Prevalence and Risk Factors of Dental Caries among Preparatory School Children, Menoufia Governorate, Egypt

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Authors' contributions

This work was carried out in collaboration between both authors. Author HMES designed the study, wrote the protocol and interpreted the data. Author HMG anchored the field study, gathered the initial data and performed preliminary data analysis. Both authors managed the literature searches, produced the initial draft, read and approved the final manuscript.

Article Information

Original Research Article

ABSTRACT

Objectives: Estimating the prevalence of dental caries among preparatory school children as well as identifying the possible risk factors and determining the correlation between dental caries and total antioxidant capacity in saliva in the studied group.
Background: Dental caries is one of the most common chronic diseases affecting millions of people globally with high prevalence even in adolescent ranging from 60-90% and it is a major cause of tooth loss, pain and discomfort worldwide, however it doesn't have an inevitable outcome as some of the risk factors can be modified and caries can be prevented.
Materials and Methods: A case control nested in a cross sectional study was carried out in Shebin El-kom District Menoufia governorate. The study sample consisted of1283 children (651 males, 632 females). Saliva samples and questionnaire were collected through school visits. Total antioxidant capacity in saliva was done.
Results: Prevalence of dental caries was (62.8%) with Decayed, Missed and Filled teeth index

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(DMFT) score (1.3 ± 1.32). There was significant difference between children with dental caries and ones without caries regarding dietary habits and habitual optimal teeth brushing (p value<0.05).
Conclusion: Prevalence of dental caries is high among preparatory school children, to face this problem, there should be a program carried by government specially Ministry of Education and Ministry of Health targeted both of children and their parents through different public media approaches. Programs should focus on the optimal teeth brushing and the healthy nutritional habits needed for better teeth health.

1. INTRODUCTION

Dental caries is an infectious, transmissible bacterial disease; the most predominant bacterial species are *Streptococcus mutans* and lactobacilli species as in ordinary pattern of dental caries [1].

Dental caries is a multifactorial disease that starts with microbiological shifts within the complex biofilm (dental plaque). Caries is affected by the consumption of dietary sugars, salivary flow, exposure to fluoride and preventive behaviors, it is therefore very important to prevent dental caries, but this will not be successful unless the available scientific knowledge about changing the etiological factors of the disease is applied [2].

The World Health Organization's (WHO) 2003 report on oral health provided an overview of global caries epidemiology that confirms its international pandemic distribution. It reported caries prevalence in school-age children as 60–90%. It mentioned also that caries experience in 12-year-olds is decreasing in developed and increasing in developing countries [3].

The WHO report does not include data from Egypt. Published caries epidemiological data are very few and old. Based on the available data on caries experience among adolescents, the prevalence of dental caries is low and skewly distributed with the large majority of dentinal carious lesions being present in a small percentage of children [4].

There are four main criteria required for caries formation: a tooth surface (enamel or dentin); cariogenic (or potentially caries-causing) bacteria; fermentable carbohydrates (such as sucrose); and time. The caries process does not have an inevitable outcome, and different individuals will be susceptible to different degrees depending on the shape of their teeth, oral hygiene habits, and the buffering capacity of their saliva. Dental caries can occur on any surface of a tooth that is exposed to the oral cavity, but not the structures which are retained within the bone [1].

The risk factors for dental caries are bad oral hygiene and socioeconomic state [5]. Antioxidants have many health benefits [6]. It was found to reduce the susceptibility to dental caries [7].

As dental caries in preparatory school age is serious because it affects permanent teeth which are not replaceable in addition to the scanty Egyptian research in this field, both constitute two factors which trigger the conduction of this study.

2. MATERIALS AND METHODS

This study was conducted during the period between September and October 2016. It was carried out in Shebin El Kom District, Menoufia governorate preparatory schools. The Menoufia Faculty of Medicine Committee for Medical Research Ethics reviewed and formally approved the study before it began (ethical approval no 3118). Approval from Ministry of Education was obtained, and guardians of all participants gave written consents.

Menoufia governorate has 10 districts from which shebin el kom district was chosen randomly.

Number of preparatory schools in Shebin El-Kom district was 66: (44 rural and 22 urban). Three rural and two urban schools were chosen randomly by simple random sample methodology then two classes from each grade were chosen randomly in the selected schools. Total number was 1383 children from the selected schools, 704 rural (Kafr Tanbdy, AL Batanoon and Melig) and 679 urban (Shebin El Kom city).

