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PREVALENCE OF DENTAL FLUOROSIS IN 6-12-YEAR-OLD CHILDREN IN DISTRICT HAPUR, UP- AN EPIDEMIOLOGICAL STUDY

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ABSTRACT

Background: Despite remarkable achievements in the oral health of populations globally, problems still remain in many communities worldwide in which dental fluorosis is one of the most common oral health diseases in endemic belt.

Aim: To evaluate the prevalence of dental fluorosis in 6-12 years old school going children of District Hapur, Uttar Pradesh.

Methodology: An epidemiological study was carried out on 1500 school going children from 20 schools located in urban and rural areas of 5 zones of Hapur district. A prior permission was taken from all the 20 schools and informed consent was sent to the schools prior to the day of examination. Dental fluorosis was assessed by Dean's fluorosis index. Children were assessed for caries correlation with dental fluorosis using the DMFT index. Data was entered into MS excel and analysed with statistical software SPSS.

Result: Dental fluorosis was highly observed in 11-12-year age group with 88.68% (p=0.001). Dental fluorosis's distribution among various geographical zones was highly statistically significant with highest in zone 1 and zone 5 (p=0.001).

Conclusion: The findings highlight an urgent need to provide defluoridated drinking water in the affected villages to lower the burden of dental fluorosis and improve their quality of life.

Key words: Prevalence, fluorosis, DMFT, Caries, fluoride, Zone, DFI

BACKGROUND

The state of one's teeth has a direct bearing on their general health.1 The World Health Organization has set an upper limit of 1.5 mg/l for fluoride level in drinking water, however the Bureau of Indian Standards only permits up to 1.0 mg/l of fluoride.2. Fluoride is a two-edged sword: excessive and negligent usage can result in dental and skeletal fluorosis, yet optimal and sensible use can protect against caries to the maximum extent feasible[3].

Dental fluorosis is a disorder that develops in the early stages of tooth formation. During the tooth-development process, fluoride crystals are incorporated and then fix and emerge as fluorapatite. This results in the abnormally pitted enamel surface's ameloblasts and odontoblasts, the tooth production organs, being destroyed.

The literature presents mixed results about the connection between fluoride levels in drinking water and dental cavities.10,11 Dental caries must be prevented since it can have a major negative influence on public health in underdeveloped countries.12,13 Of the 25 nations on the planet, dental caries trends are on the rise in India. It's a slowly developing illness that has migrated to places with limited dental treatment facilities, low public health knowledge and motivation, and increased use of refined carbohydrates.14. Fluoride mapping and the national oral health survey conducted in India showed that dental caries was common in children between the ages of 12 and 15, with rates of 53.8% and 63.1%, respectively.15. Drawing from an extensive analysis, a meta-analysis, and studies conducted in 2020[16]

The national oral health survey and fluoride mapping conducted in India showed that dental caries was common in children between the ages of 12 and 15, with rates of 53.8% and 63.1%, respectively.15 It has been observed that the prevalence of dental caries in India is 54.16% overall and 57% among children aged 3 to 18 years, based on a thorough investigation, meta-analysis, and research from 2020—2024.16. Oral health policies and programs at the national level are critically needed to lessen the cause. Fluorosis and tooth decay are becoming serious problems. The implementation of suitable public health policy interventions is necessary to lower the incidence of dental fluorosis in India. The availability of relevant national statistics is a prerequisite for this. Several publications have listed the districts' zonal distribution; nonetheless,

AIM

Aim of the study was to determine the prevalence of DF in children of 6-12 years age group attending school in District Hapur, Uttar Pradesh through an epidemiological study. The objectives of the study are (1) To assess the DF prevalence in 6-12 years old children enrolled in 20 school in the Hapur District, Uttar Pradesh. (2) To evaluate the severity of DF among school attending children lying in the age group of 6-12 years using DFI. (3) To correlate prevalence of DF with DMFT index.

