

Prevalence of dental fluorosis among school children residing in Kanpur City, Uttar Pradesh, India

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ABSTRACT

Objective: The objective was to find the prevalence of dental fluorosis among school children residing in Kanpur city, Uttar Pradesh India. **Materials and Methods:** A total of 1343 school children, residing in the city since childhood and consuming the groundwater, in the age group of 7–17 years was selected from various schools. Schools were selected from all four directions of the city. Children were categorized in five age groups and were examined for dental fluorosis. Dean's criteria for assessment of dental fluorosis were used, and observations were recorded on a study specific performa. **Results:** Among the 1343 children examined, 243 (18%) were found to be having dental fluorosis, among which number of males (131) was more than females (112). Among the different grades of fluorosis observed, mild dental fluorosis was observed in most of the cases (158). It was observed that the southern part of the city had a maximum number of cases of dental fluorosis. **Conclusion:** It was evident from the results that the city had a good number of cases of dental fluorosis and that the groundwater in certain areas had more than normal quantity of fluoride. Since this study was the first attempt in this area, more studies can be undertaken to substantiate our findings.

Key words

Dean's fluorosis index, dental fluorosis, Kanpur, school children

INTRODUCTION

Fluorine is a naturally occurring element and is one of the essential microelement required for proper growth and function of the body. It exists in nature as complex form referred to as fluoride. Fluoride is found most frequently in groundwater due to weathering and leaching of fluoride-bearing minerals from rocks and sediments. India lies in the geographical fluoride belt that extends from Turkey to China and Japan through Iraq, Iran, and Afghanistan.^[1]

Fluoride content has always been a concern for health care professionals as the deficiency of the element fluoride has been associated with defective enamel formation in teeth and the excess has been associated

with skeletal and dental fluorosis. Hence, it is important that the fluoride consumption should be at an optimum level for proper development of the calcified tissues.

In India, 62 million people including 6 million children, are estimated to have serious health problems due to consumption of fluoride contaminated water.^[2] About 96% of the fluoride is found in bones and teeth.^[3] When ingested in small quantities (<0.5 mg/L or 0.7 ppm) fluoride is beneficial for teeth by reducing dental caries, whereas ingestion of higher concentrations (>1.5 mg/L) may cause fluorosis. Dental fluorosis manifests as opaque white spots or lines, and in severe cases, enamel becomes discolored and brittle, leading to chipping.^[4,5] In India, Prakasam district of Andhra Pradesh was the first place where fluorosis was detected^[6] and at that time, the disease was prevalent in only four states, namely Andhra Pradesh, Tamil Nadu, Punjab, and Uttar Pradesh. Now, fluorosis has been reported endemic in 20 out of 32 constituent states of India^[7] and day by day more new areas have been engulfed by this problem.

The occurrence of dental, skeletal fluorosis, and muscular fluorosis has been reported by various studies conducted^[8-10] in Unnao District of Uttar Pradesh and the cause has been related to the use of fluoride

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contaminated ground water. However, no attention has been paid so far to the huge industrial city of Kanpur, which is just adjacent to Unnao district and also part of Indo-Gangetic plain.

Kanpur is an important Industrial town of Uttar Pradesh with industries ranging from that of food products to tanneries. The city harbors a large number of populations because of its industrial significance and so it is home for many. Although there is a central water supply in the city but most of the people rely on groundwater for drinking and domestic purpose.

People who consume ground water have higher chances of developing dental fluorosis because of the higher level of fluoride in deep groundwater of the city as reported by the Water Department of Kanpur district^[11] and other literature.^[12,13] No study showing the prevalence of dental fluorosis has been carried out so far in this region.

Keeping this in mind, the study was undertaken to know the prevalence of dental fluorosis among school going children residing in the Kanpur city of Uttar Pradesh, India.

