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Original

Is diet quality associated with early childhood caries in preschool children? A descriptive study

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SUMMARY: İnan-Eroğlu E, Özşin-Özler C, Erçim RE, Büyüktuncer Z, Uzamış-Tekçiçek M, Güçiz-Doğan B. Is diet quality, associated with early childhood caries in preschool children? A descriptive study. Turk J Pediatr 2017; 59: 537-547.

Limited evidence about the role of diet quality, an important component of nutritional status, in the etiology of dental caries has been reported. The aim of this study was to examine the association between diet and dental caries in children by using the dietary intake data, anthropometrical measurements and dental examination. A total of 395 children (52.7% boys and 42.8% girls) who were 36-71 months of age (mean age 58.7±8.6 months) and attended one of the eleven preschools within a district of Ankara participated in this descriptive study. Dental examinations were performed in the schools under day-light by a pediatric dentist; decayed, missing and filled teeth as well as surfaces were recorded. Data related to socio-demographic characteristics and 24-hour dietary recall of children were gathered via a structured, pre-tested questionnaire which was conducted by the research dietitian. The Healthy Eating Index-2010 (HEI-2010) and Mediterranean Diet Quality Index for children and adolescents (KIDMED) were used to assess dietary intake. Anthropometric measurements including weight, height, upper arm circumference and head circumference were taken by the same researcher. The percentage of Early Childhood Caries (ECC) was increased by age ($p<0.001$) whereas no significant difference was observed by sex, socioeconomic status, tooth brushing frequency and body mass index ($p>0.05$). Although children who had bad KIDMED scores had slightly higher mean values of decayed missing and filled teeth (dmft) (5.39± 4.6) and decayed missing and filled surface (dmfs) (8.45± 8.69), compared to the scores of children with good or medium KIDMED scores, the differences were not statistically significant ($p>0.05$). On the contrary to the KIDMED findings, the mean value of tooth decay was significantly higher among children with bad HEI-2010 score (4.2±4.3) compared to children with medium HEI-2010 score (2.47±2.9) ($p=0.043$). It is concluded that a healthy eating pattern and high diet quality is essential for the prevention of early childhood caries in preschool children. Further studies are required to develop dietary strategies for the prevention of dental caries.

Key words: dental caries, childhood, preschool, diet quality, body measures.

Dental caries is one of the most common chronic disease of the childhood period as well as an important public health problem for every age group.[1] Early childhood caries (ECC) has multifactorial etiology and defined as "presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a child under the age of six."[2] The prevalence of dental caries varies between 1.0%-94.0% in

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preschool aged children in the world.[3-6] ECC prevalence among 5 years old children in Turkey was found to be 69.8% in 2004.[7]

The main risk factors for dental caries are cariogenic bacteria, cariogenic diet, poor oral hygiene techniques, including lack of tooth brushing and dental flossing or inadequate period of brushing.[1] Among these factors, diet has a different role in the etiology of dental caries since there is a dual relationship between diet and dental caries.[8] Dietary habits have potential to be a risk factor for dental caries; on the other side, impaired oral health might cause deficiencies in dietary intake.

Both dietary and oral habits are gained during the childhood period.[9-12] It is important to distinguish the differences between anti-cariogenic, cariogenic and cario-static foods for a better evaluation of oral health.[13] The anti-cariogenic foods can increase the pH of the saliva to an alkaline level and prevent enamel from demineralization. Dairy products (especially cheese), unrefined plant foods, wholegrain foods and xylitol, the five-carbon sugar alcohol are considered as anti-cariogenic foods or food components. The cariogenic foods including sweets, starchy foods and beverages, and products with added sugar contain fermentable carbohydrates that is fermented by microorganisms in the mouth, and result in a decrease in pH of the saliva to 5.5 or less that promote formation of caries. The cario-static foods do not cause caries since they are not metabolized by microorganisms in the mouth thus salivary pH does not change within 30 minutes. Protein foods such as egg, meat, fish and poultry; most vegetables; fats and non-carbohydrate sweeteners are the examples of cario-static foods.[13-14]

