

# Longitudinal monitoring of nutritional status of schoolchildren at a public school

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## Abstract

**Introduction:** The nutritional transition in Brazil is reaching the child population. In this context, studies have shown high prevalence of overweight and obesity in schoolchildren. **Objective:** To analyze the nutritional and anthropometric status of children in a public school between the years 2013 and 2015.

**Methods:** This is a longitudinal research using a study from 2013 as a baseline. The sample consisted of 73 students aged between 3 and 9 years old. Socioeconomic, anthropometric and school feeding information were collected using questionnaires according to the age of the student. The nutritional status was determined by collecting weight and height measurements, which were later used to express Weight/Age and Height/Age scores. Statistical analysis was done with the SPSS program.

**Results:** The results showed that a significant portion of the students remained overweight and obese according Weight/Age index (21.8%) and at risk of low weight by the Height/Age and Weight/Age indexes (4.1% and 3.6%). These students had growth and weight gain within the normal range and most of them with an appropriate weight for their age, however there was a significant portion of students underweight and overweight/obese.

**Conclusion:** The early identification of factors, which affect the growth and weight gain in childhood, may contribute to design strategies between the health team and the school crew to promote healthy eating habits among this audience.

**Keywords:** children, school feeding, overweight, malnutrition, nutrition surveillance

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## Authors summary

### Why was this study done?

This study was carried out after a nutritional call was made in the municipality and noted that there was a high prevalence of nutritional inadequacy in the Eudocia school Alves dos Santos.

### What did the researchers do and find?

Conducted a study of longitudinal monitoring of nutritional status of schoolchildren from that school in the years 2014 and 2015 during a project of extension. Among the data found, we can mention that the majority of those studied had adequate weight, but the prevalence of overweight and obesity six times greater than underweight and after follow-up, an improvement in the nutritional status of monitored children.

### What do these findings mean?

The results show that the studied population has a growth and weight gain within the normal range although there is an expressive portion of schoolchildren who are underweight and overweight / obese, showing that it is important to develop actions of food and nutritional surveillance among students for monitor and identify the factors that influence the development of themselves.

## INTRODUCTION

The nutritional transition in Brazil is expressed by the expansion of the distribution and magnitude of obesity and the reduction of malnutrition in recent years<sup>1,2</sup>. In this regard, Brazil experienced a rapid nutritional transition, which almost eliminated malnutrition in less than 30 years. On the other hand, this transition has led to a situation in which more than half of the population is overweight, because of changes in dietary patterns and the sedentary nature of modern life<sup>3,4</sup>.

The phenomenon of nutritional transition also affects the child population. The Family Budget Survey (FBS) carried out in Brazil 2008-2009 diagnosed that 4.1% of children between 5 and 9 years old are underweight, 33.5% are overweight and 14.3% are obese<sup>5</sup>. In the interior of Paraíba, in children, there is still a relevant prevalence of weight deficit (12%) in relation to excess weight (19.8%)<sup>6</sup>. Other studies that assessed the nutritional and anthropometric status of schoolchildren corroborated this scenario of high prevalence of overweight / obesity in this population<sup>7-9</sup>.

This study was developed from a food and nutrition education project with the premise that inadequate nutritional status in children may be influenced mainly by socioeconomic factors, their family lifestyle and the low effectiveness of public health policies targeting this population<sup>10,11</sup> and those researchers have emphasized the importance of carrying out nutritional surveillance studies, with monitoring of nutritional status<sup>12</sup>.

With the inadequacy of nutritional status in children, cases of obesity and malnutrition stand out, then it is necessary to analyze their nutritional condition with a longitudinal approach, so this study during three consecutive years assessed the anthropometric nutritional status of children from a public school in a low economic development region of northeast Brazil.

