



Oral Hygiene Status and Gingivitis in Overweight and Obese Children

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Abstract

Introduction: Obesity poses a significant health risk to our society with prevalence that has dramatically increased in children. Obesity and periodontal diseases share many common risk factors.

Aim: To study the oral hygiene status and prevalence of gingivitis in children with increased body mass index.

Materials and methods: A cross-sectional study was performed in Plovdiv, October-December 2017 and January-March 2018 among 1826 school children aged 6-11. The oral hygiene status was determined using Silness-Loe plaque index and Green-Vermillion calculus index assessed on vestibular surfaces of first maxillary permanent molars and one maxillary and one mandibular central permanent incisor, and lingual surfaces of mandibular first permanent molars. The condition of the gingiva was determined as presence or absence of gingivitis.

Results: The study included 1826 children (953 boys and 921 girls). With regard to BMI, the distribution should be 5% underweight, 66.5% normal weight, 17.7% overweight, and 10.8% obese, as in the text below. There was no significant correlation between age and BMI. No significant correlation was found between BMI and gingivitis ($p > 0.05$). Quality of oral hygiene was significantly associated only with gender: $\chi^2(2) = 18.847, p < 0.001$; $\chi^2(1) = 7.582, p < 0.05$ as the group of boys presented with greater accumulation of dental plaque and calculus.

Conclusion: Increased BMI is not an independent predictor of gingivitis. Poor oral hygiene is strongly associated only with gender.

Keywords

body mass index, gingivitis, obesity, oral hygiene,

INTRODUCTION

Obesity, one of the most significant health risks of modern society, is now recognized as a chronic disease with multifactorial etiology. Its prevalence has reached epidemic levels among children and adolescents in developing and developed countries.¹

Overweight is defined as a disease, in which the energy intake with the food exceeds the body's requirements, resulting in body fat accumulation.² A commonly used anthropometric measurement for diagnosis is the body mass

index (BMI). The Centers for Disease Control and Prevention classifies children with BMI between 85 and 95 percentile, specific for age and sex, as overweight and those with BMI above 95 as obese.³

The prevalence of overweight and obesity has doubled over the past 20 years.⁴ According to the World Health Organization for the European region, every third child is overweight or obese.⁵ In Bulgaria, the latest national representative study on the prevalence of obesity among school children aged 7 years, conducted in the 2015/2016 academic year, reported that 15.4% of the boys and 11.4% of

girls were obese, which ranks the country fourth in Europe regarding childhood obesity.⁶

Overweight and obesity are multifactorial diseases. Common risk factors are known to be genetic ones, including the thrifty gene hypothesis,⁷ but according to researchers in the field the behavioral risk factors are even more important - dietary habits and consumption of "fast food", snacks, and soft drinks⁸. Combined with a sedentary life style, watching TV for long periods of time, playing computer games, and the lack of sports and physical activity, it contributes to the increasing number of overweight and obese children in modern societies.

General complications of obesity are poor self-esteem, decreased life span, high risk of type 2 diabetes mellitus, cardiovascular diseases, asthma, arthritis, high cholesterol, and high blood pressure.⁹ Obese children and adolescents are more likely to become obese adults.¹⁰

The relationship between obesity and periodontal disease (PD) in adults is well known.¹¹ However, PD is much less frequent in paediatric populations, although gingivitis is often documented. Untreated gingivitis may progress to a more complex destructive chronic PD later in life.¹² The present study was motivated by the scarcity of research of periodontal health in overweight and obese children in Bulgaria, and by the controversial result reported in the relevant literature.

AIM

To investigate the oral hygiene status and prevalence of gingivitis in children with increased BMI and to compare the results with those of healthy children of the same age.

