Dental caries risk indicators by using International Caries Detection and Assessment System in Mosul City.

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الخلاصة

اهداف البحث: تهدف الدراسة الى تقيم تأثير عوامل مختلفة مثل معدل دخل الأسرة و الحالة الاجتماعية و المادية و مستوى تعليم الأسرة و تنظيف الأسنان بالفرشاة و المعجون و مراجعة طبيب الأسنان ونوع العلاجات السنية التي اجريت على حدة تسوس الأسنان الدائمية   للطلبة في مدينة الموصل . المواد و طرائق البحث: بلغ حجم العينة (531) طالبا (260 ذكر و271 انثى) تم اختيارهم عشوائيا من عشر مدارس ابتدائية و متوسطة من مدينة الموصل تتراوح اعمارهم بين (166) سنة. العوامل المؤثرة على حدة تسوس الأسنان شملت مستوى دخل و تعليم الأسرة و مراجعة طبيب الأسنان و نوع العلاجات السنية المقدمة و تنظيف الأسنان بالفرشاة و المعجون. أخذ ايضا بنظر الاعتبار انتشار تسوس الأسنان على كلا جهتي الفكين و الدالة تسوس و قلع و حشوة الأسنان (DMFT) و نسبة الطلبة الخالية من تسوس الأسنان. تم قياس شدة تسوس الأسنان باتباع النظام الدولي لكشف و تقييم تسوس الأسنان (ICDAS). النتائج: لوحظ ان للعوامل المذكورة سابقا تأثير على زيادة او نقصان تسوس الأسنان اما معنويا او غير معنوي.   الاستنتاج: أظهرت الدراسة وجوب الأخذ بالاعتبار تأثير تلك العوامل لخفض حدة تسوس الأسنان لدى هذه الفئة العمرية.

ABSTRACT

Aims: To determine the effect of risk factors such as income level, socioeconomic status, parents education, brushing behavior , dental attendance, type of treatment performed and others on dental caries severity of permanent teeth. **Materials and Methods:** Sample size was (531) students (260 males and 271 females) who were selected randomly from (10) primary and intermediate schools in Mosul City, their ages were ranged between (6-16) years. Risk factors considered on caries severity included parent's income level, parent's education, visiting the dentist, types of dental treatment performed and brushing behavior. Distribution of dental caries on each side of the mouth, DMFT and the percentage of caries free students were also considered. Caries severity was measured using International Caries Detection and Assessment System. **Results:** These factors have an effect to increase or decrease caries severity either significantly or not significantly. **Conclusion:** These risk factors should be kept in mind when we decide to reduce caries severity.
Key words: caries severity, socioeconomic status, ICDAS.

INTRODUCTION

Dental caries is an infectious communicable disease resulting in destruction of tooth structure by bacteria found in dental plaque, an intra oral biofilm. The disease can result in irreversible loss of minerals and eventually extraction of the tooth, if left unchecked.[1]

Dental caries is still very important public health problem, and it remains the most common and widely spread disease affecting children, adolescents, adults as well as elderly people especially in developing countries.[2,3] Age of the individual is the strongest determinant of the caries experiences, and it has been found that the increase of caries with age should be interpreted as a result of irreversibility and accumulation naturally of dental caries. Cavitation has occurred and DMF rate will tend to rise with increasing age.[4]

Several studies that correlate the caries prevalence in permanent teeth of children have shown greater rate in females than in

males at the same age groups probably because of earlier tooth eruption pattern in females than males which exposed to oral environment and caries attack.[5,6] Other studies showed no significant difference in caries experience between males and females in different age groups.[7,8]

The prevalence and severity of dental caries showed a wide variation from one geographical location to another and they are affected by residential and it's related factors.[9] Dental caries is considered to be a multifactorial disease that is strongly related to social factors in general.[10] Two factors are important concerning dental caries. The first is income, where those in high social class in general receive a higher income have low caries level, young children from poorer social back ground have high caries level.[11,12]

