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Nutritional quality and food expenditure in preschool children

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Abstract

Objective: To assess correlations between the cost and the nutritional quality of the diets of preschool children from low socioeconomic status families, taking into account intakes of micronutrients and foods with high concentrations of sugars and fats.

Methods: This was a cross-sectional study undertaken with 346 children aged 3 to 4 years recruited for the "Ten steps in action" (BRATSA I) study, who comprise a nested cohort from the randomized field study. Two 24-hour dietary recall surveys were conducted. Expenditure on food was calculated by taking the price of each food, as verified at a number of different establishments, and adjusting it for the quantity eaten.

Results: Mean expenditure on food for one child was R$ 100.17±34.1 per month. There was a positive correlation between intakes of iron ($r = 0.115$; $p = 0.033$), zinc ($r = 0.214$; $p < 0.001$), and vitamins A ($r = 0.197$; $p < 0.001$) and C ($r = 0.162$; $p < 0.001$), adjusted to 1,000 kcal, and expenditure on food/1,000 kcal. There were no significant relationships between expenditure on food/1,000 kcal and risk of overweight ($p = 0.208$) or intake of foods with a high fat or sugar content ($p = 0.894$ and $p = 0.964$).

Conclusions: The study found that consumption of energy provided by fat and sugar-rich foods was not associated with expenditure on feeding these 3-to-4-year-olds. In contrast, nutritional quality, assessed in the form of essential micronutrient intakes, demonstrated a positive correlation with food costs.

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Introduction

According to the national family budget surveys (FBS) of 1988, 1996 and 2003, the dietary profile of the Brazilian population has evolved with an increasing intake of calories provided by lipids, primarily saturated fatty acids, and an increasing consumption of processed foods, such as sodas and biscuits, has maintained a high intake of refined sugar and has progressively reduced consumption of complex carbohydrates. Furthermore, the survey demonstrated that the population's consumption of grains, pulses, salads, vegetables, fruit and natural juices has stagnated or reduced, achieving just one third of the recommended intake of these foods.[1] This dietary profile, which is considered as a risk factor for nutritional deficiency and overweight, tends to be consumed by populations with low socioeconomic status and limited resources.[2]

Nutritional quality has been related to expenditure on food.[3,4] Studies have demonstrated that increased spending on food is associated with a lower dietary energy content, a reduced percentage of total and saturated body fat and an increased vitamin intake, leading to the supposition that a high quality diet demands increased expenditure in low-income populations.[5,6]

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No studies have been conducted in Brazil to assess the cost and nutritional value of the diets of low socioeconomic status children. Therefore, the objective of this study was to determine whether expenditure on food is correlated with the nutritional quality of the diet, in terms of micronutrient intakes, and also whether it is correlated with the consumption of sugar and fat rich foods by low socioeconomic status children.

Methods

This was a cross-sectional study undertaken with the cohort from the "Ten steps in action" (BRATSA I) study, which was a randomized nested cohort field study conducted between October of 2001 and June of 2002 as part of the implementation of the "Ten steps to a healthy diet: feeding guide for children under 2" program (Dez passos da alimentação saudável: guia alimentar para crianças menores de dois anos).[7] The children who took part in this study were recruited at the Hospital Centenário, in the city of São Leopoldo, Brazil. Undergraduate nutrition students were trained to undertake data collection of children's anthropometric, dietary, sociodemographic and health status variables during home visits between 6 and 12 months of age. Adopting a statistical power of 90% and a significance level of 5%, the sample size calculation for the analysis of expenditure on food returned a minimum of 124 children.

Between November of 2005 and May of 2006, the same children were located at home when aged between 3 and 4 years. Sociodemographic, dietary and anthropometric (weight and height) data collection was performed again by trained nutrition students. The data provided on 5% of the sample were confirmed by telephone contact. A clinical assessment was scheduled at a municipal health center and dietary assessment was performed once more.

Anthropometric measurements were taken as follows: wearing light clothing and unshod, each child was weighed on a digital balance (Filizola®) with 100 g gradations, while stature was measured using a stadiometer (Seca®) fixed to a smooth wall, with the child in the erect position, heels touching the wall. Nutritional status was classified using the World Health Organization's (WHO),[8] Anthro program and values greater than one z-score (one standard deviation) were considered indicative of risk of overweight.