METHODOLOGY

1. **Sources of Data:** This study was carried by the Department of Pediatric and Preventive Dentistry, Shree Bankey Bihari Dental College and Research Center, Ghaziabad Uttar Pradesh, among 20 different schools located in urban and rural areas of 5 different zones of Hapur district.

2. **Type of study/study design:** The present study is an epidemiological study.
   The study comprised a total of 1500 students in the 6–12 age range from 20 schools spread over urban as well as rural areas of 5 zones of the Hapur district. Before starting the study, approval was taken from the Institutional Ethical Committee. Permission letter for the parents was taken from all the schools before commencing the study. The children whose parents willingly signed the consent form were included in the study.

3. **Feasibility**
   A pilot study was performed on 50 students pursuing education in schools located in

Hapur district to assess the feasibility.

A. Inclusion criteria-

i. Age group of 6-12 years.
ii. Children who had more than half of the crown of their permanent teeth erupted and norestorations on facial aspect of the tooth.
iii. Children who were lifelong inhabitants of Hapur district since birth.
iv. Children who have been getting their drinking water from groundwater since birth.

B. Exclusion criteria-

i. Children undergoing permanent or removable orthodontic treatment.
ii. Children having anteriors that are carious or absent.
iii. Children with dentofacial deformities or any syndrome.
iv. Children having other than fluorosis stains are excluded.
v. Children with crowns.
vi. Medically and physically compromised patients
vii. Condition for which pre-medication is necessary before a dental appointment or treatment
viii. Severe dental tartar (calculus) or moderate to advanced periodontal disease.
ix. Children who were either new or temporary residents of the study region weren't permitted to participate.
x. Children who were migrants from another place or who were not permanent residents ofthe area.
xi. Children that have a history of consuming water from multiple sources during their firstten years of life.
xii. Children whose teeth had extensive external stains that made it impossible to determinetheir fluorosis.
xiii. Parents who did not give consent.

4. **Data collection**

A. Sample size

According to the results of the pilot study, which involved 50 students pursuing education in schools located in hapur district, the sample size was calculated where the prevalence were calculated to be 32% using the following formula.

$$N = [Z2 * p * (1-p) / d2]$$

Where, p: Expected prevalence = 0.6 or 60%, d: absolute precision required on either side of prevalence = 0.23 or 5%, Z: 1.96.

Using nMaster software (version 2, CMC, Vellore), the sample size was assessed. With the expectation of a 60% prevalence of DF among children aged 6 to 12 in the Hapur district, an absolute precision of 5% and a 95% Confidence range, and a design effect of 4, a sample size of 1476, rounded to 1500, was found to be sufficient.

For the study, a total of 1500 students from 20 schools spread over 5 zones of the Hapur district—20 of which are in urban and rural areas—of both sexes were chosen.

The following Hapur district zones were involved:

