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Relationship between increased body weight and oral health in children

Povećana telesna masa i oralno zdravlje dece

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Abstract

Backgraund/Aim. Increased body weight in childhood may have negative effects on many tissues and organs in the body. The aim of this study was to determine whether the state of oral health in children with increased body mass is different from the children with normal body weight. **Methods.** The study included 190 children, aged 6 to 15 years. Assessment of nutritional status of subjects was performed by the use of Body Mass, and the respondents were divided into a group of increased body weight children (IWC) and a group of normal body weight children (NWC). Hard dental tissue state of health was assessed by the decayed, missing and filled teeth (DMFT) index. The gingival health was assessed using gingival index (GI). Community Periodontal Index (CPI) was used for the assessment of periodontal tissue. The oral hygiene was assessed using the Simplified Debris (Plaque) Index Greene-Vermilion. **Results.** Average DMFT value in the IWC group was 5.01 ± 2.4, and in the NWC 4.43 ± 2.0; ($p > 0.05$). GI values in the IWC group was 0.64 ± 0.37, while in the NWC group it was 0.55 ± 0.35 (the difference was not statistically significant). Average CPI index values were 1.33 ± 0.49 in the IWC group and 0.77 ± 0.61 in the NWC group and statistically significant differences were observed concerning periodontal tissue state of health. The GV index values in the IWC group were 1.01 ± 0.49, and in the NWC group 0.89 ± 0.45; it was not statistically significant. **Conclusion.** Results of this research do not indicate that children with increased body weight have more affected teeth. However, they have a worse condition of periodontal tissue in comparison to normal weight children.

Key words:
body weight; child; body mass index; obesity; periodontal index; oral hygiene; tooth.

Apstrakt

Uvod/Cilj. Povećana telesna masa u dečijem uzrastu može negativno da utiče na mnoga tkiva i organe u organizmu čoveka. Cilj ove studije bio je da se ustanovi da li se stanje oralnog zdravlja dece sa povećanom telesnom masom razlikuje u odnosu na decu koja imaju normalnu telesnu masu. **Metode.** U studiju je bilo uključeno190 dece, uzrasta od 6 do 15 godina. Procena stepena uhranjenosti ispitanika izvršena je pomoću Indeksa telesne mase, a ispitanici su podeljeni u grupu dece sa povećanom telesnom masom i decu sa normalnom telesnom masom. Stanje zdravlja tvrdih zubnih tkiva ocenjeno je pomoću KEP indeksa (ukupan broj karoiznih, ekstrahovanih i plombiranih zuba). Stanje zdravlja gingive procenjeno je pomoću loe Gingivalnog indeksa (GI). Za procenu parodontalnih tkiva upotrebljen je *Community Periodontal Index* (CPI). Stanje oralne higijene utvđeno je uz pomoć Plak indeksa po Greene-Vermilion-u. **Rezultati.** U grupi djece sa povećanom telesnom masom prosečna vrednost indeksa KEP bila je 5,01 ± 2,4 a kod dece sa normalnom telesnom masom 4,43 ± 2,0; ova razlika nije bila statistički značajna. Vrednost GI u grupi gojazne dece bila je 0,64 ± 0,37, a u grupi dece sa normalnom telesnom masom 0,55 ± 0,35; ni ova razlika nije bila statistički značajna. Prosečne vrednosti CPI u grupi gojazne dece bila je 1,33 ± 0,49, a u grupi dece sa normalnom telesnom masom 0,77 ± 0,61 što je bilo statistički značajno ($p < 0.05$). Vrednosti plak-indeksa nisu bile statistički značajno različitie u obe ispitivane grupe dece. **Zaključak.** Rezultati istraživanja ne ukazuju da deca sa povećanom telesnom masom imaju više obolelih zuba. Međutim, ona imaju teži stepen obolenja parodontalnih tkiva u odnosu na decu koja imaju normalnu telesnu masu.

Ključne reči:
telesna težina; deca; telesna masa, indeks; gojaznost; periodontalni indeks; usta, higijena; zub.

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Introduction

Excessive nutrition is a growing problem in modern age population. Excess body weight has a negative impact on many tissues and organs in human body. Excessive nutritional status in childhood is one of the main risk factors that may lead to the occurrence of obesity in adulthood. The World Health Organization (WHO) defines obesity as abnormal or increased accumulation of fat in the adipose tissue to the extent that damages health and leads to the development of numerous health complications [1].

