

Relating Dental Caries Experience with Body Mass Index among Primary School Children from Ohrid City - A Pilot Study

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Abstract

Aim: The aim of this study was to investigate the relationship between Body Mass Index (BMI) and mean DMFT score of 12 year old school children in Ohrid city.

Materials and Methods: This cross-sectional study assessed school children aged 12 years with measurement of the DMFT (Decayed, Missed, and Filled Teeth) dental indexes and BMI (Body-Mass Indexes) analyzed during four months period in 2014 year. Anthropometric measurements: the height and weight of the participants were determined according to standard criteria. Depending on their nutritional status, the subjects were categorized, as being 'normal weight,' "at risk of overweight" and "overweight".

Results: In the group of 102 12-year-old children, 55 children were with normal weight, 25 children were at risk of overweight and 22 overweight children. The majority of the children were having normal weight (BMI < 20.50) with 21.57% classified as overweight (BMI 24.35–34.53) and 25.49% at risk of overweight obese (BMI 20.50–24.35). The mean DMFT score of the 12 year old children from city Ohrid was 2.25±2.17. The mean DMFT score between the children with normal weight was 2.53±2.27, between the overweight children was 2.32±2.46 and while between the children at risk of overweight was 1.6±1.55. The children with normal weight had highest DMFT score. The difference between the average DMFT scores

between the children with normal weight and the overweight children was not statistically significant. Children at risk of overweight were with lowest DMFT score.

Conclusion: Being overweight was found to be negatively associated with mean DMFT in primary school children from Ohrid city.

Keywords: Body Mass Index; Dental Caries; School Children

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Introduction

Obesity and dental caries are both multifactorial diseases that impact children's health and psychosocial development. Therefore, the World Health Organization (WHO) emphasizes the need to adopt a unified approach for the - promotion of general and oral health instead of the previous single-level strategies [1]. Recent national data from Sweden [2] suggest a positive correlation between dental caries and Body Mass Index (BMI), and showed that obesogenic behavior such

as snacking in early childhood predicted caries development in adolescence.

Under nutrition in early childhood affects skeletal growth and results in decreased height. Similarly, poor nutrition in early childhood affects tooth eruption and results in delayed emergence of the teeth. Delayed tooth eruption leads to exposure of the teeth in the oral environment for a lesser period of time. This may lead to the delay in caries acquisition. There appears to be a strong physiological association between skeletal growth and delayed tooth eruption [3-5]. Malnutrition has also been associated with enamel hypoplasia with evidence showing that children with enamel hypoplasia have increased caries risk [6].

BMI is widely used as a surrogate measure for obesity because it corrects for an individual's height in relation to weight, and is a commonly used indicator, which can indicate nutritional status. Given that dental caries rates and BMI both measure diet-related health outcomes [7-10]; an association between the two is not surprising.

The problem of overweight and obesity is confined not only to adults but also to children and adolescents. Various studies also indicate that the prevalence of overweight and obesity among children of all ages is increasing in developing countries [11-13]. Obesity is a condition in which energy intakes exceed the energy requirements resulting in the deposition of body fat; it is defined as an excess of body fat and has both genetic and environmental origins [14].

Current researches in dental sciences trends toward exploring the link between oral health and systemic health [15, 16]. The present changing dietary pattern among children is contributing to childhood overweight and on other hand stands as a risk factor in the development of dental caries, this relation between childhood overweight and dental caries is biologically plausible [17].

The aim of the present study was to evaluate the relationship between childhood obesity and dental caries, in Macedonian paediatric population, through the use of the method of diagnosis of overweight-obesity by Body Mass Index (BMI).

Materials and Methods

The study was conducted in Ohrid city, its settlement Rača and one village in its surrounding, during 2014 year. Eight primary schools and one primary music school in the Ohrid city exist. In the primary school "Bratstvo i Edinstvo" (Brotherhood and Unity) teaching process is conducting in three languages: Macedonian, Albanian and Turkish. Primary school "Gligor Prlichev" is located in the downtown area of Ohrid city. Children from three nationality are enrolled in primary school "Bratstvo i Edinstvo", that was the reason why we selected this school in our investigation. In the school a total of 1305 students are enrolled, of which 117 are in settlement Rača and 90 students in the preparatory year. Leskoec village is located in Ohrid valley, 2 km north from Ohrid city. Near the center of Leskoec village, surrounded by fenced and landscaped spacious schoolyard, the school building of primary school "Vanco Nikoleski" is located. The total number of students enrolled at the primary school "Vanco Nikoleski" was 402. According to the nationality, all 402 students are Macedonians and teaching process is conducting in Macedonian language.

