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Fluoride contamination of underground water and health hazard in Nasipur village of Birbhum district (WB) - A case study

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Abstract

Water is life. Human being can not survive with out water. Water is needed for drinking, taking bath, washing, irrigation and for building purpose. Of all these, drinking purpose is most sensitive because drinking water must be purified from the viewpoint of health. Nextly, water used for irrigation must also be well balanced mineralised. Underground water is such a source which is equally important for both these purposes. Fluoride is a compound remains in a certain amount in water. Fluoride compound (F^-) is necessary for a certain content to eradicate the dental caries. It does harden the tooth and bones. The normal level of fluoride in underground water is 1 or 1.5 mg. per litre. World Health Organization (WHO) guideline value and the permissible limit of fluoride as per Bureau of Indian Standard (BIS) is 1.5 mg/L. Crossing this limit fluoride contaminates the water. If that water is used for drinking purpose then health hazard may occur. This health hazard is known as fluorosis. Person once attacked by this never is cured from this. Patients lost their ability to do work. "The Nasipur is the first place to report cases of fluorosis in West Bengal. The village is located in Nalhati Block-I of Birbhum district" (Chatterjee, 2004). It is in interest to us to find out the problems of fluoride affected people of Nasipur village and to find out the alternative measures to solve this in conclusion part.

Keywords: *1.Fluoride contamination, 2.Source of drinking water, 3.Fluorosis.*

Introduction:

During a rapid assessment survey by Public Health Engineering Department, Government of West Bengal (2005), 729 sources were found to be contaminated with fluoride above 1.5 ppm in 43 blocks of seven districts of West Bengal, with the affected population being approximately 2.26 lakhs. Fluorided seven districts are Purulia, Birbhum, Bankura, Malda, South Dinajpur, North Dinajpur and South 24-Parganas (Keller, E., 1976). Though ground water contamination by fluoride is a recent issue but it has become a very common problem to the people specially those of remote areas through out the world with the increasing demand of water. India is not away from this menace which is controlled mainly by the geological strata. It has been said earlier that Nasipur is first at West Bengal to report this case. The study area Nasipur village is situated at Nalhati Block-I of Birbhum district (W.B), India (Figure: 1).

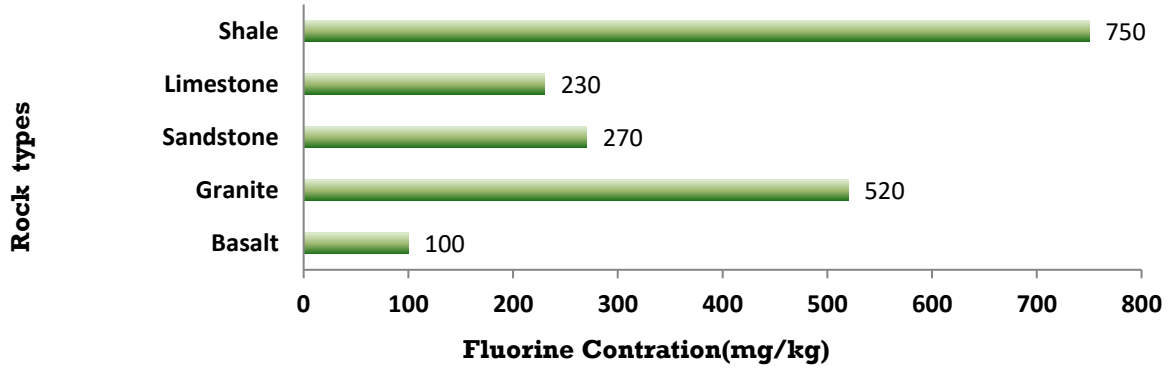
Methodology:

Primary data has been collected from Nasipur village. Beside this, few information have been collected from CMOH-II of Suri Sadar Hospital and PHED (Suri) through the oral discussion. Before analysing, all the primary data have been transferred into indicators with the help of different statistical techniques viz; mean or average, standard deviation (SD) and coefficient of variance (CV). Tables are those indicators.

Discusstion:

"The Nasipur is the first place to report cases of fluorosis in West Bengal. The village is located at Nalhati Block-I of Birbhum district. It is the Nalhati-1 block of the extreme western part of the Birbhum district, West Bengal. Geologically, the area consists of fine grained, hard, and compact basaltic rocks" (Chatterjee, 2004). "Basaltic rock and water interaction with it may be responsible for the increased F in the artesian well." "Granitic rocks are quarried near Panchra (23°46' N, 87°20' E) and Dubrajpur (23°48' N, 87°22' E). These are also available near Ranihabal (24°06' N, 87°20' E), Abdarpur (24°01' N, 87°31' E) and from places in vicinity, e.g. Kushkhaspur, Haridaspur, Chak Mukunda, Chuarili and Kurabali." Nasipur village is under the Haridaspur gram panchayet. So, geological strata beneath the Nasipur also include the granite.

