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Correlative Valuesof Body Weight (Body Mass Index) And Dental Caries In Examinees With Primary Dentition

*Naskova S.[1], Iljovska S.[2],Iljovska M.[3], Denkova N.[4], Zlatanovska K.[5]
[1]*Goce Delcev" University in Stip, Faculty of Medical Sciences, Department of Dental Medicine-Stip, Macedonia*
[2]*Ss. Cyril and Methodius" University in Skopje, Faculty of dentistry-Skopje, Macedonia*
[3]*Ss. Cyril and Methodius" University in Skopje, Faculty of medical-Skopje, Macedonia*
**Corresponding author: Naskova S.1,*

Abstract: *The purpose of the examination was to determine the effects of the BMI on the onset of dental caries in children with primary dentition, and their interdependent correlation with the intensity of the dental caries.*
Material and methodology: *For the realization of our study, we randomly selected 74 pre-school children (35 female and 39 male) which were at the age of 4-6 years and were enrolled in the primary schools in the city of Stip, and then they were divided into two groups: an experimental and a control group.*
In all examinees the BMI values were calculated .The calculation of the body mass(BMI) in % was done using a scheme according to gender, using the scale given by the CDC (Center for Disease Control and Prevention) and clinical trials were also carried out (dmf and intensity of dental caries).
Results*: The results of the study indicated that between the body weight of the children and the presence of dental caries for Pearson Chi-square = 2.80 and p> 0.05 there is no significant correlation.*
In the determination of the significance of the contribution of each component toward the presence of dental caries, it was found that malnutrition had the greatest influence (Wald = 2.06 / p> 0.05 (p = 0.15), then being overweight (Wald = 0.89 / p> 0.05 (p = 0.35) and the weakest influence was seen by the normal weight (Wald = 0.39 / p> 0.05 (p = 0.53).As a conclusion, we would say that decades of research focused on the identification of children with a high risk for development of dental caries and the detection of their cause is of paramount importance, and it has been proven that BMI is one of the most serious factors.
Keywords*: Body Mass Index (BMI), dmf, intensity of dental caries*

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I. Introduction

The diet is one of the decisive factors in the development of caries, and the association between dental caries and the consumption of highly fermented carbohydrates is a debated subject amongst the scientific and the expert community. Ivanovic believes that special attention should be paid to the diet especially in people with absent oral hygiene and fluoride prophylaxis. She highlights the relevant evidence that havinmultiple meals a day is a direct cause of caries. [1]Timiş [2] emphasizes that in general, population groups, with low levels of dental health understanding, are characterized by low levels of education and a poor economic status. In most cases, high income families provide space for optimum living conditions, while having increased access to dental services. The authors believe that differences, such as the monthly income and the educational level of the parents, generate inequality among children concerning their general, oral and dental health.

Increased weight in children is a global health problem with a multifactorial disorder, environmental and genetic risk factors, where, there is an imbalance between the intake of energy substances through food, and energy consumption, which allows the storage of excess energy as fat, which means, that poor eating is the primary factor of obesity. [3]Alm and et al. [4] cite that the body mass index (BMI) imposes a weight and height ratio and is used as a tool to identify body mass and is recommended by the American Academy of Pediatrics (AAPD) as a diagnostic tool for screening the weight in children since the beginning of the 2nd year of their life and classifying them into the following groups: normal weight, underweight, overweight and obese. [5]
Godlewski et al. [6] found that for the last 20 years, on a global scale, the prevalence of obesity is constantly increasing in both children and adults. They believe that obesity is often associated with other pathological conditions, the most common of which are cardiovascular, oncological and systemic (diabetes), which requires monitoring with a multidisciplinary approach. Obesity and oral health have common risk factors, and the importance of an unbalanced diet is especially important. As a result of these relationships, the World Health Organization has included oral health in the Global Health Program as a priority. [7]

In the studies carried out by Jong-Lenters et al. [8] for the relationship of being overweight and dental caries, statistically significant differences were found between the mean value of DMFT or DMFS and the examined groups which were of normal weight and those who were overweight. The authors did not support the Ludwig hypothesis for a positive association of BMI and dental caries in children aged 5-8 years. [9]
The purpose of the examination was to determine the effects of the BMI on the onset of dental caries in children with primary dentition, and their interdependent correlation with the intensity of the dental caries.

