ASSOCIATION BETWEEN ANTHROPOMETRIC MEASUREMENTS AND DENTAL CARIES IN TURKISH SCHOOL CHILDREN

Eda Köksal[1], Meryem Tekçiçek[2], Sıddıka Songül Yalçın[3], Belma Tuğrul[4], Suzan Yalçın[5], Gülden Pekcan[6]

[1]Gazi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Turkey
[2]Hacettepe University, Faculty of Dentistry, Department of Pedodontics, Ankara, Turkey
[3]Hacettepe University, Faculty of Medicine, Department of Pediatrics, Ankara, Turkey
[4]Hacettepe University Faculty of Education, Department of Elementary Education, Ankara, Turkey
[5]Selçuk University Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, Konya, Turkey
[6]Hacettepe University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Turkey

SUMMARY

Aim: To evaluate the association between anthropometric measurements and dental caries in school children.

Methods: The study was conducted on 245 primary school children (50.2% boys, 49.8% girls,), aged 5 to 9 years. The prevalence and severity of dental caries was measured using the decayed, missing or filled surfaces (dmfs, DMFS) and teeth (dmft, DMFT) indices.

Results: Mean dmft indices in children for boys and girls were 5.5±3.92 and 5.0±3.64, respectively. The prevalence of children with dental caries (dmft ≥1) was 84.9%. The prevalence of children with body mass index (BMI) <−1SD and ≥+1SD was 15.9% and 22.9%, respectively. Dental caries were found in 89.7% of children with low body weight (including underweight and at risk for underweight) and in 66.1% of overweight-obese children ($p<0.05$). Similarly, high indices were detected significantly more often in children with low body weight ($p<0.05$). Height, weight, BMI and percent of fat mass were found to be negatively correlated with dmft indices (r:−0.141, p: 0.028; r:−0.171, p: 0.007; r:−0.139, p: 0.030; r:−0.158, p: 0.013, respectively).

Conclusion: Children with low body weight have a higher risk of developing dental caries than overweight-obese children. For these reasons, the evaluation of nutritional status in children should be implemented in control programs for dental caries both on the community and individual levels.

Key words: public health, health status, access to healthcare, general health insurance, private health insurance

Address for correspondence: S. S. Yalcın, Hacettepe University, Faculty of Medicine, Department of Pediatrics, 06100 Sihhiye, Ankara, Turkey. E-mail: siyalcin@hacettepe.edu.tr

INTRODUCTION

Dental caries is the most common chronic childhood disease in oral health; several factors such as food low in fermentable carbohydrates, oral hygiene techniques, adequate fluoride supplementation, as well as regular dental examinations have to be taken into consideration (1, 2). An assessment of nutritional status using various anthropometric measurements provides information on growth and body composition. Obtaining such data is important for evaluating underweight, stunting, wasting or overweight associated with increased risk for adverse health outcomes (3). Information regarding the association between underweight/obesity and dental caries is inconclusive (4–8). Some cross-sectional studies have shown a positive association between obesity and dental caries (4, 8), while another study has reported a weak or no association between body mass index (BMI) and dental caries (6). The aim of our study was to evaluate the association between anthropometric measurements and dental caries in Ankara, Turkey.

MATERIALS AND METHODS

This cross-sectional study included 245 healthy primary school children (50.2% boys, 49.8% girls) whose age ranged from 5 to 9 years, living in Ankara, the capital city of Turkey. Informed consent was obtained from parents of all the children studied. Infants with chronic illness were not included in the study. The study was approved by the Ethical Committee for Medical, Surgery and Drug Research at Hacettepe University Faculty of Medicine, Ankara, Turkey.

Questionnaires were utilised to obtain demographic data. The body weight of each child was measured while wearing minimal clothing to the nearest 0.1 kg with a digital scale (Seca 767). Height was determined without shoes to the nearest 0.5 cm, using a stadiometer (Seca 220). Body mass index (BMI; kg/m^2) was calculated as body weight (kg) divided by height (m) squared. Z scores of weight for age, weight for height, height for age and body mass index for age were calculated from the WHO Growth Reference Data for children aged 5–19 years (9). The children

were grouped into three categories according to the body mass index for age: low weight, normal weight and overweight-obese, in accordance with the cut-off points of <−1SD, ≥−1SD — +1SD and ≥+1SD z-scores, respectively. Hip and waist circumferences were measured to the nearest 0.5 cm in a standing position. Skinfolds were taken at two sites; the triceps and subscapular. Each skinfold was measured twice with Holtain skinfold calipers. The triceps and subscapular skinfold thickness were used to predict percent body fat using the equations based on multi-component models for Caucasian children (10).

