



## Effectiveness of Fluoride Mitigation in Madhya Pradesh after Intervention

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### Abstract

**AIM** – The aim of the following study is to analyse fluoride level in different areas of M.P so as to find effectiveness of fluoride mitigation in entire state of M.P. **OBJECTIVE** :1.This study will help agencies to monitor the implemented schemes.

2. The study will help increase the scientific knowledge regarding fluoride in water and its effect on human beings. It shall also inform the people about different fluoride mitigation options at regional and national level.

3. Fluorosis being an important endemic disease of the area requires its mitigation as this disease is preventable but not curable once it occurs. Thus it is important to analyze the effectiveness of fluoride mitigation programs.

**MATERIALS:** In this study Water samples from one water resources is collected like –

1. bore well

Collected above 500 ml of water in a dry polythene container and label it with the name of area / source. As the sample couldn't be analysed immediately, added 2 cc of 6N Hcl to bring PH approximately below 2.0 inhibit microbial growth or enzymatic change. And stored in 4<sup>0</sup> C till analysis.

These samples will then be checked for fluoride levels by electrode method.

**RESULT:** The given study is effective as it shows reduced fluoride content comparing to previous study. The value of fluoride in drinking water varies from 3.66 – 13.86 mg/ltr. whereas the tolerance limit as per WHO of fluoride is 1.5mg/ltr. Even though the mitigation process is effective the results obtained are not reached the tolerance limit as per WHO in few areas.

**CONCLUSION** : the given study shows the effectiveness of mitigating process of fluoride.

**Keywords:** fluoride mitigation, effectiveness, electrode method

### Introduction

Naturally occurring in the earth's crust, fluoride can often be found in the world's water supplies. While Fluoride is innocuous and even beneficial in small amounts, but when consumed in excess by humans and animals it can cause varying degrees of fluorosis.<sup>1</sup> In an effort to combat this public health problem, various technologies have been explored in both developing and the developed world.

Fluoride being one of the many minerals available in soil and rocks, is readily found in water bodies, thus present in fresh water systems also.<sup>1</sup>

In India about 62 million people suffer from dental, skeletal and or non-skeletal Fluorosis. Of these, 6 million are children below the age of 14 who are at risk.<sup>2</sup>

In India about 20 states have been identified with a problem of excess fluoride in groundwater, among which is State of Madhya Pradesh. Rural populations who are mainly dependent on groundwater for drinking purposes, are the worst affected.

Fluoride ingestion have effect on Dental and skeletal systems. In human system fluoride has a dual personality a derogatory effect (greater than 4 ppm) and caries preventive and health promoting effect at 1 ppm.

### Geological distribution of Madhya Pradesh

The incidences of Fluorosis in the area reported from several villages viz. Tikdimoti, Umariya, Surdiya Kotda, Rambhapur, Behrapada, Thapli, Bawadi Khurd, Behawada Sadli of Jhabua, Rama, Meghnagar, Petlawad, Jobat, Alirajpur, Jhabua district. M.P. The value of Fluorine in drinking water varies from 3.66 to 13.86 mg/liters, where as the tolerance limit as per WHO of fluorine is 1.5 mg/liters.<sup>2</sup>

In Chapri village, in Rama block of Jhabua district, most children have stained teeth. But residents of the village are now attentive to the problem of Fluorosis as the result of the awareness generated by the intervention of UNICEF and allied NGOS.

In the adjoining area at Khadauburg Dhar district a hand pump contained fluoride in excess of permissible limit which has seriously affected children with teeth and bone deformation problems as such local authorities have capped the hand pump.<sup>3</sup>

### Fluorosis

Dental fluorosis is by far the most common manifestation of over-consumption of fluoride. It is visible as white, yellow, and brown streaks on the teeth, characteristic of the hypoplasia and hypocalcification. Severe Dental Fluorosis is more than just cosmetic problem, as it tends to be associated with painful "cavity-like" feelings. While all teeth are affected, the incisors (especially the maxillary incisors) and permanent molars are often the teeth most affected by fluorosis as these are the first teeth to develop. skeletal fluorosis is far more severe than its dental counterpart. For skeletal fluorosis to occur it generally takes far more time, and higher concentrations of fluoride (typically over 10mg/l<sup>[2]</sup>), Though not initially obvious to diagnose,

skeletal fluorosis can be detected early on radiologically. Skeletal fluorosis is characterized by deformation of bone structure.

