

NUTRITIONAL STATUS AND PERMANENT TOOTH ERUPTION IN BULGARIAN CHILDREN AGED 5–12 YEARS

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Abstract

One of the most important factors influencing the process of tooth eruption is the nutritional status. The aim of the present study is to assess the relationship between different categories nutritional status and permanent tooth eruption in Bulgarian children. A total of 709 children (361 boys and 348 girls) aged 5–12 years in good physical and psychological health were included in the study. The oral and dental status was checked directly by intraoral examination. The tooth was registered as erupted when any part of the clinical crown was present inside the oral cavity. The number of erupted teeth (NET) was evaluated for each child. Descriptive statistics, Student's *t*-test and One-Way ANOVA were applied. Pearson Chi-square test was used to assess the differences in frequency characteristics between BMI categories.

The largest part of the examined children in this study fell into the 'normal weight' category, and approximately a quarter of all participants were overweight and obese. The established association between tooth eruption and BMI categories is not statistically significant. The overweight and obese boys and girls have a higher number of erupted teeth. The highest percentage of nonerupted teeth is established in underweight children. The results of the study could be used in public health, such as pediatric and therapeutic dentistry, pediatrics, as well as in medical anthropology and forensic medicine.

Key words: tooth eruption, BMI, children, nutritional status, permanent teeth

Introduction. One of the most important factors influencing the process of tooth eruption is the nutritional status. It can be defined as the result of needs, intake, absorption and use of nutrients [1]. Nutrient deficiencies could lead to growth retardation, influencing body size and proportions, and could also affect the quality of tissues composing bones and teeth and the process of tooth eruption [2]. Developing tooth needs macronutrients such as carbohydrates, fats and proteins, micronutrients – iodine, calcium, magnesium, phosphorus, and C and D vitamins [3]. A number of studies have revealed the relationship between eruption of permanent teeth and different categories of nutritional status (underweight, normal, overweight and obese) [4]. The results show that underweight children have delayed eruption of permanent teeth, while taller, heavier and obese children have accelerated tooth eruption.

In Bulgaria, there are few studies establishing the relationship between body mass index (BMI) and permanent tooth eruption. The results obtained by the authors demonstrate that increased BMI is associated with accelerated tooth eruption [5].

The association of another unhealthy BMI category – ‘underweight’ with the permanent tooth eruption in Bulgarian children is poorly studied.

The aim of the present study is to assess the relationship between different categories nutritional status and permanent tooth eruption in Bulgarian children.

Materials and methods. A total of 709 children (361 boys and 348 girls) aged 5–12 years in good physical and psychological health were included in the study. The mean age for boys was 8.79 (± 2.20) years and for girls – 8.68 (± 2.20) years.

The oral and dental status was checked directly by intraoral examination with a dental mirror and a probe. The tooth was registered as erupted when any part of the clinical crown was present inside the oral cavity. Permanent tooth was categorized into two grades: 1 – erupted and 0 – unerupted, and all erupted teeth were assessed for each child. The number of erupted teeth (NET) was evaluated for studied age groups. The stature was measured in a standing position with an anthropometer to the nearest 0.1 cm by Martin–Saller classical methods. The body weight was measured with an electronic scale to the nearest 0.1 kg, and the BMI was calculated (body weight in kilograms divided by the height in meters squared). According to the International Obesity Task Force (IOTF) cut-off values for BMI children were classified into the following categories – underweight, normal weight, overweight, and obese [6].

The statistical analyses were performed using Statistical Package for the Social Sciences (SPSS for Windows, Version 16.0. Chicago, SPSS Inc.). Descriptive statistics, Student’s *t*-test and One-Way ANOVA (with post hoc procedures for multiple comparisons Tukey HSD test) were applied. Pearson Chi-square test and Cramer’s V were used to assess the differences in frequency characteristics between BMI categories. Binary Logistic Regression analysis was also performed to eval-

uate the association between BMI categories and NET. The differences between sex and age groups were considered statistically significant at $p \leq 0.05$.

The study was approved by the Ethical Committee of the Institute of Experimental Morphology, Pathology and Anthropology with Museum – Bulgarian Academy of Sciences (Protocol 10/08.07.2020). Before starting the examination, information about the purposes of the study was given to the children and parents and written informed consent was obtained in accordance with the Declaration of Helsinki for human studies (World Medical Association 2008).

Results. The investigated boys and girls fall into the ‘normal weight’ category with exception of 11-year-old boys and 12-year-old girls, who are categorized as overweight (Table 1). Significant differences between age groups are observed only in girls aged 10–11 years. Differences between both sexes are not established ($p > 0.05$).

