Association between breastfeeding and overweight in preschoolers

Associação entre aleitamento materno e excesso de peso em pré-escolares

Relación entre la lactancia materna y el exceso de peso en niños preescolares

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Abstract

Objective: To analyze association between breastfeeding and overweight in preschoolers.

Methods: A cross-sectional study with 448 preschoolers from 10 Municipal Centers of Early Childhood Education in the city of Teresina, state of Piauí. A meeting was held with the parents, at which time the structured questionnaire with questions related to sociodemographic data and past feeding of the children was applied. Subsequently, the anthropometric measurements of the children (weight and height). Overweight (overweight + obesity) was considered when the z-score result was greater than or equal to +2. Children younger than +2 were classified as not overweight. The association between exclusive breastfeeding up to six months, exclusive breastfeeding up to four months and breastfeeding with the child's nutritional status was analyzed using Pearson's chi-square test (χ^2), while the prevalence ratio (PR) was estimated to quantify the associations between breastfeeding and nutritional status controlled by sociodemographic variables. All estimates and 95% confidence intervals were calculated using the robust variance Poisson regression model.

Results: The prevalence of overweight and the proportion of children who received exclusive breastfeeding until 6 months of age were 11.16% and 41.9%, respectively. Overweight was 2.5 times higher among non-breastfed children (95% CI: 1.09; 5.83). After controlling for sociodemographic variables, it was found that children older than 48 months were at high risk for overweight (PR: 1.69; 95% CI: 1.01; 2.85) compared to children younger than 48 months. months old (p = 0.04).

Conclusion: The present study demonstrated that breastfed newborns were protected against overweight.

Resumo

Objetivo: Analisar associação entre aleitamento materno e excesso de peso em pré-escolares.

Métodos: Estudo transversal com 448 pré-escolares de 10 Centros Municipais de Educação Infantil do município de Teresina-PI. Realizou-se reunião com os pais, momento em que foi aplicado o questionário estruturado com questões relativas aos dados sociodemográficos e alimentação pregressa das crianças. Posteriormente, foram obtidas as medidas antropométricas das crianças (peso e altura). Foi considerado excesso de peso (sobrepeso + obesidade) quando o resultado do escore-z foi maior que ou igual a +2, e os menores que +2 foram classificados como sem excesso de peso. A análise da associação entre o aleitamento materno exclusivo até seis meses, aleitamento exclusivo até quatro meses e o aleitamento materno com o estado nutricional da criança foi feita utilizando-se o teste *qui-quadrado de Pearson* (χ^2), enquanto a razão de prevalência (RP) foi estimada para quantificar as associações entre o aleitamento materno e o estado nutricional controlado pelas variáveis sociodemográficas. Todas as estimativas e os intervalos de confiança de 95% foram calculados utilizando o modelo de regressão de Poisson com variância robusta.

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Resultados: A prevalência do excesso de peso e a proporção das crianças que receberam o aleitamento materno exclusivo até os 6 meses de idade foi de 11,16% e 41,9%, respectivamente. O excesso de peso foi 2,5 vezes mais elevado entre as crianças não amamentadas (IC 95%: 1,09; 5,83); e, após o controle das variáveis sociodemográficas, verificou-se que as crianças maiores de 48 meses tiveram risco elevado para o excesso de peso (RP: 1,69; IC 95%: 1,01; 2,85) em relação aos menores de 48 meses de idade (p = 0,04).

Conclusão: O presente estudo demonstrou que as crianças que receberam aleitamento materno foram protegidas contra o excesso de peso.

Resumen

Objetivo: Analizar la elación entre la lactancia materna y el exceso de peso en niños preescolares.

