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Socio Economic and Nutritional Status as Dental Caries Risk Factors in 12 Year Old Children

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Abstract: *The examined material consisted of 71 examinees from both genders at the age of 12, from which the experimental group consisted of 40 children and the control group consisted of 31 examinees.A survey was carried out in order to assess the socio-economic status of the families, to assess the nutritional status (BMI) of the examinees, to verify the dental health while noting the DMFS, DMFT and the intensity of dental caries.*
The data that presented the socio-economic status of the examinees in both groups showed a significant statistical correlation (p<0,001).The examined relation between the socio-economical status of the children with permanent dentition and the intensity of dental caries showed a weak and insignificant correlation. Notably with the increase of the socio economical status of the children the presence of dental caries also increased.The distribution of the data, which presented the diet in the children in correlation to the presence of dental caries, showed no significant difference in both groups (p>0,05).As a conclusion we would like to indicate that the association of the socio-economical conditions and the body mass index can be one of the many factors responsible for the onset of dental caries but they can also be used as serious screening factors and can participate as an instrument in the assessment of the dental caries risk. The results suggest promotion of oral health in children from all age groups.

Keywords: *Dental Caries, Permanent Teeth, Nutritional Status, BMI*

I. Introduction

The carious lesions evolve in a certain time frame and in essence, are the result of dynamic and complex interactions between the cariogenic bacteria and the defense of the host – the tooth. This pathogenesis concept for the dental caries is focused on the fermentation of the carbohydrates of the cariogenic bacteria in the dental plaque and the production of acid, which disturbs the sensitive mineral structure or the tooth. The contemporary concepts believe that the dental caries is a product of the interaction between the genetic and ecological factors in which the social, biological, psychological and the behavioral factors interact in a complex way [1,2].

From the many studies in existence, we can conclude that the prevalence of dental caries is relatively higher in children from countries that are in development, in correlation to the children of the same age in developed countries, where in the last ten years we can notice a significant fall in dental caries in children from many developed countries in Europe and the USA [3,4]. The authors emphasize that the influence of fluoride as one of the most influential factors which are responsible for drastically decreasing dental caries, especially in children but they do not exclude its influence in adults.

The epidemiological studies carried out to assess the correlation between the oral health and the socio-economical conditions show that the low socio-economical status is linked to a higher prevalence of dental caries. Mamot claims that the cause for the association between the oral health and the socio-economical status is a results of the fact that the socio-economic status allows that group access to the resources which enables them to inform themselves on how to conserve their oral health, from which the following factors are always emphasized : sugar consumption, brushing, preventive measures and regular dental examinations [5].

Generally, the population groups with low oral and dental health consciousness are characterized by a low level of education and a bad economic status. In most of the cases, high income insures an optimal lifestyle, which in turn gives greater accessibility to dental health care. Unfortunately the differences such as monthly income and the level of education of the parents, generate inequality in the general, dental and oral health of the children [6].Alm. and ass. point out that the body mass index (BMI) is a relation between the weight and the height and is used as a tool to identify body mass.[19] The American academy of pediatricians (AAP) recommends this tool as a diagnostic tool for screening the weight of the children over the age of two and classifying it in the following groups: normal, underweight, overweight and obese. [7]

The studies carries out by Chatterjee and ass. [8] carried out in eastern India, studies the widespread of dental caries in permanent teeth and the association with the diet, in 544 school girls at the age from 6 – 19 years from a Bengal ethnic background, where the assessment of the DMFT was done according to the Oral Health

Survey guidelines (WHO) and the nutritional status was calculated using the BMI and the classification of the nutritional status was achieved using the standards of WHO and CDC growth chars that include an age – and sex- specific BMI reference for children aged 2-20 years and showed that the total prevalence of dental caries was 44,5% and the DMFT varied from 0,45 – 1.57. The nutritional status showed that around 30% of the examinees were underweight and 6,69% were overweight. The authors found that there is a close relation between the nutritional status and the dental caries in the mentioned region.

The contradictory information in the literature, that point out the association between the social-economic status and the body mass index (BMI) with the onset of dental caries, from different regions of the world, was the reason that our study was focused towards assessing the relation between the socio-economical status and the body mass index with the intensity of dental caries.

II. Methodology

2.1. Examinees included in the study

In the study we included 71 examinees from both genders at the age of 12 years, from which 40 examinees where in the experimental group (16 female and 24 male) and 31 examinees where in the control group (10 female and 21 male).