Figure: 2 Average concentration of Fluorine in main rocks types



Source: Athavale R.N and Das R.K (1999). Down to Earth, 8(6): 24-25.

Fluorine concentration in different rocks is not same. We can see in Figure: 2 that the basalt contains lowest amount of fluorine among the rock types shown in the diagram. "Concentration of fluorides is five times higher in granite than in basalt rock" (Figure: 2). So, it can be said that geological strata beneath the Nasipur is related with the both viz; granite and basalt which contain fluoride. When the fluorosis disease was detected at Nasipur village, the tube wells and wells which were inside the village sealed and the water of Tripita Nala was started to be supplied through the tap by the Government. "The Tripita Nala flows east from the Santal Parganas, enter the district at 87°44' E & 24°17'30" N., becomes perennial east of 87°45' E. and joins the Brahamni as left bank tributary at 87°50' E. & 24°17' N." (Majumdar, 1975). But the villagers drink from alternative source when tap service is halted. Tap service is provided at particular time of each day. Many poor villagers miss to collect or store the tap water at the right time. Beside this if electric load shading occurs then water is not provided. Then almost all villagers use alternative water sources, e.g. water stored in unfilled stone mine, neighbouring village tube well, well outside the Nasipur village or canal. All these alternative sources excepting canal may be affected by the fluoride because all these sources remain adjacent to granite and basalt rock. "Beside water, food items especially agricultural crops are heavily contaminated with fluoride as they are grown in the areas where the earth's crust is loaded with fluoride bearing rocks." '...use of fertilizers and pesticides and other sources of contamination (Garg and Singh, 2007)' is another cause to recharge the soil by fluoride. "The sources of atmospheric fluoride include the burning of coal and manufacturing of steel, lead, copper and nickel. It is liberally used for making super phosphate- an inorganic fertilizer indiscriminately utilised in the third world countries. Plants absorb fluoride from atmosphere as well as from the soil. Man obtains fluoride compound from

plants and water" (Chatterjee, 2004). This may be a cause of fluorosis at Nasipur. "In Bihar Chotonagpur Plateau are also reported cases of fluorosis. It is very close to hills of Bihar (Jharkhand) border and it is a part of Chotonagpur plateau. The groundwater pollution in the region may be an extension of the Bihar malaise" (Chatterjee, 2004) "The source of this F^- contamination in ground water at Nasipur may be due to the presence of intertrappean sedimentary beds that were originally enriched in F^- at the time of deposition and subsequently became soluble in entrapped water by favourable physico-chemical conditions" (Gupta et al., 2006). Though the only source of fluoride is soil or may be said to as geological strata, but human being gets it from different sources, e.g., underground water, crops, air etc. It is because of the fact that all these sub sources are related with soil in one or different way directly or indirectly. The source which most efficiently helps the fluoride to enter the human body is underground water.

As a result of fluorosis tooth become faint yellow, brown or black in colour; tooth suffers by pitting chipped off, enamel hypoplasia (when tooth becomes thin); beside these, delayed eruption, white opacities and fragileness in tooth occur. All these are symptoms of dental fluorosis. At Nasipur all these symptoms are found to the patients. More than 50 % patients are suffering from all these diseases (See average value. Table:1). Change of normal tooth colour into yellow, brown or black is the most prominent diseases to them. Pitting chipped of and delayed eruption are two other diseases which occur frequently in them. Pitting chipped of later on has led to mouth sore whereas delayed eruption leads to problem of chewing.

Table:1- Dental fluorosis (% of affected patients)

Faint yellow	Brown stain	Pitting chipped off	Black discoloration	Enamel hypoplasia	Delayed eruption	White opacities	Fragile teeth	Average	SD	CV
71.226	85.147	53.186	68.776	35.343	70.245	33.53	36.667	**56.77**	**19.84**	**34.95**

Source: Field survey by author.

At Nasipur skeletal fluorosis also occurred to the fluoride affected patients. The symptoms of this disease are heal pain, painful& restricted joint movement, deformities in limbs, hunch back, paralysis, muscular wasting and pre-maturing aging (Table:2). Heal pain, painful & restricted joint movement, deformities in limbs, muscular wasting and premature aging are most prevalent in them.

Table:2- Skeletal fluorosis (% of affected patients)

Heel pain	Painful & restricted joint movement	Deformities in limbs	Hunch back	Paralysis	Muscular wasting	Premature aging	Average	SD	CV
98.235	95.147	47.539	3.088	3.088	39.853	95.885	**54.69**	**42.48**	**77.67**

Source: Field survey by author.