Obesity may occur in all age groups and is increasingly evident in children. In 2006, the European Commission reported that 22 million of children within the European Union are overweight or obese, with an increase in incidence of 400,000 new cases per year [2]. It can be said that obesity presents a chronic health problem that reduces quality of life and has a significant impact on morbidity and mortality [3]. In obesity, uncontrolled chronic inflammation of low intensity keeps the body in a constant state of stress, which leads to peripheral tissues insulin insensitivity, insulin secretion disorders, underutilization of glucose by the liver and muscles, what may further lead to metabolic disorders development, damage to the heart and blood vessels as well as locomotor apparatus [3].

Lifestyle factors such as a lack of physical activity, changes in eating habits and social changes, have been considered as crucial factors for the global spread of obesity [4] and they, at the same time, present risk factors for oral diseases occurrence, too. In order to reduce the obesity incidence, it is necessary to promote and improve coordination between various primary health care services as a priority. Contacts between pediatric dentists and patients are relatively common; therefore, dentists are able to identify obesity risk patients even at the early age [5]. Many previous studies that have investigated the impact of obesity on population general health, suggest that everyone responsible for primary care of children (pediatricians, dentists and dental hygienists) should join together to achieve a common goal [6–8].

Literature generally provides data about impact of obesity on the general health, while data about impact of obesity on the teeth, gingiva and periodontal tissue states of health are very scarce. As oral health is an important part of overall health, the aim of this study was to determine whether oral health of increased body weight children is different from that of normal body weight children.

Methods

The study was designed as an academic cross sectional study. The study included 190 subjects (122 boys and 68 girls) aged 6 to 15 years. Children from four cities in the Republic of Srpska, Bosnia and Herzegovina (Višegrad, Rogatica, Čajniče, Foča) were examined in this study. The study was conducted in accordance with the Declaration of Helsinki and principles of Good Clinical Practice. Parents were informed about the purpose of the study and signed an informed consent form. The study protocol was approved by the Ethical Committee of the Faculty of Medicine, University of East Sarajevo (No. 01-8/38).

All participants underwent dental examination with the use of standard dental diagnostic instruments. Dental caries was determined by the DMFT index (decayed, missed, filled teeth) for permanent dentition, according to the World Health Organization (WHO) standards [9]. The gingival health was assessed using the gingival index (GI), as described by Löe [10]. Community Periodontal Index (CPI) was used for periodontal tissues state of health assessment [9]. As participants of this study were less than eighteen years old, modified version of this index, corresponding to their age, was used. The oral hygiene was assessed using the Simplified Debris (Plaque) Index Greene Vermilion (GV) [11]. Since the all the aforementioned indices cannot be applied to deciduous dentition, in accordance with the determining criteria, only permanent teeth were assessed in this study and state of health of permanent dentition was analyzed.

Assessment of nutritional state of the respondents was conducted using Body Mass Index (BMI). All participants underwent basic anthropological examination, i.e., body weight (kg) was measured and height (cm), on the basis of which BMI was determined. BMI was calculated as the body weight (in kg) divided by the square of height (in meters). Percentiles defined the position of a particular index value compared to children and adolescents of the same sex and age. According to the WHO growth references for children and adolescents, BMI between the 5% and 85% was categorized as "normal weight" children and adolescents, those with a BMI between the 85% and 95% were classed as "at risk of overweight", and those with a BMI greater than the 95% as "overweight" [12–14]. The children and adolescents with BMI < 5% were excluded from this study. Based on the BMI value, the respondents of this study were evenly divided into two groups: children with increased body weight (IWC) and children with normal body weight (NWC). The IWC group consisted of 95 patients (61 boys and 34 girls) with increased body weight (BMI > 85%) who visited the Pediatric Dental Clinic, the Faculty of Medicine in Foča, or the Pediatric Ward of the University Hospital in Foča. The NWC group consisted of the same number of normal weight respondents (BMI 5–85%), which were matched with the IWC group by gender, age and city they lived in. Both groups included children without any chronic or systemic disease.

Methods of descriptive and analytical statistics were used for results description. The used descriptive statistics method parameters were: mean value, standard deviation and percentages. The differences of individual parameters between and within the studied groups, depending on the distribution, were tested with the Mann-Whitney test, Fisher test and χ^2-test. The statistical data analysis was performed in SPSS 11.5 (SPSS Inc., Chicago, IL, USA). The obtained results were presented in Tables, with the level of significance set at 0.05.

Results

The study included more boys (64.2%) than girls (35.8%), that was of highly statistically significant difference ($p < 0.05$; χ^2-test). The average age of the IWC group was 10.7 ± 1.6 years, while the average age of the NWC group was 10.2 ± 1.4 years. No statistically significant difference

between the groups was observed related to the age structure ($p > 0.05$, χ^2-test).

