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The effects of socioeconomic status, oral and dental health practices, and nutritional status on dental health in 12-year-old school children

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Abstract

Background: This study aims to examine the effects of socioeconomic status, oral, and dental health practices, dietary habits and anthropometric measurements on dental health in 12-year-old schoolchildren.

Methods: The sample of the study consisted of a total of 254 children (44.1% boys and 55.9% girls) in three schools which were identified as low, moderate and high socioeconomic status. The data were collected by face-to-face interviews via a questionnaire form. Dentist determined DMFT and dmft indices of the children. SPSS (Statistical Package for the Social Sciences) package program was used to analyze the data.

Results: It was found that 70.9% of the children have dental caries on their permanent teeth. The number of girls with caries in permanent teeth and boys with caries in milk teeth was higher ($p < 0.05$). The frequency of seeing a dentist and changing toothbrush vary according to the socioeconomic status ($p < 0.05$). Oral and dental health indicators were determined to be affected by the frequency and duration of tooth brushing ($p < 0.05$). It was found that dmft values of the children consuming molasses and table sugar are lower ($p < 0.05$). There is a negative correlation between oral and dental health indicators and anthropometric measurements.

Conclusion: Dietary habits, anthropometric measurements, oral and dental health practices, gender, and socioeconomic status were shown to be effective on caries. Caries risk assessment and determining leading risk factors enable effective prevention programs to be implemented at different levels.

Keywords: Anthropometry, Nutrition, Children, DMFT, Socioeconomic status

Background

Oral and dental health is an integral part of complete health and well-being [1]. In most developing low-income countries, the prevalence of dental caries is high and more than 90% of caries are reported to be untreated [2]. Dental caries is the most common progressive chronic disease in school-age children with an increasing

prevalence as children grow up [3, 4]. Recent trends relating to the increase in the prevalence of dental caries in children emphasize the need for more comprehensive measures as it is a preventable disease [5]. Oral and dental health in school-age children totally depends on oral hygiene behavior of children and their parents, dietary habits, parental education level, socioeconomic status, regular dental examination, adequate fluoride supplementation, oral microflora, age, and other demographic and cultural characteristics [3, 6, 7].

Caries risk assessment and determining leading risk factors enable effective prevention programs to be

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implemented at different levels (families, schools, institutions, local communities, etc.). In assessing a caries risk, a single method or model cannot simultaneously measure host resistance, microbial pathogens, and carcinogenicity of the diet. Therefore, caries risk should be assessed by analyzing and integrating several causal factors [8]. This study aims to examine the effects of socioeconomic status, oral and dental health practices, dietary habits, and anthropometric measurements on dental health in 12-year-old school children, and unlike the other studies, many factors involved in the etiology of dental caries were assessed together.

Methods

Research sample and design

The sample of this study was composed of a total of 254 voluntary 12-year-old school children (44.1% boys and 55.9% girls) enrolled in three different middle schools (low, moderate, and high socioeconomic level) in Turkey. The World Health Organization develops basic methods and criteria for use in oral and dental health field surveys and recommends the use of specific age or age bands to make comparisons between countries. It is stated in the “basic principles” of the World Health Organization that it is sufficient to select 5 years of age to determine the condition of milk teeth and to select sample among 12- and 15-year-old children who have different risks to determine the condition of permanent teeth in childhood. This study was carried out with 12-year-old children due to the fact that all permanent teeth except for the third molars should erupt until 12 years of age and this age group is a global indicator age group for monitoring international comparisons and disease trends [9]. The study was conducted with the approval of the Ethics Committee of Mardin Artuklu University dated 11.01.2018 and no. 2018/01-3.

