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Correlation between dental caries and nutritional status: preschool children in a Brazilian municipality

Correlação entre cárie dentária e estado nutricional: pré-escolares em um município brasileiro

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Resumo

Introdução: A cárie dentária e o estado nutricional em crianças na idade pré-escolar são sérios problemas de saúde pública com etiologia multifatorial, com a dieta como fator de risco comum. **Objetivo**: Este estudo transversal avaliou a relação entre a cárie dentária e o estado nutricional de pré-escolares matriculados em escolas públicas em um município no estado de São Paulo. **Material e método**: A população de estudo foi composta de pré-escolares entre 3 e 5 anos de idade (n = 229) matriculadas em escolas públicas, onde o índice ceod (cariado, extração indicada, obturado, por dente) foi utilizado para avaliação da cárie dentária e o Índice de Massa Córporea foi utilizado para avaliação do estado nutricional de acordo com as recomendações da Organização Mundial da Saúde. Análise estatística foi conduzida de modo descritivo por meio de frequências absoluta e relativa e teste de Correlação de Spearman e Kruskall Wallis($p<0,05$). **Resultado**: Foram encontrados um ceod de 1,65(±2,87) e um Índice Sic (Índice Significativo de Cárie) de 4,88(±3,20) indicando polarização da cárie dentária. Foi observado que 66,81% das crianças apresentaram estado nutricional normal e as crianças com desnutrição demonstraram uma média de 4,00 (±3,66) o qual foi duas vezes maior que as demais categorias de estado nutricional. Não foi encontrada relação estatisticamente significativa entre o CPOD e componentes e o estado nutricional. **Conclusão**: Este estudo não identificou relação entre o estado nutricional e a cárie dentária. Estudos devem ser conduzidos para elucidar tal relação.

Descritores: Cárie dentária; estado nutricional; saúde bucal.

Abstract

Introduction: Dental caries and nutritional status in children in preschool age are serious public health problems, with multifactorial etiology, with diet as a common risk factor. **Objective**: This cross-sectional study assessed the relationship between dental caries and nutritional status of preschool children attending public schools in a city in the State of Sao Paulo. **Material and method**: The study population was comprised of 3-5 year-old preschool children (n = 229) attending public schools, in which dmft (decay, missing, filled, teeth) was used for dental caries assessment and Body Mass Index (BMI) was used for nutritional status in accordance with the recommendations of the World Health Organization. Statistical analysis was performed in a descriptive way through absolute and relative frequencies and Spearman Correlation test and Kruskal Wallis ($P<0.05$). **Result**: A dmft of 1.65 (2.87) and a SiC index (Significant Caries Index) of 4.88 (3.20) have been found, indicating polarization of dental caries. It was observed that 66.81% of children presented with nutritional status within the normal range and children with malnutrition had a mean dmft of 4.0 (3.66), which is two times higher than the other categories of nutritional status. No statistically significant correlation has been found by correlating dmft and components with Body Mass Index. **Conclusion**: This research did not identify a significant correlation between the occurrence of dental caries and nutritional status of preschool children, researches should be conducted to elucidate this relationship.

Descriptors: Dental caries; nutritional status; oral health.

INTRODUCTION

An ongoing challenge for professionals and researchers regarding oral health is the control and the prevention of dental caries[1]. In Brazil, a decline of 61.70% in dental caries from 1986 to 2003 could be observed as well as a decline of 26% from 2003 to 2010 in children under 12 years of age. In the same way, it was observed a reduction of 16.86% in dental caries in 5 years old children from 2003 to 2010[2,3].

Despite steady improvements in oral health indicators, dental caries remains a serious public health problem in Brazil, with unequal distribution of disease between different regions, where

the worst situations can be observed in the Northeast region and the best situations in the South and Southeast regions[4]. This inequality generates a demand for access to oral health services beyond medical treatment, since they demonstrate broader processes, such as socioeconomic conditions and the most subjective issues such as suffering and psychoaffective untranslated primarily for specific care[5].

Similar to dental caries, nutritional status in children in preschool age is a serious public health problem, with multifactorial etiology, with diet as a common factor[6,7]. It is demonstrated significant association between daily intake saturated and unsaturated fats, and carbohydrates, including sucrose, with obesity in children. These eating habits related to nutritional disorders may also determine a higher prevalence of dental caries, since both the amount of sucrose ingested as the frequency of intake are important factors involved in the etiology of dental caries[7].