Métodos: Estudio transversal con 448 niños preescolares de 10 Centros Municipales de Educación Infantil del municipio de Teresina, estado de Piauí. Se realizó una reunión con los padres, momento en que se aplicó el cuestionario estructurado con preguntas relativas a datos sociodemográficos y alimentación anterior de los niños. Posteriormente, se obtuvieron las medidas antropométricas de los niños (peso y estatura). Se consideró exceso de peso (sobrepeso + obesidad) cuando el resultado de la puntuación z fue mayor o igual a +2; y los menores a +2 se clasificaron como sin exceso de peso. El análisis de la relación entre lactancia materna exclusiva hasta los seis meses, lactancia exclusiva hasta los cuatro meses y lactancia materna con el estado nutricional del niño se realizó mediante la prueba c² de *Pearson*. Para cuantificar las relaciones entre la lactancia materna y el estado nutricional controlado por las variables sociodemográficas se calculó la a razón de prevalencia (RP). Todas las estimaciones y los intervalos de confianza de 95% se calcularon utilizando el modelo de regresión de Poisson con varianza robusta.

Resultados: La prevalencia del exceso de peso y la proporción de los niños que recibieron lactancia materna exclusiva hasta los 6 meses de edad fue de 11,16% y 41,9%, respectivamente. El exceso de peso fue 2,5 veces más elevado en niños no amamantados (IC 95%: 1,09; 5,83). Luego del control de las variables sociodemográficas, se verificó que los niños mayores de 48 meses tuvieron un riesgo elevado de exceso de peso (RP: 1,69; IC 95%: 1,01; 2,85) con relación a los menores de 48 meses de edad (p = 0,04).

Conclusión: El presente estudio demostró que los niños que recibieron lactancia materna fueron protegidos contra el exceso de peso.

Introduction

Obesity is characterized by the accumulation of excess body fat, impairing health at all ages - especially in the early years of life. It has an increasing incidence and prevalence.[1,2] Data from the World Health Organization (WHO) show that around 42 million children under 5 worldwide were overweight in 2013.[3] In Brazil and the state of Piauí,[4] recent studies show a prevalence of 15.8% and 14.2%, respectively.

Preschool is the period from 2 to 6 years old, and this is a critical period in the child's life, when it becomes necessary and important to sediment healthy eating habits. This is a transitional phase: the child moves from a phase of total dependence (newborns) to a phase of greater independence (school and adolescence). Building a healthy eating habit can provide adequate growth and development, prevent nutritional deficits and prevent health problems such as hypertension, type 2 diabetes, cardiovascular disease, osteoporosis and obesity.[5] Thus, these habits should be constituted even in the first years, as is the case of continued breastfeeding until 2 years of age or older.[6]

The WHO[7] recommends maintaining EBF until 6 months of age and supplemented until 2 years of age or older. However, the II Breastfeeding Prevalence Survey conducted in Brazilian Capitals and the Federal District (2008) found that the prevalence of EBF was 41% and 43.7% in Brazil and Teresina, respectively.[8] Among the main causes of low adherence to EBF are lower maternal education, early return to work, lack of support during the pregnancy-puerperal cycle, and subjective issues such as feelings of defeat and frustration.[9-11]

Thus, it is necessary to correct such distortions and ensure conditions for children to receive breastfeeding as recommended by WHO, finding an entry point for access to mothers and children.[12] In this sense, the preschool environment is attractive and ideal to investigate the occurrence of nutritional disorders such as overweight in children, as well as to propose intervention strategies aimed at improving these conditions.

Thus, considering the fact that preschool age is a crucial moment for the prevention of eating disorders, associated with the possibility of intervention in the school environment and the lack of comprehensive studies conducted in Teresina to raise this problem, we aimed to investigate the association between breastfeeding and overweight in preschoolers. We will test the hypothesis that breastfeeding, as the first healthy food, can offer protection against overweight in preschoolers.

Methods

This is a cross-sectional study with children aged 3 to 6 years old, enrolled in the Municipal Centers of Early Childhood Education (CMEI - *Centros Municipais de Educação Newbornil*) in the urban area of Teresina, capital of Piauí. According to the Municipal Department of Education (SEMEC - *Secretaria Municipal de Educação*), in 2015 there were 83,003 students enrolled in the municipal school system, of which 12,806 of these children were preschoolers and were distributed in 143 CMEIs.[13]

The sample size calculation was performed using Levin's formula,[14] with a 20% sample loss, a 5% sampling error for a 95% confidence level. The test power used for sample calculation was 80.43%. The final sample consisted of 448 children. Data were collected from September to October 2016. There were no losses or refusals to participate in the study.

