

High prevalence of dental and skeletal fluorosis in the rural children of Bankura District, West Bengal, India

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Abstract

Background: Fluoride is essential for bone and teeth formation and when intake of fluoride is more than the permissible limit, fluorosis occurs.

Objectives: To study the prevalence of dental and skeletal fluorosis in primary school students from rural areas of Bankura District, West Bengal, India.

Method: Study was carried out in 159 primary school students in four primary schools of four different Grampanchayats (Laxmisagar Grampanchayat, Simlapal Grampanchayat, Harmasra Grampanchayat and Machatora Grampanchayat) in Bankura District, which is one of the Fluorosis endemic districts in West Bengal, India. Dean's fluorosis index was used to identify the possible presence of dental fluorosis. Fluoride in drinking water was estimated using ION-METER.

Results: Prevalences of dental caries, dental fluorosis and skeletal fluorosis among students were 32.7%, 72.3% and 11.3% respectively. The maximum water fluoride levels of the tube wells of the zones were 4.80ppm, 4.24ppm, 2.60ppm and 1.77ppm respectively, while prevalence of dental fluorosis among students of these zones was 52.6%, 72.2%, 84.8% and 100% respectively. This was statistically significant ($\chi^2=22.265$; $p<0.001$).

Conclusions: In the rural areas of Bankura District, West Bengal, India, prevalence of dental fluorosis and skeletal fluorosis among students was 72.3% and 11.3% respectively.

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(Key words: Bankura District, fluorosis; school students; rural area)

Introduction

Fluoride is important for bone and teeth development^{1,2}. It is essential for fluorapatite formation in the teeth that help resist acid demineralization and make the teeth stronger³. Inadequate intake of fluoride results in dental caries. On the other hand, the intake of high fluoride containing food/water for long periods results in dental, skeletal, and non-skeletal fluorosis manifesting as muscle weakness, tiredness, fatigue, anaemia, dyspepsia, male infertility, polyuria, polydipsia, repeated stillbirths, abortions, etc.⁴⁻⁶. Thus, fluoride is considered a double-edged sword⁴. The World Health Organisation and the Indian Council of Medical Research have recommended that the permissible level of fluoride in drinking water is 1.5 ppm^{7,8}. Fluorosis is slowly progressive affecting most organs and tissues in the body, resulting in symptoms which overlap with those of other disorders⁹. Twenty four countries, including India, are affected by this disease. The fluoride belt extends from Turkey to China and Japan through Iraq, Iran and Afghanistan¹⁰. The total amount of fluoride deposited on the earth crust is 85 million while in India it is 12 million¹¹. A recent report showed that 66 million individuals from 275 districts are at risk of fluorosis in India¹². Another report showed that 6 million children in India were estimated to have fluorosis¹³. Bankura district is a fluorosis endemic district in West Bengal with 17 blocks affected with dental and non-skeletal fluorosis symptomatic cases and only five blocks were not affected till now¹¹. However, only a few studies have reported dental and skeletal fluorosis in schoolchildren of this region.

Objectives

To study the prevalence of dental and skeletal fluorosis in primary school students from rural areas of Bankura District, West Bengal, India

Method

Area of study: It was carried out in four primary schools of four different Grampanchayats viz. Laxmisagar Grampanchayat, Simlapal Grampanchayat, Harmasra Grampanchayat and Machatora Grampanchayat (Table 1).

Table 1: Location of the studied schools

Location	School 1	School 2	School 3	School 4
Habitation	Guli Majhi Para	Simlapal Bazar	Laldihi	Jafla
Village	Jamda	Simlapal	Laldihi	Sovarajpur
Grampanchayat	Laxmisagar	Simlapal	Harmasra	Machatora
Block	Simlapal	Simlapal	Taldangra	Simlapal

Of these four Grampanchayats, Laxmisagar Grampanchayat, Simlapal Grampanchayat and Machatora Grampanchayat are located in the Simlapal Community Development Block, while Harmasra Grampanchayat is located in the Taldangra Community Development Block under Khatra Sub-Division of Bankura District (Figure 1).

