

Research Article

# Dental caries and gingival health condition among secondary school adolescents in relation to the nutritional status in Kerbala City, Iraq

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**Abstract:** Background: Oral health as a part of general health is affected by various, factors including oral hygiene, smoking, age, nutritional status, and socioeconomic status. This study aims to measure the impact of nutritional status on the prevalence and severity of some oral health variables (dental caries and gingival health conditions) to develop plans for future reduction and prevention of both diseases. Materials and methods: The sample included a total of 500 male students aged 15 years old who were randomly selected from secondary schools in Karbala City, Iraq. Dental caries, and gingival health condition were recorded. Anthropometric measurements include measurement of weight and height to determine the BMI = Body weight / (height)<sup>2</sup> = BMI kg/m<sup>2</sup> and using the CDC growth chart to determine the nutritional status. Data analysis were done by using one-way analysis of variance and Games-Howell post hoc test. Results: The prevalence of dental caries was (95.60%). Caries (DS) and missing teeth (MS) are more prevalent in the underweight group, whereas filling (FS) is more prevalent in the normal-weight group. Caries-free percentages were higher in the group of risk of overweight (6.82%) compared with other nutritional groups. Meanwhile, the prevalence of gingivitis among the students was 100%, all students have had the moderate type of gingivitis (1.1–2). The highest mean of gingivitis belonged to the normal weight group (1.923) and there was a significant difference observed. Conclusion: In this study, dental caries experience was not significantly affected by nutritional status. Meanwhile, nutritional status had a significant impact on the gingival health condition which attracted attention to the importance of healthy nutrition concerning oral health and to develop of a good nutritional school program.

**Keywords:** Dental caries, Gingivitis, Nutritional status, BMI

## Introduction

Nutritional status and socioeconomic factors were shown to have as much impact on health as treatment options<sup>(1)</sup>. Diet and nutrition have an impact on the oral cavity; however, the opposite is also true. A person's ability to eat a balanced diet and achieve nutrient balance may be negatively affected by oral cavity problems<sup>(2)</sup>. On the one hand, malnutrition affects oral cavity development and disease advancement by altering tissue healing and lowering tissue repair ability<sup>(3)</sup>. On the other hand, poor oral health directly impacts dietary quality and nutrient intake, thereby increasing the risk of several systemic diseases<sup>(4)</sup>.

Dental caries and gingivitis were considered very common and highly prevalent diseases in previous Iraqi studies<sup>(5,6,7)</sup>. Dental caries is a multifactorial, dynamic disease caused by biofilms that cause cyclic demineralization and remineralization of tooth structure. In addition, dental caries can develop in both primary and permanent teeth at any time during one's life. Moreover, the balance of pathological and protective factors influences caries initiation and progression. Furthermore, it seems to be the most prevalent chronic disease worldwide<sup>(7)</sup>.

Meanwhile, gingivitis is the most prevalent type of periodontal disease. It starts in early childhood, grows in prevalence and severity into early adolescence, and then gradually fades and levels off until around the age of 20<sup>(6,8)</sup>. Various Iraqi studies have been carried out to investigate the relationship between nutritional status in relation to oral health variables<sup>(6,9,10,11)</sup>. According to Al-Hassnawy, in 2013, there were no significant differences in dental caries experience for both dentitions with nutritional and socioeconomic status<sup>(10)</sup>. Another Iraqi study revealed that malnourished children (underweight) had a higher prevalence rate of dental caries in the entire dentition than children of normal weight<sup>(11)</sup>. Therefore, this study aimed to determine the impact of nutritional status on oral health in a group of 15-year-old secondary school students in Karbala City, Iraq.

## Materials and Methods

This cross-sectional study was conducted at secondary schools for boys in Karbala City, Iraq, on 15 years old adolescent students. A total of 500 male students who were randomly selected were included in the study. Informed consent was first distributed to get permission to have their full cooperation. Following the basic methods of the oral health survey recommended by WHO in 2013, oral examinations were conducted at the school and were carried out in the classrooms under standardized conditions<sup>(12)</sup>. The gingival condition was recorded using the gingival index (Loe and Silness, 1963)<sup>(13)</sup>. Here, the six index teeth were examined using a CPI probe. Diagnosis and registration of dental caries were conducted following the criteria set by WHO (2013)<sup>(12)</sup>. Students' information was collected, including their age, weight, and height. The data collected about the weight and height were used in the anthropometric measurements to get BMI based on the formula:  $\text{Body weight}/(\text{height})^2 = \text{BMI kg/m}^2$ . The BMI-for-age for adolescents was determined using the CDC 2000 growth chart for nutritional status<sup>(14)</sup>.

### Statistical analysis

Data description, analysis, and presentation were performed using Statistical Package for Social Science (SPSS version -22). Descriptive statistics, percentage, and mean and standard error. The Inferential statistics is a one-way analysis of variance and Games-Howell post hoc test.

