

# Prevalence of dental and skeletal fluorosis in relation with the fluoride levels in drinking water among the primary school children at Laxmisagar Grampanchayat of Bankura District, West Bengal India

Sanchita Chowdhury<sup>1</sup>, Tanjib Hassan Mullick<sup>2</sup>, Dibyendu Dutta<sup>3\*</sup>

<sup>1</sup>Students, <sup>2</sup>Assistant Professor, <sup>3</sup>Post Graduate, <sup>2</sup>Dept. of Community Medicine, <sup>3</sup>Dept. of Food and Nutrition Science, <sup>1</sup>B.Sc Nutrition Science, Burdwan University, West Bengal, <sup>2</sup>Bankura Sammilani Medical College & Hospital, Bankura, West Bengal, <sup>3</sup>Sri Satya Sai University of technology and medical Science, Sheore, Madhya Pradesh, India

**\*Corresponding Author: Dibyendu Dutta**

Email: dibyendudutta99@gmail.com

## Abstract

To estimate the prevalence of dental and skeletal fluorosis in relation with different fluoride levels in drinking water among school going children aged 6-12 years. The cross sectional study was conducted in the six primary schools of Lakshmisagar Grampanchayat, Bankura District, West Bengal, India. Dental fluorosis was recorded using Dean's index. The drinking water samples were collected in polyethylene bottles and the fluoride content of these samples was determined by fluoride ion selective electrode method using Orion microprocessor analyser. The overall prevalence of dental and skeletal fluorosis among the school students of this study area was 78.47% and 13.87% respectively. The study noted that the maximum fluoride level in the drinking water of the six schools were 9.15, 3.46, 3.46, 3.46, 3.28, and 2.11 ppm respectively though the prevalence of dental fluorosis was noted among the students of this region were 100.00%, 76.92%, 78.85%, 42.86%, 91.30% and 94.74% respectively. This study found that the fluorosis level in drinking water was not the single most factors for determining the fluorosis but there might be some other factors associated with causation of fluorosis and these factors also modulate the severity of the fluorosis. Nutrition is the most important factors to reduce the fluoride level from the human body.

**Keywords:** Fluorosis, Fluoride, Bankura district, Prevalence.

## Introduction

Fluoride is an essential oligo-element. It is essential for the development of the bone and the teeth. Inadequate consumption of fluoride is responsible for dental caries. Fluorosis caused by fluoride intake through food and water.<sup>1</sup> The Fluoride is essential for the conversion of the hydroxylapatite crystals of enamel into fluorapatite. This fluorapatite is stronger and resist acid demineralization.<sup>2</sup> On the other hand intake of large quantities of fluoride through drinking water than the optimal safe level can give rise to a number of adverse effects including dental or skeletal fluorosis.<sup>3,4</sup> Thus, WHO and ICMR recommended that the permissible level of fluoride in the drinking water was 1.5 ppm.<sup>5,4</sup>

Fluorosis is a slow progressive crippling disease affects most of the organs, tissues and cells in the body, that introduce many health complaints. Fluorosis has overlapping manifestations with several other co-diseases<sup>8</sup>. It affects twenty four countries in the world, including India. The geographical fluoride belt is located from Turkey to China and Japan through Iraq, Iran and Afghanistan.<sup>8</sup> Recent report from India stated that there were 66 million people in 275 districts of 20 provinces were at risk condition of fluorosis.<sup>9</sup> This is due to the huge amount of fluoride deposited on the earth crust in India. The recent report revealed that the total amount of fluoride deposited on the earth crust was 85 million while in India it was 12 million.<sup>10</sup> The fluoride contamination is natural in India. Bankura District is one of the fluorosis endemic districts in West Bengal, India. Total seventeen blocks out of twenty two blocks of Bankura district were affected with dental and non-skeletal fluorosis symptomatic cases.<sup>11</sup> But only a few studies were reported

the conditions of the dental and skeletal fluorosis among the school children of this region particularly among the children living in the areas where the fluoride level in the drinking water is more than 9 ppm. In this scenario this study was undertaken to find out the prevalence of dental and skeletal fluorosis among the school children.

## Materials and Methods

### Area of the Study

The study was conducted in the six primary schools of Lakshmisagar Grampanchayat. Lakshmisagar Grampanchayat located in the Simlupal Community Development Block, which is under Khatra Sub-Division of Bankura District, West Bengal, India Total population of the GP are 50304. Cences (2011). Estimated population were at risk about 41%.