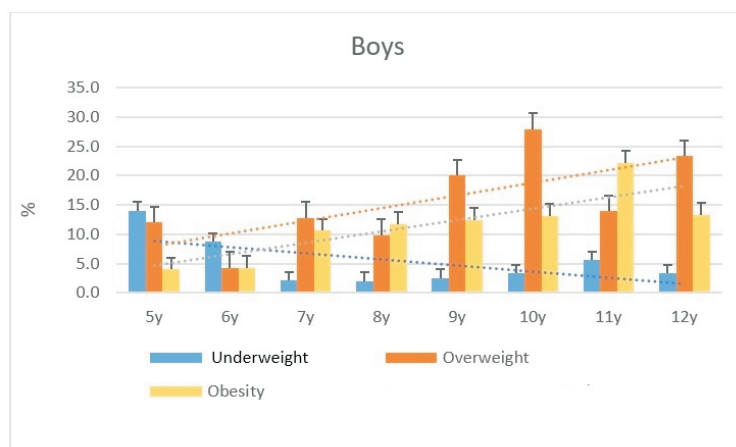
T a b l e 1
Statistical data of BMI by sex and age

Sex	Boys			Girls			T-test/p
Age group	<i>n</i>	X	SD	<i>n</i>	X	SD	σ/φ
5	50	15.97	1.73	50	16.10	2.33	0.74
6	46	15.62	1.75	47	15.94	2.22	0.45
7	47	17.03	2.83	49	16.43	1.93	0.23
8	51	17.41	2.74	50	16.98	3.01	0.45
9	40	18.24	2.99	33	17.95	3.25	0.69
10	61	19.43	4.06	54	18.93	4.35	0.52
11	36	20.72	4.99	35	21.22#	4.90	0.67
12	30	20.68	4.58	30	21.94	4.57	0.29
Total	361	17.97	3.72	348	17.88	3.91	0.76

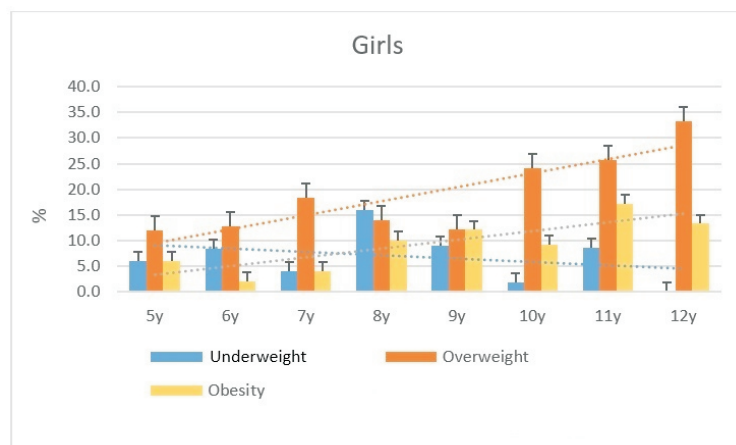
– statistically significant differences between 10 and 11 years old girls at $p \leq 0.05$

The distribution of the participants into the BMI categories is presented in Fig. 1. Data show that 246 of boys (68.1%) and 230 of girls (66.1%) have normal weight and only 19 boys and 24 girls are identified as underweight (5.3% and 6.9%, respectively). Fifty-six males (15.5%) and 64 females (18.4%) are overweight, and 70 children are classified as obese (11.1% in boys and 8.6% in girls). Statistically significant differences between separate BMI categories ($p = 0.001$) are observed.

The mean and standard deviation of NET and the percentage of erupted and unerupted teeth are calculated, separately for the different categories BMI. In girls mean NET varies between 1.36 (± 1.27) at the age of 5, and 26.03 (± 2.41) at the age of 12. In boys the mean number of erupted teeth is lower and varies between 1.84 and 25.60. Girls have a significantly higher NET in the age groups of 7, 10, and 11-year-olds.



A)



B)

Fig. 1. Percentage distribution of children into the BMI categories according to sex and age

There is no significant association between tooth eruption and BMI categories ($\chi^2(3) = 6.42$, $p = 0.093$, Cramer's $V = 0.095$), but the overweight and obese boys and girls have higher percentage of erupted teeth, compared to the children in the underweight and normal weight categories, who have higher percentage of unerupted teeth (Fig. 2).

Table 2 presents the result of a Binary Logistic Regression analysis. The odds ratio (OR) in underweight children is less than 1, which suggests that chances to have more erupted teeth are lower compared to children in the normal nutritional status category. The odds of overweight and obese children to have higher number of erupted teeth are approximately 2.3 times more than children with normal weight.

