

## Some risk factors associated with overweight, stunting and wasting among children under 5 years old

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### Abstract

**Objective:** To explore whether socioeconomic and sanitary conditions, maternal and child factors are associated with overweight, stunting, and wasting in children under five year old in the city of São Leopoldo, southern Brazil.

**Methods:** Cross-sectional study of 3,957 children aged 1 month to 5 years conducted in all primary care services of the city during the National Children's Vaccination Day in 2002. Maternal and child factors were assessed by a questionnaire. Children's height and weight were measured. Cluster analysis was used to group the areas served by the primary care services according to socioeconomic and sanitary conditions of the census tracts assessed by the 2001 National Census.

**Results:** Wasting was observed in 2.6% of children, stunting in 9.1% and overweight in 9.8%. The multivariable logistic regression model suggests that overweight was associated with higher socioeconomic status and better sanitation of the area (OR = 1.47; 95%CI 1.09-1.96), single child (OR = 1.44; 95%CI 1.00-2.07) and birth weight  $\geq 2,500$  g (OR = 2.21; 95%CI 1.27-3.83). Wasting was associated with low birth weight (OR = 3.46; 95%CI 2.06-5.80) and mother's age < 20 years (OR = 1.99; 95%CI 1.09-3.62). Stunting was associated with low socioeconomic status and poor sanitation of the area (OR = 2.36; 95%CI 1.51-3.69), three or more siblings (OR = 3.12; 95%CI 2.18-4.47), low birth weight < 2,500 g (OR = 3.49; 95%CI 2.53-4.80), child age < 36 months (OR = 1.77; 95%CI 1.37-2.29) and mother's age < 20 years (OR = 1.60; 95%CI 1.09-2.35).

**Conclusions:** Overweight and stunting were the major anthropometric problems and therefore should be a priority for public policies.

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### Introduction

Brazilian surveys conducted between 1975 and 1996<sup>1-3</sup> and recent population-based studies in different Brazilian regions<sup>4,5</sup> have suggested that there is a decrease in stunting and wasting and an increase in overweight among children younger than 5 years. However, current population based data on the nutritional status of children in Brazil is scarce. The 2000/2003 Family Budget Survey provided data on children, but the Brazilian Institute of Geography and Statistics (IBGE)

does not recommend the use of these data for children due to measurement errors in children's height.<sup>6</sup>

The assessment of the association between children's nutritional status associated and the socioeconomic conditions, maternal and child factors is essential for the development and evaluation of public policies aimed at health equity. Studies conducted in various Brazilian regions have examined the association of children's nutritional status with family income and parent's education. This studies suggest that lower socioeconomic status is a risk factor for wasting and

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stunting in children,<sup>7-10</sup> whereas the risk for overweight tends to be greater in families with a higher socioeconomic background.<sup>4,11</sup> In the last 5 years, few population-based studies on nutritional status and risk factors for overweight, stunting and wasting have been undertaken in Brazil.<sup>12,13</sup> Such studies are needed to report on social inequalities on the nutritional status of Brazilian children.

This article assesses some socioeconomic and sanitary conditions, child and maternal factors associated with overweight, stunting, and wasting in under-five year old children who attended the National Vaccination Day in the primary care services in the city of São Leopoldo, southern Brazil, in 2002.

## Methods

Data collection was carried out in children from 1 month to 5 years who attended the National Vaccination Day in the primary care services in the city of São Leopoldo, during the National Vaccination Day in 24 of August 2002. São Leopoldo is about 30 km from the capital of the southern Brazilian state, Rio Grande do Sul. São Leopoldo has 193,547 inhabitants, including 17,779 children younger than 5 years; literacy rate is 95.6%.<sup>14</sup> The immunization campaign included 13 primary care services. The four mobile health units were not included in this study because they did not have adequate conditions for the measurements of children's height and weight.

The data was collected by 102 nutrition students from Universidade do Vale do Rio dos Sinos. They were trained by nutritionists to measure children's weight and height and to apply a questionnaire to the child's mother or carer. The questionnaire assessed age, sex, date of birth, gestational age at birth, birth weight, number of siblings, and mother's age. Data collection was supervised by nutritionists. The height of infants younger than 2 years was measured using a wooden stadiometer; they were weighted using Welmy<sup>®</sup> pediatric scales. Children older than 2 years were weighed using a portable Techline<sup>®</sup> digital scales. Height was measured using a non-extensible Seca<sup>®</sup> tape attached to a smooth wall surface containing no baseboard, and with the help of a wide wooden sliding piece. Nutritional status was expressed as z-score according to the Multicentre Growth Study standard recommended by the World Health Organization.<sup>15</sup> Stunting was defined by child's height-for-age z-scores < -2 standard deviation (SD) wasting by weight-for-height < -2 SD and overweight by weight-for-height > 2 SD of these international standards.<sup>16</sup>