A Pilot study was done on 100 children (50 rural and urban); they were excluded from analysis in the study to test the methodology applied, tools and the feasibility of the study, to evaluate of the

adequacy of the questionnaire sheet and revealing any modifications that might be needed according to the results of the pilot study.

All participants were subjected to a predesigned questionnaire, general and local examination.

General examination included skin colour (pallor, jaundice, and cyanosis), anthropometric measures (weight, height and body mass index) and systemic organ examination (e.g. chest, heart and abdominal examinations).

Weight was measured on a calibrated digital electronic scale, which was set to zero before placing the student on it and was checked weekly with known calibration weights [8].

Height was measured by a tape measure permanently fixed to a wall or door frame, the head was held firmly at the top of the board [9].

Body mass index was calculated using the following formula and was interpreted by charts of Center for Disease Control and Prevention (CDC) according as follows. They will be considered underweight if they fall in a percentile range less than 5%, normal weight, over weight and obese if the fall in range from 5 to less than 85%, 85 to less than 95% and more than 95% respectively. Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters {weight in kg / (height in m)^2 }. For children and teens, BMI is age and sex specific and is often referred to as BMI for age [10].

Local oral examination for all the children was done by the help of a dentist for detection of any abnormality of the oral cavity and for dental caries using good light source, mirror and explorer. Dental caries was then assessed using the DMFT scoring system [11].

The **D**ecayed, **M**issing, **F**illed (**DMF**) **index** has been used for more than 70 years and is well established as the key measure of caries experience in dental epidemiology [12].

The DMF Index is applied to the permanent dentition and is expressed as the total number of teeth or surfaces that are decayed (D), missing (M), or filled (F) in an individual. When the index is applied to teeth specifically, it is called the DMFT index, and scores per individual can range from 0 to 28 or 32, depending on whether the third molars are included in the scoring or not [11].

Calculating DMFT: The teeth not counted are unerupted teeth, congenitally missing teeth or supernumerary teeth, teeth removed for reasons other than dental caries, and primary teeth retained in the permanent dentition. Counting the third molars is optional. When a carious lesion(s) or both carious lesion(s) and a restoration are present, the tooth is listed as (D). When a tooth has been extracted due to caries, it is listed as (M). When a permanent or temporary filling is present, or when a filling is defective but not decayed, this is counted as (F). Teeth restored for reasons other than caries are not counted as (F) [12].

The new oral health goals were not numerically specific. Instead, each country could specify its own targets based on current disease prevalence and severity, local priorities, and oral health systems. Based on DMFT values, WHO generated a scale to classify caries severity: DMFT values between 0.0 and 1.1 were very low; 1.2–2.6 were low; 2.7–4.4 were moderate, 4.5–6.5 were high, and values exceeding 6.6 were very high [3].

Among the studied children, 300 of them were chosen randomly from all the children, 200 of them had dental caries and 100 were caries free. This number was selected according to the available funding. Saliva samples were collected from them in test tubes, at least 2 ml when they were asked to expectorate in the tubes. Each sample was coded randomly by a number from one to three hundred. Samples were then refrigerated in a cold box till reached the private laboratory to be examined by Colorimetric Assay Kit (Detection method- Absorbance (570 nm)).

Data management: Data were collected, tabulated; statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 20 and Epi Info 2000 programs, where the following statistics were applied, student's t test and Z test for quantitative variables. Also, Chi squared test was used for qualitative variables, Mann-Whitney for non-parametric data, odds ratio, Spearman's correlation and t-test for correlation with a significance level of $P < 0.05$.

3. RESULTS

Socio demographic data of the studied children was 651 males, 632 females, 629 urban and 654 rural ones, the mean age was 13.05 ± 0.84 years, 60% of children were considered of middle

socioeconomic standard and prevalence of dental caries was 62.8% with DMFT score of 1.3 ± 1.32 (as mean and standard deviation) (Table 1), percent of children with decayed teeth only, treated teeth only and decayed and treated were 37.4%, 7.8% and 17.8% respectively (Table 1). There was no significant difference in dental caries prevalence between males and females (P> 0.05) and also between rural and urban children (P > 0.05, Table 2). Dental caries was statistically significantly higher with higher birth order than lower birth order (P < 0.05, Table 2) and also higher prevalence in family with large size than with small size (P < 0.001, Table 2). Dental caries was significantly higher in children whose fathers work as manual workers and professional than employees (P < 0.001) and in children whose fathers are lower educated and highly educated in relation to middle (secondary) educated ones (P < 0.05, Table 2).

