ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Overweight among children under five years of age in municipalities of the semiarid region

Excesso de peso entre menores de cinco anos em municípios do semiárido

Isabel Nunes Oppitz[I], Juraci Almeida Cesar[I], Nelson Arns Neumann[II]

ABSTRACT: *Objective:* To measure the prevalence and to identify factors associated with overweight among children under five years old living in two municipalities in the semiarid region of Piauí, Brazil. *Methods:* Previously trained interviewers visited all of the households in these municipalities and applied standard questionnaires to the mothers of the children. The questionnaires sought information on: the demographic characteristics of the mother and children, the family's socioeconomic status, care received during pregnancy and at childbirth, breastfeeding and dietary patterns. Overweight (>+ 1 standard deviation from the median to the reference population) was calculated transforming body mass index into Z scores, according to the standard by the World Health Organization (WHO). The statistical analysis was performed using Poisson regression with robust adjustment of variance. *Results:* The prevalence of overweight among the 1,640 children evaluated was of 30.2% (95%CI 27.9 – 32.4). This prevalence varied from 13.2% among children born weighing less than 2,500 g to 43.4% among those aged 12 to 23 months. Adjusted analysis showed that the prevalence ratios (PR) for overweight in children aged 48 to 59 months was 1.42 (1.07 – 1.86) for overweight compared to those aged between 0 and 11 months, whereas children pertaining to the highest quartile income showed PR = 1.44 (1.17 – 1.76) when compared to the lowest quartile. Finally, children born with weight ≥ 3500 g, the PR for overweight was 2.32 (1.33 – 4.05) in relation to those born with low weight (< 2500 g). *Conclusion:* Even in the semiarid region, the prevalence of overweight is high, and the need for early intervention to change this situation seems to be evident.

Keywords: Overweight. Obesity. Children. Prevalence. Risk factors. Nutritional status.

[I]Graduate Program in Health Sciences, School of Medicine & Division of Population and Health, *Universidade Federal do Rio Grande* – Rio Grande (RS), Brazil.

[II]National Coordinating Committee of the Child Pastorate Programme – Curitiba (PR), Brazil.

Corresponding author: Juraci A. Cesar. Rua General Osório, s/n, 4º andar, Centro, Campus Saúde, Área Acadêmica Prof. Newton Azevedo. CEP: 96200-900, Rio Grande, RS, Brasil. E-mail: juraci.cesar@gmail.com

RESUMO: *Objetivo:* Medir a prevalência e identificar fatores associados ao excesso de peso entre menores de cinco anos residentes em dois municípios do semiárido piauiense. *Métodos:* Entrevistadores previamente treinados visitaram todos os domicílios desses municípios e aplicaram às mães das crianças um questionário padrão, buscando informações sobre características demográficas maternas e da criança, nível socioeconômico da família, assistência recebida durante a gestação e na hora do parto, e padrão de amamentação e dieta. O excesso de peso (>+ 1 desvio padrão em relação à mediana da população de referência) foi calculado transformando-se o índice de massa corpórea em escore Z, conforme as curvas da Organização Mundial da Saúde (OMS). Na análise estatística, utilizou-se a regressão de Poisson com ajuste robusto da variância. *Resultados:* A prevalência de excesso de peso entre as 1.640 crianças estudadas foi de 30,2% (IC95% 27,9 – 32,4). Essa prevalência variou de 13,2% entre as nascidas com < 2.500 g a 43,4% entre aquelas com idade entre 12 e 23 meses. A análise ajustada mostrou que crianças com idade entre 48 e 59 meses mostraram RP = 1,42 (1,07 – 1,86) para excesso de peso em relação àquelas com idade entre 0 e 11 meses, enquanto para as pertencentes ao maior quartil de renda RP = 1,44 (1,17 – 1,76) quando comparadas àquelas do menor quartil. Por fim, crianças nascidas com peso ≥ 3.500 g apresentaram RP = 2,32 (1,33 – 4,05) para excesso de peso em relação às nascidas com baixo peso (< 2500 g). *Conclusão:* Mesmo no semiárido, a prevalência de excesso de peso é elevada, o que evidencia a necessidade de intervenção precoce para reversão do quadro.

Palavras-chave: Sobrepeso. Obesidade. Crianças. Prevalência. Fatores de risco. Estado nutricional.

INTRODUCTION

Overweight, in addition to the hereditary component, happens due to the excessive consumption of foods of high caloric density and decreased physical activity[1,2]. Children with these conditions, particularly those who are obese, are at higher risk of developing diseases like hypertension, stroke and metabolic syndrome, including hyperlipidemia and diabetes, in early adulthood[3].