The assessment of such factors may be an important contribution to population-based studies that aim to identify selected groups to receive care in public services, in view of scarce resource allocation to the health sector and the magnitude of the accumulated needs.

Multiple studies have attempted to explore the association between dental caries and nutritional changes but the results of these studies remain inconclusives[6-10]. There are few data available in the literature to confirm this statement and to determine the nature of this relationship[11]. A systematic review conducted with researches between 2004 and 2011 show that there is still significant disagreement as to the existence and nature of an association between dental caries and Body Mass Index[12].

In Brazil, the National Policy for the Health Promotion, and the Health Pact, emphasize the importance of the role in promoting health, its determinants and common risk factors that act in chronic diseases[13].

Based on the foregoing, the present research proposed to evaluate the relationship between dental caries and nutritional status of preschool children attending public schools in a city in the State of São Paulo, Brazil.

METHODOLOGY

A cross-sectional study was conducted in the city of Bauru, Midwest region of the state of Sao Paulo, southern Brazil, with an area of 667.7 km^2 and a population estimated at 343.997 inhabitants in 2010[14]. The city has fluoridated public water supplies since 1975 and fluoridated toothpaste has been in the market since 1989.

The target population consisted of preschool children between 3 and 5 years of age attending kindergartens in Bauru, State of São Paulo. The preschools included in the survey were randomly selected according to the North, South, East, West, and central areas of the city. The sample size calculation was based on the error level α=0.05 and β error level of 0.20. For this calculation, a correlation coefficient (R) of 0.20 was established for both a total of 198 children to be examined. The participating children were those who were in school at the time of the survey and who were allowed to participate in the research through the Term of Consent signed by parents or guardians and that allowed the clinical examination. In the present study 229 preschool children between 3 and 5 years of age were examined in both genders, been 29 children of 3 years old, 76 children of 4 years of age and 124 children of 5 years old.

Data collection took place between February and September 2009 and clinical examinations related to dental caries were conducted by a calibrated examiner and a recorder with a intraexaminer concordance of 0.95. The preschool children were examined in the schoolyard, under natural light and dental mirrors and ball point probes were used in order to confirm visual evidences of dental caries. Decay, missing, filled teeth index (dmft index) was used for dental caries and codes and criteria were used following the recommendations of the World Health Organization[15].

Anthropometric evaluation was conducted by calculating the Body Mass Index (BMI) where the weight was divided by the square of height. Thus, the weighing of children was performed using a precision digital scale and a tape measure for measuring their height. Percentile graphics advocated by the World Health Organization were used to calculate the nutritional state of children according to the age for male and female subjects[16]. The calculated values of BMI were put on the graphics and the percentages obtained were entered into a reference table for the child's diagnosis.

This study was submitted to the Municipal Office of Education of Bauru in order to get permission for the research in the Kindergartens and for consideration by the Ethics Committee of the School of Dentistry of Bauru (FOB-USP CEP) and was approved by the opinion number 156/2009.

The data were stratified according to age and analyzed and processed using Excel worksheets (Microsoft 2010). The distribution of dental caries was calculated using the percentage of DMFT and caries-free individuals. The Significat Caries Index (SiC index) was calculated by calculating the average third of the sample with the highest values of DMFT and it was used to evaluate the occurrence of polarization of dental caries in the population[17]. Polarization is a phonomenum where the great percentage of dental caries is concentrated on one third of the studied population[18].

The Kruskall Wallis test was used for comparison of DMFT according to age. The Spearman Correlation test was used to relate the DMFT with nutritional status, the tests for statistical significance level was 5%. The tests were done using Statistica 9.1.

RESULT

This study investigated the relationship between dental caries and nutritional status of preschool children enrolled in kindergartens, totaling 229 children examined, been 29 children of 3 years old (12.66%), 76 children of 4 years old (33.19%) and 124 children of 5 years of age (54.15%). Regarding dental caries, there was an increase in the prevalence of disease with

increasing age. The decayed component was the most prevalent with 1.14 (2.34) and the SiC Index was double of the dmft, showing polarization of dental caries in the studied population. It was found 58.95% with regard to the percentage of caries-free children. There was no significant difference between the ages assessed for DMFT and components as shown in Table 1.

The nutritional status of children was assessed using the Body Mass Index (BMI). In Table 2, the main findings according to the age of the children examined are listed and it has been observed an increase in the percentage with increasing age for children with malnutrition and obesity.