The study was conducted among the 274 school children of 1 to 4 standard aged 6 to 11 years. The participants were randomly selected from the schools. The purpose of the study was described to the legal guardians of the respective students prior to the study 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

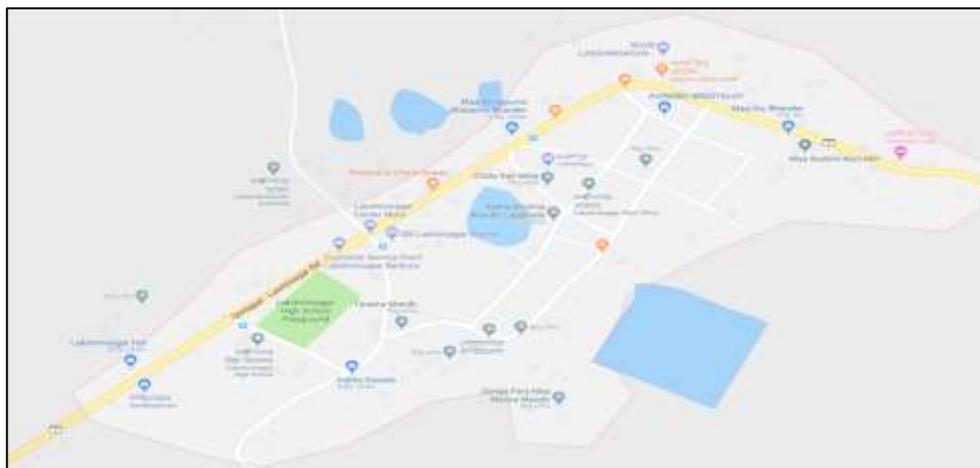
The study was carried out during 6 months survey from August 2018 to January, 2019.

### Fluoride in Drinking Water

Drinking water sample 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 hrs of duration by ION-METER using fluoride electrode methods.

**Identification of fluorosis**

Criteria for Dean’s Classification System for dental fluorosis was used to identify the possible presence of fluorosis. Dean (1993)



**Fig. 1:** Study area map of laxmisagar GP, Simlatal, Bankura.

**Table 1:** Criteria for Dean's Fluorosis Index.<sup>12</sup>

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.

**Table 2:** Relationship between fluoride levels in drinking water and severity of skeletal fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India

Zone	N	Normal	Janu Varum	Janu Vulgum	Total Skeletal fluorosis
Zone 1	18	9 (50.00)	9 (50.00)	0 (0)	9 (50.00)
Zone 2	52	35 (67.31)	15 (28.85)	2 (3.85)	17 (32.69)
Zone 3	104	103 (99.04)	0 (0)	1 (0.96)	1 (0.96)
Zone 4	35	35 (100)	0 (0)	0 (0)	0 (0)
Zone 5	46	40 (86.96)	6 (13.04)	0 (0)	6 (13.04)
Zone 6	19	14 (73.68)	5 (26.32)	0 (0)	5 (26.32)
Total	274	236 (86.13)	35 (12.77)	3 (1.09)	38 (13.87)
Data are represented as N(%)					

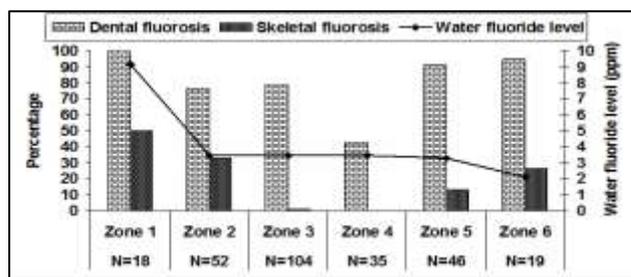
### Statistical analysis

All the statistical analysis was done using the SPSS 17.

### Results and Discussion

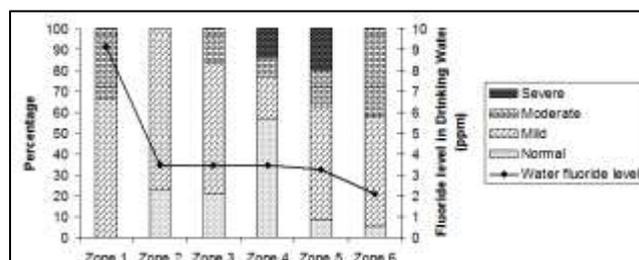
The overall prevalence of dental and skeletal fluorosis among the school students of this study area was 78.47% and 13.87% respectively. The similar finding was observed

in a study conducted endemic fluoride belt of Andhra Pradesh.<sup>13</sup> Fig. 1 presented the relationship between fluoride levels in drinking water and prevalence of dental and skeletal fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India. The study noted that the fluoride level in the drinking water of the six schools were 9.15, 3.46, 3.46, 3.46, 3.28, and 2.11 ppm respectively. This study focus that the condition of this area is serious as the upper permissible level of fluoride level in the drinking water is 1.5 ppm as per the guideline of WHO, 1963 and ICMR,1975.<sup>5, 6</sup> But the prevalence of dental fluorosis was noted among the students of this region were 100.00%, 76.92%, 78.85%, 42.86%, 91.30% and 94.74% respectively. Interestingly, the prevalence of dental fluorosis was high in Zone 6 where the fluoride level in drinking water was 2.11 ppm, even this prevalence was nearly double when comparing with Zone 4 where the fluoride level in drinking water much more (3.46 ppm) than the Zone 6. It was also noted that prevalence of dental fluorosis in Zone 6 (91.30%) was almost similar with Zone 1 (100.00%) where the fluoride level in drinking water was nearly four times greater (9.15 ppm). This may be suggested that not only the fluoride level in drinking water but also some other factors associated with the occurrence of Fluorosis. The quantities of water intake per day vary from individuals to individuals 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 plays 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 body.<sup>7</sup> Similarly, the prevalence of skeletal fluorosis was 50.00%, 32.69%, 0.96%, 0.00%, 13.04% and 26.32% in the six zones.