Dietary data were obtained using two 24-hour dietary recalls administered at an interval 15 to 30 days. The first recall was administered during a home visit and the second during the clinical assessment. Mothers were asked about all food and drink consumed by the child on the previous day. The interviewers asked detailed questions about the types of foods, quantities, brands and preparation methods. At the end of the interview a detailed review of all of the foods listed was carried out in order to correct any erroneous or forgotten data. Portion sizes were decided with the aid of an album of photographs of utensils and foods specially designed for this study and based on domestic measures (cups, tablespoons, teaspoons). Nutritional calculations to estimate nutritional intake were performed using NutWin, version 1.5, supplemented with the addition of information on foods available in tables of the chemical composition of foods[9,10] and/or provided by Brazilian manufacturers.

For the assessment of intake of sugar-rich foods (SRF) and fat-rich foods (FRF), the items listed in response to the dietary recall were classified as SRF if there was 50% or more sugar per 100 g in their composition (soda, jello, candies and artificial juice) and as FRF if they contained more than 30% fat per 100 g (fried pastries, biscuits with fillings, cold cuts and sausages, fried foods and chocolate). The mean of the results of both recalls was taken and used for analyses. Considering the recommendation for sugar and saturated fat intake for 3-to-4-year-olds, which is 10% of total calories,[11] we defined a cutoff point of a maximum of 150 kcal provided by these foods, before defining SRF and FRF intake as excessive. Each child's iron, zinc, vitamin A and vitamin C intake was calculated with the objective of determining the quality of their diets. For analyses, the mean intake of the two 24-hour recalls was taken and adjusted for 1,000 kcal.

All of the foods mentioned in response to the 24-hour recalls were listed in a spreadsheet in order to aid with locating their prices. This spreadsheet was used to compile the prices of every food at a large establishment (supermarket or hypermarket) and at a small establishment (market, minimart or bakery) as produced by three different brands. There were no specific criteria for selecting these establishments. In the event that any item was missing, or when three different brands of the same food were not stocked, other similar establishments were surveyed (small stores caused greater problems due to the restricted range of foods and brands). For example, the prices of the salads, vegetables and fruit most consumed by the population were taken from six different establishments, three large and three small, in common with the products that have specific brands. The mean cost of 100 g of each food was calculated on the basis of the prices found. We thereby obtained a price for 104 products in accordance with the criteria described above.

The prices of seven foods, classified as quick snacks were pertained at mobile establishments. For prepared foods, costs were calculated using data sheets developed at the dietary laboratory of the Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Porto Alegre, Brazil. The majority of the 56 preparations were home-made cakes and biscuits, purées, pancakes, lasagna, pies, flans and a range of desserts. The cost of 100 g of each preparation was calculated. Furthermore, in order to make it possible to calculate the final cost of the dietary recall results, a spreadsheet was compiled containing correction and yield factors for foods that change weight during the cooking process. These data were used to calculate expenditure on food represented by each dietary recall. In order to facilitate data analysis, monthly expenditure was estimated (calculated for 30 days), using the mean of both recalls adjusted to 1,000 kcal in order to avoid possible confounding factors.

The Kolmogorov test was used to verify that the data were asymmetrical and Student's *t* test and ANOVA were used to analyze associations between variables. Spearman's correlation coefficient was used to determine the relationship between expenditure on food/1,000 kcal and the intake of each micronutrient. Each analysis used a different sample size, depending on the availability of data. The cutoff for rejecting the null hypothesis was set at 5% ($p < 0.05$). Data were double-input on Epi-Info, version 64, and then the "validate" function was applied. Analyses were carried out using SPSS, version 11.0.

The research protocol was assessed and approved by the Research Ethics Committee at UFCSPA.

Results

The study recruited 346 children aged 3 to 4. Eight of the total number of 354 children recruited were excluded from analyses because their guardians had not been with them on the previous day, making it impossible for them to answer the 24-hour dietary recall or because they did not specify quantities or preparations that were needed for the calculations. Twelve children were excluded from the analysis of monthly family income and nine from the overweight analysis, because these data had been lost. One child was excluded from the analysis of iron, vitamin A and vitamin C intakes because the figures provided were extreme.

The analysis to assess the population's socioeconomic profile employed the monthly minimum wage in force at the time of data collection (R$ 374.67) and showed that 51.5% of the families had a monthly *per capita* income of less than half the minimum salary. The percentage of mothers who had completed less than 8 years in education was 56.1%, while 20.2% of the families had more than six members and 34.2% had more than two children.