## METHODS

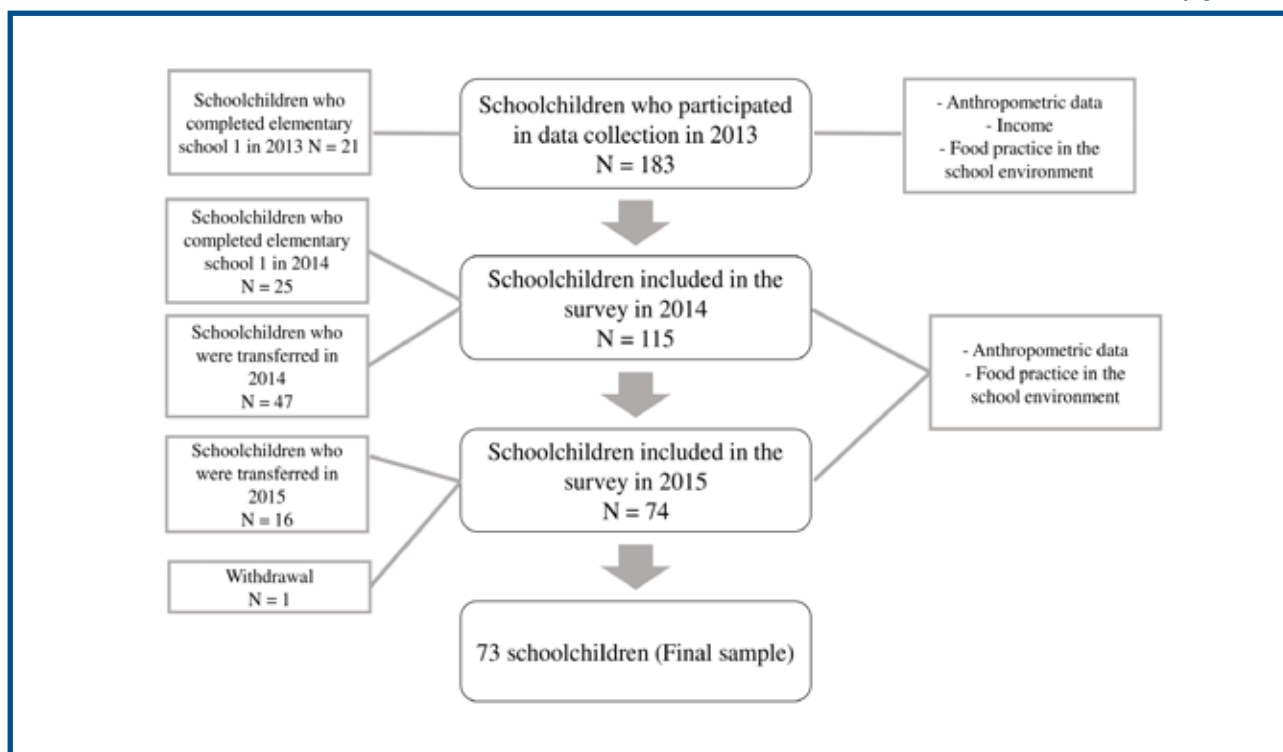
This is a longitudinal study, developed between the years 2013 and 2015 at the public school, Eudocia Alves dos Santos located in the municipality of Cuité, Paraíba, Northeast Brazil. The municipality has a population of approximately 20 thousand inhabitants and a human development index of 0.59<sup>13</sup>.

The Research Ethics Committee of the Alcides Carneiro University Hospital of the Federal University of Campina Grande (UFCG) approved the study under the protocols 15713713.0.0000.5182 and 39570014.0.000.5575. Before data collection, all students and their guardians were informed about the purpose of the study and the confidentiality of their information. After acceptance, the legal representatives signed a Free and Informed Consent Form (FICF).

The baseline of this study considers the data collected through the project "Nutritional call of schoolchildren enrolled in the Public School", which is a strategy to collect information about the nutritional status of children enrolled in public schools of northeast Brazil, carried out in 2013<sup>6</sup>.

The results of this project pointed to a high prevalence of nutritional inadequacy, due to malnutrition and obesity in students from the school Eudocia. From this in this scenario, this research team carried out a study of longitudinal monitoring of the nutritional status of the students from that school in the years 2014 and 2015.

