



Fluorosis- An Emerging Health Problem in The Rural Parts of Bankura District , West Bengal, India: A Cross-Sectional Descriptive Study

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ABSTRACT

Fluorosis is an important public health problem in 24 countries, including India. This cross-sectional observational study has been conducted in the fluoride endemic zones of Bankura district to evaluate the current status of fluorosis in the rural part of Bankura district and its impact. This study was carried out in the 3 blocks of Bankura, namely Simlupal, Taldangra, and Hirbandh, having 144 villages on 1999 subjects out of 2.79 lakh population by using stratified random sampling. The urine samples were collected from the subjects and urinary fluoride level was estimated by Ion-Meter. In the years 2013-15, 1999 subjects were studied, out of which 329 (16.46%), 32 (1.60%) and 158 (7.90%) subjects were found positive for dental, skeletal and non-skeletal fluorosis respectively. This study revealed that school going children were more affected in dental fluorosis than adults and males are more affected than females in all forms of fluorosis.

KEYWORDS : Dental fluorosis, Skeletal fluorosis, Non-skeletal fluorosis.

INTRODUCTION

Fluoride is often called two-edged sword. As to a certain extent (as per WHO; 0.6 ppm) fluoride ingestion is useful for bone and teeth development, but excessive ingestion causes a disease known as Fluorosis^{1,2}. World Health Organization (WHO) has set the upper limit of fluoride concentration in drinking water up to 1.0 mg/l^{1,2} and The Bureau of Indian Standard [BIS] has therefore, laid down the Indian standards as 1.5 mg/l as maximum permissible limit of fluoride with further remarks as "lesser the better"². WHO and BIS:10500-1991 permit only up to 1.5mg /l as safe limit of fluoride in drinking water for human consumption^{1,3}. People in several districts of West Bengal are consuming water with fluoride concentration up to 12mg/l^{2,4}. Children in the age group of 0 to 12 years are more prone to develop fluorosis and expectant mothers are also to be protected as there is growing concern about the effects of fluoride on foetus⁵. It seriously affects the teeth, bones and skeletons like weight bearing joints, as well as nervous tissues. It not only affects the body of a person to become morbid but also affects them socially and culturally.

Fluorine is the most abundant element in nature, and about 96% of fluoride in the human body is found in bones and teeth. Intake of fluoride higher than the optimum level is the main reason for dental and skeletal fluorosis. The main source of fluoride in groundwater is the rocks which are rich in fluoride. During rainy seasons heavy rain falls leads to leaching of fluoride into the ground water^{17,18}.

Fluorosis is an important public health problem in 24 countries, including India, which lies in the geographical fluoride belt that extends from Turkey to China and Japan through Iraq, Iran and Afghanistan^{2,8,9}. The available data suggest that 15 States in India are endemic for fluorosis and about 62 million people in India suffer from dental, skeletal and non-skeletal fluorosis^{4,10}. In India 62 million people including 6 million children are estimated to have serious health problems due to consumption of fluoride contaminated water and

foods^{4,11}. Some regions of north western and southern parts of India are heavily affected by fluorosis due to the presence of rocks, rich in fluoride^{6,7,9}.

International status:

The following countries have been identified for the problem of Fluorosis: Pakistan, Bangladesh, Argentina, U.S.A. Morocco, Middle East Countries, Japan, South African Countries, New Zealand, Thailand etc^{1,12}.

In India:

The problem has reached alarming proportions affecting at least 17 states of India-

50-100% districts are affected – Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Gujarat, Rajasthan.

30-50% districts are affected – Bihar Haryana, Karnataka, Maharashtra, Madhya Pradesh, Punjab, Orissa, West Bengal.

<30% districts are affected – J&K, Delhi, Kerala^{4,10}.

In Bankura:- In Bankura districts out of 22 Blocks and 17 are affected with dental & non skeletal fluorosis cases¹³.

MATERIALS AND METHODS

Study area: This cross-sectional descriptive study was carried out in the 3 blocks, namely Simlupal, Taldangra and Hirbandh of Bankura district in collaboration with public health engineering department (P.H.E), Bankura along with public health wings of Chief medical officer of health, Bankura. The biochemical analysis was done in the department of Biochemistry, B.S. Medical College, Bankura (District fluorosis detection laboratory)

Study subject: 1999 subjects were selected by stratified random sampling from about 2.79 lakh population of these blocks among them 1004 were male and 995 were female. Among 1999, 360 were school going children and rest were adults. They were physically examined and information pertaining to demographics, nature of illness were collected from them using a predesigned and pretested questionnaire. Informed consent was taken from them. The study design was approved by institutional ethical committee.

Laboratory investigations: The urine samples were collected from the 670 subjects depending on availability and stored at -20°C before analyzing. Urinary fluoride level was estimated by Ion Meter (ORION-9609BNWF). The fluoride levels in drinking water of these blocks also were estimated.

Statistical analysis:

The data were compiled in MS excel and analyzed by different statistical methods. Data display was done by tables.

RESULTS

In the year 2013-14, among the 1043 subjects, who were studied, 168 (16.10%) had dental fluorosis, 18 (1.73%) had skeletal fluorosis and 70 (6.71%) had non-skeletal fluorosis (Table no-1).

Likewise in the year 2014-15, 956 subjects were studied and 161 (16.84%), 14 (1.46%), and 88 (9.21%) subjects were suffering from dental, skeletal and non-skeletal fluorosis respectively (Table no-1).

