.21
Complete higher education	6,650	14.64	3,725	57.04	55.45; 58.63	2,925	24.71	23.15; 26.28
*Gross family income** (n=45,135)								
Up to 600 *reais*	14,268	31.61	10,296	36.55	35.62; 37.48	3,972	29.45	28.03; 30.87
601 to 1,500 *reais*	18,752	41.55	13,392	46.17	45.33; 47.02	5,360	27.91	26.70; 29.11
≥1,501 *reais*	12,115	26.84	8,006	56.38	55.29; 57.46	4,109	26.96	25.60; 28.32
Industry size (n=43,058)								
Small	10,598	24.61	7,524	42.75	41.63; 43.87	3,074	25.86	24.31; 27.41
Medium-sized	15,865	36.85	11,636	46.00	45.09; 46.90	4,229	27.71	26.36; 29.06
Large	16,595	38.54	11,254	47.72	46.80; 48.64	5,341	30.16	28.93; 31.39
Region (n=45,508)								
South	6,565	14.43	3,943	45.42	43.86; 46.97	2,622	26.04	24.36; 27.72
Southeast	5,879	12.92	3,996	43.31	41.78. 44.85	1,883	24.58	22.64; 26.53
Midwest	7,762	17.06	5,545	44.47	43.16; 45.78	2,217	26.29	24.46; 28.13
Northeast	14,114	31.01	10,076	48.71	47.74; 49.69	4,038	32.51	31.07; 33.96
North	11,188	24.58	8,396	44.10	43.04; 45.16	2,792	27.54	25.88; 29.20
*Consumes soft drinks*** (n=45,380)								
Never	5,713	12.59	3,299	49.46	47.76; 51.17	2,414	30.40	28.56; 32.24
1-3 days	25,707	56.65	17,967	45.40	44.67; 46.13	7,740	28.43	27.43; 29.44
4-6 days	9,475	20.88	7,165	44.94	43.78; 46.09	2,310	25.10	23.33; 26.87
7 days	4,485	9.88	3,426	45.30	43.63; 46.96	1,059	27.19	24.51; 29.87
*Type of soft drink*** (n=42,822)								
Does not consume	4,491	10.49	2,691	49.86	47.97; 51.76	1,800	30.94	28.80; 33.08
Regular	29,417	68.70	21,944	43.43	42.78; 44.09	7,473	25.06	24.08; 26.04
Diet/Light	2,488	5.81	1,282	66.45	63.87. 69.04	1,206	39.88	37.11; 42.65
Any	6,426	15.00	4,342	49.53	48.05; 51.02	2,084	31.28	29.29; 33.27

Note: *Minimum salaries in 2006 (R$350.00), 2007 (R$380.00), 2008 (R$415.00); **Intake during a regular week.

95%CI: 95% Confidence Interval.

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report their weight and/or height, so the final sample consisted of 45,508 (95.0%) workers. Table 1 describes the sample. Most workers were male (70.2%), aged more than 30 years (53.9%), married (56.0%), had completed high school (51.3%), and had a gross family income of R$601.00 to R$1,500.00 (41.2%).

The general prevalence of overweight was 40.5%, greater in men (45.7%) than women (28.1%). Greater prevalences of overweight were found in married men, older individuals, individuals with higher gross family income, individuals with complete higher education, individuals from medium-sized and large

Table 2. Overweight prevalence ratios and 95% confidence intervals in male industry workers by demographic and socioeconomic variables and soft drink intake. Brazil, 2006-2008.

Variables	Crude PR	95%CI	Adjusted PR	95%CI
Age				
Less than 30 years	1.00		1.00	
30-39 years	1.51	1.45; 1.57	1.40	1.34; 1.46
40 +	1.71	1.64; 1.78	1.55	1.49; 1.62
Marital status				
Other	1.00		1.00	
Married	1.47	1.42; 1.53	1.28	1.23; 1.33
Education level				
Incomplete elementary school	1.00		1.00	
Complete elementary school	0.95	0.90; 1.01	1.04	0.98; 1.10
Complete high school	0.98	0.94; 1.02	1.11	1.06; 1.16
Complete higher education	1.26	1.20; 1.34	1.33	1.26; 1.40
Gross family income[*]				
Up to 600 *reais*	1.00		1.00	
601 to 1,500 *reais*	1.26	1.21; 1.32	1.19	1.14; 1.24
≥1,501 *reais*	1.54	1.48; 1.61	1.36	1.29; 1.43
Industry size				
Small	1.00		1.00	
Medium-sized	1.08	1.03; 1.12	1.06	1.02; 1.11
Large	1.12	1.07; 1.17	1.07	1.02; 1.12
Region				
South	1.00		1.00	
Southeast	0.95	0.89; 1.02	1.03	0.99; 1.08
Midwest	0.98	0.92; 1.04	0.97	0.92; 1.02
Northeast	1.07	1.02; 1.13	0.90	0.85; 0.95
North	0.97	0.92; 1.03	0.99	0.92; 1.06
Consumes soft drinks[**]				
Never	1.00		1.00	
1-3 days	0.92	0.87; 0.97	0.99	0.94; 1.05
4-6 days	0.91	0.86; 0.96	1.00	0.94; 1.07
7 days	0.92	0.85; 0.98	1.02	0.95; 1.10
Type of soft drink[**]				
Does not consume	1.00		1.00	
Regular	0.87	0.82; 0.92	0.94	0.88; 1.00
Diet/Light	1.33	1.22; 1.45	1.24	1.13; 1.36
Any	0.99	0.93; 1.06	1.06	0.98; 1.15

Note: [*]Minimum salaries in 2006 (R$350.00), 2007 (R$380.00),2008 (R$415.00); [**]Intake during a regular week.

PR: Prevalence Ratio; 95%CI: 95% Confidence Interval.

companies, and individuals from the Brazilian Northeast region. The prevalence of overweight was also higher in men and women who did not consume soft drinks during the week than in those who did. Workers who consumed diet/light soft drinks were also more likely to be overweight than those who did not (Table 1).

In the crude regression analysis, marriage, higher age, higher education levels, higher gross family income, and working in large factories increased risk of overweight. There was also an inverse relationship between overweight and soft drink intake. In the adjusted analysis, the variables that remained associated with overweight were

Table 3. Overweight prevalence ratios and respective 95% confidence intervals in female industry workers by demographic and socioeconomic variables and soft drink intake. Brazil, 2006-2008.

Variables	Crude PR	95%CI	Adjusted PR	95%CI
Age				
Less than 30 years	1.00		1.00	
30-39 years	1.87	1.73; 2.02	1.78	1.64; 1.93
40 +	2.48	2.29; 2.69	2.38	2.19; 2.58
Marital status				
Other	1.00		1.00	
Married	1.43	1.34; 1.52	1.26	1.18; 1.34
Education level				
Incomplete elementary school	1.00		1.00	
Complete elementary school	0.78	0.69; 0.87	0.90	0.80; 1.01
Complete high school	0.65	0.59; 0.71	0.84	0.76; 0.92
Complete higher education	0.61	0.55; 0.68	0.73	0.65; 0.81
Gross family income[*]				
Up to 600 *reais*	1.00		1.00	
601 to 1,500 *reais*	0.95	0.88; 1.02	0.95	0.88; 1.03
≥1,501 *reais*	0.92	0.84; 0.99	0.90	0.82; 0.99
Industry size				
Small	1.00		1.00	
Medium-sized	1.07	0.98; 1.17	1.11	1.01; 1.21
Large	1.17	1.07; 1.27	1.16	1.07; 1.27
Region				
South	1.00		1.00	
Southeast	0.94	0.84; 1.06	1.06	0.97; 1.16
Midwest	1.01	0.90; 1.13	0.91	0.81; 1.01
Northeast	1.25	1.14; 1.37	0.87	0.78; 0.98
North	1.06	0.96; 1.17	0.92	0.82; 1.04
Consumes soft drinks[**]				
Never	1.00		1.00	
1-3 days	0.94	0.86; 1.02	1.02	0.94; 1.12
4-6 days	0.83	0.74; 0.92	0.99	0.88; 1.11
7 days	0.89	0.78; 1.02	1.07	0.93; 1.24
Type of soft drink[**]				
Does not consume	1.00		1.00	
Regular	0.81	0.74; 0.89	0.89	0.79; 1.00
Diet/Light	1.29	1.14; 1.46	1.40	1.22; 1.61
Any	1.01	0.90; 1.13	1.12	0.98; 1.28

Note: [*]Minimum salaries in 2006 (R$350.00), 2007 (R$380.00),2008 (R$415.00); [**]Intake during a regular week.

PR: Prevalence Ratio; 95%CI: 95% Confidence Interval.

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age ($PR_{\geq 40}$=1.55; 95%CI=1.49; 1.62); marital status ($PR_{married}$=1.28; 95%CI=1.23; 1.33); education level (PR_{higher}=1.33; 95%CI=1.26; 1.40); gross family income ($PR_{\geq 1.500}$=1.36; 95%CI=1.29; 1.43); type of soft drink ($PR_{diet/light}$=1.24; 95%CI=1.13; 1.36), and industry size, but only slightly. After adjustment, location was also associated with overweight: men from the Northeast region were less likely to be overweight (10%) than those from the Southern Region (Table 2).

In women, crude analysis showed that being married, higher age, lower education level, and lower family income increased the prevalence of overweight. Women working in large factories and from the Brazilian Northeast region also had higher prevalence ratios for obesity. Diet/light soft drink intake was also associated with overweight. On the other hand, soft drink intake on four to six days a week was associated with a smaller risk of overweight. After adjustments, the following variables remained associated with excess weight: age ($PR_{\geq 40}$=2.38; 95%CI=2.19; 2.58); marital status ($PR_{married}$=1.26; 95%CI=1.18; 1.34); industry size (PR_{large}=1.16; 95%CI=1.07; 1.27); and type of soft drink ($PR_{diet/light}$=1.40; 95%CI=1.22; 1.61). Education level (PR_{higher}=0.73; 95%CI=0.65; 0.81) and gross family income ($PR_{\geq 1,500}$=0.90; 95%CI=0.82; 0.99) were inversely associated with overweight (Table 3).

DISCUSSION

Demographic and socioeconomic variables are associated with excess weight. While higher education level and gross family income increase the risk of overweight in men, these indicators reduced the risk in women. Also, the frequency of soft drink intake was not associated with overweight. However, type of soft drink (specifically diet/light) increased the risk of overweight in men and women by 24 and 40%, respectively.

The study strengths include the representativeness of the sample for Brazilian industry workers, the use of a previously tested questionnaire, and the surveyed region (countrywide). On the other hand, self-reported weight and height has limitations, since individuals may underestimate their weight and overestimate their height. However, an epidemiologic study found that the use of self-reported measurements for determining nutritional status has good validity compared with measured weight and height[20]. Anyway, the prevalences of overweight and the associations with borderline 95%CI, that is, close to 1.00, should be interpreted with caution; the former, because of possible information bias, and the latter, because the sample size allows type 1 error.

Another study also found a positive relationship between overweight prevalence and higher age[21]: individuals aged more than 40 years are four times more likely to be overweight than those aged 20 to 29 years. Married workers also had a higher overweight prevalence than single workers[22]. A systematic review[13] reported that marriage is associated with weight gain and can be explained by more shared and regular meals, more portions, and lower physical activity and concern with body weight[11,12].

Higher income and education level were positively associated with overweight in the study men and negatively associated in the study women. For McLaren *et al*.[23], obesity seems to be more stigmatized in women[14]. Women with higher socioeconomic status are more aware of the causes and consequences of overweight and feel more pressure to stay in shape[21]. Meanwhile, men are not as affected by this social phenomenon despite the belief that larger bodies convey greater dominance and power[3].

The Brazilian Northeast region had a higher prevalence of overweight than the Southern region. Another study of adult Brazilians found higher prevalences of overweight in the more developed regions of the country, such as the South, Southeast, and Midwest, but obesity was increasing in the North and Northeast regions and in low-income individuals[24]. The prevalence

of overweight is also higher in large factories[25]. Geraldo *et al.*[26] analyzed dietetic aspects of the meals served in factories of *São Paulo* city and found that medium-sized and large factories offer higher-energy meals and meals with higher polyunsaturated fatty acid and cholesterol contents than very small and small factories, despite the higher availability of fruits and non-starchy vegetables.

Men who did not consume soft drinks were more likely to be overweight. This finding may stem from retrocausality in the association between soft drink intake frequency and excess weight since people with excess weight can modify their intake as a consequence of their nutritional status. However, no association was found in women despite findings that soft drink intake frequency is positively associated with overweight prevalence[15,27]. The absence of association may be due to the study not assessing the amount consumed. Another issue is that overweight is caused by many factors, and often, attributing the findings to the direct effect of a single factor may be a mistake.

Studies have found that soft drinks are Brazilians' main source of added sugar[18,28]. The *Instituto Brasileiro de Geografia e Estatística* (IBGE, Institute of Geography and Statistics) reported that Brazilians consume more than 15 million liters of soft drinks a day, and that regular soft drinks are the sixth most consumed food in Brazil, losing only to coffee, beans, rice, beef, and juices. Intake of beverages with added sugar may be one of the main contributors to overweight because of the high amount of sugar added to these beverages, their low satiety, and incomplete compensation for total energy[15]. According to Baak & Astrup[29], even more studies have associated beverages with added sugar and obesity. The association is possibly caused by sugar's low effect on satiety, which may increase intake.

Additionally, Fowler *et. al.*[30] suggest that the intense sweetness of artificial sweeteners may condition individuals to prefer sweets and thereby stimulate appetite, but this area remains controversial. The present study found a higher prevalence of overweight in diet/light soft drink consumers. Other studies have found a positive association between daily diet soft drink intake and higher waist circumference[27], and daily diet soft drink intake may also promote weight gain[31]. Studies less prone to causality thanks to longer follow-ups and more measurements found insignificant associations between overweight and diet soft drink intake[32]. Some pieces of evidence suggest that a subset of diet soft drink consumers consume them to compensate for the intake of high-energy foods[33].

Overweight adult Brazilians underreport food intake[34]. In the study sample, those with higher body mass index may have underreported their habitual regular soft drink intake, underestimating the usual intake frequency and masking their real intake. Another recent study has found that advertising and advertising strategies were associated with the increasing prevalences of overweight[35]. However, more studies are necessary to determine the magnitude of the effect of soft drink intake and type on adults' body weight, thereby maximizing intervention effectiveness.

CONCLUSION

The prevalence of overweight was high in industry workers, especially in males, and increased in males and females with age and marriage. Workers from medium-sized and large factories and those from the Brazilian Northeast region also had a higher prevalence of overweight. Moreover, gross family income and education level were positively associated with overweight in males and negatively associated in females. Consumers of diet/light soft drinks had the highest prevalence of overweight. These results indicate the importance of promoting educational campaigns and interventions in the workplace, encouraging workers to adopt good food habits and practice physical activity at the

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workplace to minimize the prevalence of overweight workers and ill health effects caused by this condition. Additionally, new studies are needed to clarify the relationship between overweight and predisposing factors to provide data for the development and implementation of programs that promote healthier lifestyles in industry workers.

CONTRIBUTORS

PM SILVEIRA and JA SILVA helped to conceive the study, review the literature, interpret the data, write and review the article, and approve the final version. KS SILVA helped to conceive the study, analyze and interpret the data, write and review the article, and approve the final version. ESA OLIVEIRA, MVG BARROS, and MV NAHAS created and coordinated the project, managed data collection, helped to outline the manuscript, and reviewed and approved the final article.

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Eating behavior toward oil and fat consumption *versus* dietary fat intake[1]

Comportamento alimentar para consumo de óleos e gorduras versus *consumo alimentar de lipídeos da dieta*

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ABSTRACT

Objective

To analyze whether the stages of change of the Transtheoretical Model are in accordance with the fat consumption of members of the *Academia da Cidade* of *Belo Horizonte*, *Minas Gerais*.

Methods

This cross-sectional study included a simple random sample of users aged ≥20 years frequenting an *Academia da Cidade*. Eating behavior toward oil and fat consumption was evaluated by the transtheoretical model and compared with fat intake adequacy, obtained through mean fat intake was investigated by three 24-hour recalls. Anthropometric and sociodemographic data were also collected. Additionally, the stages of change were verified, after reclassification the stages of change agreed with the consumption of fatty foods, fats, and fractions.

Results

A total of 131 women with a mean age of 53.9±12.1 had an average fatty acid consumption of 556.0 mL. Some participants consumed high-fat foods, lipids (20.6%), saturated (31.3%) and polyunsaturated (38.2%)

[1] Article based on the master's thesis of RAM MOREIRA intitled "*Aplicação do modelo transteórico para consumo de óleos e gorduras e sua relação com consumo alimentar e estado nutricional em um serviço de promoção de saúde* ". Universidade Federal de Minas Gerais; 2010.

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fatty acids, and cholesterol (16.0%) in excess. The stages of eating behavior were significantly different after reclassification. The number of women in action and maintenance decreased in a way that in the end, 4.6% were in precontemplation, 19.8% were in contemplation, 26.0% were in preparation, 28.2% were in action, and 21.4% were in maintenance. The consumption of chicken skin; fatty salad dressing; bread, doughnuts or cake with butter/margarine; and fats, saturated fatty acids, and monounsaturated fatty acids was lower in the final stages of the transtheoretical model.

Conclusion

After reclassification the algorithm is in agreement with the ingestion of high-fat foods, which denotes its applicability for the evaluation of eating behavior and for providing data to food and nutrition education actions.

Indexing terms: Feeding behavior. Food consumption. Lipids. Models, theoretical.

RESUMO

Objetivo

Analisar se os estágios de mudança, segundo o Modelo Transteórico, estão de acordo com o consumo de gorduras por parte de usuárias da Academia da Cidade de Belo Horizonte, Minas Gerais.

Métodos

Estudo seccional com amostra aleatória simples de usuárias (≥20 anos) da Academia da Cidade. Avaliou-se o comportamento alimentar para consumo de óleos e gorduras pelo Modelo Transteórico; posteriormente, confrontou-se tal comportamento com a adequação da ingestão de lipídeos, obtida pela média de três recordatórios 24 horas, e coletaram-se dados antropométricos e sociodemográficos. Adicionalmente, verificou-se se os estágios de mudança, após reclassificação, estavam em consonância com o consumo de alimentos gordurosos, lipídeos e frações.

Resultados

Avaliaram-se 131 mulheres com média de idade de 53,9±12,1 anos, apresentando consumo mediano de óleo de 556,0 mL; ingestão excessiva de alimentos ricos em gorduras, lipídeos (20,6%), ácidos graxos saturados (31,3%) e poli-insaturados (38,2%) e colesterol (16,0%). Os estágios de comportamento alimentar foram significativamente diferentes após reclassificação, com redução de mulheres em ação e manutenção; ao final, 4,6% das mulheres estavam em pré-contemplação, 19,8% em contemplação, 26,0% em decisão, 28,2% em ação e 21,4% em manutenção. O consumo de pele de frango, de molho com gordura para salada, de pães, rosquinhas ou bolos com manteiga/margarina, de lipídeos, de ácidos graxos saturados e monoinsaturados foi inferior nos estágios finais do Modelo Transteórico.

Conclusão

O algoritmo, após reclassificação, apresenta-se em consonância com a ingestão de alimentos ricos em lipídeos, o que denota sua aplicabilidade para avaliar o comportamento alimentar e subsidiar ações de educação alimentar e nutricional.

Termos de Indexação: *Comportamento Alimentar. Consumo de alimentos. Lipídeos. Modelos teóricos.*

INTRODUCTION

Nutrition transition is characterized by higher consumption of sugars and fats, mainly from animal origin; lower consumption of grains, legumes, fruits, and vegetables; and more away-from-home meals. These changes lead to an unfavorable health landscape that promotes Chronic Non-communicable Diseases (NCD), such as obesity, high blood pressure, and diabetes *Mellitus*[1].

In this sense, it is crucial to evaluate the characteristics of people's dietary habits, especially the quantity and quality of the fats consumed[2], to promote healthier dietary practices.

However, interventions aimed at changing dietary habits demand complex actions[2] based on

the understanding of social, cultural, economic, physiological, and hedonistic determinants, among others[3]. Hence, different theories have been developed, with an emphasis on the transtheoretical model[4] proposed by Prochaska *et al.*[5,6]. This model suggests that individuals perform behavioral changes in stages denominated precontemplation, contemplation, preparation, action, and maintenance[5]. During these stages the individual ponders upon his behavior and considers what kind of attitude to take and the moment to act[6].

Results of studies that used the transtheoretical model to phase the consumption of oils and fats showed the importance of differentiating individuals within stages of dietary behavioral changes to increase intervention effectiveness. It is then possible to determine and implement the most effective actions, improving the results of the proposed behavior changes[7-10].

After nutrition interventions based on the stages of change, individuals reported a lower intake of calories[7-9], fats, and fatty foods[7-9], mainly in the stages of action and maintenance; and a higher intake of fiber, fruits, and vegetables[9]. Such changes improved participants' serum lipid levels and blood pressure[10]. Additionally, participants advanced in stages, such that most individuals were in the action and maintenance stages at the end of the study[7]. Notwithstanding, strategies that prevent relapses and promote stage advancement, mainly to the stages of preparation, action, and maintenance, need to be implemented[7-9].