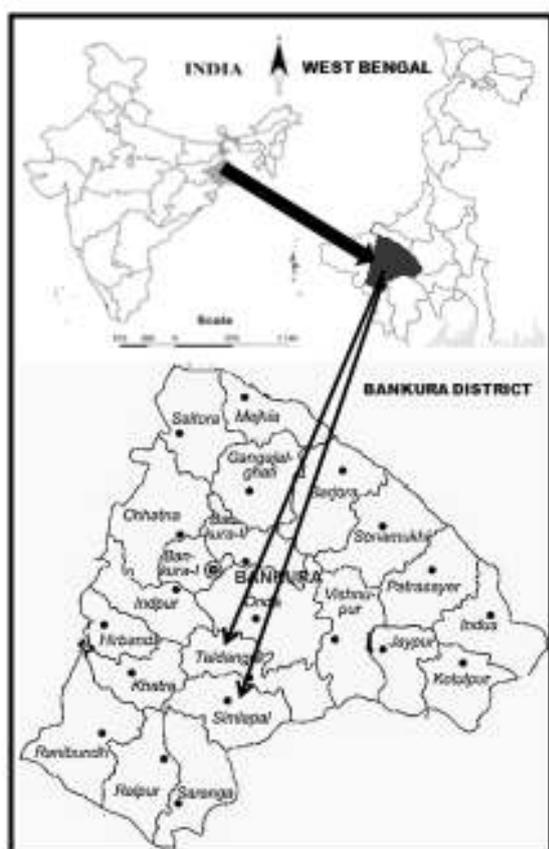


Figure 1: Study location

According to the local news report and website of WPHED, Public Health Engineering Department, these 4 Grampanchayats were noted as fluoride endemic. Four schools (one from each Grampanchayat) were selected randomly from the list of schools where tube well water was

contaminated with more than 1.5 PPM of fluoride in the 4 Grampanchayats

Participants: Minimum estimated sample size for the study was 135, calculated by utilising the formula $(n=z^2pq/d^2)^{14}$. The calculation $(1.96^2 \times 0.3382 \times 0.6618) / (0.08^2)$ was based on 33.8% prevalence of dental fluorosis in primary school students living in a rural area of West Bengal, India¹⁵. The total student strengths of the four schools were 122, 132, 68 and 72 respectively in 1 to 4 standards, aged 6 to 12 years. Each of the students had an equal chances of being in the study population and was randomly selected from the total students. Finally, 159 students were included in the study from four schools and the number of students from each of the schools was 57, 36, 46 and 20 respectively. Before carrying out the study the objective was described to the legal guardians of the respective students and the students were enrolled into the study after getting written consent from the legal guardians. The students suffering from chronic diseases or having any osteo-skeletal disorders were excluded from this study.

Study duration: The study was carried out from August 2018 to January, 2019.

Fluoride in drinking water: Samples were collected from the source of water in the school and were kept in polyethylene fluoride non-reactive plastic pots and tested within 24-48 hours by ION-METER using fluoride electrode methods.

Identification of fluorosis:

Dean's c fluorosis index was used to identify the possible presence of dental fluorosis (Table 2)¹⁶. However, no radiological testing was done for diagnosis of skeletal fluorosis. During screening of cases experts consultants, trained in National Institute of Nutrition, Hyderabad, clinically observed prominent genu varum and genu valgum like skeletal deformities.

Table 2: Criteria for Dean's Fluorosis Index

Criteria of Score	Score	Criteria
Normal	0	The enamel represents the usual translucent semivitre form type of structure. The surface is smooth, glossy, and usually of a pale creamy white colour
Questionable	1	The enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few white flecks to occasional white spots. This classification is utilized in those instances where a definite diagnosis of the mildest form of fluorosis is not warranted and a classification of "normal" is not justified
Very Mild	2	Small opaque, paper white areas scattered irregularly over the tooth but not involving as much as 25% of the tooth surface. Frequently included in this classification are teeth showing no more than about 1-2 mm of white opacity at the tip of the summit of the cusps of the bicuspid or second molars.
Mild	3	The white opaque areas in the enamel of the teeth are more extensive but do not involve as much as 50% of the tooth.
Moderate	4	All enamel surfaces of the teeth are affected, and the surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.
Severe	5	Includes teeth formerly classified as "moderately severe and severe." All enamel surfaces are affected and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread and teeth often present a corroded-like appearance.

Statistical analysis: This was done using the Statistical Package for the Social Sciences (SPSS) version 17.

Results

Prevalence of dental caries, dental fluorosis and skeletal fluorosis among students was 32.7%, 72.3% and 11.3% respectively. The water fluoride status of the studied schools is shown in Table 3.

Table 3: Water fluoride status of the studied schools

Water fluoride status	School 1	School 2	School 3	School 4
Water fluoride level (ppm)	4.80	4.24	2.60	1.77
Total no. of tube wells	5	9	6	9
No. of tube wells demarcated by PHED as unsafe (>1.5 ppm)	2	4	6	2
No of sealed tube well by PHED	1	2	0	0

In the four schools 40%, 44.4%, 100% and 22.2% of the tube wells respectively from the four school compounds were demarcated as unsafe (>1.5ppm) by the latest activities of PHED (Table 3). Prevalence of dental fluorosis among students was 52.6%, 72.2%, 84.8% and 100% respectively ($\chi^2=22.265$; $P<0.001$). In this study, a total of three tube-wells were sealed by the PHED after the inspection (Table 3) and three community fluoride filters were established in Simlapal Bazar (School 2). While studying the intake of fluoridated food item (including rock salt, raw tea etc.) in the studied area, it was noted that the students of School 1 had taken a small amount of these foods

while students of other schools had taken in moderate amount (data not shown). It was also noted that no case of severe dental fluorosis was found in Machatora the area of comparatively low water fluoride level and the other three zones viz., Laxmisagar, Simlapal, Harmasra, the prevalence severe dental fluorosis was 3.51%, 11.11%, 6.52% respectively among the school children (Figure 2).

