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Prevalence of overweight and associated factors in under-five-year-old children in urban population in Brazil

Excesso de peso e fatores associados em menores de cinco anos em populações urbanas no Brasil

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ABSTRACT: ***Objectives:*** To estimate the prevalence of overweight in children under five years old from urban households and to investigate associated factors. ***Methods:*** Cross-sectional population-based study carried out in the five regions of Brazil with a sample of 6,397 children. The World Health Organization 2006 Growth Curves were used and children were considered overweight when Z-score was higher than two standard deviations of weight for height. The following variables were investigated: family income, mothers' education level, race, age, gender, number of siblings, weight at birth and duration of exclusive breastfeeding. Proportions were compared with the χ^2 test and reasons of prevalence were calculated. Logistic regression was used for the adjusted analysis. ***Results:*** The prevalence of overweight was of 12%. After adjustments, this prevalence was significantly higher among males ($p = 0.030$) and inversely proportional to the child's age ($p = 0.032$). White children presented 22% higher overweight prevalence than non-white ones. A linear direct association was verified between weight at birth and overweight ($p = 0.000$). Children who were breastfed until 120 days presented 34% more prevalence of overweight when compared to the ones who were breastfed for a longer time. ***Conclusions:*** Overweight prevalence was higher in male, under one year old, white children, with more than 3,500 grams of weight at birth and who were exclusively breastfed until 120 days.

Keywords: Overweight. Obesity. Child. Prevalence. Population surveys.

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RESUMO: ***Objetivos:*** Estimar a prevalência de excesso de peso em menores de cinco anos em famílias urbanas e investigar fatores associados. ***Métodos:*** Estudo transversal de base populacional realizado nas cinco regiões do Brasil, com uma amostra de 6.397 crianças. Foram utilizadas as curvas de crescimento da Organização Mundial de Saúde de 2006 e consideradas com excesso de peso crianças com escore Z maior que dois desvios-padrão de peso para a altura. As seguintes variáveis foram investigadas: renda familiar per capita, escolaridade materna, cor, idade, sexo, número de irmãos, peso no nascimento e duração de aleitamento materno exclusivo. Foram comparadas as proporções com o teste do χ^2 e calculadas as razões de prevalência. Para a análise ajustada foi utilizada a regressão logística. ***Resultados:*** A prevalência de excesso de peso foi de 12% e, após ajuste, foi significativamente maior no sexo masculino ($p = 0,030$) e inversamente proporcional à idade da criança ($p = 0,032$). As crianças brancas apresentaram uma prevalência de excesso de peso 22% maior do que as não brancas. Foi verificada uma associação linear direta entre o peso de nascimento e o excesso de peso atual ($p = 0,000$). Crianças que foram amamentadas até 120 dias apresentaram uma prevalência 34% maior de excesso de peso quando comparadas às que mamaram por mais de 120 dias. ***Conclusões:*** A prevalência de excesso de peso foi maior no sexo masculino, em crianças menores de um ano, brancas, com peso de nascimento maior que 3.500 gramas e que foram amamentadas exclusivamente até 120 dias.

Palavras-chave: Sobrepeso. Obesidade. Criança. Prevalência. Inquéritos demográficos.

INTRODUCTION

Child obesity has been progressively increasing over the last few decades, being considered a worldwide epidemy by the World Health Organization. It is estimated that 43 million children under 5 years are overweight worldwide, including 35 million in developing countries and 8 million in developed countries[1].

In Europe, one out of five children is overweight and, of those, one-third is obese[1]. In the United States, the prevalence of overweight children between 2 to 5 years of age, in the period from 1999 to 2004, increased from 9.5 to 15.1% in male individuals and 11.2 to 12.6% in female ones[2]. In Brazil, studies report that the overweight prevalence in children under 5 years of age range from 2.5%, among lower economic strata, to 16.6% at the highest ones[3-6].

Several studies have been dedicated into identifying risk factors for excess weight in children, such as birth weight[4,7,8], breastfeeding[9,10], family income[3], environmental factors[11] and socioeconomic status[12].

