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Prevalence of dental fluorosis among primary school children in Thamar–Yemen.

Faraed D Salman
BDS, MSc (Lect)

Dept of Pedod, orthod, and Prev Dentistry
College of Dentistry, University of Mosul

ABSTRACT

Aims: To determine the prevalence and severity of dental fluorosis in relation to age and sex for primary school children, aged 6 – 12 years old in Thamar -Yemen. **Material and methods**: The study included 600 primary school children aged 6, 9 and 12 years old randomly selected (300 males, 300 females) in Thamar – Yemen, who had lived since birth in moderate natural fluoride level (1.8 – 2.2 ppm) by the use of Dean index to assess dental fluorosis. **Results:** Showed that the prevalence of dental fluorosis was 19.83 % and 5.23 % within students and teeth respectively, ranging from very mild to moderate form of dental fluorosis with no significant sex difference for individuals at $p \leq 0.05$ as total and significant difference between males and females for teeth as total at $p \leq 0.001$, the percentage of severity had been found to be increasing with age. The community fluorosis index for Thamar Province was 0.4 %, which was regarded low. **Conclusion:** The prevalence of dental fluorosis had been increased with increasing age with no sex difference.

Key words: Dental fluorosis, community fluorosis index, natural water fluoridation.

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INTRODUCTION

Several studies have been concerned on occurrence of mottling and other enamel defects in areas where various concentrations of fluoride in drinking water exists, their aim being to establish optimal level.[1–5] Fluoride concentration increases exponentially from a plateau level in the enamel interior to a relatively high concentration at tooth surface, this general pattern hold for both primary and permanent teeth.[6–8] The pattern of fluoride concentrateon changes with age, e.g. in young anterior teeth surface it was highest in the first formed enamel near incisal edge and decreased steeply toward the more recently formed cervical region.[9] Fluoride level is greatest in young people during the period of bone growth.[10]

Aims of the study was carried out to determine the prevalence and severity of dental fluorosis in children 6–12 years old in Thamar–Yemen, and to determine sex difference between different age groups

MATERIAL AND METHOD

The survey was conducted during the period between November 2000–January 2001, on 600 students (300 males and 300 females) aged 6, 9, 12 years old that selected randomly. Students examined had lived continuously from birth in the district areas of moderate natural fluoride level (1.8–2.2 ppm) according to WHO report[11], from which they had been examined.

The students had been examined in a suitable room under natural day light using plane mouth mirrors, sharp sickle shaped caries explorers. Any student that didn't born or live in that area had been excluded from the examination. Also information regarding name, age and sex of the student was registered prior to the examination on a special form which contained the assessment of dental fluorosis index. Also the student was asked about using any form of fluoride supplements and if the answer was yes, the student was excluded from the study.

All the examined teeth were dried with cotton wool, the tooth was considered a fully erupted when at least 2/3 of the crown erupted with no gingiva covering it, retained roots were excluded from the examination. The diagnosis was recorded according to the criteria of Dean index.[12]. Each

tooth had been graded as normal or one of the following degrees of fluorosis (Questionable, very mild, mild, moderate and severe) for assessment of prevalence of dental fluorosis within individual as follows:

Score 0: Normal, the enamel surface is smooth, glossy and usually a pale creamy–white colour.

Score 0.5: Questionable, the enamel shows slight aberrations from the translucency of normal enamel, which may range from a few white flecks to occasional spots.

Score 1: Very mild, small, opaque, paper – white areas scattered irregularly over the tooth but involving less than 25 % of the labial tooth surface.

Score 2: Mild, the white opacity of the enamel of the teeth is more extensive than for code 1, but covers less than 50 % of the tooth surface.

Score 3: Moderate, the enamel surfaces of the teeth show marked wear and brown stain is frequently a disfiguring feature.

Score 4: Severe, the enamel surfaces are badly affected and hypoplasia is so marked that the general form of the tooth may be affected. There are pitted or worn areas and brown stains are widespread; The teeth often have a corroded appearance.

These degrees of fluorosis had been given a grading equivalent to that attached to most two severely affected teeth, and if the assessment differ, the rating was the lesser of the two.[13]

In addition for assessing the degree of dental flourosis within individual, Dean[14] devised means of calculating the degree of fluorosis within a community by the use of community fluorosis index.

$$\text{Community Fluorosis Index} = \frac{\Sigma \text{ Number of individual x Statistical weight}}{\text{Total Number of individual Examined}}$$

Data were analyzed using numbers of students, teeth and percentages. X^2 test was used for determining sex differences for all forms of dental fluorosis within students and teeth. Kruskal Wallis test was used to find differences according to age (males, females and total). The differences were considered significant at $p \leq 0.05$.