The selection of children was made through a probabilistic sample proportional to the number of students enrolled in the preschool of each of the four zones of the city (North Zone, East Zone, South Zone and Southeast Zone), and the draw was simple. Thus, each area of the city had at least two schools drawn to reach the number of students enrolled to apply the questionnaires. However, when the number of students proportional to the zone was not sufficient, a new school was drawn until the minimum sample number of participants was reached.

Thus, the research was conducted in 10 schools located in the urban area of the municipality. Inclusion criteria were: age between 36 and 59 months and enrolled and regularly attending schools; not diagnosed with diseases that could interfere with the study results, such as Prader Willie's syndrome, Down's, hypothyroidism and chronic corticosteroid use.

As a strategy for collecting research data, a prior meeting was held with parents or guardians at each school to clarify the study objectives. Thus, those who agreed to participate signed the Informed Consent Form (ICF) and answered the survey questionnaire. At the time, guidance was given on children's health and nutrition, as well as a pediatric assessment of the students by the researcher responsible. The anthropometric assessment of the children was performed at the end of the meeting.

The tool used for data collection consisted of a structured questionnaire with questions related to the sociodemographic data of mothers or guardians and the children's past feeding, questions related to the practice of breastfeeding. This tool was adapted from the validated questionnaire in the research conducted by Caldeira.[15]

The anthropometric variables used in the study were weight and height, collected by a previously trained team, composed by a nutritionist supervisor and two nutrition academics. The children were weighed with light and barefoot clothes, according to SISVAN (*Sistema de Vigilância Alimentar e Nutricional* - Food and Nutrition Surveillance System) (Ministry of Health) manual instructions for the collection of anthropometric data.[11] A 180-kg digital scale of Avanutri brand was used; and portable stadiometer, graduated 0.1 cm and scale from 20 cm to 200 cm, also made by Avanutri, evaluation equipment, manufactured in the city of Três Rios, state of Rio de Janeiro, Brazil.

In this study, the BMI/age was used as a parameter to assess nutritional status, as defined by the WHO,[16] recommended by the Ministry of Health,[17] because it is a widely used index to identify overweight among children.[15,18] The classification was made according to the z-score: +2 or higher was considered "overweight (overweight + obesity)", and results lower than +2 were classified in the "no overweight" category. Thus, the child's nutritional diagnosis was considered the outcome variable, with two categories: non-overweight and overweight. The nutritional status classification was made by the field supervisor nutritionist according to the tables contained in the SISVAN[17] manual of the Ministry of Health (2011) and reviewed by the researchers responsible for the study.

Sociodemographic variables were used to describe the sample and to control the effect of breastfeeding on children's overweight. Mother's variables were considered: mother's age (≤ 36 and> 36 years),

maternal work (yes and no), monthly family income (≤ 1 minimum wage and> 1 minimum wage). Regarding the variables of the child, we used: gender (male and female), birth weight (<2,500 g and ≥ 2,500 g), age of the child (≤ 4 years and> 4 years). Regarding the type of breastfeeding, we used the categorized variables related to exclusive breastfeeding (EBF) to children under 4 months (yes and no), exclusive breastfeeding for children under 6 months (yes and no) and breastfeeding (breastfeeding) (yes and no).

The definitions of breastfeeding adopted in this study followed the recommendations in the WHO document entitled Indicators for Assessing Newborn and Young Child Feeding Practices.[19] This document considers exclusive breastfeeding when the child receives breast milk (including milked breast milk), allowing her to receive oral serum, vitamins and medicines without including any other liquid or food. Breastfeeding is considered when the child receives breast milk (including milked breast milk) and may also receive any other liquid or food, including other newborn formula and milk.

Data were tabulated in the Microsoft Office Excel spreadsheet and analyzed using the Stata® statistical package, version 12. The association between exclusive breastfeeding up to 6 months, exclusive breastfeeding up to 4 months and breastfeeding with the child's current nutritional status (without and overweight) was analyzed using Pearson's (χ^2) chi-square test or Fisher's exact test (used when frequency is below 5), when appropriate. Prevalence Ratio (PR) was calculated to quantify the associations between breastfeeding practices and nutritional status. All estimates and 95% confidence intervals (95% CI) were calculated using the robust variance Poisson regression model.[20] PR and their 95% CIs were adjusted in a model that considered nutritional status as a dependent variable and EBF and BF as independent variables, being controlled by sociodemographic variables. Variables with p <0.10 were all placed in a final model. Tests with p <0.05 were accepted as statistically significant.

