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Correlation between Obesity and the Severity of Dental Caries in Healthy Adults

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Authors
Chabuk M.I.*[1] *PhD*

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ABSTRACT

Aims Dental caries and obesity are mutually common adult diseases that could impact the overall wellbeing and are a problem to the health expenditures. This study aimed to investigate the correlation between body mass index and dental caries in adults.

Instrument & Methods In this cross-sectional study conducted at Merjan teaching hospital in Babylon, 165 patients were selected by convenience sampling from May to August 2020. Dental caries severity and obesity were identified by decayed, missing, and filled teeth and body mass indices. Data were analyzed by Pearson correlation, Chi-square, and Mann-Whitney tests.

Findings One hundred eight participants were obese, and 29 were overweight. 58.2% of the participants had poor (>10), 12.7% had bad, and 29.1% had well decayed, missing, and filled teeth index. The difference between BMI categories based on decayed, missing, and filled teeth index classes was significant, and those with poor decayed, missing, and filled teeth index were significantly heavier (p=0.004). The mean decayed, missing, and filled teeth index of all the studied participants was 13.6±10.1, which was very bad. The decayed, missing, and filled teeth index and all its components expressed a positive but insignificant correlation with the age of the participants.

Conclusion Dental caries are associated with body mass index but not with age and gender. Overweight people are more likely to have a poor decayed, missing, and filled teeth index.

Keywords Dental Caries; DMF Index; Obesity; Body Mass; Oral Health

[1]Department of Dentistry, Al-Safwa University Karbala, Iraq

Correspondence
Address: Department of Dentistry, Al-Safwa University Karbala, Iraq
Phone: -
Fax: -
miach680@gmail.com

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Introduction

Obesity is a complex multifactorial disease. The worldwide prevalence of overweight and obesity has doubled since 1980 to the extent that nearly a third of the world's population is now classified as overweight or obese. Obesity rates have increased in all ages and both sexes irrespective of geographical locality, ethnicity, or socioeconomic status, although obesity is generally greater in older persons and women. Body Mass Index (BMI) is typically used to define overweight and obesity in epidemiological studies [1].

Obesity is the excessive or abnormal accumulation of fat or adipose tissue in the body that impairs health via its association to the risk of diabetes mellitus, cardiovascular disease, hypertension, and hyperlipidemia. It is a significant public health epidemic that has progressively worsened over the past 50 years. Obesity is the second most common cause of preventable death after smoking. Obesity needs multiprong treatment strategies and may require lifelong treatment. A 5% to 10% weight loss can significantly improve the health, quality of life, and economic burden of an individual and a country as a whole [2]. The epidemic of overweight and obesity presents a major challenge to chronic disease prevention and health across the life course around the world. Fueled by economic growth, industrialization, mechanized transport, urbanization, an increasingly sedentary lifestyle, and a nutritional transition to processed foods and high-calorie diets over the last 30 years, many countries have witnessed the prevalence of obesity in their citizens double even quadruple [3]. In 2016, over $1.9X10^9$ adults over 18 years were overweight, and more than 650×10^6 were obese. Obesity is characterized by atypical and undue accumulation of fat, which to some extent causes health problems [4]. Limited data exists from a countrywide sample indicating the prevalence of fatness in Iraq.

Dental caries (DCr) is a highly prevalent chronic and cumulative disease, which affects 60 to 90% of school children and many adults worldwide [5]. Dental caries is a worldwide problem affecting nearly $2.4x10^9$ adults in 2010, rendering it the most prevailing condition globally [6, 7]. Dental caries has an intricate etiopathology; still, the impacts of nutrition, oral health, saliva, and oral flora, play a major contribution in the evolution and development of DCr [8]. The Decayed, Missing and Filled Teeth (DMFT) index has been utilized worldwide as the most important parameter to evaluate oral hygiene status; therefore, it was applied in statistical studies of the medical status of the populations [9]. As a result, DCr and obesity are mutually common adult illnesses that could impact the overall wellbeing and are a problem to the health expenditures.

Paradoxically, the two illnesses share multifactorial common risk factors, like diet and genetics [10]. Several studies to date have evaluated the relationship between tooth decay and obesity; however, results are sometimes contradictory [11-14]. Various epidemiological studies and meta-analyses have been published with controversial results on overweight, BMI, and the relevance of DCr [15, 16]. Contrarily, in a new study that inspected adults, BMI was not related to DCr but had a major association with periodontitis [7, 15, 17, 18].

In Iraq, there is still no statistical data on these issues. Given the existing dispute, this study aimed to assess the relationship between BMI and DCr in Iraqi adults.