The figure 1 shows the flowchart of data collection that occurred in three consecutive years: 2013 (baseline), 2014, and 2015. The sample loss (60%) happened due to students were transferred to other schools and others finalized elementary school I, which it made impossible the follow up of them.



**Figure 1:** Flowchart of field work related to sample collection for research

### Instruments and data collection

Questionnaires were applied taking into account the student’s age. The strategy in 2014 and 2015 included a student health-monitoring booklet in relation to anthropometry (weight and height) and food habits at school.

Nutritional status is the outcome variable, being analyzed using the software WHO Anthro and Antro Plus WHO– 2006 in which the z-scores of the nutritional status of students were generated and considered the most sensitive indicators for the classification of nutritional status, Weight for Age (W/A) and Height for Age (H/A).

The evolution of the nutritional status was analyzed based on the changes occurred in the z-score values over time. Thus, the z-score and increment averages were calculated from the initial nutritional status. Subsequently, differences in the z-score averages between 2013 and 2015 were evaluated according to exposure variables: family income; daily availability of water; adherence to school meals and the practice of bringing snacks to school.

Income was categorized both below and above the poverty line when the per capita income was either under or over R\$140.00 (Brazilian currency) respectively.

The food practice in the school environment was categorized in relation to adherence as follows: strong adherence meaning consumption 3 to 5 times a week in the three periods of the study and poor adherence when consumption was up to 2 times a week in one of the periods. For the variable “bring snacks to school”, the

statements “no” and “yes always” were considered in the three study periods.

From the SPSS for Windows program, version 20.0, means and standard deviation of the z-score were calculated in 2013 and 2015; the variation in the mean z-score and a T test for paired samples was performed to compare exposure groups.

### RESULTS

The final sample of this study was composed of 73 students. In 2013, at the beginning of the study, students were aged between 3-9 years, 64.4% of them, belonged to families below the poverty line.

In the baseline, in 2013, the prevalence of overweight/obesity and underweight was 23.3% and 6.8%, respectively and in 2015, 21.8% to 3.6%, respectively.

Table 1 indicates the initial nutritional status of students and its evolution through the mean of the z-score for the indicators W/A and H/A.

Table 2 shows the average z-score and the increase in z-score according to socioeconomic factors and dietary practice in the school environment. This difference refers to the comparison of the z-score averages between the baseline (2013) and the year 2015 according to groups referring to the independent variables.

**Table 1:** Means, standard deviation and increment of z-score according to the initial nutritional status of the students for the weight for age and height for age indexes in the baseline (2013) and in 2015, Cuité, Paraíba, Brazil.

Initial nutritional status	n	2013		n	2015		Increment
		z score Mean	SD		z score Mean	SD	
Weight / Age							
Low weight	2	-2.760	0.61	2	-2.190	0.03	0.57
Low weight risk	3	-1.526	1.03	3	-1.230	0.64	0.29
Eutrophy	63	0.241	0.72	47	0.322	0.79	0.09
High weight	5	2.922	0.65	5	2.952	0.65	0.03
Height / Age							
Very short stature	2	-1.085	0.14	2	-0.870	0.05	0.21
Short	3	-2.773	1.12	3	-2.113	0.69	0.66
Eutrophy	68	0.321	0.90	68	0.466	0.94	0.07

SD: Standar deviation

**Table 2:** Difference in the initial and final means of z-score height for age and weight for age according to socioeconomic factors and dietary practice.

Variables	Heigth/Age				Weigth/Age			
	2013	2015	p	CI	2013	2015	p	CI
Per capita family monthly income **								
Above the poverty line	0.402	0.619	0.000*	0.21	0.540	0.643	0.044*	0.11
Below the poverty line	0.037	0.204	0.016*	0.16	0.131	0.231	0.125	0.11
Water availability **								
Water available daily	0.290	0.439	0.000*	0.14	0.421	0.512	0.000*	0.06
Water not available daily	-0.718	-0.290	0.026*	0.47	-0.743	-0.535	0.021*	0.42
Adherence to school feeding								
Strong adherence in the three periods	0.201	0.237	0.627	0.03	0.158	0.135	0.686	0.03
Poor adherence in one of the three periods	0.124	0.384	0.000*	0.41	0.356	0.576	0.004*	0.33
Brings Food								
Not	-0.291	-0.079	-0.284	0.33	-0.10	0.077	0.583	0.37
Yes always	0.425	0.606	0.018*	0.18	0.799	0.955	0.149	0.07

CI: increment of z-score. \* p<0.05 shows a statistically significant difference between the means for the T test of paired samples. \*\* Baseline data (2013).

