Prevalence and severity of dental caries (DMFS) in children and adolescent living in areas with neligible and above optimal natural fluoride contained in drinking water.

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Abstract:

The purpose of the study was to determine the prevalence and severity of dental caries using DMFS index in a group of school children lived in area with neligible and above optimal natural fluoride contained drinking water in Ninevah Governorate.

The study is conducted among (1724) schools students aged 11-16 years from randomly selected schools (primary and intermediate) in two provinces in Ninevah Governorate.

Nine hundred and eleven students who had lived since birth in area with neligible fluoride level (Talkaif) province (0.11-0.19 ppm) and (813) students lived continuously from birth in area with above optimal natural fluoride in their drinking water (Sinjar province) (2.05-2.22ppm).

WHO methodology (1997) has been used to assess the dental caries status using DMFS index for permanent teeth.

The results show that in Sinjar province the mean DMFS for total sample were (2.40) and (36.2%) are caries free with no sex differences, while there is a significant increase in the mean DMFS with increase the age.

On the other hand, in Talkaif province the results reveal higher DMFT (5•14) and lower percent of caries free students (19.1%) with high significant differences from Sinjar province. The mean DMFS reported more than twice in Talkaif province than Sinjar province.

The percentage of reduction of dental caries in area with fluoride (Sinjar province) has been found to be (55.3%) compare to area with neligible fluoride (Talkaif province).

Key words:

Fluoride, Water fluoridation, DMFS, Dental caries free, Dental caries, School children student

Introduction:

Dental caries is one of the common oral diseases. The prevalence of dental caries in Iraq is high in children and adolescents [1-3].

The benefits of water fluoridation on dental caries [4-6] prevalence have been repeatedly and widely demonstrated.

The recommended level of fluoride in water supplies is (0.7-1) ppm [7], and the excess of fluoride is caused mottled enamel [8-9]. Optimum concentration of fluoride in public water supplies has been proposed in

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various countries depending more on climatic information than on local epidemiological data[10].

The reduction in caries prevalence will mitigate many of sequalor of caries, such as pain and of tooth loss, fewer denture would need to be inserted malocclusion caused or aggravated by the tooth loss [11-14], also most studies have indicated that gingival and periodontal disease tend to be reduced by fluoridation to small but some time significant extent[13,15]. Another benefit of water fluoridation extent to the time and cost required for offering dental care for children, for different dental treatment [16, 17].

So fluoridation of water supplies at a recommended level of fluoride would there for improve dental health in all aspects [18].

The aim of study was to assess the prevalence and severity of dental caries in permanent teeth in a group of school children and adolescent aged (11-16) years old lived in area with high natural fluoride contained drinking water and compared with area with low natural fluoride contain to evaluate the percentage of reduction of dental caries.

Materials and methods:

The study was conducted in two district areas in Ninevah Governorate, one with drinking water containing high natural fluoride and the second area with drinking water containing naturally low level of fluoride.

The first area is Sinjar province with drinking water used containing (2.05-2.22ppm) fluoride and the source of water is tap water from borehole. The second area, other hand is Talkaif province with its drinking water containing (0.11-0.19ppm) fluoride and the source of water is public water supply from Tigris River. The two areas are nearly of the same socio-economic and educational status. The population of the study is students (girls and boys) aged from (11-16) years. They have been examined for estimation of prevalence of dental caries. The students have been examined either at primary or secondary schools, and the selection of schools has been done randomly. Four primary schools and tow secondary schools for boys and tow secondary schools for girls have been selected for each province and the classes selected are from fifth primary up to fourth intermediate classes.

All the students examined have lived continuously from birth on the district area from which they have been examined.

The students have been examined in a suitable room, and before examination any student that does not meet the age qualification or subject not born and lived in that areas has been excluded from the examination and also information regarding name, age and sex of the student has been registered prior to examination on a special from which contained the assessment of dental caries status.

This form contains also some questionnaires that the students have to be answering them before examination these questionnaires are about the students born area, also the students asked about using any form of fluoride supplements and if the answer is yes, the students excluded from the study.

Then the examination is done during the light hours in good natural light, using plane mirrors and sharp sickle probe with the students, setting in a chair front of the examination. Clinical examination of the teeth for detection of dental caries has been preformed according to the WHO guidelines using DMFS index for

permanent teeth. On this study only permanent has been included. Radiograph for detection of a proximal caries would not recommended because it is impracticability of using the equipment in all situations.

For calculating of DMFS for permanent teeth each decayed and filled surface of the tooth takes one point and missing tooth, retained root and temporary crown, the tooth takes 3 points (three surface) as an average for missing tooth surfaces [19].

