

Nutritional status is associated with permanent tooth eruption chronology

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Either obesity and underweight are public health concerns that affect the development of children. **Aim:** The aim of this study was to evaluate whether the nutritional status affects permanent tooth eruption chronology in Brazilian children. **Methods:** A hundred sixty children were examined by a pediatric dentistry and at the clinical examination, the number of erupted permanent teeth was evaluated. The anthropometric measurements of the children were determined, and they were divided into groups: underweight, eutrophic, overweight and obese. The association between delayed tooth eruption and nutritional status groups was evaluated using chi-square test. The Shapiro–Wilk test was used to verify the normality of the data. To compare the mean number of delayed teeth according to nutritional status' groups Kruskal-Wallis test with multiple comparison by Dunn's test was performed. **Results:** Fifty-six children had delayed tooth eruption in at least one permanent teeth and delayed tooth eruption was more common in underweight children than in eutrophic children ($p=0.0091$). **Conclusion:** In conclusion, our study suggests that underweight Brazilian children have a higher incidence of delayed eruption.

Keywords: Tooth eruption. Nutritional status. Children. Dentistry



Introduction

Childhood obesity is a public health concern and has been increasing over the years¹. According to the Brazilian Institute of Geography and Statistics (IBGE), the obesity in Brazilian children ranges from 8.2% and 11.9%, depending on the gender and the geographic region². It is well known that obesity is associated to adversely health issues, including timing of puberty³ and overweight children are taller than non-overweight children at the same age⁴. Nutritional deprivation in children affects the development of most body systems⁵. Some studies have hypothesized that some systemic conditions, such as celiac disease, diabetes mellitus, congenital abnormalities and cancer affect tooth eruption^{1,6-8}.

Tooth eruption consists in the movement of the tooth from the osseous crypt into the oral cavity. This phenomenon could be affected by many factors, including molecular signaling⁹, and hormonal and growth mediators¹⁰. Overweight and obese children have hormonal metabolism alterations¹¹, so it is possible that they have alterations in tooth eruption. It has been demonstrated that obese and overweight children have more erupted teeth when compared to their age-matched peers, suggesting that obese and overweight children's teeth erupt earlier^{1,11}. Although a recent study demonstrated that malnutrition has no effects on the time of tooth formation⁵, previous studies showed an association with delayed eruption of the primary dentition¹² and of the permanent dentition in underweight children⁶. Nevertheless, this relationship between effects on eruption time and childhood nutritional status is still unclear. Therefore, the aim of this study was to evaluate an association between childhood nutritional status and permanent tooth eruption chronology.

MATERIALS AND METHODS

Ethical and sample

This study was submitted and approved by Ethics Committee of School of Ribeirão Preto of University of São Paulo (#35323314.7.0000.5419). All parents or caregivers were informed about the study and signed an informed consent.

The sample was collected in the School of Dentistry of Ribeirão Preto. The studied population is a convenience sample, with no sample size calculation, and thus, reflect the characteristics of the pediatric population that sought for dental treatment from 2014 to 2016. The parents/caregivers answered a sociodemographic questionnaire, and provided information about the children's characteristics and habits.

Clinical examination

A hundred sixty children of both sexes, aged 6-13 years old were clinically examined by an experienced pediatric dentist. Clinical examinations were performed in sitting chairs in the dental office under artificial light. At the clinical examination, the number of erupted permanent teeth was evaluated. Tooth eruption was defined as having occurred if any tooth surface had emerged the alveolar mucosa⁶.

Children that presented factors that could alter the tooth eruption, leading to dental impaction such as odontoma, cysts, dental agenesis and supernumerary teeth were

excluded after dental radiographs were taken. Children with syndromes or oral cleft were also excluded. Canines were not included on the analysis regarding their high rate of impaction^{13,14}.

The delayed permanent tooth eruption was considered according to a scale designed for Brazilian children according to the gender¹⁵. Tooth delayed was considered when the children had at least one delayed permanent tooth eruption according to the suggested chronology.

Anthropometric measurement

The children's heights were determined in meters. Also, a digital weighing machine was used to determine the children's weight in kilograms while they were wearing light clothes and no shoes. The Body Mass Index (BMI) z-score was calculated by the Pediatric Z-Score Calculator of The Children's Hospital of Philadelphia (<http://zscore.research.chop.edu/index.php>) using individual height, weight, age and gender as variables. The nutritional status was classified according to the World Health Organization (2006) as follows:

- BMI z-score < -2; percentile < 3: underweight;
- BMI z-score ≥ -2 and $\leq +1$; percentile ≥ 3 and ≤ 85 : eutrophic;
- BMI z-score $> +1$ and $\leq +2$; percentile > 85 and ≤ 97 : overweight;
- BMI z-score $> +2$; percentile > 97 : obese.

Statistical Analysis

Data were analyzed using Epi Info 7 (Epi Info 7 software, Atlanta, GA, USA). Comparisons were performed between 'eutrophic', 'underweight', 'overweight' and 'obesity' groups. Chi-square or Fisher's exact tests for the dichotomous variables. Odds ratio was used to calculate the relative risk among these groups. The Shapiro-Wilk test was used to verify the normality of the data. To compare the mean number of delayed teeth according to nutritional status' groups Kruskal-Wallis test with multiple comparison by Dunn's test was used. The established alpha was 5%.

Results

A hundred sixty children were evaluated, 82 boys (51.25%) and 78 girls (48.75%). The mean age was 8.88 (sd 2.02). The characteristics of the studied population is presented on the Table 1.

Table 1. Characteristics of the studied children.

