Dental Caries Experience, Prevalence and Severity in 13–15 Years Old Students in Mosul City Center

ABSTRACT

The **aims** of the present study is to determine dental caries experience, prevalence and severity in a group of 13–15 years olds. **Materials and Methods:** A random sample of 516 intermediate school students were examined and dental caries was recorded by DMFT values. Also, the significant caries index, care and treatment need indices were used. **Results:** Mean DMFT values for the total sample was 5.17 with a statistically significant age difference, females tended to have more caries than males with significant gender difference. The significant caries index was 7.98, care index which shows the restorative care was 10.39. **Discussion:** There has been an increase in dental caries prevalence and severity in Mosul compared with a previous study that was undertaken during the United Nations' sanctions on Iraq, due to the availability and relative cheapness of sugars and confectionaries after 2003. **Conclusions:** To improve children's oral health, community school–based oral health educational programs should be established starting from primary and extending to intermediate schools, stressing on sugar restriction and oral hygiene measures, fissure sealants and fluorides can also be used effectively.

Prof Dr **Khidhair A Al–Jumaili** *(BDS, CES, DSO)*; *Asst Prof* **Rayia J Al–Naimi** *(BDS, MSc)*; *Lect* **Karam H Jazrawi** *(BDS, MSc)*

Department of Pedodontics, Orthodon–tics and Preventive Dentistry, Dentistry College, Mosul University

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Dental caries is a major public health problem and is one of the most common chronic diseases among human populations. It affects considerable proportions of school children and adults in several countries,[1] causing pain, discomfort and resulting in high costs associated with treatment.[2] As an important determinant of general health and quality of life, the oral health policies of all countries should be based on accurate epidemiological data regarding oral health status, risk factors, and oral health care delivery systems.[3] The World Health Assembly accepted an important goal for oral health in children, the global average for dental caries experience in 12–year–old children should not be higher than 3.0 in the year 2000. By 1995, the average DMFT in six industrialized Western European countries was nearly 2.0.[4] Some detailed scientific papers and abstracts have since shown that the DMFT seems to be 'bottoming out', so that the original WHO requirement of less than 3.0 DMFT has ceased to be a useful yardstick. A detailed analysis of the caries prevalence of many of these countries often shows skewed distribution of the disease: A group of 12–year–olds had, in fact, high or very high DMFT values, while the rest of the population showed low DMFT or were totally caries–free.[5, 6] So expressing caries prevalence as the mean DMFT value does not correctly reflect the skewed distribution, leaving high caries groups to remain undiscovered in the population. So the Significant Caries Index (SiC) was introduced in the year 2000 to bring attention to those

children with the highest caries scores in each population.[7] The SiC Index is calculated by taking the mean DMFT of one–third of the individuals having the highest of DMFT values in a given population. In addition, a new goal was proposed, the SiC Index should be less than 3 DMFT among 12–year–olds by the year 2015. If a country had already reached this goal, the idea is to then focus on provinces, districts, cities or even parts of cities so that in any given population, the SiC should not be above 3 DMFT.[7]

The aim of the present study was to determine dental caries experience, prevalence and severity in a group of 13–15 years old intermediate school children in Mosul City Center expressed in DMFT values, the SiC Index, to determine the amount of restorative treatment by the use of care index and dental treatment index.

MATERIALS AND METHODS

This cross–sectional study involved 516 intermediate school students aged 13–15 years in the center of Mosul City during the academic year 2010–2011; six intermediate schools (3 for males and 3 for females) representing different socio–economic status. A legal permit from the Directorate of Education to conduct clinical oral examination during school hours was obtained. The examinations were done by one calibrated examiner using WHO caries diagnostic criteria for determining the permanent tooth DMFT Index (decayed, missing and filled teeth).[8]

Students were randomly selected from the list and examined by seating them on chairs under natural day light using dental mirror and probe.

The SiC Index was calculated; this refers to the DMFT for the third of the population which is most affected by caries.[7]

The Care Index (CI) was also calculated as part of the analysis as this shows the restorative to which a population has been according to the following formula:[9]

CI= (Filled teeth / DMFT) × 100

The Treatment Need Index (TNI) was calculated using the following formula:[9]

TNI= [Teeth with caries / (Teeth with caries + Filled teeth)] × 100

Data were recorded and analyzed using Statistical Package for the Social Sciences (SPSS) version 13.0. Descriptive analysis including mean, standard deviation, frequency and percentages. Student's *t*–test, Duncan's Multiple Range Test and Chi–square test were performed when indicated. Results were considered statistically significant when $p \leq 0.05$.

RESULTS

Table (1) displayed the distribution of the sample by age and gender. The sample was composed of 516 students (240 males and 276 females) distributed among three age groups: 13, 14 and 15 years, representing first, second and third year of intermediate schooling.