The examination was carried out using the basic criteria for assessment of oral and dental health which the WHO recommended in 1997 [9].

2.2. Design of the study

The design of the study was consisted from multiple components: questionnaire (interview), assessment of the nutritional status, objective clinical examination.

1. Survey

For the assessment of the socio-economical status of the families of the examined children and for the assessment of the dental and oral health habits we used a specially designed questionnaire which was filled out by the examined.

The first part of the questionnaire was consisted of general data of the examinees, followed by the education of the parents (high, middle and low education), profession (manager, businessmen, government employee, periodical employment and unemployed), monthly income ranked by the government statistics (low income status – one employee with a minimal salary, medium social status – one employee with an average monthly income and high social status – with at least two employees with an average monthly income), number of siblings (none, one, two or more) and conditions of living (private apartment, community, tenants) [10].

According to the survey and the questions for the socio-economical status in the families we ranked them accordingly:

Score 0 – High
Score 1- Medium
Score 2 – Low

The assessment of the nutritional status (BMI) was realized according to the World Health Organization (WHO) recommendations from 2002 and the assessment was carried out in multiple steps [11].

According to the body mass index (BMI) values, the examinees were split into the following categories[62]:

Underweight = BMI <5%
Normal weight =5%<BMI<30%
Overweight = 25%<BMI<30%
Obesity = BMI >30%

Clinical examinations

The clinical examinations consisted of verification of the dental health status in which the DMFS, DMFT and the intensity of dental caries was noted [12].

The examinees, according to the intensity of the dental caries, were ranked into the following groups:

Very low <1.2
Low1.2-2.6
Moderate 2.7-4.4
Moderate 4.4-6.5
Very high >6.5

III. Statistical Analysis

The analysis of the data was carried out in the program Statistica 7.1 for Windows and SPSS Statistics 17.0.

The following methods were used: In the analysis of the series of attributive signs (gender, socio-economical status, nutrition, presence of dental caries DMFT, DMFT risk) we determined percentages (%); The differences in the series of attributive signs are tested using the Pearson Chi – square test, Fisher Exact test / Monte Carlo Sig. (2-sided), (p), Fisher test (p); in the series of numerical signs / DMFT index, BMI, percentile / we used Descriptive Statistics (Mean; Std. Deviation; ;±95,00%CI; Minimum; Maximum); the differences were tested with the t- test for indipendent samples (t) and the Mann – Whitney U test (Z/p);the correlation between the DMFT index and the socio-economical statis was done with the use of Spearmen Rank (R);

The significance is set at $p<0,05$.

IV. Results

There was 71 examined children in total (100.00%), from which 40 (56.30%) of the children were included in the experimental group in which 16 (22,50%) of the children in the experimental group were female and 24(33,80%) children were male. The control group was consisted of 31 (43.70%) children, from which 10 (14,10%) children were female and 21 (29,60%) children were male. In the presented distribution (table 1) of the children according to gender, for the Pearson Chi Square = 0,45 and $p>0,05$ ($p=0,50$) there was no significant difference between the two groups.

Table 1. Group & Sex

			Gender		Total
			Female	Male	
Group	Experimental	Count	16	24	40
		% of Total	22,5%	33,8%	56,3%
	Control	Count	10	21	31
		% of Total	14,1%	29,6%	43,7%
Total		Count	26	45	71
		% of Total	36,6%	63,4%	100,0%

Table 2 presents the distribution of data which takes into consideration the socio-economic status of the examinees, where in the experimental group 10 (14,10%) children were with a low socio-economic status, 16 (22,50%) children with a medium and 14 (19,70%) children had a high socio-economic status. In the control group all of the 31 (41,90%) children were with a medium socio-economic status. In the presented distribution of data which takes into consideration the socio-economic status of the children with permanent dentition, the results for the Fisher Exact Test=31,10 and $p<0,001$ ($p=0,000/0,000-0,000$), the difference is significant between the two groups.

