ORIGINAL ARTICLE

Caries and Body Mass Index, What Relation?

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Abstract

Introduction: The prevalence of overweight and obesity is increasing in pediatric age and that is traditionally associated with worse oral health. However, in the literature this association is controversial. We intend to characterize the prevalence of overweight, obesity and caries in a pediatric population and check for an association between caries and body mass index.

Methods: Retrospective study of children aged 5 years or older, followed in a primary care unit in Lisbon. Demographic data such as age and sex, anthropometric data (height, weight and body mass index with percentile) and presence or absence of caries were analyzed.

Results: A sample of 1,398 children with an average age of 9.96 ± 3.39 years at the last visit was obtained, without gender predominance. In relation to the body mass index percentile, 3.1% had < 3, 72.0% between 3-85, 14.7% between 85-97 and 10.2% > 97. Only 730 clinical records referenced oral health, with a caries prevalence of 59.5%. There was a statistically significant association between the body mass index percentile < 3 and caries (p = 0.004; odds ratio 4.27, confidence interval 95% 1.47-12.48) that was independent of age.

Discussion: These results reveal that approximately one in four children are overweight or obese and three in five have caries. Body mass index percentiles < 3 are associated with a higher prevalence of caries. It is vital to continue to promote healthy lifestyles in all primary care consultations.

Keywords: Adolescent; Body Mass Index; Child; Dental Caries/epidemiology; Dental Caries/etiology; Overweight; Pediatric Obesity; Portugal

Introduction

In recent years, there has been an increase in the prevalence of overweight/obesity (OW/OB) in pediatric age, which is currently considered a global epidemic by the World Health Organization (WHO).[1] The presence of OW/OB predicts the existence of obesity in adulthood and it is associated with several comorbidities such as high blood pressure, dyslipidemia, type 2 diabetes mellitus, cardiovascular and cerebrovascular disease, obstructive sleep apnea syndrome, among others.[1-3]

Classically, it is considered that there is an association between OW/OB and worse oral health, with a higher incidence of dental caries, periodontal disorders and tooth loss. However, the association between OW/OB and the presence of dental caries is controversial in the literature. In a Spanish systematic review conducted in 2013, of the 37 articles analyzed, an association between the body mass index (BMI) and dental caries was found in 19 studies with a direct association in 14 studies and an inverse association in five studies, whereas there was no statistically significant association in 18 studies.[1] In another Australian systematic review conducted in 2012, of the 49 articles analyzed, 23 studies did not reveal any association, 17 studies revealed a direct association and nine studies revealed a reverse association.[4]

Risk factors involved in the development of dental caries are often the same as those involved in the development of OW/OB, namely diet-related and lifestyle factors. Both situations represent substantial health expenditure and are key aspects of child and adolescent health routine follow-up.

Following the implementation of several national strategies under the national oral health promotion program, the prevalence and severity of dental caries has decreased in recent years.[5] However, dental caries remain both the most common chronic disease in pediatric age and a major public health problem.[5,6]

This study aims to characterize the prevalence of OW/OB and dental caries in a pediatric population and to evaluate if there is an association between BMI and the presence of dental caries.

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Methods

A retrospective study including all children aged 5 to 18 years followed in a family health unit in Lisbon and whose last child health visit had occurred after they reached the age of 5 was conducted. Demographic data such as age and gender, anthropometric data such as height, weight and BMI with the respective percentile (P) and the presence or absence of dental caries in the last child health visit were analyzed. This was done by consulting the electronic medical record in SClínico®. Both the medical and nursing records were consulted.

The BMI was calculated using weight in kilograms divided by height in meters squared. The BMI percentile was evaluated according to the 2007 BMI percentile charts from the WHO. A BMI percentile between 85 and 97 and a BMI percentile above 97 were considered to be overweight and obese, respectively.

The presence of dental caries, dental abscess or teeth treated for dental caries was assessed in the records.