Recent publication that included 495 studies from 144 countries showed a prevalence of overweight among children under 5 years of age of 21.1%, and 14.4% were at risk for overweight and 6.7% were overweight or obese. It estimates that, in 2020, 9.1% of preschool children will be obese[4]. There is no data for Brazil regarding the prevalence of overweight, except for overweight/obesity (>+2 Z score). Between 1996 and 2006, the prevalence of this condition in the country remained at 7.2%, while in the Northeast it was 7.0%[5].

The following factors are associated with the occurrence of overweight: living in urban areas, having a good socioeconomic status, good living conditions, access to adequate health care, good maternal education, high birth weight, being firstborn and exhibiting an accelerated growth in the first year of life[6-14].

There are few population-based studies on the prevalence of overweight in this age group. That's because, until very recently, the interest on children's nutritional status was solely on

deficits, especially for height/age[6,12]. Studies found in the literature, aside from being restricted to overweight and obesity, are mostly limited to institutionalized children[15], working with samples and not censuses[6,7,9-13], are from state[12] or regional investigations[13], or larger urban centers[6,8]. No indexed publication was found with an appropriate methodology and that has treated overweight among children under five years of age in Brazilian municipalities located in poor regions.

The purpose of this study was to estimate the prevalence and identify factors associated with the occurrence of overweight among children under five years or age living in the cities of Caracol and Anísio de Abreu, PI, both located in the semiarid Northeast region of Brazil.

MATERIALS AND METHODS

This study was conducted in the cities of Caracol and Anísio de Abreu, PI, located about 600 km from the capital Teresina and with an estimated population of 8.5 and 10.8 thousand inhabitants, respectively[16].

The State of Piaui is currently the third poorest in the country. The basis of the economy of these municipalities is predominantly agriculture and public employment. The Human Development Index (HDI) reported in 2000 was 0.59 at Caracol and 0.63 in Anísio de Abreu[16,17].

All children under the age of five living in urban and rural areas of these municipalities between July and September 2008 were eligible for the study. The design was cross-sectional[18].

To calculate the sample size, the prevalence of overweight (>+1 Z score for weight/height) used was 30%, and the other parameters used were as follows: alpha error of 0.05, beta error of 0.20, exposures ranging from 20% to 80%, frequency of outcome among unexposed of at least 13% and risk ratio of 1.7. Based on this matrix, the study should include at least 1,293 children. This value is already increased by 5% for eventual losses and 15% for control of potential confounders[19].

Two questionnaires, both applied to the parent or person responsible for custody of the child in their own home, were used to collect data. The first sought information on maternal demographic and reproductive characteristics, socioeconomic status and living conditions of the family; the second investigated aspects of care received during pregnancy and childbirth, demographic characteristics of the child and type of breastfeeding, diet and use of health services. In addition, during the interview, the child was measured for weight and height, or length if younger than two years old. Weight was measured using a portable scale with 100 g precision provided by UNICEF and installed in the child's home. For length, a Harpenden infantometer with accuracy of 1 mm (Holtain, Crymych, UK) and standardized technique were used, while for height, aluminum stadiometers with 1 mm precision were used[20].

For this research, 14 candidates were preselected. This group was trained for five consecutive days. The training consisted of reading the questionnaire and instruction manual,

simulation of interviews and standardization of anthropometric techniques. The pilot study was conducted in a neighboring municipality in the same region, but not included in the study. Among the pre-selected candidates, eight were hired to act as interviewers, while the others remained as substitutes. The two supervisors were previously defined for possessing extensive experience in this type of work.

Each team, consisting of a supervisor and four interviewers, was responsible for data collection in one of the municipalities. Initially, supervisors mapped and numbered the blocks in urban areas and the villages in rural areas. The pairs of interviewers visited all households, clockwise. If there were children under five living in the household, the questionnaires were then applied to the parent or person responsible for their custody. At the end of each workday, these questionnaires were coded by the interviewers and delivered on the next day to their respective supervisor, who sent them to the project headquarters, where they were revised and retyped in reverse order, by different scholars. After typing each block of 100 questionnaires, databases were compared and, if necessary, corrected. All these steps were performed on the Epi-Info 6.04 software[19].

Regarding the variables used in this study, some required additional clarification: overweight was classified based on the body mass index (BMI) obtained by weight/height through the Anthro software[21]. The values obtained in this calculation were converted to Z scores according to the curves of growth of the World Health Organization (WHO)[1]. Children who presented a Z score for BMI >+1 in relation to the median of the reference population were considered as overweight. Thus, all children who presented risk for overweight (>+1 to +2), overweight (>+2 to +3) and obesity (>+3) were included in this category.