Each child underwent an oral examination and dental caries was diagnosed using World Health Organisation (WHO) recommendations for oral health surveys (11). The dental examination was performed by one paediatric dentist using a non-invasive technique (mirror, dental probe, cotton roll). Caries were determined visually with optimal illumination of the oral cavity, no X-rays were used. Caries lesions were recorded as present when a carious cavity was apparent on visual inspection. If the examiner was uncertain about a lesion on a dental surface, the questionable surface was investigated with a WHO-CPI probe (11). The prevalence of caries was obtained by calculating the number of decayed (d), missing teeth (e), filled teeth (f), teeth (t), or surfaces (s). Caries was defined as the presence of at least one cavitated or filled surface. To assess caries frequency, the DMFT value for the permanent dentition and the dmft value for the primary dentition were used. The decayed, missing and filled surfaces (DMFS) and decayed, missing and filled teeth (DMFT) scores for each individual were calculated by excluding teeth lost due to trauma or exfoliation. Oral data were recorded on examination forms in accordance with the WHO criteria and classification of dmft. For analysis, dental caries was coded as 1 = caries present and 0 = caries absent.

All values are reported as the mean ± standard deviation (SD). Statistical evaluation of the results was performed with the SPSS 10.0 computer program. The Kolmogorov-Smirnov test was used to determine whether outcome variables were normally distributed. As the analysis showed that all variables were not distributed normally, the Mann-Whitney U test and the chi-square test were used. Spearman correlation coefficients were used to assess relationships between independent variables. The level of significance was set at a probability of less than 5% ($p<0.05$).

RESULTS

Mean (±SD) age, anthropometric measurements and dental indices of children according to gender are presented in Table 1. The mean age of the children was 7.1±0.64 years. Mean dmft

Table 1. *Mean (±SD) age, anthropometric measurements and dental indices of the studied children according to gender*

	Boy	Girl	Total	p-value
Anthropometric Measurements				
Age (year)	7.1±0.66	7.2±0.61	7.1±0.64	0.258
Height (cm)	122.5±6.19	122.7±6.54	122.6±6.35	0.836
Weight (kg)	24.5±5.23	23.8±4.74	24.2±4.99	0.291
BMI (kg/m^2)	16.2±2.24	15.7±2.11	16.0±2.19	0.073
WAZ	0.28±1.17	0.09±1.14	0.19±1.15	0.206
HAZ	0.07±1.09	0.15±1.00	0.11±1.05	0.565
BAZ*	0.31±1.19	-0.02±1.18	0.14±1.20	0.027
% Fat*	17.4±3.36	20.1±3.25	18.7±3.59	0.000
WC (cm)	55.7±7.47	55.5±5.84	55.6±6.66	0.960
HC (cm)	64.9±6.53	64.7±7.28	64.8±6.90	0.997
MUAC (cm)	17.7±2.47	17.6±2.71	17.6±2.59	0.970
Triceps (mm)	10.6±5.01	10.4±4.25	10.5±4.62	0.743
Subscapular (mm)	8.3±5.21	8.0±4.50	8.1±4.85	0.904
Dental Indices				
dmft	5.5±3.92	5.0±3.64	5.3±3.78	0.298
dmfs	11.2±9.91	9.8±9.40	10.5±9.67	0.244
DMFT*	0.17±0.64	0.38±0.82	0.27±0.74	0.028
DMFS*	0.20± 0.80	0.47±1.06	0.33±0.95	0.024
Decayed	4.2±3.75	3.6±3.14	3.9±3.46	0.184
Filled	0.98±1.73	1.02±1.68	1.0±1.70	0.822
Missing	0.35±0.82	0.38±0.93	0.36±0.88	0.807

