Dental caries and body mass index in a sample of 12-year-old eastern Turkish children

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KEYWORDS
children; dental caries; epidemic; obesity

Abstract
Background/purpose: The objective of the present study was to investigate the possible correlation between the body mass index (BMI) and dental caries among 12-year-old Turkish children.

Materials and methods: The clinical study was performed on 224 12-year-old children at the Department of Pediatric Dentistry, Atatürk University, Erzurum, Turkey, to determine their dental caries and malnutrition status. To assess the nutritional status, the weight for age, height for age, and BMI were determined. The BMI status was categorized into four groups: 1 (underweight), 2 (normal weight), 3 (overweight), and 4 (obese). The occurrence of dental caries was determined using the decayed, missing, and filled teeth (DMFT) index.

Results: Respective mean DMFT values for BMI-1, BMI-2, BMI-3, and BMI-4 were 1.44, 1.47, 1.81, and 2.33, respectively. There were significant differences between BMI-1 and BMI-4 (P = 0.019, r² = 0.73) and between BMI-2 and BMI-4 (P = 0.022, r² = 0.72) values.

Conclusion: Paedodontics should consider the relationship between patients’ body composition and oral health, in order to provide the best service for pediatric patients, and should advice parents on oral-health promotion.

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Introduction

Overweight and obesity among children are a major public health concern, especially in developing countries.¹ Childhood obesity may be a risk factor for cardiovascular diseases, asthma, arthritis, and overall poor health.²,³ Prevalence of being overweight and obese reached 13% among 6–15-year-old Turkish children, according to the International Obesity Task Force.⁴,⁵ Changes in eating habits, and lack of sporting activities and physical exercise are responsible for this new epidemic.⁶ Obese adolescents are more likely to become
obese adults, who are at increased risks for morbidity and mortality.7

Dental caries are described as a multifactorial infectious disease8 caused by cariogenic microbiota; carbohydrate-rich diets and a susceptible host are responsible for the disease.9 In populations with a high prevalence of malnutrition, local dietary actions may be more harmful because they act on individuals who have compromised tooth structures, along with deficiencies in the salivary glands. Hence, such populations may be more susceptible to dental caries because of the association between systemic and local factors.10

Some studies have shown a positive relation between obesity and dental caries.1,11,12 On the contrary, Tramini et al13 studied 835 French children aged 12 years and found that the body mass index (BMI) was not significantly associated with dental caries. However, most studies regarding the relation between obesity and dental caries were carried out in developed countries. Turkey, located adjacent to Europe, is a developing country. The east Anatolia region is the largest geographical region in Turkey, with a total population of 6,100,000 (according to the 2000 census). It comprises 21% of Turkey’s area14 and is larger than many European countries. Therefore, the aim of present study was to determine a possible relationship between caries experience and the BMI in a group of 12-year-old eastern Turkish children.

Materials and methods

Sample collection

This study was conducted in the Department of Pediatric Dentistry, Faculty of Dentistry, Ataturk University (Erzurum, Turkey). The dental hospital has a unique pediatric dentistry department in this region. In total, 224 children were examined at the dental facility. All samples consisted of 12-year-old Turkish boys who came for a routine dental examination and who had their permanent dentition. Dental and physical examinations of the children were conducted only after written consent was obtained from their parents.

Dental examination

A clinical caries assessment was performed with a mouth mirror and a blunt probe under clinical lighting, before and after drying the tooth surface with compressed air according to International Caries Detection and Assessment System (ICDAS) criteria.15 Modified ICDAS criteria are presented in Table 1. All the children were examined during their routine dental appointments by the same investigator, who had at least 4 years of clinical experience in the pediatric dentistry department (KC). Caries experience was expressed as the decayed, missing (due to caries), and filled teeth (DMFT) index, excluding third molars, which were recorded at levels 3 and 4. As the participants were slated for further treatment, bite-wing radiographs were taken, using film holders, by an X-ray technician who had a minimum working experience of 5 years as of 1996, to aid lesion detection on proximal tooth surfaces. A radiographic evaluation was made in a darkened room with a radiographic illuminator to ensure contrast enhancement of the tooth images. To avoid observer bias, the children were evaluated without the knowledge of the anthropometric measurement results.