The statistical analysis was conducted using IBM SPSS®, version 21. A descriptive analysis of the variables was made. Categorical variables are presented as frequencies and percentages and continuous variables as means and standard deviations, whenever they have a normal distribution or with median and interquartile range, when the distribution is not normal, as verified by the Kolmogorov-Smirnov test, Shapiro-Wilk test or asymmetry and flattening tests of variable distribution. The existence of an association between BMI percentile and dental caries, as well as gender and dental caries and age and dental caries, was tested using the chi-square (χ^2) test. In order to estimate the independent effect of gender, age and BMI percentile variables as dental caries predictors, a multiple logistic regression analysis was used. All *p* values presented are for two-sided tests and the level of significance considered was $p< 0.05$.

Results

A total sample of 1,398 children with an average age at the last child health visit of 9.96 ± 3.39 years was obtained. The sample showed no gender predominance, with 701 male children (50.1%) and 697 female children (49.9%). The baseline characteristics of the study sample are represented in Table 1.

The distribution of BMI of the sample was as follows: 3.1% < P3, 11.7% between P3-P15, 29.7% between P15-P50, 30.6% between P50-P85, 14.7% between P85-P97 and 10.2% > P97, with no differences between genders (Table 1). The prevalence of OW/OB was minimal between 5 and 8 years (21.2%) and maximum between 9 and 12 years, having reached 28.3% (Figs. 1 and 2). This difference was statistically significant (χ^2, $p = 0.016$). There was a reference to oral health in the record of the last child health visit in only 730 (52.2%) children, with a total prevalence of dental caries of 59.5% (n = 434). The prevalence of dental caries by age and BMI percentile is represented in Table 2 and in Figs. 3 and 4, respectively. There was a statistically significant increase in the prevalence of age-related dental caries, with a prevalence of 53.9% between 5 and 8 years, 64.3% between 9 and 12 years and 64.7% between 13 and 17 years (χ^2, $p = 0.016$) (Fig. 3).

Table 1. Characteristics of children and adolescents in the sample

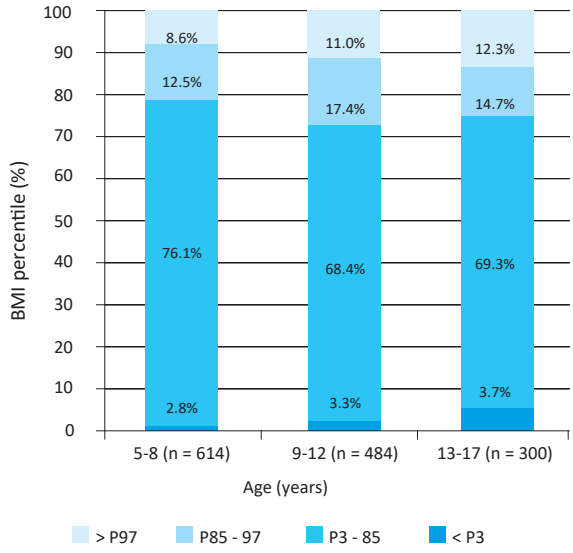
	Male		Female		Total	
	n	%	n	%	n	%
Age (years)	n = 701 (50.1%)		n = 697 (49.9%)		n = 1398	
5-8	335	24.0	279	20.0	614	43.9
9-12	236	16.9	248	17.7	484	34.6
13-17	130	9.3	170	12.2	300	21.5
BMI (percentile)	n = 701		n = 697		n = 1398	
< 3	26	1.9	18	1.3	44	3.1
3-15	89	6.4	74	5.3	163	11.7
15-50	206	14.7	209	14.9	415	29.7
50-85	204	14.6	224	16.0	428	30.6
85-97	104	7.4	101	7.2	205	14.7
> 97	72	5.2	71	5.1	143	10.2
Dental caries	n = 372		n = 358		n = 730	
Yes	228	31.2	206	28.2	434	59.5
No	144	19.7	152	20.8	296	40.5

BMI - body mass index.