On the other hand, dental caries resulted as tooth loss may decrease the ability of having a varied diet. This might be a problem especially for the consumption of fruits, vegetables and non-starch polysaccharides. Furthermore, a low plasma vitamin C level is associated with dental caries.[15]

Anthropometrical measurements were used frequently as an indicator of nutritional status in previous studies that examined the relationship between diet and dental caries.[16-22] However, the role of diet quality, -an important component of nutritional status- in the etiology of dental caries has been studied in very few studies.[23] The evaluation of the association between diet quality and dental caries might provide a better understanding for the relationship between nutritional status and dental caries in children. Starting from this point, this study aimed to examine the association between diet and dental caries in preschool children by using the dietary intake data, anthropometrical measurements and dental examination.

Materials and Methods

The data evaluated in this analysis was obtained from a broad study in which the oral health and nutritional status, and anthropometric measurements of preschool aged children were surveyed.[24] This report includes the analysis of dietary intake data, anthropometrical measurements and dental examination results (dmft/s) with the aim of examining the association between diet and dental caries in children. The study protocol was approved by the Non-Interventional Clinical Researches Ethics Board of Hacettepe University and the permission from the concerned educational authorities was obtained. The heads of the schools were informed about the study and contact meetings with the parents were organised before the data collection; written informed consent of the parents were obtained.

The target group of this descriptive study was all preschool children and their parents (n=1019) attending one of the 11 governmental nursery schools within a district of the capital city of Turkey, Ankara. The inclusion criteria were: obtaining parent's written consent, being 36-71 months of age, being at the school on examination day. At the end of data collection (dental examinations completed in 20 days by one examiner), 774 parents were accessed (76%) and interviewed. Of the children of these parents, 8 were not examined because of non-cooperation, and of the examined children (a total of 766), 37 were also excluded since they were less than 36 or older than 71 months of age. Eventually, data from 729 children was analysed. However, anthropometric measurements were taken from 395 of all dentally examined children and information for Healthy Eating Index-2010 (HEI-2010) was gathered from 225 parents

and teachers and for Mediterranean Diet Quality Index for children and adolescents (KIDMED) from 211 parents. These analyses were performed to evaluate the diet quality and ECC association.

Data related to some sociodemographic characteristics of the parents and some risk factors related to the child were gathered via a structured, pre-tested questionnaire by face to face interviews with parents (mostly mothers) in the meetings organized at the schools.

Dental Examination: The intraoral examinations of the children were done under field conditions by a pediatric dentistry research assistant. Before the study examinations, the examiner had reviewed the pufa codes and International Caries Detection and Assessment System (ICDAS) training materials by herself in order to learn what the codes are in the clinical situation and how to code them. A training session was organised with a Pediatric Dentistry Professor about the coding of oral examination criteria. Then, on 70 children between 36-71 months of age, intra- and inter-examiner variabilities were checked and Kappa values were found as 88% and 88%, respectively. Dental examination was carried out in the schools under day light using a disposable plain mouth mirror and WHO Community Periodontal Index (CPI) probe (WHO 973/80 - Martin, Solingen, Germany). Children lied on a table covered with a soft mat and the results of the oral examination was coded according to the WHO 2013 criteria[25] and ICDAS II criteria[26,27], separately.

Dietary intake: Dietary intake was assessed using 24-hour dietary recall. Two research dietitians interviewed the parents to obtain information about the food consumption of children at home, and with the teachers for their consumption at the school. Diet quality was assessed by two different tools: The Healthy Eating Index-2010 (HEI-2010) and Mediterranean Diet Quality Index for Children and Adolescents Index (KIDMED). HEI-2010 is an updated tool that can be used to determine relationships between nutrients and health-related outcomes using 24-hour dietary recall data.[29] It consists 12 components: 9 adequacy components (higher scores indicating higher consumption), namely total fruit (5 points), whole fruit (5 points), total vegetables (5 points), greens and beans (5 points), whole grains (10 points), dairy (10 points), total protein foods (5 points), seafood and plant proteins (5 points) and fatty acids (the ratio of polyunsaturated and monounsaturated fatty acids to saturated fatty acids) (10 points). The remaining 3 moderation components (higher scores showing higher consumption) including refined grains (10 points), sodium (10 points) and energy from solid fat, alcohol and added sugars (SoFAAS) (20 points). Total 12 components of HEI-2010 was assigned the appropriate scoring.[30] KIDMED, an instrument to assess adherence to the Mediterranean Diet which is one of the healthiest diet model, was also used to evaluate the diet quality. KIDMED includes 16 items, denoting a negative connotation with respect to the Mediterranean diet was assigned a value of -1, and those with a positive aspect +1. Scores range from 0 to 12.[31]