Dental caries experience expressed in mean DMFT values and its components can be seen in Table (2), which was 5.17 for the total sample. The means tended to increase with increasing age with a statistically significant age difference (from 3.93 in 13 year olds to 6.08 in 15 year olds).

Females tended to have higher values (5.50) than males (4.79) with a statistically significant gender difference.

Table (3) demonstrated the caries free students in the sample. Only 34 students representing 6.6% of the total sample were caries free, with males tending to be more caries free 8.8%) compared to females (4.7%).

Table (1): Distribution of the sample by age and gender.

Age (Years)	Sex	No.	%
13	Males	79	15.3
	Females	76	14.7
	Total	**155**	**30.0**
14	Males	81	15.7
	Females	95	18.4
	Total	**176**	**34.1**
15	Males	80	15.5
	Females	105	20.3
	Total	**185**	**35.9**
Total Males		240	46.5
Total Females		276	53.5
Total Sample		**516**	**100.0**

Table (2): Mean DMFT and its components by age and gender.

Age (Years)	Sex	No.	DMFT		DT		MT		FT	
			Mean	± SD	Mean	± SD	Mean	± SD	Mean	± SD
13	Males	79	3.32	2.23	2.77	1.92	0.09	0.33	0.46	0.83
	Females	76	4.59	2.53	3.66	2.26	0.14	0.45	0.79	1.58
	Total	**155**	**3.93$^{(A)}$**	**2.46**	**3.21$^{(A)}$**	**2.13**	**0.12$^{(A)}$**	**0.39**	**0.62$^{(A)}$**	**1.26**
14	Males	81	5.37	2.57	4.44	2.36	0.15	0.45	0.78	1.51
	Females	95	5.23	2.27	4.63	2.03	0.13	0.39	0.47	1.05
	Total	**176**	**5.30$^{(B)}$**	**2.41**	**4.55$^{(B)}$**	**2.18**	**0.14$^{(A)}$**	**0.42**	**0.61$^{(A)}$**	**1.29**
15	Males	80	5.65	2.68	5.30	2.53	0.09	0.48	0.26	0.65
	Females	105	6.40	2.41	5.39	2.31	0.18	0.48	0.83	1.26
	Total	**185**	**6.08$^{(C)}$**	**2.55**	**5.35$^{(C)}$**	**2.40**	**0.14$^{(A)}$**	**0.48**	**0.58$^{(A)}$**	**1.08**
Total Males		240	4.79	2.70	4.18	2.50	0.11	0.43	0.50	0.43
Total Females		276	5.50	2.50	4.65	2.30	0.15	0.44	0.70	1.30
Total Sample		**516**	**5.17**	**2.62**	**4.43**	**2.41**	**0.13**	**0.43**	**0.60**	**1.21**

Student's *t*–test between males and females:
DMFT: Value= –3.112; df= 514; *p*–value= 0.002 (Significant)
DT: Value= –2.236; df= 514; *p*–value= 0.026 (Significant)
MT: Value= –1.145; df= 514; *p*–value= 0.253 (Not Significant)
FT: Value= –1.844; df= 514; *p*–value= 0.066 (Not Significant)

Table (3): Caries free students by age and gender.

Age (Years)	Sex	No.	Caries Free Students	
			No.	%
13	**Males**	79	16	20.3
	Females	76	8	10.5
	Total	**155**	**24**	**15.5**
14	**Males**	81	2	2.5
	Females	95	3	3.2
	Total	**176**	**5**	**2.8**
15	**Males**	80	3	3.8
	Females	105	2	1.9
	Total	**185**	**5**	**2.7**
Total Males		240	21	8.8
Total Females		276	13	4.7
Total Sample		**516**	**34**	**6.6**

Table (4) depicted the number of decayed permanent first and second molars in the sample; 1353 permanent first molars were found to be carious while only 703 were decayed in case of permanent second molars for the total sample. Although females tended to have a higher number of decayed permanent first molars (746) compared to males (607), no significant difference was observed between them. On the other hand, a significant difference was observed in the number of decayed second molars, with females tending to have more decayed second molars (403) compared to males (300).

Table (4): Number of students with decayed permanent first and second molars.

Age (Years)	Sex	No.	No. of Decayed Permanent First Molars	No. of Decayed Permanent Second Molars
13	**Males**	79	162	41
	Females	76	189	55
	Total	**155**	**351**	**96**
14	**Males**	81	210	108
	Females	95	272	123
	Total	**176**	**482**	**231**
15	**Males**	80	235	151
	Females	105	285	225
	Total	**185**	**520**	**376**
Total Males		240	607	300
Total Females		276	746	403
Total Sample		**516**	**1353**	**703**
Pearson Chi Square Between Males and Females			Value= 3.538; df= 4; *p*–value= 0.472 (Not Significant)	Value= 10.097; df= 4; *p*–value= 0.039 (Significant)

The means of decayed permanent first and second molars can be seen in Table (5). The mean value for permanent first molars for the total sample was 2.62, while permanent second molars showed a mean of 1.36 only.

