Excess weight and factors associated in preschool of southwest of Bahia

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Abstract

Objectives: this study aimed to evaluate the environmental factors associated with excess weight in preschool children.

Methods: a cross-sectional study involving 664 full-time preschoolers enrolled in public childcare centers in Vitória da Conquista (BA). The excess weight status has been defined according to the BMI/Age index and score Z above +2. The independent variables were grouped into maternal characteristics, socioeconomic, related to children and child care. We conducted multiple logistic regression to assess the association between excess weight and the variables studied.

Results: a prevalence of excess weight was 5.7 %; 3.9% were overweight and 1.8% were obese. The factors associated with excess weight in children were cesarean delivery (OR: 2.59; IC95%: 1.11; 6.01); being singletons (OR: 3.32; IC95%: 1.44; 7.67); and exclusive breastfeeding of less than 4 months (OR: 2.59; IC95%: 1.12; 5.99).

Conclusions: the results show that interventions to reduce and/or prevent excess weight should begin prenatally, with promotion of exclusive breastfeeding and natural birth, as well as nutritional advice for mothers with singletons.

Key words *Child, Preschool, Breast Feeding, Cesarean section, Overweight, Obesity*

Introduction

In the last decades, significant changes occurred in the nutritional children panorama, characterized by the increase of Excess Weight (EW), a disorder which includes overweight and obesity.[1]

In 20 years, (1990 to 2010) the prevalance of overweight in preschool children went from 4.2% for 6.7%, which represents a relative increase of 60%.[1] Thus, the children´s EW has been showing epidemic proportion, affecting families who have low-income.[2] In regard of preschool obesity, it is estimated a prevalence of 9.1% for 2020.[2] In Brazil, this panororama is not different, for the prevalence of EW in children increased 160% in 17 years, reaching the Northeast region of this country (20.6% for each year).[3]

The EW in children is considered a serious public health problem, because leads to development of health problems (morbid conditions, lung diseases, as well as cardiovascular, endocrine, ortho-pedic and psychosocial ones).[4] Several studies showed that children who have EW evolve with the same nutritional disorder in adulthood and has a high risk to develop cardiovascular diseases and type II diabetes *mellitus*.[3,4]

For the etiology of EW in childhood, studies seek to elucidate the genetic, physiological, meta-bolic, environmental and behavioral risk factors involved in its genesis.[5,6] Although children live now in more "obesogenic" envioronment than they did in the past, not all children develop EW. Therefore, it is necessary to understand how indivi-duals interact with their environment and how these risk factors interrelate.[7] Others risk factors such as high birth weight,[6] inadequate breastfeeding,[8] weight gain in pregnancy,[9] effective maternal schooling[5] and singletons[3] are also associated with EW in childhood.

Although the data showed significant for EW in childhood, there are only a few studies who discuss about this problem in preschool children from poor regions of the country due to the greater focus of research on nutritional deficiencies.[5] Whereas chil-dren in the northeast region of the country are also exposed to the risk factors for EW, this study aimed to evaluate the prevalence and factors associated with EW in preschool children enrolled in public day care centers.

Methods

This is a cross-seccional study which was part of a larger study entitled "Characterization of the health and nutrition situation of children assisted in muni-cipal public day care centers to the City Hall in the city of Vitória da Conquista, BA", which objective was to evaluate the prevalence of anemia, intestinal parasitoses and nutritional changes in children enrolled full-time at all public day care centers in the city. The study was carried in all public day care centers (21 day care centers) in the urban to the City Hall of Vitória da Conquista, in the period of 2010 to 2012.

The day care centers attend children with 24 to 72 months; children with 24 to 60 months stay in day care centers in full-time, while older children stay half of day. The public day care is municipal respon-sible, while the affiliated ones are managed by phi-lanthropic institutions that receive from the city hall food and employees.