Instrument and Methods

The study was analytical, cross-sectional, conducted at Merjan teaching hospital in Babylon in Iraq. Patients who visited the physicians for nutritional consultation during the period from May-August 2020 were appropriate to participate. According to the study criteria, the convenience sampling method selected participants (age ≥18 years and free of systemic illness). Patients who had inherited or acquired dental malformations or underwent orthodontic intervention were excluded. Of the 199 subjects approached primarily for study registration, only 165 patients justified the study criteria and underwent oral examination and subsequent analysis.

The dental examination was performed by a calibrated and experienced dentist using a sterile dental mirror. DCr severity was identified and recorded according to World Health Organization (WHO) criteria and the Decayed, Missing and Filled Teeth (DMFT) index [6, 19]. The score designates the sum of decayed, missing, and filled teeth in all subjects.

BMI was calculated to estimate and classify the weight of all subjects using the following formula [20]:

$$BMI = \frac{Weight\ (kg)}{Height\ (m)^2}$$

The weight and height were counted by a standardized digital scale (South Korea). Applicants were divided into four subgroups (WHO criteria) based on BMI: obese ($BMI>30kg/m^2$), overweight ($BMI=25\text{-}30kg/m^2$), normal weight ($BMI=18.5\text{-}25kg/m^2$), and underweight ($BMI<18.5kg/m^2$).

Kolmogorov-Smirnov test was used to examine the normal distribution of teeth parameters (DMFT with its components: D, M, and F). Statistical records were analyzed using SPSS 23 software by

Pearson correlation, Chi-square, and Mann-Whitney tests.

Findings

One hundred sixty-five patients comprised 122 (73.9%) males and 43 (26.1%) females with mean ages of 57.7±13.5 and 63.9±14.9 years, respectively. The distribution of gender among the three age groups revealed no significant difference (p>0.05; Table 1).

Table 1) Characteristics of all study subjects based on their gender and age groups

Age groups (Years)	Male (n=122)	Female (n=43)	Total	p-value
<50	34 (20.6 %)	10 (6.1 %)	44	p>0.05 (Mann-Withney)
50-65	57 (34.5 %)	13 (7.9 %)	70	
>65	31 (18.8 %)	20 (12.1 %)	51	

One hundred eight participants were obese, and 29 were overweight. 58.2% of the participants had poor (>10), 12.7% had bad, and 29.1% had good DMFT index (Table 2).

Table 2) Distribution of study participants based on BMI categories and DMFT index classes (n=165)

Parameter	Number	Percentage
BMI (kg/m^2)		
Underweight	5	3.0
Normal	23	13.9
Overweight	29	17.6
Obese	108	65.5
DMFT index		
1-5	48	29.09
5-10	21	12.72
>10	96	58.19

The difference between BMI categories based on DMFT index classes was significant, and those with poor DMFT index were significantly heavier (p=0.004; Table 3).

Table 3) Distribution of DMFT classes based on BMI categories among the subjects (n=165)

Parameter	1-5	5-10	>10
Underweight	1.84	0	1.23
Normal	5.52	3.05	5.52
Overweight	6.75	3.07	7.98
Obese	15.34	6.13	43.56

The distribution of the DMFT index and its components based on age groups and gender among patients did not show a significant difference in its distribution (p>0.05). Overall dental parameters at all ages were poor among the subjects. The mean DMFT of all the studied participants was 13.6±10.1, which was very bad (Table 4).

BMI classes showed a significant positive correlation with DMFT, missing and decayed teeth among the subjects except for filled teeth. Meanwhile, the DMFT and all its components expressed a positive but insignificant correlation with the age of the participants (Table 5).

Table 4) Relationship between dental and demographic variables

Variable	DMFT	Missing	Filled	Decayed
Age groups				
<50 years	9.9±7.4	7.7±6.3	0.5±0.9	1.9±2.3
50-65 years	16.9±9.9	13.5±9.1	0.8±1.4	2.8±2.5
>65 years	12.5±11.1	10.6±10.7	0.7±2.2	1.8±2.1
Total	13.6±10.1	11.1±9.2	0.7±1.6	2.3±2.4
Gender				
Male	14.7±10.1	11.9±9.4	0.8±1.5	2.3±2.4
Female	12.0±10.5	9.6±9.3	0.5±1.8	2.5±2.5

Table 5) Correlation of BMI and age with dental indices among the study subjects

Parameter	r	F	P	β1
Correlation of BMI with dental indices				
Decayed	0.037	6.059	0.015	0.397
Missing	0.039	6.501	0.012	0.107
Filled	0.001	0.159	0.691	-0.098
DMFT	0.056	9.587	0.002	0.118
Correlation of age with dental indices				
Decayed	0.001	0.032	0.859	0.002
Missing	0.015	2.368	0.126	0.079
Filled	0.012	1.866	0.174	0.012
DMFT	0.012	1.886	0.172	0.076

Nevertheless, after considering the patients' characters, including age and sex, the relation between the DMFT index and BMI categories showed no significant variation in the mean value of DMFT in all age groups (p>0.05), except among underweighted females over 65 years of age, which were heavier significantly (p<0.05; Table 6).

