

# Relationship Between Socioeconomic Status, Body Mass Index and Dental Caries of Children



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## Introduction

Obesity, which is characterised as a global epidemic by World Health Organisation (WHO) [1], is described as a multifactorial disease characterised with metabolic, endocrinological and behavioural changes due to high levels of lipid deposition in body which occurs when the energy amount taken with nutrients is higher than the energy amount consumed with metabolism and physical activities [2,3].

The physical growth measurements are convenient criteria for evaluating the physical development in the early years of a growing child. Hence, the measurement of height and weight are basic procedures in pediatric clinical practice being particularly useful for monitoring the growth of individual children during the first six years of life [4]. An accepted method to evaluate an individual's body weight relative to population norms is through the calculation of body mass index (BMI) using the formula  $BMI = \text{weight in kilograms} / \text{height in square meters}$  [5]. For 2 to 20 years old, BMI is combined with age and gender and expressed as a percentile [6]. The Centers for Disease Control and Prevention (CDC) use BMI percentiles to classify 2 to 20 year old children into 4 weight groups. Age-and-gender-specific BMI percentiles (AGS BMI) are categorized as: 1) under weight (85<sup>th</sup> to 95<sup>th</sup> percentile) and 4) overweight (>95<sup>th</sup> percentile) [7,8].

Nutrition plays an important role in the epidemia of obesity. Beside obesity, high carbohydrate consumption frequency and overconsumption of glucides are reported as effective for caries development [9]. As dental caries negatively effect nutrition, wrong feeding habits also causes dental caries and impairment of oral health. It is envisioned that there is an acceptable biological relationship between dental caries and obesity, but in literature different results were reported [9-12]. Lifestyle factors (such as dietary habits) and lifestyle-influenced conditions/diseases (such as overweight/obesity and dental caries) are shown to covary with SES [11,12]. In spite of the fact that SES appears to be a confounder when the association between overweight and caries is evaluated, Hence, the aim of this study is to reveal the relationship between dental caries, BMI and socioeconomic status.

## Materials and Method

This study was carried out among a group of 856, 6 to 12 year-old children attending Istanbul Medipol University, Faculty of Dentistry, Department of Pedodontics. The study protocol was approved by the ethics comitee of Istanbul Medipol University. An informed written consent was also obtained from the parents of the children who participated in the study.

The scale which was developed by the researchers to determine the socio-economic status of families that added to the Socio-economic Status Determining Scale Study Group includes information about; educational backgrounds of parents, their professions, real estates, household items, average mounthly income, cars, newspaper, magazine and book reading frequency and participating to personal development programs and art and culture activities. Some articles was not distinctive so they had beenremoved from the scale. Socio-economic Status Determining Scale was evaluated by principal components analysis. The average of analysis results was 0 and standard deviation was 1. When the values was analyzed, the group less than or equal to -0.5 was accepted as low socio-economic status, the group greater than or equal to 0.5 was accepted as high socio-economic status, and the group between -0.5 and 0.5 was accepted as average socio-economic status.

The weight of each child without footwear was measured to the nearest 0.1kg, using a portable glass electronic scale. The height was measured to the nearest 0.5cm, using a portable height measuring unit. Body Mass Index (BMI) was calculated using the following formula i.e.  $\text{weight in kilograms} / \text{height in meter square}$ .

$$BMI = \text{Weight in kilograms (kg)} / \text{Height meters (m)}^2$$

The number obtained was plotted for age and gender specific percentile curves on Centre of Disease Control 2000 growth charts [7]. Based on these percentile curves, the children were grouped according to the following categories:

- a. Underweight: BMI-for-age less than the fifth percentile
- b. Normal: BMI-for-age greater than or equal to the fifth percentile and less than the 85<sup>th</sup> percentile
- c. Risk of overweight: BMI-for-age, greater than or equal to the 85<sup>th</sup> percentile and less than the 95<sup>th</sup> percentile and
- d. Overweight: BMI-for-age greater than the 95<sup>th</sup> percentile.