The municipality of Vitória da Conquista, located in the Southwest of Bahia and according to IBGE data (Brazilian Institute of Geography and Statistics),[10] has a territorial area of 3,356,886 km2 and population of 306,866 inhabitants, constituting the third largest city of the State.

For the calculation of the sample it was taken the maximum prevalence estimate (50%), because it was a broad project, encompassing several outcomes to be studied. Besides, it was considered the full number of preschool enrolled fulltime in 21 day care centers (1726 children), with precision of 5% and a 95% of confidence interval, resulting 378 subjects. However, it was analyzed data from 664 children.

The sample size was selected by the random number draw, with Microsoft Excel 2007® program, adopting the following inclusion criteria: age lower than 60 months and children enrolled in day care centers full time that did not present a previous diag-nosis of chronic disease.

The data were collected by nutrition students, previously trained for applying the structured ques-tionnaire and collecting the anthropometric measure-ments. The structured questionnaire was applied with children's parents or guardians, containing information about child´s health, family´s socioeco-nomic conditions, maternal information and related to the day care center. The data were collected in meetings held in day-care centers with those guardian children. The studied variables present a different sample size, because the interviewees did not always know some questions or the mother and/or guardians were absent in day to applied the questionnaire.

The anthropometric measurements of weight and height was performed using standardized norms, according to the procedures established by the

Sistema de Vigilância Alimentar e Nutricional (SISVAN) do Ministério da Saúde (Nutritional and Food Surveillance Systen of the Minstery of Health).[11] To obtain body weight, it was necessary Marte®, an electronic scale capacity to weigh (Manufacturer: Minas Gerais, Brazil), capacity of 200 kg and its sensitivity of 50g. The height was verified using a portable stadiometer, Alturexata® (Manufacturer: Minas Gerais, Brazil) (213cm and 1mm of accuracy).

To obtain the nutritional status, it was used the growth curves of the World Health Organization (WHO), with the help of the WHO *Anthro* software version 3.2.2 (Manufacturer: Geneva, Switzerland).[12] The nutritional status of children was classified by Body Mass Index/Age (BMI/A), expressed as Z score. Cut-off point established for BMI/A $> + 2$ e $\leq + 3$ z score for overweight, $> + 3$ z score for obesity.[13]

Children's food consumption was performed by directly using the Marte® food scale, dish weighing offered during three non-consecutive days in all the day care centers. The food was offered for individuals dishes, properly identified. The food preparation was weighed before. Weighing leftovers and seconds of each dish were noted and the portioning was performed. It was assessed on centesimal composition of energy and macronutrients (carbohydrate, lipid and protein), through by *Avanutri* software (Manufacturer: Rio de Janeiro, Brazil) version 3.1.4. The adequacy of food intake was calculated on the basis of the Conselho Deliberativo do Fundo Nacional de Desenvolvimento da Educação - (CD- (Deliberation counseling fund) (FNDE - National Education Development) Resolution/CD/FNDE number 26, of june 17, 2013[14] which recommends 70 % of daily requirements of nutrients for children attending full-time basis, to calculate the adequacy divided in age groups: 1 to 3 years and 4 to 5 years.

Considered children with excess weight (dependent variable) when presented Z score $> + 2$ Z score. Thus, in this category it was included all children with overweight and obesity.

The independent variables were grouped in maternal and socioeconomic characteristics: maternal age in the interview moment, categorized into two age groups (< 20 e ≥ 20 years);[15] matrimonial status (with or no husband/partner); number of children (1 and 2 or more children);[16] maternal and paternal schooling in full years of study, grouped in < 8 e ≥ 8 years;[17] family income in minimum wages or salaries (MS) and subdivided into ≤ 1 and > 1 MS (value R$ 510.00 reais). The variables related children were: age in months, categorized into two age groups (24 to 36 incomplete months and 36 months to 60 months);[15] gender; ethnicity referred by the mother (white and non-white); type of delivery (vaginal and cesarean section); birth weight ($< 4,000$g and $\geq 4,000$ g);[18] received breastfeeding (yes or no); time to exclusive breastfeeding (< 4 months and ≥ 4 months).[19] In relation to the variables related to day-care centers, were studied (if the children enrolled in a public or affiliated day care); age from children who attended day care center (≤ 12 months and > 12 months) and the adequacy of food intake, energy, lipid, carbohydrate and protein offered in day care ($\leq 100\%$ and $> 100\%$ recommendation). The variable categorized was performed using previous references for comparison and distribution from the mean and quartiles.