The other factor is education, children of parents at high level of education had significant lower caries level experience than those of parents at lower educational level.[13] This has been attributed to the reason that high socioeconomic level individuals who had a higher level of education and had more knowledge about dental health, so they perform more regular dental visits for professional cleaning and other preventive measures.[14] The relationship between oral cleanliness and caries has been widely explored, where dental caries occur only after plaque has accumulated on susceptible tooth surface in individuals who eat sugar frequently.[15] It has been demonstrated that the development of new caries lesion can be prevented by vigorous and regular individual and professional tooth cleaning.[16]

Oral health considerably improved in industrialized countries mainly due to the wide spread of fluoride and a change in dietary habits. Developing countries have experienced a deterioration in oral health due to the change in socioeconomic condition, dietary habits and lack of education.[17]

The ICDAS system was developed in 2002 by a group of cariologists and epidemiologists after a review conducted for an international conference of clinical trials on dental caries identified a wide variation among contemporary criteria system that differentiate cavitated and non cavitated lesions. [18]

This study assesses the prevalence, severity of dental caries risk factors such as parents education, income level, socioeconomic status, demographic variables (such as age, gender), dental attendance….etc using the International Caries Detection and Assessment System (ICDAS) and distribution of dental caries on the permanent teeth of students living in Mosul city center.

MATERIALS AND METHODS
Criteria of Sample Selection:

The study sample was randomly selected from (5) primary and (5) intermediate schools in Mosul City. The sample size was (531) students, their ages ranged between (6-16) years. Risk indicators were coded as follows:

1. Demographic variables; age:
      Group 1: 6-8 years old
      Group 2: 9-11 years old
      Group 3: 12-14 years old
      Group 4: ≥ 15 years old

2. Family income monthly:
      Group 1: < 250000 Dinars
      Group 2: < 500000 Dinars
      Group 3: < 1000000 Dinars
      Group 4: > 1000000 Dinars

3. Parent's education:
      Group 1: Primary school
      Group 2: Secondary School
      Group 3: College
      Group 4: High education (Diploma or postgraduate studies)

4. Last dental visit:
      Group 1: Less than 2 years ago
      Group 2: Between 2-5 years ago
      Group 3: More than 5 years ago

5. Reason of dental visit:
      Group 1: Pain / treatment
      Group 2: Prevention
      Group 3: Restoration
      Group 4: Extraction
      Group 5: Orthodontic treatment

6. Teeth brushing:
      Group 1: Brush their teeth
      Group 2: Do not brush their teeth
      The (brushing) group was subdivided into (infrequent brushing), (once daily) and (twice daily and more).

Clinical Examination: Detection and Classification of Carious Lesion.

For each factor groups, all student's teeth were examined for the presence and severity of dental caries on the permanent teeth. Dental examination was carried out under natural day light periodically by one researcher to avoid interexaminer variation. Instruments used were plane mouth mirror, air syringes, sharp probes to check for surface discontinuity, saliva ejector, cotton and disinfectant solution. The dentist follows the (ICDAS) to measure the stages of the carious process.[18] Both primary carious lesion (non cavitated) and cavitated lesions were examined.

The criteria followed for caries severity of International Caries Detection and Assessment System.[18]

Code	Description
0	Sound tooth surface
1	First visual change in enamel. When seen wet, there is no evidence of any change in color attributable to carious activity, but after air drying for 5 seconds a carious opacity is visible
2	Distinct visual change in enamel, there is a carious opacity or discoloration that is not consistent with the clinical appearance of sound enamel. This lesion may be seen directly when viewed from the buccal or lingual direction. When viewed from occlusal direction, this discoloration may be seen as a shadow confined to enamel.
3	Initial brake down in enamel due to caries with no visible dentin. Once dried for 5 seconds, there is a distinct loss of enamel integrity, viewed from the buccal or lingual direction.
4	Non cavitated surface with underlying dark shadow from dentin. This lesion appears as a shadow of discolored dentin visible through an apparently intact marginal ridge, buccal or lingual walls of enamel.
5	Distinct cavity with visible dentin. Cavitation if opaque or discolored enamel with exposed dentin in the examiner's judgment.
6	Extensive distinct cavity with visible dentin. Obvious loss of tooth structure, the extensive cavity may be deep or wide and dentin is clearly visible on both the walls and at the base.

