



RELATIONS BETWEEN ERUPTION OF PERMANENT TEETH AND BODY MASS INDEX IN BULGARIAN CHILDREN

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ABSTRACT:

Introduction: Obesity and dental caries are diseases that have a strong social impact. Being overweight and obesity during childhood are a risk factor for cardiovascular, respiratory, skeletal diseases and other health problems in both children and adults.

Aim: The aim of the study is to estimate the relationship between tooth eruption, tooth pathology and BMI in 7-8 year old Bulgarian children.

Methods and Material: The present study observed 187 individuals. Oral and dental status were examined. The height was measured in a standing position with an anthropometer, weight was measured with an electric scale to the nearest 0.1 kg, and Body Mass Index (BMI) was calculated. The data was analyzed with the Statistical Package for Social Sciences (SPSS) version 16. The differences were considered statistically significant at $p < 0.05$.

Results: A positive relation is found between the eruption of teeth and BMI. A statistically significant association is found between BMI and dental caries on the upper left first molar (26).

Conclusion: A high percentage of the examined children were overweight and obese. A positive but low correlation between BMI, tooth eruption and dental caries is established. With the increase of the BMI, the number of erupted teeth also increases. Girls had more erupted teeth compared with boys. The caries of the first molar (26) correlate positively with the nutritional status of the 7-8 year old children studied.

Keywords: BMI, Eruption, Permanent Teeth, Children, Obesity,

INTRODUCTION

Obesity is a common problem in modern society. With the rising standard of life, more cases of overweight and obese people are observed. A large percentage of obese adults were overweight and/or obese as children. Being overweight and obese in childhood is a risk factor for cardiovascular, respiratory, skeletal diseases and other health problems in both children and adults. It is found that a higher body fat percentage affects hormonal metabolism and growth [1]. Considering the higher percentage of over-

weight and obese people, Further information about the effects on general health, dental development and caries formation is needed. Body Mass Index (BMI) can be used for the evaluation of overweight and obesity. Knowledge of growth patterns, as well as the time and sequence of tooth eruption, are factors which are needed for successful orthodontic and pediatric dental treatment [2, 3]. Dental caries is the most common childhood disease, and it has impacts on health, quality of life, development and educational performance [4]. The importance of the negative effects of dental pathology should be taken into consideration.

The process of eruption of the permanent teeth as an indicator of the morpho-functional status and biological maturity of children is closely dependent on nutrition and basic anthropometric features (height and body weight) for assessment of physical development and body mass index [1, 5, 6, 7, 8, 9]. A number of studies have found a positive relation between tooth eruption, anthropometric features and BMI. In underweight and short statured children, delayed tooth eruptions are reported, and taller and heavier children have accelerated eruptions of the permanent teeth [10, 11].

A balanced diet is important for the development of the dental and maxillofacial complex in children. The main groups of nutrients that have the strongest influence on the construction and eruption of teeth are proteins, vitamins and minerals. There is evidence that deficiency or lack of these macro- and micronutrients in food, as well as chronic malnutrition lead to delayed dental development and eruption, reduction of tooth size, as well as the development of caries and periodontal pathology [12, 13, 14].

The aim of the study is to establish the relationship between tooth eruption, tooth pathology and BMI in 7-8-year-old Bulgarian children.

MATERIALS AND METHODS

The present study includes 187 individuals (97 males and 90 females) separated into two age groups: 7 years old (48 males, 50 females) and 8 years old (49 males, 40 females). One hundred and forty-five of the investigated children are from Sofia, and 42 are from the Sofia Region.

Before starting the examination, information about the purpose of the study was given and written informed consent was obtained in accordance with the Declaration

of Helsinki of the World Medical Association [15].

The study was approved by the Ethical Committee of the Institute of Experimental Morphology, Pathology and Anthropology with Museum – Bulgarian Academy of Sciences.