MATERIALS AND METHODS

This study was aimed to estimate the prevalence and severity of dental fluorosis among 7–17 years old school going children of Kanpur city, Uttar Pradesh, India. For study purpose, the entire geographical area of Kanpur was divided into four zones: North, West, South, and East. Schools were selected from these four zones. Schools with an adequate number of pupils were approached for the study, and care was taken to include almost equal number of subjects from each zone. The subjects were divided into five groups based on age range.

Children were selected from the schools randomly who satisfied the following inclusion criteria:

- The school children in the age group of 7–17 years
- The children who were lifelong residents of that particular region and
- The children who were using groundwater as a source of drinking water from birth
- Children with teeth with at least more than 50% of the crown erupted and no restoration.

Only those schools were included in the study which used ground water for drinking purpose. An official permission was obtained from the administrative authority of each school for carrying out the study. A study specific proforma was prepared based on the World Health Organization oral health assessment form, 1997.^[14] It consisted of two parts, first consisted of information on demographic data, permanent residential address, information on source of drinking water, aids used for oral hygiene maintenance (fluoridated or nonfluoridated)

and 2nd part consisted of table for recording fluorosis using the Dean's Fluorosis Index.^[15]

Students were examined under bright natural light or under artificial light source. Type 3 examination was followed for screening of subjects.^[16] Instruments were disinfected with an antiseptic solution after every use. Single examiner performed all the examination procedure in this study so as to maintain consistency and to eliminate inter examiner bias. Recording was done by another person who assisted the examiner in recording the details. Assessment of dental fluorosis was done using Dean's index. The recording was made on the basis of the two teeth that are most affected. If the two teeth were not equally affected, the score for the less affected of the two was recorded.^[15,17]

Calculations and graphical presentation were done using Microsoft Excel 2007 software by Microsoft Corporation.

RESULTS

Subjects were divided into five groups according to age which consisted of 723 (53%) males and 620 (46%) females. The number of subjects belonging to each group was, group A-267 (19.8%), group B-306 (22.7%), group C-336 (25%), group D-228 (16.9%), and group E-206 (15.3%) [Table 1].

Of total 1343 children examined, 243 children (18%) had dental fluorosis [Table 2]. Among the 243 affected children, 131 (53.9%) were males and 112 (46%) were females [Table 2 and Graph 1]. The number of children having dental fluorosis also varied according to the grades of fluorosis [Table 3 and Graph 2].

In group A, out of a total of 59 children, 5 children (1.8%) had grade 1 fluorosis, 2 children (0.7%) had grade 2 fluorosis, 37 children (13.8%) had grade 3 fluorosis, 11 children (4.1%)

Table 1: Distribution of sample by age and gender

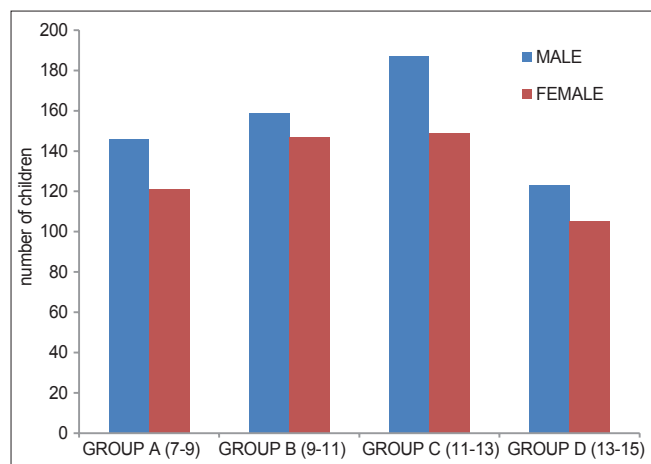
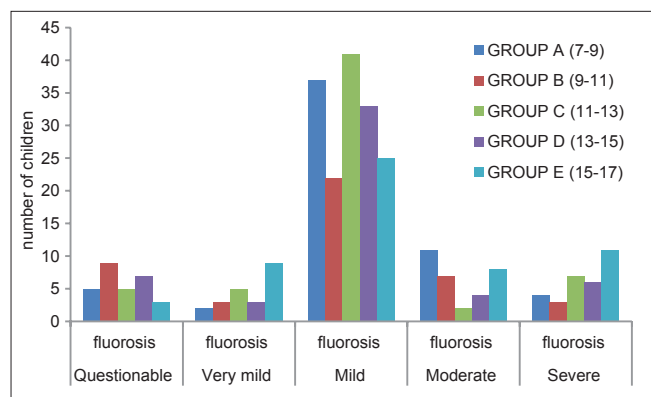
	Male (%)	Female (%)	Total (%)
Group A (7-9)	146 (10.8)	121 (9.0)	267 (19.8)
Group B (9-11)	159 (11.8)	147 (10.9)	306 (22.7)
Group C (11-13)	187 (13.9)	149 (11.0)	336 (25.0)
Group D (13-15)	123 (9.1)	105 (7.8)	228 (16.9)
Group E (15-17)	108 (8.0)	98 (7.3)	206 (15.3)
Total	723 (53.6)	620 (46)	1343