<table>
<thead>
<tr>
<th>Code</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No or slight change in enamel translucency after prolonged air drying (&gt;5 s)</td>
</tr>
<tr>
<td>1</td>
<td>Opacity or discoloration hardly visible on the wet surface, but distinctly visible after air drying</td>
</tr>
<tr>
<td>2</td>
<td>Enamel demineralization limited to outer 50% of the enamel layer</td>
</tr>
<tr>
<td>3</td>
<td>Localized enamel breakdown in opaque or discolored enamel; grayish discoloration from underlying dentine</td>
</tr>
<tr>
<td>4</td>
<td>Cavitation in opaque or discolored enamel exposing the underlying dentine</td>
</tr>
</tbody>
</table>

Data analyses

Descriptive summary statistics were obtained for all groups. To evaluate the association between caries experience and the BMI, a simple regression and one-way analysis of variance (ANOVA) were calculated. Statistical analyses were performed with the SPSS 15.0 package (SPSS, Chicago, IL, USA) for Windows.

Results

In this clinical study, 224 12-year-old boys were evaluated. The mean BMI was 20.7 and ranged from 13.4 to 29.3. The respective prevalence of caries in groups BMI-1 to BMI-4 was 62%, 69.1%, 79.6%, and 90.2%, respectively. The mean...
prevalence of caries for the total sample was 79.8%. The mean DMFT values for groups BMI-1 to BMI-4 were, respectively, 1.44, 1.47, 1.81, and 2.33 (Table 2), and for the total sample it was 1.75. Fig. 1 shows the relationship between the BMI and DMFT scores.

DMFT score increments did not reach a significant level for BMI-1 and BMI-2 (\( P = 0.982, r^2 = 0.01 \)), BMI-2 and BMI-3 (\( P = 0.668, r^2 = 0.12 \)), or BMI-3 and BMI-4 (\( P = 0.315, r^2 = 0.23 \)). There were, however, significant differences between BMI-1 and BMI-4 (\( P = 0.019, r^2 = 0.73 \)) and between BMI-2 and BMI-4 (\( P = 0.022, r^2 = 0.72 \)), according to a one-way ANOVA and the regression analyses.

### Discussion

In the past two decades, rates of obesity have tripled in developing countries that have adopted a Western lifestyle involving decreased physical activity and the over-consumption of cheap, energy-dense foods.\(^1\) Such lifestyle changes are also affecting children in these countries; prevalence of being overweight among them ranges from 10% to 25%, and that of being obese from 2% to 10%.\(^1\) Turkey faces the greatest threat. Prevalence of overweight and obesity is 7.3–13.2% and 1.6–11.2% in Turkish children and adolescents, respectively.\(^4,5,19\)

Obesity is related to a host of health problems. Abdominal obesity is particularly associated with serious problems such as type 2 diabetes, cardiovascular and cerebrovascular diseases, hypertension, digestive disorders, and cancer.\(^20\) Interrelations among being overweight, being obese, and one’s dental health status are an ignored research area, especially in developing countries such as Turkey. A few studies suggested that an elevated incidence of caries was correlated with obesity and overweight in children and adolescents.

Willerhausen et al\(^1\) examined 1290 elementary school children to assess the relationship between dental caries and weight. Those authors found that 44.7% of underweight children, 40.7% of normal-weight children, 31% of overweight children, and 31.7% of obese children had healthy dentition. In the present study, 38% of underweight children, 32% of normal-weight children, 20% of overweight children, and 10% of obese children had healthy teeth. The distribution of caries frequencies from the present study was comparable to the data obtained from other Turkish states. In this study, 21.2% of 12-year-old children from the eastern Anatolian region in Turkey were caries free, and in a study by Gökalp et al\(^21\) in 2010, 23% of 12-year-old children from the central Anatolian region in Turkey were caries free.