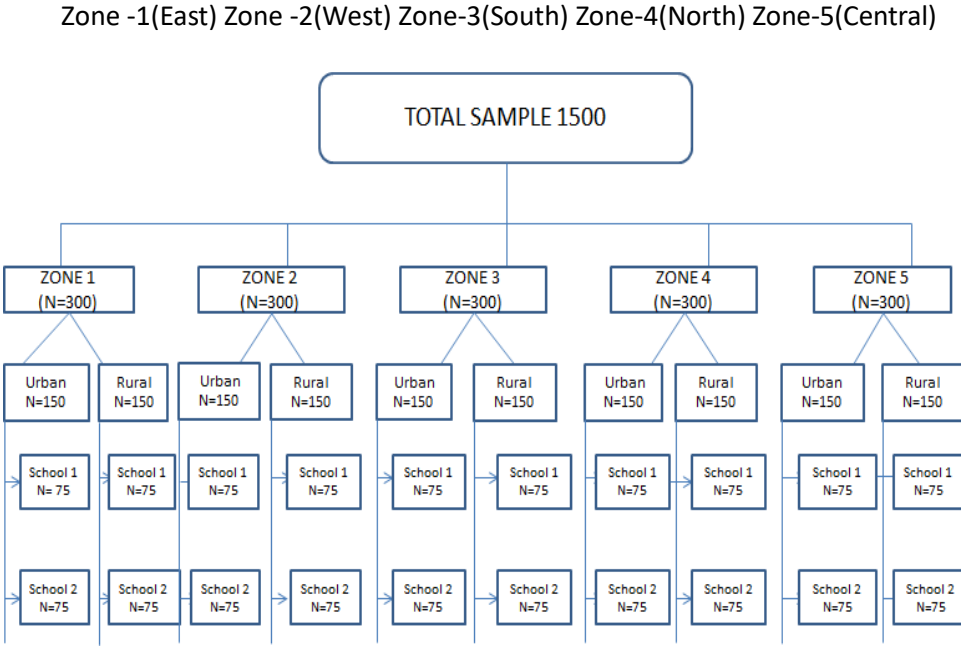

Figure 1:
Study Design

5. **Method of data collection**

1500 School children of age 6-12 years fulfilling the selection criteria were included.

To prevent inter-examiner bias, a single examiner conducted the clinical examination on school premises in a setting with adequate natural light.

Prevalence of dental fluorosis was assessed using the Dean's fluorosis index.
Dental caries was assessed by DMFT criteria.

6. **Statistical analysis**

Microsoft Excel 2007 was used to enter the data for this study, and SPSS statistical

software, version 23.0, was used for analysis. The mean, standard deviation, frequency, and percentage were among the descriptive statistics. For this study, the significance level was set at five percent.

One Way ANOVA and independent t tests will be used for the intergroup comparison. The Chi Square test was used to compare the category variables. Levene's test was used to examine the homogeneity of the variables, and the Shapiro-Wilk test was used to investigation the distribution of the data.

TABLE 1, GRAPH 1: AGE WISE DISTRIBUTION OF PREVALENCE OF DENTAL FLUOROSIS

Table 1, Graph 1 represents the age wise prevalence of DF in the study sample. The prevalence of DF across the different age groups was in the range of 75-90%. The highest prevalence of DF was recorded in the 11-12 years .The lowest prevalence of DF was observed in the 9-10 years. A highly statistically significant difference was seen in age wise distribution of DF(p=0.001).