II. Material And Methodology

2.1 Examinees included in the study

For the realization of our goals, 74 pre-school children at the age of 4-6 years(35 females and 39 males) were randomly selected from the primary schools in the city of Stip and then were divided into two groups: I. Control group - 31 examinees without (dmf = 0) and II. Experimental group -43 examinees with dmf.
The study contains the following components: assessment of the nutritional status (body mass index), and an objective clinical examination

2.2.Determination of the nutritional status (Body mass)

The anthropometric measurements that we took into account were for weight and height and were according to the World Health Organization (WHO) guidelines of 2002, and were realized in the following few steps. [10]

2.3 Preparation for assessment of the body mass

The examinees were dressed lightly and the measurements were made using a standardized digital scale, with weight measuring below and above 500grams rounded up to the nearest number. During the determination of the height, the respondents were without shoes and the height was determined using a measuring tape which was graded in centimeters and meters.

***2.3*Calculation of thebody mass index (BMI) was done with a calculator usingstandardized formulas:**

$$BMI = \frac{\text{Weight in kilograms}}{(\text{Height in centimeters}) \times (\text{Height in centimeters})} \times 10{,}000\%$$

2.4Determination of the body mass

Determination of the body mass (BMI) in% was done according to a scheme according to the gender, using a scale given by the CDC (Center for Disease Control and Prevention). The body weight on the scheme for the examinees is indicated on the vertical line of the graph while the age is on the horizontal line of the graph, thus forming an imaginary line and point on the graph, where these imaginary lines intersect. The intersection point of the imaginary lines represents the body mass (BMI) expressed in%.
The interpretation was carried out according to the age and gender, by using aBMI scheme and graphs issuedby the Center of Disease Control and Prevention and a specially prepared WHO software (AnthroPlus v1.0.4)which enables the calculation of body mass data in children and adolescents by generating scores shown in% according to which, the category of BMI is determined according to the graph presented. [11]

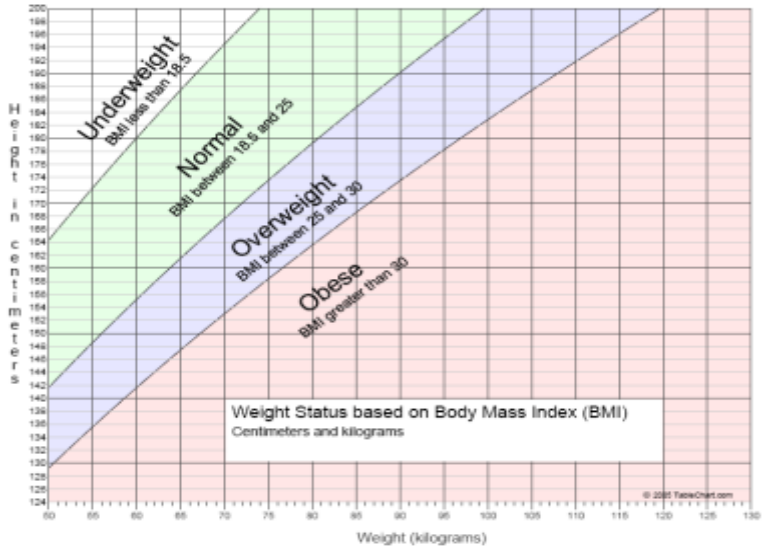


Figure 1. Graph for determining the body mass

According to the obtained values of the Body Mass Index (BMI), the examinees were divided into 4 categories:
Underweight = BMI<5%
Normal weight = 5 <BMI<25%
Overweight = 25 <BMI<30%
Obese = BMI> 30%

III. Clinical Examination

The clearly visible lesions on the surfaces of the teeth were noted as cavities, while changes in the transparency and initial demineralization with an intact surface, without cavitation, was noted as a healthy tooth.
2.1 Assessment of the caries risk in primary and permanent dentition
According to the obtained data from the clinical examination, we determined the intensity (presence / absence) of dental caries (WHO, Geneve, 1997) and we noted and interpreted them in the following manner[11]:
For primary dentition the interpretation was
a) ≤ 3 low dental caries risk
b) 4-6- moderate dental caries risk
c) ≥ 7 high dental caries risk