Data collection tools

The data were collected by face-to-face interviews via a questionnaire form including socioeconomic status, oral and dental health practices, dietary habits, and anthropometric measurement. Children’s height (cm), body weight (kg), waist circumference (cm), hip circumference (cm), upper middle arm circumference (cm), triceps skinfold thickness (mm), and biceps skinfold thickness (mm) were taken in accordance with the technique. Waist circumference ≥ 84.5 cm for boys and ≥ 81.9 cm for girls were considered “risk”, but the ones below these values were considered “normal” [10]. Waist-to-height ratios were classified as “take care” if < 0.4 , “normal” if $0.4-0.5$, “take care” if $0.5-0.6$, and “take action” if ≥ 0.6 [11]. Body mass index (kg/m^2) was classified as < 3 “too weak”, $\geq 3- < 15$ “weak”, $\geq 15- < 85$ “normal”, $\geq 85- < 97$ “overweight”, and

≥ 97 “obese” according to the 12-year-old table of percentiles [12].

Clinical examinations were performed by a dentist to assess the oral and dental health of the children. The dentist determined the number of teeth affected by caries and its results for each child and marked them in the oral examination form. The sums of the number of decayed teeth (DT), missing teeth (MT) and filled teeth (FT) (decayed, missing, and filled teeth: DMFT), and teeth surfaces (decayed, missing, and filled surfaces: DMFS) were calculated. DMFT and DMFS indices of the children were determined as a result of these calculations. dmft and dmfs indices were used for milk teeth. The missing teeth were not included in the examination for milk teeth. The dental caries levels of the children were determined using WHO classification based on the means DMFT and dmft (< 1.2 “very low”, $1.2-2.6$ “low”, $2.7-4.4$ “moderate”, $4.5-6.5$ “high”, and > 6.5 “very high”) [9].

Statistical analysis

SPSS (Statistical Package for the Social Sciences) package program was used to analyze the data. Chi-square and Fisher’s exact chi-square tests were performed to determine whether there was a significant relationship between qualitative variables. Mann-Whitney U test was used to analyze the means between the two groups that did not show normal distribution, and mean (\bar{X}), median, standard deviation (SD), and upper and lower values were shown. Kruskal-Wallis variance analysis was used to analyze the means among the three and more groups. Kruskal-Wallis hypothesis test was applied to uncover which group caused the difference. Spearman correlation was used to determine the relationship between the factors affecting oral and dental health indicators. Statistical significance was evaluated at $p < 0.01$ and $p < 0.05$. The confidence interval for all statistical tests was adopted as 95.0%.

Results

A total of 254 12-year-old children (44.1% boys and 55.9% girls) participated in the study. It was found that 70.9% of the children have dental caries on their permanent teeth and 44.1% of them have at least one caries on their milk teeth. Moreover, it was found that the number of girls who have caries on their permanent teeth and boys who have caries on their milk teeth is higher ($p < 0.05$). dmft and dmfs indices were found to be very low in 47.2% and 75.2% of the children, respectively. It was discovered that low DMFT rates (girls 20.5%, boys 9.8%) were higher in girls and high dmft rates (girls 2.1%, male, 9.8%) were higher in boys ($p < 0.05$) (Table 1).

Table 1 Classification of indicators of permanent and milk teeth of children

Oral health indicators	Boy		Girl		Total		p ^x
	n	%	n	%	n	%	
Permanent teeth							
Have caries	69	61.6	111	78.2	180	70.9	8.319
Have not caries	43	38.4	31	21.8	74	29.1	0.004*
Milk teeth							
Have caries	59	52.7	53	37.3	112	44.1	5.988
Have not caries	53	47.3	89	62.7	142	55.9	0.014*
Classification of DMFT							
Very low	63	56.2	57	40.1	120	47.2	12.561
Low	11	9.8	29	20.5	40	15.7	0.014*
Middle	25	22.4	47	33.1	72	28.3	
High	11	9.8	8	5.6	19	7.5	
Very high	2	1.8	1	0.7	3	1.3	
Classification of dmft							
Very low	73	65.2	118	83.2	191	75.2	14.698
Low	17	15.2	10	7.0	27	10.6	0.005*
Middle	10	8.9	11	7.7	21	8.3	
High	11	9.8	3	2.1	14	5.5	
Very high	1	0.9	–	–	1	0.4	
Total	112	100.0	142	100.0	254	100.0	