RESULTS

The distribution of the sample by age and sex was shown in Table (1). The total sample was divided into three age groups 6, 9, 12 years old lived continuously from birth in moderate natural fluoride le-vel area, each group consisted of 200 students (100 males and 100 females) each consisted 50 % of the age group.

Table (2) showed the number and percentage of students who suffered from dental fluorosis in Thamar Province. The results of the study showed that (80.17 %) of the students had normal teeth, which means that (19.83%) of the individuals had dental fluorosis. The percentage of normal individuals decreased with increasing the age of the students, this difference was statistically significant at $P \leq 0.05$. The results showed that the very mild and moderate forms of dental fluorosis had the higher percentages in all age groups and for the total sample. The results revealed that the severity of dental fluorosis increased with increasing age of the student. The total males reported more severe dental fluorosis in (mild and severe) than females, these sex differences were found to be not significant.

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

Age (year)	Males		Females	
	Number	%	Number	%
6	100	50	100	50
9	100	50	100	50
12	100	50	100	50
Total sample	300	50	300	50

Table (2): Number and percentage of students distributed according to Dean index of fluorosis by age and sex

Age (year)	Sex	No.	Dean Index											
			Normal		Questionable		Very mild		Mild		Moderate		Severe	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6	M	100	92	92	1	1	3	3	2	2	1	1	1	1
	F	100	90	90	0	0	6	6	0	0	3	3	1	1
	Total	200	182	91	1	0.5	9	4.5	2	1.0	4	2.0	2	1.0
9	M	100	84	84	1	1	4	4	1	1	8	8	2	2
	F	100	77	77	1	1	9	9	4	4	7	7	2	2
	Total	200	161	80.5	2	1.0	13	6.5	5	2.5	15	7.5	4	2.0
12	M	100***	70	70	0	0	9	9	6	6	10*	10	5	5
	F	100***	68	68	4	4	13	13	4	4	9	9	2	2
	Total	200***	138	69.0	4	2.0	22	11.0*	10	5.0*	19	9.5**	7	3.5
Total males	No.	300	246	82.0	2	0.67	16	5.33	9	3.0	19	6.33	8	2.67
	%	50	51.14		28.57		36.36		52.94		50		61.54	
Total females	No.	300	235	78.33	5	1.67	28	9.33	8	2.67	19	6.33	5	1.67
	%	50	48.86		71.43		63.94		47.06		50		38.46	
Total sample	No.	600	481	80.17	7	1.17	44	7.33	17	2.83	38	6.33	13	2.17
	%	100	100		100		100		100		100		100	

M: Male; F: Female; No: Number of sample

******* Significant difference between age groups for males at $p \leq 0.05$, the same for females and total using Kruskal Wallis test (df= 2).****** At $p \leq 0.05$. ***** At $p \leq 0.05$, for total males and females (df = 1).

Table (3) showed the number and percentage of students' teeth affected by dental fluorosis. The results showed that the very mild form of dental fluorosis had a higher percentage for the total sample (1.99%) and for all age groups followed by moderate, mild forms of dental fluorosis as decreased the percentage with the decrease of the severity with significant difference between total males and females for very mild, mild forms at $P \leq 0.05$. The study revealed that the severity of dental fluorosis increased with age. The total females reported more severe dental fluorosis than males in categories (questionable, very mild, mild, severe) forms with significant difference between them at $P \leq 0.05$.

Table (4) reported the number of students in Thamar Province distribution according to Dean index categories from (0) to (4). The table showed the statistical weight of each category:

$$\text{Community Fluorosis Index for Thamar} = \frac{247.5}{600} = 0.412\%$$

DISCUSSION

This was the first study conducted in Thamar–Yemen concerning the prevalence of dental fluorosis on this age group.

The criteria selected for assessment of dental fluorosis is by Dean index [12]. This criteria depended on the clinical appearance of the teeth and not on the histological background, so it was a simple description pattern and easy to be used to identify groups of lesions that were likely to be good reflection of the prevalence and severity of dental fluorosis within students considered. Also, it enabled the user to have a clear picture about the community fluorosis score, which can be calculated in very simple equation.