3.1Statistical assessment of the results

1. The data analysis was performed usingthe statistical programs Statistica 7.1 for Windows and SPSS Statistics 17.0. The following methods were used:
2. In the analysis of the series with attributive features the presence of dental caries and dental caries risk, percentages of the structure (%) are determined;

a. The characteristics of the series with attributive features were tested using the Pearson Chi-square test, Fisher Exact test / Monte Carlo Sig. (2-sided), (p), Fisher test (p);
b. The differences were tested with the t-test for independent samples (t) and Mann-Whitney U test (Z / p);

3. Significance is determined by p <0.05. The data is tabulated and graphically displayed.
4.

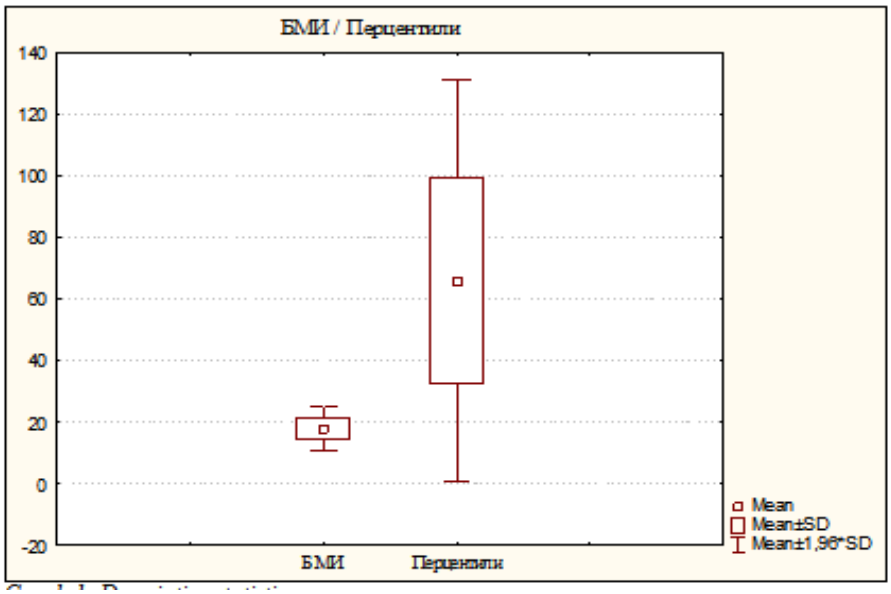
VI. Results

4.1 Control group

The descriptive statistics of the values of the BMI and the percentiles in the control group shown in Table 1 and Graph 1 vary in the interval 18.07 ± 3.56; ± 95.00% KI: 16.77-19.38, the minimum value is 11.9 and the maximum is 28.30. The values of the percentiles vary in the interval 65.78 ± 33.27; ± 95.00% KI: 53.58-77.99; the minimum value is 0.10 and the maximum value is 99.50.

Table 1. Descriptive statistics

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
BMI	31	18,07	16,77	19,38	11,90	28,30	3,56
Percentiles	31	65,78	53,58	77,99	0,10	99,50	33,27