GRAPH 1: AGE WISE DISTRIBUTION OF PREVALENCE OF DENTAL FLUOROSIS

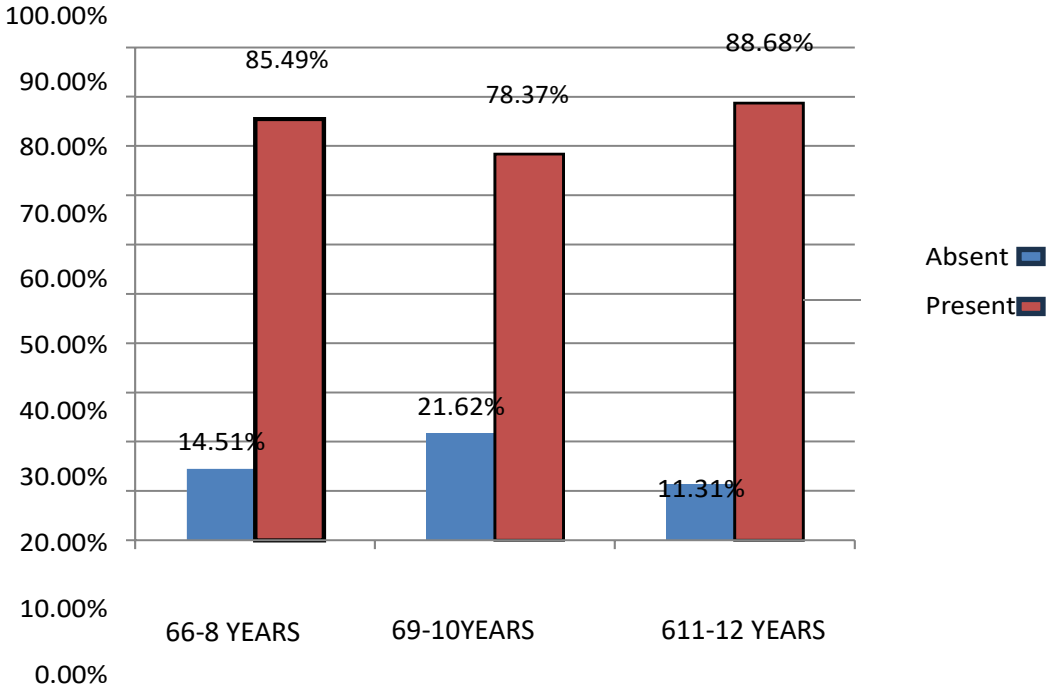

TABLE 1: AGE WISE DISTRIBUTION OF PREVALENCE OF DENTAL FLUOROSIS

	Absent	Present	Chu Square value	P value
6-8 years	71	418	12.781	0.001 (Sig)
	14.51%	85.49%		
9-10 Years	125	453		
	21.62%	78.37%		
11-12 Years	49	384		
	11.31%	88.68%		

TABLE 2, GRAPH 2: ZONE WISE PREVALENCE OF DENTAL FLUOROSIS

The prevalence of DF was highest in the Zone -1 (89.70%) and Zone -2 (87.00%). The prevalence of DF was lowest in the Zone -5 (76.50%). In the Zone -4 and Zone -3 the prevalence of DF was 83.30% and 81.70%. The variability in the distribution of DF across different geographical zones was highly statistically significant with p value of 0.001.

TABLE 2: ZONE WISE PREVALENCE OF DENTAL FLUOROSIS

	Absent	Present	Chi Square value	P value
Zone-1	31	269	22.003	0.001 (Sig)
	10.3%	89.70%		
Zone-2	39	261		
	13.0%	87.00%		
Zone-3	55	245		
	18.3%	81.70%		
Zone-4	50	250		
	16.7%	83.30%		
Zone-5	70	230		
	23.3%	76.50%		