Table 2. Prevalence of dental caries by age group and body mass index percentile

		Age (years)			Total
		5-8	9-12	13-17	
BMI (percentile)	< 3	n = 11	n = 11	n = 6	n = 28
		10 (90.9%)	9 (81.8%)	5 (83.3%)	24 (85.7%)
	3-85	n = 266	n = 183	n = 88	n = 537
		135 (50.8%)	116 (63.4%)	55 (62.5%)	306 (57.0%)
	> 85	n = 68	n = 75	n = 22	n = 165
		41 (60.3%)	48 (64.0%)	15 (68.2%)	104 (63.0%)
Total		n = 345	n = 269	n = 116	n = 730
		186 (53,9%)	173 (64.3%)	75 (64.7%)	434 (59.5%)

BMI - body mass index.



BMI - body mass index; P - percentile.

Figure 1. Distribution of the body mass index percentile by age group.

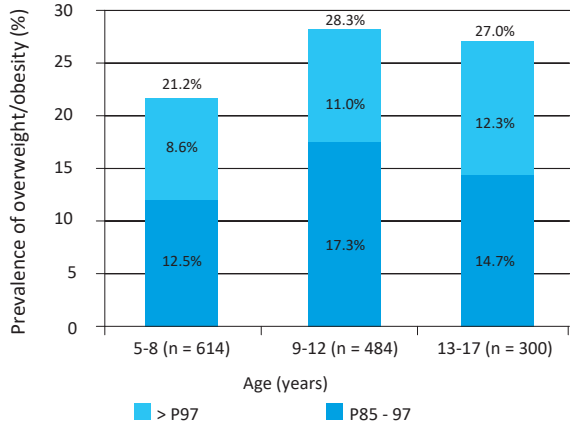


Figure 2. Prevalence of overweight and obesity by age group. There was a statistically significant difference of prevalence of overweight and obesity among different age groups (p = 0.016).

For the prevalence of dental caries according to the BMI percentile, 85.7% of children with BMI < P3, 67.1% with BMI between P3-P15, 55.6% with BMI between P15-P50, 54.6% with BMI between P50-P85, 63.6% with BMI between P85-P97 and 62.1% with BMI > P97 had dental caries (Fig. 4). The differences found in the prevalence of dental caries were statistically significant (χ^2, p = 0.012), with a higher prevalence of dental caries (χ^2, p = 0.004; odds ratio 4.27, confidence interval of 95% (CI95%) 1.47-12.48) for BMI percentiles < 3.

There was no association between the gender and prevalence of dental caries.

The prevalence of dental caries was significantly higher in children with BMI < P3 (odds ratio 3.61, CI95% 1.12-11.67, p = 0.032), regardless of age and gender. On the other hand, this prevalence was lower in the 5-8 year age group (odds ratio 0.63, CI95% 0.41-0.98, p = 0.04), regardless of gender and BMI.

Of the 434 children with dental caries, in 362 there was a reference to the total number of dental caries, being that only one dental caries was found in 74 (20.4%) and more than one dental caries in 288 (79.6%). Regarding the dentition affected, information was only recorded in 113 cases, with the majority affecting the primary dentition (n = 84; 74.3%), followed by permanent dentition in 19 cases (16.8%) and both dentitions in 10 cases (8.9%).

Discussion

Despite the national strategies implemented to reduce the prevalence of overweight, obesity and dental caries, the prevalence found was quite high, with 25% of OW/OB and 60% of dental caries. The values are even more worrying above the age of 9, with a prevalence of OW/OB of 28% between the ages of 9-12 and a prevalence of dental caries of 65% between the ages of 13-17.

