

Dental Caries Status and Its Determinants among 12-Year-Olds

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Abstract

To evaluate the prevalence and severity of dental caries and to observe the variables associated with dental caries among Iraqi adolescents aged 12 years. A cross-sectional study was conducted with 504 adolescents aged 12 years in Kut city, Iraq, from November 2025 to April 2026. Background about the adolescents was captured using a questionnaire that covered demographic characteristics and oral health-related behaviours. Additionally, a clinical dental examination incorporated assessment of decayed, missing, and filled teeth and surfaces (DMFT, DMFS) and the simplified oral hygiene index (OHI-S) based on the criteria of the World Health Organization (WHO). The statistical analysis comprised the Chi-square test, ANOVA test, an independent sample t test, and simple and multiple logistic regressions. The caries prevalence and the mean of DMFT among the adolescents were 74% and 1.92 (± 1.74), respectively. Multiple logistic regression indicated that lower maternal education level (OR=3.83, 95% CI: 2.21 to 5.65), never toothbrushing practice (OR=2.98, 95% CI: 1.67 to 5.14), and fair oral hygiene (OR=3.23, 95% CI: 1.45 to 7.20) were positively associated with the prevalence of dental caries among the adolescents. Dental caries was highly prevalent, whereas good levels of oral health behaviors were low in adolescents in this investigation. Maternal educational level, toothbrushing frequency, and oral hygiene conditions were associated with dental caries.

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Introduction

Dental caries is multifactorial and remains one of the most prevalent chronic oral diseases globally; however, it is a preventable disease [1]. According to the Global Burden of Disease report, oral diseases affect billions of people worldwide, with dental caries exemplifying a main public health challenge among children and adolescents [2,3]. Dental caries results from complex interactions between dental plaque, carbohydrates, host variables, and environmental effects, destroying dental hard tissues [4]. Adolescence is a critical period for oral health since it is associated with the establishment of lifelong health behaviors and increased freedom in dietary and oral hygiene practices [5]. Twelve-year-old adolescents are

considered a major index age group for oral health screening because most permanent teeth have erupted by this age, allowing significant measurement of dental caries experience and comparison within populations [6]. Hence, this age group has been widely recommended by the World Health Organization for surveillance of oral health status and appraising preventive oral health programs [7]. Dental caries is determined by a broad spectrum of predictors working at individual and community levels. Numerous investigations have detected the role of oral health practices, socioeconomic factors, and oral health knowledge in the initiation and progression of dental caries [8-11]. Insight into these variables is critical for identifying high-risk groups and

creating successful preventive strategies targeted at improving oral health outcomes among adolescents. However, dental caries is considered a crucial public health problem worldwide; limited recent data are available about dental caries experience and its determinants in Iraqi adolescents. Caries prevalence among Iraqi children and adolescents was 61% and 64%, respectively [12,13]. Moreover, variations in social, behavioral, environmental, and healthcare-related conditions may impact the determinants of dental caries among the Iraqi population. Thus, updated epidemiological evidence is required to provide a thorough understanding of dental caries and its related factors in Iraqi adolescents and to reinforce the

evolution of evidence-based oral health policies.

This study aimed to assess the prevalence and severity of dental caries and to observe the variables associated with it among Iraqi adolescents aged 12 years. The null hypothesis stated that there is no statistically significant association between dental caries experience and the investigated sociodemographic, behavioral, and oral hygiene status among Iraqi adolescents aged 12 years.

Material and Methods

The current study complies with the STROBE standards [14]. The participants in the current cross-sectional study were composed of adolescents aged 12 years attending primary and secondary schools in Kut City, Iraq. Sample size estimation was performed using G*Power version 3.1.9.7 [15], assuming a significance level of 0.05, a statistical power of 0.90, and an effect size of 0.15. The minimum required sample size was 469 subjects. The final sample included 504 children, 7.5% above the calculated sample size to compensate for incomplete data and ensure adequate statistical power. To recruit study participants, 10 schools (5 boys and 5 girls) were selected from a list of 64 primary and secondary schools using a lottery method. About 50 participants were selected randomly from each specified school using a numbering system. The inclusion criteria for enrolment in the investigation were Iraqi citizenship and aged 12 years. The exclusion criteria included any systemic disorder, special needs, and inability to provide consent to participate in the investigation.