To do so, a fundamental part of this process is to use a specific algorithm to identify individuals' current stages of change. Different algorithms regarding the consumption of oils and fats have been proposed, and in some of them, classification is based on questions that consider only the intention of lowering oil and fat intakes. Thus, the classification of the stage of change will depend on an individual's ability to perceive his diet correctly[11].

Therefore, incorrect perception of oil and fat consumption might lead to an incorrect classification of the stage of change, compromising intervention selection[12]. Thus, it is critical to use an algorithm that agrees with individuals' fat consumption and allows reclassifying their stages of change according to their dietary intake and perceptions.

Given the above, this study analyzed whether the transtheoretical model's stages of change are in accordance with the fat consumption of *Belo Horizonte* (MG) *Academia da Cidade* (City Gym) users.

METHODS

This is a cross-sectional study with users of a health-promoting service, the City Gym of *Belo Horizonte* (MG), which is part of the *Sistema Único de Saúde* (Unified Health Care System). It aims to promote regular physical activity and a healthy diet. The study City Gym was founded in 2006 and is located in the Eastern Sanitary District of Belo Horizonte, one of the city's regions with the highest level of Social Vulnerability (SVI=0.77)[13]. This establishment has a capacity of 400 individuals. Users join spontaneously or are referred by the Family Health Groups of the nearby Primary Health Care Units.

The present study is part of the first phase of a major project called "*Desenvolvimento de Intervenções Nutricionais realizadas nas Academias da Cidade pertencentes ao Projeto BH Saúde - Belo Horizonte - MG*" (Development of Nutrition Interventions at the City Gyms of the Project BH Health - *Belo Horizonte* - MG), which consists of three phases: phase 1) identification of the baseline stage of change of eating behavior toward fat and oil consumption; phase 2) planning and development of interventions according to the stages of change of eating behavior toward fat and oil consumption and their implementation in workshops; and phase 3) re-administration of the stages of change algorithms to evaluate stage progression and intervention effectiveness.

A random sample of City Gym users dedicated to the development of the three phases of the major project was taken based on the

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following parameters: significance level of 5%; power of explaining the effectiveness of the interventions by switching stages of eating behavior toward fat and oil consumption of 80%; difference of stage changing on the eating behavior after development of nutrition intervention of 15%; and a 53% dropout rate during the 14 months of development of the project due to the attrition rate of users of the City Gym.

Sample size calculation was based on all eligible individuals aged 20 years or more who joined the City Gym between October 2007 and November 2008, totaling 336 individuals. Application of the sample parameters resulted in a sample of 168 individuals randomly divided into two groups of physical activity, Group 1 (Mondays, Wednesdays, and Fridays); and Group 2 (Tuesdays, Thursdays, and Saturdays).

The study inclusion criteria were: being female, since most City Gym users are women; not having participated in nutrition interventions related to oils and fats; and having undergone physical and nutritional assessment.

The following data were collected: sociodemographic data; oil consumption; and anthropometric data. The following instruments were used: the Portuguese version of the algorithm for fat and oil consumption proposed by Greene & Rossi[7] whose use has been authorized in Brazil[14]; and the 24-Hour dietary Recall (24 HR).

The algorithm was administered in stages. In the first part, the participant reported her perception regarding the consumption of oils and high-fat foods; whether she avoided high-fat foods and if so, since when; or for how long did she intend not to reduce his oil and fat intake. She was then classified into one of the five stages of change of eating behavior. In the second part, the women classified as being in the action and maintenance stages were quantitatively evaluated to compare their mean consumption of total fats, given by three consecutive 24 HR, with the stages of change and determine whether they needed to be reclassified. The individuals with appropriate fat consumption, that is, less than 30% of the total dietary energy coming from fats, were classified into action or maintenance, according to the first part. The third part consisted of reclassifying the remainder (those with more than 30% of the total calorie intake coming from fats) into the stages of precontemplation, contemplation, and preparation based on four questions related to the consumption of high-fat foods and one question related to the consumption of fruits and vegetables together with hig-fat-foods[7,14].

The 24-hour dietary recall assessed food consumption. This method was chosen for its higher accuracy and applicability to individuals of low education levels. The three 24 HR were administered every other day, including one weekend day, to cover inter-day food intake variability[15]. To optimize portion size estimates, the 24 HR used household measures.

The foods listed in the 24 HR were converted into grams and milliliters using a specific food composition table. The amounts were then transformed into nutrients using the program DietWin Software *de Nutrição*© (version 2006, DietWin Inc, *Porto Alegre*, RS) with added food composition tables and commercial food preparations and labels when needed. Evaluation of calorie and macronutrient followed the Institute of Medicine[16] (IOM) criteria; and of fatty acids and cholesterol, the World Health Organization[17] (WHO) criteria.

The monthly per capita oil consumption was given by taking the number of oil bottles used in the household monthly, converting the total volume to mL, and dividing by the number of persons consuming them. The reference values of 1 to 2 portions were used to determine oil intake adequacy, as proposed by the Food Pyramid for the Brazilian Population[18], that is, a minimum of 240 mL and a maximum of 480 mL.

Weight, height, and Waist (WC) and Hip (HC) Circumferences were measured as recommended by the WHO[19]. Body Mass Index (BMI) was calculated by dividing the weight by

the square of the height and Waist-To-Hip *ratio* (WHR), by dividing the WC by the HC.

Adult body mass index was classified as recommended by the WHO[20] and older adult BMI, as recommended by the Nutrition Screening Initiative[21]. Metabolic risk was assessed by WC[19] and the risk of developing cardiovascular diseases, by the WHR[19].

The data were treated by the software Statistical Package for the Social Sciences (SPSS) for Windows (version 17.0).

After descriptive analysis, the Kolmogorov-Smirnov test assessed variable distribution. The variables with normal distribution are expressed as Means ± Standard Deviations (SD) and the others, as medians and 95% Confidence Intervals (95%CI).

The Fisher's exact test verified associations between variables. For the variables with normal and non-normal distributions, one-way Analysis of Variance (Anova) and the Kruskal-Wallis test, respectively, measured the differences between the stages of change on dietary behavior and fat consumption and its fractions. The Mann-Whitney test identified the stage(s) of change associated with the significant differences. The significance level was set at 5% for all tests.

Table 1. Characterization of the sample with regard to sociodemographic characteristics and nutritional status. *Belo Horizonte* (MG), Brazil, 2009.

Variables	Mean/Median	Standard Deviation/Confidence Interval
Sociodemographic data		
Age (years)*	53.9	12.1
Age group (%)		
Adults	68.7	-
Elderly	31.3	-
Education (years)**	7.0	6.2 - 7.8
Residents in the household**	4.0	3.4 - 3.9
Per capita monthly income (reais)***	311.25	324.32 - 431.28
Professional occupation (%)		
Housewife	47.3	-
Pensioner	15.5	-
Maid	3.6	-
Unemployed	2.7	-
Cleaning lady	2.7	-
Craftsman	2.7	-
Other	25.5	-
Anthropometry		
Nutritional status (%)		
Underweight	2.3	-
Normal weight	33.6	-
Overweight	64.1	-
Risk of developing metabolic complications - Waist Circumference (%)		
No risk	29.8	-
High risk	22.1	-
Very high risk	48.1	-
Risk of developing cardiovascular diseases - Waist-to-Hip Ratio (%)		
No risk	32.3	-
Risk	67.7	-

Note: *Mean and standard deviation; **Median and confidence interval.

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The study was approved by the Research Ethics Committees of *Universidade Federal de Minas Gerais* (COEP nº ETIC 103/07) and of the City Hall of *Belo Horizonte* (COEP-SMSA/PBH - Protocol nº 087/2007). All participants signed an Informed Consent Form.

RESULTS

Thirteen percent of the 168 users were lost because of refusal to participate (n=18) or not filling out all three 24 HR (n=5). Additionally, male subjects were excluded (n=16) to homogenize the sample, so 131 women were assessed. Table 1 describes the sociodemographic variables and nutritional status of the participants. Most subjects were overweight adults with low income and education level and at risk of developing metabolic complications and cardiovascular diseases.

The monthly per capita oil ingestion was 556.0 mL (95%CI=557.5 mL - 686.2 mL); monthly oil intake was appropriate in 34.1% (240 to 480 mL); and excessive in 56.1% (>480 mL). The prevalence of poor eating habits associated with the intake of high-fat foods, such as chicken skin (21.4%), high-fat cheese (52.7%), bread, doughnuts, or cakes containing butter/margarine (52.7%), and fatty dressings on salads (48.1%), was high.

The mean intakes were: 31.9±5.7% kcal of fats, 8.4±2.0% kcal of Monounsaturated Fatty Acids (MUFA), 9.4±2.5% kcal of Polyunsaturated Fatty Acids (PUFA), and 1,689.1±493.4 kcal of calories; and the median intake of Saturated Fatty Acids (SFA) was of 8.7% kcal (95%CI=8.8%-9.8%) and of cholesterol, 163.7 mg (95%CI=178.0 mg-222.4 mg). Calorie intake was inadequate in 67.9% of the users. Additionally, many women consumed fats (20.6%), SFA (31.3%), PUFA (38.2%), and cholesterol (16.0%) in excess.

The classification of perception of oil and fat consumption and the intention to change dietary behavior according to the transtheoretical model showed that 75.6% of the women were either in action (n=25) or maintenance (n=69). However, when evaluated on fat consumption (<30.0%), only 49.6% of the women were in these stages; of the ones in action (n=27), 63.0% (n=17) were really in this stage; of the ones in maintenance, only 38.9% (n=28) had appropriate fat consumption. Thus, the number of women in contemplation and preparation increased by 9.9% and 13.8%, respectively, and the number of women in maintenance decreased by 33.6%, a significant difference (p<0.001) (Figure 1).

All stages of change had similar mean total fat consumption (p=0.395). However, after reclassification, fat intake was lower in the stages of action (Classification: 31.6±6.1% kcal *vs* Reclassification: 31.0% kcal; 95%CI=30.3-33.9% kcal) and maintenance (Classification: 31.5±5.7% kcal *vs* Reclassification: 27.4% kcal; 95%CI= 24.9-27.5% kcal) (p<0.001) (Table 2).

Additionally, subjects in action and maintenance had lower intake of high-fat foods than those in other stages: chicken skin (56.3% action and maintenance, p=0.037); fatty salad dressing (70.5% action and maintenance, p<0.001); bread, doughnuts or cakes with butter or margarine (66.1% action and maintenance, p<0.001); SFA (action: 8.9% kcal; 95%CI= 8.7-10.3% kcal and maintenance: 7.5% kcal;

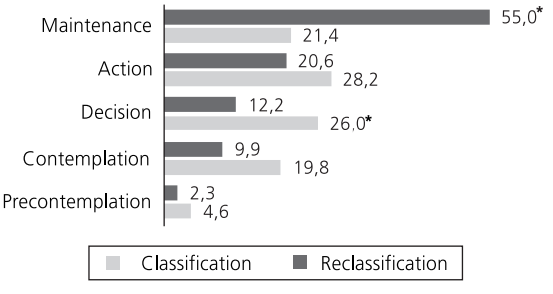

Figure 1. Stages of behavioral change toward consumption of oils and fats according to classification and reclassification of the participants' perception. *Belo Horizonte* (MG), Brazil, 2009.

Note: *Significant difference between classification and reclassification frequencies (p<0.05).

95%CI=6.7-7.8% kcal, $p<0.001$); and MUFA (action: 7.9% kcal; 95%CI=7.6-8.8% kcal and maintenance: 7.0% kcal; 95%CI=6.3-7.4% kcal, $p<0.001$) (Tables 3 and 4).

Table 2. Lipid intake of the participants according to classification and reclassification of the stages of change of eating behavior toward oil and fat consumption. *Belo Horizonte* (MG), Brazil, 2009.

Nutrient	Evaluation of stages	Stages of change	n	Consumption	*p*-value
Lipids (% kcal)	Classification	Precontemplation	3	29.0 ± 6.7	0.395**
		Contemplation	13	33.0 ± 3.6	
		Preparation	16	34.0 ± 5.7	
		Action	25	31.6 ± 6.1	
		Maintenance	69	31.5 ± 5.7	
	Reclassification	*Precontemplation[a]	6	32.9 (24.6 - 43.9)	<0.001***
		*Contemplation[b, c]	25	33.4 (32.3 - 35.8)	
		*Preparation[d, e]	32	34.2 (32.8 - 36.1)	
		*Action[b, d, f]	36	31.0 (30.3 - 33.9)	
		*Maintenance[a, c, d, e, f]	27	27.4 (24.9 - 27.5)	

Note: *Same letters correspond to statistically significant differences: $p<0.05$ (Mann Whitney test); **Analysis of Variance (mean and standard deviation); ***Kruskal-Wallis Test (median and 95% confidence interval).

Table 3. Monthly per capita lipid intake according to reclassification of the stages of change of the eating behavior toward oil and fat consumption. *Belo Horizonte* (MG), Brazil, 2009.

Nutrients	Stages of Change	n	Consumption	*p*-value
Monthly oil *per capita* (mg)	Precontemplation	6	828.0 (185.5 - 1929.9)	0.168***
	Contemplation	25	630.0 (517.3 - 822.5)	
	Preparation	32	600.0 (535.6 - 777.6)	
	Action	36	513.2 (456.5 - 632.7)	
	Maintenance	27	450.0 (421.8 - 663.1)	
Saturated Fatty Acid (% kcal)	Precontemplation[g]	6	8.3 (5.8 -15.1)	<0.001***
	Contemplation[h]	25	9.1 (8.6 - 10.6)	
	Preparation[i]	32	9.9 (9.3 - 11.5)	
	Action[j]	36	8.9 (8.7 - 10.3)	
	Maintenance[g, h, i, j]	27	7.5 (6.7 - 7.8)	
Monounsaturated Fatty Acid (% kcal)	Precontemplation	6	9.8 (5.1 - 14.9)	<0.001***
	Contemplation[k]	25	8.9 (8.2 - 9.4)	
	Preparation[l, m]	32	9.1 (8.7 - 9.9)	
	Action[l, n]	36	7.9 (7.6 - 8.8)	
	Maintenance[k, l, m, n]	27	7.0 (6.3 - 7.4)	
Polyunsaturated Fatty Acid (% kcal)	*Precontemplation[c]	6	6.8 (6.3 - 7.4)	0.093***
	*Contemplation[d, e]	25	10.2 (8.9 - 10.9)	
	*Preparation[f, g]	32	9.9 (8.8 - 10.3)	
	*Action[d, f, h]	36	9.4 (8.4 - 10.4)	
	*Maintenance[c, e, g, h]	27	8.5 (7.7 - 9.3)	
Cholesterol (mg)	Precontemplation	6	168.8 (-21.2 - 635.5)	0.106***
	Contemplation	25	169.8 (155.0 - 221.5)	
	Preparation	32	205.3 (183.8 - 257.5)	
	Action	36	140.5 (151.8 - 234.0)	
	Maintenance	27	126.2 (124.2 - 221.7)	

Note: *Same letters correspond to statistically significant differences: $p<0.05$ (Mann Whitney test); ***Kruskal-Wallis Test (median and 95% confidence interval).

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Table 4. High-fat food intake according to stages of change in the participants' eating behavior. *Belo Horizonte* (MG), Brazil, 2009.

Variables	Precontemplation	Contemplation	Preparation	Action	Maintenance	*p*-value[a]
Always removes chicken skin (%)						
Yes	3.9	16.5	23.3	**33.0**	**23.3**	0.037
No	7.1	32.1	**35.7**	10.7	14.3	
Frequently eats high-fat cheese (%)						
Yes	4.3	24.6	**30.4**	20.3	20.3	0.183
No	4.8	14.5	21.0	37.1	22.6	
Frequently uses fatty dressings on salad (%)						
Yes	4.8	25.4	**42.9**	12.7	14.3	**≤0.001**
No	4.4	14.7	10.3	**42.6**	**27.9**	
Frequently eats bread, doughnuts or cakes with margarine/butter (%)						
Yes	8.7	21.7	**34.8**	21.7	13.0	**≤0.001**
No	0.0	17.7	16.1	35.5	**30.6**	

Note: Numbers in bold mean significant differences between the stage values: $p<0.05$ ([a]Fisher's exact test). Only significant values were submitted.

DISCUSSION

When the classified and reclassified stages of change were compared, a considerable proportion of women in the stages of action and maintenance were displaced to the stages of precontemplation, contemplation, and preparation, corroborating the high prevalences of overweight and excessive consumption of oils and fats. Furthermore, after reclassification significant associations were observed between the consumption of greasy foods, fats, SFA, and MUFA and the stages of dietary behavior toward fat and oil consumption, denoting the possibility of using this model to help to create more customized interventions that aim to reduce the intake of high-fat foods.

Initially, more subjects were classified in the action and maintenance stages of change, corroborating the literature, which provides added prevalences for these two stages in excess of 30%[22,23]. However, such findings can be due to an unrealistic perception of oil and fat consumption[11,12,23,24], which might underestimate dietary fat intake. In the present study, this erroneous perception was evidenced by the participants' high intake of fats and high-fat foods. Moreover, the difficulty of evaluating dietary intake should be mentioned[11,23,24] given the participants' unfamiliarity with diet and nutritional terms and their lack of critical-reflexive sense for comparing their diet with a healthy diet[7,12]. Nonetheless, underreporting-related issues are influenced by the complexity of food intake[25].

A study in Rhode Island with adults in a nutrition intervention program found an average consumption of total fats higher than that found herein[7]. However, the lipid, SFA, and PUFA intakes of adults with hyperlipidemia reported by Nasser *et al.*[26] were similar to the present intakes, but their MUFA intake was higher.

The study results denote the need of reclassification to include subjects that were classified in action and maintenance but still had a high fat intake. To reinforce this finding, the associations found between the consumption of high-fat foods, lipids, SFA, and MUFA and the stages of change on the consumption of oils and fats were emphasized after reclassification. These figures corroborate some studies that found that fat consumption decreased as the stages advanced[23,27,28]. However, despite the fact that fat consumption is higher in the first three stages,

subjects in action presented a high ingestion of this nutrient, emphasizing that they still need to implement changes in their dietary behavior[5,8], which is a consequence of stage dynamism[4,5,9], with habits that require modification and rethinking.

Lower consumption of fat and its fractions as the stages of change advance shows, in turn, the importance of promoting interventions that also reduce the consumption of these nutrients by the subjects in precontemplation, contemplation, and preparation. Considering the benefits that a good dietary lipid profile can have on health, such as lower risk of obesity and other NCD[7,26], the importance of interventions that focus on these nutrients is justified.

Participant reclassification by stage made it possible to consider risk groups based on dietary inappropriateness, not only on recognizing intake[29]. Thus, we hope to contribute to the design of better customized interventions that consider subjects' self-perception regarding food ingestion and that contribute to broaden their view of dietary intake, helping to improve their autonomy and consequently, their motivation to make changes[12].

Moreover, the development of interventions on fat and oil consumption mentioned in the transtheoretical model is important because it enables determining the most effective activities for the proposed behavioral changes[7,8]. Thus, we hope to contribute to the control and/or prevention of NCD and their complications[4] and to promote healthy habits, such as low consumption of high-fat foods.

This study presents some limitations, such as the scarcity of studies that use the transtheoretical model to assess oil and fat intake and its relationship with the consumption of specific nutrients. Furthermore, the existing studies were conducted in other countries with populations of distinct socioeconomic and education levels, which impair comparisons. To such degree, the use of an algorithm to classify the stages of change on oil and fat consumption is still restricted to specific populations.

Moreover, different algorithms have been used[28,30], and there is no golden standard, that is, a widely used algorithm that best identifies participants' dietary behavior, and this makes it difficult to compare different studies[30]. Such aspect strengthens the importance of using algorithms validated in distinct populations, as performed in this study.

The study results denote that the use of the transtheoretical model on fat and oil consumption as an instrument that helps the understanding of the behavioral changes associated with the ingestion of total lipids and their fractions is useful and important. This is possible because it enables a more specific analysis of the quality of ingested fats in each stage of change, favoring interventions that are actually individualized and therefore, more effective.

CONCLUSION

The use of the transtheoretical model on the consumption of oils and fats proved to be important because it enables investigating perceived dietary consumption, intention of changing behavior, and women's dietary habits. However, the algorithm results were more reliable after reclassification, enabling the evaluation of the stages of change according to the participants' consumption of foods and nutrients related to oils and fats. Hence, its applicability for assessing dietary behavior is denoted, as is its use for supporting dietary and nutrition education actions that consider individuals' diverse promptness to change their fat consumption. The design of interventions that help participants to understand their actions and behaviors is therefore expected, providing greater autonomy for the subjects to critically reflect and make decisions regarding their fat intake.

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CONTRIBUTORS

RAM MOREIRA helped to conceive the study; collect, supervise collection, analyze, and interpret data; and review the article. LC SANTOS helped to analyze and interpret data; and to review the article. MC MENEZES helped to review the article. ACS LOPES helped to obtain a grant; coordinate the project; conceive and design the study; analyze and interpret the data; and write and review the article.