Examinations were performed according to the criteria of World Health Organization (WHO) [13]. For this purpose, children were seated upright on a chair and were examined in adequate natural day light so as to receive maximum illumination. The Community Periodontal Index (CPI) probe was used to confirm visual evidence of caries on the occlusal, buccal and lingual surfaces. Training and calibration for examination of dental caries was carried out in our department.

Statistical analysis was performed using the Statistical Package for Social Science version 17 (SPSS; Chicago, IL, USA). The data obtained was analyzed using Chi-square test, Fischer exact test, and One way ANOVA. Levels of statistical significance were set at  $p < 0,05$ .

### Results

Among the 856 children examined, 384 were males (44,85%) and 452 (55,15%) were females. A higher percentage of underweight children (61,71%) belong to the lower class, whereas higher percentages of risk of overweight (15%) and overweight (15%) were observed in upper class respectively (Table 1).

**Table 1:** Comparison of BMI-for-age with socioeconomic status.

BMI-for-Age	Socioeconomic Status		
	Lower class (N=512) n (%)	Middle class (N=284) n (%)	Upper class (N=60) n (%)
Under weight	316(61,71%)	89 (31,33%)	12 (20%)
Normal	174 (33,98%)	153 (53,87%)	30 (50%)
Risk of overweight	17 (3,32%)	28 (9,85%)	9 (15%)
Overweight	5 (0,97%)	14 (4,92%)	9 (15%)

The mean dmft score was highest (1,32) in underweight children which was highly significant compared to that of children with normal BMI-for-age (0,89). The DMFT scores of children at risk of overweight (1,34) as well as of overweight children (1,22) were significantly higher when compared to that of underweight children (0,6) ( $p \leq 0,01$ ) (Table 2 and 3).

**Table 2:** Caries score according to BMI-for-age.

BMI-for-Age	dmft score Mean $\pm$ SD	DMFT score Mean $\pm$ SD
Under weight	1.32 $\pm$ 1,89	0,62 $\pm$ 1.17
Normal	0.89 $\pm$ 1,47	0,72 $\pm$ 1.37
Risk of overweight	0,82 $\pm$ 1.21	1.34 $\pm$ 1.89
Overweight	1.21 $\pm$ 1.55	1.22 $\pm$ 1.38

**Table 3:** Comparison of dmft/DMFT scores according to BMI-for-age groups.

	dmft score	DMFT score
Underweight - normal	<0,001**	0,434
Underweight - Risk of overweight	0,027	<0,001**
Underweight - Overweight	0,986	<0,001**
Normal - Risk of overweight	0,974	<0,001**
Normal - Overweight	0,490	0,017
Risk of overweight - Overweight	0,376	0,923

$p \leq 0,01$ \*\* is highly significant.

**Table 4:** Caries score according to socioeconomic status.

Socioeconomic Status	dmft score Mean $\pm$ SD	DMFT score Mean $\pm$ SD
Lower class	3,89 $\pm$ 4,93**	0,32 $\pm$ 1,48
Middle class	0,03 $\pm$ 0,94	0,09 $\pm$ 1,76
Upper class	0,87 $\pm$ 1,01	1,63 $\pm$ 2,85**

One way ANOVA\*\* = significance at  $p < 0,001$ .

Table 4 presents the distribution of caries lesions respectively relative to socioeconomic status. The mean dmft score was highest among children in lower class (Mean $\pm$ SD; 3,89 $\pm$ 4,93), compared to risk of children in middle (Mean $\pm$ SD; 0,03 $\pm$ 0,94) and upper class (Mean $\pm$ SD; 0,87 $\pm$ 1,01). The differences were statistically significant. However, in the permanent dentition, the mean DMFTscore was highest among upper class (Mean $\pm$ SD; 1,63 $\pm$ 2,85) compared to risk of children in lower (Mean $\pm$ SD; 0,32 $\pm$ 1,48) and middle class (Mean  $\pm$ SD; 0,09 $\pm$ 1,76). This difference was also statistically significant.