GRAPH 2: ZONE WISE PREVALENCE OF DENTAL FLUOROSIS

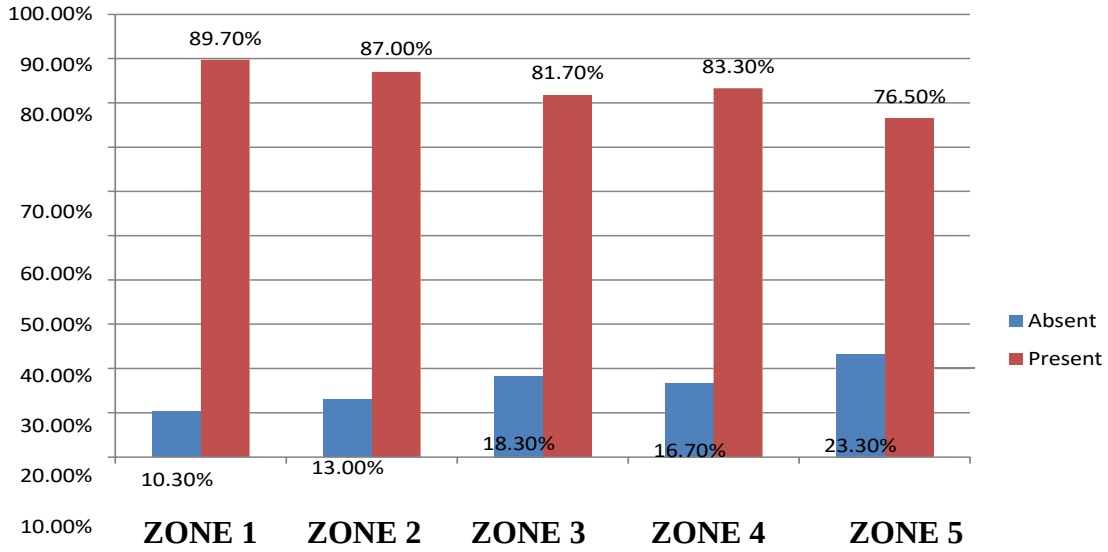

TABLE 3: ZONE - WISE SEVERITY OF DENTAL FLUOROSIS

In Zone 1, maximum participants, 37.3% were having mild dental fluorosis.
In zone 2, maximum participants, 25.3% were having very mild dental fluorosis
In zone 3, maximum participants, 21.7% were having mild dental fluorosis.
In Zone 4, maximum participants, 32.3% were having very mild dental fluorosis.
In Zone 5, maximum participants, 23.3% were having normal teeth.
The association between the severity of DF and zonal distribution was found to be statistically significant with most severe form of DF in Zone 1 and Zone -2.

TABLE 3: ZONE - WISE SEVERITY OF DENTAL FLUOROSIS

	Normal	Questionable	Very Mild	Mild	Moderate	Severe	P value
	31	14	32	112	66	45	
Zone-1	10.3%	4.7%	10.7%	37.3%	22.0%	15.0%	
Zone-2	39	58	76	44	30	53	
	13.0%	19.3%	25.3%	14.7%	10.0%	17.7%	0.001
Zone-3	55	48	61	65	39	32	(Sig)
	18.3%	16.0%	20.3%	21.7%	13.0%	10.7%	
Zone-4	50	68	97	39	36	10	
	16.7%	22.7%	32.3%	13.0%	12.0%	3.3%	
Zone-5	70	46	64	37	46	37	
	23.3%	15.3%	21.3%	12.3%	15.3%	12.3%	

TABLE 4. GRAPH 4: PREVELANCE OF DENTAL FLOUROSIS BETWEEN RURAL AND URBANAREAS

In eachof the zone the prevalence of DF was significantly higher in the rural area as compared to the urban area.(p=0.01).

TABLE 4: PREVELANCE OF DENTAL FLOUROSIS BETWEEN RURAL AND URBAN AREAS

		Normal	Questionable	Very Mild	Mild	Moderate	Severe	P value
Zone- 1	Urban	20	8	18	53	30	21	0.001 (Sig)
		13.33%	5.33%	12%	35.33%	20%	14%	
	Rural	11	5	19	58	31	26	
		7.33%	3.33%	12.67%	38.67%	20.67%	17.33%	
Zone- 2	Urban	25	33	41	18	12	21	0.001 (Sig)
		16.67%	22%	27.33%	12%	8%	14%	
	Rural	14	29	38	23	19	27	
		9.33%	19.33%	25.33%	15.33%	12.67%	18%	
Zone- 3	Urban	34	30	36	24	16	10	0.001 (Sig)
		22.67%	20%	24%	16%	10.67%	6.67%	
	Rural	21	24	31	35	23	16	
		14%	16%	20.67%	23.33%	15.33%	10.67%	
Zone- 4	Urban	30	39	53	14	12	2	0.001 (Sig)
		20%	26%	35.33%	9.33%	8%	1.33%	
	Rural	20	34	46	23	21	6	
		13.33%	22.67%	30.67%	15.33%	14%	4%	
Zone- 5	Urban	49	30	35	15	13	8	0.001 (Sig)
		32.67%	20%	23.33%	10%	8.67%	5.33%	
	Rural	21	21	28	25	27	28	
		14%	14%	18.67%	16.67%	18%	18.67%	