Anthropometrical measurement: Anthropometric measurements including weight, height, upper arm circumference and head circumference were taken by one of the research dietitian. The body weight was assessed by using a digital scale (SECA) and the height was measured by a stadiometer without shoes. BMI was assessed using WHO Child Growth Charts 2006 and BMI according to age was divided into 5 groups as severe thinness ($<3^{rd}$ percentile), thinness ($\geq 3^{rd}$ -$<15^{th}$ percentile), normal ($\geq 15^{th}$ -$<85^{th}$ percentile), overweight ($\geq 85^{th}$-$<97^{th}$ percentile) and obese ($\geq 97^{th}$ percentile).[32]

Statistical analysis: Data were analysed by the Statistical Package for the Social Sciences (SPSS), version 15.0. HEI-2010 scores were calculated in Microsoft Excel program (2007). KIDMED scores were also calculated in SPSS 15.0. Descriptive statistics including mean, standard deviation, first and third quartiles, median, minimum and maximum values were used for continuous variables. For qualitative variables frequency and percentage distributions were used. The normality distribution of data was examined using the Kolmogorov-Smirnov test. Since the distribution was not normal, nonparametric tests (Mann-Whitney U and Kruskal-Wallis tests) were used. p value <0.05 (two tailed) was considered significant.

Results

In this study, 395 children, 52.7% boys and 42.8% girls, with a mean age of 58.7±8.6 months old were evaluated. More than half of the children (52.7%) were 60-72 months old. The mean age for mothers was 34.5±5.2 years and 38.0±5.1 years for fathers. Two-third of the parents had graduated from high school or university (63.8% of mothers and 63.5% of fathers). Almost half of the mothers and fathers were currently working (Table I).

Table I. Distribution of Participants by Some Characteristics.

Characteristics (n=395)	n	%
Sex		
Male	226	57.2
Female	169	42.8
Age (months)		
36-47	48	12.2
48-59	139	35.2
60-71	208	52.6
Mother's age (years)		
20-24	15	3.8
25-29	132	33.4
30-34	136	34.4
35-39	75	18.9
40-44	31	7.9
45+	6	1.6
Father's age (years)		
25-29	37	9.4
30-34	141	35.4
35-39	129	32.8
40-44	67	16.9
45+	21	5.5
Breast fed status		
Not breast fed	12	3.0
≤ 1 month	14	3.5
1-6 months	299	75.7
≥ 6 months	63	15.9
Not known	7	1.9
Nursing bottle use		
Never used	111	28.1
Formerly used	227	57.5
Currently using	57	14.4
Tooth brushing		
Never	27	6.8
Alone	245	62.0
Under supervision	123	31.2
Frequency of tooth brushing		
Never	27	6.8
Not regularly	60	15.2
Once a day	184	46.6
Twice or three times a day	124	31.4

Table II. Anthropometric Measurements and Some Dental Health Indices of the Participants.

	Mean±SD	1st quartile	Median	3rd quartile	Min-Max
Dental Health Indices (n=395)					
Decayed tooth	4.3±4.4	0.0	3.0	7.0	0.0-19.0
Missing tooth	0.1±0.4	0.0	0.0	0.0	0.0-4.0
Filled tooth	0.2±0.8	0.0	0.0	0.0	0.0-5.0
dmft	4.7±4.7	1.0	3.0	8.0	0.0-20.0
dmfs	8.0±10.2	1.0	4.0	12.0	0.0-70.0
Anthropometric Measurements (n=395)					
Height (cm)	113.7±6.3	109.5	113.5	118.0	98.0-134.0
Weight (kg)	19.8± 3.7	17.4	19.0	21.3	13.7-40.6
BMI (kg/m^2)	15.3±1.9	14.1	14.8	16.0	10.3-25.0
Mid-upper arm circumference (cm)	15.9±2.6	14.0	16.0	18.0	10.5-22.0
Head circumference (cm)	46.9±2.1	45.0	47.0	48.8	42.0-52.0