According to the latest data published in the study of the Portuguese Association Against Child Obesity, referring to the school year 2016-2017, the prevalence of OW/

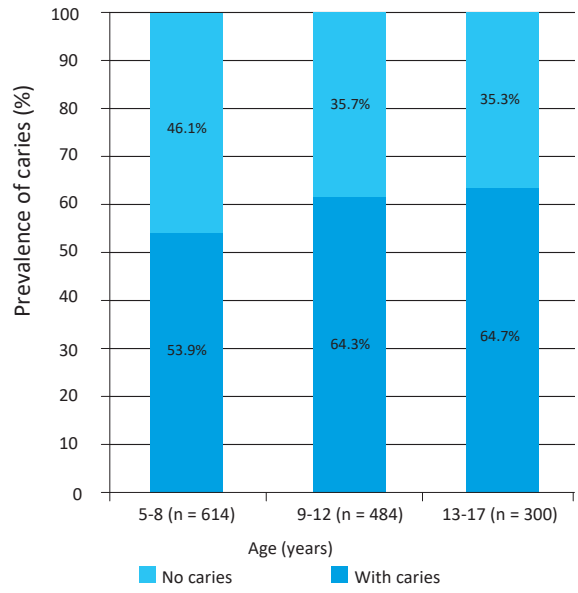


Figure 3. Prevalence of dental caries by age group.

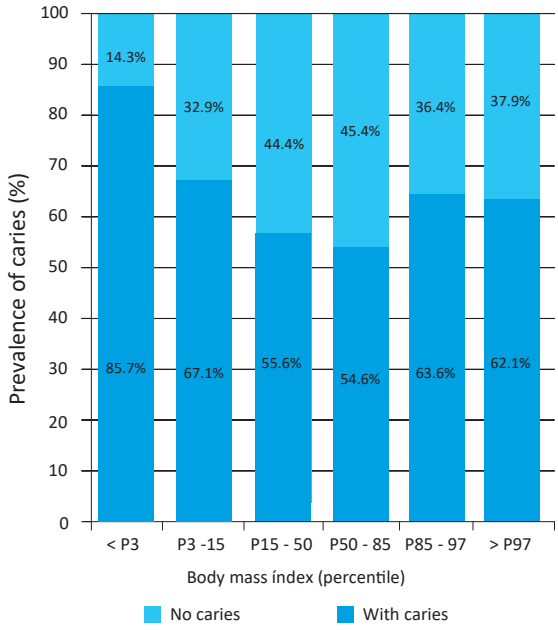


Figure 4. Prevalence of dental caries in different body mass index percentiles.

OB between 2 and 10 years was 28.5%.[7] Compared to these data, the results obtained between 5 and 8 years are more favorable (prevalence of OW/OB of 21%) and between 9-12 years are overlapping (28.3%).

Regarding the prevalence of dental caries, according to the Portuguese study on oral disease prevalence carried out in 2008, the prevalence of dental caries was of 49% at 6 years, 56% at 12 years and 72% at 15 years.[5] Compared to these results, the studied sample showed a higher prevalence of dental caries at 6 and 12 years (54% between 5 and 8 years, 64% between 9 and 12 years) and a lower prevalence at 15 years (65% between 13 and 17 years).

The association between the BMI percentile and presence of dental caries was demonstrated in several studies, although there is controversial data in the literature.[1,4] In the analyzed sample, there was an association between a BMI percentile < 3 and presence of dental caries, regardless of age and gender. In contrast to the literature, there was no association between OW/OB and dental caries, with an increased prevalence of dental caries in the BMI percentile group > 85 compared to the percentile between 3 and 85 probably dependent on the upper mean age of OW/OB patients.