GRAPH 4: PREVELANCE OF DENTAL FLOUROSIS BETWEEN RURAL AND URBAN AREAS

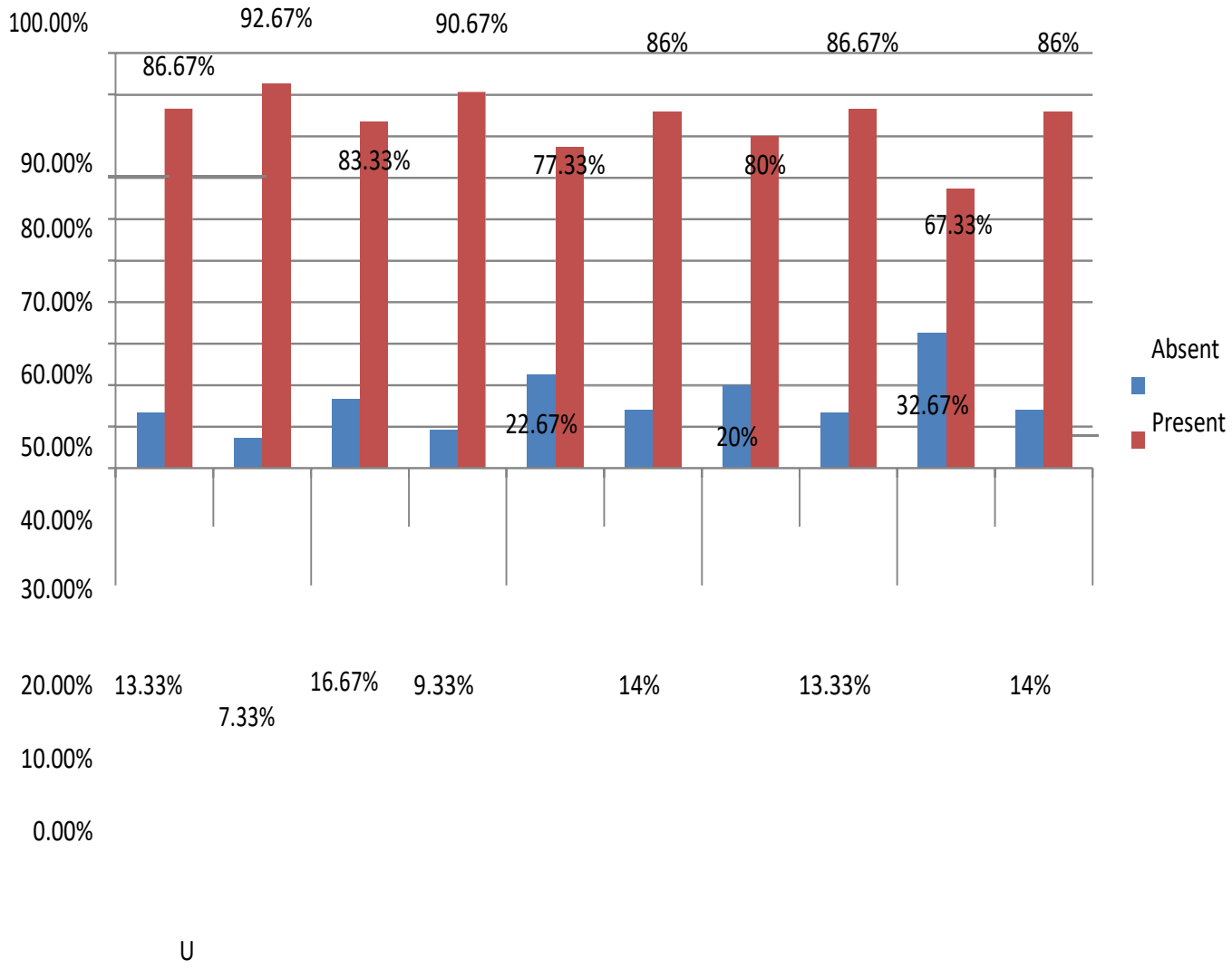
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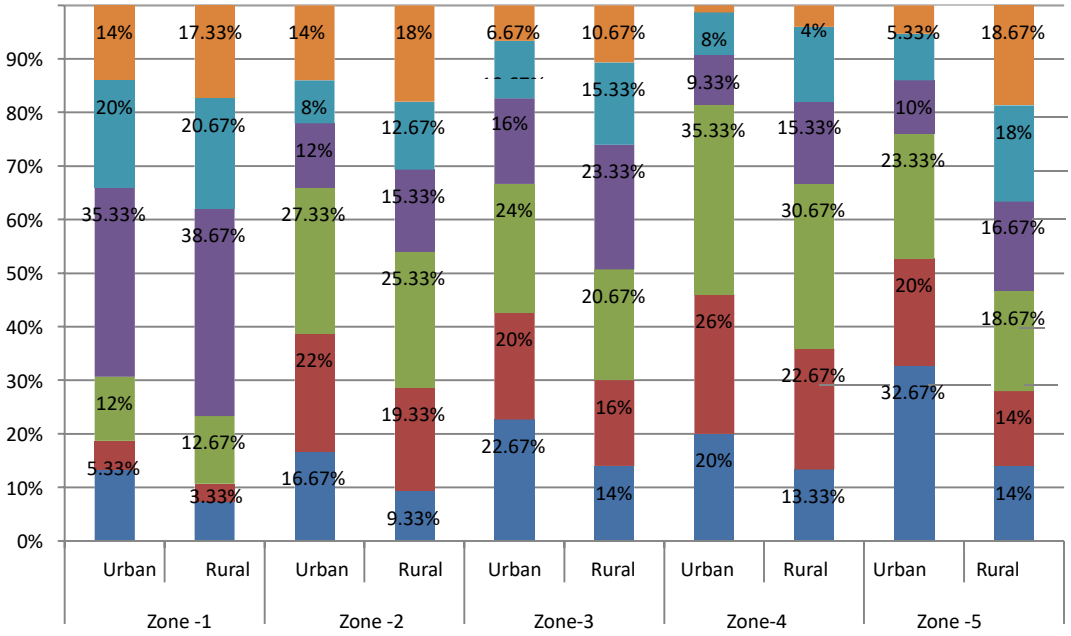
TABLE 5, GRAPH 5: SEVERITY OF DENTAL FLUOROSIS IN RURAL AND URBAN REGIONS

