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Study of fluorosis problems in Hardia Sector D (Jajpur Village) of Rajauli Block of Nawada District, Bihar

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Abstract : Water contamination is a major problem in the present scenario. The groundwater of many sources have become polluted. The contamination is due to both natural reasons as well as due to human activities. The groundwater of some villages of Rajauli block of Nawada district, Bihar is highly contaminated with fluoride - the intake of which has resulted into a severe bone deformity called fluorosis. The maximum permissible limit of fluoride in groundwater as per the WHO guidelines is 1.5 mg/L. However many groundwater sources of Hardia Sector D (Jajpur) have fluoride level more than the permissible limit and in one of the sources it has reached the value of 3.59 mg/L. Many visible cases of fluorosis have been found in the village.

Keywords : contamination, deformity, fluoride, fluorosis

INTRODUCTION

Stress on fresh water is one of the major problems faced these days. Only 0.5% of the global water is available for human use. Major part of the water is present in seas and oceans which is not suitable for domestic consumption.¹ Water pollution is another great challenge to face. Water in many sources-both surface water and groundwater has got polluted. Human beings have played a major role in polluting the water sources. Surface water is exposed to toxic contaminants. The groundwater in many sources too is highly contaminated.² Several toxic chemicals including heavy metals have entered the

groundwater sources.^{3,4} Fluoride (F⁻) ions beyond the permissible limits have also been found in many groundwater sources in different parts of the country.⁵

Groundwater contaminated by fluoride has been found in 20 states of India including Bihar and Jharkhand. 11 districts of Bihar have high groundwater fluoride contamination.⁶ The district of Nawada is one among the 11 districts of Bihar where groundwater is contaminated by fluoride ions. The Rajauli block of Nawada district is one of the worst fluorosis endemic areas. Hardia Sector D (Jajpur) located 5 km away from sub-district headquarter Rajauli is affected by fluorosis. It is located at 24.60°N latitude and 85.51°E longitude.⁷

The intake of fluoride rich water leads to a medical condition called fluorosis. The maximum permissible limit

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of fluoride in drinking water as per the WHO guidelines is 1.5 mg/L.^{8,9} But maximum groundwater sources have their fluoride level higher than the maximum permissible limit of 1.5 mg/L and in one source it has touched the value of 3.59 mg/L. Clean and fluoride free water is an essential requirement in the village. However this facility has recently been started. The water of Phulwaria Dam is now being made fluoride free and supplied to the villagers. Certain steps must be taken by both governmental and non-governmental organisations in providing nutritious food to the people.

Fluorosis can be divided into four categories- dental fluorosis, skeletal fluorosis, non-skeletal fluorosis and muscular fluorosis.

Dental fluorosis: The initial symptoms of this disease are the appearance of white patches in the teeth. Brown stains appear in mild conditions. Severe cases include the degradation of the brown stained teeth and in some cases complete breaking of the affected teeth.¹⁰

Skeletal fluorosis: It is a bone disease caused by excessive deposition of fluoride ions in the bones. It results in deformity of bones. Some people suffering from skeletal fluorosis have knock knee while others have bow legs.^{11,12}

Non-skeletal fluorosis: In this type of fluorosis pain in the joints occur which causes painful movement near the joints. Abdominal problems also results in many cases. Non-ulcer dyspepsia, viz. nausea, vomiting, pain in the stomach, bloated feeling/gas formation in the stomach, constipation followed by diarrhoea, may be due to fluoride toxicity.^{13,14}

Muscular fluorosis: Symptoms include stiffness and pain in the muscle and loss of muscle power.^{15,16}

MATERIALS & METHODS

The method of sampling and testing includes the following processes:

1. Collection of water samples from different groundwater sources of Hardia Sector D.
2. Testing of the samples for fluoride contamination.

1. Collection of water samples from different groundwater sources of Hardia Sector D

The different groundwater sources from Hardia Sector D (Jajpur) where the groundwater is contaminated by fluoride was identified by sampling and testing the groundwater sources by the 'Aquasol Kit' (Rakiro Biotech Sys Private Limited). Water from different groundwater

sources were collected during June 2019. Water was collected from hand pumps and bore wells- the depth of which ranged from 80 ft to 130 ft.

2. Testing of the samples for fluoride contamination

Water samples were collected in 1 L size plastic bottles. A total of 20 samples of different drinking water sources were analysed. The samples were then analysed in the Centre for Fluorosis Research, Department of Chemistry, A.N. College, Patna. The samples were analysed by the Ion Selective Electrode Method.^{17,18}



Fig. 1



Fig. 2

Fig .1 and 2- Skeletal Fluorosis in Hardia Sector D

RESULTS & DISCUSSION

On testing the samples for fluoride it was found that maximum groundwater sources of the village were contaminated with fluoride. Most of the groundwater sources had the fluoride level more than the permissible limit of 1.5 mg/L. out of 20 samples taken from 20 groundwater sources only 1 source had the fluoride level within the permissible limit. All the remaining sources were fluoride contaminated. In one of the sources the fluoride was found to be as high as 3.59 mg/L.

Table 1- The level of fluoride in various water samples of Hardia Sector D (Jajpur) are as follows

Sample no	Concentration of fluoride (mg/L)
01	3.51
02	1.64
03	2.61
04	2.31
05	2.54
06	2.38
07	1.88
08	1.13
09	3.58
10	1.85
11	3.07
12	1.75
13	2.21
14	3.59
15	1.98
16	1.95
17	3.35
18	3.35
29	3.13
20	2.68

Most of the people during the health survey reported dental problems, muscular pains, joint pains, tooth discolouration, bone deformities and many more ailments related to fluorosis. Some cases of knock knee and bow legs were also observed. Lack of proper diet has also added to the severity of the disease.

CONCLUSION

Maximum groundwater sources in Hardia Sector D (Jajpur) are highly contaminated by fluoride which has resulted into fluorosis. All the four types of fluorosis affected people were observed in the village.

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