

## PREVALENCE OF FLUOROSIS AMONG THE INHABITANT OF SANTOSH PUR AND JOYPUR VILLAGES OF BIRBHUM DISTRICT, WEST BENGAL

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### Abstract:

The high level of fluoride concentration in groundwater resources has become one of the most important toxicological and geo-environmental issues in India. This study aims to assess the link between fluoride content in groundwater and its impact on the dental health in rural villages of Santoshpur and Joypur, Birbhum district, West Bengal. A total of 30 tube well water were collected from the target villages. The health impact of fluoride was evaluated based on clinical examination of dental fluorosis among school children using the Dean's index. In total, seventy nine (N = 79) inhabitant between the age of 5-10 years old using water from tube wells of fluoride range of 0.18 to 0.31 mg/L were examined. Signs of dental fluorosis (Dean's score  $\geq 1$ ) were observed in all individuals. Most of the teeth (13 %) recorded Dean's scores of 4 at Santoshpur, followed by 17 % and 12 % of Dean's scores 3 for Santoshpur and Joypur, respectively. Correlation analysis revealed that fluoride level in tube well water directly linked with dental fluorosis status of school children. However, other parameters such as BMI and head circumference also showed inverse relationship with water fluoride levels.

**Keywords:** Fluoride; tube well; dental fluorosis; Dean's index; BMI; Head circumference

### INTRODUCTION

High fluoride contents in groundwater have been reported worldwide [1-7]. The quality of ground water, which is the main source of drinking water, depends mainly on the lithology and soil of the contaminated area [8]. The problem of high fluoride concentration in ground water sources is one of

the most important toxicological and geo-environmental issues in India [9]. Fluorosis is endemic in several regions of the world, with skeletal fluorosis being the most reported worldwide [10]. Dental fluorosis, a hypoplasia or hypomineralization of tooth enamel or dentin, produced the chronic ingestion of excessive amounts fluoride during a period when teeth are developing in a range of intensity from barely noticeable whitish striations to confluent pitting and staining [11]. Radiographically detectable mineralization of the primary incisors occurs by 24 months of age and prior to 6 years of age for the second molars and premolars [9]. Therefore, dental fluorosis does not occur when exposure occurs in children\6–7 years of age [12]. Keeping in mind the above facts, the present study was conducted in a semi-arid zone of Birbhum district in order to determine the fluoride levels in ground water which is used for drinking purposes and the dental fluorosis status of the target locations (Santoshpur and Joypur villages of Birbhum).

## **MATERIALS AND METHODS**

### ***Study area:***

The study was carried out in the villages of Santoshpur and Joypur primary schools of Birbhum district. This district situated between 23° 32' 30" (right above the tropic of cancer) and 24° 35' 0" north latitude and 87° 5' 25" and 88° 1' 40" east longitudes, and about 4,545 square kilometres (1,755 sq mi) in area, this district is triangular in shape. River Ajay forms the southern base whereas the apex of the triangle points to the north. The climate on the western side is dry and extreme, but is relatively milder on the eastern side. During summer, the temperature can shoot well above 40 °C (104 °F) and in winters it can drop to around 10 °C (50 °F). It has been observed that rainfall is higher in the western areas as compared to the eastern areas. The annual average rainfall is 1,405 millimetres. According to the 2011 census Birbhum district had a literacy rate of 70.9%.

### ***Study participant:***

The Inclusion criteria consisted of both the primary schools children from 1st standard to 4<sup>th</sup> standard present on the day of the survey.

### ***Exclusion criteria:***

Children having local deposits on their teeth like debris were excluded from the study.

### ***Estimation of Fluoride:***

Fluoride content of water samples (n = 30) from both the studied villages was estimated by using ionselective electrode (ORION 4star).

### ***Sample size estimation:***

The pilot study carried out by the investigator revealed that the prevalence of dental fluorosis to be 20 %. The sample size for the present study was determined based on the above prevalence rate with a

absolute precision of  $\pm 2$  and at 95% confidence level. The required sample size for the study was worked out to be 79 children of age group 5 to 10 years.

***Measurement of anthropometric parameter:***

Body weight was measured to the nearest 0.5 cm. Body weight was measured on a digital scale to the nearest 0.1 kg. The children's body weights were measured in light clothes and bare foot. Body mass index (BMI) was calculated as a quotient between body weight in kilograms and squared body height in meters. Head circumference were recorded by using measuring tape.

***Sampling method:***

Primary schools of both the villages were taken as the main sampling unit of the study. By adopting simple random sampling, two schools were randomly selected from a total of 7 schools to meet the above sample size. All the children present in the two schools were enlisted for the study.