^x Chi-square test

**p* < 0.05

It was found that nearly all of the children brush their teeth (96.1%) and the number of those who do not brush their teeth (7.9%) is higher among ones the with low socioeconomic status (*p* < 0.05). 34.3% of the students reported that they brush their teeth once a day and 21.7% reported they sometimes brush their teeth. The number of those who brush their teeth several times a week (10.1%) is higher among the ones with moderate socio-economic status and the number of those who brush their teeth three times a day (6.3%) is higher among the ones with high socioeconomic status (*p* < 0.05). Nearly half of the children (49.2%) stated that they first saw a dentist at the age of 6–10 and 14.2% reported that they have never seen a dentist. It was found that the number of those who see a dentist 1–2 times a year (30.0%), have previously received oral and dental health education (65.6%) and change their toothbrush every 3 months (43.8%) is higher among the ones with high socioeconomic status (*p* < 0.05). It was discovered that 39.0% of children have harmful oral and dental health habits in which lip bite (62.6%) is the leading (Table 2).

There are 1.7 ± 1.78 decay, 0.1 ± 0.35 missing, and 0.2 ± 0.69 fillings in permanent teeth of the participants. The mean numbers of decayed and filled milk teeth are 1.0 ± 1.49 and 0.5 ± 0.36 , respectively (data not shown). The mean DMFT is 2.0 ± 1.90 , and dmft is 1.0 ± 1.57 . dt, dmft, ds, and dmfs values of boys were found to be higher

than of girls (*p* < 0.05). It was determined that those who brush their teeth, brush their teeth after the meal and before bedtime, brush in a circular style, and change their toothbrush every 3 months have better oral examinations (*p* > 0.05). Those who brush their teeth three times a day (DMFT 1.3 ± 1.42 , dmft 0.0 ± 0.00) have better permanent (*p* > 0.05) and milk teeth (*p* < 0.05) examination than sometimes brushers (DMFT 2.4 ± 2.02 , dmft 1.5 ± 1.93). According to the brushing duration, those who brush their teeth for 2–3 min have the minimum mean DMFT values (1.8 ± 1.70) (*p* > 0.05) and it was found that those who brush more than 3 min (0.2 ± 0.58) have lower mean dmft values than those who do not know their brushing duration (1.9 ± 1.20) (*p* < 0.05) (Table 3).

Those consuming crackers, cornflakes, bread, flavored milk, dried fruit, instant fruit juice, fizzy drinks, iced teas, energy drinks, dessert, candy\delight etc., pastry products, jam, table sugar, jelly food, and sugary chewing gum have higher mean DMFT values than those who do not consume such foods and drinks, but the differences are not statistically significant (*p* > 0.05). Considering the mean dmft values, those who do not consume crackers, chips, bread, dried fruit, instant fruit juice, fruity drinks, fizzy drinks, energy drinks, dessert, cookies, cakes, pudding, biscuits, chocolate, table sugar, jelly foods, and sugary chewing gum have lower mean dmft values and the differences are statistically