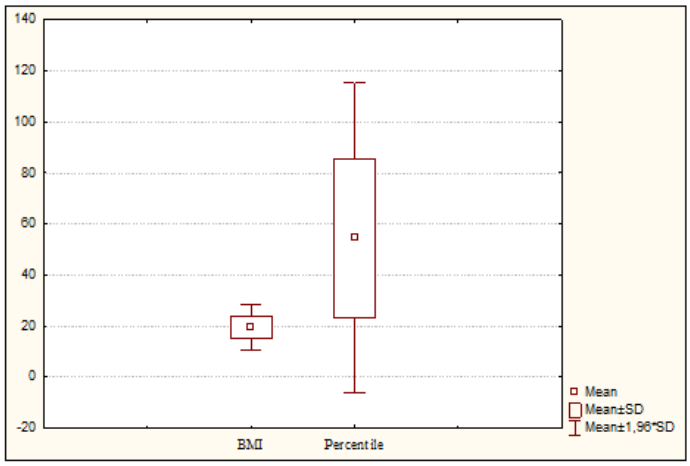
Table 2. Group & Socio-economic status

			Socio-economic			Total
			Low	Medium	High	
Group	Experimental	Count	10	16	14	40
		% of Total	14,1%	22,5%	19,7%	56,3%
	Control	Count	0	31	0	31
		% of Total	,0%	43,7%	,0%	43,7%
Total		Count	10	47	14	71
		% of Total	14,1%	66,2%	19,7%	100,0%

The descriptive statistics for the values of the BMI and the percentiles of the control group (table 3 and graph 1) show that they varied in the interval from 19,49±4,47; ±95,00%KI:17,85-21,13; the minimal value was 14,20 and the maximal value was 37,10. The values of the percentiles varied in the interval from 54,54±31,07; ±95,00%KI:43,15-65,94; the minimal value was 1,10 and the maximal value was 99,50.

Table 3. Descriptive statistics

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
BMI	31	19,49	17,85	21,13	14,20	37,10	4,47
Percentile	31	54,54	43,15	65,94	1,10	99,50	31,07

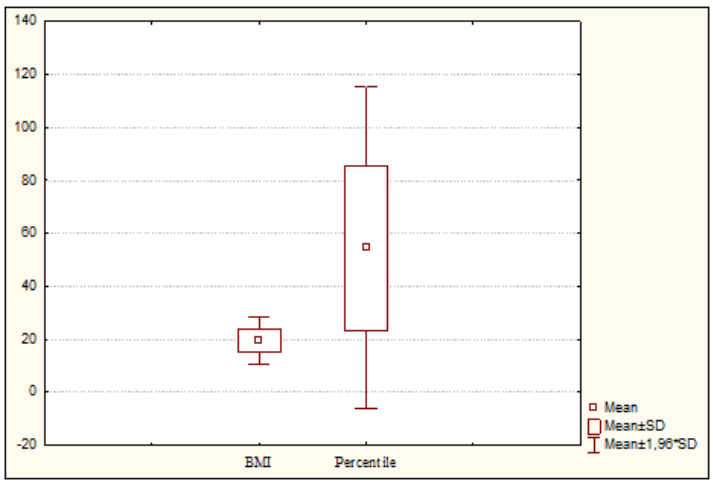


Graph 1.

The descriptive statistics of the BMI values and the percentiles of the experimental group (table 4 and graph 2) show that the same values varied in the interval from 19,33±3,92; ±95,00%KI:18,07-20,58; the minimal value was 14,50 and the maximal value was 29,70. The values of the percentiles varied in the interval 53,41±33,16; ±95,00%KI:42,80-64,01; the minimal value was 2,00 and the maximal value was 98,70.

Table 4. Descriptive statistics

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
BMI	40	19,33	18,07	20,58	14,50	29,70	3,92
Percentiles	40	53,41	42,80	64,01	2,00	98,70	33,16



Graph 1.

The values of the BMI in the children from the control group for Z=0,19 and p>0,05(p=0,85) is insignificantly greater in correlation to the value of the percentiles in children from the experimental group (table 5).

The values of the percentiles in children from the control group for Z=0,23 and p>0,05 (p=0,82) is insignificantly greater in correlation to the value of the percentiles in the children from the experimental group (table 5).

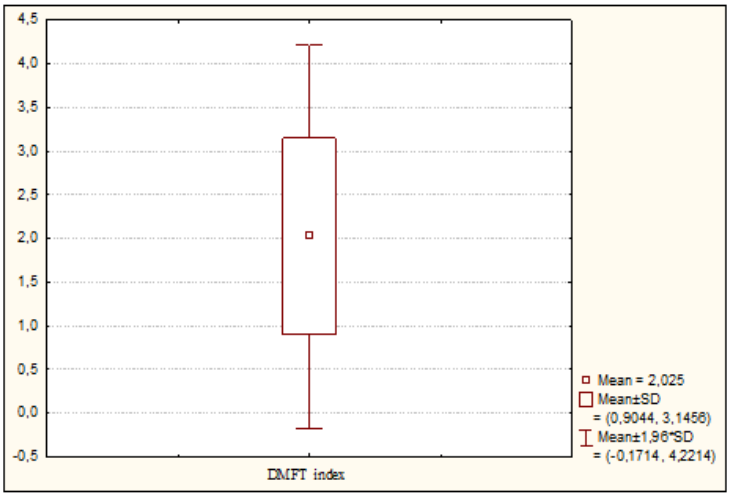
Table 5. Difference / Control group & Experimental group