Victora et al.[4], when analyzing a cohort of births in 1982, reviewed in 2006, with a sample of 856 individuals and with the objective of evaluating the effects of birth weight and weight gain up to 23 years of age, showed that the gain of weight in the intrauterine phase and in the first 2 years of life are associated to weight increase of abdominal fat in young adults[4]. Considering the need for health promotion, the early detection of excess

weight in children may contribute to the reduction of risks of hypertension, dyslipidemia, diabetes mellitus type II[13], orthopedic disorders[14] and psychosocial issues[14]. In addition to individual benefits, this reduction could have a positive impact on the costs of the health system. International studies have shown that public spending on drugs to treat the complications of obesity increased from 6.5 to 9.1% from 1998 to 2006, when compared to the expenses 40% lower with non-obese subjects[14,15].

Several studies on breastfeeding have shown a protective effect on the development of child obesity. However, this relation is yet quite controversial in the literature, because of its delineations, samples and different diagnostic methods, making the comparison between them rather difficult[9,10,16,17].

A cross-sectional study carried out in Germany, with 9,357 children between 5 and 6 years of age, found a 4.5% prevalence of obesity among those who were not breastfed and 2.8% among the breastfed ones. The prevalence of obesity was inversely proportional to the duration of exclusive breastfeeding: at 2 months, the prevalence was 2.3%; at 3 to 5 months, 1.7%; and among those children who were exclusively breastfed for more than 12 months, it was 0.85%. The effects were adjusted for confounding factors such as social class and lifestyle, showing that breastfeeding was a protective factor against child obesity [17].

The objectives of this study were to verify the prevalence of excesso f weight in children under Five years of age in urban populations in Brazil, and to investigate their association with sociodemographic characteristics, exclusive breastfeeding, number of siblings and birth weight.

METHODOLOGY

To assess the access and quality of the health care system in Brazil, an epidemiological population-based survey was conducted with samples of elderly, adults and children[18]. This work refers to the sample of children under 5 years of age living in private households in the urban areas of 100 municipalities of small, medium and large size in the 5 geopolitical regions. Children hospitalized at the time of the interview were excluded.

Considering that the prevalence of child obesity is estimated at 5%[14], 1,821 children would be required, assuming a range of error of 1 percentage point. For an overweight estimate of 15%[6], with the same margin of error, 4,874 children would be necessary. In order to investigate associations with a power of 80% and a confidence interval of 95% (95%CI), with a prevalence ratio estimated at 1.6 to 3% of obesity in children with siblings and adding 10% for losses and 15% for confounding factors, the necessary sample would be 5,253 children.

The sampling process was carried out in multiple stages, using as a basis the data of the population census 2000 from the Brazilian Institute of Geography and Statistics[19]. Initially, a systematic sample of approximately 2% of Brazilian municipalities was selected. In urban areas, the number of selected sectors was proportional to the number of residential areas and to the population size.

The definition of the number of children to be located in each census area of the city (standard unit of population aggregation) has considered an average concentration of 0.34 children under 5 years of age, per household. Thus, in a sector, i.e., approximately 300 households, it was expected 102 children to be found, having chosen a sample quota of 10 children per sector, locatable in 30 households, with systematic gap of 10 households. All children under five years of age found in each of the households were included. The sample was not selected by age and 1.2 children, per household, were located.

The fieldwork took place from August to November 2008, with data collected by a team of 11 supervisors and 44 interviewers. All of them underwent a 40-hour training on techniques of household approaching and interviews and on how to standardize the collection of anthropometric data. The data were collected electronically, through a handheld computer (personal digital assistent – PDA), with specific programming for the study.

The anthropometric assessment was made using a platform scale, Geratherm®, with a capacity of up to 150 kg, accuracy of 0.1 kg and extendable measuring tape. The selected devices had their quality tested at the National Institute of Metrology (INMETRO) and its use authorized by the National Health Surveillance Agency (ANVISA). Both measurements were taken twice and the scale was placed in a secure and leveled place. A reading would be performed and then it would be recorded at the PDA, where the weights of the clothes were also taken note, though the interviewers were instructed to obtain measurements with as little clothes on as possible. The PDA was programmed to calculate the averages of the two measurements and to subtract the total weight of the clothes, providing, this way, the final weight of the child. For children aged two or more years, one would position the child in the center of the platform, with their feet standing together, standing up straight and with arms hanging along the body. The weight of the children under two years of age was obtained as the difference between the weight of the biological parent or guardian with and without the child in their lap.