In the overall sample, 16.04% of children had all permanent teeth healthy. In the IWC group, percentage of healthy permanent teeth was 15.75%, while 17.84% teeth were in the NWC group; the difference between the groups was not statistically significant ($p > 0.05$, χ^2-test).

The average value of DMFT for the entire population studied was 4.64. In the IWC group average value of DMFT was 5.01 ± 2.4 while in the NWC group the index value was 4.43 ± 2.0. The difference between observed groups was not statistically significant ($p > 0.05$; χ^2-test). DMFT index distribution is presented in Table 1.

Table 1

Structure of DMFT in the study groups

Index	Parameters of DMFT	IWC (%)	NWC (%)
DMFT	D	60.0*	52.8*
	M	9.5	11.9
	F	30.4	34.9

IWC – increased body weight children; NWC – normal body weight children; DMFT – decayed, missing, filled teeth; *$p < 0.05$, Mann-Whitney test.

Concerning percentage of decayed teeth (%D), the results showed that children in the IWC group had a higher percentage of decayed teeth compared to children in the NWC group, which was significant difference ($p < 0.05$; Mann-Whitney test). The maximum number of decayed teeth in one respondent from the IWC group was 13 teeth, while their number in the NWC group was 9 teeth. The average number of untreated teeth per respondent was 2.31 in the IWC group, and 1.58 teeth in the NWC group. When observing percentage of extracted teeth (%E), results showed that the percentage of extracted teeth was slightly higher in the NWC group. The maximum number of extracted teeth at one respondent in the IWC group was 3 teeth, while that number in the NWC group was 7 teeth. The average number of extracted teeth per respondent was 0.23 in the NWC group and 0.19 in the IWC group. The percentage of filled teeth (%F) was higher in the NWC group. The maximum number of filled teeth at one respondent of the IWC group was 12 while that number in the NWC group was 15. In the IWC group, the average number of tooth fillings per respondent was 1.68 while that number in the NWC group was larger and was 1.79. Statistically significant differences were not observed in relation to %E and %F teeth between the two study groups ($p > 0.05$; Mann-Whitney test).

The average value of the GI for all respondents was 0.60 ± 0.36. GI values were slightly higher in the IWC group 0.64 ± 0.37 compared to the NWC group of respondents (0.55 ± 0.35), but the difference between the groups was not statistically significant (Table 2). The respondents from both groups, in the highest percentage, had mildly inflamed gingiva. In this study, there were no patients with severely inflamed gingiva because the maximum value of the index was 1.71 which corresponds to moderate inflammation.

Table 2

Gingival state of health (gingival index – GI) [10] in the study groups

GI	IWC (%)	NWC (%)
Normal gingiva	31.9	30
Mild inflammation	64.5	66.8
Moderate inflammation	3.6	3.2
Severe inflammation	0	0

IWC – increased body weight children; NWC – normal body weight children.

The average value of the CPI for all respondents was 1.04 ± 0.57. The average values of this index were higher in the IWC group 1.33 ± 0.49 compared to the NWC group of the respondents (0.77 ± 0.61). There was a statistically significant difference when it comes to the periodontal tissue state of health between the groups ($p < 0.05$; Mann-Whitney test). Distribution CPI index percentages are presented in Table 3. Calculus deposits were more frequently observed in the IWC children than in the normal body weight children.

Table 3

Community periodontal index (CPI) distribution in the study groups

CPI	IWC (%)	NWC (%)
0	38.3	62.2
1	54.5*	31.5*
2	17.2*	6.3*

CPI – community periodontal index: 0 – healthy periodontium; 1 – gingival bleeding after probing; 2 – calculus; IWC – increased body weight children; NWC – normal body weight children.
***$p < 0.05$, Mann-Whitney test.**

The average value of soft debris index (Greene-Vermillion, GV), for all subjects involved in this study, was 0.95 ± 0.48. The obtained values indicate that soft deposits along the marginal edge of the gingiva were present in most respondents from both the observed groups. The values of this index in the children with increased body weight were 1.01 ± 0.49, and 0.89 ± 0.45 in the normal body weight children, but statistically significant difference between the groups was not observed ($p > 0.05$; Mann-Whitney test). Distribution of the GV percentages in the observed groups is given in Table 4.