Table 6) Statistical comparison of DMFT index and category of body mass index by age and gender

Parameter	Underweight	Normal	Overweight	Obese
<50				
Male (n=33)	4.0±0.01	16.0±6.3	12.0±4.2	9.0±7.8
Female (n=7)	-	25.0±0.1	6.0±5.6	9.5±6.5
50-65				
Male (n=29)	-	-	15.8±9.0	19.5±10.0
Female (n=9)	-	28.0±0.1	10.5±7.7	16.6±13.4
>65				
Male (n=52)	-	8.8±10.5	14.0±11.5	17.9±9.4
Female (n=21)	31.0±0.1	2.0±2.4	3.0±4.7	15.0±7.5

Discussion

There is ample evidence to suggest an association between DCr and BMI among adults. Nevertheless, this was the first study to qualitatively estimate the relationship between obesity (as shown by BMI) and DCr among adults in Babylon to the best of our knowledge. Even if it cannot define a measurable association between DCr and BMI, it has underscored the multifaceted relationship between the two. This study aimed to determine the relationship between BMI and DCr categories in adult caries. The insight of this work is to simplify the health improvement and program design for a couple of the most prevailing illnesses amongst Iraqi adults.

A closer look at the data indicates that about 2/3rd of the enrolled subjects displayed a poor (>10)

overall DMFT index, 13.6. Internationally, the severity of DCr (DMFT index) ranges critically, from <5 to >20 [21]. According to the WHO scale, the mean DMFT in this study is modest for DCr [22]. Our outcomes were comparable to those described by other countries, like Russia, the United States, and Australia [22]. A previous study from Babylon city reported similar results [23].

The interrelationship between BMI and DCr is uncertain. A systematic review conducted in 2012 and involved 48 various articles that evaluated the possible relationship between BMI with DCr among children and teenagers, revealed no relations in twenty-three papers, whereas the residual twenty-two papers showed the different outcomes; this contradiction makes a conclusive decision difficult [24]. Owing to its equivocal results, a systematic review from Saudi Arabia last year also explored a complex relationship [16]. The same outcomes were published by a Saudi narrative review that revealed both DCr and obesity are multidimensional illnesses, and their relationship is so intricate to be clarified by a mutual risk factor [25].

Nonetheless, it was salient to stress that most of the preceding revisions showed a linkage between DCr and obesity, whether positive or negative, had directed on children or pubescent aged <18 years. Instead, limited studies were directed to assess this association among adults. In addition, another systematic review verified that only a single survey with a high value of proof exposed a significant and direct relation between DCr and obesity [26].

In line with our outcomes, a recent revision on adults aged 18-35 years exposed a robust link between obesity and DCr; however, the studied subjects were limited; besides, no linear regression statistics were achieved to exclude the confounders' weight [27].

According to a recent study, the prevalence of obesity among our participants was relatively high (65.5%) compared to the national prevalence of adult obesity in Iraq, which is 33.9% [28], probably caused by a method of patients' selection.

In our belief, our findings are interesting in the context of preceding studies; the miscellany and paradox of outcomes among the researches might be ascribed to disparities in genomic proneness to DCr and obesity, nutritional customs, and lifestyle, which are exclusive for every nation and community. Nevertheless, all of these variables should be encompassed in the forthcoming longitudinal survey with greater cohorts from many geographical districts to acquire a more detailed guesstimate of the association between BMI and DCr.

The data in this study, like several available articles, have some limitations. Cross-sectional and single-center designs prevent the detection of any causal-effect association among the variables. Secondly, little info was available on the dietary styles of the participants. In addition, the study's small sample size makes it difficult to generalize our results to reflect the real situation in Iraq. Therefore, future longitudinal and large cohort studies of several cities are necessary to develop a more comprehensive estimate of the association between BMI and DCr.

Conclusion

Dental caries are associated with BMI but not with age and gender. Overweight people are more likely to have a poor DMFT index.

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Ethical Permissions: This study was permitted ethically by the Institutional Review Committee of Babylon Health Directorate . All applicants were asked to give consent, and all events were commenced according to the moralities of the Helsinki Statement.

Conflicts of Interests: The authors declare that there is no conflict of interest.

Authors' Contribution: Chabuk M.I. is the writer of the whole text (100%).

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