Analysis of the data included calculation of percentage, Kruskal-Wallis test, Mann-Whitney test and one way Kolmogorov-Smirnov test.

RESULTS

Table (1) shows the distribution of the students according to age and gender. It is clear from the table that the student of small ages were less in number than the older ages due to incooperation of children compared with the others.

Table (2) and figure (1) show the relation between gender and dental caries severity for all age groups. It is clear from the table that there are slight gender differences in the severity of dental caries from (D1) to (D6) in all ages The differences were statistically not significant

In age groups (≥15y) and (12-14y), most of the students (39.87%) and (48.65%) respectively were affected by (D5) caries (Table 3). In group (9-11y), (D3) was prominent (40%) while in group (6-8 y), (D2) was obvious (75%). In general, smaller ages have less carious teeth and less caries severity than the older ages except for D2 and D3 severities. This indicates an increase in the severity of dental caries by increasing age. The differences were statistically significant. The most common ICDAS type carious lesion detected in all age groups were those classified (D5) (distinct cavity with visible dentin).

Table (1): Distribution of the students according to age and gender.

Age group		Males		females		Total	
		No.	%	No.	%	No.	%
6-8 year	No.	44	57.89	32	42.11	76	100
	%	16.93		11.81		14.31	
9-11 year	No.	30	48.39	32	51.61	62	100
	%	11.54		11.81		11.68	
12-14 year	No.	48	46.6	55	53.4	103	100
	%	18.46		20.29		19.40	
≥15 year	No.	138	47.58	152	52.42	290	
	%	53.07		56.09		54.61	
Total	No.	260	48.96	271	51.04	531	100
	%	100		100		100	

Table (2): ICDAS gender differences.

Age	Sex	No.	D1		D2		D3		D4		D5		D6	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6-8 year	male	44	0	0.0	4	80	1	20	0	0.0	0	0.0	0	0.0
	female	32	0	0.0	2	66.67	1	33.33	0	0.0	0	0.0	0	0.0
	total	76	0	0.0	6	75	2	25	0	0.0	0	0.0	0	0.0
9-11 year	male	30	0	0.0	2	25	3	37.5	0	0.0	3	37.5	0	0.0
	female	32	0	0.0	2	28.6	3	42.8	0	0.0	2	28.6	0	0.0
	total	62	0	0.0	4	26.67	6	40	0	0.0	5	33.33	0	0.0
12-14 year	male	48	1	1.89	6	11.32	16	30.18	0	0.0	27	50.94	3	5.67
	female	55	1	1.72	7	12.07	19	32.76	0	0.0	27	46.55	4	6.9
	total	103	2	1. 8	13	11.71	35	31.53	0	0.0	54	48.65	7	6.31
≥15 year	male	138	9	1.82	86	17.37	94	18.99	16	3.24	194	39.19	96	19.39
	female	152	4	0.86	80	17.28	89	19.23	11	2.38	188	40.6	91	19.65
	total	290	13	1.36	166	17.33	183	19.10	27	2.82	382	39.87	187	19.52