In assessing the prevalence of dental caries according to the different categories of body mass index (BMI), it was revealed that 37.50% of children with malnutrition were presented with caries-free, a percentage that has increased in preschool children with nutritional status normal and overweight. It was verified that children with malnutrition had a mean DMFT of 4.0 (3.66), which is two times higher than the other categories of nutritional status (Table 3).

By correlating the dmft and components with the BMI, statistically significant relationship was not found. Likewise, when assessing the relationship between different BMI categories and dmft no significant relationship was observed (P>0.05).

DISCUSSION

The principal limitation of this study relates to the sample size and the fact that these results cannot be generalized to the entire population, because the sample calculation was drawn from a specific population (preschool children enrolled in public schools).

Dental caries is highlighted as one of the most common diseases in adults and children and an important public health problem, therefore, the identification of groups at highest risk for disease development presents fundamental importance for its prevention and early treatment[19]. In the present study, a percentage of caries-free children of 58.95% was found; this result was similar to that observed by Feitosa with 53.00%[1] and Rihs that found 57.40%[20]. A dmft of 1.65 was found, similar to studies that found a dmft of 1.97 in Salvador, State of Bahia, in 2009, 1.40 in Bauru, State of São Paulo and 1.73 in Indaiatuba, State of São Paulo, in the same year[19-21], but higher than the study conducted by Almeida, in Salvador, in a Family Health Program's region, 2010, with a dmft of 1,15[22]. However, the results found in this research were lower than the results found in the national research conducted in 2010 in witch it was found a dmft index of 2.43 on a national level and lower than the results that was found in southeast region with 2.10, both with greater expression of decay component[3].

The relationship between nutritional status and oral health condition is not well enlightened, showing often controversial versions and limited knowledge. There is some agreement that the nutritional status and the oral health are inter-related, but there are few data available in the literature to confirm this statement and to establish which would be the nature of any relationship as possible[11].

The nutritional status of preschool children was assessed by BMI. According to the Centers for Disease Control in Atlanta, the IMC is the method of choice to assess the status of overweight and obesity in children at the age of 5, because it incorporates the value of height in the nutritional status[23].

A rapid reduction in malnutrition rates associated with an increase in obesity in children has occurred in a short period of

Table 1. dmft and components according to the age of preschool children examined, Bauru, São Paulo, Brazil, 2010 (*n* = 229)

	Decay (sd)	Missing (sd)	Filled (sd)	dmft (sd)	Caries free (%)	SiC Index (sd)
3 years	0.66 (1.8)	0.03 (0.19)	0.38 (1.18)	1.07 (2.12)	68.97	3.44 (2.55)
4 years	1.01 (2.49)	0.03 (0.16)	0.29 (0.92)	1.33 (2.94)	69.74	4.04 (3.94)
5 years	1.33 (2.36)	0.02 (0.12)	0.63 (1.63)	1.98 (2.95)	50.00	5.34 (2.95)
Kruskal Wallis P	0.690 ns	0.492 ns	0.666 ns	0.332 ns	-	-
Amount	1.14 (2.34)	0.02 (0.15)	0.49 (1.38)	1.65 (2.87)	58.95	4.88 (3.20)

ns - statisticaly non significant diference. sd - standard deviation.

Table 2. Nutritional status according to the age of preschool children examined, Bauru, São Paulo, Brazil, 2010 (*n* = 229)

	Tinness n (%)	Normal Weight n (%)	Over Weight n (%)	Obesity n (%)
3 years old	0(0.00)	20 (68.96)	8 (27.59)	1 (3.45)
4 years old	3 (3.95)	58 (76.32)	11 (14.47)	4 (5.26)
5 years old	5 (4.03)	75 (60.48)	29 (23.39)	15 (12.10)
Amount	8 (3.50)	153 (66.81)	48 (20.96)	20 (8.73)

Table 3. Prevalence of dental caries according to categories of body mass index of preschool children, Bauru, São Paulo, Brazil, 2010 (n = 229)

BMC	Caries free (%)	dmft (sd)	SiC Index (sd)
Thiness	37.50	4.00 (3.66)	7.67 (0.57)
Normal weight	57.52	1.60 (2.79)	4.53 (3.21)
Overweigh	68.75	1.27 (2.58)	3.81 (3.25)
Obesity	55.00	1.95 (3.46)	5.29 (4.19)

time in Brazil[24], so, there is a need to incorporate in the country's public policies a new concern for children's healthcare, food and nutrition. Such a change in nutritional status appears to be related to changes in lifestyle and food habits of the population. Among the causes attributed to the reduction in the nutritional deficits in children in Brazil can be cited the increase in family income, expanding coverage of basic sanitation services, public health policies and education as well as the offer of food supplement programs[24].