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ORIGINAL | *ORIGINAL*

Action of ascorbic acid on the healing of malnourished rats' skin wounds[1]

Ação do ácido ascórbico na cicatrização de feridas cutâneas de ratos desnutridos

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ABSTRACT

Objective

To evaluate the action of ascorbic acid on the healing of malnourished rats' cutaneous wounds compared with normal weight rats.

Methods

We used 92 adult, male Wistar rats divided into four groups: 24 normal weight rats given only water and chow; 24 normal weight rats given vitamin C by gavage (340 mg/kg 12/12 hours); 22 malnourished rats given only water and chow; and 22 malnourished rats given vitamin C by gavage (340 mg/kg 12/12 hours). Malnutrition was induced by feeding the animals half of their daily energy requirement for 30 days. Two incisions were made, one sutured (healing by primary intention) and one left unsutured (healing by secondary intention). The rats were euthanized on the third, seventh, and fourteenth days of the experiment.

Results

The following parameters differed significantly between the groups ($p>0.05$): granulation of the wound edge in the primary and secondary intention; extent of injuries on day 7 for primary intention and on day 3 for secondary intention; reepithelialization on day 7 for primary intention; fibrin-leukocyte scab on day 14 for

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primary intention; amount of neovascularization and concentration of macrophages, fibroblasts, and collagen fibers for primary and secondary intention.

Conclusion

The use of vitamin C in malnourished and normal weight rats increases fibroblast proliferation and collagen deposition in the tissue, which helps to improve healing both by primary and secondary intention.

Indexing terms: Ascorbic acid. Malnutrition. Skin. Vitamins. Wound healing.

RESUMO

Objetivo

Avaliar a ação do ácido ascórbico na cicatrização de feridas cutâneas de ratos desnutridos e de eutróficos.

Métodos

Utilizaram-se 92 ratos Wistar, adultos, machos, divididos em quatro grupos: 24 ratos eutróficos que receberam somente água e ração; 24 ratos eutróficos que receberam vitamina C por gavagem (340 mg/kg de 12/12 horas); 22 ratos desnutridos que receberam somente água e ração; 22 ratos desnutridos que receberam vitamina C por gavagem (340 mg/kg de 12/12 horas). A desnutrição foi realizada fornecendo-se aos animais metade da ração diária durante 30 dias. Realizaram-se duas incisões, uma suturada (cicatrização por 1ª intenção) e outra não suturada (cicatrização por 2ª intenção). Os ratos foram sacrificados no 3º (D3), 7º (D7) e 14º (D14) dia do experimento.

Resultados

Observou-se diferença estatística ($p<0.05$) entre os grupos para os parâmetros: granulação na borda da ferida para 1ª e 2ª intenção; medida das lesões por 1ª intenção em D7 e para cicatrização por 2ª intenção em D3; reepitelização das lesões em D7 para 1ª intenção; crosta fibrinoleucocitária em D14 para 1ª intenção; quantidade de neovascularização, concentração de macrófagos e concentração de fibroblastos e de fibras colágenas para 1ª e 2ª intenção.

Conclusão

O uso de vitamina C em desnutridos assim como em eutróficos aumenta a proliferação fibroblástica e depósito de colágeno no tecido, o que contribui para melhorar a cicatrização de 1ª e 2ª intenção.

Termos de indexação: *Ácido ascórbico. Desnutrição. Pele. Vitaminas. Cicatrização.*

INTRODUCTION

A chronic or complex wound may be an important source of morbidity in many individuals in critical condition or in patients with infection or pressure ulcers[1].

Wound healing involves a perfect and coordinated cascade of cellular and molecular events that interact to repave and rebuild tissue[2]. It is a complex but ordered phenomenon coordinated by chemical mediators, such as Vascular Endothelial Growth Factor (VEGF) and Transforming Growth Factor Beta (TGF-β), among others, that involves the following process: induction of the inflammatory process in response to the initial injury with removal of the damaged tissue; proliferation and migration of parenchymal and connective tissue cells; angiogenesis and formation of granulation tissue; synthesis of extracellular matrix proteins and collagen deposition; tissue remodeling; wound contraction and acquisition of wound strength[2].

Scars are classified according to the type of procedure performed and their closing, whether by primary intention or primary closure or secondary intention or secondary closure. The first type occurs in adjacent injury margins, joined either by suture (threads, staples, or tapes) or skin grafts. This method is performed on uninfected wounds and located in well vascularized areas. There is little formation of granulation tissue, rapid epithelialization, and better cosmetic results[2].

Secondary intention healing relies on granulation and wound contraction for joining the edges[2].

The factors that affect the healing process can be local (infection, foreign body, mechanical factors) and/or systemic (metabolic condition, nutrition, circulatory condition), and they may increase or reduce the scar. Hemodynamic instability, metabolic stress, and nutritional status may interfere with the healing stages[3].

Although the role of nutritional supplementation on wound treatment is still unclear[4], and the nutrients that promote proper healing are unknown, it is certain that proteins, vitamins, arginine, glutamine, iron, zinc, and selenium have significant beneficial effects on healing and the immune system[5].

Ascorbic acid hydroxylates the lysine and proline in protocollagen necessary for the cross-links between collagen fibers because they maintain the prosthetic iron (cofactor) of hydroxylase enzyme in the ferrous form (reduced) while maintaining enzymatic activity. For this reason ascorbic acid is important in maintaining normal connective tissue and in healing by participating in the synthesis of the collagen matrix[6].

Protein malnutrition is associated with poor healing by reducing fibroblast production, decreasing angiogenesis and collagen synthesis, and lowering tissue remodeling capacity[7].

In third world countries, Protein-Energy Malnutrition (PEM) remains a common problem, but it also occurs in the richest societies and impoverished communities[7]. Additionally, PEM is associated with surgical procedures like bariatric surgery[5]. Despite recent evidence of reduced rates of protein-calorie malnutrition in Brazil, especially in the Northeast, malnutrition remains the most important endemic deficiency in our country, placing a high demand on health services and causing high mortality rates[8-10].

The framework of malnutrition can impair the process of tissue repair, and ascorbic acid deficiency decreases fibroblast synthesis of collagen. No studies in the literature have evaluated the effect of ascorbic acid on the wound healing of malnourished rats.

This study aimed to determine the action of ascorbic acid on the healing of skin wounds in malnourished versus normal weight rats.

METHODS

This study was approved by the Animal Research Ethics Committee of *Universidade do Oeste Paulista* under Protocol nº 1.103, on June 1, 2012.

For this study, we used 96 adult, male Wistar rats (*Ratus Norvegicus albinus*) weighing 200 to 250 g. The rats were separated and placed in individual small and rectangular boxes measuring 30x20x13 cm, the accommodation recommended for adult rats. The rats were kept in an air-conditioned vivarium with controlled humidity and temperature and a 12:12-hour light-dark cycle. The animals were weighed weekly until euthanized.

All animals (n=96) received the same chow (*Supralab Comércio e Serviço Ltda, São Leopoldo*, Brazil). Malnutrition was induced in 48 animals by feeding them 50% of the recommended daily chow for 30 days[11], equivalent to 15 to 20 g, based on their usual daily intake[12]. Malnutrition was assessed by weighing the animals weekly. Animals with a weight loss of 15 to 20% were considered malnourished.

At experimental day thirty, incisions were made after anesthetizing the animals with 25 mg/kg of thiopental (Syntec, United States of America) intraperitoneally[13]. After upper back shaving and antisepsis with Povidone-iodine (PVP-I [Iodopovidone] degermante 10% - Rioquímica - *Rio de Janeiro*, Brazil), two incisions of 1.5 cm were made along the sagittal plane[14] on either side of the backbone, using a scalpel blade 11. The right incision was sutured with mononylon 3-0 thread (Ethicon, Brazil) (healing by primary intention) and the left incision was left unsutured and exposed (healing by secondary intention). The painkiller

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acetaminophen was administered postoperatively at a dose of 25-75 mg/250 g of body weight orally (in the drinking water), 4/4 hours, for two days[13].

Four malnourished animals died after the incisions were made as there was no recovery from anesthesia.

The animals were then divided into four groups: E (normal weight rats) - 24 normal weight rats with free access to food and water, EVC (normal weight rats given vitamin C) - 24 normal weight rats given vitamin C (Cewin drops, Sanofi Aventis Pharmaceuticals, São Paulo, Brazil) by gavage at a dose of 340 mg/kg at 12/12 hours (7:30 hours a.m. and 7:30 hours p.m.) diluted in 1 mL of 0.9% saline[15], M (malnourished rats) - 22 malnourished with free access to water and 50% of the recommended daily amount of chow, MVC (Malnourished Rats Given Vitamin C) - 22 malnourished rats given vitamin C (Cewin drops, Sanofi Aventis Pharmaceuticals, *São Paulo*, Brazil) by gavage at a dose of 340 mg/kg at 12/12 hours (7:30 hours a.m. and 7:30 hours p.m.) diluted in 1 mL of 0.9% saline and half the recommended daily amount of chow.

Eight rats from each group were euthanized on the third (D3), seventh (D7) and fourteenth (D14) days of the experiment[16]. The animals were killed in a CO_2 chamber (Industry Seaside, *São Paulo*, Brazil). After euthanasia, the area containing the skin wound was removed.

We observed the following morphological parameters with their respective scores color of the wound (1 - pale pink, 2 - yellow, 3 - pale, 4 - cyanotic); wound edges (1 - without granulation, 2 - little granulation, 3 - much granulation); scab (0 - absent, 1 - small, 2 - moderate, 3 - large); scab features (1 - serous, 2 - hematic, 3 - purulent); and sensitivity, assessed by reaction to touch (1 - no pain, 2 - with pain).

At euthanasia the lesion was measured with a vernier caliper (Digimess Precision Instruments Ltd., *São Paulo*, Brazil).

All parameters were evaluated only at euthanasia (D3, D7, and D14), except body weight.

The specimens were fixed in 10% formalin (*Cinética Indústria Química, São Paulo*, Brazil) for 24 hours, embedded in paraffin (*Dinâmica Reagentes Analíticos, São Paulo*, Brazil), sectioned in 5 ìm sections, and stained with Hematoxylin and Eosin (HE) (Dolles, *São Paulo*, Brazil) and the Masson's trichrome stain (Merck, Darmstadt, Germany) for better identification of collagen fibers[17].

Blind histological analysis was performed by a trained and experienced observer who evaluated and scored the following parameters using an optical microscope: skin re-epithelialization (0 - absent, 1 - partial, 2 - total), fibrin-leukocyte scab (0 - absent, 1 - present), neovascularization (0 - absent, 1 - mild, 2 - moderate, 3 - severe), intensity of inflammatory process (0 - no inflammation, 1 - mild, 2 - moderate, 3 - severe), type of inflammatory cell (neutrophils, lymphocytes, or mixed), concentration of macrophages (0 - absent, 1 - mild, 2 - moderate, 3 - severe), concentration of fibroblasts (0 - absent, 1 - few, 2 - moderate, 3 - many) and concentration of collagen fibers (0 - absent, 1 - few , 2 - moderate, 3 - many) in the incised area.

The nonparametric Kruskal-Wallis test with contrasts using the Dunn's test were used for determining whether the variable scores differed by experimental group and day. The paired t-test compared the weights of the rats before and after. Analysis of Variance (Anova) with contrasts using the Tukey test verified whether lesion sizes differed between groups and days. The data were analyzed by the software Biostat 5.0 as described by Ayres *et al.*[18] with a significance level of $p<0.05$.

RESULTS

Animals in the normal weight group (E) had a mean initial weight of 220.53 g (Standard Deviation-SD=±32.85 g) and final weight of 243.54 g (SD=±23.71 g) (p=0.007). The normal weight rats given vitamin C (EVC) had a mean initial weight of 216.60 g (SD=±36.46 g) and final weight of 244.29 g (SD=±30.21 g) (p=0.0011).

The malnourished group (M) had a mean initial weight of 242.80 g (SD=±19.69 g) and final weight of 187.20 g (SD=±15.64 g) (p<0.0001) and the malnourished group given vitamin C (MVC) had a mean initial weight of 245.28 g (SD=±0.07 g) and final weight of 188.84 g (SD=±16.99 g) (p<0.0001). While the animals in groups E and EVC gained weight, the animals in groups M and MVC lost about 20% of their body weight.

Wound dehiscence did not occur in any animal. The wounds of all animals were pale pink regardless of intention or experimental day.

On day 3 the animals in the normal weight groups (given or not vitamin C) had no granulation on the wound edges of the primary and secondary intention lesions, unlike the malnourished groups (given or not vitamin C), which presented slight granulation on the wound edges of the primary and secondary intention lesions (p<0.0001). The lesions of the four groups healed by primary or secondary intention had no granulation on the edge of the lesions by days D7 and D14, respectively. (Não foi possível entender o original)

Most cases (85%) had small amounts of hematic scabs on D3 and D7. On D14, only two M animals had scab on the primary intention lesion. The presence and type of scab in the primary and secondary intention lesions did not differ, regardless of experimental day and group (p>0.05).

Only two animals (groups EVC and M) experienced pain in both lesions on D3 (p>0.05).

Lesion size healed by primary intention did not differ by group on D3 and D14, but did on D7 between the groups E and EVC, E and M, and E and MVC (p<0.05). Lesion size healed by secondary intention did not differ by group on D7 and D14, but did on D3 between groups E and M (p<0.01), and B and C (p<0.05).

On day 3, only one animal in the group EVC showed any re-epithelialization of the primary intention lesion. However, on D7, most animals (87.5%), regardless of group, presented complete re-epithelialization of the wound, and epithelialization of the primary intention lesions differed by group (p=0.0197). The re-epithelialization of secondary intention lesions did not differ by experimental day or group (p>0.05) (Figures 1, 2, and 3).

On day 3, all animals had fibrin-leukocyte scab on both lesions, and on D14, this was present only in the primary intention lesion of two animals of group C. Most animals in groups EVC and MCV (87.5%) no longer had fibrin-leukocyte scab on D7, while most animals in groups E and M (87.5%) did. On D7, the presence of fibrin-leukocyte scab only differed in the primary intention lesions (p=0.0093) (Figures 1, 2, and 3).

Only two animals (groups EVC and MVC) had no neovascularization in the primary intention wounds by D3, and four animals (three from group E and one from group M) still had slight neovascularization in their secondary intention wounds by D14. The amount of neovascularization in the primary intention lesions on D3 (p=0.0445) and D7 (p=0.0109) differed, but not on D14 (p=0.9422). The amount of neovascularization in the secondary intention lesions differed only on D3 (p=0.0009), particularly between groups E and EVC, and E and M (Figures 1, 2 and 3).

Only two animals (one from group E and one from M) had no inflammation in the primary intention lesions on D3. On D7, most animals (75.0%) in group EVC had no inflammation in either lesion, while most animals in the other groups (E - 100.0%; M - 75.0%; EVC - 62.5%) had mild inflammation. On D14, only animals of group M (62.5%) still had mild inflammation in both lesions. However, healing of the primary intention lesion did not differ by day (p>0.05), and healing of the secondary intention lesion only differed on D7 (p=0.0393) (Figures 1, 2, and 3).

On day 3, the predominant inflammatory cell type in the lesions of all animals in all groups was neutrophils. On D7, animals of all groups,

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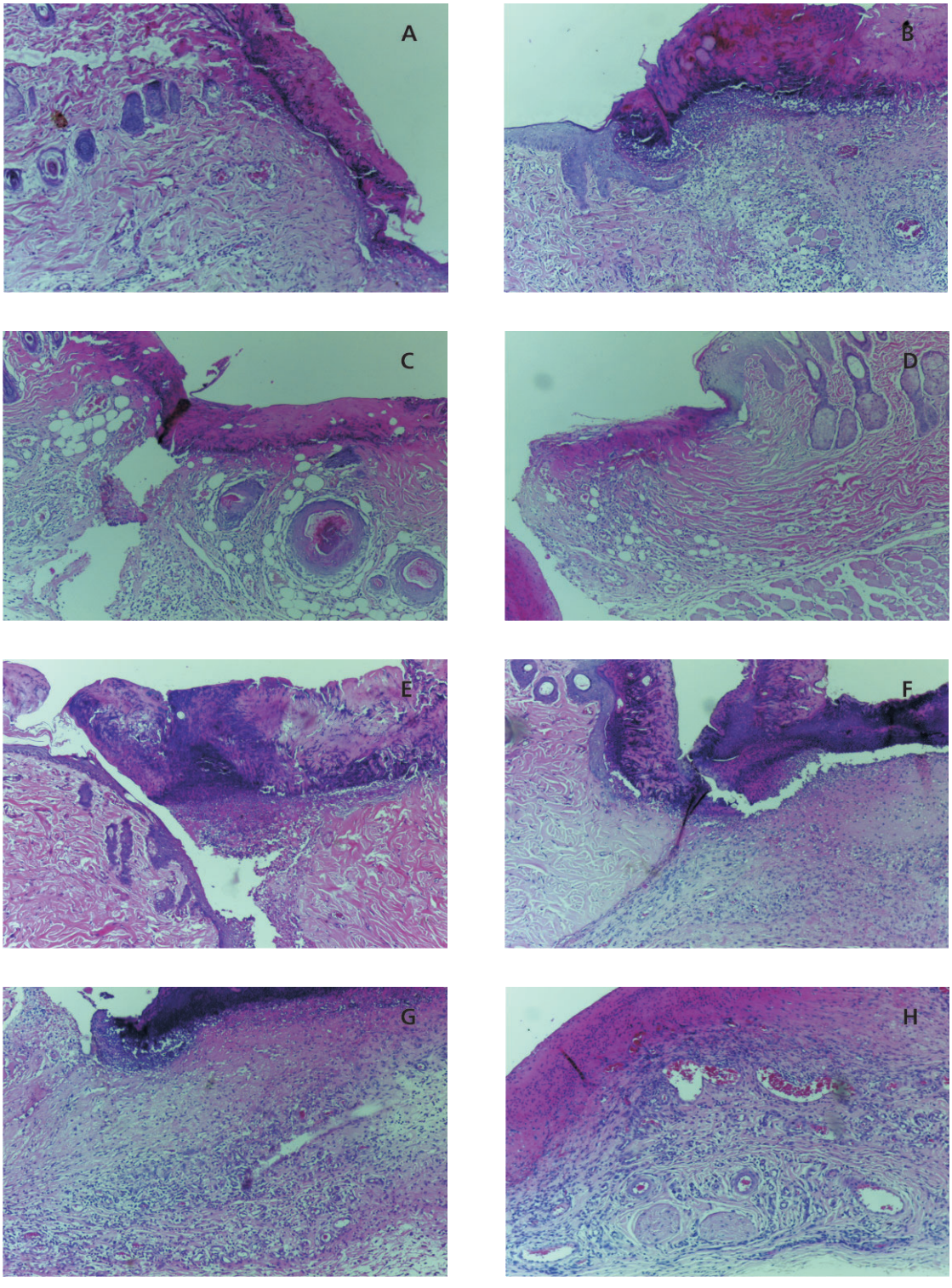

Figure 1. Histological analysis on D3. Right healing by primary intention and left healing by secondary intention. Note the presence of fibrin-leukocyte scab and inflammatory infiltrate in all images. A and B: from Group E. C and D: from Group EVC. E and F: from Group M. G and H: from Group MVC (Hematoxylin-eosin, 200x magnification). *Presidente Prudente* (SP), Brazil, 2013.

Note: E: Normal weight rats; EVC: Normal weight rats given Vitamin C; M: Malnourished rats; MVC: Malnourished rats given Vitamin C; D3: Experimental day 3.

