

Correlation between Body Mass Index (BMI), dental caries and respiratory system disease among 8 – 15 years old patients in Kosovo: A Pilot Study

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Abstract

Every modern society's primary goal is to ensure proper health care for their children. Problems of obesity/overweight and underweight in children related to caries and overall oral health is well documented. In our pilot study we compared the potential correlation between Body Mass Index (BMI), dental caries and Respiratory System Disease in children age 8 – 15 years old patients.

Data for a total of 121 children was obtained at the University Dentistry Clinical Center of Kosova, Pediatric and Preventive Dentistry Clinic from May until December 2016. The children's demographic data, age, gender, dental status, OHI-S calculations, respiratory disease data, orthodontic anomalies and dmft/DMFT values are noted. Research team members observed eight most frequent diagnoses, respiratory tract infections both in upper and lower airways, asthma and allergic rhinitis (ICD 46X).

121 subjects are included age 8 - 15, average age was 11.4 (SD ± 2.3 years). From the overall population 60 children were overweight or 49.6%, orthodontic abnormalities are represented with 41.3%, respiratory system disease with 49.9%, stage one OHI-S are represented with 38.8%, stage two OHI-S is represented with 15.7% and third stage of OHI-S 14.9%. Based on gender, we have not found any important statistical significance difference (P>0.05). Meanwhile, significant statistical difference between the dmft/DMFT (P=0.002) between the obese and non-obese subjects and the OHI-S index (P=0.017). Whereas, there was no statistical important significance in the overall morbidity caused by respiratory disease (P=0.717) and orthodontic abnormalities (P=0.463).

Our results suggested that correlation between dmft/DMFT and OHI(s) and obesity was significant, although weak correlation was found between obese/normal weight children and respiratory disease frequency and orthodontic abnormalities.

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Introduction

Over the last decade, the role of childhood underweight and obesity on later development of oral health disease and conditions was well documented, furthermore some acute and chronic health conditions can deteriorate their clinical condition. In many recent research papers related to childhood

underweight, overweight and obesity characterized through Body Mass Index(BMI) showed that weight disproportion conditions are serious social and public health problem.^{1,2,3,4,5}

Obesity during childhood is frequently correlated with same condition in adult phase of life.⁶The most frequent health related risk due to obesity in early life are cardiovascular, osteo muscular and respiratory system disorders.^{7,8,9} In some related studies, the linkage between lung function and dental health is weak, but respiratory tract infections are still the leading cause of morbidity among children in urban areas in the majority of developing countries.^{10, 11}

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Oral health conditions and dental caries prevalence related to Body Mass Index (BMI) is well documented in the current literature, therefore revealing the correlation between those factors can improve the overall public health strategies and promote oral health habits among children and young adolescents, in addition, both obesity and caries have common determinants and require a comprehensive, integrated management approach by multidisciplinary teams. Effects of diet on individuals' nutritional habits for longer period of time can mostly improve the OHI and dmft/DMFT scores. Action for better eating habits should be taken both at the individual level and at the social level by creating conditions, attitudes, interventions, and plans for healthy meals and eating habits at the different areas where young people are having their everyday living activities.^{12,13,14}

Kosovo has the youngest population in Europe, the population aged 14 years or less is represented with 32.8%.¹⁵ The non-governmental organization Public Oral Health Promotion was the pioneer as far as restoration of the oral health promotion and awareness right after the war of 1999. The most reliable data regarding the prevalence of dental caries was obtained during the period 2002 – 2005, and the results for Kosovo children (89.2% among preschool children and 94.4% among school children). The mean dmft/DMFT index was 5.86 for preschool children (ages 2 to 6) and 4.86 for all school children (ages 7 to 14).¹⁶ Caries prevention programs, appropriate interventions and parental counseling was not used systematically in Kosovo, even that pediatric dentists and other dental practitioners promoted the need for comprehensive oral health care educative measures in primary dental service settings.¹⁷