Parameter	Rank Sum Control	Rank Sum Experimental	U	Z	p-level	Valid N Control	Valid N Experimental
BMI	1132,00	1424,00	604,00	0,19	0,85	31	40
Percentiles	1136,00	1420,00	600,00	0,23	0,82	31	40

The descriptive statistics for the values of the DMFS in the examinees from the experimental group show that they varied in the interval 2,03±1,12; ±95,00%KI:1,67-2,38; where the minimal value was 1 and the maximal value was 5 (table 6 and graph 3).

Table 6. DMFS / Descriptive statistics

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
DMFT	40	,03	1,67	2,38	1	5	1,12

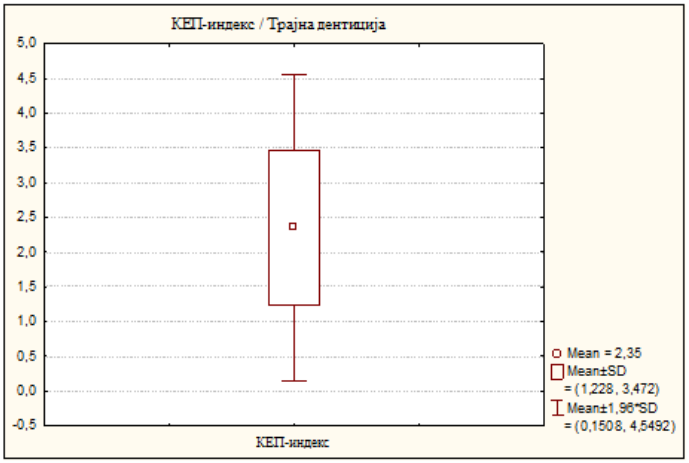


Graph 3.

The descriptive statistics for the values of the DMFT in the examinees from the experimental group show that they variee in the interval from 2,35±1,12; ±95,00%KI:1,99-2,71; where the minimal value was 1 and the maximum value was 5 (table 7 and graph 4).

Table 7. DMFT / Descriptive statistic

Parameters	Valid N	Mean	Confidence -95,00%	Confidence +95,00	Minimum	Maximum	Std.Dev.
DMFT index	40	2,35	1,99	2,71	1	5	1,12



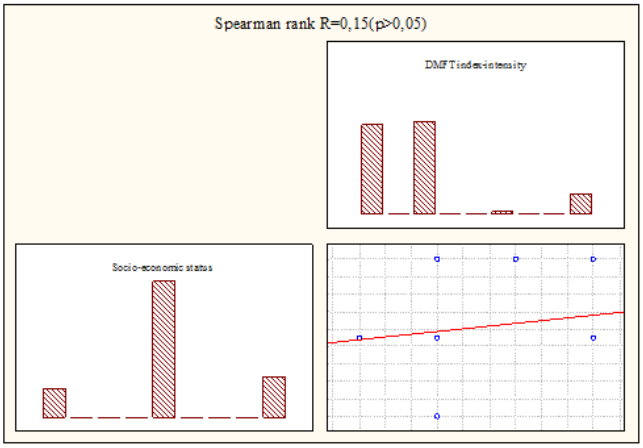
Graph 4.

The data which presents the intensity of dental caries in children from the experimental group, show that from a total of 40 (56,30%) children, 32 (45,10%) children had a low dental caries risk (1,0-2,4), 1(1,40%) child had a medium dental caries risk (2,5-3,8) and 7 (9,90%) children had a high dental caries risk (3,9-5,5).
In the control group (without dental caries) all of the 31 (43,70%) children had a very low dental caries risk (0,0 – 0,9). In the presented distribution of data that present the intensity of dental caries in children with permanent dentition, the results for the Fisher's Exact Test=85,30 и p<0,001(p=0,000 / 0,000-0,000) and the difference between the two groups is significant (Table 8).