## Results

The prevalence of dental caries in this study was (95.60%) and caries-free students represented (4.40%). Considering the nutritional status findings, the highest distribution of students was those who belonged to the normal BMI group for both caries (265) and caries-free (12) students. Moreover, the caries-free percentage was more in the at risk of overweight group (6.82%) than in other nutritional groups, as shown in Table 1.

**Table 1:** Distribution of caries experience by the nutritional status of the students.

		Caries status			
		Caries		Caries free	
BMIC		No	%	No	%
		<b>Underweight</b>	103	97.17	3
	<b>Normal</b>	265	95.67	12	4.33
	<b>At risk of overweight</b>	82	93.18	6	6.82
	<b>Overweight</b>	28	96.55	1	3.45
	<b>Total</b>	478	95.60	22	4.40

Meanwhile, by taking the DMF components with nutritional status findings: DS, MS, and DMFT were more in the underweight group (8.000), (0.708), and (6.594), respectively, as shown in Table 2, while filling (0.809) and DMFS (9.159) were more in the normal weight group. Furthermore, finding caries and missing teeth decreased as the weight status increased, whereas filled teeth decreased when the weight status decreased. However, no significant differences were observed.

**Table 2:** Distribution of DMF components by BMI categories of the sample.

Variables	Underweight		Normal		At risk of Overweight		Overweight		F	P	Total	
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE			Mean	±SE
DS	8.000	0.447	7.700	0.330	7.670	0.599	7.759	1.285	0.088	0.967	7.762	0.242
MS	0.708	0.206	0.650	0.137	0.511	0.214	0.690	0.410	0.141	0.936	0.640	0.098
FS	0.387	0.095	0.809	0.129	0.625	0.145	0.586	0.251	1.473	0.221	0.674	0.080
DMFS	9.094	0.533	9.159	0.404	8.807	0.718	9.034	1.458	0.065	0.978	9.076	0.292
DMFT	6.594	0.284	6.408	0.214	6.170	0.414	6.241	0.713	0.253	0.859	6.396	0.157

NS = not significant at  $p > 0.05$ .

The prevalence of gingivitis among the adolescents was 100% and all students had the moderate type of gingivitis (1.1–2). Considering gingivitis and BMI, Table 3 indicated that the highest and lowest mean belonged to the normal weight group (1.923) and the at risk of overweight group (1.851), respectively. In addition, there was a significant difference observed ( $P < 0.05$ ).

**Table 3:** The distribution of gingivitis experience among BMI groups of students.

BMI	Mean	±SE	F	P
Underweight	1.912	0.013		
Normal	1.923	0.008		
At risk of overweight	1.851	0.021	5.004	0.002
Overweight	1.922	0.033		
Total	1.908	0.007		

Sig = significant at  $p < 0.05$ .

There was a significant difference found between the normal weight group and the at risk of overweight group (0.01284), while the other differences were not significant, as shown in Table 4.

**Table 4:** Multiple comparisons of gingivitis between BMI groups using the Games-Howell post hoc test.

Multiple comparisons of GI between BMI using Games-Howell post hoc test			
(I) BMIC	(J) BMIC	MD	p-value
Underweight	Normal	-0.01128	0.879
	At risk of overweight	0.06024	0.078
	Overweight	-0.01184	0.986
Normal	At risk of overweight	0.07152	0.012
	Overweight	-0.00056	1.000
At risk of overweight	Overweight	-0.07208	0.268

NS = not significant at  $p > 0.05$ , Sig = significant at  $p < 0.05$ .

### Discussion

In this study, most of the sample had a normal weight status (55.4%), which was rarely found in other Iraqi studies<sup>(10,11,16)</sup>. The decreasing trend in the percentage of the normal weight group could be a sign of

an unhealthy lifestyle. It could be a result of poor oral health, as nutritional status was also negatively affected by oral health and the ability to get proper nutrients<sup>(4)</sup>.

The highest percentage of caries-free was found in the at risk of overweight group (6.82%), and the less percentage was found in the malnourished group (underweight) (2.83%). Results agreed with other Iraqi studies<sup>(10,11)</sup> which found that malnourished adolescents were less caries-free compared to those who were well-nourished, which was also in contrast to other Iraqi studies<sup>(16,17)</sup>.

Being in a good nutritional status, particularly at an early age before teeth formation, indicates a good chance to have a well-formed tooth and less chance for caries formation<sup>(18)</sup>. Malnutrition may affect teeth's mineralization and salivary composition, thus increasing the susceptibility of teeth to dental caries<sup>(3)</sup>.