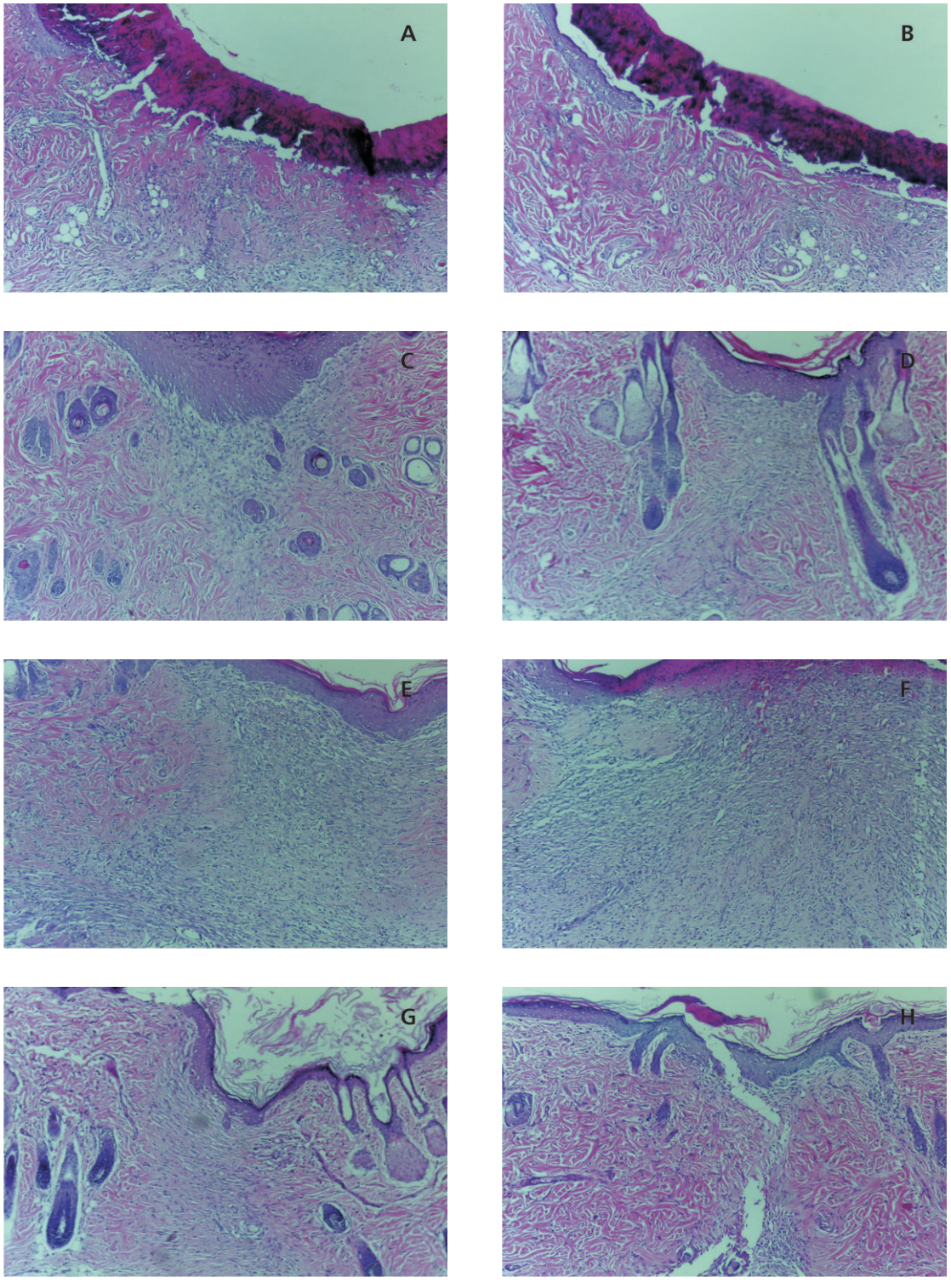

Figure 2. Histological analysis on D7. Right healing by primary intention and left healing by secondary intention. Note the presence of fibrin-leukocyte scab only in A, B, and F, and more exuberant inflammatory infiltrate in E and F. A and B: from Group E. C and D: from Group EVC. E and F: from Group M. G and H: from Group MVC (Hematoxylin-eosin, 200x magnification). *Presidente Prudente* (SP), Brazil, 2013.

Note: E: Normal weight rats; EVC: Normal weight rats given Vitamin C; M: Malnourished rats; MVC: Malnourished rats given Vitamin C; D7: Experimental day 7.

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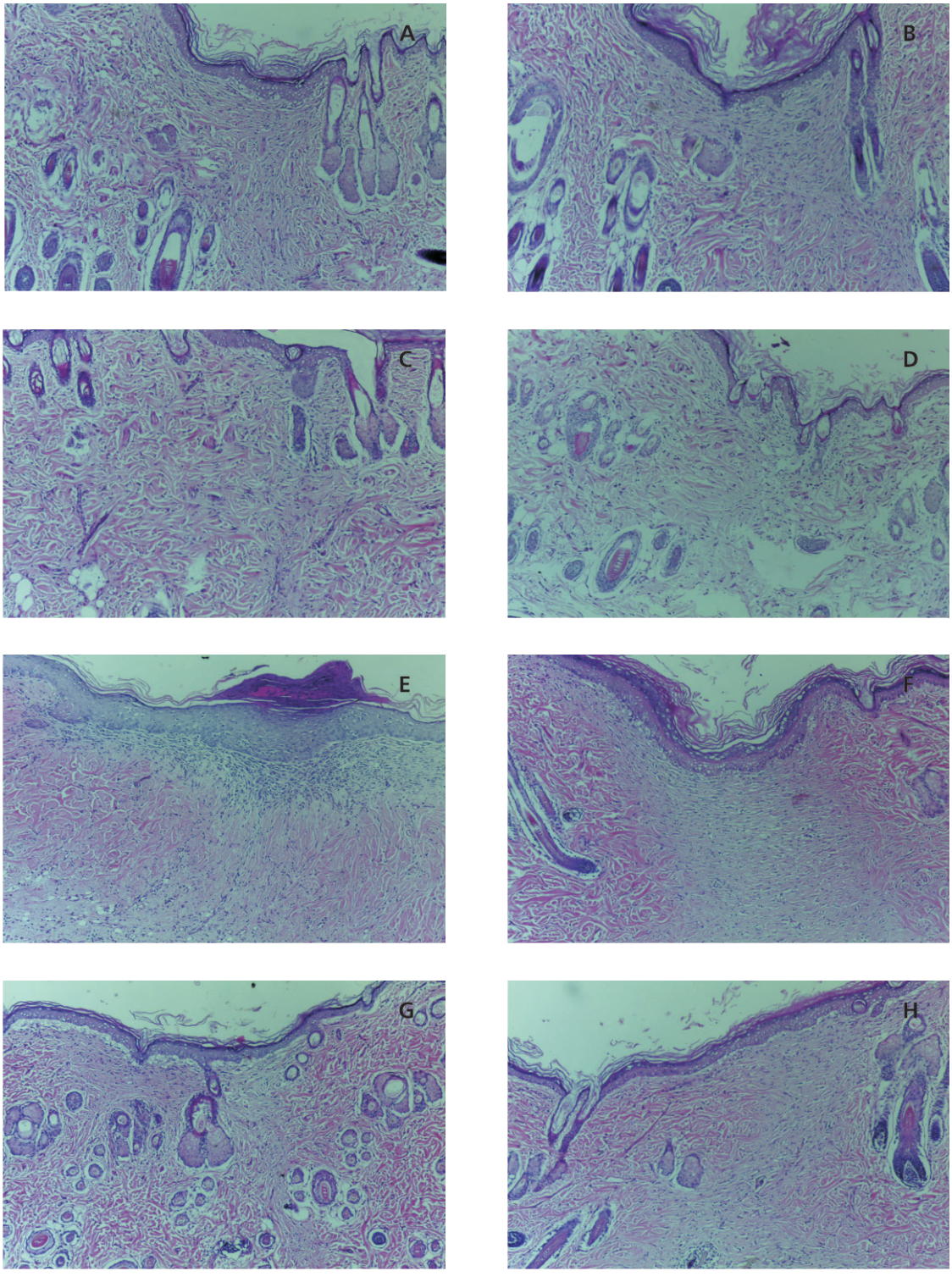

Figure 3. Histological analysis on D14. Right healing by primary intention and left healing by secondary intention. Note the presence of fibrin-leukocyte scab and inflammatory infiltrate only in E. A and B: from Group E. C and D: from Group EVC. E and F: from Group M. G and H: from Group MVC (Hematoxylin-eosin, 200x magnification). *Presidente Prudente* (SP), Brazil, 2013.

Note: 3E: Normal weight rats; EVC: Normal weight rats given Vitamin C; M: Malnourished rats; MVC: Malnourished rats given Vitamin C; D14: Experimental day 14.

regardless of the type of lesion, presented mixed inflammatory infiltrate with polymorphonuclear and mononuclear cells (lymphocytes). On D14, lymphocytes prevailed in the inflamed lesions of the animals in group M.

On day 3 and day 14, macrophages were not present in any lesion of any animal. On D7, the concentration of macrophages in primary intention lesions (p=0.0004) and secondary intention lesions (p<0.0001) differed: while all animals in group EVC had no macrophages in either lesion, all animals in groups E and M, and most of group MVC (62.5%) had a small concentration of macrophages in both lesions. Healing by primary and secondary intention differed between groups E and EVC, EVC and M, and EVC and MVC (p<0.05).

The concentration of fibroblasts in both lesions of all animals was higher (small to moderate) on D7; and in most animals on D14 (E

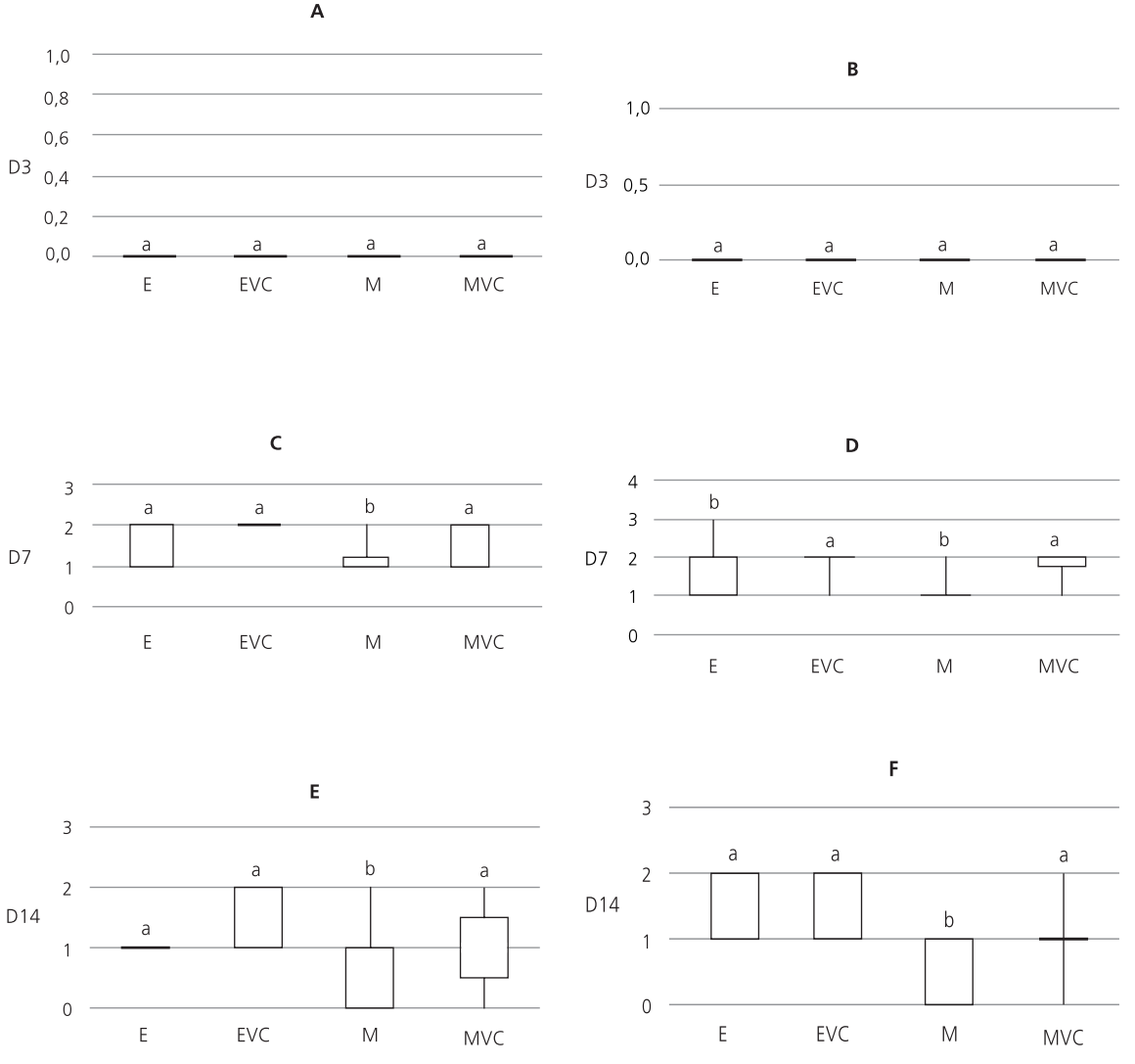

Figure 4. Concentration of fibroblasts in the four study groups on different study days (expressed as scores). *Presidente Prudente* (SP), Brazil, 2013.

Note: The central line indicates the median, the upper and lower edges delimit the interquartile range, and the outer vertical lines indicate maximum and minimum values. Results with different superscripts differ significantly (p<0.05).

E: Normal Weight rats; EVC: Normal Weight rats Given Vitamin C; M: Malnourished rats; MVC: Malnourished rats Given Vitamin C; D3: Experimental Day 3; D7: Experimental Day 7; D14: Experimental Day 14.

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-100.0%; EVC -100.0%; M e MVC - 87,5%). The groups differed for this parameter only on D7 for healing by primary intention (p=0.0243); and on D7 (p=0.0219) and D14 (p=0.0119) for healing by secondary intention (Figures 1, 2, 3, and 4).

By D3, the concentration of collagen fibers had not yet increased in any group. On D7, most animals (E, EVC, and MVC - 100.0%; M - 87.5%) had a small or moderate amount of collagen fibers in the tissue. On D14, all animals in Group EVC and most in Group MVC (85.7%) had great concentration of collagen fibers in both lesions, while most animals from the other groups (E - 62.5%; M - 71.4%) had only moderate amounts. The groups differed for this parameter only on D14 for healing by primary (p=0.0001) and secondary (p<0.0001) intention (Figures 1, 2, 3 and 5).

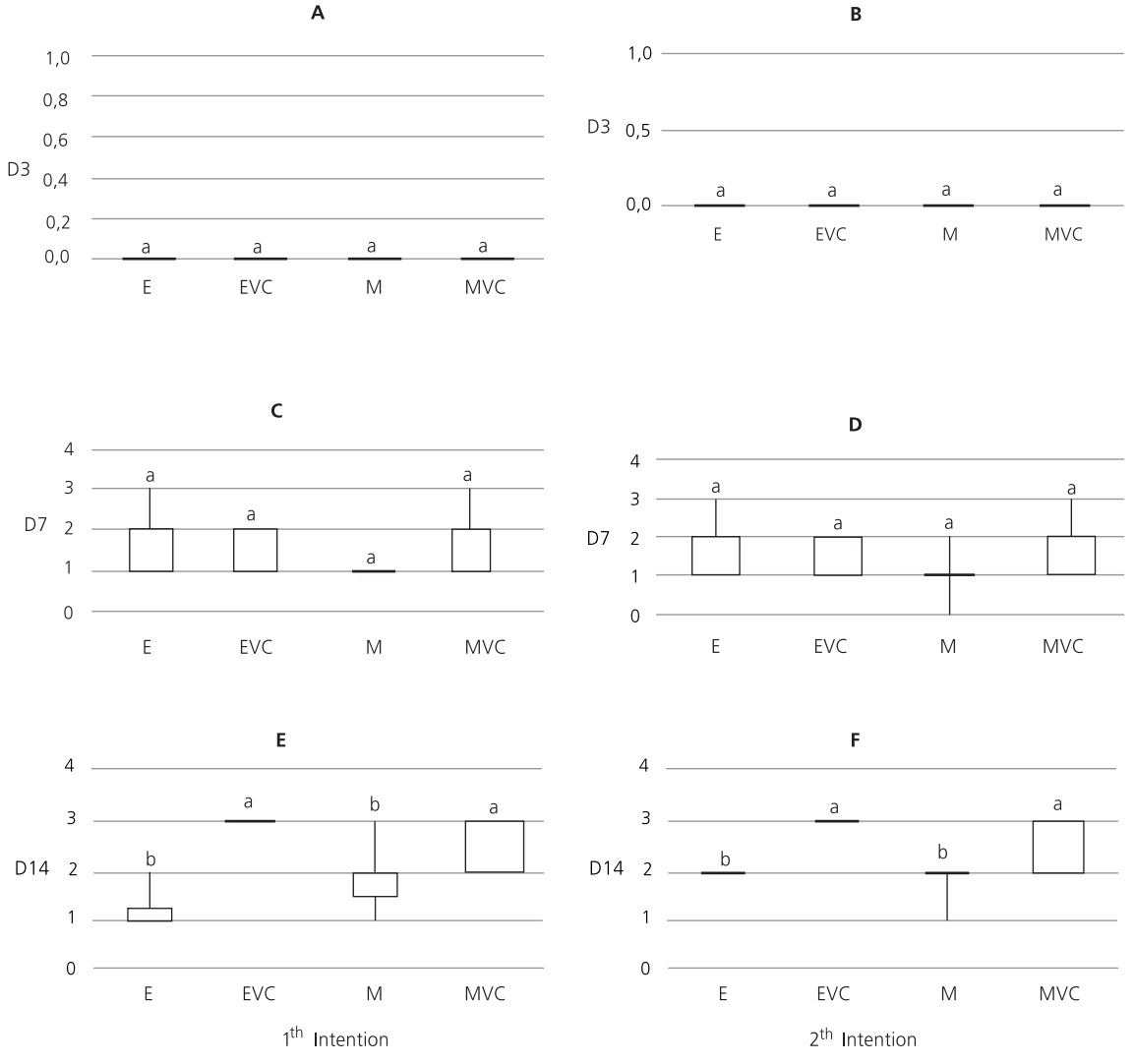

Figure 5. Concentration of collagen fibers in the four study groups at different moments of analysis (expressed in scores). *Presidente Prudente* (SP), Brazil, 2013.

Note: The central line indicates the median, the upper and lower edges delimit the interquartile range, and the outer vertical lines indicate maximum and minimum values. Results with different superscripts differ significantly (p<0.05).

E: Normal Weight rats; EVC: Normal Weight rats Given Vitamin C; M: Malnourished rats; MVC: Malnourished rats Given Vitamin C; D3: Experimental Day 3; D7: Experimental Day 7; D14: Experimental Day 14.

DISCUSSION

The healing process in animals of group M was delayed, and vitamin C contributed to fibroblast proliferation and collagen deposition in the primary and secondary intention wounds of the animals in group MVC. However, the use of this vitamin did not affect the decrease in macrophage migration in the malnourished rats and only decreased lymphocyte migration in this group in the final stages of healing.

Healing involves several growth factors, such as Epidermal Growth Factor (EGF), TGF, VEGF, Platelet Derived Growth Factor (PDGF), Fibroblast Growth Factor (FGF), which act by stimulating the proliferation of keratinocytes, fibroblasts, and endothelial cells; and the chemotaxis of polymorphonuclear macrophages and fibroblasts[2]. Cytokines are also involved, such as Tumor Necrosis Factor (TNF), interleukins, and interferons, which activate macrophages, have chemotactic activity for polymorphonuclear cells, stimulate angiogenesis, and even inhibit fibroblast proliferation and extracellular matrix synthesis[2].

Furthermore, the inflammatory process that occurs primarily in the initial phase of the healing process leads to the activation of various chemical mediators (histamine, bradykinin, prostaglandins, leukotrienes, nitric oxide, cytokines, etc.)[2].

After exposure to microorganisms, chemokines, and immune complexes in the extracellular medium or after phagocytic activation, leukocytes can release oxygen free radicals[2]. These free radicals can injure the endothelium and parenchymal cells and inactivate antiproteases. However, the influence of oxygen free radicals on any inflammatory reaction depends on the balance between production and inactivation of these metabolites by cells and tissues[2]. Since ascorbic acid is an antioxidant, it could help to minimize the effects of free radicals on inflamed tissues. Oxidative damage can be further reduced by giving patients preoperatively a diet rich in proteins (e.g, glutamine and arginine) and antioxidants, especially ascorbic acid[19].

The diary recommendation for vitamin C is 90 mg/day for males and 75 mg/day for females[20]. In the present study, we administered a daily dosage of 136 mg of vitamin C. Será que não tem algum erro nos números? Uma dose de 340 g/kg num rato de 250 g seria uma dose de 85 mg. Essa mesma dose num humano de 70 kg equivaleria a 23,8 g de vitamina C.

Malnutrition is one of the major global health problems, affects between 20 and 60% of hospitalized patients, and relates closely to higher morbidity and mortality[21] since it changes immune function and causes hypoalbuminemia, low hemoglobin, impaired healing, and more complications[22]. An experimental study feeding malnourished rats half of their chow requirement found that the animals had impaired healing, increasing mortality by 15% compared with a control group[11].

Mild, moderate, and severe malnutrition are defined as body weight losses of 10%, 10-20%, and >20%, respectively[23]. In the present study, the animals in groups M and MVC can be classified as moderately malnourished because most of them lost about 20% of their body weight.

Both wounds healed by primary and secondary intention were beefy red/pale pink on all study days. Although malnourished patients have a higher risk of infection and wound dehiscence, this was not observed in this study. Also, very few animals experienced pain in the lesions and when they did, it was only on D3, confirming the absence of infection in the wounds.

Rats fed an extremely low-protein diet presented impaired wound contraction and delayed healing[7]. Another study that subjected rats fed diets of varied protein content to standardized musculoskeletal trauma also found low scar contraction and levels of inflammatory

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cells in animals consuming inadequate protein[24]. The same was observed in a study on oral wound healing, where rats fed a diet containing specific nutrients presented better healing clinically and histologically[25]. On D7 primary intention lesion sizes differed significantly, as did secondary intention lesion sizes on D3, regardless of nutritional status or vitamin C supplementation ($p>0.05$). Likewise, scab and hematic type occurred only on D3 and D7 regardless of group, corroborating the abovementioned data on adequate wound retraction. On D3, no animal had wound re-epithelialization, but on D14, all of them did. On D7, most animals had complete re-epithelialization and some partial, with statistical difference only for healing by primary intention regardless of nutritional status or vitamin C supplementation, a finding that disagrees with the literature In this study, the absence of infection in addition to the absence of purulent scab may have contributed to proper wound contraction and re-epithelialization.