Descriptive analysis consisted of measures of prevalence, while the crude and adjusted analyzes evaluated the outcome (occurrence of overweight) in relation to the independent variables. For ordinal categorical variables (child's age, family income, education, household crowding, parity, maternal age and birth weight), the p-value of the linear trend test was reported, while for all other variables, the Wald test for heterogeneity was used[22]. For the adjusted analysis of factors associated with excess weight, a conceptual model consisted of three levels was used[23]. In the first level, demographic variables (gender, skin color of the mother and child's age) and socioeconomic characteristics (maternal education and family income) were included, while in the second level, variables related to the environment (receiving Bolsa Familia, area of residence and number of household members) were included; in the third and final level, maternal parity (and age) and nutritional (birth weight) and reproductive variables were included. The outcome, in turn, consisted of the occurrence of excessive weight[1,21].

In this regression model, the variables were controlled for those on the same level or previous levels. To maintain the model, the p-value of the association between the independent variable and the outcome should be ≤ 0.20. The measure of effect used was the prevalence ratio (PR) obtained by Poisson regression with robust adjustment of

variance. The level of significance was 95%[22]. All of these analyzes were performed using Stata software, version 11.2[24].

For quality control, a summarized version of the standard questionnaire was used, and 5% of the interviews with the mothers in the household were remade. The main purpose of this practice was to confirm the interviews and compare the responses obtained in the questionnaire with those obtained by the interviewer.

This project was approved by the Research Ethics Committee of Universidade Federal de Pelotas (CEPAS/UFPel). Ethical principles were provided to the respondents and a free and informed consent form was signed.

RESULTS

This study identified 1,663 children under five years of age in the two municipalities. The interviewers obtained information of about 99% of this total in Caracol and 98% in Anísio Abreu. The overall rate of non-responders was 1.4% (23 in 1,663).

Table 1 shows that children of Caracol constituted the majority of the sample (56%) and they were poorer than those of Anísio de Abreu. Considering all children studied, the distribution by gender was very similar; 73% were of brown skin; 10% of their mothers were teenagers; 37% of their mothers and their families had no more than four years of schooling and belonged to the lowest income quartile, respectively; 43% were enrolled in the Bolsa Família Program and 56% lived in rural areas. The average number of residents in the households of these children was 4.6; 28% of mothers had three or more children; 5% of them had low birth weight (< 2,500 g) and the total breastfeeding median was of 12.2 months; 12% had been hospitalized in the last 12 months, 45% had consulted a doctor within the last three months and 21% had been sick in the last 15 days according to their mothers. Overweight was found in 30.2% (95%CI 27.9 – 32.4) of the children studied. Of these, 22% were at risk for overweight, 6.4% were overweight and 1.8% were obese (Table 1).

Table 2 shows the prevalence of overweight according to the categories of the variables included in the model and the results of crude and adjusted analyzes. The prevalence of overweight ranged from 13% among children born weighing less than 2,500 g to 43% among those aged between 12 and 23 months. After adjustment according to the previously proposed model, it was found that the higher the child's age, maternal age, family income quartile and birth weight, the greater the risk of becoming overweight by the age of five in the locations studied. The PR for overweight was at least 10% higher for children aged one or older compared to those who were younger; children whose mothers aged 30 or older showed PR = 1.41 (1.10 – 1.82) for overweight compared to children of teenage mothers, while children belonging to the highest quartile of income were PR = 1,44 (1.17 – 1.76) for overweight compared to the lowest quartile. Finally, birth weight greater than 3,500 g implied PR = 2.32 (1.33 – 4.05) for overweight in relation to low birth weight (< 2,500 g).

Table 1. Distribution of the main variables studied for mothers and children under five years old in the municipality of Caracol (n = 928) and Anísio de Abreu (n = 712), Piauí, Brazil, 2008.