## DISCUSSION

Over the three periods of analysis, about 70% of students were eutrophic, but when nutritional inadequacy is assessed, there is a prevalence of overweight and obesity (21.8%) six times higher than underweight (3.6%). The National Survey of Schoolchildren Health (PeNSE) demonstrated this increase in overweight and obesity by identifying in a sample of children from 9th grade of public schools a prevalence of underweight of 3.1% while overweight reached 14.5% and obesity 6.5% using the value of body mass index (BMI)<sup>14</sup>.

The higher prevalence of overweight/obesity in relation to underweight found in this study reflects the current situation of nutritional status of schoolchildren in Brazil considering the phenomenon of nutritional transition that has been occurring for many years in the

country, where studies show increasing prevalence of overweight in children school-aged<sup>15-17</sup>. Leal *et al.*<sup>18</sup> in their study that described trends in nutritional status among schoolchildren aged 7 to 10 who participated in two cross-sectional studies in 2002 and 2007 in Florianópolis, Santa Catarina, southern Brazil, reported a continuous increase in prevalence of overweight in both boys and girls.

In this context, Hook *et al.*<sup>19</sup> reported that in preschool children aged 0-5 the prevalence of overweight/obesity has increased in developing countries, including Brazil. These data corroborate with those of FBS - 2008/2009 that reported that over the last 30 years the prevalence of overweight in the child population increased in all Brazilian regions and in all income strata<sup>5</sup>.

Closer to the scenario of our study, Santos *et al.*<sup>6</sup> showed a higher prevalence of overweight than

underweight, regardless of family income in children aged 0-9 years enrolled in daycare centers and municipal public schools in the urban area of Cuité, Paraíba, Brazil.

Corroborating, Sousa *et al.*<sup>9</sup> in their systematic review with meta-analysis aiming to verify the prevalence of height deficit and overweight/obesity in Brazilian children according to different epidemiological scenarios, demonstrated that the progressive increase in overweight/obesity rates in this population has distribution equitable between social classes.

After three years of follow-up, there was an improvement in the nutritional status of the children. The results presented in 2015 pointed to a lower weight deficit prevalence than that found in the Brazilian semiarid region (5.6%) and Paraíba (5.9%) for children under five years old and for a lower prevalence of overweight/obesity than that found through the BMI in the city of Campina Grande (23.5%)<sup>20</sup>.

It is observed a slight increase in the averages in all categories of nutritional status and a positive advance in relation to the students who in the baseline presented minor risk of low weight, as they gained points in the averages of z-score (0.57) higher than those who started the study in a situation of high weight (0.03). This fact is positive, as it indicates that for both risk categories the student seems to approach the z-score of adequacy.

When assessing the influence of income on the nutritional status, it is noted that the averages in the z-score varied in relation to socioeconomic condition, being higher for schoolchildren who in the baseline lived with families classified above the poverty line ( $p=0.044$ ), a hypothesis that can be generated from this is that the higher the income, the greater the growth and weight gain. Studies show that obesity affects all economic classes, although malnutrition is still present among children with lower social situation<sup>10,16,21</sup>.

Accordingly, Netto-Oliveira *et al.*<sup>22</sup> assessed overweight and obesity in children aged 6-7 years, enrolled in 24 schools in Maringá, Paraná, Brazil, from different economic classes, and demonstrated that the prevalence of overweight was markedly higher among schoolchildren of higher socio economic level.