However, 102 pupil aged 12 years from four primary schools were selected for the study. The four schools were three central schools "Gligor Prlichev" and "Bratstvo and Edinstvo" from Ohrid city, "Vanco Nikoleski" from village Leskoec and one regional school of the central school "Gligor Prlichev", located in settlement Rača. It has been decided to use cluster sampling because it was more economical and achievable within the constraints of resources and finance. The primary schools were selected based on accessibility to these schools and ability to get consent from the head teachers and parents. Participants were randomly selected from all children attending a above mentioned primary schools. In this preliminary investigation we include only 102 school children.

We have limited our study only to the 12 year old school children, because it is the last age at which a reliable sample may be obtained easily through the school system. Also, it is likely that by this age all the permanent teeth except the third molars will have erupted. For these reasons, age 12 years

has been chosen as the global indicator age group for international comparisons and surveillance of disease trends.

Pupil diagnosed of systemic diseases, which have a likelihood of increasing propensity to dental caries like asthma were excluded. Signed parent consent was obtained and permission was obtained from the school authorities before the study. Thereafter, clinical oral examination was carried out by calibrated dental doctors (regional coordinator and another dentist) to assess the presence of dental caries, missing and Filled Teeth (FT) using a mirror and probe in accordance with the World Health Organization criteria [18], which was used subsequently to calculate the Decayed Missing Filled Teeth (DMFT). They underwent a training and calibration exercise before the survey. Ethical approval for the study was obtained from the Ethics Committee of the School of Dentistry of Skopje, University St.Cyril and Methodius. A tooth was recorded as carious when there was a frank cavitation, undermined enamel or a detectable softened floor or wall, which caught the probe. The weight and height of subjects were also measured using a bathroom scale (METALIJA Subotica, type OVB, factory number 3628, Year of Production 1975) and a meter rule respectively. The BMI was calculated using the standard formula of body weight divided by the square of height [19], and the participants were categorized into normal, at risk of overweight and overweight using the BMI percentile set thresholds for children of the same sex and age in growth charts of WHO [20]. A total of four doctors did the examination with two of them doing the oral examination and the remaining two measuring the height and weight used for the calculation of the BMI. The assessment of inter examiner reliability during examiners calibration revealed correlation coefficient of 0.9 value, which was high. The reliability of the assessments is measured by determining the degree to which examiners can produce uniform and consistent results when performing independent replicate examinations without discussion. Data from the calibration sessions are analyzed to measure correlation between each examiner and the standard examiner. If correlations between each of the examiners and the standard

examiner are not within acceptable ranges, additional training sessions will be scheduled.

It is necessary to assess the consistency of each individual examiner (intra-examiner reproducibility) and also the variations between examiners (inter-examiner reproducibility). In general, the consistency level for most assessments should be in the range of 85–95% [21]. Inter-and intra-examiner consistency can be assessed in a number of ways, the simplest being the percentage of agreement between scores, i.e. the percentage of subjects allocated the same score by two examiners. In the case of dental caries, however, if the prevalence of disease is low, this method does not provide an accurate assessment of reproducibility. A more reliable way of assessing overall agreement between examiners is the kappa statistic [21, 22]. The kappa statistic relates the actual measure of agreement with the degree of agreement which would have occurred by chance.

The data were analyzed using the SPSS version 17.0. Test for significance was carried out using the Chi-square statistics, independent-test, ANOVA and Spearman's correlation coefficient test was done to assess whether there is any relation between BMI and caries. $P > 0.05$ was considered as a significant.

Results

All parents agreed to their child's participation, giving a response rate of 100%. The kappa statistic for the presence or absence of caries varied from 0.89 to 0.94 for inter-examiner or intra-examiner agreement. The kappa statistic for measuring of the BMI was 0, 90.