Studies indicate that vitamin C associated with pantothenic acid and protein is important for patients with pressure ulcers and poor surgical wound healing[26]. Topical use of ascorbic acid in rats decreases the number of macrophages, increasing the amount of fibroblasts and promoting collagen deposition and wound organization, which results in better tissue repair and shorter healing time[16].

Healing is divided into an inflammatory, a proliferative, and a remodeling phase. In the inflammatory phase, there is an increase in capillary permeability that allows the migration of specific cells to the wound, such as neutrophils (6 to 48 hours), macrophages (72 hours), and lymphocytes (5 days)[2]. In this study, we observed the expected pattern of inflammatory cells during the healing process. Both wounds healed by primary and secondary intention had a predominance of neutrophils on D3 and mixed inflammatory infiltrate (neutrophils and lymphocytes) on D7; only group M still had lymphocytes in both lesions on D14. This suggests that vitamin C in malnourished rats (Group MVC) may have contributed to the absence of lymphocytes on D14. Although vitamin C was given orally, our results agree with those of Lima *et al.*[16], who found an anti-inflammatory effect of topical vitamin C. On D7, unlike most animals in Group EVC, most animals had inflammatory infiltrate. This datum shows that vitamin C decreases inflammation intensity in normal weight animals sooner than in malnourished ones, probably by decreasing inflammatory cell migration. Moreover, vitamin C promoted the absence of fibrin-leukocyte scab in healing by primary intention; on D7 most animals in groups EVC and MVC no longer had this scab, contrary to most animals in groups E and M ($p<0.05$).

Macrophages were present on D7, but absent on D3 and D14. However, vitamin C decreased macrophage migration only in the normal weight groups, corroborating the literature[16]. These groups also did not have macrophages on D7, unlike the malnourished groups. These data indicates that vitamin C does not reduce macrophage migration in malnourished animals.

The proliferative phase occurs 3 to 7 days after surgery, characterized by high vascular proliferation (angiogenesis) and fibroblast levels[2]. Microscopically on D3, all animals presented neovascularization, and most animals in Group E, like those in group MVC, presented moderate neovascularization. No normal weight animal (groups E and EVC) had granulation in the wound edges of either lesion, while all malnourished animals (groups M and MVC) did ($p<0.05$). Neovascularization is the granulation present at wound edges and bed of scarred tissue[2]. The intensity of neovascularization differed between groups E and EVC in healing by primary intention on D3 and D7, and between groups E and EVC and E and M in healing by secondary intention on D3, expectedly showing that neither vitamin C nor malnutrition influenced this parameter. This

shows that the influence of malnutrition on healing cannot be related to neovascularization.

Fibroblasts produce ground substance (composed of glycosaminoglycans, fibronectin, and hyaluronic acid) and collagen, which will reconstitute the destroyed tissue[6]. The number of fibroblasts increased on D7: most of group E, all of group EVC, half of group MVC, but only a few in group M ($p<0.05$) had a moderate amount of fibroblasts in the lesion healed by primary intention. On D14, all animals in group E had few fibroblasts, some of group EVC had some fibroblasts, most of group MVC had few to some fibroblasts, and most of group C did not have fibroblasts ($p<0.05$). With respect to healing by secondary intention, most animals in groups E, EVC, and MVC had moderate amounts of fibroblasts, while animals in group M had a slight increase on D7 ($p<0.05$). On D14, most animals in group EVC and some in group E had a moderate amount of fibroblasts ($p<0.05$). These data show that vitamin C increases the proliferation of fibroblasts in the tissue of even malnourished animals, which may improve wound healing but at different rates depending on intention.

Deposition, clustering, and remodeling of collagen tissue and endothelial regression occur on the third stage of healing, called remodeling. The collagen tissue is present in the form of long fibrils. After many substances are placed disorderly on the scar, including collagen, the wound is restructured, or ordered. More fibroblasts and collagen fibers appear in the lesion[27]. Ascorbic acid is important in this process because hydroxylases do not function in its absence and consequently, hydroxyproline, hydroxylysine, and collagen are not formed[27]. Collagen fibers increased from D7, as expected. All animals in group EVC and most in group MVC had high levels of collagen fibers in both lesions on D14, unlike the animals without vitamin C supplementation, which had only moderate levels ($p<0.05$) Thus, even in malnourished rats, vitamin C can increase collagen deposition and improve the healing process.

CONCLUSION

In conclusion, vitamin C increases fibroblast proliferation and collagen deposition and reduces lymphocyte migration in the final stages of healing, speeding the healing of primary and secondary intention wounds regardless of nutritional status. However, early inflammation and macrophage migration subsidence only occur in normal weight animals.

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CONTRIBUTORS

All authors helped to collect, analyze, and discuss the data and to write the article; all read and approved the final version.

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REVISÃO | *REVIEW*

Crianças indígenas brasileiras: revisão dos estudos sobre o estado nutricional

Brazilian indigenous children: Review of studies about nutritional status

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RESUMO

Objetivo

Sistematizar os estudos sobre o estado nutricional antropométrico de crianças indígenas brasileiras a fim de examinar a capacidade de abordar a integralidade dos aspectos biológicos, antropológicos e ecológicos, bem como caracterizar os principais resultados analíticos dos determinantes do estado nutricional das crianças indígenas brasileiras.

Métodos

Realizou-se busca bibliográfica nas bases de dados *MedLine* e Lilacs, por meio da interseção dos descritores "índios sul-americanos" e "estado nutricional" (a busca no *MedLine* também incluiu o descritor "*Brazil*").

Resultados

Identificaram-se 65 estudos, dos quais 23 foram considerados relevantes para o presente trabalho. A sistematização dos estudos revisados destaca a concentração nas regiões centro-oeste e norte, assim como a carência de abordagens cultural, bioquímica e sobre o consumo alimentar. Em relação ao estado nutricional, sugerem-se: 1) maior vulnerabilidade nas crianças menores, principalmente em relação ao déficit de estatura; 2) ausência de diferenças no estado nutricional segundo o sexo; 3) determinação socioeconômica do estado nutricional; 4) diferenças no estado nutricional entre crianças de diferentes aldeias.

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Conclusão

O estado nutricional das crianças indígenas brasileiras apresenta determinação etária, socioeconômica e étnica, sendo necessários esforços para compreender a influência étnico-cultural no estado nutricional e na sua rede causal, bem como fatores vários abordados minimamente.

Termos de Indexação: Antropometria. Criança. Estado nutricional. Índios sul-americanos.

ABSTRACT

Objective

To systematize studies on the anthropometric nutritional status of Brazilian indigenous children in order to examine the ability to address the totality of biological, anthropological, and ecological aspects, as well as to characterize the main analytical results of the determinants of nutritional status of Brazilian indigenous children.

Methods

MedLine and Lilacs *were searched using the intersection of "South American Indians" and "nutritional status" descriptors (the search in MedLine also included the descriptor "Brazil").*

Results

Overall, 65 studies were identified, and 23 were considered relevant to this study. The systematization of these studies highlights the concentration of studies in the midwestern and northern regions of Brazil, as well as the lack of cultural, biochemical, and food consumption approaches. Regarding nutritional status, we found: 1) greater vulnerability of younger children, especially in relation to stunting; 2) absence of differences in nutritional status according to sex; 3) socioeconomic determination of nutritional status; 4) differences in nutritional status between children from different villages.

Conclusion

The nutritional status of Brazilian indigenous children is associated with age, socioeconomic status, and ethnic characteristics. Efforts are needed to understand the ethnic and cultural influence on nutritional status and on its causal network, as well as of various factors minimally discussed.

Indexing terms: *Anthropometry. Child. Nutritional status. South American Indians.*

INTRODUÇÃO

Existem, no Brasil, segundo resultados do Censo Demográfico de 2010[1], 505 terras indígenas reconhecidas, presentes em praticamente todos os estados do País e representando 12,5% do território nacional. A população indígena é de 896,9 mil: 36,2% presentes em área urbana e 63,8% na área rural, abrangendo 305 etnias que falam 274 idiomas. Entre as características da população indígena brasileira figuram: 1) estrutura etária marcada por uma população jovem, fruto da persistência de altos níveis de fecundidade; 2) nível educacional mais baixo do que o da população não indígena; 3) situação econômica, habitacional e de saneamento básico desfavoráveis; 4) indicadores econômicos, habitacionais, educacionais e de saúde com pior situação nas áreas rurais, onde a proporção de crianças é maior. Do ponto de vista da saúde, as populações indígenas representam um dos segmentos mais desfavorecidos, o que demanda o fortalecimento de políticas públicas específicas. Entretanto, razões culturais e territoriais, dentre outras, tornam a obtenção de informações sobre as condições de vida desses povos um processo complexo, o que se aplica também às dimensões alimentar e nutricional e restringe o desenvolvimento de intervenções nutricionais.

O perfil nutricional das crianças brasileiras e sua evolução têm sido bem definidos a partir de inquéritos nacionais[2]: Estudo Nacional da Despesa Familiar (ENDEF) de 1974/1975, Pesquisa Nacional sobre Saúde e Nutrição (PNSN) de 1989, Pesquisa sobre Padrões de Vida (PPV) de 1996/1997, Pesquisas Nacionais de Demografia e Saúde

(PNDS) de 1996 e 2006. Essas pesquisas mostram um intenso declínio da desnutrição, incluindo ambos os sexos, todas as faixas etárias, áreas urbana e rural, e todos os estratos socioeconômicos, sendo os estratos sociais mais desfavorecidos os que apresentam, ainda, maiores prevalências. De acordo com os dados específicos da PNDS de 2006, as prevalências de déficit de estatura/idade, déficit de peso/estatura, déficit de peso/idade, excesso de peso/estatura, anemia e deficiência de vitamina A em crianças menores de cinco anos foram de 7,0%, 1,98%, 1,7%, 6,6%, 20,9% e 17,4%, respectivamente[3,4]. Porém, os povos indígenas não fizeram parte desses inquéritos, o que resulta no desconhecimento das suas condições de alimentação e nutrição.

Diante desse panorama, e considerando a maior vulnerabilidade da população indígena em relação à situação de saúde, que tem no estado nutricional um importante determinante, evidenciou-se a necessidade de dados de abrangência nacional sobre a situação nutricional dos povos indígenas. Assim, planejou-se o desenvolvimento do "I Inquérito Nacional de Saúde e Nutrição dos Povos Indígenas" (INSNPI), pesquisa realizada entre 2008-2009[5]. Os resultados desse inquérito apontaram prevalências de déficit de estatura/idade, déficit de peso/idade e anemia de 26,0%, 5,9% e 51,3%, respectivamente, em crianças menores de cinco anos, valores esses bem maiores que os referidos na PNDS de 2006 sobre o estado nutricional das crianças brasileiras não indígenas. Os dados do INSNPI foram analisados para verificar a associação de variáveis demográficas, socioeconômicas, sanitárias e materno-infantis com os déficits antropométricos, resultados que foram publicados posteriormente[6]. Contudo, o INSNPI não considerou a diversidade ecológica, social e cultural dos povos indígenas[5], o que é essencial para uma melhor compreensão da ecologia e epidemiologia nutricional desses povos.

Considerando os argumentos anteriores, este trabalho teve por objetivo sistematizar os estudos sobre o estado nutricional antropométrico de crianças indígenas brasileiras, com o fim de examinar a capacidade de abordar a integralidade dos aspectos biológicos, antropológicos e ecológicos, bem como caracterizar os principais resultados analíticos dos determinantes do estado nutricional das crianças indígenas brasileiras.

MÉTODOS

O estudo é uma revisão de artigos científicos, que incluíram nas suas amostras menores de cinco anos, sobre o estado nutricional antropométrico de crianças indígenas brasileiras.

Para a identificação dos artigos, realizou-se, em 10 de março de 2013, uma busca nas bases de dados *National Library of Medicine, Estados Unidos* (*MedLine*), e Literatura Latino-Americana e do Caribe em Ciências da Saúde (Lilacs) de todos os estudos publicados no período de 1990 até a data da busca.

A busca bibliográfica foi realizada por dois revisores por meio da interseção dos descritores, em língua inglesa e portuguesa, "índios sul-americanos" e "estado nutricional". No caso da busca no *MedLine*, o descritor "*Brazil*" também foi usado.

Para o cômputo do total de estudos identificados, foi verificada a duplicação deles entre as bases de dados, sendo cada artigo contabilizado somente uma vez. A partir dos estudos identificados, selecionaram-se aqueles que parecessem preencher os critérios para sua inclusão, considerando-se a leitura dos títulos e os resumos pelos revisores. Os estudos selecionados foram avaliados pelos revisores, levando-se em conta a leitura e a análise criteriosa do texto completo. Após esta ação os estudos classificaram-se como excluídos ou incluídos considerando os critérios estabelecidos para esses fins (Quadro1).

Os artigos classificados como incluídos foram caracterizados segundo o autor e o ano de publicação, procedência acadêmica dos autores, grupos estudados e localização, amostra, índices antropométricos utilizados, uso de outros métodos de avaliação do estado nutricional

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Quadro 1. Critérios para inclusão e exclusão dos estudos, que incluíram nas suas amostras menores de cinco anos, sobre o estado nutricional antropométrico de crianças indígenas brasileiras.

Parâmetros de análise	Critérios de inclusão	Critérios de exclusão
Tipos de estudos	- Estudos empíricos publicados em revistas científicas	- Artigos de revisão - Livros/conferências em congressos/teses
Participantes	- Crianças indígenas brasileiras, incluindo nas suas amostras menores de cinco anos	- Estudos realizados fora do Brasil - Crianças não indígenas - Idade inapropriada (amostras de escolares, adolescentes, adultos)
Desfechos	- Escore-Z de estatura para idade - Escore-Z de peso para estatura - Escore-Z de peso para idade - Escore-Z de índice de massa corporal para idade	- Índices antropométricos não avaliados

(bioquímica, consumo alimentar, socioeconômica, cultural) e principais resultados analíticos. Os artigos foram categorizados segundo o tipo de delineamento: transversal ou longitudinal. Possíveis diferenças nas referências de classificação do estado nutricional adotadas pelos pesquisadores não foram consideradas.

RESULTADOS

Identificaram-se 65 estudos. Após análise dos títulos e resumos, foram selecionados 33, que, aparentemente, preenchiam os critérios de inclusão. Com a leitura na íntegra, foram classificados como incluídos um total de 23 artigos, que, adequadamente, preenchiam todos os critérios de inclusão. O fluxo do número de estudos excluídos e incluídos encontra-se no Quadro 2.

O Anexo mostra a caracterização dos estudos quanto aos parâmetros adotados. Dos 23 artigos incluídos[7-29], 21 apresentam desenho transversal[7-27], e dois, desenho longitudinal[28,29]. Três[13,17,26] dos estudos transversais consideraram mais de um inquérito, analisando a evolução do estado nutricional em diferentes momentos.

Considerando a procedência dos autores, verifica-se que apenas sete trabalhos[11,19,24-27,29] foram desenvolvidos por pesquisadores vinculados a uma única instituição. A maioria dos estudos tem autores de regiões diferentes do País[8-10,12-15,17,20-22,28], com vínculos com instituições das regiões Sul e Sudeste, principalmente. Apenas um estudo[28] tem autor da região Nordeste. Destacam-se com maior quantidade de estudos a Fundação Osvaldo Cruz (Rio de Janeiro), a Universidade Federal de Santa Catarina, a Universidade Federal do Rio de Janeiro e a Universidade Federal de São Paulo.

As aldeias estudadas localizaram-se, principalmente, na região Centro-Oeste[7,9,11-15,17,19,21,24,27-29]; desses estudos, quatro[9,15,19,27] estudaram, também, aldeia da região Norte. Além dos men-

Quadro 2. Estudos excluídos e incluídos na revisão de artigos sobre o estado nutricional antropométrico de crianças indígenas brasileiras (estudos incluindo nas suas amostras menores de cinco anos).

Etapas/critérios de exclusão e inclusão	nº de estudos
Estudos identificados	
MedLine	33
Lilacs	48
Estudos em duplicata	16
Total de estudos identificados	65
Estudos excluídos	
Artigos de revisão[a]	1
Livros/conferências em congressos/teses[a]	15
Estudos realizados fora do Brasil[a]	7
Crianças não indígenas[a]	2
Idade inapropriada[a]	7
Índices antropométricos não avaliados[b]	10
Total de estudos excluídos	42
Estudos selecionados (leitura de títulos e resumos)	33
Estudos incluídos (leitura na íntegra)	23
Total	**23**

Nota: [a]Leitura de títulos e resumos; [b]Leitura na íntegra.

cionados anteriormente, outros sete trabalhos[10,18,20,22,23,25,26] estudaram grupos localizados na região Norte. No Centro-Oeste, contemplaram-se os estados de Mato Grosso[7,9,11,12,14,15,19,24,27-29] e Mato Grosso do Sul[13,17,21]. Na região Norte, Pará[18,19,22,25,26], Rondônia[9,15,20,27] e Amazonas[10,23], foram os estados contemplados. Nenhuma comunidade indígena da região Nordeste foi estudada.

No que concerne à amostra, observa-se que a maioria dos autores buscou incluir o total de crianças nas faixas etárias de interesse; três estudos transversais[7,21,22] foram desenvolvidos com quase todos os indivíduos da população-alvo, e apenas um[13] com amostra probabilística. Considerando a faixa etária, seis estudos[8,9,13,16,21,26] incluíram exclusivamente crianças menores de cinco anos, e em oito[7,12,14,15,17,22,24,28], de um total de catorze[7,11,12,14,15,17,18,20,22,24,25,27-29], foram relatados resultados desagregados para crianças menores de cinco anos. Ressalta-se que três artigos[17,19,20] não incluíram crianças com idade inferior a dois anos.

Além da avaliação antropométrica, análises bioquímicas foram consideradas em cinco estudos[10,11,15,17,18], todos eles relacionados à anemia, à exceção de um estudo que determinou as concentrações de mercúrio capilar como medida do consumo de peixe[18]. O consumo alimentar foi método de avaliação em um único estudo[21]. A análise socioeconômica foi utilizada em cinco[7,8,10,16,21]; e o contexto cultural não foi considerado em nenhum dos manuscritos revisados. Ressalta-se que somente dois estudos[10,21] incluíram mais dois métodos de avaliação do estado nutricional, além da antropometria.

A caracterização dos principais resultados analíticos dos estudos aponta que somente cinco[7,8,10,16,21], dos quais três[7,10,16] com análise multivariada, analisaram a influência de diversas variáveis, além das biológicas (sexo, idade), no estado nutricional antropométrico das crianças. A maioria dos estudos não indicou o sexo da criança como discriminante do estado nutricional, seja para a estatura/idade, seja para o peso/estatura ou para o peso/idade. A associação inversa entre a idade da criança e o déficit de estatura/idade foi estabelecida em seis[7,14,16,17,21,22] dos 13 estudos[7,8,10,11,13-17,21,22,24,25] que consideraram esse índice. Resultado similar foi observado em três[14,16,26] dos 11 estudos[7,8,10,13-16,21,24-26] que trabalharam com o peso/idade e em um[14] dos dez artigos[10,11,13-16,21,22,24,25] com resultados para o peso/estatura. Mattos *et al*.[24] observaram melhores condições de peso/estatura e peso/idade nas crianças menores de 12 meses quando comparadas a crianças na faixa etária entre 12 e 60 meses e maiores que 60 meses.

Análises estatísticas entre níveis de hemoglobina e índices antropométricos foram realizadas somente em dois estudos[10,17], um deles[17] com significância em relação à estatura/idade. Variáveis relacionadas às condições sanitárias e socioeconômicas, bem como a idade materna, estiveram associadas de maneira inversa ao estado nutricional antropométrico em estudos com análises múltiplas[7,16]. Outras variáveis explicativas do estado nutricional às quais os autores prestaram atenção foram o acometimento por doenças infecciosas[8,10], a idade materna[16] e o peso ao nascer[8].

Os três estudos[19,26,27] que compararam o estado nutricional de crianças de diferentes aldeias indicaram melhor situação para a estatura/idade em uma das aldeias. Para o peso/estatura (índice de massa corporal/idade) e peso/idade, diferenças entre os grupos foram constatadas, também, em dois[19,26] desses estudos. Em geral, crianças das populações de Alto Xingu[19], Moroxewara[26] e Gavião[27] tiveram melhores indicadores do estado nutricional quando comparadas às crianças de Ikpeng, Paranatinga e Zoró/Suruí respectivamente. Comparação entre crianças de diferentes civilizações foi conduzida por Viera *et al.*[23] e constatou crianças indígenas com maior prevalência de déficit de estatura/idade se comparadas às não indígenas de similar vulnerabilidade.