The socioeconomic and sanitary conditions of the areas served by the primary care services were estimated using census tracts data of the 2001 National Census. The following information was collected for each census tract: percentage of heads of household with primary education, income of the heads of household (in percentiles) and percentage of households with inadequate sewage system. Cluster analysis was used to group the areas served by the primary care services

according to these socioeconomic and sanitary conditions as follows: (I) area with low socioeconomic and sanitary conditions (n = 1 area), which presented one third of households with inadequate sewage system and most of the principal earners did not complete primary education and were below the 3rd percentile for the income municipality; (II) area with intermediate socioeconomic and sanitation (n = 8 areas), characterized by < 10% of households with inadequate sewage system, but still a predominance (50-60%) of low schooling and income; (III) area with higher sanitary conditions and socioeconomic conditions (n = 4 areas), where almost all households had adequate sewage system (97.5%) and a predominance of primary education and (58%) and income higher than the 3rd percentile. Ethical clearance was obtained from Ethics Committee of the Universidade Federal do Rio Grande do Sul (UFRGS). A questionnaire about child and mother's factors were applied to the mother or care giver, after a written informed consent. The data was double-entered by independent data entry operators using Epi-Info. Anthro 2005 was used to calculate the children's nutritional status.<sup>17</sup>

Multivariable logistic regression taking into account the conceptual hierarchy of the risk factors in the process that determines overweight, wasting and stunting was carried out using the SPSS, version 11.0. Initially, we estimated the odds ratios for sociodemographic variables, child's age and sex, adjusted for each other (variables of block 1). It was pre-defined that variables of block 1, whose statistical significance was lower than 20% (p < 0.2), would be included as possible confounding factors for the variables of interest in block 2: mother's age; model 3: number of siblings and birth weight. Likewise, if the p for mother's age would be lower than 0.2, these variable would be also kept as possible confounding factor for the variables of interest in block 3: number of siblings and birth weight. An association was taken as statistically significant if the p < 5% (p < 0.05).

## Results

Wasting was observed in 2.6% (n = 103), stunting in 9.1% (n = 361) and overweight in 9.8% (n = 389) of the assessed children. Tables 1 through 3 show the distribution of children according to the exposure variables analyzed.

Table 1 shows the factors associated with overweight. The odds ratios adjusted for possible confounding factors suggest that overweight is positively associated with the area with high socioeconomic level (OR = 1.47; 95%CI 1.09-1.96), with birth weight  $\geq$  2,500 g (OR = 2.21; 95%CI 1.27-3.83) and with a tendency towards significant association in case of no siblings (OR = 1.44; 95%CI 1.00-2.07).

Table 2 shows the factors associated with wasting. The odds of wasting was three times as high for children whose birth weight was less than 2,500 grams compared to the others (OR = 3.46; 95%CI 2.06-5.80) and it was twice as high

**Table 1** - Prevalence of children with overweight and socioeconomic and demographic variables (odds ratios and confidence interval)

Variables	Children with overweight	Number of children assessed (n)	OR (95%CI)*	OR (95%CI)†
Sex				
Male	225 (9.9%)	2,274	1	1
Female	164 (9.7%)	1,683	1.01 (0.82-1.26)	1.00 (0.80-1.25)
Socioeconomic and sanitation of the area				
I (low)	71 (9.2%)	769	1	1
II (intermediate)	242 (9.3%)	2,608	1.01 (0.76-1.34)	1.42 (0.98-2.05)
III (high)	76 (13.1%)	580	1.48 (1.04-2.12)	1.47 (1.09-1.96)‡
Child age (months)				
0 to 36	234 (10.2%)	2,295	1.11 (0.89-1.38)	1.05 (0.83-1.32)
Over 36	143 (9.3%)	1,542	1	1
Mother's age (years)				
Less than 20	45 (11.3%)	397	1.19 (0.85-1.65)	1.11 (0.77-1.60)
20 and more	339 (9.7%)	3,483	1	1
Birth weight (grams)				
Less than 2,500	14 (4.8%)	292	1	1
2,500 g and more	358 (10.5%)	3,422	2.32 (1.31-4.18)	2.21 (1.27-3.83)‡
Siblings				
Single child	155 (11.4%)	1,365	1.55 (1.10-2.19)	1.44 (1.00-2.07)
One to two siblings	183 (9.5%)	1,928	1.27 (0.91-1.78)	1.26 (0.98-1.61)
Three and more siblings	50 (7.6%)	655	1	1

95%CI = 95% confidence interval; OR = odds ratio.