Although, this study presents no significant differences considering caries-free with nutritional status. Based on the result of this study, malnourished subjects (underweight) had a higher mean of dental caries in the entire dentition than normal-weight subjects. Consistent with previous studies<sup>(12,19)</sup>, underweight children eat more snacks, which increases their risk of developing dental caries and causes them to eat fewer main meals, typically high in fat and protein<sup>(20)</sup>. However, on another note, children with dental caries may experience pain and eventually tooth loss, which could lead to reduced food intake and eventually lead to malnutrition and underweight<sup>(21)</sup>. Meanwhile, the DMF components with nutritional status findings show that caries (DS) and missing teeth (MS) are more prevalent in the underweight group, whereas filling (FS) is more prevalent in the normal weight group. Thus, there is an inverse relationship between nutritional status and dental caries as weight increases. Therefore, there is a higher score of dental caries DMFS in the normal weight group. Although, no significant differences were observed between different weight groups.

The present study found that the prevalence of gingivitis was 100% (and regarding the gingival severity, all subjects have the moderate type of gingivitis (1.1–2), which was very high compared with other Iraqi studies<sup>(5,12,22)</sup>. The differences in the results of these studies may be due to differences in oral habits, socio-economic status, gender, and residency<sup>(7)</sup>.

Considering gingivitis and BMI in this study: the highest and the lowest mean belonged to the normal weight group (1.923) and the at risk of overweight group (1.851), respectively, and there was a significant difference observed (0.002). Compared with the other Iraqi studies, malnourished adolescents had a significantly higher incidence of gingivitis<sup>(10)</sup>. The gingival index was slightly lesser among the under-weight than the other categories, with no significant differences observed<sup>(12)</sup>.

## **Conclusion**

There was a relatively high prevalence of both caries and gingivitis, which are important indicators of oral health. Herein, caries experience was not significantly affected by nutritional status. At the same time, there was a significant relationship between nutritional status and gingivitis, which required good planning for nutritional and oral health programs for adolescent school students.

## **Conflict of interest**

The authors have no conflicts of interest to declare.

## Author contributions

A.R. Kareem contributed to the conception and design of the work and was responsible for the collecting of data. A.M. Alwaheb contributed to the interpretation of results. A.R. Kareem. and A.M. Alwaheb N.F. Abdulhameed drafted the work. All authors approved the final version of the manuscript and are responsible for all aspects of the work.

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**علاقة تسوس الأسنان والتهاب اللثة في سن المراهقة في المدارس الثانوية بالحالة التغذوية في مدينة كربلاء-العراق.  
احمد راند كريم، عذراء مصطفى الوهب، نادر فرحان عبد الحميد  
المستخلص:**

الخلفية: تتأثر صحة الفم كجزء من الصحة العامة بالعديد من العوامل بما في ذلك نظافة الفم والتدخين والعمر والحالة التغذوية والاجتماعية والاقتصادية. تهدف هذه الدراسة إلى قياس تأثير الحالة التغذوية على بعض متغيرات صحة الفم بما في ذلك تسوس الأسنان والتهاب اللثة، وقياس مدى انتشار وشدة كل من تسوس الأسنان والتهاب اللثة من أجل وضع خطط للحد والوقاية في المستقبل من كلا المرضين. المواد وطرق العمل: شملت العينة 500 تلميذ يبلغون من العمر 15 سنة اختيروا عشوائياً من المدارس الثانوية في مدينة كربلاء. تم تسجيل تسوس الأسنان وفقاً للمعايير التي وصفها منظمة الصحة العالمية. تم اتباع مؤشر اللثة لتسجيل حالة صحة اللثة. القياسات الأنتروبومترية متضمنة قياس الوزن والطول من أجل تحديد مؤشر كتلة الجسم وفقاً للمعادلة (منظمة الصحة العالمية، 2000): - وزن الجسم / (الطول)<sup>2</sup> = مؤشر كتلة الجسم كجم / م<sup>2</sup>. وباستخدام مركز السيطرة على الأمراض، مخطط النمو لتقييم حالة الوزن لتحديد الحالة التغذوية. النتائج: بلغ معدل انتشار تسوس الأسنان في هذه الدراسة (95.60%). كما كانت النسبة الخالية من التسوس في المجموعة المعرضة لخطر زيادة الوزن (6.82%) أكثر من المجموعات الغذائية الأخرى. كان معدل انتشار التهاب اللثة بين الطلاب 100%، وكان كل الطلاب مصابين بنوع متوسط من التهاب اللثة (1.1-2). اعلى معدل لالتهاب اللثة كان من مجموعة الوزن الطبيعي (1.923) وكان هناك فرق معنوي. الاستنتاج: كان هناك تأثير واضح وهام للحالة التغذوية على حالة صحة اللثة وهو ما يلفت الانتباه إلى أهمية التغذية الصحية للسعي إلى صحة الفم والتخطيط لبرنامج مدرسي غذائي جيد.