Table 2 Information on oral and dental health of children

Information	Low socioeconomic status		Moderate socioeconomic status		High socioeconomic status		Total		p
	n	%	n	%	n	%	n	%	
Status brushing teeth									
Brushes	82	92.1	100	99.0	62	96.9	244	96.1	5.573 ^a
Not brushes	7	7.9	1	1.0	2	3.1	10	3.9	0.049*
The frequency of tooth brushing									
1 time per day	22	24.7	37	36.6	28	43.8	87	34.3	21.932 ^a
2 times a day	29	32.6	24	23.8	21	32.8	74	29.1	0.010*
3 times per day	4	4.5	2	2.0	4	6.3	10	3.9	
Several times a week	5	5.6	11	10.9	2	3.1	18	7.1	
Sometimes	22	24.7	26	25.7	7	10.9	55	21.7	
Never	7	7.9	1	1.0	2	3.1	10	3.9	
The frequency of brush replacement									
Quarterly	21	23.6	10	9.9	28	43.8	59	23.2	49.286 ^b
Once in 6 months	19	21.3	30	29.7	24	37.5	73	28.8	p < 0.01**
Once a year	34	38.2	54	53.5	9	14.0	99	39.0	
Once in 2 years	8	9.0	6	5.9	1	1.6	15	5.9	
Never	7	7.9	1	1.0	2	3.1	8	3.1	
The age of see the dentist for the first time (years)									
1–5 years old	16	18.0	20	19.7	25	39.1	61	24.0	16.930 ^b
6–10 years old	40	44.9	55	54.5	30	46.9	125	49.2	0.010*
11–12 years old	16	18.0	11	10.9	5	7.8	32	12.6	
Never	17	19.1	15	14.9	4	6.2	36	14.2	
The frequency of see the dentist (n= 218)									
When complaints	64	88.9	77	89.5	42	70.0	183	83.9	17.783 ^b
1–2 times per year	8	11.1	9	10.5	18	30.0	35	16.1	0.001**
Previously oral health education									
Have training	18	20.2	19	18.8	42	65.6	79	31.1	47.629 ^b
Have not training	71	79.8	82	81.2	22	34.4	175	68.9	p < 0.01**
Harmful oral health habits									
Have not	48	53.9	65	64.4	42	65.6	155	61.0	2.923 ^b
Have	41	46.1	36	35.6	22	34.4	99	39.0	0.232
Total	89	100.0	101	100.0	64	100.0	254	100	
If there are harmful oral habits (n= 41)^c									
Lip biting	29	70.7	20	55.5	22	100.0	62	62.6	
Nail biting	15	36.6	20	55.5	15	68.2	50	50.5	
Cheek biting	7	17.1	5	13.9	1	4.5	13	13.1	

^a Fisher's exact test^b Chi-square test^c Multiple answers were given

*p < 0.05 **p < 0.01

significant only for molasses and table sugar ($p < 0.05$) (Table 4). The mean duration of breastfeeding of children is 14.1 ± 7.46 months and the mean time of starting complementary feeding is 6.1 ± 1.64 months. It was determined that children with low socioeconomic status have less breastfeeding time ($p < 0.05$), and oral and dental health indicators do not differ according to

breastfeeding time and the time of starting complementary feeding ($p > 0.05$) (data not shown).

It was discovered that there is a negative relationship between waist-to-height ratio and FT; between waist circumference and FT and DMFT; between hip circumference and DMFT ($p < 0.05$). It was also found that there is a negative relationship between dt and body mass index,

Table 3 Oral Health Indicators According To Gender and Oral/Dental Health Practices

