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Dental Caries And Its Correlation With Nutritional Status Among Children From 3 To18 Year-Old

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Abstract

Background: *Globally, dental caries appears a major public health problem and a widespread non -communicable disease. It is more prevalent among children. A combination of poor oral health status and malnourishment ultimately affect the quality of life of the person.* ***Aim:*** *This study aimed to examine the prevalence of dental caries and its correlation with nutritional status in 3–18-year olds.* ***Methods:*** *The cross-sectional study was conducted among 3–18-year olds at dental clinics from January to July 2022 in KSA. A total of 859 subjects participated in the study. The body mass index (BMI) was used to assess the nutritional status of participants. The anthropometric measurements for BMI were recorded. The World Health Organization (WHO) Child Growth Standards Reference for BMI was used to categorize the participants into obese/overweight, normal, or underweight for age. Dental caries was assessed using decayed, missing, and filled primary teeth (DMFT) and decayed extracted filled teeth (deft) index. A parent-administered questionnaire was used to obtain data on oral hygiene practice, parental education, dental visits, and sugar exposure.* ***Results:*** *The prevalence of dental caries was found to be 48.8%. A total of 54.6% of study participants were malnourished, and 47.7 % were underweight for their age. The nutritional status was found to be inversely related to dental caries. The children with higher B[1]MI (obese and overweight) were likely to have less caries experience.* ***Conclusion:*** *Nutritional status was found to be inversely related to dental caries. Children with lesser BMI were at higher risk of having dental caries and vice versa. Clinical significance: Dental caries and nutritional status have common risk factors. Diet is the major risk factor, common to both conditions. Diet is a modifiable risk factor. Therefore, strategies can be developed and targeted at the prevention of both dental caries, and malnutrition in the community. Healthy dietary habits and practices can be promoted for the control of dental caries and malnutrition.*

Keywords: *Body mass index, Dental caries, Nutritional status.*

Introduction

Oral health, as defined by the World Health Organization (WHO), is a state of being free of mouth and facial pain, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity for biting/chewing, smiling, speaking, and psychosocial wellbeing (1). According to the 2017 Global Burden of Disease study,

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dental caries of the primary teeth affect more than 530 million children worldwide [2]. Consequently, dental caries is a major public health problem globally, and is the most widespread non-communicable disease (NCD) among school-age children [1, 2].

Dental caries is a complex disease affecting teeth and is one among the major public health problems, which in an individual, may cause pain and suffering and also, adversely impact the person's quality of life. It is a common chronic disease that may progress to pain and disability especially in children since they are in growing stage [3]. As children enter the phase of adolescence, their dietary habits change which affects the body fat and represents effectual phase in growth and development [4]. There is an alarming burden of malnutrition in KSA. United Nations Children's Fund report states, that malnutrition is still a matter of concern and impacts the lives of young children [5].

Under nutrition and susceptibility to infections form a vicious cycle of deteriorating health and poor nutritional status. Poor nutrition during the developmental stage of a child's life can also lead to stunted growth. While the South Asian countries have shown to have the maximum occurrence of stunted growth and malnutrition in children, obesity is very less prevalent [5]. Assessment of nutritional status can be done through various methods. These methods include clinical, biochemical, anthropometric methods, functional, and emotional assessments [6].

Anthropometry measures size, weight, and body mass. Commonly used anthropometric measures are height, weight, head circumference, body mass index, and skin fold. Body mass index has been commonly used to assess nutritional status owing to its simplicity, noninvasiveness, and good validity [7]. BMI is calculated as a person's weight in kilograms divided by the square of height in meters (kg/m^2). BMI helps to assess a measurement of a person's chubbiness for the given gender and age. It is indicative of whether a person has optimum weight corresponding to his height. It has been used to make age growth charts and has more relevance in growing age. Depending on the calculated BMI value, a person is categorized as underweight, normal, overweight, or obese [6, 7].

Common oral diseases such as dental caries and periodontitis and systemic diseases such as type II diabetes, obesity, and cardiovascular disease are similar in their multifactorial and behavioral characteristics. There are two possibilities identified with the association of common oral diseases and systemic diseases. One that they may have common risk factors or either may be itself, a risk factor for the other [8]. The common risk factors associated with oral health are diet, oral hygiene, smoking, alcohol use, and trauma. Since these factors are common to a number of other chronic diseases, a study of their mutual risk factor approach seems to be more rational [8].

Diet is considered a common risk factor for both dental caries and malnutrition. Dental caries is one of the most common non-communicable diseases worldwide, especially in children, which is usually untreated [9]. Dental caries is strongly associated with the frequency and amount of intake of sugar-rich foods [10]. Dental caries during childhood continue to remain a significant public health problem. Dental caries has been on a declining trend over the past two decades. However, this trend is not uniform across the globe. The decline in caries was mostly observed in developed countries. Moreover, recent studies indicate that it is on the increase again due to various factors affecting health [11].