With regard to eating practices in the school environment, there was a greater increase in z-score for students who had poor adherence in one of the three periods ( $H/A = 0.41$  and  $W/A = 0.33$ ) and for students who did not bring a snack to school ( $H/A = 0.33$  and  $W/A = 0.37$ ). The growth was greater on the part of students who did not show strong adherence in one of the three periods ( $p = 0.001$ ) and those who brought snacks to school ( $p = 0.018$ ), as well as the greatest weight gain was found in the group that had poor adherence ( $p = 0.004$ ). Among

the foods that children bring to school the most mentioned in the baseline were packaged snacks (35.7%), cookies or stuffed cookies (21.4%) and fruits (19.6%). In 2015, it remained practically the same pattern, with packet snacks (35.6%), fruits (21.9%) and cookies or stuffed biscuits (16.4%).

Studies show that children have good adherence to school meals, and those children who do not consume it have the practice of bringing snacks to school, their main justifications for non-adherence is because they prefer to play during recess time and lack of appetite at break time<sup>23,24</sup>. Most children bring processed food to school that are rich in sugars and fats such as stuffed crackers, snacks, popcorn, candies and soft drinks. These foods, in addition of being low in nutrients, provide excess calories to the body, contributing to both excessive weight gain and nutrient deficiency<sup>24</sup>. Given this, the weight gain is higher among students who bring snacks from home.

The results show that the studied population has a growth and weight gain within the normal range and most of them have an appropriate weight for their age, however exists a significant portion of students either underweight or overweight/obese, a fact consistent with the nutritional transition process that Brazil has been going through.

It is worth mentioning that the children studied participated in activities of food and nutrition education during the period of the research that may have collaborated with the increase for those with low weight (increase: 0.57) and weight gain control (increase: 0.03). The sample loss resulting from students transferred to other schools, those who finalized the elementary instruction and the lack of biochemical tests to increase the indicators of nutritional status make up the limitations of this study.

## CONCLUSION

In view of our findings, it is perceived the importance of instituting actions of food and nutrition surveillance as well as the promotion of food and nutrition education among schoolchildren to monitor their development.

The early identification of factors that influence the growth and weight gain in childhood may contribute to design strategies between the health team and the school crew to promote healthy eating habits among this audience.

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## Resumo

**Introdução:** A transição nutricional no Brasil vem alcançando também a população infantil. Neste âmbito, estudos tem demonstrado altas prevalências de sobrepeso e obesidade em crianças em idade escolar.

**Objetivo:** Analisar o estado nutricional e antropométrico de crianças de uma escola pública entre os anos de 2013 e 2015.

**Método:** Foi desenvolvido um estudo longitudinal utilizando um estudo de 2013 como baseline. A amostra final foi composta de 73 escolares com idade inicial entre 3 e 9 anos. Foram coletadas informações socioeconômicas, antropométricas e de prática de alimentação escolar utilizando questionários de acordo com a idade do escolar. O estado nutricional for determinado pela coleta de medidas de peso e altura, posteriormente estas foram utilizadas para expressão z escores de Peso/Idade e Altura/Idade. Utilizou-se o SPSS para análises estatísticas.

**Resultados:** Os resultados mostraram que uma expressiva parcela dos escolares se manteve em sobrepeso e obesidade a partir do índice Peso/Idade (21,8%) e em risco de baixo peso pelos índices Altura/Idade e Peso/Idade (4,1% e 3,6%). Estes escolares apresentaram um crescimento e ganho de peso dentro dos padrões de normalidade e a maioria apresentou peso adequado para a idade, no entanto existiu uma parcela expressiva de escolares que apresentam baixo peso e sobrepeso/obesidade.

**Conclusão:** O estado nutricional de crianças está relacionado a diversos fatores que devem ser trabalhados por meio de ações de desenvolver ações de vigilância alimentar e nutricional e de educação alimentar e nutricional com os escolares para promover hábitos alimentares saudáveis.

**Palavras-chave:** crianças, alimentação escolar, sobrepeso, desnutrição, vigilância nutricional.

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