(dmft: decayed, missing and filled teeth; dmfs: decayed, missing and filled surfaces)

More than four out of five of the children were breastfed less than 6 months. Nursing bottle usage was recorded by 71.9% of the children. Of the children, 93.2% were brushing their teeth; three out of five children were brushing alone while others under supervision. The frequency of tooth brushing was recorded as 'once a day' by 46.6% of the children and 'twice or three times a day' by 31.4% (Table I).

Anthropometric measurements and some dental health indices of the participants were given in Table II. The median (1st-3rd quartiles) dmft and dmfs were 3.0 (1.0-8.0) and 4.0 (1.0-12.0), respectively. The median decayed teeth were 3.0 while 0.0 for both missing and filled teeth. Of all children, %75.2 (n=297) had at least one decayed, filled or extracted tooth (dmft≥1).

The presence of at least one decayed, filled or extracted surface existence was found significantly different by age ($p<0.001$, for each); the number of children with decayed, missed or filled tooth was higher in the oldest age group. Although it was not statistically significant, the number of decayed tooth, dmft and dmfs scores in boys were slightly higher than girls ($p>0.05$, for each). A similar distribution was seen for tooth-brushing status: dmft and dmfs scores were lower among the children who brush their tooth at least 'once a day, compared to children who do not brush their tooth regularly but the difference was not statistically significant ($p>0.05$, for each). dt, mt, ft, dmft or dmfs scores did not significantly differed by socioeconomic status ($p>0.05$, for each) (Table III a).

Of all children, 259 (65.6%) had a normal BMI according to age, while 20.0% were severely thin or thin, and 14.4% were overweight or obese. The mean dmft and dmfs scores were slightly higher among the severely thin and thin children compared to normal, whereas these values were slightly lower among overweight and obese children than the normal. However, any of these differences was not statistically significant ($p>0.05$, for each) (Table IIIa). Children who had bad diet quality according to KIDMED had slightly higher mean values of dmft and dmfs, compared to the children who were classified in good or medium diet quality groups but the differences were not statistically significant ($p>0.05$ for each) also (Table IIIb).

On the contrary to KIDMED, the findings of dental examination significantly differed among HEI groups. Since there was no child with a high HEI-2010 score for the good group, the children were classified into two groups: medium and bad. The mean value of decayed teeth was significantly higher among children with bad diet quality (4.2±4.3) compared to children with medium (2.5±2.9) ($p<0.05$). The mean missing teeth (mt), filled teeth (ft), dmft and dmfs values of children with bad diet quality were higher than the values

Table IIIa. Dental Health Indices by Age, Sex, SES, Frequency of Tooth Brushing and BMI According to Age