The questionnaire included 2 sections: section one included the sociodemographic profile of the participants, comprising gender and parental education level. Section 2 comprised questions about adolescents' oral health-related behaviours, including brushing frequency and the timing of sugary snack intake. Data recording encompassed a clinical examination according to the WHO-recommended method [16], in which decayed, missing, and filled index was assessed by surface (DMFS) and by teeth (DMFT), and the simplified oral hygiene index (OHI-S). Each participant's OHI-S score was categorized as 0–3. The categorical rating scale for measuring the OHI-S was Good: 0.0–1.2; fair: 1.3–3.0; and poor: 3.1–6.0 [17].

The Ethics Committee of the Wasit University College of Dentistry approved this study (Reference number: 432025). Authorization was acquired from the Directorate General of Education of Kut City and the selected school principals. The clinical oral examination was preceded by calibration training on a group of 20 adolescents (selected from the same schools but not included in the main study) by an

experienced dentist (HF), repeated twice, at two-week intervals. The kappa coefficient for intra-examiner agreement was above 0.8 for all oral clinical measures assessed. The enrolment period extended from November 2025 to April 2026. An oral examination was performed using WHO probes (Dentirak®) with a 0.5 mm ball end and disposable mouth mirrors with the participant seated on a mobile dental chair using a dental unit light.

A chi-square test was conducted to compare variables depending on gender. ANOVA test and an independent sample t test were used to reveal variations in the mean DMFT regarding categorical parameters. Simple logistic regression analysis was conducted to identify potential determinants at a significance level of $p < 0.05$, which were finally incorporated into a multiple logistic regression model. This multiple logistic regression model aimed to determine the likelihood of variables being correlated with the adolescents' level of dental caries, addressed as a dichotomous variable, where 0 denoted no dental caries, and 1 indicated the presence of dental caries. The data were processed using the IBM SPSS program version 25 (Armonk®, NY).

Results

A total of 504 adolescents aged 12 years (52% boys) composed the study subjects. The distribution of adolescents by demographic factors and the rate of oral health behaviours is shown in Table 1. About half of their parents have high educational levels (higher for girls' parents than boys' parents; $p < 0.05$). Around two-thirds reported eating sugary snacks between meals (higher among boys than girls, $p < 0.001$). Twice-a-day toothbrushing was reported by approximately half of the participants.

Figure 1 presents the caries status in the study population. Mean scores of DMFT and DMFS indices were $1.92 (\pm 1.74)$ and $3.34 (\pm 3.96)$, respectively. Significantly, the decayed component forms a major proportion of the indices.

Table 2 outlines the associations between dental caries and sociodemographic factors, oral health behaviors, and oral hygiene status. Lower DMFT mean scores were associated with higher mother educational levels ($p < 0.001$), higher frequency of tooth brushing ($p = 0.002$), eating sugary snacks after meals ($p = 0.029$), and good oral hygiene ($p < 0.001$).

Table 3 specifies three variables as probable associated factors of dental caries experience (DMFT) and enters them into a multiple logistic regression model. The probability of dental caries was higher for participants with a maternal low education level (OR=3.83, 95% CI: 2.21 to 5.65), never toothbrushing (OR=2.98, 95%

CI: 1.67 to 5.14), and those with a fair oral hygiene index (OR=3.23, 95% CI: 1.45 to 7.2).