Table 8 Group / DMFS intensity

			DMFT risk				Total
			Very low dental caries risk	Low dental caries risk	Medium dental caries risk	High dental caries risk	
Group	Experimental	Count	0	28	4	8	40
		% of Total	,0%	39,4%	5,6%	11,3%	56,3%
	Control	Count	31	0	0	0	31
		% of Total	43,7%	,0%	,0%	,0%	43,7%
Total		Count	31	32	1	7	71
		% of Total	43,7%	45,1%	1,4%	9,9%	100,0%

On graph 5 we can see the examined correlation between the socio-economic status of the children and the intensity of dental caries. For R=0,15 (p>0,05) we can see a weak insignificant correlation. With the rise of the socio-economic status in children with permanent dentition, the presence of dental caries in the children increases.



Graph 5. Socio-economic status / DMFT index-intensity

The results which take into consideration the diet of the children with permanent dentition in correlation to the presence of dental caries are shown on table 8.

A total of 3 (4,23%) children were underweight from which 2 (2,82%) children were with dental caries and 1 (1,41%) child did not have dental caries. Normal weight was noticed in 52 (73,24%) children from which 29 (40,85%) children had dental caries and 23(32,39%) children did not have dental caries.

A total of 5 (7,04%) children were overweight, from which 2 (2,82%) children had dental caries and 3 (4,23%) children did not have dental caries.

Obesity was established in 11 (15,49%) children from which 7(9,86%) children had dental caries and 4(5,63%) children did not have dental caries.

In the presented distribution of data which takes into consideration the diet (BMI) of the children with permanent dentition in correlation to the presence of dental caries, and the results for the Fisher's Exact Test=1,08 and p>0,05 (p=0,840 / 0,826-0,845) hence there is no significant difference between the two groups.

Table 8 DMFs index / BMI (Diet)

	Body weight	DMFT index		Total
		Yes	No	
Count	Underweight	2	1	3
Total Percent		2,82%	1,41%	4,23%
Count	Normal weight	29	23	52
Total Percent		40,85%	32,39%	73,24%
Count	Overweight	2	3	5
Total Percent		2,82%	4,23%	7,04%
Count	Obesity	7	4	11
Total Percent		9,86%	5,63%	15,49%
Count	Total	40	31	71
Total Percent		56,34%	43,66%	

V. Discussion

Dental caries is a multi-factorial disease in which the most convincing evidence shows the association between the frequent consumption of sugars and dental caries. The evidence for this is the increase of dental caries during the wars when there was a construction in the intake of carbohydrates [13,14].

In contemporary societies, the prevalence of dental caries is associated with the consumption of sugar, ethnic groups, socio-economic class and the education of the parents 15-11[15,16,17].

The studies carried out in the Nordic countries and the countries in Western Europe show data for the DMFS in 12 year old children which varies from 2.0 to 3.1 [18,19,20]. Wierzbicka and col. [21] in 2002 established that the DMFS index in 12 year old children in Poland is 7.7. In Slovenia the DMFS index in 12 year old children was 10.2 in the year 1987 and decreased to 4.3 and according to the analysis this is due to the implementation of the preventive programs, the controlled and regular oral hygiene, fluoride prophylaxis and the preventive sealing of fissures [22]. Somewhat worse results were seen from Iljovska et al. [23] with a drastic improvement in the last 10 years in R.Macedonia which is due to the implementation of preventive strategies on a national level.

In the experimental group (with dental caries) from a total of 40 (56,30%) children, 32 (45,10%) children had a low dental caries risk (1,0-2,4), 1 (1,40%) child had a medium dental caries risk (2,5-3,8), 7 (9,90%) children had a high dental caries risk (3,9-5,5) and in correlation to the control group, there is a significant difference between the two groups ($p<0,001$) which is in correlation to the results of Vrbic and Iljovska [22,23] but drastically differ from the results gotten by Wierzbicka in Poland [21].

The results that we got were satisfying which according to us is partly owed due to the fact that the city of Shtip has drinking water that contains the optimal quantity of fluorides.The correlation between the socio-economical status and the oral and dental health status is confirmed in the literature. Numerous studies show that people with a low socio-economic status have bad oral and dental health as a result of the inequalities which can be biological (age and gender) or general (restricted knowledge, unavailability to dentists) [24].

The correlation between the general health and the socio-economic status is well known but also the bad oral health is linked to the low socio-economic status [25].The data which takes the socio-economic status of the examinees from both groups into consideration shows a statistical significance ($p<0,001$).