Characteristic	dt			mt			ft			dmft			dmfs		
	Mean± SD	Median (1st-3rd quartile)	p	Mean± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p
Age (month)* (n=395)															
36-47 (n=48)	2.75± 3.62	1.0 (0.0-4.0)	0.003	0.0± 0.0	0.0 (0.0-0.0)	0.040	0.0± 0.0	0.0 (0.0-0.0)	0.000	2.75± 3.62	1.0 (0.0-4.0)	0.000	3.85± 3.62	1.0 (0.0-5.0)	0.000
48-59 (n=139)	3.98± 4.22	3.0 (0.0-6.0)		0.07± 0.43	0.0 (0.0-0.0)		0.11± 0.51	0.0 (0.0-0.0)		4.16± 4.40	3.0 (0.0-7.0)		4.16± 4.4	4.0 (0.0-9.0)	
60-71 (n=208)	4.94± 4.52	4.0 (1.0-8.0)		0.12± 0.45	0.0 (0.0-0.0)		0.39± 1.02	0.0 (0.0-0.0)		5.45± 4.87	4.0 (1.0-9.0)		5.45± 4.87	6.0 (2.0-15.0)	
Sex** (n=395)															
Female (n=169)	4.11± 4.25	3.0 (0.0-7.0)	0.312	0.1± 0.47	0.0 (0.0-0.0)	0.719	0.27± 0.83	0.0 (0.0-0.0)	0.346	4.48± 4.60	3.0 (0.0-8.0)	0.379	7.30± 9.37	4.0 (0.0-11.0)	0.327
Male (n=226)	4.51± 4.45	3.0 (1.0-7.0)		0.08± 0.37	0.0 (0.0-0.0)		0.22± 0.80	0.0 (0.0-0.0)		4.81± 4.71	3.5 (1.0-8.0)		8.47± 10.74	4.5 (1.0-13.0)	
Socioeconomic status (self-assessed)** (n=395)															
High (n=102)	4.04± 4.36	3.0 (0.0-7.0)	0.340	0.05± 0.33	0.0 (0.0-0.0)	0.180	0.2± 0.73	0.0 (0.0-0.0)	0.489	4.28± 4.66	3.0 (0.0-7.25)	0.252	7.23± 10.92	3.5 (0.0 -11.25)	0.199
Middle-low (n=293)	4.44± 4.37	3.0 (0.0-7.0)		0.1± 0.44	0.0 (0.0-0.0)		0.26± 0.84	0.0 (0.0-0.0)		4.8± 4.65	3.0 (1.0-8.0)		4.8± 4.65	5.0 (1.0-12.5)	
Frequency of tooth-brushing* (n=395)															
Never (n=27)	4.92± 4.44	3.0 (2.0-7.0)	0.660	0.11± 0.42	0.0 (0.0-0.0)	0.917	0.11± 0.42	0.0 (0.0-0.0)	0.380	5.15± 4.65	3.0 (2.0-8.0)	0.813	9.44± 11.70	4.0 (2.0-15.0)	0.803
Not regularly (n=60)	5.03± 5.27	3.0 (1.0-8.8)		0.13± 0.53	0.0 (0.0-0.0)		0.08± 0.38	0.0 (0.0-0.0)		5.25± 5.5	3.5 (1.0-9.8)		10.06± 13.85	4.0 (1.0-16.8)	
Once a day (n=184)	4.11± 4.02	3.0 (0.0-7.0)		0.08± 0.43	0.0 (0.0-0.0)		0.27± 0.82	0.0 (0.0-0.0)		4.47± 4.30	3.0 (0.0-8.0)		7.19± 8.56	4.0 (0.0-11.0)	
Twice or three times a day (n=124)	4.21± 4.38	3.0 (0.0-6.8)		0.07± 0.32	0.0 (0.0-0.0)		0.31± 0.98	0.0 (0.0-0.0)		4.59± 4.75	3.0 (0.3-7.8)		7.78± 9.94	3.0 (0.3-10.8)	
BMI according to age* (n=395)															
<3. percentile (severe thin) (n=15)	5.53± 4.67	3.0 (2.0-11.0)	0.701	0.00± 0.00	0.0 (0.0-0.0)	0.451	0.27± 1.03	0.0 (0.0-0.0)	0.316	5.80± 5.21	4.0 (2.0-11.0)	0.689	9.47± 10.49	5.0 (2.0-20.0)	0.700
≥3-<15. percentile (thin) (n=64)	4.67± 4.75	3.0 (0.0-9.0)		0.08± 0.41	0.0 (0.0-0.0)		0.11± 0.44	0.0 (0.0-0.0)		4.85± 4.98	3.0 (0.0-9.75)		8.79± 11.12	3.0 (0.0-15.0)	
≥15-<85. percentile (normal) (n=259)	4.22± 4.32	3.0 (0.0-7.0)		0.09± 0.42	0.0 (0.0-0.0)		0.3± 0.93	0.0 (0.0-0.0)		4.62± 4.63	3.0 (1.0-8.0)		7.83± 10.16	4.0 (1.0-11.0)	
≥85-<97. percentile (overweight) (n=31)	4.13± 4.42	3.0 (1.0-7.0)		0.16± 0.58	0.0 (0.0-0.0)		0.03± 0.18	0.0 (0.0-0.0)		4.32± 4.68	3.0 (1.0-7.0)		7.42± 10.60	3.0 (1.0-7.0)	
≥97. percentile (obese) (n=26)	3.19± 3.06	3.0 (0.0-4.5)		0.00± 0.00	0.0 (0.0-0.0)		0.15± 0.46	0.0 (0.0-0.0)		3.35± 3.22	3.0 (0.0-4.5)		4.88± 5.93	4.0 (0.0-6.25)	