Skeletal fluorosis is non-curable thus efforts should be directed toward prevention and attempting to alleviate some of the symptoms.

It is suspected that Neurological complications are caused by fluorides effects on the spine and compression on the spinal cord. Studies have shown that high levels of fluoride can cause headaches, insomnia, and reductions in the IQs of children.

Thus this is a overview of revised ground- water fluoride levels in districts of Devjhiri (Jhabua), Amarkantak, Rotla, Bhuri Ghati, Kaidawat, Jhabua main, Alirajpur, Mataaula, Manawar, dhar, Guna.<sup>4</sup>

### MATERIAL AND METHODS

In the current study, the fluoride levels were assessed using electrode method. Following were values of ground water samples derived from the districts in the given study.(Table 1)

These results are based on the Report of flurosion mitigation programme on Dhar district conducted during (Nov 2008 – Feb 2011) (Table 2).<sup>1</sup>

Another Results from , AN ATTEMPT TO STUDY FLUOROSIS AND ITS IMPECTS IN PARTS OF JHABUA DISTRICT (M.P.) Aziz1 , Maria and Khan2 , A.A 1.Care well ,Bhopal (M.P.), INDIA 2.Ex. Director Geological Survey of India, INDIA (Table 3).<sup>4</sup>

#### Sample collection

In this study Water samples from one water resources is collected like –

#### 2. bore well

collected above 500 ml of water in a dry polythene container and label it with the name of area / source. As the sample couldn't be analysed immediately, added 2 cc of 6N Hcl to bring PH approximately below 2.0 inhibit microbial growth or enzymatic change. And stored in 4<sup>0</sup> C till analysis.

these samples will then be checked for fluoride levels by electrode method.

Electrode method is choosed because reproducibility is independent of concentration and in this method

the calculation of concentration of fluoride is done by direct ppm reading

The results are then derived and effectiveness of mitigation process is assessed from the above obtained data.

And unlike other studies the data obtained will then be used for flouride mitigation in the district dhar by one of the following ways. Most commonly used technique now a days is reverse osmosis. Though Nalgonda technique also gained popularity.

## RESULT & DISCUSSION

A report on fluorosis mitigation program in Dhar district was conducted in nov2008-feb2011.<sup>1</sup> which reduced the fluoride concentration in those areas, and our study is of checking the effectiveness of mitigation process that the how much it is sustained till 2019. Fluorosis mitigation approach needs to begin with better understanding of health impacts of excessive fluoride intake in relation with nutritional aspects and establishing tolerable levels of risk to human health. (NEERI, 2007). These aspects are fulfilled by Integrated Fluorosis Mitigation, introduced by NEERI and UNICEF in Madhya Pradesh in 2007.<sup>5</sup>

The disctripts included in our study of Madhya Pradesh is Jhabua, Jabalpur, Alirajpur, Guna, Dhar and Anuppura and around samples of water from 11 villages in these districts has been collected and the fluoride level has been checked by using electrolyte method.

The Jhabua district in the western Madhya Pradesh is occupied by Aravalli Supper

Group of rocks comprising of gneisses, granite pegmatite feldspathic granite and by thick sequence of eruptive volcanic rocks consisting of thick pile of basaltic lava flows these rocks contain Fluoride as essential and accessory mineral which are the main source of Fluorine.

The villages namely Matasule, Devjhiri, Bhurighat, Manawar, Dhar showed higher fluoride content in water collected than the normal recommended 1.5 mg/dl

Ampaypura, Rotla shows little higher flouride content than recommended

Whereas, Kaidawad, Amarkantak, Guna showed within recommended fluoride content and since the effectiveness of the mitigation process conducted early is sustaining in these areas.<sup>6</sup>

Comparing Effectiveness of mitigation process in high fluoroide conc areas(Table 4)

It has been suggested that a “sliding scale” of acceptable levels of fluoride should be used based on the average maximum temperature (Table 5).

Given this, it has been noted that those who live in hotter/humid climates and/or labor outdoors are far more likely to develop symptoms of fluorosis than those who do not. This is because they consume far more water than those in other regions and lifestyles. Other factors that have affected the severity of fluorosis in individuals are altitude of residence, nutritional status, and use of dentifrice. It is estimated that about 60% (80-90% for infants) of fluoride ingested in person’s body is retained while the rest is primarily expelled through urine.

The maximum mean temperature of villages included in our study are:(Table 6)

Because fluoride does not cause water to have any abnormal, taste, and odor, it is difficult to determine if water has significant fluoride concentrations.

