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Oral conditions and body weight in children from a public school in Manaus, AM, Brazil

Condições orais e peso corporal em crianças de uma escola pública de Manaus, AM, Brasil

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Resumo

Introdução: Estudos têm apontado para relações existentes entre prevalência de cárie e doença periodontal e ocorrência de sobrepeso ou obesidade, porém poucos estudos foram conduzidos em crianças. **Objetivo:** Avaliar a relação entre doença periodontal, cárie e peso corporal em crianças de uma escola pública de Manaus – AM, Brasil. **Material e método:** Cento e sessenta e nove crianças foram incluídas no estudo. Registros foram obtidos, tais como, dentes cariados, perdidos e obturados na dentição permanente (CPO-D) e cariados, com extração indicada e obturados em decíduos (ceo), além do registro do índice periodontal comunitário (CPI). A classificação da categoria de peso corporal foi obtida em percentil pela tabela Escore-z. **Resultado:** Maiores médias de peso e índice de massa corporal (IMC) foram verificados nos grupos com sobrepeso e obesidade ($p<0,05$). Todos os grupos foram semelhantes com relação aos códigos do CPO-D/ceo e CPI de 0 a 4 ($p>0,05$). Todos os grupos apresentaram maiores médias de CPI 0 em comparação aos demais códigos CPI de 1 a 4 ($p<0,05$), ou seja, a maioria das crianças apresentou sítios com profundidade de sondagem <3,5 mm e sem sangramento à sondagem. **Conclusão:** Não houve relação entre o peso corporal com a ocorrência de cárie dental e doença periodontal nessa população estudada. A obesidade e o sobrepeso não mostraram influência negativa para o aumento da prevalência dessas doenças.

Descritores: Doença periodontal; cárie dental; peso corporal; obesidade; criança.

Abstract

Introduction: Some studies have pointed to links between the prevalence of caries and periodontal disease, and the occurrence of overweight or obesity; but, few studies have been conducted in children. **Objective:** To assess the relationship between periodontal disease, tooth decay and body weight in children from a public school in Manaus, AM, Brazil. **Material and method:** The study included one hundred and sixty-nine children. Records were obtained of decayed, missing and filled (DMFT) permanent teeth, and of decayed, extracted, or filled (DEF) deciduous teeth, as well as the record of the community periodontal index (CPI). The classification of body weight category was obtained in percentile using the z-Score table. **Result:** Higher averages of weight and body mass index (BMI) were seen in the overweight and obesity groups ($p<0.05$). All groups were similar regarding the DMFT /DEF and CPI codes from 0 to 4 ($p>0.05$). All groups showed higher averages of CPI 0 in comparison with other CPI codes from 1 to 4 ($p<0.05$), and most of the children showed sites with probing depth <3.5 mm and without bleeding on probing. **Conclusion:** There was no relationship between body weight and the occurrence of dental caries and periodontal disease in the studied population. Obesity and overweight showed no negative influence on the increase in the prevalence of these diseases.

Descriptors: Periodontal disease; dental caries; body weight; obesity; child.

INTRODUCTION

Periodontal disease is considered an infectious pathology that causes an inflammatory process which can destroy the tissues that support the teeth. Local, environmental and systemic factors can modulate individual response to the aggressor agent, in which the immune system plays an important role because it recognizes pathogens and helps fight established infections. Immune-inflammatory response may result in tissue lesion, leading to tissue fiber decomposition and alveolar bone reabsorption[1].

In addition to periodontal disease, another important oral pathology is dental decay, which has a multifactor etiology and leads to destruction within the dental cavity due to a demineralization process caused by cariogenic pathogens that use the substrate of a diet rich in sugar. High intake of carbohydrates such as fructose and sucrose, among others, is one of the leading causes of dental caries[2].

Both oral pathologies, periodontitis and dental decay, have a high incidence in the population and some studies have shown a higher prevalence of these conditions in individuals with high body mass index (BMI). Obesity is considered a chronic, complex and multifactorial condition, and it is related to lifestyle, hyper-caloric diet, sedentary lifestyle, as well as endocrine and/or metabolic disorders, resulting in the increase of hip and abdominal circumference and alterations of body weight[3]. Fat tissue is metabolically active, and it is able to produce pro-inflammatory cytokines or adipokines, such as the inhibitor of plasminogen activator, which increase the risk for vascular diseases due to the decrease in blood flow, which could explain one of the mechanisms involved in the exacerbation of the severity and progression of periodontal diseases[4]. Scientific evidence gathered in studies with animals and in some clinical trials has suggested that obesity might be an indicator of progression of periodontal disease. The first study to identify this possible relation was carried out by Perlstein, Bissada[5], and it showed higher bone loss in obese mice compared to non-obese ones. A recent meta-analysis showed that obese individuals may present 33% more chance of developing periodontitis than non-obese ones[6].