Assessment of childhood morbidities before and after their school age is crucial in order to evaluate child's response to disease and stress, which can vary with age. Various age groups can express different concerns, properties, and needs.¹⁸ Related to these efforts, our study intends to explore the correlation between respiratory tract disease, dental caries and overall dental health. High smoking rate in Kosovo and environment pollution are the leading cause of increased respiratory disease during 2005 – 2015 period.¹⁹

Dental caries is the mostly spread disease in the world. European goals for Oral

Health which are in concordance with WHO campaign by the year 2000 is that at least 50% of 5 – 6 years old children should be caries free and the population of 12 years old schoolchildren should have a mean DMFT of no more than 2.²⁰ The recent study regarding mean DMFT score in Kosovo young population showed huge improvement. In the epidemiologic study performed in the period 2002 – 2005 the mean DMFT showed a high prevalence of dental caries dmft/DMFT 4.86 for schoolchildren, meanwhile in the recent study the mean dmft/DMFT was 2.6.21

Aim of the Study

The main goal of our study is the correlation of BMI, caries and respiratory tract disease in children 8-15 years old in the Republic of Kosovo.

Materials and methods

This prospective pilot study has been carried out at the University Dentistry Clinical Center of Kosova, Pediatric and Preventive Dentistry Clinic from May until December 2016. Initially, 130 subjects were included, but due to some subjective and objective reasons only 121 children finished the study. Approval for our study was obtained by the ethical committee of the University Dental Clinical Center of Kosova.

The inclusion criteria were: children aged 8 - 15 with at list one episode of upper or lower respiratory tract infection, asthma or allergic rhinitis in last 6 months with no evidence of other systematic diseases and full eruption of first molars. Children having endocrinal problems, renal disease, physical and mental defects, malignant disease and undergoing orthodontic treatment were excluded from our study.

Prior to any evaluation, children's parents were asked for written informed consent. Data were collected from ambulatory visits for all subjects. The study questionnaire included children demographic data, age, gender, dental status, OHI-S calculations, respiratory disease data, orthodontic anomalies and dmft/DMFT values. All children have undergone clinical examination using dental mirror and explorer. WHO caries diagnostic criteria for Decayed, Missing and Filled teeth for mixed or permanent dentition (dmft/DMFT) was used for every child.²²

DMFT shows numerically expressed caries experience and its acquired by calculating

the number of decayed (D), missing (M), and filled (F) teeth (T). In our study we used the Simplified Oral Hygiene Index (OHI-S) with 6 teeth surface scored, four from posterior and two anterior teeth.

Criteria for classifying Debris:

- 0 - No debris or stain present
- 1 - Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered
- 2 - Soft debris covering more than one third, but no more than two third, of the exposed tooth surface.
- 3 - Soft debris covering more than two thirds of the exposed tooth surface.²³

At the first appointment, one of the research team members took the anthropometric measurements. The patients' weights (kg) are assessed to the nearest 0.1 kg using a digital scale and patient's height (cm) using a wall mounted measuring device. Body mass index (BMI) is the usual tool in expressing body fat percentile and is calculated by dividing weight by squared height: $BMI = \text{mass}(\text{kg}) / (\text{height}[\text{m}])^2$. BMI between 85 and 95 percentile is considered to be overweight and a BMI between 5 and 85 is deemed as a normal weight. In addition, a BMI less than 5 percentile is considered as underweight and above the 95 percentile as obese.²⁴ Gender - specific growth charts from the Centers for Disease Control (CDC) were used to obtain the BMI percentile values for each subject with age - and gender-specific growth charts.²⁵

Orthodontic anomalies were also registered like anterior and posterior cross bite, overjet and malocclusions class 1, 2 and 3.

In our study we observed eight most frequent diagnoses, respiratory tract infections both in upper and lower airways, asthma and allergic rhinitis (ICD 46X). Children with at least three episodes/recurrence of respiratory tract disease in the last six months prior to the beginning of our research were included in our study at the first Group A, and in Group B children with at least one or two episodes/recurrences of respiratory disease in the last six months.