In the present study, significant differences were found in the caries experience between the underweight (BMI-1) and obese groups (BMI-4), and between the normal-weight (BMI-2) and obese groups (BMI-4). However, no significant differences were found among the underweight, normal-weight, and overweight groups. This is in agreement with a French study in which the obese group had an average DMFT index of 6.9 compared to 4.3 for the non-obese group of 12–18-year-old children.\(^22\) Additionally, Larsson et al\(^23\) found a significant positive correlation between the DMFT index and BMI in 15-year-old Swedish children. Tuomi\(^24\) reported a positive relation between dental caries and the BMI in Finnish adolescents. On the contrary, Sanchez-Perez et al\(^25\) examined 110 7–11-year-old Mexican children and found no significant association between dental caries in the permanent dentition and the BMI. Those authors found that the prevalence of dental caries did not significantly differ among the BMI groups. This discrepancy may have been due to differences in the study designs.

There are some limitations of the present study, including socioeconomic factors, nutritional differences, gender discrepancies, and a small sample size. However, the present study differs from similar studies in the study design. As our study was carried out in a dental facility, very reliable caries diagnoses were made. Caries evaluations were performed with a clinical examination and intraoral radiographs.

### Conclusions

Although the results of this preliminary study indicate a possible correlation between obesity and caries, a correlation between overweight and caries was not seen. Future research should incorporate a validated dietary evaluation, oral-hygiene compliance, socioeconomic status, and other factors that may act as confounders or effect modifiers.

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**Table 2** Mean DMFT and BMI values for each group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (n = 58)</td>
<td>14.01</td>
<td>13.4</td>
<td>15.6</td>
<td>0.53</td>
</tr>
<tr>
<td>BMI</td>
<td>1.44</td>
<td>0</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>DMFT</td>
<td>1.44</td>
<td>0</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Normal weight (n = 61)</td>
<td>18.82</td>
<td>14.3</td>
<td>22.1</td>
<td>2.27</td>
</tr>
<tr>
<td>BMI</td>
<td>1.47</td>
<td>0</td>
<td>5</td>
<td>1.39</td>
</tr>
<tr>
<td>DMFT</td>
<td>1.47</td>
<td>0</td>
<td>5</td>
<td>1.39</td>
</tr>
<tr>
<td>Overweight (n = 54)</td>
<td>23.5</td>
<td>22</td>
<td>25.4</td>
<td>1.11</td>
</tr>
<tr>
<td>BMI</td>
<td>1.81</td>
<td>0</td>
<td>7</td>
<td>1.71</td>
</tr>
<tr>
<td>DMFT</td>
<td>1.81</td>
<td>0</td>
<td>7</td>
<td>1.71</td>
</tr>
<tr>
<td>Obese (n = 50)</td>
<td>27.87</td>
<td>26.7</td>
<td>29.3</td>
<td>0.86</td>
</tr>
<tr>
<td>BMI</td>
<td>2.35</td>
<td>0</td>
<td>7</td>
<td>1.77</td>
</tr>
<tr>
<td>DMFT</td>
<td>2.35</td>
<td>0</td>
<td>7</td>
<td>1.77</td>
</tr>
</tbody>
</table>

BMI = body mass index; DMFT = decayed—missed—filled index; Max = maximum; Min = minimum; SD = standard deviation.

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**Figure 1** Relationship between BMI and DMFT among children.
Childhood and adolescent obesity is a significant public health problem and requires a comprehensive, integrated management approach by multidisciplinary medical teams. Dental professionals, especially pediatric dentists, should consider the relationship between body composition and oral health, in order to provide the best service for pediatric patients, and should advise parents on oral-health promotion.

Information regarding the oral-hygiene status and how to improve it should be given to underweight and obese patients. They should be instructed to brush their teeth with fluoride-containing toothpaste three times a day for a minimum of 3 minutes each time, following the modified Bass technique (which should be explained using a model), while using interdental brushes and flossing well. A sodium-fluoride mouth rinse should also be prescribed. Patients should be instructed about dietary habits in terms of restricting sugary food and drink consumption.

References