The prevalence of obesity has increased rapidly worldwide. In Brazil, the Family Budget Research, carried out by the Brazilian Institute of Geography and Statistics[7], showed rapid overweight growth in children between 5 and 9 years of age, and that the number of overweight children has more than doubled between 1989 and 2008/2009. Moreover, the number of obese individuals has grown by more than 300% in this age range, which is staggering.

Most studies associating periodontal disease and obesity were published using information about young people and adults[8-10]. In Katz, Bimstein's[11] systematic review, it became evident that few clinical studies had been carried out with children in specific age ranges, and some studies included children and adolescents in a single sample. Thus, the objective of this study was to assess the relationship among periodontal disease, dental decay and body weight in children from a public school in Manaus, AM, and to evaluate if overweight and obesity contribute to the increase in the prevalence of these conditions.

MATERIAL AND METHOD

This is a cross-sectional, observational study that involved 200 children, ranging from 9 to 12 years of age, from the municipal public school Maria das Graças, in Manaus, AM. The selected school is part of the Health at School Program (Programa Saúde na Escola (PSE), carried out by the Ministry of Health. The school principal was informed about the aim of the study and, after it was approved, the children's parents or guardians received and signed a free consent form, approved by the Research Ethics Committee at the *Centro Universitário da Fundação Educacional de Barretos – UNIFEB* (protocol n.º 011/2012). Participation in the research was voluntary and the evaluations were made from December 2013 to June 2014.

All 9 to 12 year-old children who studied in the morning were enrolled. The exclusion criteria were: children with systemic diseases (related by the parents in the anamnesis); children who were using, at the time of the study or during the month prior to it, antibiotics or local or systemic anti-inflammatory drugs; children whose parents did not sign for their voluntary participation in the study; children who wore braces, and children who quit school. Out of 200 children invited to take part in the study, 169 were included and 31 were excluded for various reasons.

Caries Index

The DMFT is an index standardized by the World Health Organization-WHO[12], that it is widely used to characterize oral health. The adapted version, which considers only the dental crown, was used for this study. The DMFT index was used for the permanent dentition, where "D" stands for decayed, "M" stands for missing (due to caries or other reasons), and "F" stands for filled. The *DEF* index was used for deciduous dentition, where "D" stands for decayed, "E" stands for extraction indication, and "F" stands for filled. Indexes were measured with natural light and using a disposable wooden spatula. During clinical assessment, children were seen by a single examiner, previously calibrated and trained for the clinical consultation (SPA). Teeth were considered decayed when there was a fossula/fissure, either on a cavitated smooth surface or on a surface with temporary restoration, or having permanent restoration with cavitated areas. Teeth were considered filled when there were permanent restorations, with no evidence of caries. Teeth were considered missing when they were extracted because of caries or for other reasons such as agenesis, orthodontic extractions, periodontal disease or trauma, among others.

Community Periodontal Index (CPI)

The exam was performed by a duly calibrated and trained (SPA) examiner, using World Health Organization (WHO)[12] probes. The probes present, as a unique feature, a coded area in black, which measures 3.5 mm to 5.5 mm, and a 0.5 mm diameter ball-point. This index measures the basic need for periodontal treatment in individuals younger than 20 years by assessing six indexes in teeth, one in each sextant: 16, 11, 26, 36, 31 and 46, or substitute deciduous teeth 55, 51, 65, 75, 71 and 85. The classification of each tooth was done considering: 0) absence of bleeding on probing and colored stripe completely visible; 1) bleeding on probing and

colored stripe completely visible; 2) presence of calculus and/or plaque retentive factors and colored stripe completely visible; 3) colored stripe partially visible, representing periodontal pockets between 4-5 mm; 4) colored stripe no longer visible, representing periodontal pockets ≥6 mm; and X) excluded sextant (when fewer than two teeth present).

Bleeding on Probing (BOP)

BOP was verified after about a 30-second clinical probing[13]. Codes: 0 = absence of bleeding; 1 = presence of bleeding.