According to a systematic analysis of the global burden of diseases in 2015, "dental caries, especially permanent caries, was ranked the first in prevalence and the third in incidence among all chronic diseases in a general sense [12]." Despite the changing trends, lifestyle has contributed significantly to increased consumption of refined sugar and packaged foods lacking healthy nutrition. This has resulted in weight gain and an increased incidence of dental caries in some countries globally [13]. Hence, this study is designed to survey the prevalence of dental caries and correlate its association with nutritional status in 3–18-year-old children in KSA. It was hypothesized that malnourishment might be a marker for dental caries in children.

Methods

A cross-sectional study was conducted among 3–18-year-old children at dental clinics from January to July 2022 in KSA. The research was approved by University Ethics Committee. Written informed consent was obtained from the parents/guardians of the selected children. All the children in the age range of 3–18 years were invited to participate in the study. Participants with any systemic illness, undergoing any treatment, having physical/mental deformities, or those who were absent on the day of examination were excluded from the study. A final sample of 859 participants was obtained.

Demographic Data

Data on socio-demographic characteristics and oral hygiene behavior of the children was collected using a questionnaire administered to the parents. The socio-demographic data included information on the age of the child, parental educational level, the child's oral hygiene practice, sugar consumption, and previous dental visit.

Anthropometric Measurements for Assessment of Nutritional Status

Nutritional assessment was done using anthropometric measures. Body mass index based on height and weight for age was used to assess the nutritional status of children. Since the study group comprised children, this non-invasive anthropometric index reflecting the growth was the index of choice. The height and weight of the children were measured by the primary researcher using a Hesley BMI Digital Body Analyzer (Hesley Inc). The children stood in an upright position, without any footwear. An average of two readings was recorded for the analysis.

The BMI was calculated as a measure of weight adjusted for height. The WHO Child Growth Standards Reference was referred to gauge the nutritional status of children based on BMI [(14)]. "This new growth reference is recommended for young children and provides a scientifically reliable standard of children's growth achieved under desirable health and nutritional conditions [(15)]."

Interpretation of Cut-offs

- Overweight: > +1 standard deviation above mean (1SD).
- Obesity: > +2SD.
- Thinness: < −2SD>.

Oral Examination

A single examiner performed the dental examination using a mouth mirror and explorer in sufficient natural daylight. World Health Organization modification of DMFT/deft was used to assess dental caries. For primary dentition, the number of decayed (d), missing of indicated for extraction due to caries (e) and filled (f) teeth (t), and the deft index was recorded. The κ coefficient of intra examiner reliability was 0.81 in this study.

Statistical Analysis

Data were analyzed using SPSS version 28. Descriptive analysis was performed and presented in the form of frequencies and percentages for categorical variables. Chi-squared test was used as a test of significance for categorical variables. Spearman's correlation test was used to test the correlation between dental caries and BMI. The level of significance was kept at 5% for statistical analysis.

Results

Table (1) shows the data for a total of 859 participants were analyzed. It was found that 79.27% of the mothers had education below the primary education level. Of these, 164 mothers were illiterate.

Only 10.5% of mothers had an education of graduation or higher level. When the tooth brushing habit was analyzed, it was found that 86.2% of participants brushed daily. Only 10.1% reported brushing twice daily. Medium sugar consumption frequency was reported by 50.2% of participants, and 36.7% reported high sugar consumption frequency. 84. 1% reported having never visited a dentist before.

Table (2) shows age-wise mean deft and DMFT. The sample comprised 403 males and 456 females. The mean DMFT score was 0.54 ± 1.16, while the mean deft score for the sample was 0.79 ± 1.60. The participants were grouped into three groups by age depending on dentition status. The primary dentition group comprised 69 children from 3 to 5 years of age. 586 Children in the age range of 6–14 were grouped in mixed dentition, and 204 those above 14 years were in permanent dentition.

Table (3) shows distribution of participants by nutritional status. When compared by the nutritional status, it was found that more than half of the participants were malnourished (54.6%), which majorly comprised undernourished children (45.4%). Only 2.2% were obese, while 4.7% were at risk of obesity. However, there was no statistically significant difference between males and females with respect to any BMI category. The representation was almost similar between the two sexes across all BMI groups.

Table (4) shows the caries prevalence in the study population was found to be 48.8%. However, when caries experience was compared between males and females, there was no significant difference found. A high dental caries score (total caries score >3) was found in 13% of participants only.

Table (5) shows the correlation between BMI and DMFT was not significant. However, there was an inverse relationship between BMI and deft observed (p = 0.006). This negative correlation was also observed for total caries experience (DMFT + deft) and BMI (0.045).