Because of this and the cumulative nature of fluoride as a toxin (that is, the results of consumption are not immediate), many peoples do not automatically connect water consumption to fluorosis

Therefore, there is a great need for education on and awareness of fluorosis in fluorotic areas and to connect water consumption to the symptoms of fluorosis.

In many of these areas, little priority is given to water defluoridation because water sources are scarce enough that peoples are not concerned with water quality.

And because fluoride consumption has no immediate health effects and defluoridation methods are generally more time and money intensive than other water treatment types, there is generally a lack of motivation on the part of the people to be concerned with defluoridation.

Even when defluoridation methods are used, the lack of immediate results is a hindrance in encouraging the continued use of defluoridation.

## CONCLUSION

Fluorosis is a public health problem in children . High fluoride content in the sources of drinking water is the main reason for dental fluorosis, suggesting an urgent need for defluoridation of water sources involving synergistic action of health planners, health administrators, engineers, and health authorities to lower the burden of dental fluorosis in the community. As, shown in the Table : 4,the given study is effective as it shows reduced fluoride content comparing to previous study. The value of fluoride in drinking water varies from 3.66 – 13.86 mg/ltr. whereas the tolerance limit as per WHO of fluoride is 1.5mg/ltr. Even though the mitigation process is effective the results obtained are not reached the tolerance limit as per WHO in few areas.

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**TABLE 1: Values of ground water samples derived from the districts in the given study**

S.No.	Location	Source	Result F (mg/L)
1.	Matasule - Jhabua district	Borewell	4.04
2.	Ampaypura – Alirajpur dist	Borewell	1.79
3.	Jhabua	Borewell	1.29
4.	Kaidawad – Jhabua dist	Borewell	0.87
5.	Devjhiri – Jhabua dist	Borewell	3.99
6.	Amarkantak - Anuppur dist	Borewell	0.25
7.	Rotla – Alirajpur dist	Borewell	2.63

8.	Bhurighat – Jabalpur dist	Borewell	4.83
9.	Manawar – Dhar dist	Borewell	3.79
10.	Dhar	Borewell	3.01
11.	Guna – Guna district	Borewell	0.28

**TABLE 2: Results are based on the Report of flurosis mitigation programme on Dhar district conducted during (Nov 2008 – Feb 2011)**

s.no	Name of the block	Max fluoroide concentration mg/l
1	Dhar	10.2
2	Nalanda	28.5
3	Tiria	18.1
4	Sardarpur	4.56
5	Badnawar	9.81
6	Kukshi	8.6
7	Bagh	17.2
8	Nisarpur	6.69
9	Dahi	13.2
10	Manawar	9.52
11	Gandhwani	19.4
12	Dharampuri	23.0
13	Umarban	19.2
14	Anuppura	10.8

**TABLE 3: Results from , an attempt to study fluorosis and its impacts in parts of jhabua district (m.p.)**

s.no	District	Flouride concentration
1.	Jhabua	River water – 2.4 -3.6 HP - 1.2- 7.5 PW - 0.8 – 11.7 DW - 0.6 – 11.9
2.	Alirajpur	River water – 1.8 -2.4 HP - 15.4 PW - 2.0 – 11.1 DW - 0.3 – 14.0

**TABLE 4: Comparing Effectiveness of mitigation process in high fluoroide conc areas**

Districts	Fluroide conc (mg/L)in previous study	Fluroide conc (mg/L)in given study
Jhabua	11.7	1.29
Alirajpur	15.4	1.79 & 2.63
Jabalpur	9.02	4.83
Manawar	9.52	3.79
Dhar	10.2	3.01
Anuppura	10.8	0.25

**TABLE 5: Average maximum temperature**

Maximum Mean Temperature of Region (°C)	Maximum Recommended Concentration of Fluoride (mg F/l)
0	2.1
10	1.3
20	0.9
30	0.7
40	0.6
50	0.5
60	0.4

**TABLE 6: The maximum mean temperatures of villages included in our study are,**

Districts included in the study	Maximum mean temperature	Fluoride concentration mg/dl as per study
Jhabua	32.8 <sup>0</sup> C	0.87-4.04
Alirajpur	32.8 <sup>0</sup> C	1.79 – 2.63
Jabalpur	30.4 <sup>0</sup> C	4.83
Anuppura	29 <sup>0</sup> C	0.25
Guna	24.8 <sup>0</sup> C	0.28
Dhar	40 <sup>0</sup> C	3.01- 3.79