Mann-Whitney test between males and females; For 6-8 y: U=17.5; *P*-value =0.924; (N.S.). For 9-11 y: U=16.5; *P*-value = 0.794; (N.S.); For 12-14 y: U=16.5; *P*-value = 0.809; (N.S.). For: ≥15 year: U=14.0; *P*-value = 0.522; (N.S.)
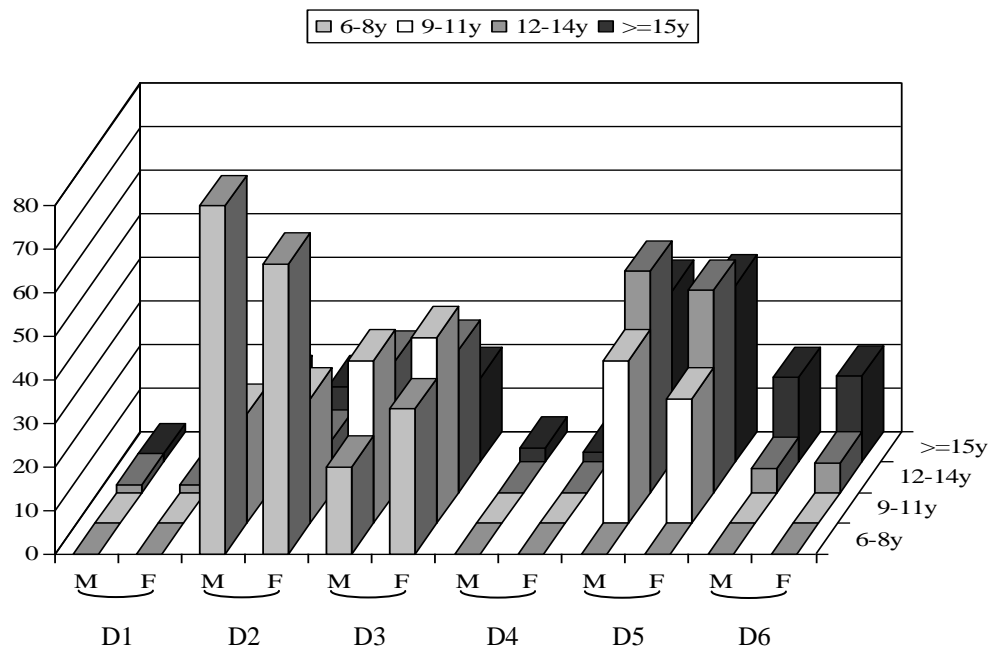

Figure (1): ICDAS gender differences.

Table (3): ICDAS differences among age groups.

Age	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6-8 y	76	0	0.0	6	75	2	25	0	0.0	0	0.0	0	0.0
9-11y	62	0	0.0	4	26.67	6	40	0	0.0	5	33.33	0	0.0
12-14y	103	2	1.8	13	11.71	35	31.53	0	0.0	54	48.65	7	6.31
≥15 y	290	13	1.36	166	17.33	183	19.1	27	2.82	382	39.87	187	19.52

Kruskal-Wallis test; chi-square = 14.971 , d.f. = 3 , *P*-value = 0.002 (significant)

Regarding the relation between the level of parent's income and severity of dental caries (Table 4), D1 severity for all the four groups were close to each other. D2 severity for group (< 250000) (18.87%) and (<10000000) (18.84%) were higher than the other groups [(16.83%) and (15.43%) for (>1000000) and (<500000) respectively]. Group (<1000000) has more D3 severity (23.01%) while group (<500000) has less D4 severity (1.93%) and D6 severity (13.18%) but more D5 severity (47.91%) ,that is to say, severity of caries increment (D4 and D6) are lowest in group (<500000) than others. Statistical differences among the groups were not significant.

Table (4): Relation between income level and dental caries.

Income level	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< 250000	109	2	1.26	30	18.87	32	20.13	4	2.51	66	41.51	25	15.72
< 500000	128	4	1.29	48	15.43	63	20.26	6	1.93	149	47.91	41	13.18
<1000000	152	6	1.92	59	18.84	72	23.01	9	2.88	108	34.5	59	18.85
>1000000	142	3	0.97	52	16.83	59	19.09	8	2.59	118	38.19	69	22.33

Kruskal-Wallis test; chi-square = 1.459 , d.f. = 3 , *P*-value = 0.692 (not significant)

Regarding the relation between parent's education and dental caries (Table 5), group (primary school) has no D1 severity and less D2 (7.96%) and D3 (10.62%) but more D5 (59.29%) than other groups. Group (high education) has the highest severity D1 (3.92%), D2 (24.71%) and D3 (25.1%) but less D5 (26.27%). D6 presented at highest percentage for group (secondary school) (20.74%) and lowest percentage for group (college) (15.78%) the differences were statistically not significant.