Body Mass Index (BMI)

The World Health Organization[14] formula, weight (kg)/height^2 (m), was used to determine BMI. The children's weight was measured using a mechanical platform scale set on a flat, firm and smooth surface, and it was placed far from a wall. The scale was calibrated and assessed by INMETRO (National Institute of Metrology, Standardization and Industrial Quality). The children were weighed barefoot, standing erect, facing the scale, arms stretched and feet apart. Height was measured using a stadiometer attached to the scale. To do so, the children stood barefoot, with their backs to the scale, arms stretched and feet together.

Body Weight Classification

For the final body weight classification, the intersection points in the WHO[15] percentile Escore-z table were considered. The vertical axis represents BMI (kg/m^2), and the horizontal axis represents age (years). The classification was considered as follows: Leanness (≥Escore-z -3 and <escore-z -2), Normal or eutrophic weight (≥Escore-z -2 and ≤Escore-z +1), Overweight (≥Escore-z +1 and ≤Escore-z +2) and Obesity (≥Escore-z +2 and ≤Escore-z +3), according to the child's gender.

Statistical Analysis

Data were entered into an Excel spreadsheet and submitted to statistical analysis using the software BioEstat 5.0® (Belém, PA, Brazil), with a significance level of 5%. The Chi square test was used to test differences between genders. The Kruskal-Wallis test was used to detect differences between the means in the sample descriptive data, intra and inter groups, from different categories of body weight.

RESULT

Two-hundred children were selected and 31 were excluded because they did not meet the inclusion criteria, leaving a total of 169 children in the study. The allocation of the study sample according to body weight and gender made it possible to verify that the category of body weight was similar for both genders, with roughly the same number of boys and girls in each group (p = 0.7376). For the categories of body weight; obese, overweight, normal and lean, the proportion for the boys was 5 (41.7%), 18 (60%), 63 (52.1%) and 3 (50%), respectively. The proportion for the girls was 7 (58.3%), 12 (40%), 58 (47.9%) and 3 (50%), respectively. The median (standard deviation) age of the study population was 10.08 (1.00).

Table 1 shows sociodemographic, clinical and anthropometric descriptive data. It could be seen that there were no significant differences between the groups with regard to age, height, number of teeth and number of sites with BOP (p>0.05). Regarding anthropometric measurements, it was found that overweight and obese individuals presented statistically significant higher means of weight and BMI than the normal weight or lean ones (p<0.05). The distribution of the DMFT index for each category of body weight is shown in Table 2. All groups (obese, overweight, normal and lean) were similar regarding DMFT/DEF, with no statistically significant differences (p>0.05). All groups presented a higher frequency of healthy permanent teeth, compared to the other DMFT/DEF codes (p<0.05).

Table 3 shows low prevalence of decay in the permanent (D) and deciduous (d) teeth; low prevalence of missing permanent teeth, low prevalence of teeth with extraction indication in the deciduous teeth, low prevalence of filled teeth in the permanent (F) and deciduous (f) teeth in all groups, with a total percentage of only 4.6%, 0.02%, 2.0% and 1.45%, respectively. Moreover, it is possible to verify the high prevalence of healthy permanent (H) and deciduous (h) teeth in all groups.

Table 4 shows that all groups (obese, overweight, normal and lean) were similar in regard to the CPI index, 0 to 4, with no statistically significant differences (p>0.05). Regarding CPI indexes in each group, it was found that all groups presented higher means of CPI 0 when compared to the other codes (CPI 1 to 4) (p<0.05), meaning that most children presented sites with Probing Depth <3.5 mm, no BOP and no dental calculus.

Table 1. Descriptive data of the sample (mean ± standard deviation)

	Obese	Overweight	Normal	Lean	p-value
Age (years)	9.9 ± 0.9 [a]	10.1 ± 0.9 [a]	10.1 ± 1.0 [a]	9.8 ±1.3 [a]	0.7312
Weight (Kg)	46.45 ± 5.5 [a]	39.75 ± 6.0 [a]	31.5 ± 6.0 [b]	23.5 ± 3.9 [c]	<0.0001*
Height (m)	1.4 ± 0.07 [a]	1.4 ± 0.07 [a]	1.4 ± 0.07 [a]	1.35 ± 0.05 [a]	0.2018
BMI (kg/m^2)	24.2 ± 2.1 [a]	20.2 ± 1.35 [a]	16.7 ± 1.8 [b]	12.8 ± 1.4 [c]	<0.0001*
Number of teeth	24 ± 1.2 [a]	24.1 ± 1.9 [a]	23.9 ± 2.3 [a]	22 ± 3.2 [a]	0.5143
Number of sites with BOP	0.75 ± 2.6 [a]	3.1 ± 4.8 [a]	2.6 ± 5.8 [a]	5.8 ± 9.3 [a]	0.3411

Different letters on the lines represent statistically significant differences among groups (Kruskal-Wallis test). *p<0.0001. BOP = Bleeding on Probing; BMI = Body Mass Index.