The software employed in the statistical analysis was Statistical Package for the Social Sciences (SPSS) version 17.0 (manufacturer: New York, United States). The normality Kolmogorov Smirnov test was performed for evaluation the distribution of numerical data. The magnitude of association between risk factors and EW is expressed as *odds ratios* (OR) and its respective confidence intervals (95% CI). Initially, it was considered to use the bivariate analysis for evaluating the possible associations between independent variables with EW in childhood. Thereafter, the variables with $p \leq 0.20$ value were selected in the bivariate analysis, because they are potential confounders; Then the multiple analysis was performed using the logistic regression, removing the least significant variables until adjustment of the final model containing all significant independent variables. ($p < 0.05$), associated with EW. To assess the adequacy of the multivariate model, the Hosmer and Lemeshow test was used, which showed a value of p equal to 0.798.

This study was approved by the Ethics Committee on Human Research, at State University of Bahia Southeast, protocol number: 130/2009. The children's parents or guardians were informed about the objectives of the study and agreed to participate, having signed the Informed Consent. After data collection, all parents and/or guardians were informed of the nutritional diagnosis, and those children who presented nutritional deviations were referred to the health units.

Results

This study was composed with 664 children, aged between 24 to 60 months and average of 40.7±7.2 months, prevailing male gender (51.2%). Approximately a quarter of the children were born

with cesarean section. Regarding maternal characteristics, the average age was 27.2±61 years old and the majority (65.9%) lived with their husband/partner. Almost half of families (47%) received less than the minimum wage, the income varied of R$ 44.00 to R$2,180.00 reais, with median of R$ 510.00 reais. As to schooling time, the majority of mothers (57.4%) and fathers (64.0%) had less than eight years.

As for children food consumption, it was observed that 44.7% of lipids, 74.8% of proteins and 49.8% of carbohydrates were above the recommendations.

The EW prevalence were 5.7%. These, 3.9% were overweight and 1.8% were obese.

Based on the bivariate analysis, among the maternal and socioeconomic characteristics related to EW, the variables included in multiple logistic regression were: matrimonial status, number of children and family income (Tabela 1); among variables related to the children it was included: delivery type and exclusive breastfeeding duration (Tabela 2) and among variables related to the day care center, only type of day care was included (Tabela 3). After the multivariate analysis regression, the independent risk factors associated with EW: children was born cesarean delivery, singletons and exclusive breastfeeding less than 4 months (Tabela 4).

Table 1

Prevalence of EW and *Odds Ratio* (OR) according to maternal and socioeconomic variables in preschool children attended in full-time at day care center (n = 664) in Vitória da Conquista, Bahia,Brazil, 2010 to 2012.

Variable	N	%	Excess Weight (%)	OR gross	CI95%	*p*
Mother's age (years)					0.21-1.77	0.36
<20	103	16.6	3.9	0.62		
≥20	519	83.4	6.2	1		
Matrimonial status					0.24-1.19	0.13
No husband/partner	215	34.1	3.7	0.53		
With husband/partner	416	65.9	6.7	1		
Number of children					1.25-4.90	0.009
1	175	27.7	9.7	2.47		
≥2	456	72.3	4.2	1		
Maternal schooling (years)					0.38-2.34	0.91
<8 years of study	112	17.9	5.4	0.95		
≥8 years of study	515	82.1	5.6	1		
Father´s schooling (years)					0.58-3.69	0.41
<8 years of study	68	13.1	8.8	1.46		
≥8 years of study	453	86.9	6.2	1		
Family income (minimum wage)*					0.86-3.49	0.11
<1	293	47.0	7.2	1.74		
≥1	330	53.0	4.2	1		

*Value in the period of study R$ 510.00 reais.