The association between low weight and dental caries was previously demonstrated, namely in Spanish and Australian systematic reviews.[1,4] This association may be explained by the nutritional deficits related to the decrease of food intake, which condition dental enamel hypoplasia.[4,6] In the literature, it is also postulated that protein-energy malnutrition may lead to a change in saliva composition and to a lower salivary flow, which leads to a greater wear of dental enamel.[4,8] Another possible explanation is that children with a lower BMI may eat less consistent main meals, leading to eating more at intervals, in particular foods with more added sugar.[1]

As a limitation of this study we highlight the fact that this is a study with a retrospective data collection, with a number of records with reference to the oral health of only approximately half of the total sample (52.2%). Another study limitation was that no other variables such as the socio-economic group, eating habits, dental hygiene level, among others, were considered.

As strengths of the study, it has a large sample population (1,398 children and adolescents) and it is the first study that seeks to establish an association between the BMI percentile and dental caries in a sample of the Portuguese population.

The prevalence of both OW/OB and dental caries is still very high in this population, despite national efforts to promote healthy lifestyles. This demonstrates the importance of the systematic approach of these topics in child and adolescent health visits and of promoting activities aimed at children and adolescents in the school health programs.

The association between dental caries and lower BMI percentiles leads us to highlight the importance of actively looking for this condition in children with a lower BMI and not to focus only on those OW/OB and/or those who have eating habits with excessive consumption of simple sugars.

Studies with larger sample populations and a greater variety of socio-cultural backgrounds are essential for understanding this association in order to establish new strategies aimed at improving oral health and lifestyles of the Portuguese population.

WHAT THIS STUDY ADDS

- It characterizes a sample of children and adolescents from a family health unit of the Portuguese capital city regarding the prevalence of overweight, obesity and dental caries.
- It establishes an association between dental caries and a body mass index percentile < 3, regardless of age and gender.
- To our knowledge, there is no other study that tries to establish this association in the Portuguese population, so the present study contributes to a better characterization of the Portuguese reality.

Conflicts of Interest

The authors declare that there were no conflicts of interest in conducting this work.

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Consent for publication

Consent for publication was obtained.

Confidentiality of data

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

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Awards and presentations

Previously presented at 18º Congresso Nacional de Pediatria of the Sociedade Portuguesa de Pediatria

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Cáries e Índice de Massa Corporal, Que Relação?

Resumo:

Introdução: Nos últimos anos verificou-se um aumento da prevalência de excesso de peso e obesidade em idade pediátrica, classicamente associada a pior saúde oral. Contudo, na literatura esta associação é controversa. Pretende caracterizar-se a prevalência de excesso de peso, de obesidade e de cáries numa população pediátrica e verificar a existência de associação entre cáries e o índice de massa corporal.

Métodos: Estudo retrospetivo de crianças com 5 ou mais anos seguidas numa unidade de saúde familiar de Lisboa. Foram analisados dados demográficos, como idade e sexo, dados antropométricos (altura, peso e índice de massa corporal com respetivo percentil) e a presença ou ausência de cáries.

Resultados: Obteve-se uma amostra de 1398 crianças com idade média na última consulta de 9,96 ± 3,39 anos, sem predomínio de sexo. Relativamente ao percentil do índice de massa corporal, 3,1% tinham < 3; 72,0% entre 3-85; 14,7% entre 85-97 e 10,2% > 97. Apenas 730 dos registos tinham referência à saúde oral, com uma prevalência de cáries de 59,5%. Verificou-se prevalência de cáries significativamente superior entre as crianças com índice de massa corporal no percentil < 3 (p = 0,004; *odds ratio* 4,27, intervalo de confiança 95% 1,47-12,48), independentemente da idade e sexo.

Discussão: Aproximadamente uma em cada quatro crianças tem excesso de peso / obesidade e três em cada cinco têm cáries. Crianças com índice de massa corporal no percentil < 3 tinham maior prevalência de cáries. É fundamental continuar a promoção de estilos de vida saudáveis em todas as consultas de saúde infantil.

Palavras-Chave: Adolescente; Cárie Dentária/epidemiologia; Cárie Dentária/etiologia; Criança; Índice de Massa Corporal; Obesidade Pediátrica; Portugal; Sobrepeso