Table 2. Distribution of DMFT/DEF indexes in each group - (mean ± standard deviation)

Codes DMFT /def	Obese	Overweight	Normal	Lean	p-value
D	0.5 ± 0.8 $^{\alpha a}$	0.6 ± 0.9 $^{\alpha a}$	0.7 ± 1.1 $^{\alpha a}$	1.0 ± 2.4 $^{\alpha a}$	0.8936
M	0 ± 0 $^{\alpha a}$	0.03 ± 0.2 $^{\alpha a}$	0 ± 0 $^{\alpha a}$	0 ± 0 $^{\alpha a}$	0.9939
F	0.25 ± 0.6 $^{\alpha a}$	0.3 ± 1.1 $^{\alpha a}$	0.2 ± 0.6 $^{\alpha a}$	0.2 ± 0.4 $^{\alpha a}$	0.9730
Healthy	17.25 ± 4.9 $^{\beta a}$	18.6 ± 5.0 $^{\beta a}$	18.4 ± 5.6 $^{\beta a}$	16.0 ± 6.6 $^{\beta a}$	0.8367
d	0.25 ± 0.45 $^{\alpha a}$	0.2 ± 0.5 $^{\alpha a}$	0.4 ± 0.9 $^{\alpha a}$	1.2 ± 1.8 $^{\alpha a}$	0.7243
e	0.3 ± 0.8 $^{\alpha a}$	0.2 ± 0.5 $^{\alpha a}$	0.3 ± 0.8 $^{\alpha a}$	0 ± 0 $^{\alpha a}$	0.8653
f	0± 0 $^{\alpha a}$	0.3± 0.65 $^{\alpha a}$	0.1 ± 0.4 $^{\alpha a}$	0.2 ± 0.4 $^{\alpha a}$	0.6983
Healthy	5.5 ± 4.9 $^{\alpha a}$	3.5 ± 4.1 $^{\alpha a}$	3.6 ± 3.9 $^{\alpha a}$	3 ± 2.9 $^{\alpha a}$	0.5314

DMFT: decayed, missing and filled permanent teeth (DMFT/permanent teeth); def: decayed, with extraction indication and filled deciduous teeth. $^{\alpha, \beta}$ Different symbols in the columns indicate statistically significant differences among DMFT codes within the group (Kruskal-Wallis test followed by Dunn; P<0.05 indicates statistically significant difference). ^{a} Same letters in the lines indicate statistically non-significant differences among the groups (Kruskal-Wallis test; P>0.05).

Table 3. Distribution of the sample according to findings in permanent and deciduous teeth

Body weight	Subjects	Total of teeth	Decayed (D+d)	Missing Permanent teeth	Extraction Indicated deciduous teeth	Filled (F + f)	Healthy teeth (H + h)
			n (%)	n (%)	n (%)	n (%)	n (%)
Obese	12	289	9 (3.1)	0 (0)	4 (1.4)	3 (1.0)	273 (94.5)
Overweight	30	723	25 (3.45)	1(0.1)	14 (1.9)	18 (2.5)	665 (92)
Normal	121	2902	140 (4.8)	0(0)	63 (2.2)	36 (1.2)	2663 (91.8)
Lean	6	132	13 (9.8)	0 (0.0)	1 (0.75)	2 (1.5)	116 (87.9)
Total	169	4046	187 (4.6)	1(0.02)	82 (2.0)	59 (1.45)	3717 (91.9)

D + d: decayed permanent and deciduous teeth, respectively; F + f: filled permanent and deciduous teeth, respectively; H + h: healthy permanent and deciduous teeth, respectively .