Table 2

Prevalence and *Odds Ratio* (OR) of excess weight according to variables in preschool children attended in full-time at day care center (n = 664) in Vitória da Conquista, Bahia, Brazil, 2010 to 2012.

Variable	N	%	Excess weight (%)	OR gross	CI95%	*p*
Age (years)					0.32-1.61	0.43
24 |- 36 months	176	26.5	4.5	0.72		
36	-	60 months	488	73.5	6.1	1		
Gender					0.49-1.82	0.87
Male	340	51.2	5.6	0.95		
Female	324	48.8	5.9	1		
Ethnicity					0.44-1.72	0.70
Non-White	370	58.6	5.4	0.87		
White	261	41.4	6.1	1		
Type of delivery					1.27-4.98	0.008
Cesarean	159	25.3	10.1	2.5		
Vaginal	470	74.7	4.3	1		
Birth weight (g)					0.21-2.48	0.62
≥4000	23	4.0	4.3	0.73		
<4000	545	96.0	6.1	1		
Breastfeeding					0.27-3.06	0.88
No	57	9.0	5.3	0.91		
Yes	574	91.0	5.7	1		
Exclusive breastfeeding duration (months)					0.98-5.02	0.05
<4	159	37.6	8.8	2.22		
≥4	264	62.4	4.2	1		

Table 3

Prevalence and *Odds Ratio* (OR) of excess weight according to variables related to children attended in full-time at day care center (n = 664) in Vitória da Conquista, Bahia, Brazil, 2010 to 2012.

Variable	N	%	Excess weight (%)	OR gross	CI95%	*p*
Type of day care					0.31-1.27	0.20
Affiliated	276	41.6	4.3	0.63		
Municipal	388	58.4	6.7	1		
Time of day care (month)					0.22-1.12	0.89
≤12	223	33.9	3.6	0.50		
>12	434	66.1	6.9	1		
Adequacy of energy intake					0.76-2.81	0.26
>100% recommendation	291	43.8	6.9	1.46		
≤100% recommendation	373	56.2	4.8	1		
Adequacy of lipids intake					0.58-2.16	0.74
>100% recommendation	297	44.7	6.1	1.12		
≤100% recommendation	367	55.3	5.4	1		
Adequacy of carbohydrate intake					0.73-2.74	0.31
>100% recommendation	331	49.8	6.6	1.41		
≤100% recommendation	333	50.2	4.8	1		
Adequacy of protein intake					0.57-2.84	0.55
>100% recommendation	497	74.8	6.0	1.28		
≤100% recommendation	167	25.2	4.8	1		

Table 4

Final model of the determinants for excesse weigth in children attended in day care centers in Vitória da Conquista, BA, 2010-2012.

Variable	OR gross	CI95%	*p*
Type of delivery		1.11-6.01	0.03
Cesarean	2.59		
Vaginal	1		
Number of children		1.44-7.67	0.005
1	3.32		
≥2	1		
Exclusive beastfeeding duration (months)		1.12-5.99	0.03
<4	2.59		
≥4	1		

Discussion

The prevalence of EW (5.7%) observed in this study is consistent with the National Survey of Demographics and Health of Children and Women[20] which estimated prevalence of EW in Brazilian children between 5% and 7%. However, it appeared superior than the Chamada Nutricional made in children from the Brazilian semiarid, which prevalence in Bahia State was 3.5%.[21] In Pernambuco State, the prevalence of EW in 954 preschool was 8.1% and 9% for Recife metropolitan region.[22]