Table 1. Prevalence of dental caries among studied children (n=1283)

Socio-demographic data	No.	%
Prevalence of dental caries		
- Absent	477	37.2
- Present	806	62.8
Status of teeth:		
-Decayed only(untreated)	480	37.4
-Treated only (missed or filled)	101	7.8
-Decayed and treated	225	17.8

There was significantly higher caries in children with high socioeconomic standard and low socioeconomic standard in relation to with middle one (P < 0.05) and no significant difference regarding mother's job or education (P > 0.05, Table 3).There was no statistically significant difference between caries occurrence in children who don't brush their teeth as a habit and those who habitually brush their teeth (P> 0.05, Table 3). Dental caries was less significantly common in children who brush their teeth more than once per day (P<0.001, Table 4) and those who consume dairy products daily and red meat regularly (weekly) (P < 0.001) and it was significantly higher in children who consume soda and soft sugary drink on daily regular basis (P< 0.05, Table 3). Pain experience was highly significantly present feature occurring with caries 92.9% (P <0.001, Table 3).

Prevalence of dental caries varied significantly (P < 0.05) with body mass index as it was higher with overweight and obese children (Table 3).

Total antioxidant capacity (TAC) in the saliva was significantly higher in children with caries (Table 4) than those without caries (P <0.001). There was positive correlation between TAC and DMFT (P < 0.05) and no significant correlation between TAC and both age and body mass index (P> 0.05). There was no correlation between DMFT score and age (P< 0.05).
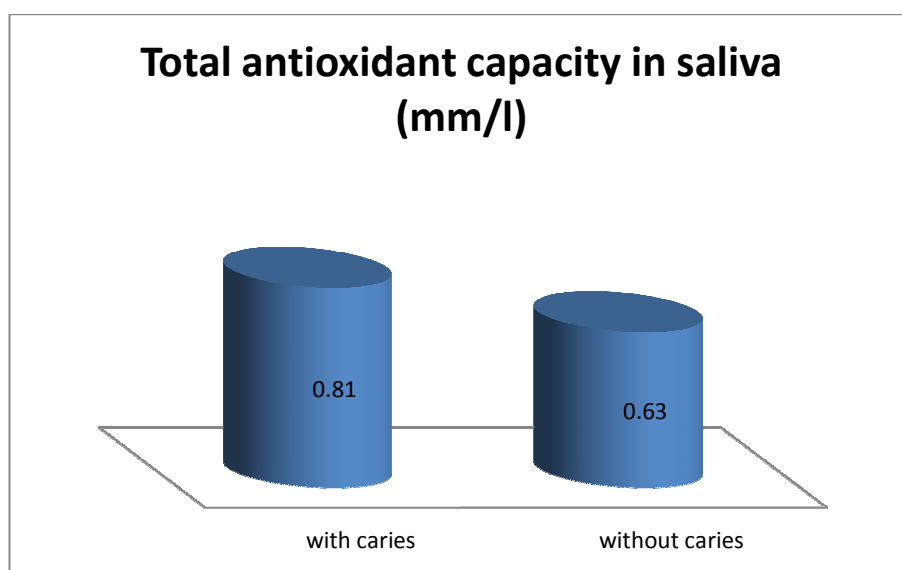

Fig. 1. Total antioxidant capacity in saliva difference in relation to dental caries among studied children

Table 2. Socio-demographic characteristics in relation to dental caries among studied children (n=1283)

Socio-demographic data	Studied children				Total		χ^2	OR (CI 95%)	P value
	With caries (No=806)		Without caries (No=477)		No.	%			
	No.	%	No.	%					
Age (years) ($\bar{X}$ ± SD)	13.02 ±0.86		13.08±0.86		*t test 1.268 P value >0.05				
Gender									
- Male	397	61	254	39	651	100	1.912	1.73(0.96-1.48)	>0.05
- Female	409	64.7	223	35.3	623	100			
Educational year									
1st	257	64.2	143	35.8	400	100	1.66	0.93(0.83-1.03)	>0.05
2nd	318	64.5	175	35.5	493	100			
3rd *	231	59.2	159	40.8	390	100	2.35	0.92(0.83-1.02)	> 0.05
Residence									
- Urban	390	62	239	38	629	100	0.35	1.07(0.85-1.34)	>0.05
- Rural	416	63.6	238	36.4	654	100			
Birth order									
- >3rd	97	70.8	40	29.2	137	100	4.18	1.49(1.01-2.20)	< 0.05
- 1st - 3rd	709	61.9	437	38.1	1146	100			
Socioeconomic standard									
- Low	36	73.5	13	26.5	49	100	3.35	1.91(1.00-3.6)	<0.05
- Middle*	455	59.2	314	40.8	769	100			
- High	315	67.7	150	32.3	465	100	8.72	1.45(1.14-1.85)	<0.05