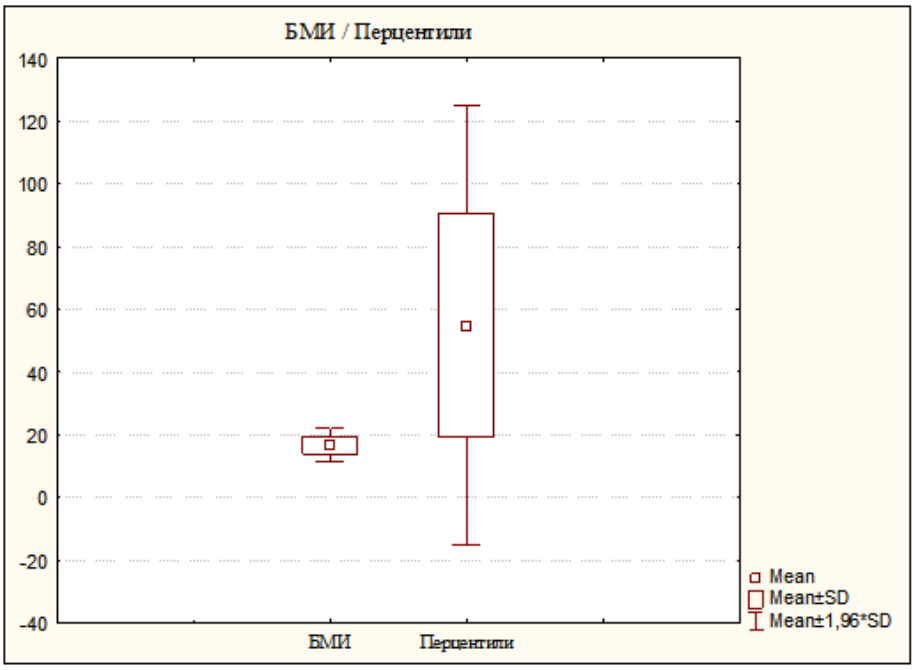
.Graph 1. Descriptive statistics

4.2 Experimental group

The descriptive statistics of the values of the BMI and the percentiles in theexperimental group are shown in Table 2 and Graph 2 and they vary in the interval 16.77 ± 2.79; ± 95.00% KI: 15.91-17.63; the minimum value is 12.20 and the maximum is 22.50. The values of the percentiles vary in the interval 54.91 ± 35.65, ± 95.00% KI: 43.94-65.88; the minimum value is 0.10 and the maximum value is 98.20.

Table 2. Descriptive statistics

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
BMI	43	16,77	15,91	17,63	12,20	22,50	2,79
Percentiles	43	54,91	43,94	65,88	0,10	98,20	35,65



Graph 2. Descriptive statistics

Difference / Control group & Experimental group

The BMI value in children in the control group is greater compared to the experimental group, but the difference for t = 1.77 and p> 0.05 (p = 0.08) is not significant (Table 3).

Table 3. Difference / Control group & Experimental group

Parameter	Mean Control	Mean Experimental	t-value	df	p	Valid N Con.	Valid N Exp.	Std.Dev. Con,	Std.Dev. Exp.
BMI	18,07	16,78	1,77	72	0,08	31	43	3,56	2,79

The value of the percentiles in the children from the control group for Z = 1.35 and p> 0.05 (p = 0.18) is insignificantly higher than the value of the percentiles in the children of the experimental group (Table 4).

Table 4. Difference / Control group & Experimental group

Parameter	Rank Sum Control	Rank Sum Experimental	U	Z	p-level	Valid N Control.	Valid N Experimental.
Percentiles	1286,00	1489,00	543,00	1,35	0,18	31	43

The results of the examinationreferring to the body mass index are shown in Table 5. In the experimental group of 43 (58,10%) children, 5 (6,80%) children were underweight, 23 (31,10%) children had normal weight, 9 (12.20%) were overweight, and 6 (8.10%) children were obese. In the control group (without dental caries) of 31 (41.90%) children, 1 (1.40%) child was underweight, 18 (24.30%) children had normal weight, 5 (6.80%) wereoverweight, and 7 (9.50%) children were obese.In the shown distribution of data for body mass index, for Fisher's Exact Test = 2.47 and p> 0.05 (p = 0.50 / 0.486-0.512) there is no significant difference between the two groups.