The statistical analysis of the data, which was conducted using SPSS (for windows version 9.0), include the following:

1. Classification of data and calculation of frequencies.
2. Calculation of statistical parameters: the mean and standard deviation.
3. One way analysis of varience (ANOVA), followed by Duncan's Multiple Range test, was used to determine the significant difference between age groups and sexes of different age group of DMFT.
4. Chi-square test have been used for comparing the difference between two provinces for caries free students, and also for sex differences for the most affected teeth by dental caries.
5. Z-test has been used for determine the significant difference between the two provinces selected.
6. The differences were considered significant when the probability was less than (5%) level ($p<0.05$).

Results:

The distribution of the sample by age and sex is shown in table (1). The total sample is divided into two main groups. The first group consisted of 813 (47.15%) students lived continuously from birth in high level natural fluoride area (Sinjar province). This group is divided into three age groups. The second group consists of 911 (52.85%) students lived continuously from birth in low level natural fluoride area (Talkaif province), which was also subdivided into three age groups. The total sample consists from 1724 students, 969(56.2%) males and 755(43.8%) females.

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

Age (year)	Area	Males		Females	
		No.	%	No.	%
11-12	Sinjar	190	49.00	198	51.00
	Talkaif	185	45.12	228	54.80
13-14	Sinjar	194	70.50	81	29.50
	Talkaif	195	61.50	122	38.50
15-16	Sinjar	94	62.70	56	37.30
	Talkaif	111	60.00	70	40.00
Totals	Sinjar	478	58.79	335	41.21
	Talkaif	491	53.89	420	46.11
Total Sample		969	56.20	755	43.80

Table (2) shows the mean DMFS and its components for Sinjar province students. The mean for total sample is 2.40, mean DS=2.16, MS=0.17and FS=0.06.

The mean DMFS and its components appear to be increase with age of students. There is a significant difference between age group (11-12) years with age groups (13-14) and (15-16) years old for DMFS and DS only. On the other hand, it has been found that there is no significant difference between total boys and girls in mean DMFS and its components.

Table (2): Mean DMFS and its components ± SE by age and sex for Sinjar province students.

Age (year)	Sex	DMFS		DS		MS		FS	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
11-12	Male	$2.193^{(A)}$	0.192	$1.905^{(A)}$	0.176	$0.191^{(A)}$	0.060	$0.097^{(A)}$	0.016
	Female	1929^{a}	0.168	1.773^{a}	0.150	0.136^{a}	0.058	0.040^{a}	0.019
Total		1.929^{A}	0.168	1.773^{A}	0.150	0.136^{A}	0.058	0.040^{A}	0.009
13-14	Male	$2.700^{(AB)}$	0.223	$2.487^{(AB)}$	0.204	$0.187^{(A)}$	0.008	$0.026^{(A)}$	0.017
	Female	2.420^{a}	0.260	2.060^{a}	0.233	0.259^{a}	0.094	0.099^{a}	0.067
Total		2.614^{B}	0.175	2.360^{B}	0.159	0.208^{A}	0.056	0.048^{A}	0.023
15-16	Male	$2.968^{(B)}$	0.287	$2.777^{(B)}$	0.268	$0.192^{(A)}$	0.076	$0.021^{(A)}$	0.015
	Female	2.607^{a}	0.391	2.411^{a}	0.322	0.133^{a}	0.169	0.147^{b}	0.339
Total		2.833^{B}	0.231	2.640^{B}	0.204	0.200^{A}	0.079	0.180^{A}	0.135
Total males		2.500	0.135	1.949	0.118	0.179	0.035	0.122	0.063
Total females		2.261	0.135	1.949	0.118	0.179	0.035	0.122	0.063
Total sample		2.401	0.095	2.162	0.086	0.147	0.031	0.068	0.027

- Means with same letters refers to non-significant difference.
- Capital letters in brackets show Duncan results for males between age groups.
- Small letters show Duncan results for females between age groups.
- Capital letters without brackets show Duncan results for totals between age groups.
- There was no significant difference between total males and females when Z test is applied.

Table (3) shows the mean DMFS and its components for Talkeif province students. The mean DMFS for total sample is 5.14, mean DS= 5.03, MS=0.05 and FS=0.08.

Table (3): Mean DMFS and its components ± SE by age and sex for Talkaif province students.