Table 2: Distribution of effected samples according to gender

Gender	Having fluorosis (n) (%)
Male	131 (53.9)
Female	112 (46.0)
Total	243

Table 3: Distribution of sample according to age group, grades, and percentage of fluorosis

Age group	Number of children	Questionable fluorosis (%)	Very mild fluorosis (%)	Mild fluorosis (%)	Moderate fluorosis (%)	Severe fluorosis (%)	Total
Group A (7-9)	267	5 (1.8)	2 (0.7)	37 (13.8)	11 (4.1)	4 (1.4)	59
Group B (9-11)	306	9 (2.9)	3 (0.9)	22 (7.1)	7 (2.2)	3 (0.9)	44
Group C (11-13)	336	5 (1.4)	5 (1.4)	41 (12.2)	2 (0.5)	7 (2.0)	60
Group D (13-15)	228	7 (3.0)	3 (1.3)	33 (14.4)	4 (1.7)	6 (2.6)	53
Group E (15-17)	206	3 (1.4)	9 (4.3)	25 (12.1)	8 (3.8)	11 (5.3)	56
Total	1343	29 (4)	22 (1.6)	158 (11.7)	32 (2.3)	31 (2.3)	

**Graph 1: Distribution of sample by age and gender****Graph 2: Distribution of sample according to age group and grades of fluorosis**

had grade 4 fluorosis, and 4 children (1.4%) had grade 5 fluorosis [Table 3 and Graph 2].

In group B, 9 children (2.9%) had grade 1 fluorosis, 3 children (0.9%) had grade 2 fluorosis, 22 children (7.1%) had grade 3 fluorosis, 7 children (2.2%) had grade 4 fluorosis, and 3 children (0.9%) had grade 5 fluorosis [Table 3 and Graph 2].

In group C, 5 children (1.4%) had grade 1 fluorosis, 5 children (1.4%) had grade 2 fluorosis, 41 children (12.2%) had grade 3 fluorosis, 2 children (0.5%) had grade 4 fluorosis, and 7 children (2.0%) had grade 5 fluorosis [Table 3 and Graph 2].

In group D, 7 children (3.0%) had grade 1 fluorosis, 3 children (1.3%) had grade 2 fluorosis, 33 children (14.4%) had grade 3 fluorosis, 4 children (1.7%) had grade 4 fluorosis, and 6 children (2.6%) had grade 5 fluorosis [Table 3 and Graph 2].

In group E, 3 children (1.4%) had grade 1 fluorosis, 9 children (4.3%) had grade 2 fluorosis, 25 children (12.1%) had grade 3 fluorosis, 8 children (3.8%) had grade 4 fluorosis, and 11 children (5.3%) had grade 5 fluorosis [Table 3 and Graph 2].