\* Unadjusted odds ratio.

† Adjusted odds ratio (block 1 = sex, socioeconomic and sanitary conditions, child's age; block 2 = block 1 plus mother's age; block 3 = block 1 plus mother's age, birth weight and number of siblings).

‡ Statistical significance.

for those whose mother's age was less than 20 years (OR = 1.99; 95%CI 1.09-3.62).

Table 3 shows the factors associated with stunting. The odds for stunting was two times as high in the area with low socioeconomic and sanitary (OR = 2.36; 95%CI 1.51-3.69) and 1.5 times higher in the area with intermediate conditions (OR = 1.57; 95%CI 1.20-2.05), compared to the wealthier areas. The odds of stunting was also higher among infants with low birth weight (OR = 3.49; 95%CI 2.53-4.80) and among children with one or two siblings (OR = 1.82; 95%CI 1.36-2.43) it was three times as high among those with three

or more siblings (OR = 3.12; 95%CI 2.18-4.47) compared to single child. Male sex (OR = 1.36; 95%CI 1.07-1.72) and age up to 36 months (OR = 1.77; 95%CI 1.37-2.29) were also associated with stunting.

## Discussion

Overweight and stunting are the major nutritional problems, which is consistent with the latest studies conducted in Brazil.<sup>1-3</sup> In this study, the risk for overweight was higher for children attending the National Vaccination Day at primary care centres located in areas with a high socioeconomic and

**Table 2** - Prevalence of children with wasting and socioeconomic and demographic variables (odds ratios and confidence interval)

Variables	Children with wasting	Number of children assessed (n)	OR (95%CI)*	OR (95%CI)†
Sex				
Male	59 (2.6%)	2,274	1	1
Female	44 (2.6%)	1,683	1.01 (0.67-1.52)	0.90 (0.59-1.39)
Socioeconomic and sanitation of the area				
I (low)	13 (1.7%)	769	1	1
II (intermediate)	74 (2.8%)	2,608	1.70 (0.91-3.23)	1.50 (0.69-3.27)
III (high)	16 (2.8%)	580	1.65 (0.75-3.67)	0.99 (0.55-1.80)
Child age				
0 to 36 months	67 (2.9%)	2,295	1.47 (0.95-2.25)	1.26 (0.80-2.00)
Over 36 months	31 (2.0%)	1,542	1	1
Mother's age				
Younger than 20 years	19 (4.8%)	397	2.08 (1.25-3.47)	1.99 (1.09-3.62)‡
20 years or older	82 (2.4%)	3,483	1	1
Birth weight				
Less than 2,500 g	21 (7.2%)	292	3.37(2.05-5.54)	3.46 (2.06-5.80)‡
2,500 g and more	77 (2.3%)	3,422	1	1
Siblings				
Single child	35 (2.6%)	1,365	1	1
One or two siblings	54 (2.8%)	1,928	1.09 (0.70-1.72)	1.11 (0.55-2.28)
Three and more siblings	14 (2.1%)	655	0.87 (0.44-1.60)	0.87 (0.45-1.66)

95%CI = 95% confidence interval; OR = odds ratio.

\* Unadjusted odds ratio.

† Adjusted odds ratio (block 1 = sex, socioeconomic and sanitary conditions, child's age; block 2 = block 1 plus mother's age; block 3 = block 1 plus mother's age, birth weight and number of siblings).

‡ Statistical significance.

sanitary conditions. The association between overweight and socioeconomic factors seems to depend on the country and on the age assessed. In industrialized countries, the prevalence of childhood obesity is higher among children whose families have a lower socioeconomic costatus.<sup>18,19</sup> Conversely, in developing countries, overweight and obesity among children are usually more prevalent in families with a higher socioeconomic conditions.<sup>4,11,20,21</sup> Our study also shows a higher prevalence of overweight in areas with a higher socioeconomic and sanitary conditions, thus corroborating the latest data obtained by Brazilian studies. Similarly to other

studies<sup>5,11,18</sup> low-birth weight was associated with a lower risk of overweight, whilst being a single child increased this risk. This association may be partially explained by better socioeconomic status of families. However, there are other factors known as strongly correlated with overweight in children which were not covered by our study, such as early weaning, inappropriate nutritional practices and sedentary lifestyle.