Habits	Permanent teeth		Milk teeth		p
	DMFT ^c		dmft ^d		
	$\bar{X}\pm SD$	Median (Min-Max)	$\bar{X}\pm SD$	Median (Min-Max)	
Gender					
Boy	1.9±2.09	1.00 (00-9.00)	1.4±1.83	1.00 (00-9.00)	0.073 ^c
Girl	2.1±1.73	2.00 (00-9.00)	0.7±1.26	0.00 (00-6.00)	0.003^{d*}
Total	2.0±1.90	2.00 (00-9.00)	1.0±1.57	0.00 (00-9.00)	
Status brushing teeth^a					
Brushes	2.0±1.90	2.00 (00-9.00)	0.9±1.54	0.00 (00-9.00)	0.675 ^c
Not brushes	2.2±1.81	2.00 (00-5.00)	1.6±2.22	0.50 (00-6.00)	0.450 ^d
Tooth brushing time					
After meals	2.4±1.79	2.00 (00-6.00)	0.8±1.64	0.00 (00-9.00)	0.099 ^c
After meals and before bedtime	1.5±1.69	1.00 (00-6.00)	0.5±0.98	0.00 (00-4.00)	0.150 ^d
Before bedtime	2.0±1.96	2.00 (00-9.00)	1.2±1.68	0.50 (00-6.00)	
Uncertain	2.2±2.00	2.00 (00-9.00)	1.6±2.22	0.00 (00-6.00)	
Never	2.2±1.90	2.00 (00-5.00)	1.6±2.22	0.50 (00-6.00)	
The frequency of tooth brushing^b					
1 time per day	2.1±1.94	2.00 (00-9.00)	1.1±1.60 ^{xy}	0.00 (00-6.00)	0.392 ^c
2 times a day	1.8±1.80	1.00 (00-6.00)	0.6±0.92 ^{xy}	0.00 (00-4.00)	0.015^{d*}
3 times per day	1.3±1.42	1.00 (00-4.00)	0.0±0.00 ^x	-	
Several times a week	1.7±1.93	1.00 (00-5.00)	1.1±1.78 ^{xy}	0.00 (00-6.00)	
Sometimes	2.4±2.02	2.00 (00-9.00)	1.5±1.93 ^y	1.00 (00-9.00)	
Never	2.2±1.81	2.00 (00-5.00)	1.6±2.22 ^{xy}	0.50 (00-6.00)	
Brushing style^b					
Left to right	1.9±2.00	1.00 (00-9.00)	1.2±1.68	0.00 (00-6.00)	0.111 ^c
Up and down	2.5±1.87	2.00 (00-8.00)	1.2±1.69	1.00 (00-9.00)	0.121 ^d
Circular	1.8±1.67	1.00 (00-6.00)	0.6±1.20	0.00 (00-5.00)	
Do not know	2.2±3.49	1.00 (00-9.00)	1.2±1.94	0.50 (00-5.00)	
Never	2.2±1.81	2.00 (00-5.00)	1.6±2.22	0.50 (00-6.00)	
Brushing duration^b					
Less than 1 min	2.3±2.16	2.00 (00-9.00)	1.2±1.85 ^{xy}	0.00 (00-9.00)	0.502 ^c
2-3 min	1.8±1.70	1.00 (00-6.00)	0.8±1.29 ^{xy}	0.00 (00-6.00)	0.017^{d*}
More than 3 min	2.3±1.91	2.00 (00-6.00)	0.2±0.58 ^x	0.00 (00-2.00)	
Do not know	2.3±2.30	2.00 (00-9.00)	1.9±1.20 ^y	2.00 (00-6.00)	
Never	2.2±1.81	2.00 (00-5.00)	1.6±2.22 ^{xy}	0.50 (00-6.00)	
The frequency of brush replacement^b					
Quarterly	1.6±1.82	1.00 (00-6.00)	0.7±1.37	0.00 (00-6.00)	0.254 ^c
Once in a six month	1.8±1.75	1.00 (00-6.00)	0.8±1.37	0.00 (00-6.00)	0.114 ^d
Once a year	2.3±2.09	2.00 (00-9.00)	1.2±1.70	1.00 (00-9.00)	
Once in two years	2.4±1.30	3.00 (00-4.00)	1.3±1.80	0.00 (00-5.00)	
Never	2.4±1.85	2.00 (00-5.00)	1.4±2.06	0.50 (00-6.00)	

* $p < 0.05$ ^a Mann-Whitney U Test^b Kruskal Wallis Test^c p value for DMFT^d p value for p dmft^{xy,y} The differences between the averages indicated in different letters in the same column are statistically significant.

Table 4 Oral health indicators of children according to their nutrient consumption status