Variable	Municipality		Total %	p-value
	Caracol n (%)	Anísio n (%)		
Gender				0.461
Male	460 (49.6)	366 (51.4)	50.4	
Female	468 (50.4)	346 (48.6)	49.6	
Child's age (months)				0.851
0 – 11	182 (19.6)	141 (20.9)	20.2	
12 – 23	181 (19.5)	133 (18.5)	19.1	
24 – 35	200 (21.5)	157 (22.0)	21.8	
36 – 47	265 (17.8)	132 (18.7)	18.2	
48 – 59	200 (21.5)	149 (19.8)	20.8	
Skin color				< 0.001
White	141 (15.2)	211 (29.6)	21.5	
Brown	740 (79.4)	459 (74.5)	73.1	
Black	47 (5.1)	42 (5.9)	5.4	
Maternal age (years)				0.850
13 – 19	105 (11.3)	74 (10.4)	10.4	
20 – 24	349 (37.6)	281 (39.5)	39.5	
25 – 29	260 (28.0)	193 (27.1)	27.6	
≥ 30	214 (23.1)	164 (23.0)	23.0	
Maternal education (years)				0.003
0 – 4	371 (40.0)	228 (32.0)	36.5	
5 – 8	336 (36.2)	278 (39.0)	37.4	
9 or more	221 (23.8)	206 (28.9)	26.0	
Income quartile				< 0.001
1st (lowest)	386 (41.6)	220 (30.9)	36.9	
2nd	214 (23.1)	203 (28.5)	25.4	
3nd	170 (18.3)	163 (22.9)	20.3	
4th (highest)	158 (17.0)	126 (17.7)	17.3	
Enrolled in the Bolsa Família Program				0.245
	384 (41.4)	315 (44.2)	42.6	
Number of residents in household				< 0.001
2 or 3	256 (22.8)	215 (30.2)	26.0	
4 or 5	460 (49.6)	389 (54.6)	51.8	
≥ 6	256 (27.6)	108 (15.2)	22.2	
Area of residence				< 0.001
Urban	574 (38.2)	347 (51.3)	43.8	
Rural	354 (61.8)	365 (48.7)	56.2	
Parity				0.100
1	348 (39.5)	294 (43.0)	41.0	
2	271 (30.7)	219 (32.0)	31.3	
≥ 3	263 (29.8)	171 (25.0)	27.7	
Weight at birth (g)				0.090
< 2500	56 (6.1)	28 (4.0)	5.2	
2500 to 3499	466 (50.7)	347 (49.2)	50.1	
≥ 3500	397 (43.2)	330 (46.8)	44.7	

Continue...

Table 1. Continuation.

Variable	Municipality		Total %	p-value
	Caracol n (%)	Anísio n (%)		
Breastfeeding (months)				0.404
0 – 0.9	51 (8.3)	34 (7.6)	8.0	
1 – 5.9	93 (15.1)	75 (16.7)	15.8	
6 – 11.9	121 (19.6)	69 (15.4)	17.8	
12 – 23.9	199 (32.3)	143 (31.9)	32.1	
24 – 35.9	119 (19.3)	104 (23.2)	20.9	
36 – 59.9	33 (5.4)	24 (5.4)	5.4	
Hospitalized in the last 12 months				0.103
	103 (11.1)	98 (13.8)	12.3	
Consulted a doctor in the last three months				0.040
	410 (43.2)	344 (48.3)	45.3	
Were sick in the last 15 days				0.131
	170 (19.3)	159 (22.3)	20.6	
Nutritional status according to BMI (Z score for weight/age)				0.403
Deficit (<-1)	72 (9.1)	58 (8.3)	8.7	
Eutrophic (-1 to +1)	555 (61.7)	424 (60.2)	61.1	
Risk of overweight (>+1 to +2)	187 (20.8)	166 (23.6)	22.0	
Overweight (>+2 to +3)	56 (6.2)	47 (6.7)	6.4	
Obese (>+3)	19 (2.1)	9 (1.3)	1.7	
Total	100%	100%	100	

Table 2. Prevalence according to the category of variable and crude and adjusted analyzes for overweight among children under five years old in the municipalities of Caracol and Anísio de Abreu, Piauí, Brazil, 2008.

Level	Variable	Prevalence of overweight[†] %	Prevalence ratio (95%CI)	
			Crude	Adjusted*
I	Gender		p = 0.25	p = 0.33
	Female	28.9	1.00	1.00
	Male	31.5	1.09 (0.94 – 1.27)	1.08 (0.93 – 1.24)
	Child's age (months)		p < 0.001	p < 0.001
	0 – 11	32.7	1.00	1.00
	12 – 23	43.4	1.14 (0.85 – 1.54)	1.11 (0.82 – 1.49)
	24 – 35	30.6	1.49 (1.14 – 1.94)	1.42 (1.09 – 1.85)
	36 – 47	23.4	2.11 (1.65 – 2.71)	1.99 (1.55 – 2.55)
	48 – 59	20.5	1.59 (1.22 – 2.07)	1.42 (1.07 – 1.86)
	Skin color		p = 0.06	p = 0.47
	White	35.0	1.00	1.00
	Brown	28.6	0,82 (0.69 – 0.97)	0.91 (0.76 – 1.09)
	Black	32.5	0,93 (0.66 – 1.31)	1.02 (0.73 – 1.46)
	Maternal age (years)		p = 0.002	p = 0.04
	13 – 19	41.5	1.00	1.00
	20 – 24	30.4	1.05 (0.84 – 1.32)	1.05 (0.84 – 1.31)
	25 – 29	28.2	1.13 (0.92 – 1.39)	1.13 (0.92 – 1.40)
	≥ 30	26.8	1.55 (1.21 – 1.97)	1.41 (1.10 – 1.82)

Table 2. Continuation.