MATERIAL AND METHODS

A cross-sectional study was performed in October-December 2017 and January-March 2018 among 6-11-year-old school children in Plovdiv. They were randomly selected from all public schools in Plovdiv by random cluster sampling. No private schools were included in the study. Informed consent was obtained by the participants' parents with a short questionnaire appended, concerning the child's medical history. The inclusion criteria stipulated that the children had no systemic disease and had received no medication. In the study we included 1826 children that met the inclusion criteria and signed informed consent (65 children reported a systemic disease and 87 didn't return signed inform consent). They were examined in the school's medical rooms by 5 calibrated specialists of pediatric dentistry. The oral hygiene was assessed early in the morning before the children had breakfast and they had not been invited to brush their teeth prior to the dental exam. A sterile individual dental kit with probe and mirror and portable light were used. The thickness of accumulated plaque was assessed on the vestibular surfaces of the first maxillary

permanent molars and one maxillary and one mandibular central permanent incisor, and the lingual surfaces of the mandibular first permanent molars (Ramfjord teeth). The following teeth surfaces were scored using a four-point scale: 0 - there is no visible and scraped plaque, 1 - plaque is not seen but a small amount is scraped on the tip of the probe, 2 - plaque is visible and regular amount of plaque is scraped, 3 - abundance of plaque and materia alba covering the tooth surface. Silness-Loe plaque index (PI) was calculated as an arithmetic mean of the values for the sixth examined teeth. The oral hygiene status was classified into good (PI: 0-1), unsatisfactory (PI: 1.1-2) and poor (PI: 2.1-3). In case that some of the examined teeth were missing, the adjacent tooth or the corresponding primary ancestor was evaluated. In addition, Green - Vermillion calculus index (CI) was determined. Gingivitis was considered when observed erythema and edema of the marginal gingiva around the Ramfjord teeth, excluding these in process of eruption.

Data for BMI of the examined children was obtained from the medical documentation of the participants from the mandatory annual prophylactic examinations performed by general practitioners. Children were classified into underweight, normal weight, overweight and obese in accordance to 2007 WHO criteria for assessment of body weight among children aged 5-19 years.

STATISTICAL ANALYSIS

All collected data was analyzed using statistical software package SPSS 17. Descriptive statistics, the χ^2 test of independence and multiple linear regression analysis were used to explore the effect of BMI, age, sex, and oral hygiene status on the prevalence of gingivitis. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The study included 1826 school children, 929 boys and 897 girls.

By their BMI, 5% of all children were identified as underweight, 66.5% as normal weight, 17.7% as overweight, and 10.8% as obese. This distribution in the group of males and females is given in **Table 1**. The percentage of obese boys was significantly higher than that of obese girls: $\chi^2(3) = 8.245$ $p < 0.05$.

There was no significant correlation between age and BMI: $\chi^2(18) = 12.451$, $p > 0.05$, $N = 1826$.

Mean, median, mode and standard deviation of age, BMI, PLI, CI in the whole studied population is given in **Table 2**.

Quality of oral hygiene among children with different BMI is given in **Table 3**.

Good oral hygiene was most frequent in the group of underweight children (34.4%). The highest prevalence of children with unsatisfactory oral hygiene was observed in the group of overweight (52.9%), and poor oral hygiene - in the group of obese children (20.7%). The prevalence of good

Table 1. Distribution of females and males by their BMI

Sex	Underweight	Normal weight	Overweight	Obese
Female	41 (4.6%)	607 (67.4%)	168 (19%)	81 (9%)
Male	50 (5.3%)	612 (65.7%)	149 (16.4%)	118 (12.6%)

Table 2. Mean, median, mode and standard deviation of age, BMI, PLI, and CI

	Age	BMI	PLI	CI
N Valid	1826	1826	1826	1826
Mean	8.49	17.15	1.45	0.04
Median	8.50	16.50	1.33	0.00
Standard deviation	1.17	3.14	0.71	0.13

Table 3. Quality of oral hygiene among four groups of children classified by BMI

Oral hygiene	Underweight	Normal weight	Overweight	Obese
Good	32 (34.4%)	401 (33.1%)	105 (32.3%)	62 (31.3%)
Unsatisfactory	42 (46.7%)	613 (50.6%)	172 (52.9%)	95 (48.0%)
Poor	17 (18.9%)	198 (16.3%)	48 (14.8%)	41 (20.7%)
Total	91	1212	325	198