Foods	Permanent teeth DMFT ^a X̄±SD	Milk teeth dmft ^b X̄±SD	p ^c
Crackers			
Consume	2.0±1.91	1.1±1.64	0.543 ^a
Not consume	1.8±1.80	0.6±0.93	0.096 ^b
Chips			
Consume	2.0±1.92	1.1±1.59	0.833 ^a
Not consume	2.0±1.60	0.5±1.26	0.053 ^b
Cornflakes			
Consume	2.0±1.94	1.0±1.50	0.881 ^a
Not consume	1.9±1.82	1.0±1.69	1.000 ^b
Bread			
Consume	2.0±1.90	1.0±1.57	0.403 ^a
Not consume	1.2±1.50	0.5±1.00	0.492 ^b
Flavored/sweetened milk			
Consume	2.1±1.90	1.0±1.64	0.053 ^a
Not consume	1.7±1.85	1.0±1.41	0.637 ^b
Dried Fruits			
Consume	2.1±1.93	1.1±1.64	0.335 ^a
Not consume	1.8±1.82	0.9±1.38	0.681 ^b
Instant Fruit Juice			
Consume	2.1±1.95	1.1±1.63	0.432 ^a
Not consume	1.6±1.37	0.5±0.73	0.118 ^b
Fruity Drinks			
Consume	2.0±1.92	1.1±1.64	0.929 ^a
Not consume	2.0±1.78	0.7±1.08	0.667 ^b
Fizzy Drinks			
Consume	2.0±1.93	1.1±1.66	0.995 ^a
Not consume	1.9±1.77	0.8±1.20	0.620 ^b
Biscuits			
Consume	2.0±1.92	1.1±1.60	0.728 ^a
Not consume	2.1±1.55	0.3±0.48	0.138 ^b
Chocolate			
Consume	2.0±1.90	1.0±1.58	0.614 ^a
Not consume	2.2±1.75	0.5±0.75	0.504 ^b
Sugary Chewing Gum			
Consume	2.1±1.96	1.1±1.63	0.648 ^a
Not consume	1.9±1.73	0.9±1.39	0.736 ^b
Iced teas			
Consume	2.1±1.99	1.0±1.50	0.809 ^a
Not consume	1.9±1.83	1.1±1.62	0.482 ^b
Energy drinks			
Consume	2.3±2.13	1.4±1.55	0.442 ^a
Not consume	1.9±1.87	0.9±1.57	0.066 ^b
Desserts			
Consume	2.0±1.90	1.0±1.62	0.549 ^a
Not consume	1.8±1.82	0.8±1.12	0.776 ^b

Table 4 (continued)

Foods	Permanent teeth DMFT ^a X̄±SD	Milk teeth dmft ^b X̄±SD	p ^c
Cookies\cakes			
Consume	2.0±1.90	1.0±1.57	0.806 ^a
Not consume	2.0±1.00	0.3±0.58	0.526 ^b
Candy\delight etc.			
Consume	2.1±1.89	1.1±1.64	0.445 ^a
Not consume	1.9±1.92	0.8±1.25	0.620 ^b
Pastry products (muffin, pastry, fruit pie)			
Consume	2.0±1.90	1.0±1.60	0.565 ^a
Not consume	1.8±1.87	0.8±1.0	0.639 ^b
Honey			
Consume	2.0±1.90	1.1±1.66	0.781 ^a
Not consume	2.0±1.87	0.8±1.15	0.767 ^b
Molasses			
Consume	2.0±1.94	1.2±1.72	0.972 ^a
Not consume	2.0±1.80	0.6±1.04	0.006 ^{b*}
Jam			
Consume	2.1±1.93	1.0±1.54	0.113 ^a
Not consume	1.7±1.76	0.9±1.64	0.855 ^b
Table sugar			
Consume	2.1±1.94	1.1±1.64	0.516 ^a
Not consume	1.8±1.64	0.5±0.97	0.025 ^{b*}
Jelly food			
Consume	2.3±2.13	1.3±1.62	0.410 ^a
Not consume	1.9±1.81	0.9±1.54	0.061 ^b
Pudding			
Consume	1.9±1.90	1.0±1.61	0.236 ^a
Not consume	2.3±1.87	0.9±1.41	0.796 ^b

* $p < 0.05$ ^a p value for DMFT^b p value for p dmft^c Mann-Whitney U Test

hip circumference, upper middle arm circumference, biceps skinfold thickness, and triceps skinfold thickness ($p < 0.01$); and between ft and hip circumference ($p < 0.05$). There is a negative relationship between dmft and Body Mass Index, waist circumference, hip circumference, upper middle arm circumference, biceps skinfold thickness, and triceps skinfold thickness ($p < 0.01$) (Table 5).

Discussion

The present study was conducted with a total of 254 12-year-old children enrolled in three different middle schools (high, moderate, and low socioeconomic status) to examine the effects of socioeconomic status, oral and

Table 5 Correlation between oral health indicators and children's anthropometric measurements, socioeconomic status, and educational status of parents