Table (5): Relation between parents education and dental caries.

Parents' education	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Primary	29	0	0.0	9	7.96	12	10.62	2	1.77	67	59.29	23	20.35
Secondary	61	2	0.92	21	9.68	28	12.9	3	1.38	118	54.38	45	20.74
College	244	3	0.59	96	18.93	122	24.06	17	3.36	189	37.28	80	15.78
high	197	10	3.92	63	24.71	64	25.1	5	1.96	67	26.27	46	18.04

Kruskal-Wallis test; chi-square = 2.913 , d.f. = 3 , *P*-value = 0.405 (not significant)

About the relation between last dental attendance and caries severity (Table 6), D1 severities were close to each other for the three groups. Group (<2 years) has more D2 (19.68%) and D4 (3.17%). Group (>5 years) has less D2 (13.08%), D3 (18.08%) and D4 (1.92%) but more D6 (22.69%) and D5 (43.08%). Group (2-5 years) has less D6 (14.32%). The statistical difference was not significant.

Table (6): Relation between last visit to dentist and dental caries.

Last visit	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< 2 year	178	5	1.59	62	19.68	67	21.27	10	3.17	110	34.92	61	19.37
2-5 years	286	7	1.35	93	17.99	112	21.66	12	2.32	219	42.36	74	14.32
> 5 years	67	3	1.15	34	13.08	47	18.08	5	1.92	112	43.08	59	22.69

Kruskal-Wallis test; chi-square = 2.012 , d.f. = 2 , *P*-value = 0.366 (not significant)

Table (7) shows the relation between the reason of last dental attendance and caries severity. Group (prevention) has greater percentage of D1 (2.82%) and D2 (28.87%) but less D6 (8.45%) than other groups. Group (extraction) has no D1 and less D5 (21.74%) but more D3 (26.09%) and D4 (21.74%). Group (restoration) has less D2 (5.07%) and D4 (1.69%) but more D5 (49.66%) than other groups. D6 presented at greater percentage for group (orthodontic treatment) (27.07%). The differences among the reasons of dental treatment were statistically significant at *p* <0.001 level.

Table (7): Relation between reason of last dental visit and dental caries.

reason of visit	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pain	191	7	1.41	104	20.88	93	18.67	9	1.81	197	39.56	88	17.67
Prevention	125	4	2.82	41	28.87	32	22.54	4	2.82	49	34.5	12	8.45
Restoration	163	3	1.02	15	5.07	72	24.32	5	1.69	147	49.66	54	18.24
Extraction	6	0	0.0	3	13.04	6	26.09	5	21.74	5	21.74	4	17.39
Orthodontic	46	1	0.75	26	19.55	23	17.29	4	3.01	43	32.33	36	27.07

Kruskal-Wallis test; chi-square = 18.405 , d.f. = 4 , *P*-value = 0.001 (significant)

Table (8) shows the relation between tooth brushing practice and caries severity. D2, D5 and D6 severities were greater for (Don't brush) group (17.9%, 41.92% and 18.34% respectively) than the (Brush) group (16.88%, 39.27% and 17.35% respectively). While the opposite was true for D1, D3 and D4 [0.66%, 19.43% and 1.75% respectively for (Don't brush) group compared with 1.89%, 21.61% and 3% respectively for (brush) group] . Regarding the frequency of teeth brushing, sub group (twice daily) has more D1 (3.53%), D2 (22.35%) and D3 (24.71%) than the other sub groups, but it has less D4 (2.36%), D5 (35.29%) and D6 (11.76%). D5 (40.14%) and D6 (21.45%) were greater for sub group (Infrequently). Sub group (once daily) has greater D4 (3.46%) than the other sub groups.