Level	Variable	Prevalence of overweight[†] %	Prevalence ratio (95%CI)	
			Crude	Adjusted*
I	Maternal education (years)		p = 0.008	p = 0.47
	0 – 4	26.1	1.00	1.00
	5 – 8	30.6	1.17 (0.98 – 1.40)	1.03 (0.85 – 1.24)
	9 or more	35.2	1.35 (1.12 – 1.64)	1.13 (0.92 – 1.39)
	Income quartile		p = 0.008	p = 0.004
	1st (lowest)	26.7	1.00	1.00
	2nd	32.0	1.20 (0.99 – 1.46)	1.23 (1.02 – 1.50)
	3nd	28.3	1.06 (0.86 – 1.32)	1.08 (1.87 – 1.34)
	4th (highest)	37.4	1.40 (1.14 – 1.72)	1.44 (1.17 – 1.76)
II	Enrolled in the Bolsa Família program		p = 0.02	p = 0.34
	No	32.6	1.00	1.00
	Yes	27.0	0.83 (0.71 – 0.97)	0.93 (0.79 – 1.09)
	Area of residence		p = 0.02	p = 0.07
	Rural	27.8	1.00	1.00
	Urban	33.3	1.20 (1.03 – 1.39)	1.15 (0.99 – 1.33)
	Number of residents in household		p = 0.04	p = 0.71
	2 or 3	28.7	1.00	1.00
	4 or 5	28.4	0.82 (0.67 – 1.02)	0.93 (0.73 – 1.17)
	≥ 6	34.9	0.81 (0.69 – 0.97)	0.93 (0.77 – 1.12)
III	Parity		p = 0.10	p = 0.97
	1	32.5	1.00	1.00
	2	30.6	0.81 (0.66 – 0.98)	1.04 (0.69 – 2.33)
	≥ 3	26.2	0.94 (0.79 – 1.12)	1.02 (0.79 – 1.31)
	Weight at birth		p = 0.001	p = 0.03
	< 2500	13.2	1.00	1.00
	2500 – 3499	28.7	2.16 (1.23 – 3.79)	1.97 (1.13 – 3.44)
	≥ 3500	33.9	2.56 (1.46 – 4.48)	2.32 (1.33 – 4.05)
	Breastfeeding (months)		p = 0.01	p = 0.21
	0 – 0.9	23.2	1.00	1.00
	1 – 5.9	33.1	1.43 (0.91 – 2.24)	1.35 (0.87 – 2.02)
	6 – 11.9	31.9	1.38 (0.88 – 2.15)	1.26 (0.81 – 1.96)
	12 – 23.9	28.1	1.21 (0.79 – 1.87)	1.14 (0.75 – 1.74)
	24 – 35.9	21.0	0.91 (0.57 – 1.45)	0.93 (0.58 – 1.49)
	36 – 59.9	12.3	0.53 (0.24 – 1.18)	0.69 (0.31 – 1.55)
IV	Hospitalized in the last 12 months		p = 0.32	p = 0.41
	No	30.6	1.00	1.00
	Yes	27.0	0.88 (0.69 – 1.13)	0.90 (0.71 – 1.15)
	Consulted a doctor in the last three months		p = 0.01	p = 0.08
	No	27.4	1.00	1.00
	Yes	33.4	1.21 (1.05 – 1.41)	1.14 (0.98 – 1.32)
	Were sick in the last 15 days		p = 0.68	p = 0.70
	No	30.0	1.00	1.00
	Yes	31.1	1.04 (0.87 – 1.25)	0.96 (0.80 – 1.16)
Total (n = 1640)		30.2		

[†] > +1 Z score for BMI according to the curve by WHO, 2006.
*Wald test for heterogeneity.

DISCUSSION

This study showed that three out of ten children were overweight for their height according to the Z score of BMI. It also reported that the main factors associated with this condition were child's age, mother's age at the time of interview, family income and birth weight.