In each of the zone the severity of dental caries was significantly higher **(Severe and Moderate Category Scores)** in the rural area as compared to the urban area

TABLE 5: SEVERITY OF DENTAL FLUOROSIS IN RURAL AND URBAN REGIONS

		Normal	Questionable	Very Mild	Mild	Moderate	Severe	P value
Zone- 1	Urban	20	8	18	53	30	21	0.001 (Sig)
		13.33%	5.33%	12%	35.33%	20%	14%	
	Rural	11	5	19	58	31	26	
		7.33%	3.33%	12.67%	38.67%	20.67%	17.33%	
Zone- 2	Urban	25	33	41	18	12	21	0.001 (Sig)
		16.67%	22%	27.33%	12%	8%	14%	
	Rural	14	29	38	23	19	27	
		9.33%	19.33%	25.33%	15.33%	12.67%	18%	
Zone- 3	Urban	34	30	36	24	16	10	0.001 (Sig)
		22.67%	20%	24%	16%	10.67%	6.67%	
	Rural	21	24	31	35	23	16	
		14%	16%	20.67%	23.33%	15.33%	10.67%	
Zone- 4	Urban	30	39	53	14	12	2	0.001 (Sig)
		20%	26%	35.33%	9.33%	8%	1.33%	
	Rural	20	34	46	23	21	6	
		13.33%	22.67%	30.67%	15.33%	14%	4%	
Zone- 5	Urban	49	30	35	15	13	8	0.001 (Sig)
		32.67%	20%	23.33%	10%	8.67%	5.33%	
	Rural	21	21	28	25	27	28	
		14%	14%	18.67%	16.67%	18%	18.67%	