The results of this study showed that 66.81% of the examined children were within the normal range of body mass. One possible explanation for the observed result with the highest percentage of obese children in the 5-year-old group compared to 3 and 4 as well as the reducing of the percentage of overweight children from 3 to 4 years of age and the increasing in the 5-year-old group is that the preschool children present two distinct phases of growth spurt, one between 2 and 5 years of age and a slower growth between 5 and 7 years of age, with higher energy accumulation in this phase[15]. Another possible explanation is that there has been in the country an increase in the percentage of overweight and obesity and reduced nutritional deficiencies called epidemiological transition[25].

Moreover, the study conducted by Guimarães, Barros[25], in public schools, reported the absence of nutritional deficiencies in the studied population and found a prevalence of overweight from 5.70% in the preschool children examined, while boys showed a lower prevalence than girls.

The relationship between nutritional status and oral health is not well understood. Study have shown that malnutrition during tooth development may lead to an increased susceptibility to dental caries due to defects in teeth formation (deciduous and permanent), delayed eruption and change in salivary glands[26].

The results of this study showed no statistically significant relationship between body mass index (BMI) and DMFT (P = 0.088), and components such as decay (P = 0.141), missing (P = 0.470) and fillings (P = 0.328). And neither has it found any correlation among preschool children with malnutrition (P = 0.538), normal (P = 0.252), overweight (P = 0.151) and obesity (P = 0.303) and DMFT.

Similarly, a study conducted with adolescents assessed the relationship between BMI and DMFT in public and private schools and it was found that the distribution of BMI in adolescents was normal in 55.93%, underweight 35.59%, pre-obese by 8.47% in private schools. There was no correlation between increased BMI and the increment of DMFT[27]. Moreover, the results of a research carried out by Silva in 2005 found out that 22.20% of preschool children were overweight and 13.80% were obese[28].

In the present study, it has been observed an increase in the percentage of caries-free children by increasing the nutritional status. Additionally, a reduction in the DMFT with increased body mass index was observed. Similarly, a study conducted in Diadema, State of São Paulo, Brazil, with 1,018 children between 12 and 59 months old found out that those children with low weight for their age were 5.58 times more likely to have early childhood caries than those with normal weight[29].

Meanwhile, a study conducted in Germany, noted that there was a reduction in the percentage of caries-free with increasing BMI, where 44.70% of underweight children were caries free, 40.70% of infants with normal weight, 31.00% of children were overweight and 31.70% of children were obese. Regarding the DMFT, it was observed in underweight children a DMFT of 0.38, in children with normal BMI a DMFT of 0.53, overweight 0.85 and 0.82 in the obese ones. Association was found between BMI and frequency of dental caries in primary teeth[9]. In a study conducted in Mexico with preschool children, approximately 53.70% of the children were classified as normal weight, 14.20% as at risk for overweight, and 32.10% overweight. The logistic regression model showed that there was a significant association between at-risk overweight children (P < 0.001), overweight (P < 0.001) and dental caries. The authors concluded that obese children had more tooth decay than children with normal weight[3]. However the research conducted by Granville-Garcia et al, in 2008 no correlation it was found between obesity and dental caries[10].

However a survey conducted in the United States with children from 2 to 6 years of age, 74.00% of the children were classified as normal weight, 11.00% at risk for overweight, and 11.00% overweight. When dental caries experience was compared between the BMI categories stratified by age and race, a statistically significant association between obesity and dental caries was found only for the age group from 60 to 72 months. According to the authors, there seems no significant association between childhood obesity and caries experience after controlling for age, race and poverty/ income ratio[30].

The mechanism of association between dental caries and obesity is not well understood. One possible explanation is the hypothesis that the association between obesity and tooth decay is caused by the link between the consumption of refined carbohydrates in the development of obesity as well as the development of dental caries[3].

CONCLUSION

The present research revealed that dental caries remains a serious health problem in children in preschool age considering the high prevalence among preschool children studied. This study did not identify a significant correlation between dental caries and nutritional status of the preschool children, however, children with malnutrition showed higher prevalence of dental caries than those with normal nutritional status, overweight

or obesity. Researches should be conducted to elucidate the relationship between inadequate nutritional status and dental caries. Public health programs can be conducted in order to plan strategies for prevention and treatment of nutritional disorders and improvement in standards of oral health.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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