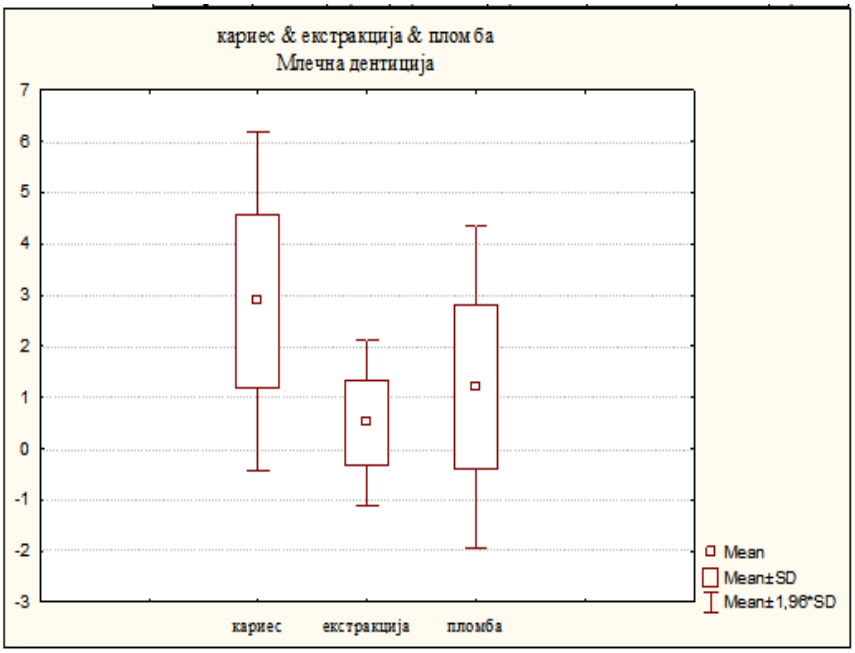
Table 5. Group / Body mass index

Group			Nourishment				Total
			Underweight	Normal weight	Overweight	Obese	
	Experimental	Count	5	23	9	6	43
		% of Total	6,8%	31,1%	12,2%	8,1%	58,1%
	Control	Count	1	18	5	7	31
		% of Total	1,4%	24,3%	6,8%	9,5%	41,9%
Total		Count	6	41	14	13	74
		% of Total	8,1%	55,4%	18,9%	17,6%	100,0%

The results of the descriptive statistics which take into consideration the components of the dmf-decayed, missing and filled teeth in children with primary dentition in the experimental group is presented in table 6 and graph 3. The values of the dental caries (decay) vary in the interval 2,88±1,69; ±95,00%KI:2,36-3,40; the minimum value is 0 and the maximum value is 8. The values for the extraction (missing) vary in the interval 0,51±0,83; ±95,00%KI:0,26-0,77; the minimum value is 0 and the maximum is 3. The value of the dental fillings (filled teeth) vary in the interval 1,21±1,61; ±95,00%KI:-0,71-1,71; the minimum value is 0 and the maximum value is 6.

Table 6. **Decay & Extractions & Filling / Descriptive statistics**

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
Decay	**43**	**2,88**	**2,36**	**3,40**	**0**	**8**	**1,69**
Extractions	**43**	**0,51**	**0,26**	**0,77**	**0**	**3**	**0,83**
Filling	**43**	**1,21**	**0,71**	**1,71**	**0**	**6**	**1,61**



Graph 3. Decay & Extractions & Filling / Descriptive statistics

The descriptive statistics of the values which take into consideration the decay and fillings / according to surfaces / in children with primary dentition from the experimental group (table 2 and graph 2) show that the values vary in the interval 4,63±2,79; ±95,00%KI:3,77-5,49; the minimum value is 0 and the maximum value is 12. The values for dental fillings according to surfaces vary in the interval 1,63±2,36; ±95,00%KI:0,90-2,35; the minimum value is 0 and the maximum value is 9.

4.3 dmf index/ BMI

The results which present the nourishment in children with primary dentition in correlation to the presence of decay are shown in table 7. A total of 6 (8,11%) children were underweight, from which 5 (6,76%) children had dental caries and 1 (1,35%) child did not have dental caries. 41 (55,41%) children had normal weight, from which 23 (31,08%) children had dental caries and 18 (24,32%) children did not have dental caries.

A total of 14 (18,92%) children were overweight, from which 9 (12,16%) children had dental caries and 5 (6,76%) children did not have dental caries. 13 (17,57%) children were obese, from which 6 (8,11%) children had dental caries and 7 (9,46%) children did not have dental caries. In the presented distribution of data which takes into consideration the nourishment of children with primary dentition in correlation to the presence of dental caries, for Fisher's Exact Test=2,47 and p>0,05(p=0,501) there is no significant difference between the two groups.

Table 7. dmf index / BMI (nourishment)

	Nourishment	кеп индекс		Вкупно
		Да	Не	
Count	Underweight	5	1	6
Total Percent		6,76%	1,35%	8,11%
Count	Normal weight	23	18	41
Total Percent		31,08%	24,32%	55,41%
Count	Overweight	9	5	14
Total Percent		12,16%	6,76%	18,92%
Count	Obese	6	7	13
Total Percent		8,11%	9,46%	17,57%
Count	Total	43	31	74
Total Percent		58,11%	41,89%	

The results of the predictive nutritional values for the presence of dental caries are shown in Table 8. Between the body weight of children and the presence of dental caries for Pearson Chi-square = 2.80 and p> 0.05 (p = 0.42) there is no significant correlation.In the determination of the significance of the contribution of each component towards the presence of dental caries, it was found that being underweight had the greatest influence (Wald = 2.06 / p> 0.05 (p = 0.15), followed by increased weight (Wald = 0.89 / p> 0.05 (p = 0.35) and the weakest influence was seenby the normal weight (Wald = 0.39 / p> 0.05 (p = 0.53).
The normal weight is taken as a referent category.