Thamar Province is considered a moderate fluoride level area (1.8 – 2.2 ppm) [11], and the fluoride level was twice the recommended optimum level of fluoride. The study of different concentrations of fluoride and their effects on producing dental fluorosis is very important if it exceeds the optimal level resulting in unacceptable appearance of enamel of the teeth. [13 – 16] The results revealed a prevalence of dental fluorosis of about 19.83 % and 5.23 % for individuals and within the teeth of the students respectively. These two percentages were considered as a low prevalence of dental fluorosis, this result was in agreement with other studies in areas with nearly the same level of fluoride in their drinking water. [17 – 19]

Table (3): Number and percentage of students' teeth distributed according to Dean index of fluorosis by age and sex

Age (year)	Sex	No.	Dean Index											
			Normal		Questionable		Very mild		Mild		Moderate		Severe	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6	M	100	1933	96.65	8	0.40	22	1.10	23	1.15	2	0.10	12	0.60
	F	100	1937	96.85	0	0.0	38	1.90	9	0.45	12	0.60	4	0.20
	Total	200	3870	96.80	8	0.20	60	1.50	32	0.80	14	0.30	16	0.40
9	M	100	2708	96.71	8	0.29	17	0.61	19	0.68	31	1.11	17	0.60
	F	100	9616	93.43	34	1.21	62	2.22	45	1.61	27	0.96	16	0.57
	Total	200	5324	95.07	42	0.75	79	1.41	64	1.41	58	1.04	33	0.59
12	M	100	3009	94.03 ***	12	0.38	65	2.02 ***	21	0.66	71	2.22 ***	22	0.69
	F	100	2960	92.50 ***	34	1.06 ***	115	3.59 ***	34	1.07 ***	51	1.59 ***	6	0.19*
	Total	200	5969	93.27 ***	46	0.72 ***	180	2.81 ***	55	0.86	122	1.90 ***	28	0.44**
Total males	No.	300	7650	95.62	28	0.35	104	1.30	63	0.79	104	1.30	51	0.64
	%	50	50.45		29.17		32.60		41.72		53.60		66.23	
Total females	No.	300	7513	93.90*	68	0.85*	215	2.69*	88	1.10*	90	1.13	26	0.33*
	%	50	49.55		70.83		67.40		58.28		46.40		33.77	
Total sample	No.	600	15163	94.77	96	0.60	319	1.99	151	0.94	194	1.22	77	0.48
	%	100	100		100		100		100		100		100	

M: Male; F: Female; No: Number of samples.

Significant difference between total males and females at $P \leq 0.05$ (df= 1). ******* Significant difference between age groups for males at $p \leq 0.05$, the same for females and total using Kruskal Wallis test (df= 2). ****** At $p \leq 0.05$. ***** At $p \leq 0.05$, for total males and females (d.f. = 1).

Table (4): Number of students for each category of Dean index and its statistical weight for Thamar province.

Number of students	Score	Statistical weight
481	0	0
7	0.5	3.5
44	1	44
17	2	34
38	3	114
13	4	52
600		247.5

This low prevalence of dental fluorosis compared with the concentration of fluoride in drinking water had been found to be related to the low temperature of climatic condition of the province especially in winter season lead to the low attitude of the individual for consumption of small quantity of water from the bore hole. In addition to that, they drink canned bottle water lead to decrease in fluoride concentration reaching the body of the individual during teeth formation which will affect teeth and create dental fluorosis. Also the difference between examiners in interpretation of criteria of the index used may cause this variation of prevalence in dental fluorosis. [16]

These low percentages of dental fluorosis were in accordance with other studies in areas with the same level of fluoride in their drinking water [17, 18] than within teeth. [19, 20]

The highest type of dental fluorosis was very mild to moderate form for the in-

dividual and very mild for teeth, and this had given a support to findings of many studies. [2, 3, 21, 22]

Also this study revealed an increase in the severity of dental fluorosis with the increasing of age of the students, this was due to accumulative nature of dental fluorosis and this agreed with the result of Vincent *et al*.,[15] who found no association between the age of the individual and percent of occurrence of dental fluorosis. This increase has been found to be very little for individual but for the teeth it was 50 % increased from age group 6 and 9 also this was represented by the eruption of permanent teeth during mixed dentition stage that cause this increase in prevalence of dental fluorosis within teeth while there was no difference between 9 and 12 years old because almost teeth except canines had already been present.

Sex difference that had been found in this study was not significant for individuals, this result was in agreement with other studies. [15, 23–25]

The percentage of dental fluorosis was 19.83 % for individual and 5.23 % within teeth. This low prevalence reflected the low consumption of bore hole water in comparison to the concentration of fluoride in drinking water, the individual prevalence was found to be similar to that of other studies. [22, 25, 26] The prevalence on the teeth was nearly the same of other studies. [20, 22, 27]

The community dental fluorosis index for Thamar Province was 0.41 %, it was accordance with other studies of Dean *et al*.,[28] and Segretto *et al*., [2,22] this prevalence of community fluorosis index was in accordance with other studies of the same fluoride concentration in drinking water.[26, 28] Since Yemen is a primitive country, so the main source of dental fluorosis is from drinking water and not from other supplements.

CONCLUSION

Throughout all studies carried out in this field, it is apparent that there is optimal level of fluoride in drinking water of beneficial dental effects that is with 1 ppm of fluoride, there will be esthetically accepted development.

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