Table 4

Oral hygiene presented by GV distribution in the study groups

Hygiene	IWC (%)	NWC (%)
Excellent	11	12.4
Good	31.3	31.6
Fair	48.7	50.4
Poor	9	8.8

IWC – increased body weight children; NWC – normal body weight children; GV – simplified debris (plaque) Greene-Vermilion.

Discussion

This study investigated the relationship between increased body weight in children and state of permanent dentition health. Oral health affects the proper development of orofacial system, chewing, speech and swallowing functions, and has a great importance to the psychological and social aspects of human life. Also, it has a significant impact on the aesthetic appearance and therefore a sense of personal satisfaction [15]. Although obesity and oral health are globally leading health problems in children and adolescents, possible relationship between obesity and the periodontal status or frequency of caries in children has been neglected [16].

Excessive nutritional status and oral diseases count as multifactorial diseases due to the fact that they have a common „risk factors". For example, both diseases are associated with negative eating habits, with lower economic status and irresponsibility toward personal health [17].

The results of our study indicate that about 16% of the respondents had all permanent teeth healthy. Obtained data is worrying when having in mind that respondents were up to 15 years old, their permanent teeth have relatively recently emerged or even just formed at that age. The average score of DMFT per respondent was 4.64, indicating that we are still far from the objectives set by the WHO.

When observing the average DMFT index values between the observed groups, results of this study did not indicate association between excessive nutrition and affected teeth in children. However, after analyzing the individual DMFT components, it was observed that the %D was more prevalent in children with increased body weight compared to normal body weight children and the difference between the groups was statistically significant. The results of this study are consistent with previous research conducted by Sharma and Hegde [18].

Review of the literature indicates that available results, from increasing number of studies that deal with this issue, are different. Some studies demonstrated that overweight and obese children were more affected by tooth decay, in deciduous as well as permanent dentition, compared to normal weight children [7, 19–22]. In contrast, there are also studies that reported different results [23–25]. In a study from Turkey, which included 5–9 years old subjects, it was concluded that children with reduced body weight have a higher risk of tooth decay than overweight or obese children [26].

It should also be pointed that all of these studies used the BMI as a parameter for obesity assessment. However, the study conducted in Italy in 2011, also used BMI for nourishment assessment, but the dual-energy x-ray absorptiometry DXA index as well (i.e., percentage of body fat determined by McCarthy classification). When the authors classified patients according to BMI, no statistically significant difference between the groups and observed parameters was found. However, when patients were classified according to McCarthy classification, it was shown that obese children had a higher number of deciduous and permanent decayed teeth, compared with normal body weight children [5].

In our study, the normal body weight children had more fillings and extracted teeth, which might suggest that children with increased body weight neglect both general and oral health.

During physiological teeth replacement, as normal phenomenon, eruption gingivitis occurs and may mask gingival state of health. In this study, gingival state was assessed around completely emerged permanent teeth. Differences in gingival state of health between the children with increased body weight and the normal body weight children were not observed in our study. In contrast to this, some studies reported that overweight children had higher degree of gingival inflammation than normal body weight children [16].

Periodontal diseases are caused by dental plaque microorganisms, while the severity of periodontal disease may be associated with the mouth and teeth health. The results of our research indicate that the respondents with the increased body weight had worse condition of periodontal tissue. The main findings of this study demonstrate a positive association between increased body weight and periodontal risk indicators in children and adolescents, which, in the long term period, may lead to chronic systemic inflammation. Our results are in line with other recently reported data [16, 17, 27, 28]. The average CPI value in this study indicates that it is necessary to motivate and train the patients on how to regularly and properly maintain oral hygiene as well as to remove supra-gingival, sub-gingival deposits and inadequate fillings. None of the respondents from either of the groups needed mechanical debridement of periodontal pockets or surgical treatment. A survey, conducted in Finland, demonstrated higher prevalence of periodontal disease in the increased body weight group of respondents as well as the presence of periodontal pockets in the normal weight group of respondents [17].

Oral hygiene state analysis did not show differences among the examined groups related to the presence of soft debris. However, the results of some studies suggest that children [29] reported that there was a difference in bacterial plaque composition between obese and normal body weight children as well as that the larger sum of bacterial cells in subgingival biofilm was significantly associated with obesity.

Conclusion

The results of this study do not suggest that children with increased body weight have more affected teeth than normal body weight children; however, they have a worse periodontal tissue state of health. Due to this, it can be stressed that excessive body weight may affect state of health of individual oral structures. Therefore, application of preventive measures, proper and regular oral hygiene, proper selection of oral hygiene maintenance tools and if needed application of chemical prophylactic means, can prevent the occurrence or further development of oral diseases.

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