The mean expenditure per child, estimated for 30 days, was R$ 100.17±34.1 and, adjusting for 1,000 kcal, the mean was R$ 66.34±15.89. Breaking the average expenditure on food/1,000 kcal down by monthly family income terciles, it was found that mean expenditure per child was greater in families with higher incomes, as shown in Table 1.

With relation to intake of SRF and FRF, analyses showed that there were no statistically significant differences in the mean expenditure on food /1,000 kcal between children who consumed different quantities of these foods. There was also no difference in expenditure on food between children with or without risk of being overweight. In contrast, analysis of nutritional quality found a positive correlation between mean expenditure on food/1,000 kcal and the children's iron, zinc, vitamin A and vitamin C intakes. Intakes of all micronutrients were adjusted for 1,000 kcal, and correlations are illustrated in Figure 1.

Discussion

The results of this study showed that expenditure on child nutrition, estimated for 1 month, was the equivalent of 27% of the minimum monthly wage.[12] Considering that

Table 1 - Mean expenditure on food/1,000 kcal estimated for 30 days, broken down by total family income, dietary variables and risk of overweight in children 3 to 4 years old

	n	Mean expenditure/1,000 kcal (R$)	p
Total monthly family income (R$)			
< 600	110	62.50±14.0	
600-950	115	66.39±16.3	
> 950	109	70.42±16.5	< 0.001
Calories from SRF			
≤ 150 kcal	320	66.37±15.98	
> 150 kcal	26	65.96±15.07	0.894
Calories from FRF			
≤ 150 kcal	242	66.37±16.59	
> 150 kcal	104	66.29±14.19	0.964
Risk of overweight			
No (≤ 1 z score)	266	65.93±14.55	
Yes (> 1 z score)	71	68.59±20.17	0.208

SRF = sugar-rich foods (soda, jello, candies, and artificial juice); FRF = fat-rich foods (fried pastries, biscuits with fillings, cold cuts and sausages, fried foods, and chocolate).