Table 4. Presence of calculus in four groups of children classified by BMI

Calculus	Underweight	Normal weight	Overweight	Obese
Yes	12 (12.2%)	161 (13.3%)	41 (12.3%)	30 (15.2%)
No	79 (87.8%)	1051 (86.7%)	284 (87.7%)	168 (84.8%)
Total	91	1212	325	198

Table 5. Prevalence of gingivitis in four groups of children classified by BMI

	Underweight	Normal weight	Overweight	Obese
Gingivitis	38 (42.2%)	520 (42.9%)	142 (43.7%)	95 (48.5%)
Healthy	53 (57.8%)	692 (57.1%)	183 (56.3%)	102 (51.5%)
Total	91	1212	325	198

oral hygiene among girls was 36.1%, and of poor oral hygiene - 13.2%, whereas amongst the boys these values were 29.6% and 20%, respectively. No statistically significant correlation was found between BMI and PI: $\chi^2(6) = 2.632$; $p > 0.05$, $N = 1826$.

The presence of calculus among children with different BMI is given in **Table 4**.

No significant correlation was observed between CI and BMI: $\chi^2(6) = 2.632$, $p > 0.05$, $N = 1826$.

Quality of oral hygiene was significantly associated only with sex: $\chi^2(2) = 18.847$, $p < 0.001$; $\chi^2(1) = 7.582$, $p < 0.05$, where greater accumulation of dental plaque and calculus was found in the boys' group.

Among the whole studied population, 795 children

(42.4%) had gingivitis, while 1030 children (57.6%) were with healthy gingiva.

Prevalence of gingivitis among children with different BMI is shown in **Table 5**.

No statistically significant correlation was observed between gingivitis and BMI: $\chi^2(6) = 10.786$, $p > 0.05$, $N = 1826$.

In order to evaluate the effect of a combination of factors on the development of gingivitis, a multiple regression analysis was performed. BMI, age, sex and oral hygiene status were set as explanatory variables, and gingivitis - as response variable. The analysis showed statistical significance of the model $p < 0.0001$, with 27% predictability ($R^2 = 0.267$). Only age and oral hygiene status were inversely associated with gingivitis: $B = -0.075$ and $B = -0.350$, $p < 0.0001$.

DISCUSSION

The present study on the prevalence of gingivitis among obese children has a significant contribution, as being the first of its kind in Bulgaria, and one of the largest worldwide regarding the sample size. In this study 5% of all children were identified as underweight, 66.5% as normal weight, 17.7% as overweight and 10.8% as obese, which corresponds to the results of the National Representative Study on the prevalence of overweight and obese children in Bulgaria.⁶ The current investigation demonstrated a non-significant correlation between body weight and periodontal health, which coincides with much other research on this topic¹³⁻¹⁵ but conflicts with others. Sfasciotti G et al. in a cross-sectional study among 100 children of 7-12 years old found out that a full-mouth plaque score value equal to 21.86% was observed in the group of non-obese patients against 50.08% in the group of overweight/obese patients.¹⁶ Several biological mechanisms of interaction between obesity and periodontal diseases were reported in the literature: impaired glucose tolerance, disturbances in the lipid profile, changes in the immune defense system of the host, increased macrophages activity, impaired microvascular function, secretion of proinflammatory substances from the adipose tissue, such as C-reactive protein, interleukins (IL-1 β , IL-6 and IL-8), adipokines (leptin, adiponectin, resistin and plasminogen activator inhibitors-1), tumour necrosis factor alpha (TNF- α), reactive oxygen species (ROS), which induce a chronic immunological response and directly affect periodontal tissues.¹⁷⁻²⁰ Children, who are obese or overweight, may display other comorbidities, such as dyslipidemia and/or insulin resistance and such associations between the positive gingival index, insulin resistance and excess body fat ($p = 0.008$) were described by Casavalle P et al.²¹ Other authors state that evidence showing common biological mechanisms of both obesity and periodontal diseases are not convincing, suggesting that poor attitude towards personal oral health together with overall unhealthy lifestyle of obese children is another possible etiological factor for development of periodontal problems.^{22,23} Psychosocial stress associated with over-