Os resultados relacionados à evolução do estado nutricional, analisada em três estudos

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transversais que utilizaram vários inquéritos[12,16,26] e em dois longitudinais[28,29], são conflitantes. Para a estatura/idade, relataram-se diminuições[12,28] e aumentos[17,28] (um[17] com o aumento condicionado à faixa etária e outro[28] com aumento e diminuição para períodos de tempo diferentes). Para o peso/estatura, um estudo[17] relatou aumento e outro[28] relatou diminuição, sendo a associação do primeiro[17] condicionada à faixa etária. Para o peso/idade, dois estudos[12,28] relataram diminuição, e outros dois[17,26] relataram aumento condicionado à faixa etária.

DISCUSSÃO

De fato, a investigação dos fatores determinantes da desnutrição nas crianças é considerada um tema de relevância em saúde pública. Os estudos voltados para a análise casuística dos principais agravos à saúde das populações indígenas iniciaram-se na década de 1990. No Brasil, as discussões abordavam a influência das mudanças sociais, ambientais e econômicas no perfil epidemiológico dos povos indígenas[30], inserindo a saúde indígena na saúde pública ou coletiva.

Entretanto, observa-se nos resultados desta pesquisa que há um fator importante de dispersão das publicações associado ao tempo (23 anos para 23 estudos) e de concentração associado ao espaço nas regiões Norte e Centro-Oeste. A descrição da procedência acadêmica dos autores também mostra concentração nas regiões Sul e Sudeste, o que contrasta com o panorama que revela a concentração dos estudos em regiões diferentes. Esse cenário pode explicar a pouca diversificação das etnias estudadas e sugerir o interesse dos pesquisadores pelo tema. Essas apreciações podem ser indícios das dificuldades que ainda persistem para o desenvolvimento de pesquisas com populações indígenas, anteriormente descritas[31].

Outro aspecto importante constatado neste estudo - a dificuldade em obter dados representativos nos estudos de saúde e nutrição das populações indígenas -, tinha sido anteriormente verificado em pesquisa similar com enfoque na América Latina[32], evidenciando-se a necessidade de avançar nesse sentido. Outras questões relacionadas à padronização dos estudos sobre os procedimentos metodológicos na obtenção e na análise dos dados antropométricos não se trataram nesta revisão. Essas questões foram tratadas criticamente em estudo anterior sobre o estado nutricional de crianças indígenas brasileiras que sistematizou os resultados das prevalências de déficit antropométrico[30].

É importante destacar, também, que foram poucos os estudos com abordagens integrais do estado nutricional, incluindo análise bioquímica, de consumo alimentar, socioeconômica e cultural, o que limita a compreensão dos determinantes do estado nutricional. Portanto, indica-se a necessidade de mais pesquisas que abordem os fatores que permanecem pouco explorados no estudo do processo saúde-doença em populações indígenas, sobretudo o contexto cultural/antropológico e o consumo alimentar.

Dosagens bioquímicas são importantes a fim de se obterem informações precisas e precoces sobre alterações produzidas pela insuficiência e/ou excesso de consumo alimentar, como as carências nutricionais específicas[33]. Nesse sentido, é importante esclarecer a contribuição da deficiência de ferro/anemia no estado nutricional das crianças indígenas, principalmente no déficit de estatura, uma vez conhecida a associação entre esses fatores[34] e a alta prevalência de anemia nas crianças indígenas brasileiras[5].

A avaliação do consumo alimentar fornece indicadores indiretos do estado nutricional[35]. Nas comunidades indígenas, a avaliação do consumo de alimentos é importante, uma vez que existem populações submetidas à transição cultural e alimentar, o que pode levar tanto à desnutrição quanto ao sobrepeso[30,36]. As repercussões negativas das mudanças alimentares sobre o perfil de crescimento físico foram discutidas por Ribas *et al*.[21]. Além do abandono das práticas tradicionais, a dependência do ambiente para sua manutenção e a exposição dos povos indígenas a trans-

formações socioeconômicas os colocam em situação de alta vulnerabilidade dietética e nutricional[30,36,37].

O contexto cultural como fator determinante do estado nutricional de populações indígenas explica-se em função de dois fatores: 1) a diversidade ecológica, social e cultural dessas populações; 2) a contribuição negativa nas condições de saúde e de vida dessas populações decorrentes do processo de aculturação[37]. Além disso, determinantes importantes do estado nutricional, como os hábitos alimentares, as práticas de cuidado, a amamentação e o desmame, apresentam uma alta dimensão cultural entre as sociedades indígenas[6,37].

Apesar das limitações anteriores, os estudos aqui sistematizados fornecem resultados analíticos relevantes que possibilitam traçar um panorama da influência de determinantes no estado nutricional das crianças indígenas brasileiras, considerando o modelo conceitual da desnutrição na infância proposto pelo Fundo das Nações Unidas para a Infância[38] e as assimetrias com os resultados do INSNPI[5,6]. Percebe-se, primeiramente, de maneira semelhante, nos manuscritos sistematizados e no INSNPI[6], que enquanto o sexo da criança não representou fator discriminante do estado nutricional, a idade da criança associou-se de maneira inversa à ocorrência de desnutrição, principalmente da baixa estatura, e, a seguir, do déficit de peso/idade. Converge com esses resultados o de uma análise que constatou os dois primeiros anos de vida como o principal momento do déficit de crescimento, com início pouco antes da concepção, considerando crianças de grupos populacionais não indígenas observadas em 54 inquéritos demográficos de países de ingressos baixos e médios[39]. Explicam-se esses resultados por ser essa a fase da vida que corresponde ao período mais dinâmico do crescimento, com grande vulnerabilidade às condições ambientais relacionadas aos padrões alimentares e ao perfil de morbidade. Se não corrigidos até o segundo ano de vida, os efeitos gerados pela desnutrição crônica infantil podem ser permanentes e irreparáveis, com consequências na morbimortalidade, da infância até a vida adulta[40-43], justificando a importância das evidências antepostas para a tomada de decisões e formulação de ações precoces.

Embora poucos estudos da presente revisão tenham incluído análises estatísticas multivariadas, variáveis que caracterizam vulnerabilidade socioeconômica mostraram-se associadas à desnutrição, semelhantemente aos resultados do INSNPI[6]. Essas são condições que produzem privações das necessidades básicas de vida, como alimentação, saúde, saneamento e educação, com restrições no consumo alimentar e elevada carga de morbidade, prejudicando o potencial de crescimento na infância[44]. Nesse contexto, melhorias nas condições do ambiente social e econômico devem ser prioridades relacionadas às questões de saúde das populações indígenas.

Apesar da impossibilidade de se posicionar por meio dos resultados deste trabalho sobre o peso ao nascer e o acometimento por doenças infecciosas, cabe ressaltar que os resultados do INSNPI indicaram prevalências maiores de desnutrição nas crianças nascidas com baixo peso e naquelas hospitalizadas nos últimos 12 meses[6]. É meritório comentar, também, que nenhum dos trabalhos sistematizados abordou as práticas de cuidados e o acesso aos serviços primários de saúde, fatores que exercem notável impacto nos indicadores de saúde e de nutrição das crianças[44,45].

Ainda, destaca-se, entre os resultados desta pesquisa, a ocorrência de diferenças no estado nutricional de crianças de diferentes etnias. Considerando que o INSNPI verificou maiores prevalências de desnutrição na região Norte[6], sugere-se que sejam as etnias dessa região as mais vulneráveis. A constatação desse panorama preliminar mostra grande relevância, pois, apesar de o Brasil apresentar uma das maiores diversidades sociais das Américas, a relação entre etnicidade e saúde

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tem sido pouco explorada. Além disso, outros desafios reconhecidos relacionam-se à capacidade das pesquisas de lidar com grandes diferenças socioculturais, incluindo cosmologias, línguas, formas de subsistência, organização social e sistemas políticos próprios[46-48]. No INSNPI, ressalta-se, ainda, a necessidade de considerar as transformações ambientais, socioeconômicas, culturais e relativas aos estilos de vida que se verificam, de maneira heterogênea, em praticamente todas as terras indígenas do País[5].

Nessa conjuntura de desafios, aborda-se, na literatura, o impacto que nas condições de saúde e nutrição têm as mudanças socioeconômicas, culturais e ambientais que vêm experimentando os povos indígenas no Brasil[31]. Nesse quadro de transformações, a restrição territorial, o progressivo esgotamento dos recursos naturais e o comprometimento das atividades de subsistência, com consequências negativas na diversidade alimentar, aparecem como elementos comuns[5,37]. À instabilidade na produção de alimentos soma-se, ainda, a homogeneidade nas precárias condições de saneamento, baixas coberturas dos serviços de saúde, deficiências nos serviços de saúde de atenção primária e um perfil de morbimortalidade caracterizado por frequências elevadas de doenças infecciosas e parasitárias que influenciam negativamente o estado nutricional[5,8,12,37]. Assim, evidencia-se a necessidade de reforçar as ações que melhorem o acesso às terras e à assistência à saúde, ao saneamento básico e à educação das famílias indígenas, com respeito à cultura indígena.

É importante enfatizar que os resultados deste trabalho não permitem uma caracterização nacional nem generalista no tocante ao estado nutricional das crianças indígenas brasileiras. Possibilitou, porém, traçar um panorama do conhecimento sobre fatores determinantes, podendo subsidiar tanto as decisões de pesquisas futuras, quanto a definição de políticas públicas. Nesse contexto, cabe ressaltar a importância de compreender como a diversidade étnica, geográfica, ecológica, cultural e social dos povos indígenas relaciona-se com outros determinantes intermediários do estado nutricional que não apresentam significado uniforme em contextos interculturais, como os fatores socioeconômicos, e como influencia determinantes imediatos, como o consumo alimentar e as práticas de cuidados. A consolidação e a ampliação do Sistema de Vigilância Alimentar e Nutricional Indígena podem ser estratégicos para esses fins.

CONCLUSÃO

Com este trabalho, foi possível produzir um importante conjunto de dados sobre o perfil do estado nutricional de crianças indígenas, com enfoque principal nos fatores determinantes, delimitando a influência da idade da criança, das condições socioeconômicas e a maior vulnerabilidade de algumas etnias quando comparadas a outras. É importante ressaltar, nesse sentido, que o delineamento de futuras pesquisas deve considerar fatores pouco estudados como o consumo alimentar, o estado nutricional de micronutrientes, o adoecimento por doenças infectoparasitárias, as práticas de cuidados e o acesso à assistência primária de saúde, bem como a influência étnico-cultural no estado nutricional e na sua rede causal. Para que os estudos possam apreender a sociodiversidade própria dos povos indígenas e a influência dos contextos locais, é necessária a desconcentração geográfica dos estudos e da procedência acadêmica dos pesquisadores.

COLABORADORES

D FIGUEROA PEDRAZA concepção do artigo; levantamento, análise e interpretação dos dados; redação e revisão crítica do artigo; aprovação final do artigo. MC SALES levantamento, análise e interpretação dos dados; redação e revisão crítica do artigo; aprovação final do artigo. D QUEIROZ levantamento, análise e interpretação dos dados; redação e revisão crítica do artigo; aprovação final do artigo. LCA LEITÃO levantamento e análise dos dados; redação do artigo; aprovação final do artigo.

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ANEXO

CARACTERÍSTICAS DOS ARTIGOS, QUE INCLUÍRAM NAS SUAS AMOSTRAS MENORES DE CINCO ANOS, SOBRE O ESTADO NUTRICIONAL ANTROPOMÉTRICO DE CRIANÇAS INDÍGENAS BRASILEIRAS

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Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
Estudos de desenho transversal						
Ferreira *et al.*, 2012[7]	- Fundação Oswaldo Cruz (Rio de Janeiro) - Universidade do Estado do Rio de Janeiro - Universidade Federal do Rio de Janeiro	Povo Xavante (aldeia de Pimentel Barbosa) em Mato Grosso	242 crianças <10 anos (94,3% das crianças da aldeia) 242 crianças <5 anos (crianças com parâmetros antropométricos)	E/I, P/E, P/I	Socioeconômica	- Maior prevalência de déficit de E/I (análise bivariada) nas crianças do sexo feminino, diferença não encontrada para o P/I - Sem diferenças entre os índices E/I e P/I segundo a idade das crianças (análise bivariada) - Variabilidade do escore-Z de E/I (análise multivariada) explicado pela idade das crianças e proporção de adultos na família (entre as crianças <2 anos), IMC materno (entre as crianças ≤2 e <5 anos), posse de bens e estatura materna (entre as crianças ≥5 anos) - Análises estatísticas para P/E não foram realizadas, nem multivariadas para P/I
Kühl *et al.*, 2009[8]	- Universidade Estadual do Centro-Oeste - Universidade Federal de Santa Catarina - Universidade Federal de Pelotas	Povo Kaingáng (aldeias Sede ou Campina, Água Santa, Paiol Queimado, Fazenda ou Trevo e Mato Branco) em Paraná	141 crianças <5 anos (96% das crianças da aldeia)	E/I, P/E, P/I, IMC/I	Socioeconômica	- Maior prevalência de déficit de E/I e P/I em crianças com baixo peso ao nascer (<2.500 g) - Maior déficit de P/I em crianças que habitavam construções com paredes feitas de material não durável - Sem diferenças entre os índices E/I e P/I segundo o sexo e a idade das crianças, variáveis de morbidade (diarreia, pneumonia) e características maternas (escolaridade, idade, estado civil) - Análises estatísticas para P/E e IMC/I não foram realizadas
Orellana *et al.*, 2009[9]	- Fundação Oswaldo Cruz (Manaus) - Fundação Oswaldo Cruz (Rio de Janeiro) - Universidade Federal do Rio de Janeiro - Universidade Federal de Santa Catarina	Povos Suruí, Xavante e Wari' em Rondônia e Mato Grosso	336 crianças <5 anos (buscou-se incluir nas análises a totalidade das crianças nas faixas etárias de interesse, sem especificar o total de crianças)	E/I, P/E, P/I, IMC/I	-	- Sem diferenças entre os índices antropométricos segundo o sexo das crianças

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Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
Carvalho-Costa *et al*., 2007[10]	- Fundação Oswaldo Cruz (Rio de Janeiro) - Universidade do Estado do Rio de Janeiro	Povos de descendência Tukano Oriental (Tukano, Pira-tapuya, Desana) e Aruak (Baniwa, Bare, Tariana) (população urbana de Santa Isabel do Rio Negro) em Amazonas	242 crianças 6 - 84 meses (crianças não atendidas em Centro Comunitário, de um total de 720) Não probabilística	E/I, P/E, P/I	Bioquímica (anemia), Socioeconomica	- Menores escores-Z de P/E e P/I em crianças com *Giardia lamblia* (análise multivariada: controle para idade, sexo, renda familiar e infecções por *Ascaris lumbricoides* e *ancilostomídeos*), diferença não encontrada para a E/I - Sem associação entre os níveis de hemoglobina e índices antropométricos
Mondini *et al*., 2007[11]	- Universidade Federal de São Paulo	Povo Kamaiurá (aldeias de Morena e do Ipavu) em Mato Grosso	112 crianças <120 meses (sem distinção para <5 anos) (30,77% da população)	E/I, P/E	Bioquímica (anemia)	- Escores-Z de E/I e P/E, bem como da prevalência de déficit de E/I, sem diferenças segundo o sexo e idade das crianças - Análises estatísticas entre níveis de hemoglobina e índices antropométricos não foram realizadas
Leite *et al*., 2007[12]	- Universidade Federal de Santa Catarina - Fundação Oswaldo Cruz (Rio de Janeiro)	Povo Wari' (aldeia Santo André) em Mato Grosso	Primeira avaliação: 111 crianças <10 anos, 60 crianças <5 anos Segunda avaliação: 108 crianças <10 anos, 60 crianças <5 anos (buscou-se incluir nas análises a totalidade das crianças nas faixas etárias de interesse, sem especificar o total de crianças)	E/I, P/E, P/I	-	- Menores escores-Z de E/I e P/I logo após a estação das chuvas (segundo inquérito), diferença não encontrada para o P/E
Pícoli *et al*., 2006[13]	- Universidade de São Paulo - Universidade Estadual Paulista Júlio de Mesquita Filho - Universidade Federal de Mato Grosso do Sul	Povos Kaiowá e Guaraní (área Indígena de Caarapó) em Mato Grosso do Sul	137 crianças <5 anos Probabilística	E/I, P/I	-	- Sem diferenças entre os índices antropométricos segundo o sexo e idade das crianças, e a escolaridade materna

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Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
Leite *et al*., 2006[14]	- Universidade Federal de Santa Catarina - Fundação Oswaldo Cruz (Rio de Janeiro) - Universidade Federal do Rio de Janeiro	Povo Xavante (aldeia São José) em Mato Grosso	227 crianças <10 anos 123 crianças <5 anos (13,37% da população)	E/I, P/E, P/I	-	- Maiores prevalências de déficit de E/I, P/E e P/I no grupo de crianças <5 anos do que no grupo de crianças <10 anos (análise não estatística)
Orellana *et al*., 2006[15]	- Fundação Oswaldo Cruz (Manaus) - Fundação Oswaldo Cruz (Rio de Janeiro)	Povo Suruí (reserva Indígena Sete de Setembro) em Rondônia e Mato Grosso	293 crianças <10 anos75 crianças <5 anos (21,25% das crianças <10 anos)	E/I, P/E, P/I	Bioquímica (anemia)	- Sem diferenças entre os índices antropométricos segundo o sexo e idade das crianças - Análises estatísticas entre níveis de hemoglobina e índices antropométricos não foram realizadas
Menegolla *et al*., 2006[16]	- Universidade do Vale do Rio dos Sinos - *University of East Anglia*	Povo Guarita em Rio Grande do Sul	583 crianças <5 anos Não probabilística	E/I, P/E, P/I	Socioeconômica	- Maior prevalência de déficit de E/I quando (análise multivariada): 1) água para alimentação coletada em fonte, poço ou rio; 2) não disponibilidade de geladeira; 3) mães <16 anos ao nascimento da criança mais velha entre os filhos menores de 5 anos; 4) mãe analfabeta; sem diferenças segundo o destino dos dejetos e o número de filhos <5 anos - Maiores prevalências de déficit de E/I (análise bivariada) nas crianças do sexo masculino e nas crianças 1-2 anos (<1 ano e ≥3 anos foram as outras categorias de análise) - Análises estatísticas para P/E e P/I foram realizadas somente em relação a sexo e idade, com menor prevalência de déficit de P/I em crianças ≥3 anos (<1 ano e ≥3 anos foram as outras categorias de análise), diferenças não encontradas para o P/E (análises bivariadas)
Morais *et al*., 2005[17]	- Universidade Federal de São Paulo - Universidade Federal do Mato Grosso do Sul	Povo Teréna (aldeias Limão Verde e Córrego Seco) em Mato Grosso do Sul	Primeira avaliação: 61 crianças <24 meses, 84 crianças >24 e ≤60 meses, 108 crianças	E/I, P/E, P/I	Bioquímica (anemia)	- Aumento, entre a primeira e segunda avaliação, dos escores-Z de P/I e P/E nas crianças <24 meses, e dos escores Z de P/I e E/I nas crianças >24 e ≤60 meses

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Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
			>60 e ≤120 meses (todas as crianças <5 anos das aldeias)segunda avaliação: 54 crianças <24 meses, 69 crianças >24 e ≤60 meses, 121crianças >60 e ≤120 meses (90% das crianças <10 anos das aldeias)			- Na primeira avaliação, menor prevalência de déficit de E/I nas crianças >60 e ≤120 meses - Na segunda avaliação, menores escores-Z de E/I nas crianças anêmicas de idade >24 e ≤60 meses (<24 meses, ≥24 e ≤60, >60 e ≤120 meses foram as faixas etárias analisadas) (outras análises estatísticas não significativas)
Dórea *et al*., 2005[18]	- Universidade de Brasília - Instituto Brasileiro do Meio Ambiente (Brasília)	Povo Munduruku (aldeias Kuburua e Cururu) Povo Kayabi (aldeia Kayabi) em Pará	203 crianças <120 meses (sem distinção para <5 anos) Não probabilística	P/I	Bioquímica (mercúrio capilar: marcador de consumo de peixe)	- Sem correlação entre o P/I e o consumo de peixe
Fagundes *et al*., 2004[19]	- Universidade Federal de São Paulo	Povo Xingu (aldeias Alto-Xingu e do Ikpeng) em Mato Grosso e Pará	164 crianças 24-117 meses (sem distinção para <5 anos) (95 crianças da aldeia alto-Xingu e 69 crianças da aldeia do Ikpeng) Não probabilística	E/I, P/I, IMC/I	-	- Maiores escores-Z de E/I, P/I e IMC/I nas crianças do Alto Xingu - Maior prevalência de déficit de E/I nas crianças do Ikpeng
Escobar *et al*., 2003[20]	- Universidade Federal de Rondônia - Universidade Federal do Rio de Janeiro - Fundação Oswaldo Cruz (Rio de Janeiro)	Povo Wari' (aldeias Bom Futuro, Santo André e do Posto Indígena Lage) em Rondônia	131 crianças 24-120 meses (sem distinção para <5 anos) (76% das crianças das aldeias)	E/I, P/E, P/I	-	- Maior prevalência de déficit de P/I em crianças do sexo masculino, diferença não encontrada para a E/I nem para o P/E
Ribas *et al*., 2001[21]	- Universidade Federal do Mato Grosso do Sul - Universidade Católica Dom Bosco	Povo Teréna (aldeia Córrego do Meio) em Mato Grosso do Sul	100 crianças <59 meses (97,1% das crianças da aldeia)	E/I, P/E, P/I	Consumo alimentar, socioeconomica	- Maiores prevalências de déficit de E/I e P/I em crianças do sexo masculino - Maior prevalência de déficit de P/E em crianças do sexo feminino