Characteristics	Groups				p-value
	Eutrophic	Underweight	Overweight	Obese	
Age mean (sd)	8.97 (2.08)	8.00 (1.63)	8.92 (1.92)	8.25 (2.00)	0.54
	Gender n (%)				
Male	57 (69.5%)	2 (2.5%)	15 (18.2%)	8 (9.7%)	0.19
Female	47 (60.2%)	2 (2.4%)	25 (32.0%)	4 (5.1%)	

The z-score of the evaluated children ranged from -2.93 to 2.62, and the percentile from <1 to >99. Four (2.5%) of the children were underweight; 104 (65%) were eutrophic; 40 (25%) were overweight, and 12 (7.5%) were obese.

Fifty-six children (35%) had delayed tooth eruption in at least one permanent teeth, out of those 26 (46.4%) were girls and 30 (53.6%) boys, and there was no statistical difference ($p=0.33$).

The association between tooth eruption and the nutritional status is presented on table 2. Delayed tooth eruption was more common in underweight children than in eutrophic children ($p=0.0091$). The number of delayed erupted teeth ranged from 1 to 10, with the mean of 2.63 (sd 1.83). Figure 1 shows the mean number of delayed erupted teeth according to each group. The mean number of delayed teeth in eutrophic children was 0.92 (sd 1.50), for underweight children 1.75 (sd 0.50), for overweight children 1.07 (sd 2.18) and for obese children 0.16 (sd 0.38). Underweight children had more delayed teeth and a statistical difference was observed between underweight and children ($p<0.05$).

Table 2. Association between delayed tooth emergence and the nutritional status

Nutritional status	Without delayed tooth eruption n (%)	With delayed tooth eruption n (%)	p-value	OR (95% IC)
Eutrophic	67 (64.4%)	37 (35.6%)	Reference	Reference
Underweight	0 (0%)	4 (100%)	0.0091*	Undefined
Overweight	27 (67.5%)	13 (32.5%)	0.72	0.87 (0.40–1.89)
Obesity	10 (83.33%)	2 (16.67%)	0.33	0.36 (0.07–1.14)

Note: *indicates statistics significance; all comparisons were related to eutrophic

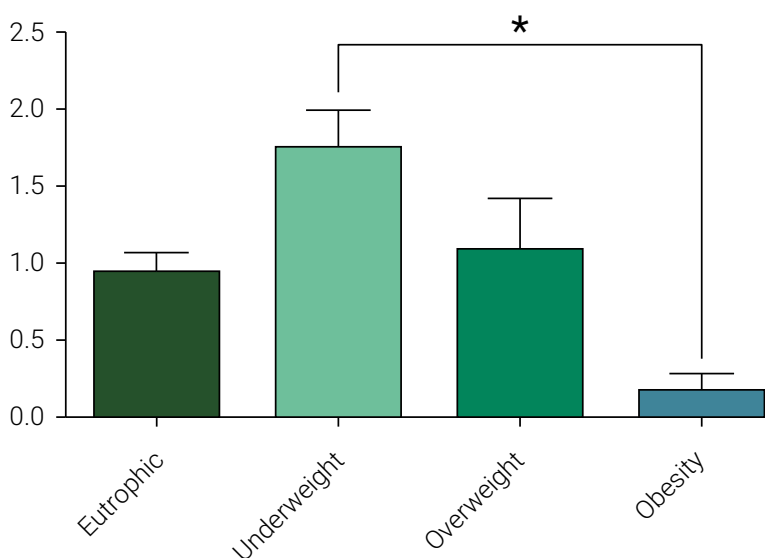


Figure 1. Mean number of delayed teeth according to the nutritional status. * indicates statistical significance.

Discussion

The health burden from obesity and malnutrition is the driving factor behind several research studies regarding the impact of nutritional status alterations on oral health. Many studies attempted to evaluate associations between oral issues and overweight/obesity, but studies evaluating those issues associated to undernutrition are uncommon. It was previously demonstrated a positive correlation between BMI and decayed, missing and filled teeth (DMFT) in adults¹⁶ and in children^{17,18}, although it has also been demonstrated that overweight children have lower caries index^{11,19}, which might be explained by the fact that those children consume more fatty acids and sugar than eutrophic or underweight children²⁰. Some studies have also proved that obesity is a risk factor for periodontitis^{21,22} and that obese children are more likely to have dental erosion when compared to healthy children²³.

The relationship between the nutritional status and tooth eruption chronology has been evaluated by few studies^{1,6,11,24,25}. Our study found an association between permanent tooth eruption and the nutritional status, in which delayed permanent tooth eruption was more common in underweight children. This association between delayed permanent tooth eruption is supported by other studies^{6,24,25}, and underweight is also associated with delayed eruption of primary teeth¹². In contrast the literature supports that obese children have teeth erupted earlier than non-obese¹, which can be due to their earlier puberty³. In our study, although earlier teeth eruption was more frequent in obese children, we were not able to observe a statistical difference. This might be explained by the low frequency of obesity in our population. It is possible that our result is a false-negative. It is well known that results from small samples sizes may lead more commonly to falsely negative leading to a type II error²⁶, in which accepted the null hypothesis regarding the association between tooth eruption and obesity.

Our results also demonstrated that the number of teeth with delayed eruption differs according to the nutritional status, in which the mean number of delayed tooth eruption was higher, suggesting that the nutritional status is an important etiological factor involved in the chronology of permanent tooth eruption. However, it is important to emphasize that our study has some obvious limitations. Some other factors could be involved in tooth eruption^{9,10,11}. In addition, some aspects involved in the nutritional status, such as dietary intake were not evaluated in this study and should not be taken into consideration in future studies.

In conclusion, Underweight Brazilian children have a higher incidence of delayed eruption and a higher number of affected teeth.

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