The SiC Index for the sample was shown in Table (6), with a mean value of 7.98 for the total sample. It could be observed that there was no significant age or gender difference in the means between age groups and total males and females.

The CI and TNI can be depicted in Table (7). The mean CI for the total sample was 10.39, while TNI for the total sample was 89.36. both indices did not show a significant age difference between the three age groups nor a gender difference between total males and females.

Table (5): Means of decayed permanent first and second molars.

Age (Years)	No.	No. of Decayed Permanent First Molars		No. of Decayed Permanent Second Molars	
		Mean	± SD	Mean	± SD
13	155	2.26	1.45	0.62	1.02
14	176	2.74	1.25	1.31	1.26
15	185	2.81	1.24	2.03	1.44
Total Sample	**516**	**2.62**	**1.33**	**1.36**	**1.39**

Table (6): Significant Caries Index by age and gender.

Age (Years)	Sex	No.	Significant Caries Index	
			Mean	± SD
13	**Males**	6	7.17	0.41
	Females	13	8.54	2.07
	Total	**19**	**8.11**$^{(A)}$	**1.82**
14	**Males**	23	8.48	1.83
	Females	30	7.77	1.57
	Total	**53**	**8.08**$^{(A)}$	**1.71**
15	**Males**	35	8.06	1.28
	Females	65	7.82	1.55
	Total	**100**	**7.90**$^{(A)}$	**1.46**
Total Males		64	8.13	1.49
Total Females		108	7.89	1.63
Total Sample		**172**	**7.98**	**1.57**

Student's *t*–test between males and females:
Value= 0.950; df= 170; *p*–value= 0.343 (Not Significant)

Table (7): Care Index and Treatment Need Index by age and gender.

Age (Years)	Sex	No.	Care Index		Treatment Need Index	
			Mean	± SD	Mean	± SD
13	Males	64	11.80	19.32	87.91	19.51
	Females	71	14.38	26.04	85.15	26.41
	Total	**135**	**13.15**$^{(A)}$	**23.05**	**86.46**$^{(A)}$	**23.35**
14	Males	79	13.14	21.73	86.57	21.97
	Females	92	7.73	15.34	92.18	15.46
	Total	**171**	**10.23**$^{(A)}$	**18.71**	**89.59**$^{(A)}$	**18.90**
15	Males	77	3.71	9.47	96.29	9.47
	Females	103	12.03	18.23	87.61	18.59
	Total	**180**	**8.47**$^{(A)}$	**15.63**	**91.32**$^{(A)}$	**15.92**
Total Males		220	9.45	18.02	90.36	18.21
Total Females		266	11.17	19.87	88.54	20.18
Total Sample		**486**	**10.39**	**19.06**	**89.36**	**19.32**

Student's *t*–test between males and females:
Care Index: Value= –0.992; df= 484; *p*–value= 0.322 (Not Significant)
Treatment Need Index: Value= 1.038; df= 484; *p*–value= 0.300 (Not Significant)

DISCUSSION

For most of the 20th century, caries was a disease of the economically developed countries with their refined carbohydrate consumption, and was of relative insignificance in the poorer developing countries. However, a global reversal in this pattern has been observed towards the end of the past century. Many developing countries westernized their dietary habits and refined sugars became key ingredients.[10]

The caries attack rate in industrialized countries, including Europe, United States, and Canada, has decreased dramatically over the past 40 years, so the extent that it is no longer unusual to be caries–free.[11, 12]

An important determinant of general health and quality of life, the oral health policies of all countries should be based on accurate epidemiological data regarding oral health status, risk factors, and oral health care delivery systems.[3, 13] This type of information in Iraq is scarce, that has been through two wars over the last two decades and suffered from 13 years of economic sanctions. Nutrition, the health system and daily living conditions of the Iraqi population have been profoundly influenced by the wars causing political and economical instability.

Our present study revealed that dental caries experience for the sample expressed in DMFT values was 5.17. This figure was much greater than that reported in a previous study[14] that was carried out in Mosul 13 years prior to the present study (3.43 for the same age group) during the United Nations' sanctions that were imposed on Iraq. So there was a drop in sugar consumption from 50 Kg/person/year to 12 Kg/person/year and similar trends of reduction of dental caries were observed.[15] Means tended to increase with increasing age from 3.93 in 13 year olds and this figure is beyond that proposed by WHO for the year 2000 for 12 year olds to 6.68 in 15 year olds with a statistically significant age difference. Caries experience with age advancement might be due to more exposure of teeth to the oral environment and accumulative nature of the disease. After 2003, the sugar consumption began to rise and increase in the

population.[16] So one would predict DMFT values to increase also.