Age (year)	Sex	DMFS		DS		MS		FS	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
11-12	Male	$4.054^{(A)}$	0.279	$3.930^{(A)}$	0.267	$0.087^{(A)}$	0.043	$0.070^{(A)}$	0.047
	Female	4.089^{a}	0.296	4.107^{a}	0.291	0.013^{a}	0.013	0.045^{a}	0.023
Total		4.073^{A}	0.184	4.007^{A}	0.179	0.046^{A}	0.021	0.056^{A}	0.025
13-14	Male	$5.133^{(B)}$	0.337	$5.047^{(B)}$	0.328	$0.062^{(A)}$	0.031	$0.031^{(A)}$	0.026
	Female	5.000^{a}	0.373	4.943^{a}	0.367	0.049^{a}	0.035	0.033^{a}	0.020
Total		5.082^{B}	0.252	5.003^{B}	0.246	0.057^{A}	0.023	0.032^{A}	0.018
15-16	Male	$7.955^{(C)}$	0.528	$7.846^{(C)}$	0.524	$0.040^{(A)}$	0.001	$0.099^{(A)}$	0.044
	Female	7.122^{b}	0.638	6.500^{b}	0.580	0.203^{b}	0.088	0.419^{b}	0.177
Total		7.622^{C}	0.407	7.314^{C}	0.393	0.081^{A}	0.036	0.227^{B}	0.076
Total males		5.365	0.218	5.259	0.213	0.057	0.020	0.061	0.023
Total females		4.985	0.210	4.771	0.200	0.097	0.020	0.107	0.035
Total sample		5.145	0.152	5.034	0.147	0.057	0.014	0.082	0.020

- Means with same letters refers to non-significant difference.
- Capital letters in brackets show Duncan results for males between age groups.
- Small letters show Duncan results for females between age groups.
- Capital letters without brackets show Duncan results for totals between age groups.
- There was no significant difference between total males and females when Z test is applied.

The mean DMFS and DS increase significantly with age of the students. The MS score also increases with age, but with no significant difference between age groups. On the other hand, the FS score for age group (15-16) years old reported a significant higher score than the other two age groups. The total girls reported low score of DMFS and DS than boys with no significant difference between them.

Table (4) demonstrates the percentages of caries free students (DMFS=0) for the three age groups for both provinces. The study indicated that the percentage of caries free students is (36.4%), in Sinjar province and (19.1%) in Talkaif province with very high significant difference between them. While there were no differences between boys and girls in Sinjar province, and in Talkaif the boys reported slightly higher percentage than girls with no significant difference between them. The percentage of caries free children decreases with increasing age in Sinjar province. When caries free for Sinjar students is compared with that for Talkaif students using X^2 test, high significant differences is observed in all age groups.

Table (4): Caries free children by age and sex (expressed as No. and % for both studied provinces).

Age	Sex	Sinjar			Talkaif			X^2	P
		No.	Caries free students		No.	Caries free students			
			No.	%		No.	%		
11-12	Male	190	83	43.7	185	38	20.5	23.34	<0.001
	Female	198	80	40.4	224	38	17.0	28.38	<0.001
Total		388	165	42.0	409	76	18.6	51.75	<0.001
13-14	Male	194	64	33.5	195	47	24.1	4.17	<0.001
	Female	81	25	30.9	122	21	17.5	5.41	<0.001
Total		275	89	32.17	317	68	21.0	9.37	<0.001
15-16	Male	94	24	25.5	111	17	15.3	3.32	<0.001
	Female	56	17	30.4	74	13	17.6	2.8	<0.015
Total		150	41	27.3	189	30	16.2	6.13	<0.001
Total Males		476	171	36.0*	491	102	20.8*	27.41	<0.001
Total Females		335	122	36.4*	420	72	17.1*	36.44	<0.001
Total Sample		813	293	36.2	911	174	19.1	63.27	<0.001

* No significant difference between males and females using X^2 test.

To compare between the mean DMFS for Sinjar and Talkaif provinces, Z-test is applied, the results are listed in table (5) with p-value and percent of caries reduction. The results show that the Sinjar students have lower DMFS than Talkaif students with high significant difference between them P<0.001. the percentage of reduction in DMFS varies with age groups. It was (50.2%) in (11-12) years old; (48.5%) for (13-14) years old and (62.8%) for (15-16) years old. The reduction for total sample is 55.3%, and there were no difference between the boys (53.1%) and girls (54.6%) in percentage of reduction dental caries.

Table (5): The percentage of reduction and difference between DMFS scores for Sinjar and Talkaif province students.

Age	Sex	DMFS Sinjar	DMFS Talkaif	% Reduction	Z	P-value
11-12	Male	2.193	4.054	46.0	5.34	<0.001
	Female	1.929	4.089	52.8	11.43	<0.001
Total		2.015	4.073	50.2	9.30	<0.001
13-14	Male	2.700	5.133	47.3	5.75	<0.001
	Female	2.420	5.000	51.6	6.93	<0.001
Total		2.614	5.082	48.5	6.55	<0.001
15-16	Male	2.968	7.955	62.6	7.05	<0.001
	Female	2.607	7.122	63.6	5.79	<0.001
Total		2.833	7.622	62.8	6.55	<0.001
Total Males		2.500*	2.365	53.5*	9.55	<0.001
Total Females		2.261*	4.985	54.6*	11.10	<0.001
Total Sample		2.401	5.175	55.3	14.45	<0.001

* No significant difference between males and females using X^2 test.