The male population constituted 50% and the female 50 % (Table 1). A total of 24.5 % and 21.6 % of the participants were at risk of overweight and overweight respectively (Figure 1). The mean DMFT was significantly associated with gender and female participants have higher mean DMFT than male participants (2.53 vs 1.98) (Table 2). Of the participants, 77 (75.49 %) of the children had dental caries with a mean DMFT of 2.25 ± 2.17 . The prevalence of untreated caries (Decayed Teeth [DT]), the FT and the Missing Teeth (MT) were 56 (54.9

%), 47 (46.08 %) and 6 (5.88 %) respectively. DT contributed 52% (0.52) of DMFT. The mean DT, FT and MT were 1.17 ± 1.47 , 0.94 ± 1.32 and 0.15 ± 1.01 respectively. The mean DMFT in normal weight children was 2.53 ± 2.27 , that for the children at risk of overweight was 1.6 ± 1.55 and for the overweight children was 2.32 ± 2.46 (Table 2 and Figure 2). The prevalence of caries

was the highest among children with normal weight, followed by overweight and at risk of overweight participants. The component of the DMFT in numbers and percentages of each BMI category (nutritional status) among the participants was showed on Table 3.

Table 1: Demographic characteristic of the participants

Characteristics	Frequency (no.)	Percent
12 years	102	100%
Gender		
Male	51	50%
Female	51	50%

Figure 1: The body mass index categories among the participants

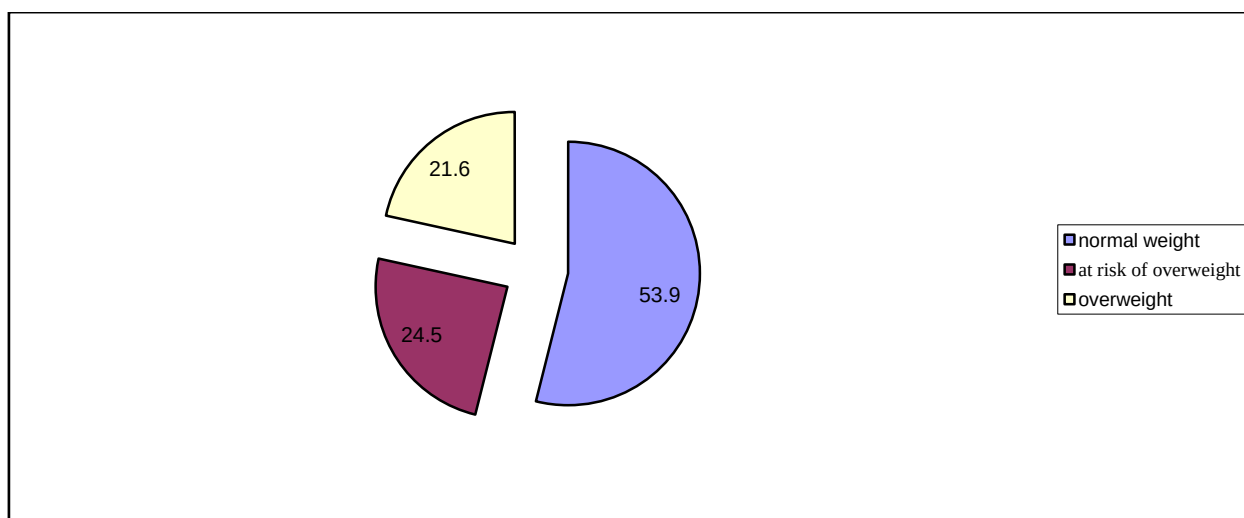


Table 2: Demographic characteristics and mean DMFT among the participants with different nutritional status

Characteristics		DMFT (mean $\pm$ SD)		P value
Gender				
Male		1.98 $\pm$ 1.89		<.0001
Female		2.53 $\pm$ 2.41		
Nutritional status				
Normal weight		2.53 $\pm$ 2.27		<.0001
at risk of overweight		1.6 $\pm$ 1.55		
overweight		2.32 $\pm$ 2.46		

