

THE RELATIONSHIP OF CARIES WITH ORAL HYGIENE STATUS AND EXTRA-ORAL RISK FACTORS

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Background: Dental caries is a lifetime disease, with highest priority risk group between 11–14 years of age group. Environmental factors such as culture, socioeconomic status, life style and dietary pattern can have a greater impact on caries-resistance or development. The present study was performed to evaluate the relationship between dental caries, oral hygiene status and risk factors among students. **Methods:** Oral examination was performed in 242 adolescent between 11 and 14 years to check decayed, missing and filled teeth (DMFT) index and simplified oral hygiene (OHI-S) score. A questionnaire was distributed to gather data concerning external modifying risk factors such as socioeconomic status, oral hygiene practices and snacking habits. **Results:** Average DMFT was found, 3.27 and OHI-S score was fair in majority of students. DMFT in 67.77% of students fell between 0 and 3. The prevalence of caries is significantly higher in female students as compared to their male counterparts. The major component of the DMFT was the untreated decay (D) in both genders. Half of the students claimed to be familiar with the benefits of fluoride and use toothbrush before bedtime. 16.1% of the subjects were aware of a bad-breath problem. **Conclusion:** Caries experience was significantly inversely related to socio-economic status whereas strongly correlated with frequency of sugar intake and frequency of snacking in between meals. No relationship was found between OHI-S and DMFT.

Keywords: Caries, Oral Hygiene Status, Risk Factors

INTRODUCTION

Dental caries is a lifetime disease, with a possibility of new lesions that continue to befall humanity. The highest priority risk group is between 11–14 years of age.¹ Females have usually demonstrated higher decayed, missing and filled scores than males of the same age. It was long argued that certain races (such as Africans & Asians) enjoy greater caries-resistance (compared to Europeans and Americans). However, today it is believed that an environment with its typical culture, socioeconomic status, life style & dietary pattern can have a greater impact on caries-resistance or development than the so-called inherent racial attributes.^{2,3}

Approximately 70% of the countries in the world have succeeded in achieving WHO goal of decayed, missing and filled teeth (DMFT) index 3 for 12 year-olds.^{4,5} The result of National survey in Brazil, conducted in 2003, showed a significant drop in caries prevalence in 12 yr olds from 8.3 to 2.8.⁶ DMFT index (1991) in French children at the age of 12 was 2.59 in a similar survey.⁷ Data from the World Health Organization, surveys (1990–1995) in developed countries elsewhere (such as Australia, Ireland, Finland, US, UK, Denmark, Germany etc revealed very low DMFT scores, ranging from 0.8 to 1.9 in 12 year olds.⁸

A cross-sectional study in Belgaum, India (2005) has shown a mean DMFT of 2.41 in 13–15 year old school children.⁹ A recent study conducted in Tehran (2006) revealed that the DMFT index in 12-year-old students dropped from 1.67 (1993–194)¹⁰

to 0.77.¹¹ WHO global data (2003) has shown an increase in DMFT of 12 years old Pakistani children from 0.9 to 1.38.¹² The prevalence of caries amongst primary school children of Riyadh, Saudi Arabia (2002) is still very high (94.4%).¹³

Mean DMFT index for UAE 12 year olds was 1.6, as shown in WHO global data⁽¹²⁾. According to an assignment report on oral health in the UAE (1995–96) by WHO consultant, dental caries prevalence amongst children and youths was alarmingly on the rise, carious lesions were left untreated with only little preventive activities.¹⁴

The UAE is a multicultural country, the population of which 20% are nationals & 80% are expatriates; Arab expatriates 10%, Asian 69%, other nationalities 1%. The diversity & multiple cultures, races, religions & backgrounds, in addition to migration of settlers into or back from their countries of origin do not really offer an accurate indication of caries prevalence in Abu Dhabi.

Aims and objectives of present study were to measure the DMFT scores and oral hygiene index (OHI) of 11–14 year old school students from Abu Dhabi. It was to find the relationship between caries and oral health status of children with extra oral or demographic factors such as socio-economic status, frequency of snacking mostly with meals and frequency of snacking in between meals were also assessed.