GRAPH 5: SEVERITY OF DENTAL FLUOROSIS IN RURAL AND URBAN REGION



DISCUSSION

In the mineralization stage of development, enamel absorbs fluoride. People five years of age and older are more likely to exhibit dental mottling, which typically affects permanent teeth. Therefore, the widespread dental fluorosis in developing youngsters is believed to be an expression of the current fluorosis problem.[18] In preventive dentistry, fluoride application has been shown to be one of the most effective interventions. It is also acknowledged as the keystone of dental caries prevention techniques, as dental caries is a major global health, economic, and social concern.[19]

There were fifteen hundred students in the six to twelve year age range. There was no statistically significant difference ($p>0.05$) between the age group of 9–10 years (38.5%), 6–8 years (32.5%), and 11–12 years (28.6%) as the minimum and maximum number of research participants. The entire frequency of fluorosis was found to be between 75 and 90 percent in the various age groups. The age group of 11–12 years old had the highest prevalence (88.68%), while the age group of 9–10 years old had the lowest prevalence (78.37%), with a highly significant statistical difference ($p=0.001$). Shashi A et al. (2011) also found that 91.12% of subjects had DF.Twenty In comparison to other earlier research, a higher prevalence was seen in the current investigation. (2003)21 Chandrashekar J et al. in Davangere

The zonal distribution of DF indicated a statistically significant difference with Zone -1 being most affected (89.70%), followed by Zone -2 (87%) and least affected zone was Zone -5 (76.50%) ($p=0.001$). Also, in each of the zone the prevalence of DF was significantly higher in the rural area as compared to the urban area($p=0.01$). These findings were in line with those of Handa S et al. (2016), who deduced a high prevalence (46%) of fluorosis, ofwhich 11.23% had moderate and 9.6% had severe cases, with a higher frequency of rural population being affected. The increased prevalence of DF in the rural area may be attributed to lack of access to treated drinking water in the rural areas and its prolonged intake. Previously, hand pumps served as the sole water source in Hapur. However, in recent years, tap water distribution has been implemented in urban areas. The increased temperatures may also contribute to the need for higher water consumption.

In the current study, an inverse relationship was observed between DFI and the DMFT scores .'with a statistically significant linear correlation ($p<0.05$). Our findings align with the previous research by Tuli A et al and Shanthi M, who noted an inverse relationship between caries and DF but were in contrast to the results deduced by Wondwossen F et al; while another study by Esa R et al reported no significant relationship. It is well-established that fluoride enhances dental health by integrating into the tooth's crystalline structure, forming fluorapatite, which is more resistant to solubility than hydroxyapatite, thus preventing demineralization or decay. Fluoride also promotes remineralization of the tooth surface, inhibits bacterial metabolism, and prevents plaque formation. Therefore, an inverse association between DF and dental caries was observed in this study.

CONCLUSION

1. DF was most commonly recorded in age of 11-12 years, and the least in of 9-10 years with a highly statically significant difference (p=0.001).
2. There was no statistically significant difference in distribution of DF between males and female study subjects.
3. The distribution of DF across different geographical zones was highly statistically significant (p=0.001). In each of the zone, the prevalence of dental caries was significantly higher in the rural areas as compared to the urban areas (p=0.01).
4. An inverse correlation was inferred between the severity of DF and mean DMFT scores.

CLINICAL SIGNIFICANCE

Epidemiological national based data/survey is in utmost need to solve the major oral health
Problems, dental fluorosis and dental caries. National oral health policies and programmes need to be laid down with modified formulations.

Oral health treatment should be enlisted for low economic people under several on-going policies like railways, Ayushman Bharat, state government schemes, private sector job employees, etc.. at the hospitals or health care centres at discounted rates.

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