Discussion:

The effect of fluoride ion on reducing the dental caries experience, especially at 1 ppm in temperature climate of concentration, regarded the fluoride as the most important factor for the controlling of dental caries [19-21].

The presence of natural fluoride in high concentration exceeding the optimal level, will reduce the dental caries and unfortunately results in unacceptable appearance of enamel of the teeth, so the study of different concentration of fluoride and their effects on producing dental fluorosis is very important to be correlated with their effect on reducing the dental caries experience [22-24].

This was the first study carried out in Iraq to evaluate the prevalence and severity of dental caries in permanent teeth using DMFS index in areas with different natural fluoride level concentration in their drinking water supplies (high and low fluoride areas).

The study shows that the mean DMFS for high fluoride area for (11-12)years age group was (1.92) and (4.07) for low fluoride area. The mean in low fluoride area in this study is more than those obtained by Angillillo et al [20], Ellwool and owullance [25], while the result in high fluoride area is found to be less than other study [26] and nearly the same of Driscoll et al [19].

The study demonstrates that the percentage of reduction in DMFS for total age group is (55.3%) and the percentage of reduction for age group (15-16) years is (62.8%) which was more than that of Marry et al [27].

It is obvious from the results of this study that the student from Sinjar province has less mean DMFS than Talkaif province. This expressed in a form of percentage of reduction which is due to the difference in fluoride level in both areas of study.

In general, we can observe that the percentage of reduction of dental caries increases with the increasing of the age of students and this agreed with observation of other study [28]. The slight increase in percentage of reduction is mainly observed in percentage of 2nd molar teeth affected by dental caries.

The percentage of caries reduction is nearly the same of many studies carried out in areas used optimum fluoride level in drinking water supplies [19, 29-31].

The results of study reveal that the percentage of caries free students in high fluoride area is (36.2%) and (19.1%) for low fluoride area. This percentage in a high fluoride area, is higher than that observed by Forrest [32] in both (Westmersa and Harwich). Also it was higher than that in Tweerivier [26] and Szpnnar and Burt [29], and nearly the same of that Nourivier and lower than that of other areas.

The variation in the mean DMFS value and the percentage of caries free students reported in different studies may be attributed to the difference in dietary habits, especially the consumption of refine sugars between different individuals as in studies carried out in developed countries in (1950)s, (1960)s, they reported a high prevalence of dental caries. Also it may be attributed to the use of other preventive measures other than fluoride in water like the use of fluoride supplements and fissure sealant especially in developed countries as in studies carried out in (1980)s and (1990)s that reported a decline in dental caries because of the

use of the preventive measures [33, 34]. Also may be the use of different diagnostic criteria in various studies may cause this variation.

However, what is obvious in this study that the mean DMFS increases with the increasing of the age of students with statistically significant age difference and the percentage of caries free decrease with age. This finding gives agreement with many studies [20, 27, 34]. This fact is attributed to the irreversibility accumulation nature of dental caries.

The finding of study indicates no significant difference between boys and girls in the mean DMFS. This is in accordance with results of other studies [33, 35, 36].

The study revealed that the decayed component of the DMFS scores had the greatest values when compared to missing and filled surfaces in both provinces. This means that the presence of a high percentage of caries teeth is untreated. This result is in agreement with other studies carried out in third world countries [1, 37, 38] and in contrast with the results reported in developed countries, when the majority of DMFS index was formed of filled teeth [39, 40]. This finding reveals the limited restorative approach in most of developing countries, which is due to the limited resources, in addition to lack of dental awareness. Also it may be attributed to the expensive therapeutic measurements and restriction of resources which is due to the embargo imposed on Iraq. So the great emphasis should be directed toward primary prevention of dental disease, the dental health education of the population about the decrease of sugar consumption, control of the availability of sugar containing products and reducing the frequency of sugar consumption between meals in order to reduce caries activity.

According to the study finding, the mean missing component of DMFS of Talkaif is three times more than that of Sinjar. This reflects the benefit of fluoride in drinking water for reducing the evidence of tooth loss due to caries.

From the results of this study, we can easily recognize that there is a great difference observed between the two provinces in prevalence of dental caries and this difference is found to be with high significance, this is due to the fact that the difference in concentration of fluoride in their drinking water supplies. This agreed with all studies carried out in two areas with different level of fluoride in their drinking water [21, 30, 34, 38].

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