Reference group

Table 3. Oral hygiene, dietary habits and body mass index in relation to dental caries among studied children (n=1283)

Oral hygiene, dietary habits and body mass index	Studied children				Total		χ^2	Odds ratio	P value
	With caries (No=806)		Without caries (No=477)		No.	%			
	No.	%	No.	%					
Teeth brushing									
- No	79	65.8	41	34.2	120	100	0.51	1.05(0.92-1.20)	>0.05
-Yes	727	62.5	436	37.5	1163	100			
Frequency of teeth brushing									
-Not a habit	541	61.2	343	38.8	884	100	2.65	0.81(0.63-1.03)	>0.05
-Always(habit)	260	66.2	133	33.8	393	100			
No. of times of brushing									
-Once per day	489	67.6	234	32.4	723	100	21.99	1.77(1.39-2.26)	<0.001
-More than once per day	238	54.1	202	45.9	440	100			
Diary product									
-Not daily	435	68.8	197	31.2	632	100	19.25	1.67(1.33-2.10)	<0.001
-Daily	371	57	280	43	651	100			
Meat									
-Monthly and never	112	75.2	37	24.8	149	100	11	1.92(1.23-2.87)	<0.001
-Daily and weekly	694	61.2	440	38.8	1134	100			
Fish									
-Monthly and never	495	62.9	292	37.1	787	100	0.5	1.01(0.80-1.27)	>0.05
-Daily and weekly	311	62.7	185	37.3	496	100			
Vegetables and fruits									
-Daily as a habit	610	63.5	350	36.5	960	100	0.84	1.05(0.95-1.016)	>0.05
-Not daily	196	60.7	127	39.3	323	100			
Snacks									
-Daily	610	63.5	350	36.5	960	100	0.85	1.05(0.95-1.15)	>0.05
-Not daily	196	60.7	127	39.3	323	100			

Oral hygiene, dietary habits and body mass index	Studied children				Total		χ²	Odds ratio	P value
	With caries (No=806)		Without caries (No=477)		No.	%			
	No.	%	No.	%					
Soda									
-Daily	319	68	150	32	469	100	8.54	1.14(1.05-1.24)	<0.05
-Not daily	487	59.8	327	40.2	814	100			
Body mass index:									
-Under weight (<18.5)	190	62.9	112	37.1	302	100	0.41	1.11(0.84-1.47	>0.05
- Normal weight*(18.5-24.99)	406	60.5	265	39.5	671	100			
-Over weight and obese (≥25-29.99)	210	67.7	100	32.3	310	100	4.45	1.37(1.02-1.84)	<0.05

Reference group

Table 4. Multivariate regression analysis of risk factors of dental caries

Risk factors of dental caries	P value	Odd's ratio	95% C.I.	
			Lower	Upper
Birth order	.606	1.025	.933	1.127
Number of teeth brushing	.221	1.128	.930	1.368
Dairy product (not daily)	.525	1.156	.739	1.810
Red meat eating (monthly or never)	.964	1.022	.395	2.643
Soda (daily)	.634	1.215	.545	2.706
BMI	.333	1.012	.988	1.037

4. DISCUSSION

In this study, Prevalence of dental caries was 62.8% in the studied children with DMFT 1.3 ± 1.32. This result is similar to those reported by (WHO report, 2003) Eastern Mediterranean Region (EMRO) in which average DMFT index found in the region was 2 ± 1.3. Half of the countries had an index of 1.6 and the values ranged from 0.4 to 5.9, and the prevalence of dental caries is 60-90%, and against Al Agili [13] who found that prevalence of dental caries was approximately 70% for children's permanent dentition with a mean DMFT score of 3.5 which is higher than our result but falls in the range of prevalence stated by WHO. According to Bucak et al. [14] who carried a study on 553 child in 2015 and found that early childhood caries was determined to be 33,1%.