Discussion

The current study revealed the latest dental caries status in adolescents aged 12 years in Kut city, Iraq. Findings of the present study showed that caries experience is associated with adolescents' oral health behaviors, oral hygiene status, and maternal educational level. Several previous research reports have shown that dental caries is linked to social and behavioral factors and oral hygiene conditions [9,10,18,19]. In this study, the caries prevalence among the investigated adolescents (74.4%) was greater than the reported findings in comparable studies in China (44.5%) [11], Brazil (37%) [20], and India (26.8%) [21]. This finding indicated that in Iraq, forthcoming oral health strategies should emphasize preventive measures against dental caries and its related consequences among adolescents. The mean DMFT among the participating adolescents in this study (1.9) was almost in accordance with the results of previous studies conducted among Iraqi adolescents (1.6) [12] and (1.7) [22], but lower than the rates reported from Romania (2.8) [23] and Lebanon (3.42) [24]. Toothbrushing was a reliable approach to eliminate plaque and prevent dental caries. Aligned with previous studies conducted in Iran [19] and Romania [23]. Additionally, our study revealed that sweet snack consumption between meals was correlated with caries level, as confirmed by a previous systematic review [25]. The association between maternal education level and untreated dental caries was statistically supported in the present study. This agrees with previous reports in Italy and Africa [26,27]. Children were more prone to practice oral hygiene care with the rise of parental education levels; particularly, children from highly educated families were more likely to brush their teeth more regularly, visit the dentist more frequently, and have periodic dental check-ups. In addition, oral health awareness was elevated with the education levels of parents [28].

While other studies in Iran [29], Turkey [30], and Thailand [31] reported that the education level of parents did not influence dental caries in their children. Findings of the current study revealed that the dental caries severity is influenced by oral hygiene status, consistent with a previous study in Spain [9], indicating that poor oral hygiene significantly increases caries risk. Oral hygiene is important for caries prevention and behavioral modifications in adolescence [32]. A limitation of the current investigation was that through cross-section study, no causal association between dental caries and its

determinants could be established. Moreover, inherent bias (over-reporting of favourable oral health behaviours) may be expected. However, there were multiple strengths to this investigation. This study is considered the first endeavour to assess the association between caries experience and its determinants in adolescents aged 12 years in Kut city, Iraq. The utilization of a random sampling approach verified that the selected adolescents were representative of the population, improving the generalizability of the results in Kut City, Iraq.

Conclusion

The prevalence of dental caries among adolescents in this study confirms the necessity for effective preventive measures. The maternal educational level, oral hygiene condition, and brushing frequency were associated with dental caries. These findings emphasize the need for targeted interventions that focus on socio-demographic factors, enhance oral health behaviours, and improve oral hygiene conditions to reduce the burden of dental caries in this population.

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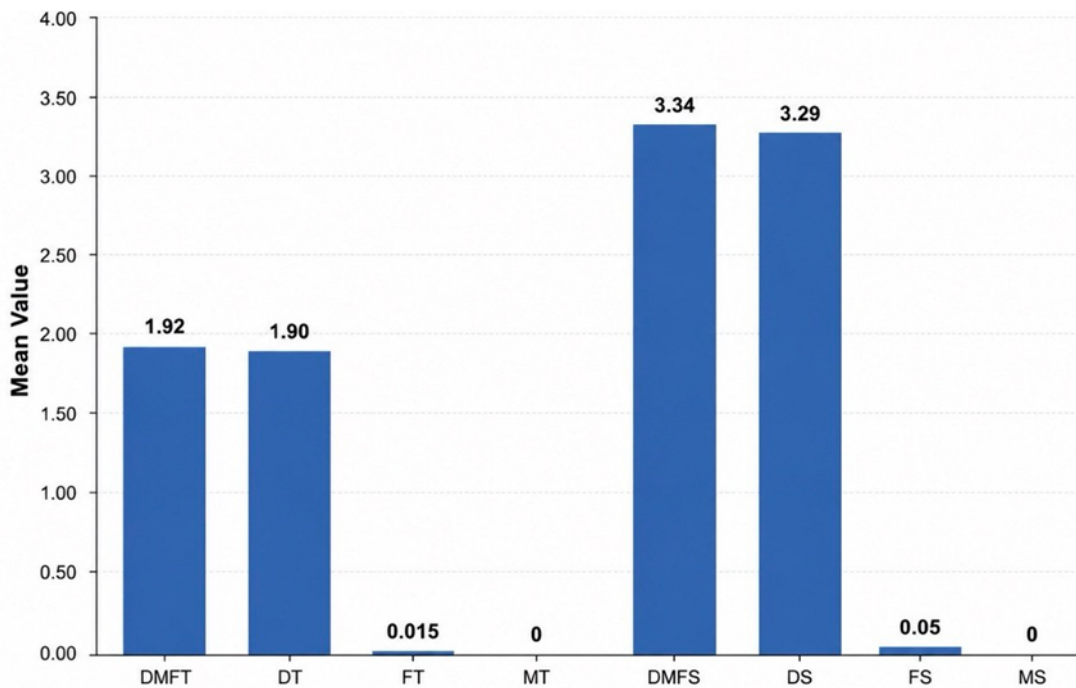


Figure 1. Mean scores of DMFT/DMFS and their components among 12-year-old Iraqi adolescents.