**Fig. 1:** Relationship between fluoride levels in drinking water and prevalence of dental and skeletal fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India

The Fig. 2 presented the relationship between fluoride levels in drinking water and severity of dental fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India. In this study, it was interestingly noted that the students who consumed high fluoride containing water till not manifested the severe dental fluorosis while in the zone where the water fluoride level was nearly three times lower than the previous one had 10 – 20% cases of severe condition of dental fluorosis cases. Similarly when compare the four zones with nearly same water fluoride level viz. Zone 2, 3, 4 and 5, the students residing in Zone 2 had not shown any them were suffering from moderate to severe degree of dental fluorosis while in Zone 4 the prevalence of severe dental fluorosis was 14.29% (though only 42.86% of the total students were suffering from dental fluorosis). The most affected zone in this study was Zone 5 where 19.57% of the students had severe dental fluorosis.



**Fig. 2:** Relationship between fluoride levels in drinking water and severity of dental fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India

The relationship between fluoride levels in drinking water and severity of skeletal fluorosis among the school children of different primary schools at Laxmisagar Grampanchayat of Bankura District, India were presented in table 2. It indicated that 50.00% of the students residing in the Zone 1 were suffering from skeletal fluorosis. But interestingly no case of Janu vulgum, serious condition of skeletal fluorosis, was found in this zone though Janu vulgum was noted in Zone 2 and Zone 3. This report also supported that water fluoride level was not the single most factor for determining the fluorosis but there might be some other factors associated with causation of fluorosis and these factors also modulate the severity of the fluorosis.

### Conclusion

More than three fourth of the students were suffering from dental fluorosis and the prevalence of skeletal fluorosis was fourteen per cent. This indicates that the population is in serious condition. Urgent action may be taken to cope up this situation.

**Conflict of Interest:** None.

## References

1. McDonagh MS, Whiting PF, Wilson PM, Sutton AJ, Chestnutt I, Cooper J et al, Systematic review of water fluoridation. *Br Med J* 2000;321:855-9.
2. Alanazi AH, Alsaab FA, Alatallah SS, Alfahaid SF, Alharbi AS, Almutairi BS et al, Fluoride level in drinking water and prevalence of dental fluorosis and dental caries among the school children: A descriptive cross-sectional study. *Asian Pac J Health Sci* 2017;4(4):155-9.
3. Zhu C, Bai G, Liu X, Li Y. Screening high fluoride and high arsenic drinking water and surveying endemic fluorosis and arsenism in Shaanxi province in western China. *Water Res* 2006;40:3015-22.
4. Karro E, Indermitte E, Saava A, Haamer K, Marandi A. Fluoride occurrence in publicly supplied drinking water in Estonia. *Environ Geol* 2006;50:389-96.
5. World Health Organizatio. International standards for drinking water, 2nd edn, 1963; Geneva
6. Indian Council of Medical Research (ICMR). Manual of standards of quality for drinking water supplies. In: *Special report series, 2nd edn, New Delhi, India, 1975;44.*
7. Gopalakrishnan SB, Viswanathan G, Ilango SS. Prevalence of fluorosis and identification of fluoride endemic areas in Manur block of Tirunelveli District, Tamil Nadu, South India. *Appl Water Sci* 2012;2:235-43.
8. Saravanan S, Kalyani C, Vijayarani MP, India prevalence fluorosis among primary school children in rural areas of Chidambaram Taluk, Cuddalore District, Tamil Nadu. *Indian J Commun Med* 2008;33:146-50.
9. Pandey A. Prevalence of fluorosis in an endemic village in central India. *Tropical Doctor* 2010;40:217-19
10. Sinha Mahapatra P, Chatterjee S, Sarkar P. Fluorosis induced anemia in fluoride endemic zone of Bankura District, West Bengal, India. *Int J Curr Res* 2016; 8(9): 37700-3.
11. Boule'treau PH, Bost M, Fontanges E, Lauerjat M, Gutknecht C, Ecochard R, Delmas PD, Chambrier C. Fluoride exposure and bone status in patients with chronic intestinal failure who are receiving home parenteral nutrition. *Am J Clin Nutr* 2006;83:1429-37.
12. Dean HT. Classifications of mottled enamel diagnosis. *J Am Dent Assoc* 1993;21:1421-6
13. Shekar C, Cheluviah MB, Namile D. Prevalence of dental caries and dental fluorosis among 12 and 15 years old school children in relation to fluoride concentration in drinking water in an endemic fluoride belt of Andhra Pradesh. *Indian J Public Health* 2012;56(2):122-8.

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