* Kruskall-Wallis test, ** Mann-Whitney U test
(dt: decayed teeth; mt: missing teeth; ft: filled teeth; dmft: decayed, missing and filled teeth; dmfs: decayed, missing and filled surface)

Table IIIb. Dental Health Indices by HEI and KIDMED Groups

Characteristics		dt			mt			ft			dmft			dmfs		
		Mean± SD	Median (1st-3rd quartile)	p	Mean± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p	Mean ± SD	Median (1st-3rd quartile)	p
KIDMED* (n=211)[a]																
Good	(n=42)	4.14± 4.07	3.0 (0.0-8.0)	0.356	0.04± 0.21	0.0 (0.0-0.0)	0.178	0.24± 0.69	0.0 (0.0-0.0)	0.562	4.43± 4.21	3.5 (0.0-8.0)	0.450	7.59± 9.57	5.0 (0.0-12.0)	0.649
Medium	(n=125)	4.35± 4.37	3.0 (1.0-7.0)		0.11± 0.44	0.0 (0.0-0.0)		0.15± 0.62	0.0 (0.0-0.0)		4.61± 4.65	3.0 (1.0-8.0)		7.92± 9.41	4.0 (1.0-14.0)	
Bad	(n=44)	5.22± 4.41	4.0 (1.25-10.0)		0.0± 0.0	0.0 (0.0-0.0)		0.16± 0.52	0.0 (0.0-0.0)		5.39± 4.6	4.0 (1.25-10.0)		8.45± 8.69	5.0 (2.0-15.75)	
HEI ** (n=225)[b]																
Medium	(n=32)	2.47± 2.9	2.0 (0.0-4.0)	0.043	0.03± 0.18	0.0 (0.0-0.0)	0.604	0.09± 0.53	0.0 (0.0-0.0)	0.183	2.59± 2.91	2.0 (0.0-4.75)	0.050	3.5± 3.89	2.0 (0.0-6.0)	0.076
Bad	(n=193)	4.2± 4.28	3.0 (0.0-7.0)		0.09± 0.45	0.0 (0.0-0.0)		0.22± 0.76	0.0 (0.0-0.0)		4.55± 4.59	3.0 (0.0-8.0)		7.44± 9.51	4.0 (0.0-11.0)	

* Kruskall-Wallis test; ** Mann-Whitney U test; a Only 211 parents were interviewed for KIDMED; b Only 225 parents were interviewed for HEI
(dt: decayed teeth; mt: missing teeth; ft: filled teeth; dmft: decayed, missing and filled teeth; dmfs: decayed, missing and filled surface)

of children with medium diet quality although the differences were not statistically significant ($p \geq 0.05$, for each) (Table III b).

Discussion

ECC is a serious form of dental caries that affects children in the early years of age. Among the many multifactorial etiological factors, diet has been identified as a particular risk factor for caries development in children.[33] This study examined the dual relationship between nutritional status including diet quality and anthropometrical measurements, and dental caries in preschool children.

It is known that the risk of ECC increases by age because the exposure to cariogenic risk factors including cariogenic foods prolongs by increased age.[23,34,35] Similar to previous studies[36-38], this study confirmed the higher percentage of ECC in older age in terms of the higher mean values of dt, mt, ft, dmft and dmfs age. According to Turkish national study results[39], the mean value of dmft was 3.6±3.9 among 5 year olds. The mean dmft score was slightly higher in this study. This could be explained with the age distribution of the study population, that is half of the children were 60-72 months old. The higher mean dmft (5.3±3.78) and dmfs (10.5±9.67) among 5-9 years old children in Ankara, Turkey was reported by Koksal et al.[40]. The results of these studies also showed an association between ECC and age.