When interpreting the results presented here, one has to remember that these data refer to mid-2008, were obtained through a cross-sectional study and relate to a very specific population of the Brazilian semiarid northeast. Therefore, care must be taken regarding the external validity of the results.

Studies that include risk for overweight (>+1 to +2 Z score) as overweight are rare in Brazil[25]. This may occur because the term "risk" indicates only a probability. Furthermore, the major manifestation of obesity requires a relatively long time to manifest itself and, therefore, present different opportunities for intervention. However, cardiovascular diseases and endocrine diseases are appearing at an increasingly early age[2,3], which is worrisome. In this study, for example, for every obese children, there are 11 who are overweight and 11 who are at risk of being overweight. The potential for disease burden is expressive. Considering that early intervention is less expensive and presents a better prognosis, the risk of overweight, overweight and obesity were treated with equal importance.

In Brazil, between 1974-75 and 2006, the prevalence of height/age deficit (-2 Z scores) fell from 37% to 7%, while the weight for age deficit (-2 z scores) decreased from 6% in 1989 to 2% in 2006. This, according to Monteiro, was the result of improvements in maternal education, increased purchasing power of the poor, a significant expansion of care for maternal and child health and, to a lesser extent, the expansion of the water supply network and sanitation[26]. Also between 1974-75 and 2006, childhood obesity (weight/height >+2 Z scores) has stabilized at 6 – 7%[26], unlike obesity among adolescents and adults, which increased during the period, as well as non-communicable diseases which constitute the main source of disease burden in the country[27].

Despite this apparent stagnation, there are well-designed studies in urban areas of different locations showing increase of overweight/obesity among preschoolers[8,28]. In Pelotas (RS), the prevalence of overweight/obesity increased from 6.5% in 1982 to 8.2% in 2004[8], while in São Paulo, it increased from 3.2% in 1974-75 to 3.8% in 1996[28]. Also in relation to the study of Pelotas, in 2004, the prevalence of risk of overweight was 19.8% at 12 months, 19.7% at 24 and 17.9% at 48 months[8]. In another study of children enrolled in private and philanthropic preschools in the metropolitan region of São Paulo, the prevalence of risk of overweight was 21.9%[25]. In this study, the prevalence rate was 22.0%. However, the comparison is hindered due to the difference in the socioeconomic profile of the children included in these studies and the fact that they were institutionalized.

Younger children showed a higher risk of being overweight. This risk was about twice as high among those aged 12 to 23 months compared to older children (48 to 59 months). In Porto Alegre, in a study with children aged 12 to 59 months, there was a lower risk of overweight with increasing age[7]. In Florianópolis (SC), the prevalence of overweight was 5.0% among children under two years of age and 6.5% among those aged two or more[29]. The fact is that this association is directly related to the pattern of breastfeeding and infant nutrition. Numerous epidemiological studies and meta-analyzes suggest association between breastfeeding and reduced risk of childhood obesity[30], although it reiterates the need for further research on the subject[31]. There is also the fact that the early introduction of foods of high caloric intake is responsible for excess weight gain in infancy[31]. But, in this study, there was no significant association between nutritional status and exclusive or prolonged breastfeeding, as there was no association of overweight with the early introduction of other foods. It is evident, therefore, the need for more detailed investigations on the topic with more appropriate designs.

Maternal age at delivery was directly associated with the prevalence of overweight in this study. Children of mothers aged 30 and older had OR = 1.41 (1.10 – 1.82) compared to adolescent mothers. Few studies have investigated this aspect, and no significant association was found after adjustment[7,9]. There is, therefore, the need for further investigation of this finding in more detail, since, as a rule, being an adolescent mother has implied greater risk to the children's health.

The risk of overweight was 35% higher among children belonging to the highest quartile of income than the lowest quartile, the poorest. Several studies show that the prevalence of overweight/obesity is higher among children from families with higher income In Pelotas, in the 2004 cohort, this prevalence was of 60% among households with income greater than ten times the minimum wage (MW) compared to those who received up to 1 MW[8]; in Porto Alegre, the risk of overweight for children with family incomes ≥ 2 MW was 1.86 times (1.13 – 3.08) higher in those with income of less than 1 MW[7]; in the State of Pernambuco, while the prevalence of overweight was 6.6% among children from families with a per capita income of up to 0.25 MW, among those with income ≥ 0.50 MW, the prevalence was 11.9%[11]. Finally, in the city of São Paulo, the prevalence of overweight was 1.9% among those with incomes of up to 0.5 MW versus 5.1% for those with household incomes ≥ 2 MW[28]. In the last decade, the substantial increase in purchasing power, especially in families, caused major changes in the nutritional profile of Brazilian preschool children[5].