The measuring of the height of children of two or more years of age was taken while standing up, barefoot, wearing light clothing and loose hair, on a flat surface, leaning against a wall or door, arms hanging alongside the body. A measuring tape would be extended by fixing the point zero on the ground, the reading would be made and the height would be recorded immediately afterwards. The measurement of the length of children under two years of age was performed with the child lying on a flat surface, preferably a table. The child should be barefoot, wearing light clothes and with their hair loose. With the aid of the mother, the child would be lied down, keeping their head and shoulders supported, the measuring tape then would be extended by fixing the point zero on the table. The reading would be taken and the length would be immediately recorded.

To assess the nutritional status, the growth curves of the World Health Organization (WHO)[20] were used, with the aid of the ANTHRO 3.1 software[21]. Children were considered overweight — dependent variable — when they had a Z score greater than two standard deviations above the reference average for weight and height.

The independent variables were: family income per capita (in minimum wages), maternal education (in years), skin color (caucasian and other, reported by the mother), age (in months), gender, number of siblings, birth weight (in grams) and duration of exclusive breastfeeding (up to 120 days and more than 120 days). It was considered exclusively breastfed children the ones who consumed only breast milk without any other food, water or tea.

The data analysis considered the effect of the delineation and it was made by comparing the proportions — the χ^2 test and the calculation of the prevalence ratios — adopting 95%CI. In order to adjust the confounding factors, a logistic regression technique was used, following a hierarchical analysis model with four levels, and for the independent variable to be a part of the set model, it would require a significance of $p < 0.20$ in raw analysis. In the first level, the variables of per capita income, skin color, age and gender were included. The education level was not taken into account for not meeting the requirement related to the p-value. Then, on the second level, the number of siblings was analysed; in the third, the birth weight; and in the fourth level, the duration of exclusive breastfeeding.

The execution of the project had the support of the Ministry of Health, the National Council of Municipal Health Secretaries and the Municipal Councils of Health. The study was submitted to the Ethics Committee of the School of Medicine, Universidade Federal de Pelotas, being approved on November 23rd, 2007, according to protocol 152/07. All interviewed individuals have signed a informed consent form.

RESULTS

The study included 6,397 children, of which 50% (3,195) were male and 50% (3,207) were caucasian. Each year of age gathered 20% of the sample. About 10% of the children presented low birthweight (< 2,500 grams) and 31% (1,870) of them were born weighing more than 3,500 grams. The average duration of the exclusive breastfeeding period was 120 days, 8% of the children were not breastfed and 24% were fed only breast milk until 6 months of life. Two thirds of the children belonged to families with monthly incomes of up to 0.7 minimum wages per capita (Table 1).

The prevalence of excessive weight in children younger than 5 years of age in urban population in Brazil was of 11.6% (95%CI 10.7 – 12.6). In a raw analysis, the outcome was 25% higher in males (PR = 1.25, 95%CI 1.05 – 1.50; p = 0.014). As to the age, an inverse linear association was observed: the younger the child, the greater the prevalence of excessive weight (p = 0.049). Children of 12 to 24 months of age presented an overweight prevalence 45% higher than those of four years of age or more. Caucasian children had an overweight prevalence 24% higher than non-caucasian ones (PR = 1.24, 95%CI 1.04 – 1.48; p = 0.016). No significant differences were observed as to family income.

Table 1. Sample distribution according children and sociodemographic characteristics. Brazil, 2008.

Variable	n	%
Gender (n = 6,360)*		
Male	3,195	50.2
Female	3,165	49.8
Age (months) (n = 6,309)*		
0 to 11	1,275	20.2
12 to 23	1,313	20.8
24 to 35	1,279	20.3
36 to 47	1,273	20.2
48 to 59	1,169	18.5
Skin color (n = 6,357)*		
Caucasian	3,207	50.4
Other	3,150	49.6
Birth weight (g) (n = 6,058)*		
Less than 2,500	610	10.1
2,500 to 3,499	3,578	59.1
3,500 and more	1,870	30.9
Exclusive breastfeeding (days) (n = 5,719)*		
Until 120	3,126	54.7
More than 120	2,593	45.3
Per capita family income (minimum wage) (n = 6,152)*		
Until 0.29	1,819	29.6
0,30 to 0,69	2,143	34.8
0,70 and more	2,190	35.6
Maternal school education (years) (n = 6,346)		
0 to 4	864	13.6
5 to 8	2036	32.1
9 to 11	2644	41.7
12 to mais	802	12.6
Number of siblings (n = 5,195)*		
None	1,829	35.2
One or more	3,366	64.8

*The number of children varies according to each attribute of unknown information.