The oral and dental status was checked with a dental mirror and a probe. It included the number of erupted teeth, carious activity and lesions, type of bite, rotations and orthodontic pathology, oral lesions, hypoplasia and dysplasia of the teeth. The tooth was registered as erupted when any part of the clinical crown was present inside the oral cavity. The height was measured in a standing position with an anthropometer to the nearest 0.1 cm by Martin-Saller's classical methods [12]. The body weight was measured with an electric scale to the nearest 0.1 kg, and the body mass index (BMI) was calculated. The children were classified in the BMI categories – underweight, normal, overweight and obese according to the International Obesity Task Force (IOTF) cut-offs values [16]. Only children considered to be in good physical and psychological

health were selected.

The statistical analysis was done with the SPSS program 16.0. Frequency analysis was applied for the distribution of the examined individuals by sex and age. Pearson Chi-square test was used to determine differences between the sex and age groups and to determine the existence and strength of association between the eruption of the teeth, dental caries and categories' nutritional status. A correlational analysis was also performed. The differences were considered statistically significant at $p < 0.05$.

RESULTS

The investigated children have an average BMI of 17.04 (± 2.74) kg/m^2 (17.26 kg/m^2 in boys and 16.81 kg/m^2 in girls).

Table 1 presents the distribution of the children in the categories of nutritional status. One hundred and thirty-four of them (72.4 %) have normal weight, almost a quarter of all the cases (22.2 %) are overweight and obese, and only 10 children (5.4 %) are underweight.

Table 1. Distribution of the children in the categories of nutritional status according to the BMI cut-offs.

Frequency	Under weight n (%)	Normal n (%)	Over weight and obesity n (%)	Total
Males	3 (3.2%)	70 (73.7%)	22 (23.2%)	95 (100%)
Females	7 (7.8%)	64 (71.1%)	19 (21.1%)	90 (100%)
All	10 (5.4%)	134 (72.4%)	41 (22.2%)	185 (100%)

Figure 1. a, b, shows the erupted teeth in 7-8-year-old children. At the age of 7, all incisors and first molars are erupted. With the exception of the upper left canine, all other teeth are present in the oral cavity of individuals at the age of 8.

Fig. 1. Erupted permanent teeth in 7 (a) and 8 (b) year-old children.

a)

6XXX21	12XXX6
6XXX21	12XXX6

b)

654321	12X456
654321	123456

Differences in the number of erupted teeth between the genders are also established. Girls tend to have more erupted teeth than boys. The biggest difference is observed in the upper right lateral incisor (tooth 12), which erupted with 21.3 % more frequency in the female sex.

A positive relation is found between tooth eruption and BMI. A significant but low correlation is observed only between the eruption of the lower right lateral incisor (42) and BMI categories ($r=0.169$, $p=0.022$, Cramer's $V = .187$ – Small size effect). Children with higher BMI values (The

overweight and obese children) had considerably more frequent eruption in tooth 42 than the underweight ones (Table 2).

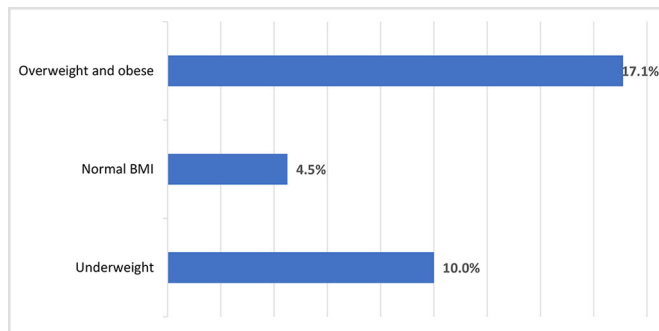
Table 2. Eruption of the lower right lateral incisor, according to nutritional status.