The Study also revealed that 24.55% and 27.51% of the subjects are clinically positive in the respective year (Table no-1) and also showed that school going children were more affected than adults in dental fluorosis and non-skeletal fluorosis whereas adults were affected more in skeletal fluorosis (1.83%) than children (0.56%).

Table No-1: Fluorosis case profile of study area

Sl.No	Description	FY 2013-2014			FY 2014-2015			Cumulative up to FY 2013-2015		
		School	Community	Total	School	Community	Total	School	Community	Total
1	Total Unit Surveyed	11	26	37	12	19	31	23	45	68
2	Total person Screened	169	874	1043	191	765	956	360	1639	1999
3	Dental Fluorosis found	27	141	168	33	128	161	60	269	329
4	Skeletal Fluorosis found	01	17	18	01	13	14	02	30	32

5	Non Skeletal Fluorosis found	14	56	70	17	71	88	31	127	158
6	Total no. of clinical cases	42	214	256	51	212	263	93	426	519
7	% of clinical fluorosis cases	24.85	24.49	24.55	26.70	27.71	27.51	25.83	25.99	25.96

In total out of 1999 (2013-15) subjects, 329(16.46%), 32(1.60%) and 158 (7.90%) had dental, skeletal and non skeletal sign & symptoms of fluorosis respectively (Table no-1).

The study also showed that males (28.69%) were more affected in all clinical forms of fluorosis than the females (23.22%) (Table no-2)

Table No-2: Distribution of fluorosis according to sex

Sl.No	Description	FY 2013-2014		FY 2014-2015		Cumulative up to FY 2013-2015	
		Male	Female	Male	Female	Male	Female
1	Total no. of subjects examined	553	490	451	505	1004	995
2	Dental Fluorosis found	95	73	87	74	182	147
3	Skeletal Fluorosis found	10	8	8	6	18	14
4	Non Skeletal Fluorosis found	43	27	45	43	88	70
5	Total no. of clinical cases	148	108	140	123	288	231
6	% of clinically found fluorosis cases	26.76	22.04	31.04	24.36	28.69	23.22

Table no-3 showed that the fluoride levels in the drinking water of the three study blocks were more than the upper limit set by WHO and BIS.

Table No-3: Drinking water Fluoride level of 3 Blocks of Bankura District

Name of the blocks	Fluoride (p.p.m. or mg/l) in drinking water (Mean±SD)
Simlupal	12.69±1.06
Hirbandh	10.80±0.92
Taldangra	10.45±1.18

Table No-4: Urinary fluoride levels of the study subject

Sl.No	Description	FY 2013-2014			FY 2014-2015			Cumulative up to FY 2013-2015		
		School	Community	Total	school	community	Total	School	Community	Total
1	No of Urine sample analyzed	88	303	391	71	208	279	159	511	670
2	No of urine sample above limit (>5ppm)	67	121	188	56	109	165	123	230	353
3	% of urine sample above limit (>5ppm)	76.14	39.93	48.08	78.87	52.40	59.14	77.36	45.01	52.68

670 urine samples were tested for fluoride level-353 (52.68%) samples were found above 5 p.p.m. (Table no-4). Table no-4 revealed that children were more prone to excrete fluoride in urine (77.36%) than the adults (45.01%).

DISCUSSION

India is one of the worst fluorosis affected country, with large number of people sufferings from fluorosis. This is because a large number of Indian populations depend on groundwater for drinking purposes and foods they consumed are contaminated with fluoride¹⁴. Fluorosis of dental enamel occurs when excess Fluoride is ingested during the years of tooth calcification-essentially during the first 7 years of life. It is characterized by mottling of dental enamel, which has been reported at levels above 1.5 mg/L intake¹⁵. Exposure to very high fluoride over a prolonged period of time results in acute to chronic skeletal fluorosis. It was stated in 1993, that crippling skeletal fluorosis might occur in people, who have ingested 10 to 20 mg of fluoride per day for over 10 to 20 years¹⁶. Skeletal fluorosis is usually not recognized until the disease reaches an advanced stage⁸. Skeletal fluorosis leads to impairment, disability and subsequently makes the affected subject handicap. Therefore, they are unable to get employment or labor for their daily livelihood, leading to totally dependent life.

In the present study, it was revealed that showed that school going children were more affected in dental fluorosis than adults which was close to findings of MedinaSolis et al.¹⁷and Ramezani et al.¹⁸. respectively. Sudhir et al¹⁹. and Manji et al.²⁰ were recorded 100 % dental fluorosis among the children of 5-14years age groups in Nalgonda district of Andhra Pradesh and Kenya, in contrast low dental fluorosis rate in Nalgonda district of Andhra Pradesh was reported by Nirgude et al.²¹.But the adults were affected more in skeletal fluorosis than children.

The study reported that males were affected more fluorosis than the females.

The fluoride levels of drinking water were much more higher in Simlapal, Taldangra and Hirbandh blocks from the upper limit. So, the People, residing in the fluoride endemic zone, are more prone to develop any form of fluorosis in long term.

CONCLUSION

As there is no proper treatment of established fluorosis till date, dictum has to be followed prevention is better than cure. A massive

initiative has to be taken from government (P.H.E. Dept & Health) & non-govt. organizations (NGOs), so that, the peoples residing in the endemic zone will get safe drinking water and proper health education as well as proper awareness about this disease. We recommend strong initiative and action so that, the peoples, particularly the school going children should be aware about the problems and its long term effects. Villagers should be educated regarding their life style, foods habits, etc to prevent the occurrence of fluorosis and its complications.

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