It was found that many factors were associated with increasing risk of dental caries. It occurred in both sex with female predominance 50.7% though no significant difference found (P> 0.05), this is in agreement with Cortés et al. [15], where Females had higher caries experience than males, but similar prevalence and severity (P> 0.05) There was no statistically significant difference between females and males for the missing teeth and filled teeth which can be due to the fact that these children haven't reached puberty yet so there is no evident hormonal difference and effect. This is in disagreement with Al Darwish et al. [16] studies which found that female children showed a significantly higher incidence of dental caries than male children (P< 0.05) and the difference was marginally significant.

This study showed dental caries was significantly higher with higher birth order than 3 than lower one (P <0.05) and in children in families with larger size than lower ones which may be caused due to lack of care of parents about their children's oral hygiene or diet or lower per capita income.

Dental caries was higher in rural children than urban ones but not statistically significant (P > 0.05) which may be due to the semi urban characters of the city of our study and that rural areas recruited are close to the city and not very low in standard.

This study showed that dental caries prevalence is significantly higher in children with low socioeconomic standard (P< 0.05) which comes in agreement with Costa et al. [17] who stated that worse socioeconomic indicators, such as subject's schooling, income and occupation are associated with a greater severity of dental caries in adults and It also showed higher prevalence of caries in higher socioeconomic standard (P< 0.05) which may be due to faulty dietary habits with excessive snacks or sugary food which come in disagreement with Al Darwish et al. [18] who stated that private school children had caries lower than public school children and also with Rashkova et al. [19] who found that low SES students had a much greater incidence of caries.

It was found that there was no statistically significant difference between caries occurrence in children who don't brush their teeth as a habit and those who habitually brush their teeth (P> 0.05) but there was statistically significant difference in caries prevalence in children who habitually brush more than one time per day than those who brush once per day (P< 0.001) which illustrates the importance not only of teeth brushing but also the number of teeth brushing per day. This result comes in concordance with Veiga et al. [20] who stated that deficient oral health behaviors as irregular brushing, lack of using dental floss daily are great risk for dental caries development and with Peneva [21] who stated that it was found out that factors such as

oral hygiene and social status which can have both a risk and protective impact usually evince as having a risk impact and also with Rashkova et al. [19] who stated that Children with bad oral hygiene have a noticeably bigger number of caries.

This study showed that there is lower prevalence of dental caries in children consuming dairy products daily (P< 0.001) and habitually eating meat (P< 0.05) which comes in agreement with Petridou et al. [22] who reported that milk and dairy products were negatively associated with dental caries in 380 Greek adolescents aged 12-17 years and with Petti et al. [23] who reported an inverse relation between milk and caries.

It was found that dental caries prevalence was statistically significant higher (P< 0.05) in children with Body Mass Index overweight and obesity than those with normal weight which may be due to faulty dietary habits specially sugary snacks eating which come in disagreement with Hooley et al. [24] who stated there is still significant disagreement as to the existence and nature of an association between dental caries and BMI, and also with Silva et al. [25] who found that no sufficient evidence regarding the association between obesity and dental caries.

Total antioxidant capacity in saliva was significantly higher in children with dental caries (0.63± 0.05 mm/l) than those without caries (0.81±0.05 mm/l) (P< 0.001), which comes in agreement Tulunoglu et al. [6] who found increase in the antioxidant activity of the saliva has been related to an increase in the suspension of proteins and of cariogenic activity, and also Uberos et al. [26] who stated that the TAC of saliva is greater among children that have caries.

There was highly significant positive correlation between total antioxidant capacity in saliva and DMFT index (p< 0.001) which is in agreement with Kumar et al. [27] who stated that with increasing dental caries experience, the TAC of saliva was found to increase and with Hegde et al. [28] who found that total antioxidant capacity of saliva has a linear relation with caries.

5. SUMMARY AND RECOMMENDATIONS

Based on the findings of the present study, we can conclude that, prevalence of dental caries

was 62.8% with DMFT 1.3 ± 1.32. Dental caries prevalence varies in relation to habitually daily brushing of teeth more than once per day and to family size, birth order, socioeconomic standard, with dietary habits as regularly consuming meat and daily consuming dairy product and soda, body mass index. The total antioxidant capacity in saliva is higher in dental caries active children than caries free and it increases with increasing the DMFT index.

While interventions should be carried out to improve oral hygiene and risk of caries among children in the communities considered, the multivariable model indicates that none of the studied risk factors associates with an increased risk of caries (Table 4).

Based on the findings of the present study, we can recommend making a health education program involving health authorities and media directed to children and their families focusing on the importance of regular ideal teeth brushing, the importance of consuming dairy products and meat, the importance of balanced diet with limiting of excess unhealthy snacks and sugars.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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