BMI	Tooth 42 (N = 185)	
	Missing	Erupted
Underweight	3 (30.0%)	7 (70.0%)
Normal	39 (29.1%)	95 (70.9%)
Overweight and obese	4 (9.8%)	37 (90.2%)
Pearson Chi-square		6.440
Df		2
P value		0.040

A statistically significant positive correlation of low degree ($r=0.150$, $p=0.041$) is also observed between BMI categories and caries of the upper left first molar (26).

The data from Figure 2 show that the dental caries progress in the presence of a deviation from the normal BMI values. The underweight group and the overweight/obese group had a higher rate of children with caries at 10.0 % and 17.1 %, respectively, while the normal weight group showed the lowest at 4.5 %. ($\chi^2_{(2, N = 185)} = 7.210$, $p = 0.027$, Cramer's $V = 0.197$ – Small size effect).

Fig. 2. Relation between BMI and dental caries in tooth 26.



DISCUSSION

Obesity and dental caries are diseases that have a strong social impact. Obesity, and in particular, abdominal obesity, is associated with different diseases such as hypertension, type 2 diabetes, cerebrovascular diseases, digestive disorders, etc. [8]. On the other hand, tooth eruption is associated with height and weight [15]. BMI is a widely used indicator for the assessment of an individual's nutritional status.

Most examined subjects are within the standard value range of BMI cut-offs, while a quarter are overweight and obese. A positive relation between BMI and tooth eruption was observed in the investigated 8-year-old children. With the increase in BMI, more erupted teeth are presented in the study group. Similar results are presented by other authors [5, 6, 17, 20]. Perez et al. studied BMI, tooth eruption and dental caries in school-children and concluded that overweight children have about 5 more permanent teeth compared to underweight children – children with high BMI have higher eruption rates. The study has also shown a trend toward increasing risk of being overweight with the increase in age [5].

Using panoramic radiographs, Boosheri et al. determined the dental age and investigated the relationship between dental age and BMI and also between the eruption of teeth and BMI. They established a significant dependence between dental development and nutritional status. Their results show an increase in eruptive age with an increase in BMI [6]. Late eruption in underweight children in comparison to overweight and obese children is found by Bagewadi et al. [17]. According to the authors, taller

and heavier children are advanced in regard to their dental development. Must et al. examined the number of erupted teeth between obese and non-obese subjects and concluded that obese children have on average 1.44 more erupted teeth when age, gender and race/ethnicity are controlled [16]. Bakirova, on the other hand, didn't find any statistically significant correlation between tooth eruption and height or tooth eruption and weight, but found a positive correlation between BMI and teeth eruption – again, with higher BMI, more teeth are found in the oral cavity [5].

Kutesa et al. present a statistically significant correlation between the weight and mean eruption times in 50% of the teeth [3]. In opposition, Gaur et al. [18] didn't find any statistically significant correlation between number of erupted teeth and stature and weight.

In this study, positive dependence between BMI and dental caries is shown – most prominently for tooth 26. The lack of an association between dental caries and BMI is presented by D'Mello and colleagues comparing DMFT (decay-missing-filled teeth) scores of overweight/obese children and children with normal weight [9]. Similar results appear in the study by K. Cantekin, where a correlation between overweight and caries is not found [8]. Our results show that underweight and overweight/obese children have more caries of the upper left first molar than those with normal weight. Higher caries indices in pre-obese and obese children than those in normal weight is also found by Costacurta. The classification for body weight was performed using two methods BMI and Dual X-ray Absorptiometry [19]. Younus reported the highest number of caries in underweight children and the lowest in those of normal weight [15]. In contrast, Sánchez-Pérez's study shows that children with higher BMI are having lower risk of caries [1]. On the other hand, Bafti shows that children with normal BMI have a 1.5 times higher mean value of DMFT than overweight ones [14].

CONCLUSION

A high percentage of the examined children are overweight and obese. A positive but low correlation between BMI, tooth eruption and dental caries is established. With the increase of the BMI, the number of erupted teeth also increases. Girls have more erupted teeth compared with boys. The caries of the first molar (26) correlate positively with the nutritional status of the 7-8-year-old children.

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