Variables	Permanent teeth				Milk teeth			
	DT	MT	FT	DMFT	dt	ft	dmft	
Anthropometric measurements								
Body mass index (kg/m ²)	<i>r</i>	-0.065	-0.026	-0.055	-0.087	-0.227	-0.087	-0.245
	<i>p</i>	0.305	0.677	0.387	0.169	<i>p</i> < 0.01**	0.165	<i>p</i> < 0.01**
Waist-to-height ratio	<i>r</i>	-0.025	0.027	-0.147	-0.087	-0.036	-0.100	-0.053
	<i>p</i>	0.695	0.670	0.019*	0.165	0.564	0.113	0.398
Waist circumference (cm)	<i>r</i>	-0.081	-0.043	-0.127	-0.135	-0.161	-0.122	-0.183
	<i>p</i>	0.196	0.491	0.043*	0.031*	0.010	0.053	0.003**
Hip circumference (cm)	<i>r</i>	-0.096	-0.054	-0.070	-0.125	-0.250	-0.128	-0.272
	<i>p</i>	0.128	0.391	0.263	0.047*	<i>p</i> < 0.01**	0.042*	<i>p</i> < 0.01**
Upper middle arm circumference (cm)	<i>r</i>	-0.076	-0.049	-0.057	-0.103	-0.225	-0.087	-0.240
	<i>p</i>	0.226	0.437	0.363	0.103	<i>p</i> < 0.01**	0.165	<i>p</i> < 0.01**
Biceps skinfold thickness (mm)	<i>r</i>	-0.080	-0.025	-0.008	-0.089	-0.171	-0.069	-0.183
	<i>p</i>	0.204	0.689	0.901	0.158	0.006**	0.272	0.003**
Triceps skinfold thickness (mm)	<i>r</i>	-0.065	-0.037	-0.043	-0.096	-0.183	-0.094	-0.197
	<i>p</i>	0.303	0.557	0.498	0.127	0.003**	0.135	0.002**

† Spearman correlation

p* < 0.05*p* < 0.01

dental health practices, dietary habits, and anthropometric measurements on oral and dental health.

Oral and dental health in school-age children totally depends on such factors like oral hygiene behavior of children, dietary habits, socioeconomic status, regular dental examination, age, and other demographic and cultural characteristics [3, 6, 7]. Socioeconomic factors have become increasingly scrutinized in studies as they affect the prevalence of dental caries, oral health practices, and parental knowledge on oral and dental health [13, 14]. It is stated that families with high socioeconomic status behave more conscious about their children's dental health [15]. In this study, it was shown that factors affecting oral and dental health, such as tooth brushing practices, age, and frequency of seeing a dentist and oral and dental health education vary by the one's socioeconomic status. Oral and dental health practices were found to be better in the children of families with high socioeconomic status (Table 2). Similarly, in other studies, children with high socioeconomic status are more likely to see a dentist [4, 16] and to have higher rates of regular brushing [17]. The fact that children from higher-income households have more chances to access to dental care, including a more specific diagnostic assessment and have one or more filled teeth explains the difference in oral and dental health by the ones' socioeconomic status. Higher prevalence of caries in lower socioeconomic status may be due to lack of prevention and treatment services most of the time. It is important that both children and their parents with low socioeconomic level are

educated in oral health, awareness raising, and guided to make more use of treatment services.

Oral and dental diseases are seen different rates in every society and ages. The World Health Organization and the World Dental Federation (FDI) recommended that DMFT should not be more than 3 for 12 years until 2000, as one of the global goals for oral and dental health [18]. In this study, the mean DMFT value is 2.0 ± 1.90 and the recommended goal was reached. Considering certain studies conducted by countries, the mean DMFT values were determined as 4.8 ± 3.22 in Bosnia and Herzegovina [8], 0.14 in Nigeria [17], 3.3 ± 2.3 in Russia and 0.5 ± 0.8 in Norway [7], and 1.64 in Thailand [19]. Dental caries were determined in 70.9% of the children in the general sample, 61.6% of boys and 78.2% of girls (*p* < 0.05) (Table 2). There was no significant difference between gender and the mean DMFT/dmft value which was found to be 1.9 ± 2.2 in 12-year-old children in the Study for Oral and Dental Health Profile of Turkey [20]. In parallel with this study, although there are other studies revealing that the mean DMFT in girls is higher [3, 21], it was determined in some studies that oral and dental health indicators were similar by gender [7, 16, 22]. It is stated that the prevalence of caries may be higher due to the earlier ages for dentition in girls and the emergence of periodontal problems due to hormonal changes in puberty period.