Statistical analysis

The data obtained was analyzed using SPSS version 22.0 for Windows. Mean and

standard deviations were calculated for each clinical parameter. Odds ratio were calculated for differences on dmft/DMFT, OHI-S index, respiratory diseases, between overweight group and normal weight. Differences between means were tested with T-test or Mann-Whitney test. Significance for all statistical tests was predetermined at probability (P) value of 0.05 or less.

Results

In this study 121 subjects are included age 8 - 15, average age was 11.4 (SD ± 2.3 years). From the overall population 60 children were overweight or 49.6%, orthodontic abnormalities are represented with 41.3%, respiratory system disease with 49.9%, stage one OHI-S are represented with 38.8%, stage two OHI-S is represented with 15.7% and third stage of OHI-S 14.9%. Based on gender, we have not found any important statistical significance difference (P>0.05), (Table 1).

	Boys n = 59	Girls n = 62	Total n=121
	59	62	121
Age yrs. (Mean ± SD)	11.3 ± 2.3	11.6 ± 2.4	11.4 ± 2.3
BMI (Mean ± SD)	22.3 ± 5.8	23.9 ± 5.8	23.1 ± 5.8
BMI			
Overweight	25 (42.4%)	35 (56.5%)	60 (49.6%)
Normal weight	34 (57.6%)	27 (43.5%)	61 (50.4%)
dmft/DMFT (Mean ± SD)	2.7 ± 1.2	2.9 ± 1.4	2.8 ± 1.3
Orthodontic Abnormalities			
No	38 (64.4%)	33 (53.2%)	71 (58.7%)
Yes	21 (35.6%)	29 (46.8%)	50 (41.3%)
Respiratory System Disease			
Group A	25 (42.4%)	36 (58.1%)	61 (50.4%)
Group B	34 (57.6%)	26 (41.9%)	60 (49.6%)
OHI(s)			
No debris	16 (27.1%)	21 (33.9%)	37 (30.6%)
Sage I	20 (33.9%)	27 (43.5%)	47 (38.8%)
Stage II	9 (15.3%)	10 (16.1%)	19 (15.7%)
Stage III	14 (23.7%)	4 (6.5%)	18 (14.9%)

Table 1. General characteristics of the population included in this study.

We have found significant statistical difference between the dmft/DMFT (P=0.002) between the obese and non-obese subjects and the OHI-S index(P=0.017). Whereas, there was

no statistical important significance in the overall morbidity caused by respiratory disease (P=0.717) and orthodontic abnormalities (P=0.463), (Table 2).

	Overweight n = 60	Normal weight n = 61	OR (95% CI)	P-value
dmft/DMFT (Mean ± SD)	3.2 ± 1.3	2.5 ± 1.2		0.002
Orthodontic Abnormalities				
No	33 (55.0%)	38 (62.3%)	0.739 (0.357 - 1.529)	0.463
Yes	27 (45.0%)	23 (37.7%)		
Respiratory System Disease				
Group A	29 (48.3%)	32 (52.5%)	0.847 (0.415 - 1.731)	0.717
Group B	31 (51.7%)	29 (47.5%)		
OHI(s)				
0	12 (20.0%)	25 (41.0%)	0.360 (0.159 - 0.811)	0.017
1	21 (35.0%)	26 (42.6%)		
2	13 (21.7%)	6 (9.8%)		
3	14 (23.3%)	4 (6.6%)		

Table 2. Results from dmft/DMFT calculations, orthodontic abnormalities, respiratory system disease and OHI(s) index.

Discussion

Dental caries is a multifactorial infectious disease. Factors which can contribute in the initial lesion development include oral hygiene, diet composition and consumption frequency, socioeconomic status, salivary immunoglobulins, bacterial load and fluoride intake.^{26, 27}

Untreated caries lesions will progress to dental pulp and the child will experience recurrent toothache and uncomfortable eating. In some cases this may contribute to impaired weight gain and slow child's growth rate, and in some cases children with severe caries may be a risk marker for malnutrition.²⁸

In our present study, we found positive association between increased weight represented through BMI and dental caries experience in children aged 8 - 15 years (P=0.002), compare to children with normal body weight, whereas similar discrepancy was also noted for OHI(s) index values between groups (P=0.017).