The difference between brushing and do not brush groups was not significant, while the differences among brushing frequencies were statistically significant at *p* <0.0003 level.

Table (8): Relation between tooth brushing and dental caries.

Teeth brushing	No.	D1		D2		D3		D4		D5		D6	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Don't brush	57	3	0.66	82	17.9	89	19.43	8	1.75	192	41.92	84	18.34
Brush	474	12	1.89	107	16.88	137	21.61	19	3	249	39.27	110	17.35
Infrequently	186	4	1.38	40	13.84	59	20.42	8	2.77	116	40.14	62	21.45
Once daily	204	5	1.92	48	18.46	57	21.92	9	3.46	103	39.62	38	14.62
Twice daily	84	3	3.53	19	22.35	21	24.71	2	2.36	30	35.29	10	11.76

Mann-Whitney test between brushing and don't brushing; U = 16 *P*-value = 0.749 (not significant)
Kruskal-Wallis test among frequency of teeth brushing; Chi-square = 11.407 d.f. = 2   *P*-value = 0.003 (significant)

Table (9) and figure (2) show the categories of DMFT and caries free ages. DMFT was clearly increased from (6-8 years) to (≥15 years) groups for both males and females (6-8y, ♂: 0.11, 6-8y, ♀: 0.09, ≥15 y, ♂: 4.159, ≥15y, ♀: 3.894). for the groups (6-8y) and (9-11y), only the decay component was found (100%) without missing or filled teeth. At age groups (9-11y),(12-14y) and (≥15y), the (D) component began to reduce because of increasing (M) and (F) components. Missing permanent teeth appeared at age group (≥15y) only, while filled teeth appeared at age group (12-14y) and increased by increasing age to (≥15y) group.

The percentage of caries free students was large at age (6-8y, ♀); (90.62%) and (6-8y, ♂);(88.64%) but it was markedly reduced by increasing the age to reach (5.8%) for group (≥15y : ♂) and (7.24%) for group (≥15y : ♀). The differences were statistically not significant

Table (9): Distribution of Decayed, Missing and Filled teeth.

| Age	gender	No.	No.& %	DMFT	Decayed	Missing	Filled	Caries free
6-8 y	males	44	No.	5	5	0	0	39
			%	0.11	100	0.0	0.0	88.64
	female	32	No.	3	3	0	0	29
			%	0.09	100	0.0	0.0	90.62
	total	76	No.	8	8	0	0	68
			%	0.10	100	0.0	0.0	89.47
9-11 y	males	30	No.	8	8	0	0	23
			%	0.26	100	0.0	0.0	76.67
	females	32	No.	7	7	0	0	26
			%	0.21	100	0.0	0.0	81.25
	total	62	No.	15	15	0	0	49
			%	0.24	100	0.0	0.0	79.03
12-14 y	males	48	No.	56	53	0	3	10
			%	1.17	49.64	0.0	5.36	20.83
	females	55	No.	62	58	0	4	12
			%	1.12	93.55	0.0	6.45	21.82
	total	103	No.	118	111	0	7	22
			%	1.14	94.07	0.0	5.93	21.36
≥15y	males	138	No.	574	495	7	72	8
			%	4.159	86.24	1.22	12.54	5.8
	females	152	No.	592	463	10	119	11
			%	3.894	78.21	1.69	20.1	7.24
	total	290	No.	1166	958	17	191	19
			%	4.02	82.16	1.46	16.38	6.55
1 sample Kolmogorov-Smirnov test								
Z =				1.136	1.107	1.277	1.205	0.724
D (absolute) =				0.402	0.391	0.452	0.426	0.256
P =				0.151	0.172	0.076	0.110	0.672
Not significant								
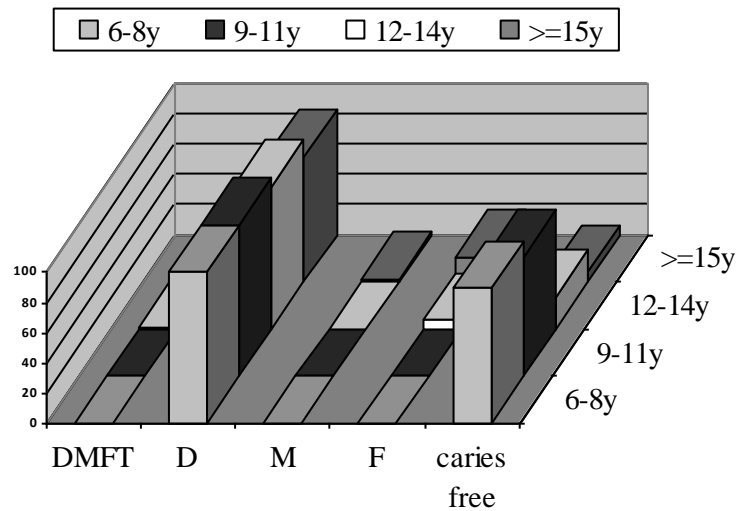
Figure (2): Distribution of Decayed, Missing and Filled teeth and caries free students.