The symptoms of non-skeletal fluorosis are tension, nervousness, depression, tingling sensation in fingers and toes, excessive thrust, to urinate frequently, muscles weakness & stiffness, muscle pain and loss of muscle, less volume of urine, yellow and red urine colour, axilla itching, very painful skin rashes, pinkish red or bluish red spot, oval or round shaped, acute abdominal pain, diarrhoea, constipation, blood in stool, bloated feeling, tenderness in stomach, feeling of nausea, mouth sores etc (Table:3, with abbreviations). Most of the patients are suffering mostly from tingling sensation in fingers and toes, muscles weakness & stiffness, muscle pain and loss of muscle.

Table:3- Non-skeletal fluorosis (% of affected patients)																				
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	Average	SD	CV
14.264	86.324	15.392	49.902	85.738	73.53	31.373	15.686	7.598	25.441	31.471	41.667	0.588	16.176	39.608	39.902	0.588	33.97	0.588	30.10	26.67	88.6

Source: Field survey by author.

Abbreviations used in Table: 3

a) Tension, nervousness, depression	k) Pinkish red or bluish red spot, oval or round shaped
b) Tingling sensation in fingers & toes	
c) Excessive thrust	l) Acute abdominal pain
d) To urinate frequently	m) Diarrhoea
e) Muscles weakness & stiffness	n) Constipation
f) Muscle pain & loss of muscle	o) Blood in stool
g) Less volume of urine	p) Bloated feeling
h) Yellow red urine colour	q) Tenderness in stomach
i) Axilla itching	r) Feeling of nausea
j) Very painful skin rashes	s) Mouth sores

Of all three types of fluorosis (dental, skeletal and non-skeletal) dental fluorosis occurs most severely in them followed by skeletal fluorosis with slight difference. So it can be said that patients suffering from dental and skeletal fluorosis are more than that of non-skeletal fluorosis because average percentage of non-skeletal fluorosis affected patients are only 30.10. Whereas, that of dental and skeletal fluorosis is 56.77 & 54.69 respectively (Table:1, 2, 3). If we see the coefficient of variance (CV) of all these three then it is found that CV is very high i.e. 88.6 % for symptoms of non-skeletal fluorosis followed by skeletal fluorosis with CV 77.67 % and that is comparatively lower for symptoms of dental fluorosis i.e. 34.95 %. It is because of the fact that few symptoms of non-skeletal fluorosis are most acute like tingling sensation in fingers & toes (b), muscles weakness & stiffness (e) and muscle pain & loss of muscle (f). Similarly heel pain, painful & restricted joint movement, premature aging are most acute problem as skeletal fluorosis. On the other hand most of the symptoms of dental fluorosis excepting two or three are found in most of the patients.

Figure:3 Example of some sorts of fluorosis found at Nasipur.

Source: Photography captured during field survey by author.

Climate change has become a problem being a headache in global scale. But villagers of Nasipur are much more vulnerable in front of water scarcity in daily life. Almost all patients (98 %) use alternative water sources, e.g. water stored in unfilled stone mine, neighbouring village tube well, well outside the Nasipur village or canal owing to various reasons. It has already been said that all these alternative sources excepting canal may be affected by the fluoride because all these sources remain adjacent to granite and basalt rock. The villagers are unconscious on this matter because of lake of education. Almost 64 % patients are illiterate, only 4 % are higher secondary passed, literacy of other 32 % varies from class 1 to class 8. Patients as well as the villagers were unknown about the crippling fluorosis which is endemic at Nasipur. 100 % patients are of the opinion that they have come to know this disease occurred in them from the doctor. Side by side media has also played a role to focus on this. Most of the patients have taken no strong measure against fluorosis. 86 % people responded that they are worried, but they are unfamiliar with the measures to eradicate the water fluoridation and fluorosis. 88 % of the patients are saying that their economic condition is poor, they depend on the government.

Conclusion:

In ancient period man used to drink any surface water when any sort of pollution was almost absent. We must not compare today's situation of Nasipur with primeval period. In these days underground water is the most usable everywhere. But villagers of Nasipur are unlucky. So, proper policy measures and action programmes are needed to release them from this environmental curse. For example, posters are given only on the walls of the gram Haridaspur panchayet in which Nasipur lie. Same posters should be provided to the walls of Nasipur village, so it can increase the awareness to the all villagers and at least to the patients. Tap service must have to be extended upto stone mine area where the villagers work. Tap service must not be halted. Operation of handicapped patients must be donated free of cost.

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