MATERIAL AND METHODS

Dental examination was carried out in 242 (112 girls and 130 boys of grade seventh), between 11 and 14

years attending two Abu Dhabi private schools. Students examined in the first private school were 140 (73 males & 67 females) and 102 (57 males & 45 females) in the second private school. The children were mostly of Asian nationality (Pakistani, Indian, Bengali or Sri Lankan). Students included in the study were current residents of Abu Dhabi since infancy. The average age of 12 years is important in conducting an oral health survey on caries, as it is generally the age at which children leave primary school, and thus in most countries, is the last age at which a reliable sample may be obtained easily through the school system. In addition, this age is the highest priority risk group.¹

The schools were visited 2 days before examination. Anonymous self-administered questionnaires were distributed amongst students. They were instructed to take them home & fill them as accurately as possible with the aid of their parents. There were 12 questions altogether, 6 pertaining to personal data such as age, sex, nationality, parent's occupation & their total incomes. Other 6 questions were related to oral hygiene practices & preventive awareness, which includes; the time, frequency and regularity in tooth brushing, use of any other oral hygiene aid such as dental floss, miswak, mouth wash, tooth powder, interdental brush or fluoride tablets, awareness about the benefits of fluoride and feeling of bad breath, frequency of eating sweets like candy, chocolate or lollipop or/drinking cola, or fruit juice etc in between meals.

Dental examination was done in the school clinic by dental diagnostic set (mouth mirror, sickle explorer), personal protective barriers (gloves, masks) and cotton roll. Natural light was used for examination, aided by flashlight. Questionnaires were collected from the students. Examination for dental caries was carried out with a plane mouth mirror & a sickle explorer in a systematic orderly fashion using the FDI tooth-numbering system, hence proceeding from one tooth or tooth space to another, starting at upper right 17 in upper arch around to upper left 27, then beginning the lower arch at lower left 37 around to lower right 47. The status of permanent teeth was scored according to the DMFT index.²

Primary teeth present were ignored & their carious status not recorded. A permanent tooth was diagnosed as SOUND if there is no evidence of treated caries (filling) or untreated caries (decay), evidence of white chalky spots (incipient enamel lesion), staining, calculus or rough spots, a deep pit or fissure (stained or unstained) that catches the probe but has no detectably softened dentin floor, undermined enamel or softened walls, fluorosis or any questionable lesion that can not be reliably diagnosed as carious.

A permanent tooth was diagnosed as DECAYED when it presented with discolored lesion in the pits/fissures or smooth surface that has detectably softened floor, undermined enamel or softened wall, definite catch of explorer tip & enamel can be scraped away with it, frankly cavitated surface, with/without pulpal involvement, temporary filling or crowned, filled tooth surface that has secondary (recurrent) caries or has primary caries on other areas of the tooth. On suspected proximal surface caries, the explorer should definitely enter & catch in the lesion.

A permanent tooth was diagnosed as FILLED when it presented with an adequate permanent restoration that has no defective or decayed areas, permanently crowned tooth (for any reason) with proper marginal adaptation and proper coverage, endodontically treated tooth with a permanent coronal restoration. When the pits & fissures are adequately sealed with a fissure sealant that exhibits no sign of decay.

A permanent tooth was diagnosed as MISSING when it has been extracted because of caries, un-restorable carious crown that will necessarily be extracted or remaining roots that cannot constitute an anchorage for post & core. Teeth that have been avulsed, or that had undergone extraction for orthodontic purposes, due to periodontal disease or due to an irreparable crown or root fracture, missing, un-erupted teeth, congenitally missing or impacted teeth are not counted as Missing.

The degree of debris & calculus accumulation on the clinical crown surfaces of permanent teeth was used to evaluate the cleanliness of the mouth & the dedication to oral hygiene practices. The index chosen to assess oral hygiene in this study is the Simplified Oral Hygiene Index (OHI-S).¹⁵

Statistical analysis was done by using Chi-square test and student t-test. The level of significance for all tests was set at $p < 0.1$.

RESULTS

The mean DMFT score for the 242 children was 3.27 (SD=3.00) and the 90% confidence interval for population mean DMFT calculated is between 2.95 and 3.58. Mean DMFT index for girls X_G was 3.82 (Standard Deviation $S.D_G = 3.42$), which was significantly higher than the mean index for boys X_B , 2.79 ($S.D_B = 2.50$) (Figure-1).

DMFT index score was lower in male as compare to female subjects. Majority of the students has DMFT between 0–3 as presented in Table-1.