Characteristics		DT (mean±SD)		P value
Gender				
Male		1.33±1.61		<.0001
Female		1.0±1.31		
Nutritional status				
Normal weight		1.27±1.51		<.0001
at risk of overweight		0.88±1.20		
overweight		1.22±1.66		
Characteristics		MT (mean±SD)		P value
Gender				
Male		0.02±0.14		<.0001
Female		0.27±1.42		
Nutritional status				
Normal weight		0.24±1.36		<.0001
at risk of overweight		0.04±0.2		
overweight		0.04±0.21		
Characteristics		FT (mean±SD)		P value
Gender				
Male		0.63±0.89		<.0001
Female		1.25±1.59		
Normal weight		1.02±1.27		<.0001
at risk of overweight		0.68±1.03		
overweight		1.04±1.70		
Characteristics		BMI (mean±SD)		P value
Gender				
Male		21.56±3.61		<.0001
Female		20.36±4.34		

Figure 2: Decayed, missing filled and teeth and body mass index category among the participants

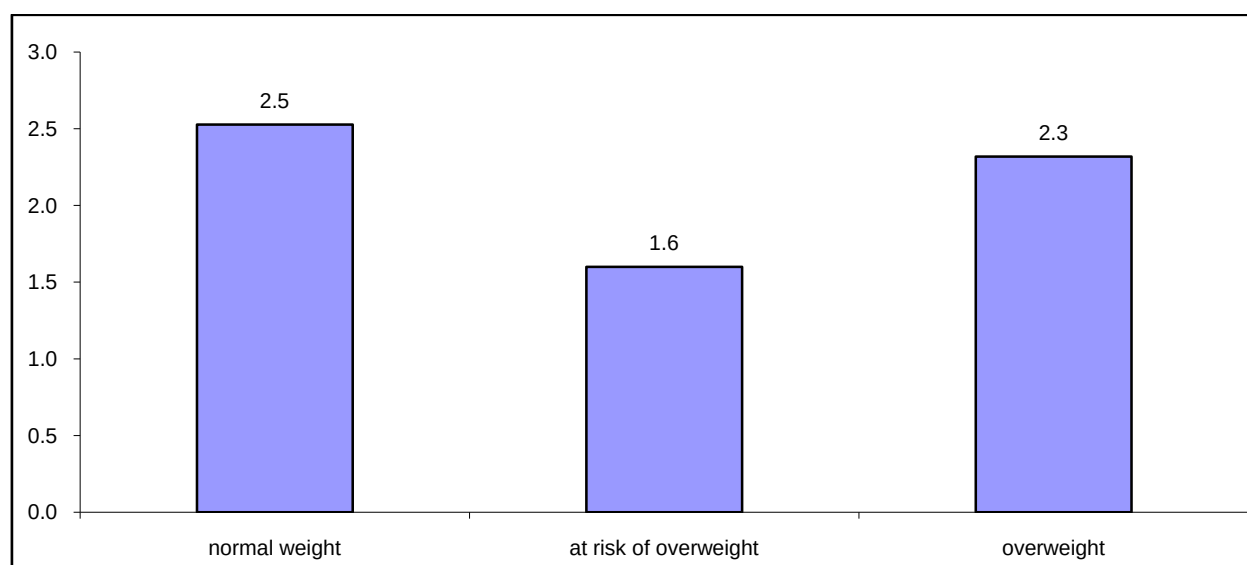


Table 3: Caries experience and BMI category among the participants

Experience	Normal weight n (%)	at risk of overweight n (%)	Overweight n (%)	Total n (%)	P value
Caries	23 (41,8)	13 (52,0)	10 (45,5)	46(45,1)	0,6973
No caries	32 (58,2)	12 (48,0)	12 (54,5)	56(54,9)	
Total	55 (100,0)	25 (100,0)	22 (100,0)	102(100,0)	
No missing teeth	51 (92,7)	24 (96,0)	21 (95,5)	96 (94,1)	0,8093
Missing teeth	4 (7,3)	1 (4,0)	1 (4,5)	6 (5,9)	
Total	55 (100,0)	25 (100,0)	22 (100,0)	102 (100,0)	
No filling teeth	26 (47,3)	16 (64,0)	13 (59,1)	55 (53,9)	0,3267
Filling teeth	29 (52,7)	9 (36,0%)	9 (40,9)	47 (46,1)	
Total	55 (100,0)	25 (100,0)	22 (100,0)	102 (100,0)	
Caries free teeth	9 (16,4)	9 (36,0)	7 (31,8)	25 (24,5)	0,1113
Decayed, missing and filling teeth	46 (83,6)	16 (64,0)	15 (68,2)	77 (75,5)	
Total	55 (100,0)	25 (100,0)	22 (100,0)	102 (100,0)	