Only children had an overweight prevalence 26% higher than the ones with siblings (PR = 1.26, 95%CI 1.04 – 1.54; p = 0.020). The higher the birth weight, the higher the prevalence of overweight, specially children who were born weighting more than 3,500 grams, with a 77% higher prevalence of excessive weight when compared to the ones born with low birth weight (PR = 1.77, 95%CI 1.25 – 2.50; p = 0.000).

As for the duration of exclusive breastfeeding, there was a 36% higher prevalence of excessive weight in children who were breastfed up to 120 days when compared to those exclusively breastfed for more than 120 days.

The adjusted analysis, according to the hierarchical model, did not reveal any significant changes in the associations found in the raw analysis. The income has completely lost its effect and the number of siblings has lost its significance. The remaining associations with gender, age, skin color, birth weight and breastfeeding remained significant after the adjustment (Table 2). For these analysis, the information of 5,195 children were used, for which all the necessary data were available.

DISCUSSION

The overall prevalence of overweight children younger than 5 years of age in urban population in Brazil was 12%, higher than the one found in the National Demographic and Health Survey of 2006[5], which was 7.3%, indicating a possible trends towards increasing the overweight prevalence worldwide, as reported by several studies[2,5,6,22-24]. These data should alert to the potential increase in public spending on the treatment of clinical and psychological complications of excessive weight[12,15].

In this study, boys had an overweight prevalence 22% higher, however, the literature is controversial regarding the risk of overweight or obesity in relation to gender[2,25], showing a slight increase in the prevalence of overweight in girls and obesity in boys[2,26,27].

The younger the child, the greater the excess of weight. A similar result was found in a cross-sectional study conducted in New York, with a sample of 1,713 children under 5 years of age, which found a higher prevalence of overweight and obesity at ages from 1 to 3. The prevalence of overweight in these age groups increased from 3.7 to 16% and the obesity one from 7.5 to 30.2% [26].

The prevalence of overweight among caucasian children was significantly higher than among the non-caucasian ones, even after the adjustment of confounding factors. A cross-sectional study conducted in the city of Feira de Santana, Bahia, with a sample of children from both public and private educational systems, in order to identify the prevalence of excessive weight and the perception of parents in relation to excessive weight gain, showed that the caucasian ethnic group was more associated to excessive weight[22], however, the literature is quite controversial regarding the influence of ethnicity as a risk factor for excess of weight in childhood[26,27].

Table 2. Prevalence of overweight and crude and adjusted prevalence ratios according sample characteristics. Brazil, 2008.

Variable	Excess of weight (%)	Crude PR (95%CI)	p-value	Adjusted PR (95%CI)	p-value
Gender (n = 6,360)					
Male	12.8	1.25 (1.05 – 1.50)	0.014	1.22 (1.02 – 1.47)	0.030
Female	10.5	1.00		1.00	
Age (months) (n = 6,309)					
0 to 11	13.3	1.46 (1.10 – 1.96)	0.049*	1.51 (1.12 – 2.03)	0.032*
12 to 23	13.0	1.42 (1.07 – 1.89)		1.45 (1.08 – 1.94)	
24 to 35	11.7	1.26 (0.94 – 1.67)		1.28 (0.94 – 1.74)	
36 to 47	10.5	1.12 (0.83 – 1.51)		1.12 (0.82 – 1.53)	
48 to 59	9.5	1.00		1.00	
Skin color (n = 6,357)					
Caucasian	12.7	1.24 (1.04 – 1.48)	0.016	1.22 (1.02 – 1.47)	0.042
Other	10.5	1.00			
Third of the per capita family income (minimum wage) (n = 6,152)					
Until 0.9	10.2	1.00	0.188T	1.00	0.351*
0.30 to 0.69	11.7	1.17 (0.93 – 1.48)		1.15 (0.91 – 1.45)	
0,70 and more	12.2	1.23 (0.98 – 1.56)		1.18 (0.93 – 1.50)	
Number of siblings (n = 5,195)					
None	12.9	1.26 (1.04 – 1.54)	0.020	1.18 (0.96 – 1.46)	0.119
One or more	10.5	1.00			
Birth weight (g) (n = 6,058)					
Less than 2,500	9.3	1.00	0.000*	1.00	0.000*
2,500 to 3,499	10.3	1.11 (0.79 – 1.56)		0.99 (0.68 – 1.45)	
3,500 and more	15.4	1.77 (1.25 – 2.50)		1.65 (1.12 – 2.43)	
Exclusive breastfeeding (days) (n = 5,719)					
Until 120	12.6	1.36 (1.12 – 1.65)	0.002	1.34 (1.07 – 1.67)	0.009
More than 120	9.6	1.00		1.00	
Total	**11.6**				

RP: prevalence ratio; *p-value for linear trend.