Since dental caries has a multifaceted etiology including general health, nutrition, plaque, saliva secretion, type and amount of microorganism, sensitivity of host,

oral hygiene habits, use of fluoride, social and behavioral factors, any relationship between oral and dental hygiene practices and caries is difficult to be detected [23]. In this study, it was found that the indicators for milk teeth of those who have higher tooth brushing time and frequency are better ($p < 0.05$) (Table 3). Proper oral and dental hygiene is also effective in preventing many diseases that are not associated with caries. The most common diseases such as caries and periodontal diseases are caused by poor oral hygiene practices as well as other factors [24], and children are important to be educated in subjects such as brushing style, duration, and frequency.

Dietary habits play an important role in general health status and oral health [25]. In one study, the predominant factor in caries risk profile was shown to be diet [8]. In this study, the mean DMFT\dmft values of the children consuming foods with high cariogenic potential were determined likely to be high (Table 4). In a study conducted to examine the effect of backward dietary habits of children on dental health, those who consumed foods increasing the risk of dental caries more than three times a day at the age of one and those who consumed candy more than once a week at the age of 3 were found to have higher number of decayed and filled teeth at the age of 15 [26]. The negative relationship between nutritional status and caries is explained by main meals and snacks. Main meals are stated to contain higher protein and fat and lower sugar than snacks so that snacks are associated with caries. While being exposed to sugary and starchy foods during meals reduces the risk of caries, it was revealed that high sugar consumption with snacks increase such risk.

Dental caries, obesity, and malnutrition are global diseases with adverse effects on health [27, 28]. As there are common risk factors for these diseases, the relationship between body weight and tooth decay has been the subject of many studies [29–32]. People who have an unbalanced diet with low nutritional value and high sugar and energy content are often affected by both malnutrition and caries. In addition, it is stated that there is a positive relationship between obesity and dental caries with increasing food and refined food consumption and consumption frequency. Therefore, it was investigated whether there is a causal relationship between dental diseases and anthropometric measurements or whether they share the same risk factors [2]. In this study, a negative relationship was found between anthropometric measurements and oral and dental health indicators (Table 5). Contradictory results were found in both research and review studies on body weight and oral health in children. Some studies showed a positive correlation between body weight and tooth decay [26, 33–35], some of them revealed a negative relationship [3, 6, 36], and others found no relationship between

them [16, 37–39]. Besides, different results were reached according to different age groups [19, 40]. A negative relationship between anthropometric measurements and tooth decay may be caused by the risk of a weak immune system and dietary habits based on foods with low nutritional values and high energy foods in children with low body weight. The difficulty in studying the relationship between dental caries and obesity is due to the fact that many factors need to be measured at the same time in a standard way.

Conclusions

It was revealed in this study that dietary habits, anthropometric measurements, oral and dental health practices, gender, and socioeconomic status are effective on caries. It is recommended that children and parents with low socioeconomic status should be given education on oral and dental health practices and guidance to dental care services should be increased. Regulation of dietary habits of children is considerable both for anthropometric measurements and prevention of dental caries. In assessing the effect of dietary habits on dental health, the amount and frequency of consumed foods should be examined in more detail.

Abbreviations

DT: Decayed teeth; MT: Missing teeth; FT: Filled teeth; DMFT: Decayed, missing, and filled teeth; DMFS: Decayed, missing, and filled surfaces; SPSS: Statistical Package for the Social Sciences; FDI: World Dental Federation.

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Authors' contributions

A.-C.J. and A.Y. contributed to the conception, design, data acquisition, analysis and interpretation, and drafted and critically revised the manuscript. O.A.-O. contributed to the conception, design, and interpretation and critically revised the manuscript. All authors gave their final approval and agree to be accountable for all aspects of the work.

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Availability of data and materials

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Declarations

Ethics approval and consent to participate

The research protocol was approved by the Ethics Committee of Mardin Artuklu University dated 11.01.2018 and no. 2018/01-3. All participants provided informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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