Table (10) and figure (3) show the distribution of decayed, missing and filled teeth on each side of the mouth. Only small percent of upper anterior teeth (1.39%) were affected, while the lower anterior teeth were absolutely sound. For the upper, lower, right and left posterior teeth, the records were close to each other. When making a comparison between the total of all age groups, for the males the same percent was obtained for upper right and left teeth (21.46%) and a very close percent for lower right (27.84%) and lower left (27.99%) posterior teeth. For the females, the percentage for upper right (19.73%) was higher than upper left (16.72%) while a very close percents were obtained for lower right (31.93%) and lower left (31.92%) posterior teeth.

Neglecting the gender, DMFT in lower right posterior teeth was the larger (29.92%) followed by lower left (29 84%) then the upper right (20.58%) and finally the upper left posterior teeth (19.05%).

Table (10): Distribution of DMFT on the mouth.

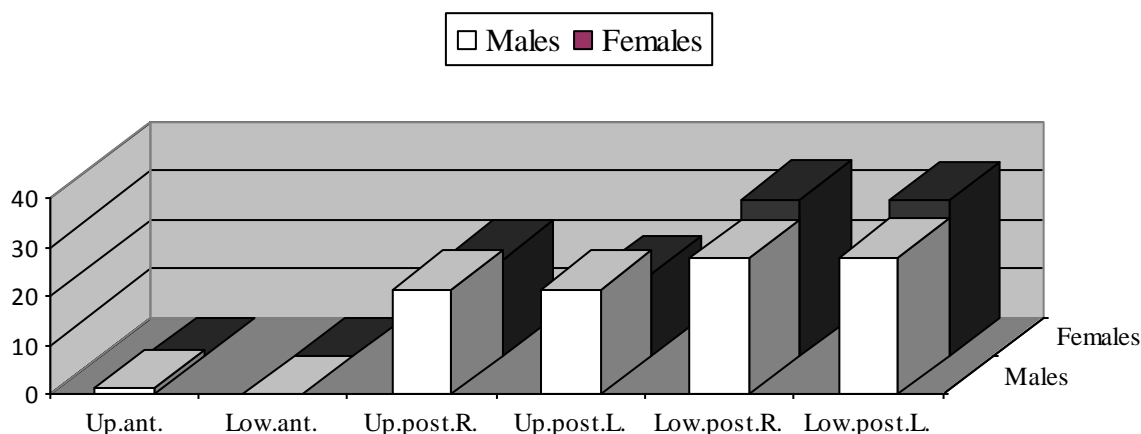| Age	gender	No.	No.&%	Up.Ant.	Low.Ant.	Up.Post.R	Up.Post.L	Low.post.R	Low.post.L
6-8 y	males	44	No.	0	0	0	1	2	2
			%	0.0	0.0	0.0	20	40	40
	females	32	No.	0	0	1	0	1	1
			%	0.0	0.0	33.33	0.0	33.33	33.34
9-11 y	males	30	No.	0	0	2	1	3	2
			%	0.0	0.0	25	12.5	37.5	25
	females	32	No.	0	0	1	1	2	3
			%	0.0	0.0	14.29	14.29	28.57	42.85
12-14y	males	48	No.	0	0	11	14	15	16
			%	0.0	0.0	19.64	25	26.79	28.57
	females	55	No.	0	0	15	14	17	16
			%	0.0	0.0	24.19	22.58	27.42	25.81
≥15 y	males	138	No.	8	0	125	122	159	160
			%	1.39	0.0	21.78	21.25	27.7	27.78
	females	152	No.	0	0	114	96	192	190
			%	0.0	0.0	19.26	16.22	32.43	32.09
Total Males		260	No.	8	0	138	138	179	180
			%	1.25	0.0	21.46	21.46	27.84	27.99
Total Females		271	No.	0	0	131	111	212	210
			%	0.0	0.0	19.73	16.72	31.93	31.62
Total males and females		531	No.	8	0	269	249	391	390
			%	0.61	0.0	20.58	19.05	29.92	29.84