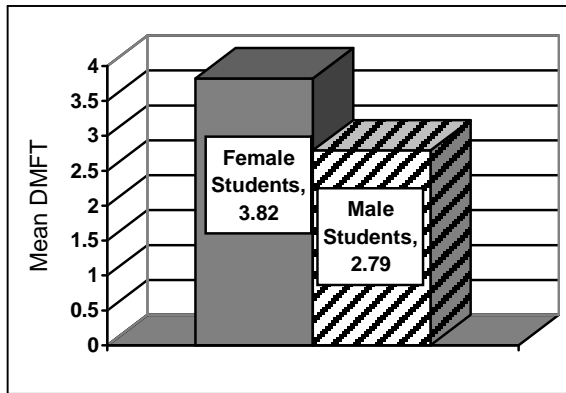


Figure-1: Mean DMFT index of female & male students

Table-1: Distribution of 242 male and female subjects according to their DMFT index

DMFT Index	Boys Frequency	Girls Frequency	Total Frequency
(0-3)	97	67	164
(4-7)	26	29	55
(8-11)	5	14	19
(12-15)	2	1	3
(16-23)	0	1	1
Mean DMFT	130 $X_B = 2.79$ $S.D_B = 2.50$	112 $X_G = 3.82$ $S.D_G = 3.42$	242

Based on their level of oral hygiene, children fell into 3 categories: good, fair & poor. The majority (60.33%) had a fair OHÿscore, (36.36 %) good and onÿÿ (3.30 %) has poor oral hygiene. No statistically significant difference was found between DMFT index and OHI (Table-2).

Table-2: Relation between DMFT & OHI-S

Degree of caries by DMFT Index	Level of Oral Hygiene			Total
	Good	Fair	Poor	
low (0 - 2)	44	90	5	139
moderate (3-5)	24	36	1	61
High (>= 6)	20	20	2	42
Total	88 (36.36 %)	146 (60.33 %)	8 (3.30 %)	242

Regarding the questionnaires related to oral hygiene practices & preventive awareness, 62% said they used other oral hygiene aids besides tooth brush and toothpaste (including floss, tongue cleanser, tooth powder, miswak and mouth wash). A similar percentage claimed to brush regularly before bedtime. There was a 57.0% affirmative response to familiarity with the benefits of fluoride against caries, while only 22.31% said they thought they had bad breath.

Dental caries prevalence amongst children was highly alarming, more than 80 % teeth were found decayed where as low number of missing and filled teeth. Among the females 87.62% has decayed, 1.26% missing and 11.1% filled teeth whereas males

have 84 % decayed, 0.73% missing and 15.27% filled teeth as illustrated in Figure-2.

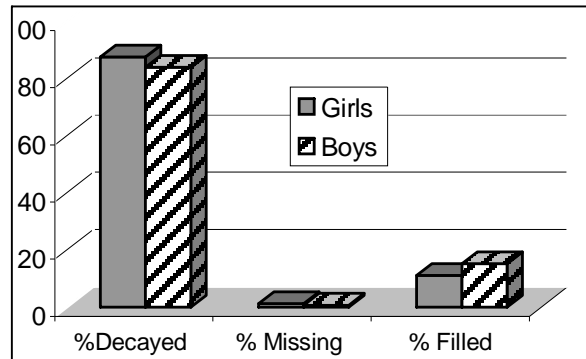


Figure-2: Components of DMF for children. Untreated decay is the component of maximum weight for both genders.

The children were asked to state their parents' occupations & their gross income per month. Amongst 242 students, 234 (96.7%) replies were available for analysis. Subsequently they were divided into 3 groups: low, middle & high social classes. Caries-free children were 33.76%, amongst whom the boys had a higher proportion of caries-free state (40.77%) than the girls (25.89%). Girls had more untreated decay & less filled teeth as compare to the boys. Caries free among the low social class 20.25%, middle social class 41.77% and 37.97% were from the high social class where as 25.16 % from the low social class, 51.61% from the middle social class and 23.22% from the high social class were having carious teeth Figure-3. There was a significant relationship between caries & social status. Children of the high S.E.S had lower (2.65) DMFT when compared to those in the middle (3.51) DMFT and lower S.E.S groups (3.53) DMFT Figure-4. There was no significant difference between the caries experience of low & middle social class groups Table-3.