Underweight children in correlation to normal weight children are 5.83 times (Exp (B) = 5.83) (95% CI: 0.53-64.82) more likely to develop dental caries, however, for p> 0.05 (p = 0.15) it is not significant. Overweight children in correlation to children with normal weight are about 2.10 times (Exp (B) = 2.10) (95% CI: 0.45-9, 84) more likely to develop dental caries, for p>0.05(p = 0.35) itis not significant. Children with normal weight compared with children who are obese are 1.49 times (Exp (B) = 1.49) (95% CI: 0.43-5.22) more likely to develope dental caries, however, for p> 0.05 (p = 0.53)it is not significant.

Table 8. dmf index / BMI

Nourishment								95% C.I.for EXP(B)	
Step 1[a]		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Lower
	Obesity			2,39	3	,50			
	Normal weight	1,76	1,23	2,06	1	,15	5,833	,525	64,823
	Underweight	,40	,64	,39	1	,53	1,491	,426	5,218
	Overweight	,74	,79	,89	1	,35	2,100	,448	9,836
	Constant	-,15	,56	,08	1	,78	,86		

a.Variable(s) entered on step 1: Nourishment.

VI. Discussion

It is a fact that children with a higher socioeconomic status are more likely to consume more food, which includes sweets between meals which is a risk for being overweight, which is further a risk for dental caries.Hooley et al. [12] made updated systematic reviews of the reference lists for papers published in the years 2004-2011 in order to determine the relationship between the body mass index and dental caries in children and adolescents (aged 0 to 18 years) and discovered the existence of a nonlinear correlation between the body mass index and dental caries, and suggests research of other factors, especially the socio-economic status.
The latest national data from Sweden [13] indicates a positive correlation between dental caries and the body mass index (BMI), and suggests that excessive weight in early childhood leads to the development of dental caries in adolescence.

The results of the examination for the body mass index in the examinees from the experimental group showed that from a total of 43 (58,10%) children, 5 (6,80%) children were underweight, 23 (31,10%) children were of normal weight, 9 (12.20%) were overweight, and 6 (8.10%) children were obese. In the control group of 31 (41.90%) children, 1 (1.40%) was underweight, 18 (24.30%) children were of normal weight, 5 (6.80%) were overweight, and 7 (9.50%) children were obese.Each component, where the increased weight was taken as the reference category, found that most affected were children who were underweight, then children who were overweight and the weakest influence was seen by children with a normal weight.Underweight children in

correlation to children who were overweight are 5.83 times more likely to develop dental caries, but for p> 0.05 (p = 0.15)it is not significant.Children who are overweight in correlation to obese children, are 2.10 times more likely to develop dental caries, but for p> 0.05 (p = 0.35) itis not significant. Children with normal weight in correlation to children who are overweight have a 1.49-fold higher probability of developing dental caries, but for p> 0.05 (p = 0.53) it is not significant.Our results somewhat overlap with the results obtained by Alm et al. [13] who in 2011 attempted to examine the relationship between body weight and dental caries in pre-school children, and found that at the age of seven, there was no relationship between obesity and caries, and emphasized the need for a multidisciplinary approach to change the lifestyle and the factors that cause increased weight.In the studies by Jong-Lenters et al. concerning the relationship between increased body weight and dental caries, a statistically significant differencewas not found between the mean value of DMFT or DMFS and examinees of normal weight. The hypothesis of the positive association between the body mass index and dental caries in children aged 5-8 years was not supported by the authors. [14]