Birth weight was the strongest factor associated with the occurrence of overweight among children studied. Birth weight higher than 2,500 g involved an at least twice as high risk for the occurrence of overweight in preschool years. The prevalence of overweight/obesity at 12 months of age in the cohorts in Pelotas was about 4 – 5 times higher among children born with 3,000 g or more compared to those with low birthweight[8]. In Feira de Santana (BA)[9], the PR was 2.75 (1.50 – 5.05) for infants with adequate weight in relation to low birth weight (< 2,500 g),

while in Porto Alegre, children with high birth weight for gestational age showed PR = 2.29 (1.36 – 3.85) in comparison to those born with appropriate weight for gestational age[7]. These findings confirm that the prevalence of overweight is higher with increasing birth weight[32].

CONCLUSION

This study showed that most factors associated with the occurrence of overweight among the children studied are similar to those of developed urban areas in the country. It is possible that because these families of the semiarid are very poor and very similar to each other, the exposure differential between one group of children and the other was not sufficient to show an independent effect of a particular variable on the outcome. That is, the near homogeneity of exposure for some variables may be causing the effect of many of them on being overweight not reaching statistical significance in the adjusted analysis.

Repetitive complaints that excessive infant weight gain is one of the most important public health problems in this new century lacks in agreement in epidemiological studies and in the goals of governments and institutions. There are few population-based studies on the subject and, in them, the risk of overweight has rarely been mentioned, and obesity and overweight have been addressed together. If this does not stop, it at least hinders the adoption of measures, because these conditions require different approaches and managements. Furthermore, excess weight, in any of its forms, has not been treated with a priority on the health and/or education agenda of any government, be it local, municipal, state or federal. Without this, it will be difficult to prevent that this condition becomes an epidemic in all Brazilian municipalities, including in poor areas such as those studied here, and, therefore, to reverse this growing trend, which is being indicated for at least a decade by WHO. This action to combat overweight should begin at home, continue in school and consolidate during youth, to avoid or at least reduce the occurrence of chronic diseases in early adulthood.

REFERENCES

1. WHO Multicentre Growth Reference Study Group. WHO child growth standards based on length/height, weight and age. Acta Paediatr Suppl 2006; 450: 76-85.

2. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics 1998; 101(3 pt 2): 518-25.

3. Berenson GS, Srinivasan SR, Wattigney WA, Harsha DW. Obesity and cardiovascular risk in children. Ann N Y Acad Sci 1993; 699: 93-103.

4. de Onis M, Blössner M, Borghy E. Global prevalence and trends of overweight and obesity among preschool children. Am J Clin Nutr 2010; 92(5): 1257-64.

5. Monteiro CA, Conde WL, Konno SC, Lima ALL, Silca ACF, Benício MHD. Avaliação antropométrica do estado nutricional de mulheres em idade fértil e crianças menores de cinco anos. In: Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher - PNDS 2006. Dimensões do Processo

Reprodutivo e da Saúde da Criança. Série G. Estatística e Informação em Saúde. Ministério da Saúde/Centro Brasileiro de Análise e Planejamento. Brasília, DF; 2009. p. 213-29.

6. Monteiro CA, Conde WL. Tendência secular da desnutrição e da obesidade na infância na cidade de São Paulo (1974-1996). Rev Saúde Pública 2000; 34(6 Suppl): 52-61.

7. Drachler ML, Macluf SPZ, Leite JCC, Aerts DRCC, Giugliani ERJ, Horta BL. Fatores de risco para sobrepeso em crianças no Sul do Brasil. Cad Saúde Pública 2003; 19(4); 1073-81.

8. Barros AJD, Victora CG, Santos I, Matijasevich A, Araújo CL, Barros FC. Infant malnutrition and obesity in three population-based birth cohort studies in Southern Brazil: trends and differences. Cad Saúde Pública 2008; 24(Suppl 3): 417-26.

9. Jesus GM, Vieira GO, Martins CC, Mendes CMC, Castelão ES. Determinants of overweight in children under 4 years of age. J Pediatr 2010; 86(4): 311-6.

10. Ferreira, HS. Prevalence of extreme anthropometric measurements in children from Alagoas, Northeastern Brazil. Rev Saúde Pública 2010; 44(2): 377-80.

11. Menezes RCE, Lira PIC, Oliveira JS, Santana SCS, Andrade SLLS, Batista-Filho M. Prevalence and determinants of overweight in preschool children. J Pediatr 2011; 87(3): 231-7.