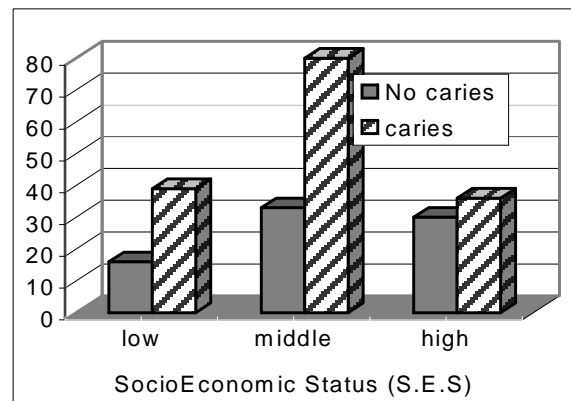


Figure-3; Relationship between Caries Experience & S.E.S

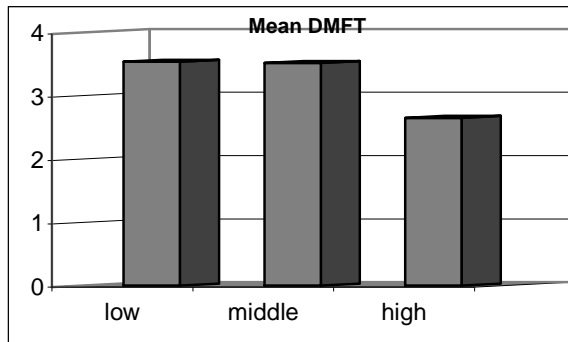


Figure-4: Children in the high economic group exhibit lower caries experience than both children of middle & low social status. The difference in caries between the middle & low groups seems negligible.

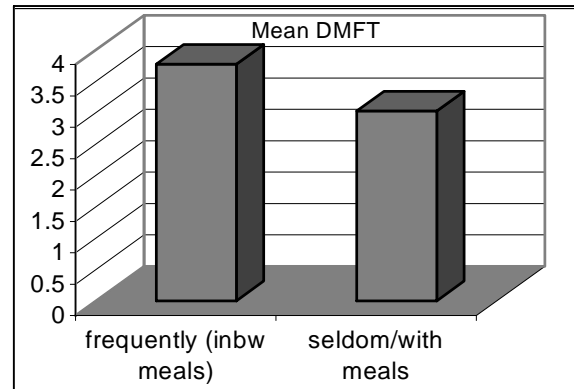


Figure-5: The mean DMF-T is higher in the group of children accustomed to snacking in between meals.

Table-3: Relationship between Caries Experience & SES

DMFT classes	Low S.E.S children	Middle S.E.S children	High S.E.S children
(0-3)	34	69	55
(4-7)	15	32	7
(8-11)	5	11	2
(12-15)	1	1	1
(16-19)	0	0	0
(20-23)	0	0	1
Mean DMFT	Total =55 X _L = 3.536 S.D _L = 2.97	Total =113 X _M = 3.518 S.D _M = 2.84	Total =66 X _H = 2.65 S.D _H = 3.27

When asked about the frequency of sugar intake, 241 responses (99.6%) were given. 33.6 % said they had sugary snacks frequently & in between meals. The majority either seldom had sweets or had them mostly during meals. Among the frequently & in between meals snakers 79.01% were having caries and 20.98% were caries free. Among the rarely/with meals snakers 59.3% exhibited caries and 40.6 % were caries free table 4. Occasional snackers had a significantly lower average DMFT compared to frequent snackers. The relationship between caries & frequency of sugary snacks was found to be statistically significant. The mean DMFT is higher in the group of children accustomed to snacking in between meals Table-5 and Figure-5.

Table-4: Frequency of sweet snacking

Caries Experience	Frequency of Sweet Snacking		Total
	Frequently, in between meals	Rarely /with meals	
No caries	17	65	82
caries	64	95	159
Total	81	160	241

Table-5: Mean DMFT index of frequent and infrequent snackers

DMFT classes	Frequent Snack-Eaters	Infrequent Snack-Eaters
(0 - 3)	45	118
(4 - 7)	27	28
(8 - 11)	8	11
(12 - 15)	1	2
(16 - 19)	0	0
(20 - 23)	0	1
Mean DMFT	Total =81 X _F = 3.77 S.D _F = 2.89	Total =160 X _I = 3.025 S.D _I = 3.04

DISCUSSION

For most of the 20th century, caries was a disease of the economically developed countries with their refined carbohydrate consumption, & was of relative insignificance in the poorer developing countries that subsisted mainly on natural farming products.^{1,2} However, a global reversal in this pattern has been observed towards the end of the past century. Developing countries like Kenya, Iraq, Lebanon Vietnam, Thailand and Greenland westernized their dietary habits: refined sugars became key ingredients. With expanding global trade, most gulf countries including the United Arab Emirates, whose traditional daily repast comprised fish & rice, followed suit. It is interesting to note that the Islamic Republic of Iran, which is geographically very close to the UAE, revealed a drop in DMFT index from 1.67 in 1993-1994 to 0.77 by 2006 in 12-year-old students, which is very low by WHO standards. The results are consistently as low as in the developed countries of central Europe.^{10,11}