The overall percentage of grade 1 fluorosis was 2.9%, grade 2 fluorosis was 1.6%, grade 3 fluorosis was 11.7%, grade 4 fluorosis was 2.3%, and grade 5 fluorosis was 2.3% [Table 3].

Among the zones, into which the city was divided, North zone had 55 children (16.2%) affected with dental fluorosis, South zone had 78 children (22.5%) affected with dental fluorosis, East zone had 43 children (13.3%) affected with dental fluorosis, and West zone had 67 children (20.3%) affected with dental fluorosis [Table 4 and Graph 3].

DISCUSSION

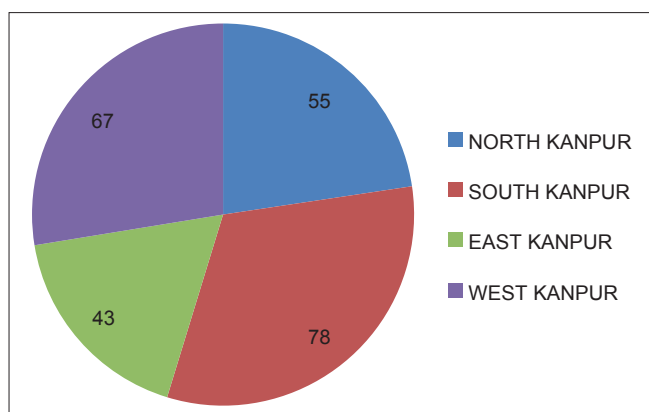
Kanpur city is one of the major industrial towns of Uttar Pradesh, situated on the bank of Ganges River. Because of the large number of tanneries and other industries, high quantity of chromium and other heavy metals have been reported in the river water. The ground water quality is fairly well as reported by the Municipality of Kanpur city.^[11,12] Several studies have been reported from the adjacent town of Unnao, whose results have shown that the area has high fluoride content in water.^[18,19]

Considering these data and a short distance between the two places, our curiosity led to this study. Our study was aimed to find out the prevalence of dental fluorosis among school children of Kanpur city, residing and consuming the groundwater since childhood.

The prevalence of fluoride-rich areas and fluorosis in Uttar Pradesh has been reported in the literature since long.^[20-23] In a study conducted in the year 1981, in Varanasi city, result showed prevalence of 28.21% of dental fluorosis.^[21] In another study conducted in

Table 4: Distribution of samples having dental fluorosis according to the zone

Geographic zone	Number of students examined	Number of children having dental fluorosis (%)
North Kanpur	338	55 (16.2)
South Kanpur	352	78 (22.5)
East Kanpur	323	43 (13.3)
West Kanpur	330	67 (20.3)
Total	1343	243 (18.0)

**Graph 3: Distribution of subjects having dental fluorosis according to the zone**

Lucknow city in the year 1975 showed a prevalence of 24% of dental fluorosis.^[22] Even in the recent studies, conducted in a different part of the same state, the prevalence has shown to rise further.

In the result of studies conducted in areas of Barabanki,^[24] Meerut,^[25] Rae Bareilly,^[26] Rampur,^[27] Sonbhadra,^[28] Agra,^[29] Unnao,^[18] it has been significantly shown that these areas have high fluoride content in the water.

In our study, the prevalence rate of dental fluorosis is falling in the range in which the surrounding high fluoride area has its prevalence. As reported by Srivastava *et al.*, the prevalence of dental fluorosis, in the adjacent area of Unnao, is 28.6%.^[18] Results of our study show 18% dental fluorosis prevalent in school children residing since childhood and the consuming groundwater both at school and home.

The prevalence of fluoride-rich areas as reported from our studies match with that reported by Sharma *et al.*^[11,12,19] Since, no study has been conducted among school children in the area for the estimation of dental fluorosis, there is a shortage of data to compare and to link. Hence, further studies in this regard are required, as the results of our study show a significant number of children affected with dental fluorosis.

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