Prevalence of dental caries, dental fluorosis and skeletal fluorosis among school children of 4 primary schools of Bankura District, India is shown in Table 4.

Table 4: Prevalence of dental caries, dental fluorosis and skeletal fluorosis among children of 4 primary schools of Bankura District, India

Prevalence	School 1 (n=57)	School 2 (n=36)	School 3 (n=46)	School 4 (n=20)
Prevalence of dental caries n (%)	23 (40.4)	07 (19.4)	14 (30.4)	08 (40.0)
Prevalence of dental fluorosis n (%)	30 (52.6)	26 (72.2)	39 (84.8)	20 (100.0)
Prevalence of skeletal fluorosis n (%)	04 (07.0)	0 (0)	04 (08.7)	10 (50.0)

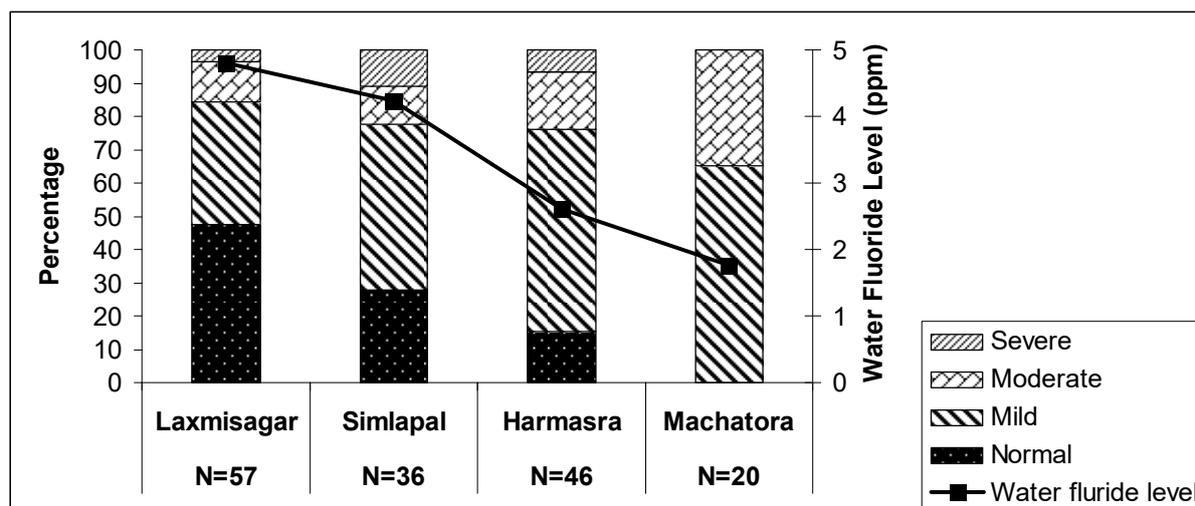


Figure 2: Relationship between fluoride levels in drinking water and severity of dental fluorosis among school children of 4 primary schools of Bankura District, India

Discussion

This study showed a very high prevalence rate of fluorosis when compared with some other studies in West Bengal. Majumdar¹⁵ carried out a similar study among 136 children of Gobindanagar primary school and Bhagabandh primary school of Purulia District of West Bengal and found only 33.8% children had dental fluorosis. Chauhan *et al.*¹⁷ found only 4.1% of school students were suffering from dental fluorosis living in Northern hilly states of India.

The most striking aspect was that the school, where only 22.2% of tube well were unsafe and the average water fluoride level was 1.77ppm, 100% students were suffering from dental fluorosis. Similar thing was noted in occurrence skeletal fluorosis also. This may trigger the association of some other factors that may be responsible for the occurrence of dental fluorosis and water fluoride level may not be the only factor. The quantities of water intake per day may vary from individual to individual and this may be responsible for changing the prevalence of fluorosis. Except the direct intake of water, the water is also ingested through food by means of water used for cooking. Thus cooking methods and dietary pattern also play an important role in the changing pattern of fluorosis occurrence. The intrinsic factors, like acidity in the stomach modulates the absorption of soluble fluoride in the body⁹. The Administration had also played an important role for the management of fluorosis. This may also responsible for the difference in the prevalence of dental fluorosis.

Conclusions

In the rural areas of Bankura District, West Bengal, India, prevalence of dental fluorosis and skeletal fluorosis among students was 72.3% and 11.3% respectively.

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