Prevalence and association of dental caries and dental fluorosis in fluoride endemic region of Mewat district, Haryana, India

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Abstract

Introduction: High fluoride concentration in drinking water causes dental fluorosis. Also fluoride is used to prevent dental caries as fluoride combines with calcium from teeth and forms calcium fluorapatite crystals which are resistant to acid dissolution. But dental caries is also prevalent among those having dental fluorosis. The present study aims to determine the prevalence of dental caries and dental fluorosis and an association between dental caries and dental fluorosis in the fluoride endemic region of Mewat district, Haryana.

Materials and Methods: A total of 800 students aged between 10-18 years in various schools of the Mewat district of Haryana were examined for dental caries and fluorosis which were divided into 3 groups as Group I(10-12 years), Group II(13-15 years) and Group III(16-18 years) using DMFT index and Dean's Fluorosis index (modified criteria-1942) respectively.

Results: Out of 800 students examined, 635(79.4%) had caries while 165(20.6%) had no caries. In case of fluorosis prevalence, 407(50.8%) students had no fluorosis whereas 393(49.21%) had fluorosis. When association between fluorosis and caries was seen, 328(41%) had both dental caries and fluorosis.

Conclusion: According to the results of the present study, significant association between dental caries and dental fluorosis was observed in age group 10-12 years. In addition, DMFT score was high in students having fluorosis mainly in age group 13-15 years which shows direct relationship among caries prevalence and fluorosis.

Keywords: Dental caries, Dental fluorosis, Dean's Fluorosis Index (modified criteria 1942), DMFT index.

Introduction

Dental caries is the most common oral disease amongst children and adolescents.[1,2] According to Miller,[3] when acidogenic microorganisms of saliva act on the accumulated carbohydrates from food, an acid is produced which dissolves the inorganic part of the tooth. The proteolytic enzymes produced by the proteolytic organisms dissolve the organic portion of the tooth. This explains the mechanism of dental caries development in a tooth.[4] Fluoride is used in dentistry to prevent caries by forming calcium fluorapatite crystals. It is seen that tooth which has calcium fluorapatite crystals is resistant to dissolution by acid and thus is resistant to caries.[5]

On the contrary, excessive fluoride intake causes dental fluorosis. In areas where dental fluorosis is an endemic disease, usually prevalence of dental caries is also seen among the persons who consume fluoridated water.[6] Thus fluoride is a double edged sword which when used in optimal quantity and judicious manner, offers maximum caries protection whereas injudicious and excessive consumption may cause fluoride toxicity in the form of dental and skeletal fluorosis. According to World Health Organization (WHO), the level of fluoride in drinking water which is permissible has been established as 0.5-1.5 mg/l (parts per million).[7] This value is determined according to the esthetic acceptability of fluorosis, rather than the action of fluoride in prevention of caries.[8]

Dean et al[9] studied the effect of fluoride on prevention and control of dental caries in the United States of America in 1940s. Since then, various studies have been conducted which stated a direct relationship between fluoride and fluorosis and an inverse relation between fluoride and dental caries, but the number of studies which investigated the association between endemic fluorosis and dental caries is scarce.[10,11] Some recent studies suggested that defects in enamel in hypoplastic teeth also including severe dental fluorosis may promote dental caries.[12-14]

The association between dental caries and endemic fluorosis has not been extensively researched in epidemiological studies in various states of India, hence the present study was conducted to assess the relation between the prevalence and severity of fluorosis and dental caries in the Mewat district in Haryana which is predominantly rural (88.61%) with a literacy rate of 54.08%.[15,16] Majority of the population uses underground water for domestic and irrigation purpose. The fluoride consumption is in the form of fluoridated water which is sourced from wells and hand pumps.[17] The district has been declared endemic fluorosis area according to National Program for Prevention and Control of Fluorosis (NPPCF) 2014, given by Ministry of Health and Family Welfare, Government of India.[18]

Materials and Methods

Before conducting the study, ethical clearance was obtained from the institutional ethical committee of SHKM Government Medical College and Hospital, Mewat (Code no IEC-19) and informed consent was taken from the administrative and school authorities along with parents/guardians of the students. A total of 800 students aged between 10-18 years in various schools of the Mewat district of Haryana were examined for dental caries and fluorosis. The students were divided into 3 groups as Group