Females tended to have higher DMFT values (5.50) compared to males (4.79) with significant gender difference. This is in agreement with other studies which showed that females tended to have more caries than males.[17–20]

The decayed portion was the highest among the DMFT values. This picture is evident in many countries due to limited resources, unavailability and cost of dental treatment.[2, 21]

Dental caries prevalence amongst children was highly alarming, and prevalent in 93.4% of the students, as the percentage of caries free students was only 6.6% (Table 3), which is much less than that reported by Al–Naimi[14] that was 16.4% caries free. This picture is the reverse to what is happening in many of the developed countries that are reporting an increase in the percentage of caries free individuals and a reduction of the disease.[5, 21–23]

It can be observed that most of the caries was in the permanent first molars (Tables 4 and 5) with a frequency of 1353 and a mean decay of 2.63 that is nearly half the mean DMFT value of 5.17 for the sample. This is in agreement with many studies that found decay to be most prevalent in permanent first molars.[20, 23] Occlusal surfaces of posterior teeth are the most vulnerable sites for dental caries due to their anatomy favoring plaque maturation and retention. Although the overall caries rate has fallen for populations in industrialized countries, the rate of caries lesions in pits and fissures has not decreased at the same time.[11]

In order to decrease dental decay in children and adolescent in our country, pit and fissure sealant should be considered as a priority, not only by sealing sound molars but also carious molars. According to Kervanto–Seppälä *et al*.,[24] occlusal caries management was improved by shifting the sealant policy from the traditional approach of prevention to interception; i.e., applying sealants over detected or suspected enamel caries lesions instead of sealing sound teeth. First and second permanent molars should be fissure sealed if on the occlusal surface there is an active enamel caries lesion and if the fissure is deep or its cleaning is difficult.[25]

The SiC for the sample was 7.98 with a mean of 8.11 in 13 year olds and 7.9 in 15 year olds (Table 6). This is the first time this index has been used in Mosul, and it represents one third of the population with the highest DMFT. There was no significant age or gender difference, and the results obtained are much within the highest limits than that reported by the WHO in many countries for index ages 12 and 15.[26]

This figure is higher than the target set for the year 2015.[7] Sweden is one of the few countries that have already achieved this goal.[27]

The WHO goal defined for the year 2000 should still be considered, especially in Iraq. Marthaler *et al*.[5] suggested the adoption a SiC Index of 5 at the age of 15 years and our investigation revealed we are much above this goal.

The CI which reflects the amount of restorative treatment in the population was 10.39 (Table 7), which was the highest in 13 year olds(13.15), and the least in 15 year olds (8.47). This indicates the limited use of restorative treatment in Mosul City and a failure in primary dental care provision. The low CI figure highlights the issue of treating dental decay in children and adolescents, currently the source of debate within the dental profession. In the past, the traditional approach is that all decay in teeth must be restored by conventional fillings that is no longer supported and preventive care should be emphasized;[2] the TNI was high (89.36).

Dental decay is a disease of lifestyle with multiple causes. It is clear that more direct and also more innovative methods of delivering preventive care than have been used in the past are necessary if advances are to be made towards reaching the 2015 target and lowering dental caries.

This study was carried out after a reasonable period of the end of the sanctions when sugar products had become commonly available to the whole population causing a sudden elevation in sweet consumption among the population and this was evident in the marked rise in DMFT values in Iraq that is still suffering from unstable conditions in different aspects of life, with a health–care systems with limited resources. So we must select the best preventive strategy that requires the least resources. This can be achieved by dental health education stressing on sugar restriction. So community school–based oral health educational programs should be established to include all primary and extending to intermediate schools stressing on sugar restriction and improvements in oral hygiene measures and use of fluoridated toothpaste is also needed to make progress. It should be borne in mind that the school forms the main setting to implement oral health promotion, and is one of the first and the most important secondary socializing agencies for children. Also, a periodic examination is required in order to determine the distribution of caries experience in the students, especially those that carry a disproportionate burden of the disease. Also, fluorides and fissure sealants can be effectively used to decrease the prevalence and severity of the disease.

CONCLUSIONS

There was an increase in prevalence and severity of dental caries within this age group. Limited amount of restorative care and most of DMFT values were due to decayed teeth. To improve student's oral health, community school–based oral health educational programs should be established starting from primary and extending to intermediate schools, stressing on sugar restriction and oral hygiene measures, fissure sealants and fluorides can also be used effectively.

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