Table 4. Frequency of sextants with Community Periodontal Index (CPI) in each group - (mean ± standard deviation)

CPI	Obese	Overweight	Normal	Lean	p-value
0	5.8 ± 0.6 $^{\alpha a}$	4.7 ± 1.8 $^{\alpha a}$	5.2 ± 1.6 $^{\alpha a}$	4.2 ± 2.4 $^{\alpha a}$	0.0602
1	0.2 ± 0.6 $^{\beta a}$	1.1 ± 1.6 $^{\beta a}$	0.65 ± 1.4 $^{\beta a}$	1.8 ± 2.4 $^{\alpha a}$	0.2192
2	0 ± 0 $^{\beta a}$	0.2 ± 0.5 $^{\beta a}$	0.15 ± 0.6 $^{\beta a}$	0 ± 0 $^{\alpha a}$	0.8972
3	0 ± 0 $^{\beta a}$	0 ± 0 $^{\beta a}$	0 ± 0 $^{\beta a}$	0 ± 0 $^{\alpha a}$	1.00
4	0 ± 0 $^{\beta a}$	0 ± 0 $^{\beta a}$	0 ± 0 $^{\beta a}$	0 ± 0 $^{\alpha a}$	1.00

$^{\alpha, \beta}$ Different symbols in the columns indicate statistically significant differences among CPI codes within the group (Kruskal-Wallis test followed by Dunn; P<0.05 indicates statistically significant difference). ^{a} Same letters in the lines do not indicate statistically significant differences among the groups (Kruskal-Wallis test; P>0.05).

DISCUSSION

Results show low prevalence of overweight (17.7%) and obesity (7.1%) in this sample of children from the northern region of Brazil. This can be explained by their diet, since dietary habits in this region of Brazil, especially in Manaus, are different from other regions of the country. They eat fish frequently, whereas in the south of Brazil, for example, there is a high intake of frozen and industrialized food[7]. Also, data from IBGE[16] have shown that both overweight and obesity are more prevalent in the southern region of Brazil than in the north, which can be directly related to dietary habits and physical activity routines.

In this study, it was not possible to verify any relationship between caries and periodontal disease in the overweight and obese children assessed. However, the aim of this study was not to report how obesity may act on periodontal disease by means of the biological mechanisms involved, but to observe the effect of body weight on the oral condition of the children by assessing the prevalence of caries and periodontal disease in this sample.

Although the association between caries and obesity could not be verified in this study, a recent systematic review[17] found a small global association between obesity and level of caries in permanent dentition in obese children when compared to those with normal weight. However, no association was found between obesity and

caries in the deciduous dentition. Other studies could not find any association between body weight and prevalence of caries[18,19] either, which agrees with our findings. On the other hand, other findings showed that obese individuals had more carious surfaces than those with normal weight[20].

The low prevalence of caries in our study can be explained by the fact that the public school selected is part of the Health at School Program (Programa de Saúde na Escola, PSE). In this program a dentist frequently lectures about diet and oral hygiene practices, and also acts on the supervised brushing of the teeth, with topical fluoride applied on the children's teeth. This program is important because Manaus is not supplied with fluoridated water, as are some cities in other regions of the country. Hence, it is important to highlight that this group of children is overseen by the PSE, a project run by the Ministry of Health, which acts on the control of oral diseases. This also explains the low prevalence of periodontal disease in this population.

Several studies have shown a positive correlation between periodontitis and obesity in adults[21-23]. However, few studies have been carried out in groups of children in specific age ranges[11], which confirms the importance of this study. In the present study, no positive association between body weight and gingival inflammation in the children was found, a fact that supports a study carried out in the southern region of Brazil. In that study[24], the authors did not find any association between gingivitis and overweight/obesity in the total sample of children, aged 8 to 12. However, it was noteworthy that boys were more likely than girls to have this association.

On the other hand, other findings verified a positive association between gingival inflammation and obesity in children and adolescents[20,25]. The study by Franchini et al.[25] also showed a significant effect of obesity on children and adolescents, aged 10 to 17, and stressed that this association may be the result of a combination of metabolic inflammation and poor oral hygiene.

Our results may be related to several limitations of this study. It is a cross sectional study, carried out over a short period of time. Therefore, it was not possible to determine the causal factor, and interpretation of the results is limited to observation and collection of data at a single moment. Moreover, the sample is relatively small, and from a single school.

Further studies are needed in order to perform some exams such as the gingival crevicular fluid flow to assess pro inflammatory cytokines, as well as microbiological and metabolic analyses during the pre-pubertal phase in children, insulin resistance, and circulating pro-inflammatory factors. Such exams would better elucidate the mechanisms involved in the relationship between obesity and periodontal disease in this population.

CONCLUSION

It can be concluded that there was no relationship between body weight and the occurrence of dental decay and periodontal disease in this population. Obesity and overweight showed no negative influence on the prevalence of these diseases.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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