I (10-12 years), Group II (13-15 years) and Group III (16-18 years). The study was carried out by single trained researcher who had sound knowledge of the coding systems used in the study. The students were examined clinically in natural day light with the help of diagnostic instruments. Dental fluorosis among the students was assessed using Dean's Fluorosis Index (Modified criteria- 1942)[19] wherein 2 severely affected teeth were observed for grading of fluorosis and graded as normal, questionable, very mild, mild, moderate and severe by giving the scores as 0,0.5,1,2,3,4 respectively. DMFT index (decayed, missing and filled teeth) for permanent dentition was used for determining the prevalence of dental caries. Each tooth was assessed and coded according to the criteria prescribed by World Health Organization (WHO).[20] The data obtained was assessed in SPSS statistical software. Chi-square test was used for comparing caries prevalence and fluorosis in different age groups separately and student t-test to compare means of DMFT score in different age groups. The alpha level of significance was considered at 5%, that is, p-values less than 0.05 were considered significant.

Results

Out of 800 students examined, distribution of different grades of fluorosis is as shown in Fig. 1 where 407 students had no or questionable fluorosis while only one student had severe fluorosis. Rest of the students were in the category of very mild, mild and moderate fluorosis. While examining caries prevalence, 635 (79.4%) students had caries while 165(20.6%) had no dental caries. Caries prevalence in three different age groups is shown in Fig. 2 where Group II (61.4%) had highest incidence of caries. Fig. 3 depicts distribution of fluorosis prevalence in three different age groups where Group II had highest prevalence of fluorosis as 231 students (58.8%) had fluorosis and Group III had lowest prevalence of fluorosis as 72 students (18.3%) in this group had fluorosis. Fig. 4 shows gender wise distribution of caries and fluorosis where 289 males and 104 females had fluorosis while 458 males and 177 females had caries. DMFT scores of the three groups have been tabulated in Table 1 while Tables 2-5 depict association of caries with fluorosis in different age groups and in total.