Table (1): Socio-demographic data of the sample

Parameter	Category	N (859)	%
Mother's education	Uneducated	164	15.6
	Primary school	517	55.4
	Higher secondary school	159	18.5
	Graduate and above	19	10.5
Frequency of tooth brushing	>1/day	87	10.1
	Once a day	741	86.2
	<1/day	31	3.7
Sugar consumption frequency	Low	112	13.1
	Medium	431	50.2
	High	316	36.7
Previous dental visit	Yes	137	15.9
	No	722	84.1

Table (2): Age-wise distribution with mean caries experience

Dentition	Age range in years	Gender		Total	DMFT		deft	
		Female	Male		Mean	± SD	Mean	± SD
Primary dentition	(3–5 years)	27	42	69	0	0	0.96	1.46

Dentition	Age range in years	Gender		Total	DMFT		deft	
		Female	Male		Mean	± SD	Mean	± SD
Mixed dentition	(6–14 years)	272	314	586	0.377	0.88	1.23	1.613
Permanent dentition	(15–18 years)	104	100	204	1.11	1.68	0	0
Total		**403**	**456**	**859**	**0.54**	**1.16**	**0.79**	**1.6**

Bold text is indicative of overall sample estimate. The rows above show the caries experience of group stratified by age, while the last row shows caries experience as DMFT or deft score is given for total sample

Table (3): Distribution of participants by nutritional status

Categories by BMI	Frequency	%	p-value	Gender	Frequency	%	p-value
Underweight	410	47.7		Females	176	42.9	
				Males	234	57.1	
Normal	390	45.4		Females	199	51.02	
				Males	191	48.98	
Risk of overweight	40	4.7	**0.001***	Females	19	47.5	0.15
				Males	21	52.5	
Overweight	19	2.2		Females	9	47.3	
				Males	10	52.7	

*difference is significant at the 0.05 level; χ^2 test

Table (4): Total caries experience stratified by gender

Total caries score	N	%	Female	Male	p-value
0	440	51.2	199	237	0.35
1–3	307	35.7	142	165	
>3	112	13.0	61	55	
Total	**859**	**100.0**	**402**	**457**	

Bold row is only a summative statement; *difference is significant at the 0.05 level; χ^2 test

Table (5): Correlation between dental caries and the BMI categories

Correlation	**BMI**	**deft**
Correlationcoefficient	0.022	1.000
Sig. (2-tailed)	0.533	
N	790	790
	BMI	**deft**
Correlationcoefficient	−0.115(**)	1.000
Sig. (2-tailed)	0.006	
N	566	566
	BMI	**Total cariesexperience**
Correlationcoefficient	−0.068(*)	1.000
Sig. (2-tailed)	0.045	
N	859	859

The last row in bold gives the correlation between BMI and total caries ex- perience i.e. (sum of DMFT and deft); *, difference is significant at the 0.05 level; Spearman's correlation test

Discussion

The cross-sectional study was conducted to assess the relationship, if any, between dental caries and BMI in children and adolescents 3–18 years of age. The study found a negative correlation between BMI and dental caries experience. It is noteworthy that this relationship was found statistically significant only with total caries experience (total of DMFT and deft scores). However, this relation was not significant independently with caries experience in permanent dentition and primary dentition. As expressed through the inverse relationship between BMI and dental caries, overweight and obese children were more likely to be caries-free.

The present study had a predominantly greater percentage of underweight and normal-weight children. This aligns well with the fact that children were from rural backgrounds and lower socioeconomic strata. In a recent obesity update, the percentage of the population with obesity by the age of 15 in India is only 5%, whereas, in the USA, it is 38.2% [(16)]. There was no significant difference between males and females with respect to the BMI categories.

The prevalence of dental caries in our study was relatively low. This is because of lifestyle changes, increased consumption of refined sugars, and more sedentary lifestyles in children from urban areas. Moreover, they lead a physically more active life. It was found that a greater number of males were caries-free compared to females. The number of males was also higher for caries score of <3. However, the difference was not statistically significant. With the known cultural difference, KSA diet is different from a Western diet. This also highlights the finding that <7% of children in the sample were either obese or at risk of obesity.

The current study noted that in primary teeth, underweight children had higher caries experience than normal-weight children. This was in accordance with a study in Peruvian children, which reported that those who were malnourished had higher dental caries prevalence in primary dentition and delay in tooth eruption [(17)].

THE ASSOCIATION BET WEEN CARIES AND BMI

Caries and obesity have common risk factors like unhealthy diet, poor lifestyle, and fermentable sugars. However, the research results on the association between caries and BMI have been inconclusive. Kopycka-Kedzierawski et al., (2008) [(18)] suggested that being overweight may be associated with decreased risk of caries in children 2–18 years of age in the USA. Alkarimi et al., (2014) [(19)] also reported an inverse relationship between dental caries and anthropometric measures in the children of Saudi Arabia. Similar finding was reported in a Chinese study, which found a weak negative association between caries and weight status [(20)]. There have been numerous research studies conducted that report otherwise. Willershausen et al., (2007) [(21)] found a positive association between weight and primary caries among the German population. Similar relationship was

reported by Marshall et al., (2007) [22] in a group of USA-based, obese subjects. Also, there are studies that report no relation between caries and BMI [23-25].

Conclusion

The study found the prevalence of dental caries to be 48.8%. More than 50% of the study population was malnourished, the majority being underweight. The study reported a negative correlation between BMI and dental caries. With an increase in BMI, there were fewer chances of developing caries, implying that overweight and obese children are at a lesser risk of dental caries. This relation was more pronounced in the primary dentition group.

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