The research project was authorized by the Research Ethics Committee (REC) of *Centro Universitário Uninovafapi* by means of Opinion 1,673,624/2016, of August 11, 2016, as recommended by Resolution 466/12 of the Brazilian National Health Boar (CNS – *Conselho Nacional de Saúde*) of the Ministry of Health (MoH). Parents or guardians signed the Informed Consent Form.

Results

A total of 448 children participated in the study, 230 (51.3%) males. Regarding birth weight, 37 (8.3%) were underweight (<2,500 g), and most (61.2%) were younger than 4 years. Regarding maternal characteristics, 391 (87.3%) were under 36 years old, 302 (67.4%) were not working and 395 (79.2%) had a family income below one minimum wage (Table 1). The percentage of breastfed children was 95.7% (429). Of these, 194 (43.3%) received exclusive breastfeeding until 4 months and 188 (41.9%) until 6 months of age.

Table 1. Sample distribution according to sociodemographic variables of preschool children and mothers

Characteristics	n(%)
Sex	
Male	230(51.3)
Female	218(48.7)
Weight at birth (grams)	
< 2,500	37(8.3)
≥ 2,500	411(91.7)
Age (years)	
≤ 4	274(61.2)
> 4	174(38.8)
Mother's age (years)	
≤ 36	391(87.3)
> 36	57(12.7)
Current maternal work	
Yes	146(32.6)
No	302(67.4)
Family income (minimum wage)	
≤ 1	395(79.2)
> 1	93(20.8)

Figure 1 presents the results of the nutritional assessment of preschoolers, showing that the prevalence of overweight among them was 11.2% (z-score> +2), 6.9% overweight and 3.8% obesity.

Table 2 shows the relationship between breastfeeding practice and prevalence of overweight,

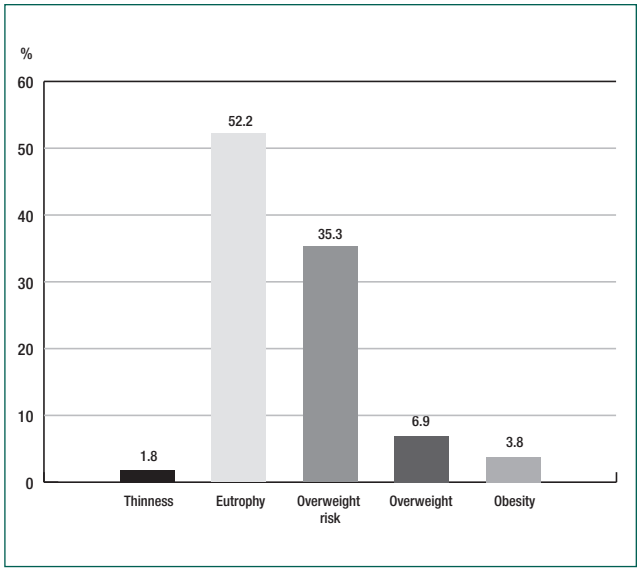

Figure 1. Nutritional status, according to BMI/age, in preschoolers

showing that only 10.5% of children who breastfed were overweight; while 26.3% of preschoolers who did not receive breast milk developed overweight. Thus, the child who was not breastfed was 2.5 times more likely to be overweight compared to the breastfeeding child (95% CI: 1.09; 5.83). Exclusive breastfeeding up to 6 months and breastfeeding up to 4 months showed no statistically significant association with overweight (Table 2).