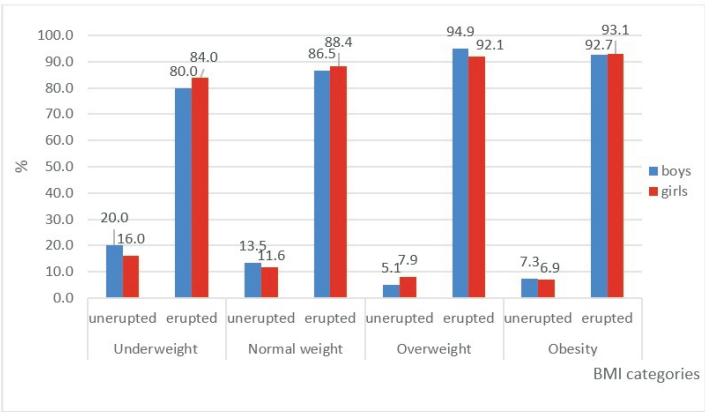


Fig. 2. Percentage of erupted teeth in 5–12-year-old children, according to BMI categories

T a b l e 2

Results of a binary logistic regression test between the number of erupted teeth and BMI categories

	B	S.E.	Wald	df	Sig.	Odds ratio	95.0% Confidence interval	
BMI categories							Lower	Upper
Normal weight			6.123	3	.106	reference		
Underweight	-.156	.462	.114	1	.736	.856	.346	2.116
Overweight	.806	.414	3.796	1	.051	2.240	.995	5.042
Obesity	.828	.534	2.409	1	.121	2.289	.804	6.516
Constant	1.975	.140	198.677	1	.000	7.207		

Discussion. Nutrition of children affects their growth and development and is a common cause of underweight or obesity. The obesity rate among children and adolescents increased globally, while the share of underweight decreased over the last 20 years [7]. Both forms of malnutrition affect children’s physical health and development, including the tooth eruption process.

This research is one of the very few studies investigating the association of nutritional status and permanent teeth eruption in Bulgarian children. The new results obtained are valuable and could be used in public health.

Approximately a quarter of all participants (26.8%) in the study are overweight and obese, and only 43 of them fell into the “underweight” category. Our results are close to those obtained by other authors [8].

Most of the studies on the theme show a positive relationship between nutritional status and tooth development. According to our results, overweight and obese children have more erupted teeth, than those with underweight and normal

weight. They are similar with the results of HASSAN and SHADID [9] who present weak relation between BMI and dental and skeletal development and found that underweight children have retardation in dental eruption. YOUNUS et al. [10] found that tooth eruption can be connected with height and weight. The results in their study show more erupted central incisors and molars in the overweight children than in the underweight, but the established differences are not statistically significant. A positive correlation between number of erupted teeth and nutritional status is established by LAILASARI et al. [11], as children with higher BMI have more erupted permanent teeth. PAZ-CORTÉS et al. [1] did not find any influence of BMI category on the process of tooth eruption. The authors explain the results with the large number of underweight children (49.52%) in the sample and the small number of children (only 2.64%) categorized as overweight. Severe malnutrition appears to have a minimal effect on the timing of tooth formation [12]. EID et al. [13] using Demirjian's method did not find any significant correlation between BMI and tooth formation. In contrast, ZANGOUEI-BOOSHEHRI et al. [14] also using panoramic radiographs found significant association between tooth eruption and BMI – as BMI increases, the age at which eruption occurs also tends to rise. The relationship between childhood obesity and the time of eruption of permanent teeth in Czech children is investigated by ŠINDELÁŘOVÁ et al. [4] in 2017. The authors found that in obese children, permanent teeth erupt earlier than in those with normal weight.

Examining the association between the number of erupted teeth and obesity, MUST et al. [15] established that obese children had an average of 1.44 more erupted teeth than nonobese ones. Our results correspond with theirs, finding that the odds of overweight and obese children to have more erupted teeth are approximately 2.3 times higher, compared to the children with normal weight. WONG et al. [16] and SAPUNAROVA et al. [5] also reported significantly higher number of erupted teeth in overweight and obese children. The results of SÁNCHEZ-PÉREZ et al. [17] show that children, in the overweight category had an average 5 more permanent teeth than those with lower BMI. The study of BAKIROVA et al. [18] showed no statistically significant relationship between tooth eruption and height or weight. However, a positive correlation was identified between BMI and tooth eruption. A significant negative correlation between eruption time of molars and BMI in boys and absence of significant correlation between eruption time of teeth and BMI in girls are established by SABHARWAL et al. [19].

Conclusions. The results of the study describe the influence of BMI on teeth eruption in children aged 5–12 years. The largest part of the examined children in this study fell into the ‘normal weight’ category, and approximately a quarter of all participants are overweight and obese. The established association between tooth eruption and BMI categories is not statistically significant. Nevertheless, it should be noted that overweight and obese boys and girls have a higher number of erupted teeth. The highest percentage of nonerupted teeth is established in

children categorized as ‘underweight’. The results of the study could be used in public health, such as pediatric and therapeutic dentistry, pediatrics, as well as in medical anthropology and forensic medicine.

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