Due to the early eruption of the teeth in girls, earlier dental caries development and higher prevalence of ECC was reported in girls in some studies.[41,42] However, the results of studies that examine the association of sex with ECC prevalence is contradictory since higher ECC among boys was also reported by some studies.[39,43,44] No significant difference in the percentage of ECC between boys and girls was obtained in this study though both the number of decayed tooth and the scores of dmft and dmfs were slightly higher in boys.

Socio-economic status of the family is another contributing factor for ECC in children. It was reported that low socio-economic status was associated with an increased prevalence of ECC.[45-47] However, this study failed to show the association between low socio-economic status and increased risk of ECC. This can be explained with two grounds. First, the study province is generally a deprived area of Ankara, Turkey, and access to dental-oral health services was limited.[48,49] Second, the data on socioeconomic status recorded according to the declaration of parents and the classification was not based on an objective assessment.

The presence of tooth brushing habit and the frequency of brushing are two important strategies for the prevention of dental caries development. It is well-known that the ECC risk decreases when the frequency of brushing increases.[46,50,51] In this study, 22.0% of the children were not brushing or not regularly brushing their teeth. However, dt, mt, ft, dmft or dmfs scores did not significantly differed with the frequency of tooth brushing in this study. The main reason for this situation might be the over reporting of tooth brushing frequency by parents due to misunderstanding of the question and/or lack of the knowledge about proper way of tooth brushing. Moreover, brushing alone without any supervision was obtained in more than three out of five children. Therefore, ineffective tooth brushing might be a related factor for ECC even if the frequency was sufficient.

Nutritional status has a profound effect on ECC. Two components of nutritional status, both dietary intake and anthropometrical measurements were assessed in this study in terms of the risk of ECC. The association between anthropometrical measurements, mainly BMI and dental caries was examined in previous studies, and conflicting results were provided.[11,52-55] Although underweight/malnutrition was shown as a risk factor for dental caries in some studies[40,56], no significant association was shown between anthropometrical measurement and caries in others.[57-60] In this study, underweight children had a slightly higher percentage of caries compared with normal counterparts whereas overweight and obese children had slightly lower. Aluckal et al.[62] concluded that the presence of undernutrition or obesity and childhood dental caries are coincidental in many populations. The insignificant association obtained in this study could be explained by this coincidental situation.

The effects of dietary intake on the risk of ECC have been studied very rarely. Dietary intake, in

particular diet quality, has been assessed using different tools.[23] In this study, two different indeces, HEI-2010 and KIDMED, were used to evaluate dietary intake of children. To our knowledge, KIDMED has not previously been used to examine the relationship between nutritional status and dental caries. This study showed no statistically significant difference related to dental caries in children with or without more favourable dietary intake according to KIDMED classification. The main reason of this situation might be related to the subjective nature of KIDMED questionnaire as it depended on the declaration of parents and children.

The anti-cariogenic characteristics of some food groups, including dairy products in particular cheese, whole grains, fruits rich in fiber have been documented in previous studies.[62-64] Apart from individual food items, the total diet should also be considered for its potential in the development of dental caries. HEI-2010 is a useful tool that reflects the overall dietary intake. Healthy Eating Index-2005 was used by Zaki et al.[23], and Nunn et al.[65] earlier for the investigation of nutritional status-dental caries relationship in preschool children. Both studies showed that children with better dietary intake were less likely to have risk of ECC compared with children with worse dietary intake.[23,65] In parallel with the results of previous studies, a higher percentage for ECC was obtained in children with a lower total HEI-2010 score in this study.

In conclusion, the period of early childhood is a very special period in which both healthy oral and dietary habits are gained. It seems that a healthy eating pattern and high diet quality is essential for the prevention of early childhood caries in preschool children. Further studies that examine the roles of different dietary components on the development of dental caries in early childhood is required to develop dietary strategies for the prevention of dental caries.

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