Results from our study showed statistical difference between the dmft/DMFT (P=0.002) between the obese and non-obese subjects. In some current literature exploring this relationship have found a positive correlation between high dmft/DMFT and obesity^{29, 30}, inverse relationship was described in the study conducted by Macek

et al³¹, whereas some recent studies found no association.^{32, 33} On the other hand, Yang et al. in their study found inverse relationship between BMI and dmft/DMFT based on Pearson correlation R values of -0.075 and -0.104.³⁴

Based on the results of their study, Jong-Lenters et al. concluded that there was no statistically difference were found between the mean dmft or dmfs scores of the two groups: overweight and non-overweight (OR 1.04 , OR 0.72).³⁵ Kesim et al. utilized multiple binary logistic regression model 1 and showed that BMI predicted DMFT scores in both gender.³⁶ Another study (Mojarad et al.), demonstrated that no statistically significant relationship was found between high weight and caries frequency in the first (p=0.08) and permanent dentition (p=0.06).¹⁴

As far as involvement of gender related predominance of caries lesions among obese subjects Chopra et al. using binomial regression revealed that females were 1.293 times at risk of developing caries as compared to males, meanwhile, simplified-Oral Health Index (OHI-s) showed 3.920 and 4.297 times risk of developing caries as compared to good oral health, respectively. In addition, overweight children had highest dmft/DMFT (3.21).³⁷ Significantly more children with severe early childhood caries were classified as overweight or obese when compared to caries - free children (p=0.038) and had significantly higher mean BMI z-scores than caries - free children (0.78 ±1.26 vs. 0.22±1.36, p=0.002).³⁸ Gupta et al. in their study showed that only oral hygiene status had a significant effect on caries prevalence (OR=5.061, P=0.004)whereas body mass index had no significant effect.¹³ Conflicting findings are presented in the study conducted by Köksal et al. in comparison with our study, stating that children with low body weight have a higher risk of developing dental caries than overweight-obese children, caries were found in 89.7% of children with low body weight and 66.1% of overweight – obese children (p<0.05).³⁹

Our study demonstrated that no statistical important significance in the overall morbidity caused by respiratory disease (P=0.717). Some other studies like Rantala et al. in their cohort study suggested that occurrence or respiratory tract infections in early childhood has a role in development of an increased number of filled teeth in young adulthood, consecutively increased number of filled teeth was found to be

related to the lower respiratory tract infections leading to hospitalizations up to the age of 7 years.⁴⁰ Strong association was found between caries experience and asthma in a study conducted by Anjomshoaa I. et al. (DMFT above 15 ($R^2=0.04$) and DMFS above 50 ($R^2=0.02$).⁴¹

Association between chronic respiratory disease periodontal status assessed using DMFS/T (summary of cumulative caries experience) was well presented in study performed by Scannapieco et al. where subjects with mean attachment loss (MAL) ≥ 3.0 mm had a higher risk of COPD than those having $MAL < 3.0$ mm (OR, 1.45; 95% CI, 1.02 to 2.05).⁴² Results from our study verified that there was no statistical important significance between obese and non-obese group of children in the overall morbidity caused orthodontic abnormalities ($P=0.463$). Hedayati et al. in his study demonstrated that there was not any significant relationship between BMI percentile, skeletal maturation and orthodontic abnormalities rate, but authors confirmed positive correlation between accelerated dental maturity and increasing BMI percentile ($p=0.002$).⁴³ Biello G et al. in their observational study assessed the impact of obesity in development of malocclusions among childhood subjects, showing that obesity has altering impact on skeletal maturation and on the onset of orthodontic anomalies, whereas Mack KB et al. acquired similar results showing that overweight children are more predisposed to orthodontic anomalies.^{44,45}

Conclusions

Based on limitations of our study regarding sample size and gender distribution, in this trial of pediatric patients, the present results suggested that correlation between dmft/DMFT and OHI(s) and obesity was significant, although weak correlation was found between obese/normal weight children and respiratory disease frequency and orthodontic abnormalities.

Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

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