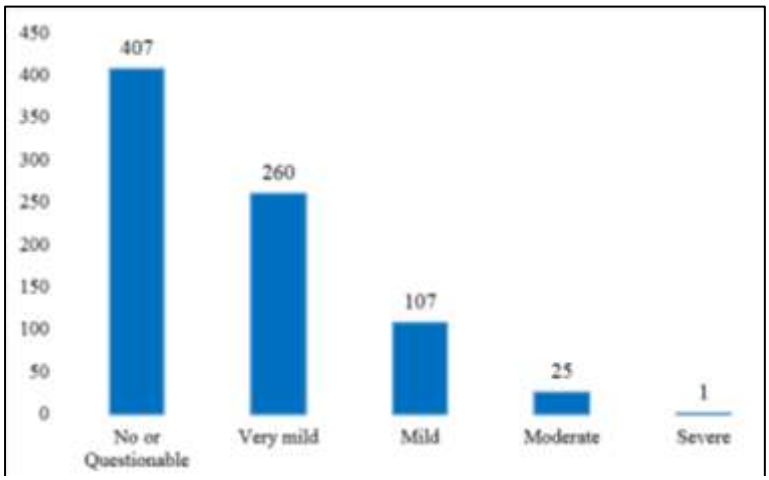

Fig. 1: Distribution of grades of fluorosis

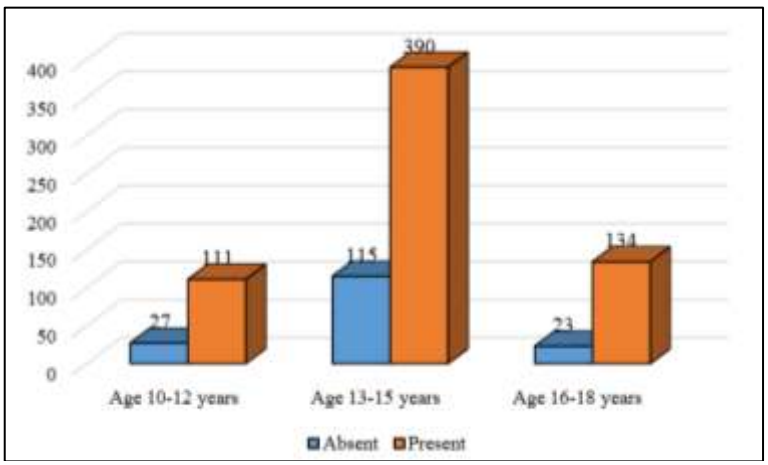

Fig. 2: Prevalence of caries in different age groups

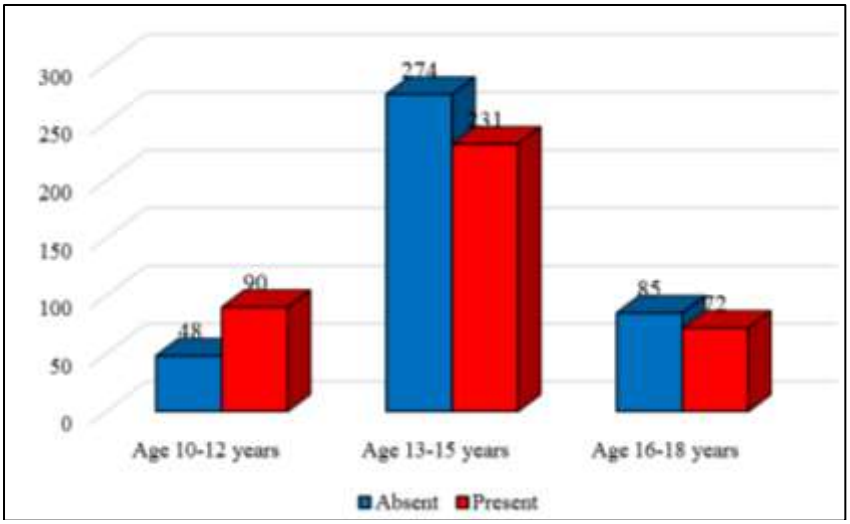

Fig. 3: Prevalence of fluorosis in different age groups

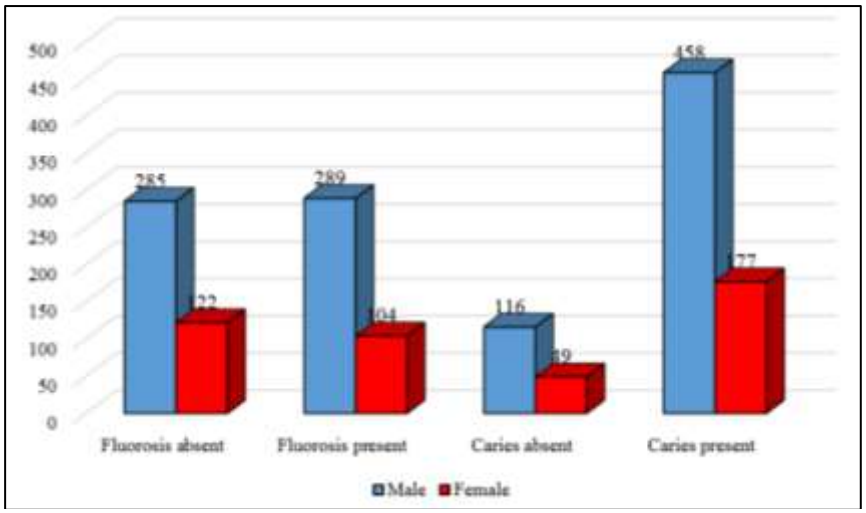

Fig. 4: Gender wise distribution of fluorosis and caries

Table 1: Different DMFT scores in different age groups in comparison to fluorosis

Groups	Condition	Mean ± SD Number of affected Teeth			
		Decayed	Missing	Filled	DMFT
Group I	No Fluorosis	2.23 ± 2.16	0.02 ± 0.14	0	2.21 ± 2.17
	Fluorosis	2.98 ± 2.34 (p>0.05)	0 (p>0.05)	0.02 ± 0.15 (p>0.05)	3 ± 2.33 (p>0.05)
Group II	No Fluorosis	3.18 ± 2.97	0.01 ± 0.09	0.01 ± 0.12	3.2 ± 2.96
	Fluorosis	4.25 ± 3.08 (p<0.001)	0 (p>0.05)	0.07 ± 0.65 (p>0.05)	4.22 ± 3.11 (p<0.001)
Group III	No Fluorosis	4.18 ± 3.25	0.04 ± 0.19	0	4.21 ± 3.28
	Fluorosis	5.13 ± 3.09 (p>0.05)	0.06 ± 0.29 (p>0.05)	0 (p>0.05)	5.18 ± 3.11 (p>0.05)

Table 2: Association of caries and fluorosis in age group 10-12 years

	Caries	No Caries	Total
Fluorosis	77	13	86
No Fluorosis	33	15	48
Total	106	28	134

Chi square χ^2=5.67, p value=0.01

Table 3: Association of caries and fluorosis in age group 13-15 years

	Caries	No Caries	Total
Fluorosis	186	45	231
No Fluorosis	203	71	274
Total	389	116	505