The caries attack rate in industrialized countries, including Europe, United States, and Canada, has decreased dramatically over the past 40 years, to the extent that it is no longer unusual to be caries-free. This may be attributed to the widespread and frequent use of fluoride-containing toothpaste. There seem to be no other factors, which can explain the reduction in dental caries occurred worldwide during the same period, in geographic regions as far apart as the Scandinavian countries, Australia & New Zealand.^{8,16-20}

Our study revealed an inverse relationship between socioeconomic status & DMFT in children (Figure-4 and Table-3). This pattern has been recognized as far back as 1842, when health-related studies established SES as a predisposing factor for disease. Even with present day availability of sugar to all classes alike accounted for SES continues to affect dental health. Mothers of the higher class have a higher level of

preventive care awareness and accompany their children regularly to visits the dentist at an earlier age. While middle and lower class mothers cannot afford complex dental treatment, opting to wait until pain develop and send their children to community dental service.

A systematic review of previous literature confirmed a fairly strong evidence for an inverse relationship between SES and the prevalence of caries among children.²¹ A study on 13 to 14 year olds concluded that dental caries experience and oral hygiene status of children were strongly correlated to socio-economic status.^{22, 23} This is inconsistent with our study where caries were more prevalent in children with middle and lower SES (Figure-3).

Our study did not correlate oral hygiene to caries prevalence (Table-2). This is consistent with previous research that poorly related individual oral hygiene to caries experience in spite of intuitive feelings to the contrary. In a Canadian review of primary prevention,²⁴ oral hygiene procedures consisting of personal plaque removal by tooth brushing and flossing as well as professional prophylaxis did not lead to caries reductions. Daily plaque removal is recommended in the interest of controlling gingival/periodontal disease. Tooth brushing is required for the self-application of fluoride dentifrice, a proven caries preventive.^{23, 24} This is in contrast to other research, which concluded that caries incidence could be virtually eliminated by the regular meticulous professional removal of plaque.^{1, 3}

Half of the students claimed to be familiar with the benefits of Fluoride and brush before bedtime and only 16.1% of the subjects were aware of a bad-breath problem. This necessitates intensive regular plaque control (including instituting dental floss use), use of fluoride and regular dental check-up for scaling, fluoride application & sealants.

Girls exhibited a significantly higher average DMFT score compared to their male counterparts in our study (Table-1), whereas incidence of decayed teeth was very high in both male and female group (Figure-2). This is similar to findings of previous research that attributed the difference to earlier eruption in female children & to a higher filled component in female adolescents. Females visit the dentist more frequently & have more restored teeth.^{3, 25, 26} Our study, however, disagrees with the latter justification since our finding was that the filled component was higher in males.

Passive smoking is considered as an important environmental risk for caries among children.²⁷ It was not included in our study because of social condition of the society.

The increase in caries experience observed between 1995 (DMFT=1.6) and in our study (DMFT=3.27) seem to be directly related to the age group selected for study and the frequency of sugary snacking Figure-5 and 6). This may be due to direct

relationship between refined carbohydrates & caries prevalence, which has been recognized for years & recent evidence continues to confirm it. Sugars levels above 60g/person/day and intake of extrinsic sugars more than four times a day increase the risk of dental caries.²⁸ Studies on animals show that addition of cooked or milled starches (as in potato chips) to sugars make a more cariogenic mixture than sugars given alone. Higher sugar consumption still seemed to be a major external risk factor for caries-susceptible children only.^{2, 3}

Our study has concluded that frequency of sugar intake, snacking frequency in between meals and socio-economic status may play an important role in DMFT of 11–14 years school going children.

CONCLUSION

Our study revealed an inverse relationship between socioeconomic status & DMFT in children. Caries were more prevalent in children with middle and lower socioeconomic status

Dental caries experience and oral hygiene status of children were strongly correlated to socio-economic status. Caries incidence could be virtually eliminated by the regular meticulous professional removal of plaque, use of fluoride and regular dental check-up for scaling, fluoride application & sealants.

Our study has concluded that frequency of sugar intake, snacking frequency in between meals and socio-economic status may play an important role in DMFT of 11–14 years school going children.

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