The results of the present study show an association between the type of delivery and childhood EW, wich children born by cesarean delivery presented 2.59 times (IC95%: 1.11; 6.01) more chances than children born to vaginal delivery. Similar results was found for Huh *et al*.[23] to analyzed a sample with 1225 children born in a health center in the United States, children´s born by surgical delivery presented 2.10 (95% CI: 1.36, 3.23) times the chance to having EW. The mechanism of this association is not elucidated. A study released by Bellone *et al*.[24] was found ghrelin (a orexigenic peptide control satiety) higher levels in 93 full term newborns by vaginal delivery (380.0; 300.0-445.0 pg/mL) when compared cesarean section. (310.0; 202.0-393.0 pg/ml), *p*<0.03, however, the authors inform the need of more studies to know the mechanisms that lead to this difference. Other factor associated to EW in children born by cesarean would be attributed the difference in the intestinal microbiota composition. Faecal samples from children born by cesarean section presented a lower count of *Bifidobacteria spp*, *Bacteroidetes* and a higher proportion of *Firmicutes* bacteria. A similar bacterial profile have been found on intestinal microbiota in obese adults.[25]

In this study, the exclusive breastfeeding less than four months was associated with EW. WHO recommends an exclusive breastfeeding until six months of years, since 2001.[26] However, studies who analyzed the protective effect of exclusive breastfeeding in children overweight and obesity showed different measures. A study carried out with preschool children in the city of Recife, Pernambuco found that overweight was more prevalent among children who received exclusive breastfeeding for less than four months (22.5%) than those received exclusive breastfeeding for four months or more (13.5%), (*p*=0.03).[3]

A publication data of National Demographic and Health Survey of Children and Women 2006, included children with less than two years old and attending preschool, having not found association between exclusive breastfeeding for less than five months and obesity.[3,27]

Other variable that show association with EW was to be singletons, with 3.33 times (IC95%: 1.44; 7.67) chances to have EW on studied group. This results is consistent to anothers studies which also found more than risk of EW in singletons.[16,28] This association is explained by the fact of a greater number of children implies a greater division of family income, therefore, singletons would present a greater possibility for acquisition to preferred products with high energetic density.[29] It is emphasized that the excessive mother´s concern with child care and the persistence of the belief that child feeding is directly related to weight gain.[30]

It was not found association between EW and socioeconomic, family income, father´s schooling variables, demonstrating that this problem is present independent socioeconomic conditions in families.

The present study did not find association between birth weight equal or more than 4.0 kg and EW, unlike another study observed this relation and mentioned that the nutritional situation intrauterine, reflected by the birth weight, is a important determinant not only for childhood survival but also of overweight at preschool and school.[18]

This is a pioneer study regarding evaluation of the relationship between amount of energy and macronutrients offered in day care centers and their relation to EW in preschoolers. However, it did not find association between these variables. It is emphasized that this study evaluated only the food offered in the day care centers, and did not consider the food consumption in the residences nor evaluated the quality of the diet about the consumption of fresh and processed foods. The design of the present study is a cross-sectional, which presents a limitation the establishment of a temporal relationship between some variables of exposure with the outcome and, therefore, it is not possible to infer a cause and effect relationship for the associations observed.

This study concludes that EW represents a relevant nutritional disorder among preschool children studied. For reducing and/or preventing EW in this population, it is important that interventions begin in prenatal care, through the guideline of health professionals regarding the importance of exclusive breastfeeding, as well as stimulation of vaginal delivery. In addition, it is emphasized the importance of nutritional orientations directed to families with singletons. The encouragement of vaginal delivery, breastfeeding and nutritional guidelines are simple measures that can be performed at health facilities

during both prenatal and growth, as well as development visits with educational activities for groups. It is expected that the reduction of childhood EW can positively impact the prevention of cardiovascular diseases and diabetes *mellitus* in adults, which consume a significant amount of public health resources.

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