***Instrument for the study:***

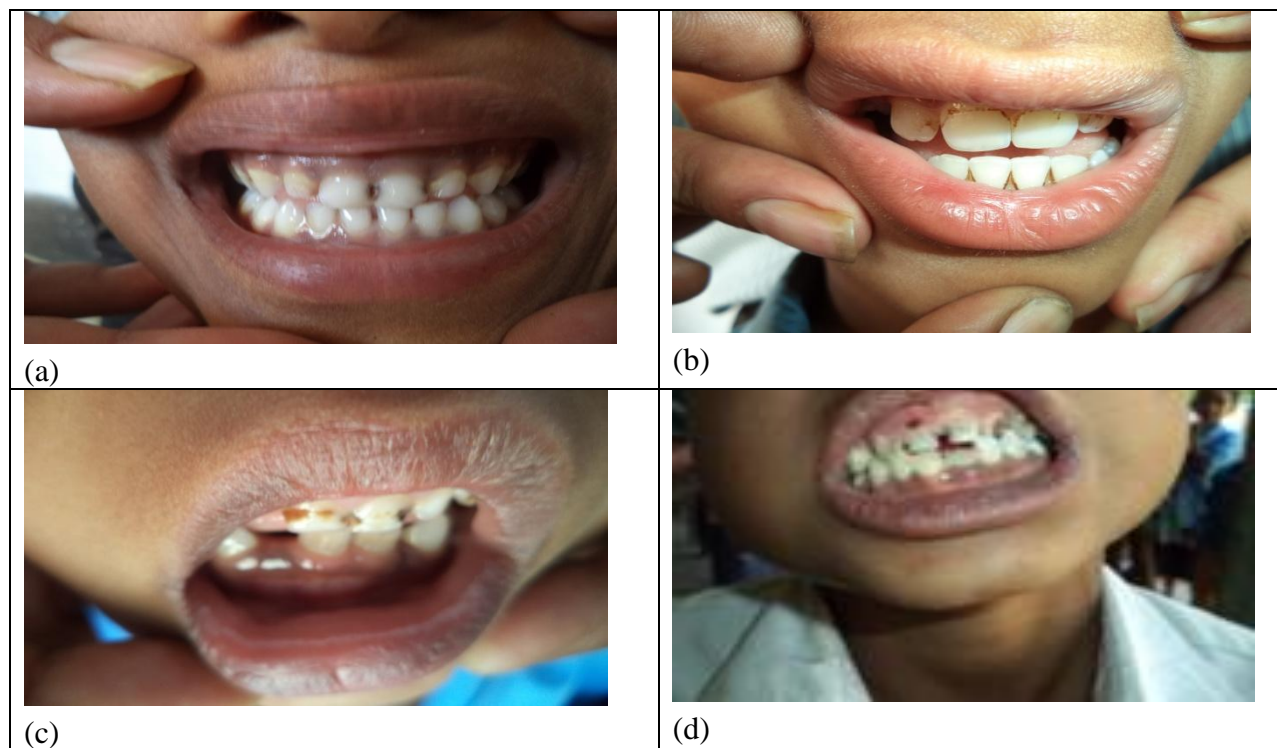
Dental examination was carried out in daylight with the help of self-illuminated hand held magnifying lens by the first investigator who had undergone training from the dental department staff. Dean's index was used to grade the severity of dental fluorosis [13]. The teeth of the schoolchildren were assessed for fluorosis, using Dean's criteria and according to the WHO guidelines [14]. Criteria for Dean's fluorosis index are described as follows [15]. Normal (0): the enamel represents the usual translucent semivitri form type of structure, and the surface is smooth, glossy, and usually of a pale creamy white color. 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."

***Statistical analysis:***

Prevalence of dental fluorosis was estimated along with 95 % confidence interval. Correlation results were used to test for the statistical association of flurosos between anthropometric parameters and gender. All the analysis was carried out using SPSS -18.0 version.

## RESULTS AND DISCUSSION

Fluoride statuses of tube well water of both the villages are presented in Table 1. The mean values of fluoride are 0.248 and 0.228 in Santoshpur and Joypur villages, respectively. The Dean's index data indicate that the children of Santoshpur village are in more vulnerable condition than the children of Joypur village (Table 2). However, Santoshpur children have no indication of severe dental fluorosis (Figure 1a-b). But the children from Joypur have both moderate and severe dental fluorosis (4.08 %)(Figure 1c-d). Almost similar observation was reported from Nasipur, Deshnabagram, and Vabanandapur villages of Birbhum district [9].



**Figure 1.** Dental fluorosis status of school children of Santoshpur (a-b) and Joypur (c-d) villages.

Correlation analysis indicated that fluoride level in tubewell water positively related with boy's dental fluorosis, head circumference of both boys and girls and BMI of girls students in Joypur village (Table 3). However, in Santoshpur village, tubewell water fluoride level negatively related with dental fluorosis status, head circumference and BMI of both boys and girls students. Almost similar positive relationship between fluoride intake by water and the prevalence of dental fluorosis has been reported by many researchers.[16-20]

**Table 1.** Fluoride content in tubewell water sample

Village	Tubewell water Fluoride(ppm)				
	Mean	SD	Min.	Max.	n
Santoshpur	0.2480	0.0377	0.19	0.31	10
Joypur	0.22750	0.02425	0.18	0.27	20

**Table 2.** Dental Fluorosis scores of two studied villages.

Dental fluorosis score	Santoshpur		Joypur	
	n	%	n	%
	30	100	49	100
0 = normal	--	--	--	--
1 = questionable	14	46.67	25	51.02
2 = very mild	7	23.34	14	28.57
3 = mild	5	16.66	6	12.25
4 = moderate	4	13.33	02	4.08
5 = severe	--	--	02	4.08
Total	30	100	49	100

**Table 3.** Correlation between tubewell water F level and other anthropometric parameters.

Parameters	Santoshpur	Joypur
Tube well F vs. BMIF	-0.317 (p < 0.372)	-0.382 (p < 0.059)
Tube well F vs. BMIM	-0.584 (p < 0.077)	--
Tube well F vs. HCM	-0.042 (p < 0.909)	-0.107 (p < 0.615)
Tube well F vs. HCF	-0.361 (p < 0.305)	-0.260 (p < 0.210)

*BMIF and BMIM : Body mass index of female/male, HCF and HCM: Head circumference of female/male*

It is evident from this study that fluorosis: is a definite public health problem in the selected villages of Birbhum district, with increased prevalence of dental fluorosis found among the study population.

#### Conflict of interest:

We declare that we have no conflict of interest.

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