ANEXO

CARACTERÍSTICAS DOS ARTIGOS, QUE INCLUÍRAM NAS SUAS AMOSTRAS MENORES DE CINCO ANOS, SOBRE O ESTADO NUTRICIONAL ANTROPOMÉTRICO DE CRIANÇAS INDÍGENAS BRASILEIRAS

5 de 6

Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
	- Universidade de São Paulo					- Maior prevalência de déficit de E/I no grupo de crianças 6-11 meses do que nos grupos de crianças 12-23 meses e 24-59 meses, bem como no grupo de crianças 12-23 meses do que nos grupos de crianças 24-59 meses (análises não realizadas para P/E e P/I) (todas as análises descritivas)
Capelli *et al*., 2001[22]	- Universidade Iguaçu - Fundação Osvaldo Cruz (Rio de Janeiro)	Povo Parkatêjê (aldeia Mãe-Maria) em Pará	104 crianças <10 anos 67 crianças <5 anos (todas as crianças da aldeia)	E/I, P/E	-	- Maior prevalência de déficit de E/I no grupo de crianças <2 anos do que nos grupos de crianças 2-5 anos e 6-9 anos - Prevalências inexpressivas de déficit de P/E em todas as faixas etárias (todas as análises descritivas)
Viera *et al*., 2000[23]	- Universidade Federal do Rio de Janeiro - Universidade Estadual do Rio de Janeiro	Povo Tikuna Povos Ribeirinhos em Amazonas	1 575 crianças 0-12 anos (sem distinção para <5 anos) (buscou-se incluir nas análises a totalidade das crianças nas faixas etárias de interesse, sem especificar o total de crianças)	E/I, P/E	-	- Maiores prevalências de déficit de E/I nas crianças Tikuna quando comparadas às crianças não-Tikuna - Análises estatísticas para P/E não foram realizadas
Mattos *et al*., 1999[24]	- Universidade Federal de São Paulo	Povos Aueti, Calapalo, Camaiurá, Coicuro, Iualapiti, Matipu-Nafuquá, Meinaco, Uaurá e Trumai (aldeias do Alto Xingu) em Mato Grosso	172 crianças <10 anos 103 crianças <5 anos Não probabilística	E/I, P/E, P/I	-	- Maiores escores-Z de P/E e P/I em crianças <12 meses quando comparadas a crianças 12-60 meses e >60 meses - Escores-Z de E/I sem diferenças segundo a idade das crianças
Xavier *et al*., 1998[25]	- Universidade Federal do Pará	Povo Parakanã (aldeias Paranatinga e Maroxewara) em Pará	94 crianças <10 anos (sem distinção para <5 anos) (todas as crianças da aldeia)	E/I, P/E, P/I	-	- Sem diferenças entre os índices antropométricos segundo a idade das crianças
Martins *et al*., 1994[26]	- Universidade Federal do Pará	Povo Parakanã (aldeias	80 crianças <5 anos	E/I, P/E, P/I	-	- Menores escores-Z de E/I, P/E e P/I nas crianças de Paranatinga

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ANEXO

CARACTERÍSTICAS DOS ARTIGOS, QUE INCLUÍRAM NAS SUAS AMOSTRAS MENORES DE CINCO ANOS, SOBRE O ESTADO NUTRICIONAL ANTROPOMÉTRICO DE CRIANÇAS INDÍGENAS BRASILEIRAS

Autor, ano	Procedência acadêmica dos autores	Grupos estudados e localização	Amostra	Índices antropométricos	Outros métodos de avaliação	Principais resultados analíticos
		Paranatinga e Maroxewara) em Pará	Evolução nutricional: 70 (27,9% das crianças das aldeias)			- Menores escores-Z de P/I nas crianças do sexo feminino e de 6-24 meses - Maior incremento dos escores-Z de P/I nas crianças do sexo feminino, de 6-24 meses e com maior grau de desnutrição (outras análises estatísticas não significativas)
Santos *et al*., 1991[27]	- Fundação Oswaldo Cruz (Rio de Janeiro)	Povo Tupí-Mondê (aldeias Gavião, Suruí e Zoró) em Rondônia e Mato Grosso	477 crianças <10 anos (sem distinção para <5 anos) (buscou incluir nas análises a totalidade das crianças nas faixas etárias de interesse, sem especificar o total de crianças)	E/I, P/E, P/I	-	- Menor prevalência de déficit de E/I nas crianças da tribo Gavião do que nas crianças das tribos Zoró e Suruí, diferença não encontrada para o P/E nem para o P/I
Estudos de desenho longitudinal						
Morais *et al*., 2003[28]	- Universidade Federal de São Paulo - Universidade Federal da Bahia	Povo Alto Xingu (aldeia Aruák, Aruák, Tupi, Trumái) em Mato Grosso	1974-1977: 81 crianças 1-4 anos1980: 264 crianças (28 crianças <1 ano; 117 entre 1 e <5 anos, 117 entre 5 e 10 anos)1992: 172 crianças (25 crianças <1 ano; 78 entre 1 e <5 anos, 69 entre 5 e 10 anos	E/I, P/E, P/I	-	- 1974-1977: diminuição dos escores-Z de P/I e P/E; aumento dos Escores-Z de E/I - 1980-1992: manutenção dos escores-Z de P/I e P/E; diminuição dos escores-Z de E/I
Morais *et al*., 1990[29]	- Escola Paulista de Medicina	Povos Aueti, Calapalo, Camaiurá, Coicuro, Iualapiti, Matipu-Nafuquá, Meinaco, Uaurá e Trumai (aldeias do Alto Xingu) em Mato Grosso	335 crianças <11 anos (sem distinção para <5 anos)	P/E	-	- Sem diferenças segundo o sexo das crianças

Nota: E/I: Estatura para Idade; P/E: Peso para Estatura; P/I: Peso para Idade; IMC/I: Índice de Massa Corporal para Idade.

Observações: Leite *et al*.[12] e Morais *et al*.[17]: estudos transversais formados por dois inquéritos com análises da evolução do estado nutricional. Martins *et al*.[26]: estudo transversal formado por três inquéritos com análise da evolução do estado nutricional. Morais *et al*.[28]: estudo longitudinal com análise da evolução do estado nutricional de crianças nascidas em 1974-1977; 1980; 1992. Morais *et al*.[29]: estudo longitudinal com análise prospectiva em pelo menos um ano entre 1974 e 1980.

INSTRUÇÕES AOS AUTORES

Escopo e política

A **Revista de Nutrição/*Brazilian Journal of Nutrition*** é um periódico especializado que publica artigos que contribuem para o estudo da Nutrição em suas diversas subáreas e interfaces. Com periodicidade bimestral, está aberta a contribuições da comunidade científica nacional e internacional.

Os manuscritos podem ser rejeitados sem comentários detalhados após análise inicial, por pelo menos dois editores da Revista de Nutrição, se os artigos forem considerados inadequados ou de prioridade científica insuficiente para publicação na Revista.

O Conselho Editorial não se responsabiliza por conceitos e imagens emitidas em artigos assinados.

Categoria dos artigos

A Revista aceita artigos inéditos em português, espanhol ou inglês, com título, resumo e termos de indexação no idioma original e em inglês, nas seguintes categorias:

Original: contribuições destinadas à divulgação de resultados de pesquisas inéditas, tendo em vista a relevância do tema, o alcance e o conhecimento gerado para a área da pesquisa (limite máximo de 5 mil palavras).

Especial: artigos a convite sobre temas atuais (limite máximo de 6 mil palavras).

Revisão (a convite): síntese de conhecimentos disponíveis sobre determinado tema, mediante análise e interpretação de bibliografia pertinente, de modo a conter uma análise crítica e comparativa dos trabalhos na área, que discuta os limites e alcances metodológicos, permitindo indicar perspectivas de continuidade de estudos naquela linha de pesquisa (limite máximo de 6 mil palavras). Serão publicados até dois trabalhos por fascículo.

Comunicação: relato de informações sobre temas relevantes, apoiado em pesquisas recentes, cujo mote seja subsidiar o trabalho de profissionais que atuam na área, servindo de apresentação ou atualização sobre o tema (limite máximo de 4 mil palavras).

Nota Científica: dados inéditos parciais de uma pesquisa em andamento (limite máximo de 4 mil palavras).

Ensaio: trabalhos que possam trazer reflexão e discussão de assunto que gere questionamentos e hipóteses para futuras pesquisas (limite máximo de 5 mil palavras).

Seção Temática (a convite): seção destinada à publicação de 2 a 3 artigos coordenados entre si, de diferentes autores, e versando sobre tema de interesse atual (máximo de 10 mil palavras no total).

Categoria e a área temática do artigo

Os autores devem indicar a categoria do artigo e a área temática, a saber: alimentação e ciências sociais, avaliação nutricional, bioquímica nutricional, dietética, educação nutricional, epidemiologia e estatística, micronutrientes, nutrição clínica, nutrição experimental, nutrição e geriatria, nutrição materno-infantil, nutrição em produção de refeições, políticas de alimentação e nutrição e saúde coletiva.

Pesquisas envolvendo seres vivos

Resultados de pesquisas relacionadas a seres humanos e animais devem ser acompanhados de cópia de aprovação do parecer de um Comitê de Ética em pesquisa.

Registros de Ensaios Clínicos

Artigos com resultados de pesquisas clínicas devem apresentar um número de identificação em um dos Registros de Ensaios Clínicos validados pelos critérios da Organização Mundial da Saúde (OMS) e do *International Committee of Medical Journal Editors* (ICMJE), cujos endereços estão disponíveis no site do ICMJE. O número de identificação deverá ser registrado ao final do resumo.

Procedimentos editoriais

Autoria

A indicação dos nomes dos autores logo abaixo do título do artigo é limitada a 6. O crédito de autoria deverá ser baseado em contribuições substanciais, tais como concepção e desenho, ou análise e interpretação dos dados. Não se justifica a inclusão de nomes de autores cuja contribuição não se enquadre nos critérios acima.

Os manuscritos devem conter, na página de identificação, explicitamente, a contribuição de cada um dos autores.

Processo de julgamento dos manuscritos

Todos os outros manuscritos só iniciarão o processo de tramitação se estiverem de acordo com as Instruções aos Autores. Caso contrário, serão devolvidos para adequação às normas, inclusão de carta ou de outros documentos eventualmente necessários.

Recomenda-se fortemente que o(s) autor(es) busque(m) assessoria linguística profissional (revisores e/ou tradutores certificados em língua portuguesa e inglesa) antes

de submeter(em) originais que possam conter incorreções e/ou inadequações morfológicas, sintáticas, idiomáticas ou de estilo. Devem ainda evitar o uso da primeira pessoa "meu estudo...", ou da primeira pessoa do plural "percebemos....", pois em texto científico o discurso deve ser impessoal, sem juízo de valor e na terceira pessoa do singular.

Originais identificados com incorreções e/ou inadequações morfológicas ou sintáticas **serão devolvidos antes mesmo de serem submetidos à avaliação** quanto ao mérito do trabalho e à conveniência de sua publicação.

Pré-análise: a avaliação é feita pelos Editores Científicos com base na originalidade, pertinência, qualidade acadêmica e relevância do manuscrito para a nutrição.

Aprovados nesta fase, os manuscritos serão encaminhados aos revisores *ad hoc* selecionados pelos editores. Cada manuscrito será enviado para dois revisores de reconhecida competência na temática abordada, podendo um deles ser escolhido a partir da indicação dos autores. Em caso de desacordo, o original será enviado para uma terceira avaliação.

Os autores devem indicar três possíveis revisores para o manuscrito. Opcionalmente, podem indicar três revisores para os quais não gostaria que seu trabalho fosse enviado.

Todo processo de avaliação dos manuscritos terminará na segunda e última versão.

O processo de avaliação por pares é o sistema de *blind review*, procedimento sigiloso quanto à identidade tanto dos autores quanto dos revisores. Por isso os autores deverão empregar todos os meios possíveis para evitar a identificação de autoria do manuscrito.

Os pareceres dos revisores comportam três possibilidades: a) aprovação; b) recomendação de nova análise c) recusa. Em quaisquer desses casos, o autor será comunicado.

Os pareceres são analisados pelos editores, que propõem ao Editor Científico a aprovação ou não do manuscrito.

Manuscritos recusados, mas com a possibilidade de reformulação, poderão retornar como novo trabalho, iniciando outro processo de julgamento.

Conflito de interesse

No caso da identificação de conflito de interesse da parte dos revisores, o Comitê Editorial encaminhará o manuscrito a outro revisor *ad hoc*.

Manuscritos aceitos: manuscritos aceitos poderão retornar aos autores para aprovação de eventuais alterações, no processo de editoração e normalização, de acordo com o estilo da Revista.

Provas: serão enviadas provas tipográficas aos autores para a correção de erros de impressão. As provas devem retornar ao Núcleo de Editoração na data estipulada. Outras mudanças no manuscrito original não serão aceitas nesta fase.

Publicação em inglês: em caso de aprovação, os artigos indicados pelo Conselho Editorial serão publicados na versão em inglês. Nestes casos para que o manuscrito seja publicado, os autores deverão providenciar sua versão completa (tal como aprovado) para o inglês, arcando com os custos de sua tradução. Para assegurar a qualidade e uniformidade dos textos traduzidos para a Língua Inglesa, esse trabalho deverá ser realizado, necessariamente, por um tradutor altamente capacitado e com experiência comprovada na versão de textos científicos, indicados e credenciados junto à Revista.

Preparo do manuscrito

Submissão de trabalhos

Serão aceitos trabalhos acompanhados de carta assinada por todos os autores, com descrição do tipo de trabalho e da área temática, declaração de que o trabalho está sendo submetido apenas à Revista de Nutrição e de concordância com a cessão de direitos autorais e uma carta sobre a principal contribuição do estudo para a área.

Caso haja utilização de figuras ou tabelas publicadas em outras fontes, deve-se anexar documento que ateste a permissão para seu uso.

Enviar os manuscritos via *site* <http://www.scielo.br/rn>, preparados em espaço entrelinhas 1,5, com fonte *Arial* 11. O arquivo deverá ser gravado em editor de texto similar ou superior à versão 97-2003 do *Word* (*Windows*).

É fundamental que o escopo do artigo **não contenha qualquer forma de identificação da autoria**, o que inclui referência a trabalhos anteriores do(s) autor(es), da instituição de origem, por exemplo.

O texto deverá contemplar o número de palavras de acordo com a categoria do artigo. As folhas deverão ter numeração personalizada desde a folha de rosto (que deverá apresentar o número 1). O papel deverá ser de tamanho A4, com formatação de margens superior e inferior (no mínimo 2,5cm), esquerda e direita (no mínimo 3cm).

Os artigos devem ter, aproximadamente, 30 referências, exceto no caso de artigos de revisão, que podem apresentar em torno de 50. Sempre que uma referência possuir o número de *Digital Object Identifier* (DOI), este deve ser informado.

O texto do artigo deverá empregar fonte colorida (cor azul) ou sublinhar, para todas as alterações, juntamente com uma carta ao editor, reiterando o interesse em publicar nesta Revista e informando quais alterações foram processadas no manuscrito. Se houver discordância quanto às recomendações dos revisores, o(s) autor(es) deverão apresentar os argumentos que justificam sua posição.

O título e o código do manuscrito deverão ser especificados.

Versão reformulada: a versão reformulada deverá ser encaminhada via <http://www.scielo.br/rn>. **O(s) autor(es) deverá(ão) enviar apenas a última versão do trabalho**.

Página de rosto deve conter

a) título completo - deve ser conciso, evitando excesso de palavras, como "avaliação do....", "considerações acerca de..." 'estudo exploratório....";

b) *short title* com até 40 caracteres (incluindo espaços), em português (ou espanhol) e inglês;

c) nome de todos os autores por extenso, indicando a filiação institucional de cada um. Será aceita uma única titulação e filiação por autor. O(s) autor(es) deverá(ão), portanto, escolher, entre suas titulações e filiações institucionais, aquela que julgar(em) a mais importante;

d) todos os dados da titulação e da filiação deverão ser apresentados por extenso, sem siglas;

e) indicação dos endereços completos de todas as universidades às quais estão vinculados os autores;

f) indicação de endereço para correspondência com o autor para a tramitação do original, incluindo fax, telefone e endereço eletrônico.

Observação: esta deverá ser a única parte do texto com a identificação dos autores.

Resumo: todos os artigos submetidos em português ou espanhol deverão ter resumo no idioma original e em inglês, com um mínimo de 150 palavras e máximo de 250 palavras.

Os artigos submetidos em inglês deverão vir acompanhados de resumo em português, além do *abstract* em inglês.

Para os artigos originais, os resumos devem ser estruturados destacando objetivos, métodos básicos adotados, informação sobre o local, população e amostragem da pesquisa, resultados e conclusões mais relevantes, considerando os objetivos do trabalho, e indicando formas de continuidade do estudo.

Para as demais categorias, o formato dos resumos deve ser o narrativo, mas com as mesmas informações.

O texto não deve conter citações e abreviaturas. Destacar no mínimo três e no máximo seis termos de indexação, utilizando os descritores em Ciência da Saúde - DeCS - da Bireme <http://decs.bvs.br>.

Texto: com exceção dos manuscritos apresentados como Revisão, Comunicação, Nota Científica e Ensaio, os trabalhos deverão seguir a estrutura formal para trabalhos científicos:

Introdução: deve conter revisão da literatura atualizada e pertinente ao tema, adequada à apresentação do problema, e que destaque sua relevância. Não deve ser extensa, a não ser em manuscritos submetidos como Artigo de Revisão.

Métodos: deve conter descrição clara e sucinta do método empregado, acompanhada da correspondente citação bibliográfica, incluindo: procedimentos adotados; universo e amostra; instrumentos de medida e, se aplicável, método de validação; tratamento estatístico.

Em relação à análise estatística, os autores devem demonstrar que os procedimentos utilizados foram não somente apropriados para testar as hipóteses do estudo, mas também corretamente interpretados. Os níveis de significância estatística (ex. $p<0,05$; $p<0,01$; $p<0,001$) devem ser mencionados.

Informar que a pesquisa foi aprovada por Comitê de Ética credenciado junto ao Conselho Nacional de Saúde e fornecer o número do processo.

Ao relatar experimentos com animais, indicar se as diretrizes de conselhos de pesquisa institucionais ou nacionais - ou se qualquer lei nacional relativa aos cuidados e ao uso de animais de laboratório - foram seguidas.

Resultados: sempre que possível, os resultados devem ser apresentados em tabelas ou figuras, elaboradas de forma a serem auto-explicativas e com análise estatística. Evitar repetir dados no texto.

Tabelas, quadros e figuras devem ser limitados a cinco no conjunto e numerados consecutiva e independentemente com algarismos arábicos, de acordo com a ordem de menção dos dados, e devem vir em folhas individuais e separadas, com indicação de sua localização no texto. **É imprescindível a informação do local e ano do estudo**. A cada um se deve atribuir um título breve. Os quadros e tabelas terão as bordas laterais abertas.

O(s) autor(es) se responsabiliza(m) pela qualidade das figuras (desenhos, ilustrações, tabelas, quadros e gráficos), que deverão ser elaboradas em tamanhos de uma ou duas colunas (7 e 15cm, respectivamente); **não é permitido o formato paisagem**. Figuras digitalizadas deverão ter extensão jpeg e resolução mínima de 400 dpi.

Gráficos e desenhos deverão ser gerados em programas de desenho vetorial (*Microsoft Excel*, *CorelDraw*, *Adobe Illustrator* etc.), acompanhados de seus parâmetros quantitativos, em forma de tabela e com nome de todas as variáveis.

A publicação de imagens coloridas, após avaliação da viabilidade técnica de sua reprodução, será custeada pelo(s) autor(es). Em caso de manifestação de interesse por parte do(s) autor(es), a Revista de Nutrição providenciará um orçamento dos custos envolvidos, que poderão variar de acordo com o número de imagens, sua distribuição em páginas diferentes e a publicação concomitante de material em cores por parte de outro(s) autor(es).

Uma vez apresentado ao(s) autor(es) o orçamento dos custos correspondentes ao material de seu interesse, este(s) deverá(ão) efetuar depósito bancário. As informações para o depósito serão fornecidas oportunamente.

Discussão: deve explorar, adequada e objetivamente, os resultados, discutidos à luz de outras observações já registradas na literatura.

Conclusão: apresentar as conclusões relevantes, considerando os objetivos do trabalho, e indicar formas de continuidade do estudo. **Não serão aceitas citações bibliográficas nesta seção**.

Agradecimentos: podem ser registrados agradecimentos, em parágrafo não superior a três linhas, dirigidos a instituições ou indivíduos que prestaram efetiva colaboração para o trabalho.