Table 2. Association between breastfeeding and overweight variables in preschoolers

Variables	With overweight n(%)	Without overweight n(%)	P (χ^2)	Prevalence Ratio (95% C)
Breastfeeding				
Yes	384(89.5)	45(10.5)	0.032	1.00
No	14(73.7)	5(26.3)		2.50 (1.12; 5.60)
Exclusive breastfeeding (< 6 months)				
Yes	167(88.8)	21(11.2)	0.996	1.00
No	231(88.8)	29(11.2)		0.99 (0.59; 1.70)
Exclusive breastfeeding (< 4 months)				
Yes	172(88.7)	22(11.3)	0.916	1.00
No	226(89.0)	28(11.0)		0.97 (0.59; 1.70)

Poisson regression, even after the introduction of variables into the model, demonstrated an association between breastfeeding and overweight with a high chance of developing overweight among non-breastfed children (PR: 2.5; 95% CI: 1.08; 5.56) and, moreover, there was a greater chance of being overweight in children older than 4 years of age (PR: 1.7; 95% CI: 1.01; 2.85) when compared to those under 4 years old (p = 0.04) (Table 3).

Table 3. Final model of factors associated with overweight in preschoolers

Variables	Prevalence Ratio	Standard Error	P values	95% CI
Breastfeeding	2.5	1.02	0.030	1.08-5.56
Age > 48 months	1.7	0.45	0.048	1.01-2.85

Discussion

The present study identified the prevalence of overweight in preschool children from Teresina, Piauí, Brazil, in 2016, and its association with breastfeeding. The result found in this study was slightly higher than the data recorded in SISVAN for the city of Teresina in the same period, in which the prevalence of overweight was 10.9% in the age group of 2 to 5 years, according to BMI/Age.[2] It is noteworthy that the coverage of SISVAN in that municipality is around 53% and that this program is mainly fed with data from beneficiaries of social income transfer programs.

A survey[21] that evaluated 2-4 year-old preschoolers during the years 2009, 2010 and 2011 in day care centers in Taubaté found an overweight prevalence of 9.3%, which is very close to that found in the present study. On the other hand, other surveys, carried out in several Brazilian cities, present different results. Surveys conducted in the states of Bahia,[22] Santa Catarina and Rio Grande do Sul,[23] whose prevalence of overweight were 5.7%, 7.5% and 14.4%, respectively, were cited. This fact shows differences in the magnitude of overweight among Brazilian states[21-23] and reinforces the need for continuous research of this nature. Despite these discrepancies in prevalence among Brazilian cities, it is possible to state that there was an increase in overweight children in Brazil, as shown in a study,[24] from the analysis of three population surveys conducted in the country, from 1989 to 2006, which showed a 160% increase in overweight in that period.

In the international setting, a census and temporal evolution study, which analyzed data from

144 countries, estimated 43 million overweight or obese children in 2010, of which 35 million were in developing countries and also showed an increase in prevalence of 4, 2% in 1990 to 6.7% in 2010.[25] Given this context, it is likely that such discrepancies in the prevalence of overweight in the different settings are due to the process of nutritional transition underway in Brazil, being mainly determined by the distinct socioeconomic factors in the states.[26]

Regarding breastfeeding, a high proportion of mothers who breastfed their children were found. This corroborates both the results found in the II Survey on Breastfeeding Prevalence in the Brazilian Capitals and Federal District[8] for the city of Teresina and in relation to the survey[15] conducted in the state of Minas Gerais, with proportions of 95.2% and 82.49% of mothers who breastfed their children for some period, respectively.

Regarding exclusive breastfeeding, a low prevalence was observed in children under 6 months of age in relation to WHO recommendations.[7] The results also resemble those found in the II Survey on Breastfeeding Prevalence in Brazilian Capitals and Federal District[7] for the city of Teresina, in which the prevalence of EBF was only 43.7%. In addition, other studies, such as the one performed by Caldeira et al.,[15] with preschoolers in schools of a municipality in the state of Minas Gerais. The study[16] conducted with preschoolers from the city of Taubaté, state of São Paulo - found prevalence rates much lower than 32.1% and 25%, respectively, in relation to the present study. Thus, it is clear that exclusive breastfeeding indicators still remain below official recommendations in different Brazilian cities, reflecting a trend in the country.