weight may affect periodontal health through physiological and behavioural pathways. Physiological responses to stress may alter blood and salivary flow and decrease the immune response to oral pathogens.²⁴ It is believed that emotional status has serious impact on personal oral health, because selfcare attitude is strongly influenced by the psychological profile.^{25,26} According to other researchers, the oral hygiene status can be affected by behavior factors, linked to obesity. Anand L. stated that more visible plaque was noticed in children who spent more time watching television and playing video games.²⁷ Reeves AF et al. and Modeer et al. found positive correlation between BMI and gingivitis only in groups of adolescents.^{28,29} Our survey is particularly focused on 6-11-year-old children, to avoid potential bias related to hormonal disorders during adolescence.

There are several limitations of this study. The analysis was able to examine only the cross-sectional association between obesity status and periodontal health, without exploring the timing of the onset of obesity. It was evaluated only the PLI, and we weren't able to assess bleeding scores and pocket depth. There was no data for the socio-economic status of the examined subjects, nor for behavioural risk factors, which can have impact on oral hygiene and gingivitis.

CONCLUSION

The present study shows that BMI is not an independent factor for poorer oral hygiene and gingivitis among 6-11-year-old children. Age and oral-hygiene status are inversely associated with gingivitis and being male is associated with greater accumulation of plaque. The different trends observed with respect to the association between obesity and periodontal diseases reflect the complex etiology of both conditions. They share common risk factors and require a complex and multidisciplinary approach. Further investigations revealing all the possible pathogenetic interactions between these two epidemics will provide both dental and medical professionals with better understanding of the nature of these diseases and with more efficient means to prevent it.

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Гигиена полости рта и гингивит у детей с избыточным весом и ожирением

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Абстракт

Введение: Ожирение представляет собой серьёзную опасность для здоровья в нашем обществе, частота которого резко возросла среди детей. Ожирение и заболевания пародонта имеют много общих факторов риска.

Цель: Изучить состояние гигиены полости рта и частоту гингивита у детей с повышенным индексом массы тела.

Материалы и методы: Исследование, основанное на текущем статусе, проводилось в Пловдиве в период с октября по декабрь 2017 года и с января по март 2018 года среди учащихся в возрасте от 6 до 11 лет. Состояние гигиены полости рта определяли с использованием индекса зубного налёта Silness-Löe и индекса зубного камня Green-Vermillion, оценённые на вестибулярных поверхностях первых постоянных коренных зубов верхней челюсти и одного центрального постоянного резца верхней челюсти и одного нижнего отдела нижней челюсти и язычных поверхностей первых постоянных коренных зубов нижней челюсти. Состояние десны оценивалось в отношении наличия или отсутствия гингивита.

Результаты: В исследование были включены 1826 детей (953 мальчика и 921 девочка). Что касается ИМТ, было обнаружено, что 8,3% всех детей имели недостаточный вес, 65% имели вес в норме, 15,6% имели избыточный вес и 10,3% страдали ожирением. Не было установлено существенной корреляции между возрастом и ИМТ. Не было обнаружено существенных различий между ИМТ и гингивитом ($p > 0,05$). Качество гигиены полости рта достоверно ассоциировалось только с категорией «пол» $\chi^2(2)=18.847$, $p < 0.001$; $\chi^2(1) = 7.582$, $p < 0.05$, поскольку в группе мальчиков наблюдалось большее накопление зубного налёта и зубного камня.

Выводы: Повышение ИМТ не является независимым предиктором гингивита. Плохая гигиена полости рта тесно связана только с категорией «пол».

Ключевые слова

Ожирение, индекс массы тела, гигиена полости рта, гингивит