In this study, the household income was not associated with the outcome. However, a study carried out with 2 birth cohorts in southern Brazil in 1982 and 1993 has evidenced a direct association between obesity and income for children born in 1982, which was not sustained in the 1993 sample. Another study aiming at the evaluation of the prevalence of obesity in preschool children in São Paulo, with a sample of 957 children, showed a positive linear association with the per capita family income[3]. These studies prove that the influence of family income in the prevalence of overweight is controversial. In developed countries, children who belong to low-income families present a higher prevalence for the outcome, whereas in developing countries there is evidence that the higher the income the higher the prevalence of overweight[1,28,29].

In the same way as the income, no association of overweight with maternal education was observed. However, when stratifying this relation according to the gender of the child, it was found that among boys the highest levels of overweight were consistent with increasing maternal education, which did not occur among girls. Further studies are needed in order to investigate if the association between higher socioeconomic status and obesity among men in adulthood[30] may manifest in early childhood.

A study carried out in kindergartens of São Paulo, with a sample of 556 children from 4 to 84 months of age, showed that having 2 or more siblings was a protective factor against overweight ($OR_{adj} = 0.28$) when compared to children who had no siblings[31]. In the present study, it was demonstrated that only children had a prevalence of overweight 26% higher than those who had one or more siblings, which was not confirmed in the adjusted analysis.

The birth weight was associated linearly and positively to overweight and similar results were found in a study conducted in southern Brazil, with a sample of 1,273 children, showing that the prevalence of overweight is directly proportional to birth weight[32].

As it comes to the duration of exclusive breastfeeding until six months of age, there is evidence that this habit may protect the child from the risk of being overweight, however, longitudinal studies are needed in order to prove this hypothesis, since the literature is still controversial[16,17,33,34,].

The fact that the average duration of exclusive breastfeeding (4 months) was much higher than the one found in PNDS in 1996 and 2006, of 1.1 and 1.4 months, respectively, is noteworthy. A study showed that the initiative of Children Friendly Hospitals, with the implementation of the "ten steps to successful breastfeeding" may contribute to the increase of this average[35]. It may be observed in Brazil, an increase in the duration of breastfeeding, however, the exclusive breastfeeding until the age of six months, as recommended by the WHO, is not yet a trend being followed. Some factors are determinant for exogenous obesity in childhood, such as early discontinuation of breastfeeding with introduction of inadequate complementary food[36] and the improper use of infant formula diluted incorrectly[37]. In 2006[5,] the prevalence of exclusive breastfeeding in the period between birth and 6 incomplete months of age was of 38.6%, whereas in the present study it was 24%, which could be related to early introduction of foods

with high caloric value, substituting breastmilk. According to the II Survey of the Prevalence of Breastfeeding in the Brazilian capitals and in the Federal District, held in 2009, there was the introduction of water, teas and other milks in 13.8, 15.3 and 17.8% of the children receiving these liquids before the first month of life, respectively[38]. Longitudinal studies which cover eating habits and lifestyle of the family are required as to establish prevention and control measures from the actual data.

It is stressed in this study some positive factors, such as: the quality of data collection in electronic media (PDA), making the fieldwork more dynamic and reliable, the size of sample capable of establishing the prevalence measures, association and nationwide power.

The use of a measuring tape is no longer appropriate for the anthropometric assessment, since reading difficulties could occur. For this, there was a special caution when performing all measurements in duplicate, to reduce the possibility of measurement errors. It is known that population-based studies are laborious, for they usually consist of large samples, in difficult accessing locations, where the use of heavy equipment makes the execution of it rather difficult.

This study concludes that the prevalence of excess weight in children appears very elevated in urban areas in Brazil, being higher in boys, in children under one year of age, caucasian, with birth weight greater than 3,500 grams and who were exclusively breastfed for less time. The adoption of measures which encourage healthy eating habits and physical activity from an early age is recommended, and within the health system, the special attention of teams in the dealing and the treatment of overweight children, making the family aware of the need for a change in the habits of everyone and not just the child's[14,39].

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