Table 1. Distribution of the participants (n=504) according to their sociodemographic factors and oral health behaviours by gender.

		All N (%)	Boys N (%)	Girls N (%)	Chi-square p-value
Father's education	Low	80 (15.9)	53 (20.5)	27 (11)	0.011
	Intermediate	165 (32.7)	84 (32.4)	81 (33.1)	
	High	259 (51.4)	122 (47.1)	137 (55.9)	
Mother's education	Low	90 (17.9)	53 (20.4)	37 (15.1)	0.023
	Intermediate	185 (36.7)	102 (39.4)	83 (33.9)	
	High	229 (45.4)	104 (40.2)	125 (51)	
Times of sugary snacks consumption	After meals	175 (34.7)	51 (22.6)	140 (50.4)	<0.001
	Between meals	329 (65.3)	175 (77.4)	138 (49.6)	
Brushing frequency	Never	81 (16.1)	150 (54)	103 (45.6)	0.085
	Once a day	165 (32.7)	98 (35.3)	86 (38.1)	
	Twice a day	258 (51.2)	30 (10.7)	37 (16.3)	

Table 2. Relationship between mean DMFT and selected variables among (n=504) Iraqi adolescents.

Variables	Simple binary logistic models			Multiple binary logistic model		
	Crude OR	95% CI	p-value*	Adj. OR**	95% CI	p-value*
Gender (reference: girls)	1.35	(0.9, 2.02)	0.137	1.19	(0.76, 1.84)	0.436
Father's education (reference: high)						
Low	1.48	(0.79, 2.77)	0.219	0.55	(0.27, 1.11)	0.1
Intermediate	0.79	(0.51, 1.23)	0.309			
Mother's education (reference: high)						
Low	4.88	(2.91, 8.2)	<0.001	3.83	(2.21, 5.65)	<0.001
Intermediate	3.05	(1.67, 5.56)	<0.001	2.57	(1.29, 5.12)	0.007
Brushing frequency (reference: twice a day)						
Once a day	2.73	(1.45, 5.12)	0.002	1.38	(0.67, 2.87)	0.376
Never	4.2	(2.46, 7.14)	<0.001	2.98	(1.67, 5.14)	<0.001
Times of sweet snacks (reference: after meals)	1.21	(0.79, 1.83)	0.367			
OHI (reference: good)	2.93	(1.36, 6.32)	0.006	3.23	(1.45, 7.2)	0.004
Variables with p<0.25 in the simple logistic regression model were included in the multiple logistic regression model						

Table 3. Factors associated with mean DMFT among Iraqi adolescents (n= 504) as evaluated by simple and multiple binary logistic regression models.

Variables		Mean (SD) DMFT	p-value ^a
Gender	Girls	1.82 (1.67)	0.210 ^b
	Boys	2.02 (1.8)	
Father’s education level	Low	2.18 (1.46)	0.065
	Intermediate	1.87 (1.67)	
	High	1.77 (1.9)	
Mother’s education level	Low	2.47 (1.87)	<0.001
	Intermediate	1.88 (1.5)	
	High	1.50 (1.6)	
Brushing frequency	Never	2.53 (2.12)	0.002
	Once a day	1.86 (1.57)	
	≥ Twice per day	1.73 (1.72)	
Times of sugary snacks consumption	After meals	1.69 (1.47)	0.029 ^b
	Between meals	2.05 (1.85)	
OHI-S	Good	1.75 (1.63)	<0.001 ^b
	Fair	3.01 (2.01)	
	Poor	-	
OHI-S: simplified oral hygiene index Good OHI-S: 0-1.2, fair OHI-S: 1.3-3.0, poor OHI-S: 3.1-6.0			
^a Statistical analysis by ANOVA test ^b Statistical analysis by independent sample t test			