12. Victora CG, Barros FC, Cesar JA, Horta BL. Saúde e nutrição das crianças Nordestinas: diagnósticos estaduais 1987-1993. Brasília, DF, UNICEF; 1995.

13. Ferreira S, Assunção ML, Florêncio TMMT, Lima MAA. Estado Nutricional De Pré-Escolares da Região Semiárida do Estado de Alagoas 2005. In: Chamada Nutricional: um Estudo Sobre a Situação Nutricional de Crianças do Semiárido Brasileiro. Desenvolvimento Social em Debate. Cadernos de Estudos No. 4. Ministério do Desenvolvimento Social e Combate a Fome. Brasília, DF; 2006. p. 37-42.

14. Monteiro PO, Victora CG. Rapid growth in infancy and childhood and obesity in later life: a systematic review. Obes Rev 2005; 6(2): 143-54.

15. Nascimento VG, Schoeps DO, Souza SB, Souza JMP. Risco de sobrepeso e excesso de peso em crianças de pré-escolas privadas e filantrópicas. Rev Assoc Med Bras 2011; 57(6): 657-61.

16. IBGE Cidades. Disponível em: http://www.ibge.gov.br/cidadesat/topwindow.htm?1. (acessado em 28 de agosto de 2010).

17. Silva IS. Cancer epidemiology: principles and methods. Lyon: World Health Organization & International Agency for Research on Cancer; 1999.

18. PNUD (Programa das Nações Unidas para o Desenvolvimento). Brasil. Índice de Desenvolvimento Humano – Municipal, 1991 e 2000 – Todos os municípios do Brasil. Disponível em: http://www.pnud.org.br/atlas/ranking/IDH-M%2091%2000%20Ranking%20decrescente%20%28pelos%20dados%20de%202000%29.htm. (acessado em 6 de setembro de 2010).

19. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, et al. Epi-Info, Version 6: A Word Processing, Database, and Statistics Program for Epidemiology on Microcomputers. Atlanta: Centers of Disease Control and Prevention; 2002.

20. Barros FC, Victora CG. Epidemiologia da Saúde Infantil: um manual para diagnósticos comunitários São Paulo: Unicef/Hucitec; 1991.

21. World Health Organization. WHO Anthro for personal computers: software for assessing growth and development of the world's children (version 3.2.2). Geneva, Switzerland: 2009. Available from: http://www.who.int/childgrowth/software/en/. (acessado em 29 de março de 2012).

22. Kirkwood BR, Sterne JAC. Essentials of medical statistics.2 ed. London: Blackwell Science Ltd; 2003.

23. Victora CG, Huttly SR, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol 1997; 26(1): 224-7

24. StataCorp. Stata statistical software: release 11.2. College Station: Stata Corporation; 2011.

25. Nascimento VG, Schoeps DO, Souza SB, Souza JMP, Leone C. Risco de sobrepeso e excesso de peso em crianças de pré-escolas privadas e filantrópicas. Rev Assoc Med Bras 2011; 57: 657-61.

26. Monteiro CA, Benício MH, Konno SC, Silva AC, Lima AL, Conde WL. Causes for the decline in child under-nutrition in Brazil, 1996-2007. Rev Saúde Pública 2009; 43(1): 35-43.

27. Schmidt MI, Duncan BB, Silva GA, Menezes AMB, Monteiro CA, Barreto SM, Chor D, Menezes PR. Chronic non-communicable diseases in Brazil: burden and current challenges. Lancet 2011; 377(9781): 1949-61.

28. Monteiro CA, Conde WL. Tendência secular da desnutrição e da obesidade da infância na cidade de São Paulo (1974-1996). Rev Saúde Pública 2000: 34(Suppl): 52-61.

29. Corso ACT, Botelho LJ, Zeni LAZR, Moreira EAM. Sobrepeso em crianças menores de 6 anos de idade em Florianópolis, SC. Rev Nutr 2003; 16(1): 21-8.

30. Sichieri R, Souza RA. Estratégias para prevenção da obesidade em crianças e adolescentes. Cad Saúde Pública 2008; 24(Suppl 2): S209-34.

31. Balaban G, Silva GAP. Efeito protetor do aleitamento materno contra a obesidade infantil. J Pediatr 2004; 80(1): 7-16.

32. Gigante DP, Victora CG, Araújo CLP Barros FC. Tendências no perfil nutricional das crianças nascidas em 1983 em Pelotas, Rio Grande do Sul, Brasil: análises longitudinais. Cad Saúde Pública 2003; 19(Suppl 1): S141-7.