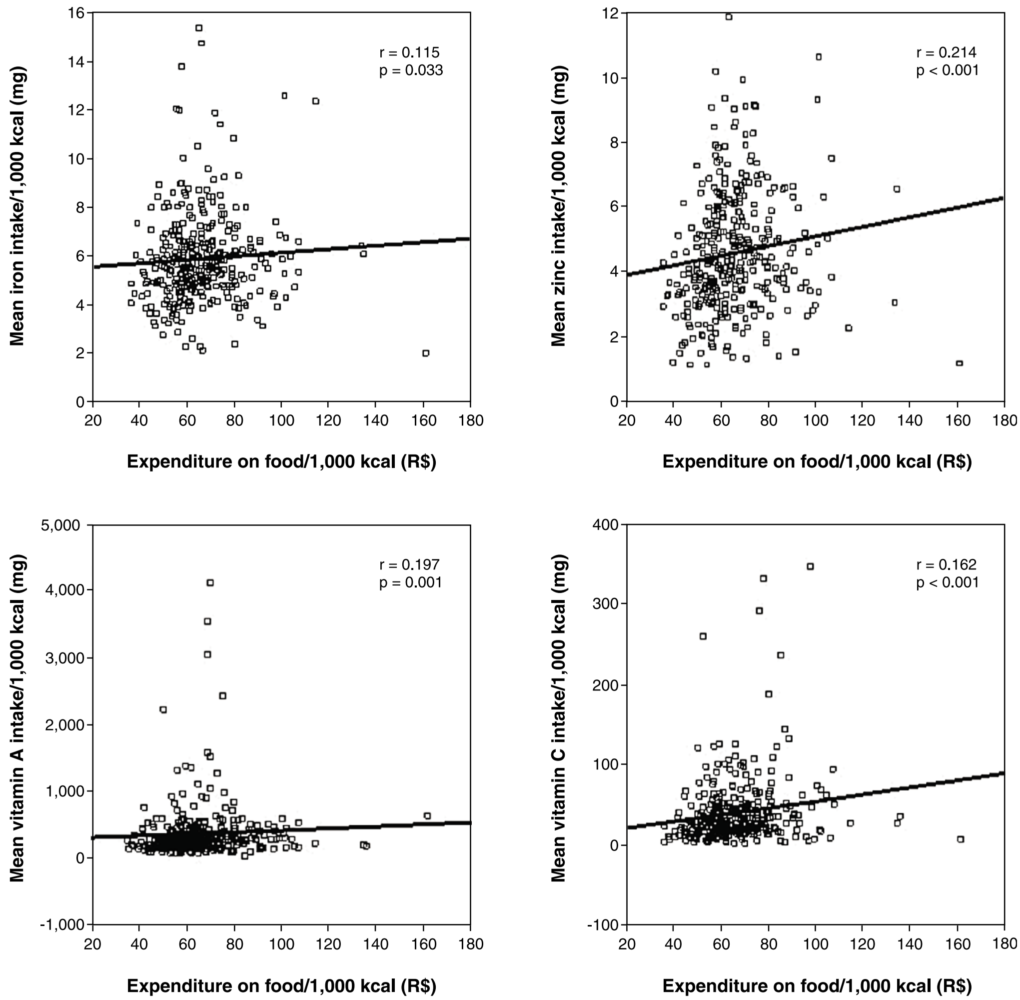

Figure 1 - Correlations with micronutrient intakes adjusted to 1,000 kcal

51.5% had a *per capita* income of less than half of a minimum monthly wage, and considering that expenditure on feeding one child was the equivalent of an average of 60% of the basic Rio Grande do Sul shopping basket during the data collection year,[12] the importance of taking into account the cost of nutrition when planning guidance for health promotion and the prevention of nutritional deficiencies and obesity, particularly among populations with low socioeconomic status, is evident. In this study, we observed that as family income increased so did the purchase of better quality food. Furthermore, nutritional quality, represented by iron, zinc, vitamin A and vitamin C intakes, demonstrated a positive correlation with expenditure on food/1,000 kcal. These micronutrients were selected due to their importance to the health and development of children less than 5 years old. These results are consistent with studies that have confirmed a direct relationship between food quality and expenditure.[6,13]

The results of our study showed that the consumption of energy provided by sugar and fat-rich foods was not associated with food expenditure, suggesting that it is easy to consume excessive quantities of these energy-rich foods,[2] and to develop obesity,[14,15] even with limited financial resources.[16,17] Although this study did not find an association between overweight and reduced expenditure on food, it is believed that the exposure period was too short to have an influence on excessive weight gain because of the age of the children studied. Dietary habits are formed very early on, at around 2 or 3 years of age,[18] and in environments in which the diet is characterized by excessive fat and sugar, which are tastier foods than vegetables,[19] and which do not increase expenditure on food, the development of obesity is more prevalent.[20,21] One further aggravating factor in this unhealthy nutritional situation is that it has been demonstrated that low-income families, and mothers who have spent less time in education, offer their children fat and sugar-rich foods more often.[22] These dietary practices, characterized by insufficient micronutrient intakes and excessive consumption of high-energy foods may in part explain the high prevalence of anemia,[23] hypovitaminosis A,[24] and under-consumption of other micronutrients, and also of obesity among the preschool children in Brazil.[25]

Publications preceding the BRATSA I study[26] showed that 75% of the mothers of low socioeconomic status children gave their children a range of treats at 12 months of age. Implementation of the Ministry of Health's "Ten steps to a healthy diet: feeding guide for children under 2," in the form of providing nutritional guidance to mothers, was effective at reducing the concomitant intake of foods with a low nutritional value, considering that, in the control group, the proportion of mothers who gave a range of unhealthy foods to their children was 44.8%, compared to 27.2% in the intervention group. It is, therefore, possible to positively change the dietary practices of children without major socioeconomic changes being necessary. Therefore, this national policy should be incorporated into the routine practice of the Brazilian National Health Service. Furthermore, the national agenda for combating childhood obesity and nutritional deficiencies must include the urgent implementation of strategies to guarantee access to good-quality foods at prices that are affordable by this population group, with a view to preventing growth deficits,[27] compromised cognitive development[24] and future obesity.[14]

The results of this study allow us to conclude that consumption of sugar and fat-rich foods is not associated with expenditure on food, but the nutritional quality of the diets of 3-to-4-year-olds, as represented by their intake of the micronutrients necessary for growth and development, was correlated with increased expenditure on food within population groups with low purchasing power.

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