BMI: Body mass index, WAZ: Weight for age Z score, HAZ: Height for age Z score, BAZ: BMI for age Z score, WC: Waist circumference, HC: Hip circumference, MUAC: Mid upper arm circumference, dmft: refers to primary dentition, d = Decayed, m = Missing due to caries (not from trauma, orthodontic extraction, congenitally missing, etc.), f = Filled, t = Teeth, dmfs: Number of dmf tooth surfaces, DMFT refers to permanent teeth:, DMFS: Number of DMF tooth surfaces
*p<0.05 for gender

Table 2. *Percentage distribution of BMI categories among dental caries and dmft indices*

	Low-weight n (%)	Normal n (%)	Overweight and obese n (%)	
Dental caries				
Yes	35 (89.7)	120 (80.0)	37 (66.1)	χ^2: 8.207, p=0.017
No	4 (10.3)	30 (20.0)	19 (33.9)	
dmft classification				
Low dmft	4 (10.3)	46 (30.7)	20 (35.7)	χ^2: 12.739, p=0.013
Medium dmft	10 (25.6)	15 (10.0)	9 (16.1)	
High dmft	25 (64.1)	89 (59.3)	27 (48.2)	

dmft: refers to primary dentition, d = Decayed, m = Missing due to caries (not from trauma, orthodontic extraction, congenitally missing, etc.), f = Filled, t = Teeth, dmfs: Number of dmf tooth surfaces.
Low-weight, normal-weight and overweight-obese were defined as <−1SD, ≥−1SD — +1SD and ≥+1SD z-scores of body mass index for age, respectively.

Table 3. *Mean dental caries, filled, missing and dmft indices of children according to the demographic characteristics of parents*

	%	Dental caries Mean±SD	Filled Mean±SD	Missing Mean±SD	dmft Mean±SD
Mothers' education					
≤8 years	66.0	4.4±3.6*	0.9±1.6	0.3±0.9	5.6±3.9
>8 years	34.0	3.1±3.3*	1.3±1.9	0.5±1.1	4.9±3.9
Father's education					
≤8 years	51.0	4.3±3.8	0.9±1.8	0.3±0.8	5.6±3.9
>8 years	49.0	3.4±3.2	1.2±1.7	0.5±1.1	5.0±3.9
Mother's working situation					
Working	10.8	2.4±2.6	1.0±1.4	0.3± 0.8	3.8±3.4
Not working	89.2	4.0±3.4	1.1±1.8	0.4±0.9	5.5±3.8
Family structure					
Nuclear	74.7	3.8±3.7	1.1±1.8	0.4±0.9	5.3±3.9
Extended	25.3	4.4±3.2	0.9±1.5	0.4±1.2	5.8±3.9
Number of brother or sister					
0	14.0	3.3±3.0	1.6±2.1	0.2±0.6	5.2±3.7
1–2	75.7	3.6±3.4	0.9±1.6	0.4±1.0	5.1±3.7
+3	10.3	4.8±4.0	1.1±1.8	0.5±1.1	7.8±4.9
Social security					
Yes	82.4	3.8±3.5	1.2±1.8*	0.4±1.0	5.4±3.9
No	17.6	4.8±3.5	0.5±1.1*	0.1±0.4	5.4±3.8
BMI classification					
Underweight	15.9	4.6±3.1a	0.9±1.7	0.5±0.9	6.1±3.3
Normal	61.2	4.0±3.5a,b	0.8±1.5	0.3±0.9	5.2±3.7
Overweight and obese	22.9	3.2±3.6b	1.4±2.1	0.4±0.9	4.9±4.2

*p<0.05, Means with different symbols show significances (p<0.05)

indices in these children, for boys and girls, were 5.5±3.92 and 5.0±3.64, respectively. The prevalence of children with dental caries (dmft ≥1) was 84.9%.

Significant differences were found only for BAZ, percent of fat mass, DMFT and DMFS according to gender (p<0.05). Percentage of body fat, DMFT and DMFS in girls and BMI for age Z-scores (BAZ) in boys were found to be higher. No statistically significant differences were found in the other dental indices by age and gender (p<0.05) (Table 1).

A total of 15.9% of children were classified as low weight, 61.2% were normal weight and 22.9% were overweight-obese. Dental caries was found in 89.7% of underweight and 66.1% of overweight-obese children. The same findings were determined for dmft indices and the differences were statistically significant

($p<0.05$) (Table 2). Neither nutritional status nor maternal education affected dmft indices ($p>0.05$).