### Discussion

Similar to obesity, dental caries is a chronic, highly prevalent, multifactorial health problem. In addition to being influenced by oral hygiene, bacterial pathogenicity, and saliva characteristics, dental caries is associated with SES, much like obesity [9,14]. Based on the concept that a common dietary pattern contributes to the development of dental caries and overweight, pediatric dentists have been suggested to be one of the cornerstones in weight counseling.

Obesity has become an important public health problem as it continually increases in developed and developing countries. The MONICA study, which WHO carried out in six different regions of Asia, Africa and Europe discovered a 10-30% increase in the prevalence of obesity [15]. Our country, Turkey, has the same problems with both the developing and developed countries about nutritional status. Regions, seasons, SES and urban-rural settlement affects the nutritional status of Turkish people. There aren't any published paper at national level about the obesity prevalence among children and adolescents in the literature, but, on the other hand there are lots of studies done at regional or local levels. The Turkish Obesity Research Association (TOAD) studied 1821 children of the 12-15 age group in Istanbul. The study found that the percentage of children with a BMI of 18-25kg/

m<sup>2</sup> (overweight) is 9.9%, while 6.2% have a BMI of greater than 30kg/m<sup>2</sup> (obese). A study from Kayseri, done with 3703 children reported that 10.6% of the children were overweight (BMI 85-95 persantile) and 1.6% of them were obese (BMI 95 persantile) [16]. In accordance with the wide spectrum of obesity rates in studies in the literature, our study resulted with 4.8% underweight and 3.2% overweight rates.

The relationship between BMI and dental caries in children is more complex than can be explained by carbohydrate consumption alone. [17,18]. Social status is reported to be a powerful determinant to affect child's general and oral health [19,20]. Previous studies that examined the relationship between socio-economic level and dental caries reported quite different results. Soares et al. indicated that there has been a reduction in dental caries experience in developed economies in the past decade, but an increase in developing economies [21]. Sogi et al. [22] have reported that children with low SES tend to have more dental caries. As mentioned above, in this study, dmft score was highest among children in lower class compared to children in middle and upper classes.

Dietary factors and SES were hypothesised to be common risk factors that associated with obesity and dental caries [9]. Marshall et al. [23] suggested that neither 'obesity increases risk of caries' nor 'caries increases risk of obesity,' but rather a common risk factor increased the likelihood of both disease [23]. In this study, more children from the lower class were underweight. Children become more independent in food choice with increasing ages. During the formative years, unbalanced diet and poor nutritional habits could be effective to increased caries in the primary dentition. Consuming more snacks causes caries in the permanent dentition and we think that this is the main cause of higher caries rates in permanent teeth of upper class children in our study. Also lifestyle changes like frequent consumption of aerated drinks, carbohydrate rich foods and unsupervised oral hygiene practices may make them more vulnerable to caries [17]. On the previous studies from USA, it was reported that normal weight children were more likely to have caries than overweight children. The main reason for this is that obesity is a major health problem in USA and that counseling services are provided to the families of overweight children [24].

### Conclusion

Economic status has significant influences on a child's development. Obesity and caries are multifactorial diseases that follow similar risk patterns. In the present study caries was not confined to any particular BMI category and socioeconomic class. This indicates that body weight exhibits the cumulative environmental effects of dietary factors, which could be responsible for the occurrence of caries in various socioeconomic classes.

Given the importance of overweight as a public health problem, medical and dental professionals should assess health/risk behaviors, connections between oral and systemic health,

and make interdisciplinary communications for diagnosing and treating precocious signs of dental diseases among children and adolescents.

### Conflicts of interest

There are no conflicts of interest.

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