The prevalence of untreated caries (decayed primary teeth [dt], the ft and the missing teeth [mt] were 17 (16, 67%), 8 (7, 84%) and 0 (0%) respectively. The decayed primary teeth [dt] contribute 78, 95 % (0.78) of dmft. The mean dt and ft were 0, 29± 0, 76 and 0, 09±0, 32 respectively. The mean dmft of the whole sample was 0.38±0.93. 79 of the children do not have primary teeth, 6 children have only one primary teeth, 3

children have two primary teeth, 6 children have three primary teeth, 2 children have four primary teeth, 4 children have 5 primary teeth, one child have six primary teeth and one have eight primary teeth. Spearman's correlation coefficient test was done to assess whether there is any relation between BMI and caries. Negative correlation ($r = -0.1105$, $p > 0.05$) was found between DMFT and BMI (Table 4).

Table 4: showing the correlation procedure

Simple Statistics							
Variable	N	Mean	Std Dev	Median	Minimum	Maximum	Label
BMI	102	20,95544	4,01811	20,47839	13,6926	34,52709	BMI
DMFT	102	2,2549	2,17404	2	0	10	DMFT

Spearman Correlation Coefficients, N = 102		
Prob > r under H0: Rho=0		
	BMI	DMFT
BMI	1	-0,11045
DMFT	-0,11045	1

Discussion

We believe this to be the first study to provide data on the relationship between the nutritional status and oral health among schoolchildren in Macedonia. Ohrid city is located in the Pelagonia region of our country (Figure 3). In our study we find

that the mean DMFT of 12 years old school children from Ohrid was 2.25 ± 2.17 .



Figure 3: Eight regions of the Republic of Macedonia

Dental caries experience among primary schoolchildren in Ohrid (2.25 ± 2.17) is lower than that reported by Ambarkova V, for the same age group (3.47 ± 2.90) of children from the Eastern region [23]. The results of systematic review conducted by Hooley et al. [24] show that there is still significant disagreement as to the existence and nature of an association between dental caries and BMI. Forty-eight percent of studies reviewed by Hooley et al. found no association between dental caries and BMI; 35% found a positive association and 19% found an inverse association. In the study conducted by Marković D et al. [25] being overweight negatively correlated with the DMFT index among the participants.

Spearman's correlation coefficient test was done to assess whether there is any relation between BMI and caries. Negative correlation ($r = -0.1105$, $p > 0.05$) was found between DMFT and BMI. This result was similar to the findings of Macek and Mitola [26] and Kopycka-Kedzierawski et al. [27].

Negative correlations indicate an inverse relationship between BMI and caries in permanent teeth.

The dietary habits of children that contribute to obesity could also increase caries risk. Our study did not show relationship between caries risk and caries experience which does not correlate with the findings of study done by Sudha P [28]. The true etiology of both obesity and dental caries is complex and multifactorial. Many of the contributing factors are rooted in evolving changes in lifestyle and the internal body as well as external environment [16]. The present study showed no relation between overweight and dental caries and is in accordance with the studies conducted by Macek, [29] Hong, [30] Jamelli, [31] Gokhale, [32] and Sudhakar [33].

It is important to consider the limitations of the study. First one being the data collected was cross-sectional and the study was performed on a small geographic location. Also study sample was small, but this is a pilot study and in the future research we will enlarge study sample. Another limitation is that we did not use the ICDAS system which gives more detailed description on the severity of caries.

Conclusion

Being overweight was found to be negatively associated with mean DMFT in primary school children from Ohrid city. Non-significant association between the BMI and caries experience was noted.

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