In the international literature, a survey[27] conducted with schoolchildren in a Health Center in Lisbon, Portugal, showed a prevalence of exclusive breastfeeding of 28.8%, a result lower than that found in this study. At the local level, a study[28] that evaluated the factors associated with exclusive breastfeeding in *Hospitais Amigos da Criança* (HAC) in the city of Teresina, state of Piauí, found a prevalence of 60.49%. This result is probably due to the fact that the children had multidisciplinary follow-up in a specialized outpatient clinic in these hospitals. However, it is noteworthy that many mothers performed early weaning of their children even before WHO recommended.[7]

Poisson regression, even after controlling for sociodemographic variables, showed a significant association between breastfeeding and overweight, showing that not breastfeeding increases the chance of this disease in the children studied. This finding was also verified in other research in different contexts and using the same design, as in Minas Gerais[15] and Lisbon (Portugal).[27] However, research conducted in the Semi-Arid Region of the state of Alagoas[29] and in the city of Pelotas, state of Rio Grande do Sul[30], did not show such an association. However, in another study conducted in the United States,[31] preschoolers who had been breastfed had a reduced risk of being obese, but this protection against overweight was not observed.

Thus, in view of this setting, it is complex to compare with such disparate results. Probably, this is due to the different methodologies applied in these studies, such as: sample calculation and selection, data collection and tools used, among others. It is worth mentioning the memory bias of mothers because they are data collected retrospectively, such as the practice of breastfeeding.[18]

However, despite these differences, a systematic review[32] demonstrated the role breastfeeding plays in reducing the prevalence of later obesity, which includes behavioral and hormonal mechanisms and differences in macronutrient intake. Among the findings it is worth mentioning: high plasma insulin concentration in formula-fed children compared to breastfed children leading to early adipocyte development; lower protein intake and amount of energy metabolism in breastfed children than formula-fed children; significant association between early protein intake early in life and increased risk of later obesity. Protein availability during early fetal and postnatal development has been reported to have a

long-term effect on metabolic programming of glucose metabolism and future body composition. These pathways alone or in combination provide plausible explanations for a protective effect of breastfeeding against obesity.[33]

In this study, after controlling for sociodemographic variables, it was shown that children older than 4 years were more likely to be overweight than children younger than 4 years, although this issue was not the subject of this research. This finding suggests that children under 4 years of age are less vulnerable to overweight due to their greater dependence on their parents or guardians, greater control over the food served and also the protection offered by breastfeeding.[3,15,27] Corroborating this study, a research[18] conducted in the city of São Paulo with children aged 2 to 6 years showed that children older than 4 years old had a high risk for overweight. For these authors, this is probably due to the greater autonomy in choosing the foods they wish to eat, giving preference to foods with higher caloric value. In addition, there is easy access to the media and longer exposure to television and electronic games, which consequently increases the sedentary lifestyle.

In addition, interventions in early childhood education centers to address the promotion of healthy eating and breastfeeding until the first two years of life are viable. In this regard, it is worth mentioning the importance of Health Promoting Schools. It is an initiative headed by the Pan American Health Organization (PAHO)[33] as a directed, integral and integrative strategy aimed at providing health services in a school environment that transcend traditional medical attention and are based on health promotion actions. Also it is worth mentioning the ability to integrate with ministerial strategies, such as the Health at School Program (*Programa Saúde na Escola*), to bring parents, students and school closer together and thus have better health outcomes.[34]

The present study contributed as a contribution to the elaboration of a diagnosis about the nutritional status of preschool children and the factors associated with the occurrence of overweight. This is the first study conducted in the city of Teresina with this theme and may contribute to the development of strategies to reduce this disease in childhood.

However, there were limitations, among which we highlight the fact that the collection of information about the duration of breastfeeding was done retrospectively, based on the mother's memories of events that occurred between three and five years earlier, which may provide a bias of memory. In addition, the study was conducted only in public schools, thus not allowing further generalizations about the prevalence of overweight in other children in the same age group.

Conclusion

Breastfeeding proved to be a protective factor against overweight among preschoolers. Thus, it is essential to adopt incentive measures to promote breastfeeding and healthy eating, in addition to offering comprehensive care to overweight children, with a view to reducing this problem and its consequences in this vulnerable population.

Collaborations

Macêdo RC, Ramos CV, Paiva AA, Martins MCC, Almeida CAPL and Paz SMRS contributed to the study design, analysis, data interpretation, article writing, relevant critical review of intellectual content and final approval of the version to be published.

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