Chi squareχ^2=2.93, p value=0.08

Table 4: Association of caries and fluorosis in age group 16-18 years

	Caries	No Caries	Total
Fluorosis	65	7	72
No Fluorosis	69	16	85
Total	134	23	157

Chi squareχ^2=2.58, p value=0.10

Table 5: Association of caries and fluorosis in total cases

	Caries	No Caries	Total
Fluorosis	328	65	393
No Fluorosis	305	102	407
Total	633	167	800

Chi square χ^2=361.27, p value=0.00

Discussion

Dental caries and fluorosis have been studied together in various populations worldwide to notice the relationship between these conditions with controversial results.[11,21,22] but there is no consensus on whether dental fluorosis increases, decreases or has no effect on the risk of dental caries.[23]Only few studies have been conducted in the state of Haryana.[24]

In the present study, caries prevalence was found to be 79.4% which is quite higher in comparison to National Oral Health Survey which states that caries prevalence was increasing with age from 51.9% to 63.1% in 5-15 years age group.[25] According to the study conducted by Kotecha et al in a district of Gujarat state,, the prevalence of dental fluorosis in high fluoride area where drinking water fluoride level was more than 1.5mg/l was 59.31%.[26] Another study conducted by Choubisa reported the prevalence of dental fluorosis as 45% among 21 different villages in southern Rajasthan where fluoride concentrations in drinking water range from 1.5 to 4.0 ppm.[27] A study conducted in an isolated village in Maharashtra also found the prevalence of dental fluorosis as 43%.[28] In the present study, 49.1% prevalence of fluorosis was seen in the study population which is comparable to these studies inspite of different levels of fluoride in drinking water.

In case of caries prevalence in the present study, Group I (10-12 years), had caries prevalence of 17.5% while in Group II (13-15 years), it was 61.4%. Also, in Group III (16-18 years), prevalence of caries was 21.1% which is almost similar to a study conducted by Ganesh et al[29] in which the students were grouped according to the levels of fluoride in drinking water in the area and the study was conducted on students aged 15-17 years. While comparing the caries prevalence amongst male and female students, in the present study, 79.8% of males and 78.3% of females had caries while in the study conducted by Ganesh et al,[29] 28% males and 25.1% females had dental caries. Also, in the present study while studying prevalence of fluorosis among male and female students, 50.34 % males and 46.01 % females had fluorosis while in the study conducted by Kotecha et al,[26] prevalence of dental fluorosis in high fluoride area was 61.30% in males and 57.26% females.

In the present study, in Group I (10- 12 years), 22.9% prevalence for fluorosis was there while in Group II (13-15 years) it was 58.8% and in Group III (16-18 years) it was 18.3% while in a study conducted by Costa et al[30] in rural districts of Minas Gerais, Brazil with endemic fluorosis, prevalence was found to be 34.6% in 10-12 year old children, 46.7% in 13-15 year olds and 48.7% in those aged between 16-22 years.

While studying the association between dental fluorosis and dental caries, it was found that in Group I, those having fluorosis had mean DMFT score of 3 which is in contrast to the study conducted by Costa et al[30] where the mean and median values of DMFT in individuals aged between 10 and 12 years were low, 1.38 and 0.00 respectively. In present study, Group II and Group III, students who had fluorosis had a DMFT score of 4.22 and 5.18 respectively, which is almost similar to the study conducted by Ganesh et al[29] where DMFT score for all fluorosis groups was 2 to 5. In our study there was a significant difference (p<.001) when DFMT score was compared between persons having fluorosis and those having no fluorosis in the age group 13-15 years.

There was a significant association (p<.001) of dental fluorosis with dental caries in total number of cases examined in our study as shown in Table 2. When examined in different age groups a significant association (p<0.05) was examined in the age group of 10-12 years. Our study is in conformity to various previous studies conducted in Rajasthan (India),[31] Sri Lanka,[32] Iran,[33] Ethiopia,[34] Mexico[35] and Western Sahara.[22]

Conclusion

According to the results of the present study conducted in an endemic fluorosis district of Haryana (Mewat), a significant association between dental caries and dental fluorosis is observed in age group 10-12 years. Also DMFT score was high in students having fluorosis mainly in age group 13-15 years which shows direct relationship among the caries prevalence and fluorosis. Hence there is a need for community health activities and awareness programs to improve oral health of the people in this particular stratum of population.

Conflict of Interest: None.

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