Anexos: deverão ser incluídos apenas quando imprescindíveis à compreensão do texto. Caberá aos editores julgar a necessidade de sua publicação.

Abreviaturas e siglas: deverão ser utilizadas de forma padronizada, restringindo-se apenas àquelas usadas convencionalmente ou sancionadas pelo uso, acompanhadas do significado, por extenso, quando da primeira citação no texto. Não devem ser usadas no título e no resumo.

Referências de acordo com o estilo *Vancouver*

Referências: devem ser numeradas consecutivamente, seguindo a ordem em que foram mencionadas pela primeira vez no texto, conforme o estilo *Vancouver*.

Nas referências com dois até o limite de seis autores, citam-se todos os autores; acima de seis autores, citam-se os seis primeiros autores, seguido de *et al*.

As abreviaturas dos títulos dos periódicos citados deverão estar de acordo com o *Index Medicus*.

Não serão aceitas citações/referências de **monografias** de conclusão de curso de graduação, **de trabalhos** de Congressos, Simpósios, *Workshops*, Encontros, entre outros, e de **textos não publicados** (aulas, entre outros).

Se um trabalho não publicado, de autoria de um dos autores do manuscrito, for citado (ou seja, um artigo *in press*), será necessário incluir a carta de aceitação da revista que publicará o referido artigo.

Se dados não publicados obtidos por outros pesquisadores forem citados pelo manuscrito, será necessário incluir uma carta de autorização, do uso dos mesmos por seus autores.

Citações bibliográficas no texto: deverão ser expostas em ordem numérica, em algarismos arábicos, meia linha acima e após a citação, e devem constar da lista de referências. Se forem dois autores, citam-se ambos ligados pelo "&"; se forem mais de dois, cita-se o primeiro autor, seguido da expressão *et al*.

A exatidão e a adequação das referências a trabalhos que tenham sido consultados e mencionados no texto do artigo são de responsabilidade do autor. Todos os autores cujos trabalhos forem citados no texto deverão ser listados na seção de Referências.

Exemplos

Artigo com um autor

Burlandy L. A construção da política de segurança alimentar e nutricional no Brasil: estratégias e desafios para a promoção da intersetorialidade no âmbito federal de governo. Ciênc Saúde Coletiva. 2009; 14(3):851-60. doi: 10.1590/S1413-81232009000300020

Artigo com mais de seis autores

Oliveira JS, Lira PIC, Veras ICL, Maia SR, Lemos MCC, Andrade SLL, *et al*. Estado nutricional e insegurança alimentar de adolescentes e adultos em duas localidades de baixo índice de desenvolvimento humano. Rev Nutr. 2009; 22(4): 453-66. doi: 10.1590/S1415-52732009000400002

Livro

Alberts B, Lewis J, Raff MC. Biologia molecular da célula. 5ª ed. Porto Alegre: Artmed; 2010.

Capítulos de livros

Aciolly E. Banco de leite. In Aciolly E. Nutrição em obstetrícia e pediatria. 2ª ed. Rio de Janeiro: Guanabara Koogan; 2009. Unidade 4.

Dissertações e teses

Duran ACFL. Qualidade da dieta de adultos vivendo com HIV/AIDS e seus fatores associados [mestrado]. São Paulo: Universidade de São Paulo; 2009.

Artigo em suporte eletrônico

Sichieri R, Moura EC. Análise multinível das variações no índice de massa corporal entre adultos, Brasil, 2006. Rev Saúde Pública. 2009 [acesso 2009 dez 18]; 43(Supl 2):

90-7. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-89102009000900120&lng=pt&nrm=iso>. doi: 10.1590/S0034-89102009000900012.

Livro em suporte eletrônico

Brasil. Alimentação saudável para pessoa idosa: um manual para o profissional da saúde. Brasília: Ministério da Saúde; 2009 [acesso 2010 jan 13]. Disponível em: <http://200.18.252.57/services/e-books/alimentacao_saudavel_idosa_profissionais_saude.pdf>.

Capítulo de livro em suporte eletrônico

Emergency contraceptive pills (ECPs). In World Health Organization. Medical eligibility criteria for contraceptive use. 4th ed. Geneva: WHO; 2009 [cited 2010 Jan 14]. Available from: <http://whqlibdoc.who.int/publications/2009/9789241563888_eng.pdf>.

Texto em formato eletrônico

Sociedade Brasileira de Nutrição Parental e Enteral. Assuntos de interesse do farmacêutico atuante na terapia nutricional. 2008/2009 [acesso 2010 jan 14]. Disponível em: <http://www.sbnpe.com.br/ctdpg.php?pg=13&ct=A>.

Para outros exemplos recomendamos consultar as normas do *Committee of Medical Journals Editors* (Grupo Vancouver) <http://www.icmje.org>.

Lista de checagem

- Declaração de responsabilidade e transferência de direitos autorais assinada por cada autor.

- Verificar se o texto, incluindo resumos, tabelas e referências, está reproduzido com letras fonte *Arial*, corpo 11 e entrelinhas 1,5 e com formatação de margens superior e inferior (no mínimo 2,5cm), esquerda e direita (no mínimo 3cm).

- Indicação da categoria e área temática do artigo.

- Verificar se estão completas as informações de legendas das figuras e tabelas.

- Preparar página de rosto com as informações solicitadas.

- Incluir o nome de agências financiadoras e o número do processo.

- Indicar se o artigo é baseado em tese/dissertação, colocando o título, o nome da instituição, o ano de defesa.

- Incluir título do manuscrito, em português e em inglês.

- Incluir título abreviado (*short title*), com 40 caracteres, para fins de legenda em todas as páginas.

- Incluir resumos estruturados para trabalhos submetidos na categoria de originais e narrativos para manuscritos submetidos nas demais categorias, com um número de 150 palavras e no máximo 250 palavras nos dois idiomas, português e inglês, ou em espanhol, nos casos em que se aplique, com termos de indexação.

- Verificar se as referências estão normalizadas segundo estilo *Vancouver*, ordenadas na ordem em que foram mencionadas pela primeira vez no texto, e se todas estão citadas no texto.

- Incluir permissão de editores para reprodução de figuras ou tabelas publicadas.

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Documentos

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GUIDE FOR AUTHORS

Scope and policy

The **Brazilian Journal of Nutrition** is a specialized periodical that publishes articles that contribute to the study of Nutrition in its many sub-areas and interfaces. It is published bimonthly and open to contributions of the national and international scientific communities.

Submitted manuscripts may be rejected without detailed comments after initial review by at least two **Brazilian Journal of Nutrition** editors if the manuscripts are considered inappropriate or of insufficient scientific priority for publication in the Journal.

The Board of Editors does not assume responsability for concepts and illustrations emitted in signed articles.

Article category

The Journal accepts unpublished articles in Portuguese, Spanish or English, with title, abstract and keywords in the original language and in English, in the following categories:

Original: contributions that aim to disclose the results of unpublished researches, taking into account the relevance of the theme, the scope and the knowledge generated for the research area (maximum limit of 5 thousand words).

Special: invited articles on current themes (maximum limit of 6 thousand words).

Review (by invitation): synthesis of the knowledge available on a given theme, based on analysis and interpretation of the pertinent literature, aiming to make a critical and comparative analysis of the works in the area and discuss the methodological limitations and its scope. It also allows the indication of perspectives of continuing studies in that line of research (maximum limit of 6 thousand words). There will be a maximum of two reviews per issue.

Communication: information reported on relevant themes and based on recent research, whose objective is to subsidize the work of professionals who work in the field, serving as a presentation or update on the theme (maximum limit of 4 thousand words).

Scientific note: partial unpublished data of an ongoing research (maximum limit of 4 thousand words).

Essay: works that can bring reflection and discussion of a subject that generates questioning and hypotheses for future research (maximum limit of 5 thousand words).

Thematic Section (by invitation): section whose aim is to publish 2 or 3 coordinated articles from different authors covering a theme of current interest (maximum of 10 thousand words).

Article's category and subject area

Authors should indicate the article's category and subject area, namely: food and social sciences, nutritional assessment, nutritional biochemistry, nutrition, nutrition education, epidemiology and statistics, micronutrients, clinical nutrition, experimental nutrition, nutrition and geriatrics, nutrition, maternal and infant nutrition in meal production, food and nutrition policies and health.

Research involving living beings

Results of research involving human beings and animals, must contain a copy of the Research Ethics Committee approval.

Registration of Clinical Trials

Articles with results of clinical researches must present an identification number in one of the Register of Clinical Trials validated by criteria established the the World Health Organization (WHO) and International Committee of Medical Journal Editors (ICMJE), whose addresses are available at the ICMJE site. The identification number must be included at the end of the abstract.

Editorial procedures

Authorship

The list of authors, included below the title, should be limited to 6. The authorship credit must be based on substantial contributions, such as conception and design, or analysis and interpretation of the data. The inclusion of authors whose contribution does not include the criteria mentioned above is not justified.

The manuscripts must explicitly contain in the identification page the contribution of each one of the authors.

Manuscript judgment process

All manuscripts will only start undergoing the publication process if they are in agreement with the Instructions to the Authors. If not, **they will be returned**

for the authors to make the appropriate adjustments, include a letter or other documents that may be necessary.

It is strongly recommended that the author(s) seek professional language services (reviewers and/or translators certified in the Portuguese or English languages) before they submit articles that may have semantic, grammar, syntactic, morphological, idiomatic or stylistic mistakes. The authors must also avoid using the first person of the singular, "my study...," or the first person of the plural "we noticed...," since scientific texts ask for an impersonal, non-judgmental discourse.

Articles with any of the mistakes mentioned above **will be returned even before they are submitted to assessment** regarding the merit of the work and the convenience of its publication.

Pre-evaluation: Scientific Editors evaluate manuscripts according to their originality, application, academic quality and relevance in nutrition.

Once the articles are approved in this phase, they will be sent to *ad hoc* peer reviewers selected by the editors. Each manuscript will be sent to two reviewers of known competence in the selected theme. One of them may be chosen by the authors' indicatiton. If there is disagreement, the manuscript will be sent to a third reviewer.

The authors must indicate three possible reviewers for the manuscript. Alternatively, the authors may indicate three reviewers to whom they do not want their manuscript to be sent.

The entire manuscript process will end on the second version, which will be final.

The peer review process used is the blind review, where the identity of the authors and the reviewers is not mutually known. Thus the authors must do everything possible to avoid the identification of the authors of the manuscript.

The opinions of the reviewers are one of the following: a) approved; b) new analysis needed; c) refused. The authors will always be informed of the reviewers' opinion.

Reviews are examined by the Editors who will recommend or not the manuscript's approval by the Scientific Editor.

Rejected manuscripts that can potentially be reworked can be resubmitted as a new article and will undergo a new peer review process.

Conflict of interest

If there are conflicts of interest regarding the reviewers, the Editorial Committee will send the manuscript to another *ad hoc* reviewer.

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Publication in English: Articles approved may be indicated by the Editorial Board will be published in English. In order to have the manuscript published, authors are responsible to finance the complete English translation version of their work. To assure the quality and uniformity of translated English manuscripts, the work should be done by a English translator expert on scientific publications, nominated by the Journal.

Preparation of the manuscript

Submission of works

Manuscripts need to be accompanied by a letter signed by all the authors describing the type of work and the thematic area, a declaration that the manuscript is being submitted only to the Journal of Nutrition, an agreement to transfer the copy rights and a letter stating the main contribution of the study to the area.

If the manuscript contains figures or tables that have already been published elsewhere, a document given by the original publisher authorizing their use must be included.

The manuscripts need to be sent to the Editorial Center of the Journal, to the site <http://www.scielo.br/rn> with a line spacing of 1.5, font Arial 11. The file must be in Microsoft Word (doc) format version 97-2003 or better.

It is essential that the body of the article **does not contain any information that may identify the author(s)**, including, for example, reference to previous works of the author(s) or mention of the institution where the work was done.

The articles should have approximately 30 references, except for review articles, which may contain about 50 references. A reference must always contain the Digital Object Identifier (DOI).

Please use a color font (preferably blue) or underline all the changes made to the text, Include a letter to the editor confirming your interest in publishing your article in this Journal and state which changes were made in the manuscript. If the authors disagree with the opinion of the reviewers, they should present arguments that justify their position. The title and the code of the manuscript must be specified.

Reviewed version: send the copies of the reviewed version to the site <http://www.scielo.br/rn>. **The author(s) must send only the last version of the work**.

Title page must contain

a) full title - must be concise, avoiding excess wording, such as "assessment of...," "considerations on...," "exploratory study...";

b) short title with up to 40 characters (including spaces) in Portuguese (or Spanish) and English;

c) full name of all the authors, indicating the institutional affiliation of each one of them. Only one title and affiliation will be accepted per author. The author(s) should therefore choose among their titles and institutional affiliations those that they deem more important;

d) all data of the titles and affiliations must not contain any abbreviations;

e) provide the full address of all the universities to which the authors are affiliated;

f) provide the full address for correspondence of the main author for the editorial procedures, including fax and telephone numbers and e-mail address.

Observation: this must the only part of the text with author identification.

Abstract: all articles submitted in Portuguese or Spanish must contain an abstract in the original language and in English, with at least 150 words and at most 250 words.

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Original articles must contain structured abstracts containing objectives, basic research methods, information regarding study location, population and sample, results and most relevant conclusions, considering the objectives of the work and indicating ways of continuing the study.

The other categories should contain a narrative abstract but with the same information.

The text should not contain citations and abbreviations. Provide from 3 to 6 keywords using Bireme's Health Sciences descriptors. <http://decs.bvs.br>.

Text: except for the manuscripts presented as Review, Communication, Scientific Note and Assay, the works must follow the formal structure for scientific works:

Introduction: must contain a current literature review pertinent to the theme and appropriate to the presentation of the problem, also emphasizing its relevance. It should not be extensive except for manuscripts submitted as Review Articles.

Methods: must contain a clear and brief description of the method, including the corresponding literature: procedures, universe and sample, measurement tools, and validation method and statistical treatment when applicable.

Regarding the statistical analysis, the authors should demonstrate that the procedures were not only appropriate to test the hypotheses of the study but were also interpreted correctly. The statistical significance levels (e.g. $p<0.05$; $p<0.01$; $p<0.001$) must be mentioned.

Inform that the research was approved by an Ethics Committee certified by the National Council of Health and provide the number of the protocol.

When experiments with animals are reported, indicate if the guidelines of the institutional or national research councils - or if any national law regarding the care and use of laboratory animals - were followed.

Results: whenever possible, the results must be presented in self-explanatory tables and figures and contain statistical analysis. Avoid repeating the data in the text.

Tables, charts and figures should be limited to five in all and given consecutive and independent numbers in Arabic numerals, according to the order the data is mentioned, and should be presented in individual sheets and separated, indicating their location in the text. **It is essential to inform the location and year of the study**. Each one should have a brief title. The charts and tables must be open laterally.

The author(s) are responsible for the quality of the figures (drawings, illustrations, tables and graphs) that should the large enough to fit one or two columns (7 and 15cm respectively); **the landscape format is not accepted**. Figures should be in jpeg format and have a minimum resolution of 400 dpi.

Graphs and drawings should be made in vector design software (Microsoft Excel, CorelDraw, Adobe Illustrator etc.), followed by their quantitative parameters in a table and the name of all its variables.

The publication of color images will be paid by the author(s) once the technical viability of their reproduction is verified. If the authors are interested, the Journal will provide the costs which will vary according to the number of images, their distribution in different pages, and the concomitant publication of color material by other author(s).

Once the authors are informed of such costs, they are expected to pay via wire transfer. The information for the wire transfer will be given at the appropriate time.

Discussion: the discussion must properly and objectively explore the results under the light of other observations already published in the literature.

Conclusion: present the relevant conclusions, considering the objectives of the work, and indicate ways to continue the study. **Literature citations will not be accepted in this section**.

Acknowledgments: may be made in a paragraph no bigger than three lines to institutions or individuals who actually collaborated with the work.

Attachments: should be included only when they are essential to the understanding of the text. The editors will decide upon the need of their publication.

Abbreviations and acronyms: should be used in a standardized fashion and restricted to those used conventionally or sanctioned by use, followed by the meaning in full when it is first mentioned in the text. They must not be used in the title and abstract.

References must follow the Vancouver style

References: must be numbered consecutively according to the order that they were first mentioned in the text, according to the Vancouver style.

All authors should be cited in references with two to six authors; if more than six authors, only the first six should be cited followed by *et al*.

The abbreviations of cited journals should be in agreement with the Index Medicus.

Citations/references of **undergraduate monographs, works** presented in congresses, symposiums, workshops, meetings, among others, and **unpublished texts** (classes among others) **will not be accepted**.

If the unpublished work of one of the authors of the manuscript is cited (that is, an in press article), it is necessary to include the letter of acceptance of the journal that will publish the article.

If unpublished data obtained by other researchers are cited in the manuscript, it is necessary to include a letter authorizing the use of such data by the original authors.

Literature citations in the text should be in numerical order, Arabic numerals, placed after the citation in superscript, and included in the references. If two authors are mentioned, both are cited using the "&" in between; if more than two authors, the first author is cited followed by the *et al*. expression.

The accuracy and appropriateness of references to works that have been consulted and mentioned in the text of the article are of the author(s) responsibility. All authors whose works were cited in the text should be listed in the References section.

Examples

Article with one author

Burlandy L. A construção da política de segurança alimentar e nutricional no Brasil: estratégias e desafios para a promoção da intersetorialidade no âmbito federal de governo. Ciênc Saúde Coletiva. 2009; 14(3):851-60. doi: 10.1590/S1413-81232009000300020.

Article with more than six authors

Oliveira JS, Lira PIC, Veras ICL, Maia SR, Lemos MCC, Andrade SLL, *et al*. Estado nutricional e insegurança alimentar de adolescentes e adultos em duas localidades de baixo índice de desenvolvimento humano. Rev Nutr. 2009; 22(4):453-66. doi: 10.1590/S1415-52732009000400002.

Book

Alberts B, Lewis J, Raff MC. Biologia molecular da célula. 5ª ed. Porto Alegre: Artmed; 2010.

Book chapters

Aciolly E. Banco de leite. In Aciolly E. Nutrição em obstetrícia e pediatria. 2ª ed. Rio de Janeiro: Guanabara Koogan; 2009. Unidade 4.

Dissertations and theses

Duran ACFL. Qualidade da dieta de adultos vivendo com HIV/AIDS e seus fatores associados [mestrado]. São Paulo: Universidade de São Paulo; 2009.

Article in electronic media

Sichieri R, Moura EC. Análise multinível das variações no índice de massa corporal entre adultos, Brasil, 2006. Rev Saúde Pública. 2009 [acesso 2009 dez 18]; 43(Supl 2):90-7. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-89102009000900012&lng=pt&nrm=iso>. doi: 10.1590/S0034-89102009000900012

Electronic book

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Electronic book chapters

Emergency contraceptive pills (ECPs). In World Health Organization. Medical eligibility criteria for contraceptive use. 4th ed. Geneva: WHO; 2009 [cited 2010 Jan 14]. Available from: <http://whqlibdoc.who.int/publications/2009/9789241563888_eng.pdf>.

Electronic texts

Sociedade Brasileira de Nutrição Parental e Enteral. Assuntos de interesse do farmacêutico atuante na terapia nutricional. 2008/2009 [acesso 2010 jan 14]. Disponível em: <http://www.sbnpe.com.br/ctdpg.php?pg=13&ct=A>.

For other examples, please see the norms of the Committee of Medical Journals Editors (Vancouver Group) <http://www.icmje.org>.

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- Include the title of the manuscript in Portuguese and in English.

- Include a short title with a maximum of 40 characters including spaces for use as caption in all pages.

- Include structured abstracts for original works and narrative abstracts for the other categories with a maximum of 250 words, in both languages, Portuguese and English, or Spanish when applicable, with the respective keywords.

- Verify if the references are listed according to the Vancouver style, numbered according to the order in which they appear for the first time in the text and if all of them are cited in the text.

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1. Declaration of responsibility: all people listed as authors must sign declarations of responsibility as shown below:

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Given the competence of the study area, I indicate the name of the following (three) researchers that may act as reviewers of the manuscript. I also declare that there is no conflict of interests for this indication.

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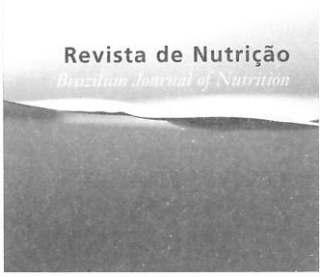

Prezado leitor,

É com satisfação que vimos convidá-lo **ASSINAR ou RENOVAR** a *Revista de Nutrição*, a melhor forma de ter contato com os trabalhos desenvolvidos por pesquisadores da área através de uma publicação nacional, indexada nas bases de dados internacionais: LILACS, Chemical Abstract, CAB Abstract, FSTA, EMBASE, POPLINE, NISC, SciELO, Latindex, Scopus, Clase, Web of Science, JCR.
Lista Qualis: B1.

Esperamos contar com sua presença entre nossos assinantes regulares. Preencha o canhoto abaixo.

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