Marshal [15] found that overweight children had higher values of DMF and DMF-T in both dentitions compared to children of normal weight.For Poutanen et al. [16] it is interesting that although the degree of secretion of stimulated saliva is reduced by the increase of the degree of malnutrition, the buffer effect increases. The explanation for this phenomenon is not yet clear, but the author considers that the correlation between the degree of malnutrition and the severity of the caries is significant.Masuda et al. [17] carried out an analysis of the risk of dental caries on primary dentition in children at the age of 6 years, by reviewing the results from 10929 papers collected from the literature and identifying them by means of electronic searching, from which, the authors concluded that factors related to the incidence of caries most commonly included S. Mutans, which is present in the oral cavity since birth, whose negative effects can be compensated by noncariogenic nutrition, good oral hygiene and plaque control. [18]Decades of research, the evaluation and identification of children with high risk of caries and the detection oftheir cause is of paramount importance, and it has been proven that several risk factors most often act simultaneously in the onset of dental caries. Because of that, our results offer data that can direct doctors towards the reduction of the risk for dental caries.

This means that the compensatory mechanisms of the factors that protect teeth from caries should always be kept in mind when recommending how to keep your teeth healthy.

References

[1]. Ivanović M., Carević M., Marković D., Vulićević Z., Stevanović R., Petrović V., Protocols in dentistry. Belgrade: School of Dentristry; 2009.
[2]. Timiș T., Dănilă I., Socioeconomic status and oral health, The Journal of Preventive Medicine, 2005;13(1-2):116-121.
[3]. Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. Br Dent J 2006;25:625–626.
[4]. Alm A. On dental caries and caries-related factors in children and teenagers. Swed. Dent. J.2008;195(Supp):7–63. [PubMed].
[5]. American Academy of Pediatric Dentistry. Policy on a dental home. Pediatric Dent. 2011;(special issue) 33:24-5.
[6]. Godlewski A.E., Veyrune J.L., Nicolas E. Obesity and oral health: risk factors of obese patients in dental practiceOdontostomatol Trop. 2008 Sep;31(123):25-32. [PubMed].
[7]. American Academy of Pediatrics. Oral health risk assessment timing and establishment of the dental home. Pediatr. 2003;11(5):1113-6. Re-affirmed 2009;124(2):845.
[8]. Jong-Lenters M ,Van Dommelen P, Schuller A. A. , Verrips E. H. W. Body mass index and dental caries in children aged 5 to 8 years attending a dental paediatric referral practice in the NetherlandsBMC Research NotesDecember 2015, 8:738.
[9]. Ludwig D.S., Peterson K.E., Gortmaker S.L. (2001) Relation between consumption of sugar sweetened drink and child obesity: a prospective observational analysis. Lancet 357: 505-8.
[10]. Petersen P.E. The world oral health report 2003. Continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme. Geneva: World Health Organization, 2003.
[11]. Oral Health Surveys: Basic methods 4thed.Geneva:World Health Organization WHO :1997.
[12]. Hooley M., Skouteris H., Boganin C., Satur J., Kilpatrick N.Body mass index and dental caries in children and adolescents: a systematic review of literature published 2004 to 2011.Syst Rev. 2012 Nov 21;1:57.
[13]. Alm A., Wendt L.K., Koch G. Dental treatment in the primary dentition of 7-12 year-old Swedish schoolchildren. Swed Dent J 2011;27:77-82.
[14]. Jong-Lenters M .,Van Dommelen P., Schuller A. A., Verrips E. H. W. Body mass index and dental caries in children aged 5 to 8 years attending a dental paediatric referral practice in the NetherlandsBMC Research NotesDecember 2015, 8:738.
[15]. Marshall A., Eichenberger-Gilmore,.M.; Broffitt, B.A. Dental caries and childhood obesity: Roles of diet and socioeconomic status. Community Dent. Oral Epidemiol. 2007, 35, 449–458.
[16]. Poutanen R, Lahti S., Seppa L., Tolvanen M., Hausen H: Oral health-related knowledge, attitudes, behavior, and family characteristics among Finnish schoolchildren with and without active initial caries lesions. Acta Odontol Scand 2007;65:87-96.
[17]. Masuda, N.Tsutsumi, Sobue, S.Hamada.Longitudinal survey of the distribution of various serotypes of Streptococcus mutans in infants,Journal of Clinical Microbiology1979,10: 4:497–502.
[18]. Alaluusua S., Renkonen O.V. (1983). Streptococcus mutans establishment and dental caries experience in children from 2 to 4 years. Scand. Dent Res 91:453-457.

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