The examined correlation between the socio-economic status of the children with permanent dentition and the intensity of dental caries, shows a weak and insignificant correlation. With the rise of the socio-economic status of the children with permanent dentition the presence of dental caries also rises.

Our results about the correlation of the socio-economic status and dental caries correspond to the results from Pickett and collaborates [24]. The studies carried out by Peterson and his collaborates conclude that the high consumption of sugars, visits to the dentist and promotion of good oral health are all signs of high dental caries risk [26].The increased weight and the association with the onset of dental caries became a frequent challenge for the general health. The examined results which associated increased weight with dental caries in children are already not consistent and inconclusive [26,28].Marsha [29] concluded that the children with increased weight have higher values for DMFS and DMF T in both dentitions in correlation to children with normal weight.

The results that presented the body mass index of the examinees, show that a total of 3 (4,23%) children were underweight from which, 2 (2,82%) children had dental caries and 1 (1,41%) child did not have dental caries.Normal weight was noticed in 52 (73,24%) children from which 29 (40,85%) children had dental caries and 23 (32,39%) children did not have dental caries.A total of 5 (7,04%) children were overweight, from which 2 (2,82%) children had dental caries and 3 (4,23%) children did not have dental caries.Obesity was noticed in 11 (15,49%) children from which 7 (9,86%) children had dental caries and 4 (5,63%) children did not have dental caries.

In the presented distribution of data which takes into consideration the diet of the children with permanent dentition in correlation to the presence of dental caries, we can conclude that between the two examined groups for the Fisher's Exact Test =1,08 and $p>0,05$ ($p=0,840$ / 0,826-0,845). A total of 3 children were underweight from which 2 (2,82%) children had dental caries and 1 (1,41%) child did not have dental caries.Normal weight was noticed in 52 (73,24%) children from which 29 (40,85%) children had dental caries and 23 (32,39%) children did not have dental caries.A total of 5 (7,04%) children had increased weight from which 2 (2,82%) children had dental caries and 3 (4,23%) children did not have dental caries.

Obesity was established in 11 (15,49%) children, from which 7 (9,86%) children had dental caries and 4 (5,63%) children did not have dental caries.

In the presented distribution of data which takes into consideration the body mass index of the children with permanent dentition and the dental caries status shows no significant statistical difference between the two groups ($p>0,05$) and must be a result of the frequent and uncontrolled consumption of carbohydrates which are a direct causative factor for a higher dental caries risk. Saurabh [30] presents that there is no connection between the body mass index and dental caries in school children in Meerut. His conclusion is based on the fact that there is a high level of implementation of preventive and preventive-reparative measures. The same author presents the need for continuous implementation of preventive and restorative measures, regular dental checkups, routine oral hygiene which in turn will give the children with an increased body mass index a healthier life.

Thippeswamy [31] and col. concluded that there is a significant correlation between increased body weight and the presence of dental caries in the school children in the area of Udupi. According to them the weight and the onset of dental caries are a common risk determinant and must be treated with a wholesome multidisciplinary model carried out by dental health professionals whilst also using dental caries preventive measures.

Marsha [29] concluded that increased weight and dental caries coexist in children with a low socio-economic status. The general health measures that include the improvement of diet, education and the access to corresponding food can decrease the risk for both diseases. The fact that children with a higher socioeconomic status have a greater opportunity to consume more food, which includes sweets in between meals which in fact is a risk for increasing weight whilst the increased weight is a risk for the onset of dental caries.As a conclusion we would like to note that the association between the socioeconomic conditions and the body mass index can be one of the many factors for the onset of dental caries and can be used as serious screening factors and can seriously participate as an instrument for the assessment of the dental caries risk.

We are hoping that the parameters which we included in this study can have scientific benefits in the preparation of strategies for the individual assessment of the dental caries risk, from which the dentists could resolve the problem by taking actions on the individual risk factors themselves, whilst using specific methods which include the assessment of clinical criteria for the uncovering of the initiative phases of the development of dental caries and the implementation of preventive and intervene measures such as educational measures, chemical measures and minimal invasive procedures.

The results we got lead us to the conclusion that there is a significant difference between the examined groups when the socioeconomic standard is taken into consideration, which in turn tells us that the lower monthly income is a significant determinant for the onset of dental caries but the difference in the body mass index, even though in the examinees with dental caries the value of the BMI was higher the difference in the values is not significant. The results suggest that promotion of oral health and the incorporation of preventive procedures should be used in the population with a particular focus on children from marginalized families.

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