The prevalence of 2.6% for wasting in children observed in study is consistent with the expected prevalence for the

**Table 3** - Prevalence of children with stunting and socioeconomic and demographic variables (odds ratios and confidence interval)

Variables	Children with stunting	Number of children assessed (n)	OR (95%CI)*	OR (95%CI)†
Sex				
Male	220 (9.7%)	2,275	1.17 (0.94-1.46)	1.36 (1.07-1.72)‡
Female	141 (8.4%)	1,683	1	1
Socioeconomic and sanitation in the area				
I (low)	102 (13.3%)	769	2.71 (1.76-4.21)	2.36 (1.51-3.69)‡
II (intermediate)	228 (8.7%)	2,608	1.70 (1.14-2.55)	1.57 (1.20-2.05)‡
III (high)	31 (5.3%)	581	1	1
Age				
0 to 36 months	67 (2.9%)	2,295	1.47 (0.95-2.25)	1.26 (0.80-2.00)
Over 36 months	31 (2.0%)	1,542	1	1
Mother's age				
Younger than 20 years	50 (12.6%)	397	1.49 (1.08-2.05)	1.60 (1.09-2.35)‡
20 years or older	307 (8.8%)	3,484	1	1
Birth weight				
Less than 2,500 g	69 (23.6%)	292	3.53 (2.62-4.74)	3.49 (2.53-4.80)‡
2,500 g or more	276 (8.1%)	3,422	1	1
Age				
0 to 36 months	245 (10.7%)	2,294	1.71 (1.34-2.17)	1.77 (1.37-2.29)‡
Over 36 months	101 (6.5%)	1,544	1	1
Siblings				
Single child	86 (6.3%)	1,365	1	1
One or two siblings	177 (9.2%)	1,930	1.50 (1.14-1.98)	1.82 (1.36-2.43)‡
Three and more siblings	96 (14.7%)	654	2.56 (1.86-3.52)	3.12 (2.18-4.47)‡

95%CI = 95% confidence interval; OR = odds ratio.

\* Unadjusted odds ratio.

† Adjusted odds ratio (block 1 = sex, socioeconomic and sanitary conditions, child's age; block 2 = block 1 plus mother's age; block 3 = block 1 plus mother's age, birth weight and number of siblings).

‡ Statistical significance.

general population. Studies conducted in other Brazilian cities and regions have also suggested low prevalence of wasting.<sup>4,12,22,23</sup> In this study, we used weight-for-height instead of the weight-for-age ratio; although growth curves based on age percentiles can be used in the health units to monitor children's growth channel, they are inadequate for nutritional

diagnosis as most children with stunting may be misdiagnosed as being wasted.

This study showed that low-birth weight was associated with wasting and stunting with stunting, which is a form of chronic malnutrition with remarkable effects on the health

health of disadvantaged populations. These findings confirm the importance that should be given to women's health, pre-natal care and the surveillance of children with low-birth weight. Young motherhood is another risk factor for wasting, which underscores the need to prioritize nutritional surveillance of teenage women due to the higher nutritional risk to which their children are exposed.<sup>24</sup> Stunting has been considered a better indicator of negative environmental influences on children's health than is wasting, since it is the most sensitive indicator of malnutrition in developing countries.

Differently from overweight which is more likely among people in higher socio-economic conditions, the risk for stunting was greater for those with a lower socioeconomic status<sup>8,10,25</sup> and low birth weight as shown in other studies.<sup>4,12,23</sup> The risk for stunting increased with the number of siblings, which probably represents another indicator of families with a lower socioeconomic status and limited mother's availability for child care. In the present study, the risk for stunting was higher for children aged up to 36 months. The same association was found by other studies and should be interpreted with caution due to the cross-sectional design of the study.<sup>13,26</sup> Further longitudinal studies are needed to clarify whether there is some recovery of linear growth after the first 3 years of life. In this study, male children were at higher risk for stunting, suggesting that boys seem to be more vulnerable. A population-based study carried out in Porto Alegre (RS) in the 1990s showed higher prevalence of stunting among male children, but no statistical significance was observed.<sup>13</sup>

With regard to the limitations of the present study, is the possibility that some children did not took part in the study because their parents did not want to spend time cueing for the anthropometric measurements of the child. The sociodemographic classification may not correspond to the area of residence of some children, who might have been vaccinated in primary care centers which were not close to their area of residence.

## Conclusions

Overweight and stunting were the major anthropometric problems observed in this study and should be contemplated by current public policies. One should evaluate the policies set up for nutritional disorders in the public health systems, which still prioritize the combat against childhood malnutrition within the anthropometric context. A previous study with 1,200 preschool children from a public municipal school of the state of São Paulo revealed a higher prevalence of overweight among children, showing a process of nutritional transition in this age group.<sup>27</sup> The adoption of public policies such as nutritional surveillance and health surveillance of children from the moment of conception may reduce low birth weight and stunting rates in Brazil, in addition to helping control excessive gain weight in the first years of life.

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