The mean (±SD) number of dental caries was statistically higher in children whose mothers' education was less than eight years when age and sex were adjusted. Also, the families of the children with social insurance had a higher number of fillings when age and sex were adjusted ($p<0.05$). Underweight children had higher mean dental caries, missing teeth and indices than overweight and obese children, but statistical differences were only found for dental caries according to BMI classification ($p<0.05$) (Table 3).

When correlations between anthropometric measurements and dental indices were analysed, only height, weight, BMI, waist circumference and percent of fat mass were found to be negatively correlated with dmft indices (r:−0.141, p: 0.028; r:−0.171, p: 0.007; r:−0.139, p: 0.030; r:−0.177, p:0.040; r:−0.158, p: 0.013 respectively). Correlations between age, missing teeth and DMFT were found to be positively correlated (r: 0.150, p: 0.019; r: 0.154, p: 0.016, respectively).

DISCUSSION

In the present study, the prevalence of dental caries was high, with 84.9% of the examined children affected. In Turkey, the 2nd National Oral Health Survey reported that nearly 70% of 5 year olds have had caries (12). The present study did not aim to be representative of the national population, as Turkey has a wide socioeconomic and cultural diversity. When dental caries rates have been reported by sex, girls were typically found to exhibit higher prevalence rates than boys. Higher caries prevalence among girls is often explained by earlier eruption of teeth in girls, hence longer exposure of girls' teeth to the cariogenic oral environment (13). In our study, we found that DMFT and DMFS were only significantly different according to gender ($p<0.05$), and they were both found to be higher in girls. No statistically significant differences were found for the other dental indices by gender ($p>0.05$).

Several studies have consistently demonstrated that low levels of parental occupation, education, household income, language barriers and lack of dental care are reflected in poor oral health outcomes in children (2, 14–16). In the present study, the level of dental caries was statistically higher in children whose mothers' education was less than eight years when age and sex were adjusted. The number of fillings was also higher in children from families with social insurance when age and sex were adjusted ($p<0.05$).

According to the Turkish Demographic and Health Survey, the prevalence of underweight (<−2 SD of WHO 2006 growth standards) and obese children (≥2 SD) among children under 5 were 2.8% and 5.8%, respectively (17). Similarly, in the present study, 4.5% of children were classified as underweight, 5.3% as obese.

Dental caries is a multifactorial infectious disease. Factors affecting the onset of lesions include oral hygiene, diet composition and consumption frequency, socioeconomic status, salivary immunoglobulins, bacterial load and fluoride intake (1, 2, 7, 14). The exploration of the link between anthropometric measurements and oral health in children has been controversial (5, 16, 18, 19). Studies have shown significant positive correlations between abdominal obesity and body mass index with periodontal disease in older adolescents and adults (16). Another study in 12 year old children found no statistically significant association between nutritional indices and the occurrence of dental caries (19). Interestingly, dmft indices were negatively correlated with height, weight, BMI, waist circumference and percentage of fat mass, however, overweight children had lower prevalence of dental caries than the underweight ones in the present study. This low prevalence of dental caries in overweight children might be investigated in further studies. As a limitation of the present study, oral hygiene was not taken into consideration and controversial results might be explained by different age groups in previous studies.

If untreated, caries will progress to the dental pulp and the child will repeatedly experience toothache and have trouble eating. Long-term effects of suffering from tooth decay may contribute to a child's impaired weight gain and slow growth rate (5). Furthermore, studies of the nutritional status of young children with severe caries have suggested that severe caries may be a risk marker for malnutrition (5, 18). In addition, Sagheri et al. (20) found lower dental caries levels in children with non-deprived social background. It has been known that children living in low socioeconomic conditions have high risk of malnutrition (17). Some findings have demonstrated that caries, mostly untreated lesions, had an impact on nutritional status, and a low percentile of BMI-for-age could signal a health problem that deserves attention (18). Our findings suggest a connection between dental caries and anthropometric measurements. Underweight children had a higher average number of dental caries than overweight-obese children.

CONCLUSIONS

Notwithstanding the fact that the results of this preliminary study support an association between dental caries and overweight and underweight, future longitudinal research should incorporate validated dietary assessments, socioeconomic status, oral hygiene compliance and other factors that may act as confounders or effect modifiers. Dental caries is a multi-factorial disease and the relationship of other risk factors and anthropometric measurements deserves evaluation in further studies.

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