Figure (3): Distribution of DMFT on the mouth.

DISCUSSION

This study presents for the first time data on the stages of carious process in a high- risk population group in Mosul City center. Secondly, the models estimated in the study incorporated community and individual risk indicators. Thirdly, the analysis focused on the components of the carious process, as this study has focused, have different determinants.

Non cavitated pits and fissures were the most prevalent caries stage (D2, D3), this finding is similar to those recorded for children by Ismail *et.al.*[12,19]

Patient oral hygiene performance was significantly and positively associated with the number of non cavitated tooth surface, the prevention group has the highest percentage for (D1, D2) components in contrast to extraction group (D3, D4) with statistical significant difference at *p*<0.001, also it was observed that those with improved oral hygiene status (twice daily brushing) and more frequently exposure to fluoridated tooth paste (although not recorded in the questionnaire) were less likely to have their non cavitated lesion progress to cavitation compared with those with poor oral hygiene status, that is to say (D1, D2, D3) components are more prevalent than (D4, D5, D6) with significant difference at *p*<0.003. This finding is similar to that of Ekstrand *et.al.* [20] which focused on that oral hygiene program in adolescent, is a major component of an overall preventive program, can significantly reduce dental caries.

This study clarified wide spread decayed teeth dominated the highest score being 100% at 6-8 years, indicating a high rate of unmet treatment needs. Missing teeth increased after 15 years old indicating the possibility that the low income minority population group (<500000) caries is managed through extraction or the people prefer to have their tooth extracted rather than restored.

Individuals who reported that they visited dentists for preventive care had significantly lower percentages of cavitated lesions (D4, D6) than those who visited a dentist for dental treatment. Also it was noted that severity of non cavitated increments (D1- D3) and D4 increased with increased level of education except D5 and D6, this result is in accordance with that of Ismail.[21]

As for the distribution of DMFT in the dental arches, lower right posterior teeth was higher than lower left, then upper right followed by upper left posterior teeth which was similar to Ricketts' *et al* study.[22] Because of the limited number of studies assessing dental caries increments in these age groups, particularly studies that included non-cavitated lesions making comparisons to other studies is difficult.

CONCLUSION

The risk indicators associated with non-cavitated carious lesions were age, educational level status reporting a history of a great deal of pain caused by teeth. Non cavitated, cavitated, filled and miss-

ing components of the carious process have different distributions and determinants. The use of ICDAS provided important information on caries distribution.

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