



***Research Paper***

**LONG TERM EFFECTS DUE TO HIGH FLUORIDE CONCENTRATION IN DRINKING WATER AND SOCIOECONOMIC STATUS OF RURAL POPULATION IN DISTRICT PALI, RAJASTHAN: A CASE STUDY**

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**Abstract**

An extensive survey was carried out to know about dominancy of dental, skeletal and non skeletal fluorosis. General information about the family size, occupation, diet, health status of local rural person was collected to know socioeconomic status in a form of questionnaire. During this survey it was noticed that majority of the resident of these villages were affected by fluorosis disease. The dental, skeletal and nonskeletal fluorosis symptoms in rural persons were identified according to clinical signs and symptoms suggested by control and prevention of fluoride and fluorosis. Crippling deformity is associated with rigidity of joints includes lateral curvature of vertebral column, deformity of knee joint. Samples of drinking water from different endemic area were also taken and data of endemic fluoride area were compared with non-endemic area of district Pali and it was found that Dental and skeletal symptoms of fluorosis in endemic area were much higher than those of non endemic area. Estimation of fluoride in human serum, urine were also taken and compared with non fluorotic person, results shows high fluoride in person of endemic area than non endemic area. Maximum people suffering with fluorosis were below poverty line, population mostly illiterate, engaged in agriculture and labour.

*Key words: Fluoride, Skeletal and nonskeletal fluorosis, Crippling deformity, Serum.*

**INTRODUCTION**

Hydrogeochemical characterization is a very important aspect of ground water management. The quality of ground water is uniformly controlled by the existing rocks and catchment area, due to the constant rock-water interaction that takes place in any aquifers. Groundwater sources plays important role as a source of drinking water in most of the part of Rajasthan State. Ground water is major source for purpose of drinking water, irrigation, cooking etc. in district Pali.

There is wide range of depth at which the water table is available. Rohat, Pali, Sumerpur, Rani areas are consists of shallow water with the depth of water level below 10 m. In major part of the district leaving side parts of Pali and Rohat, Kharchi, Jaitaran, Desuri and eastern peripheral regions has depth of water level between 10 m to 20 m.

Whereas in Rani and Bali some part of Kharchi, Sojat has deep water level with the depth of more than 20 meters. (C.G.W.D. Report,1999)

It is an essential element and significantly takes part in recovery of dental carries, within the desirable limit; above the maximum permissible level fluoride create health hazard effect to metabolic mechanism. It has been evidently proved that continuous and slow intake of high concentration of fluoride through various sources ultimately alters the metabolism of living organism.

## **MATERIALS AND METHODS**

### **Survey of fluoride endemic area**

Present study was carried out in few villages of district Pali of Western Rajasthan. Study deals with the socioeconomic survey and case study to know prevalence of Fluorosis in endemic area of present study sites. These sampling sites were village Kharchi, Kharchi(Marwar), Bitura, Bhagwanpura, Narsingpura of district of Pali.

### **Sample Collection**

During investigation water samples were collected from underground water bodies (handpumps) in sterilized polythene bottles of 500 ml capacity. All the samples were brought to laboratory in icebox.

### **Estimation of Fluoride**

Quantitative estimation of fluoride in drinking water were carried out according to fluoride selective ion electrode method APHA(1985) [1] by using cyber scan model No. 2500 ion analyzer and TISAB (total ionic strength adjusting buffer) was used to adjust the total ionic strength to the sample, results presented in mg/l.

### **Socio Economic Survey**

A health survey were conducted using a family dietary schedule in form of questionnaire and interviewed with villagers which includes the size of the family, educational status, family disease history, family income occupation, diet were taken in account to determine socio economic status of rural population in fluoride endemic area.

## **RESULTS AND DISCUSSION**

According to Indian standard of drinking water quality and WHO the desirable limit for fluoride is 1.5 mg/l. above this create health hazardous effect in human beings. Fluoride conc. in different ground water samples of study stations were ranged between minimum 1.05 mg/l (July, 2013) to maximum 6.58 mg/l (January, 2014) (Table no. 1 and Fig. 1) while the maximum permissible limit is 1.5 mg/l [12], [13]. Seasonal mean concentration was ranged between maximum 5.71 mg/l (Station No. 4) in winter to minimum 1.65 mg/l in monsoon season. Overall seasonal variation of fluoride concentration was highest in winter season whereas minimum in summer season (Table no.2 and Fig.2). Results indicate maximum population of these villages of district Pali, Rajasthan are exposed to high fluoride.

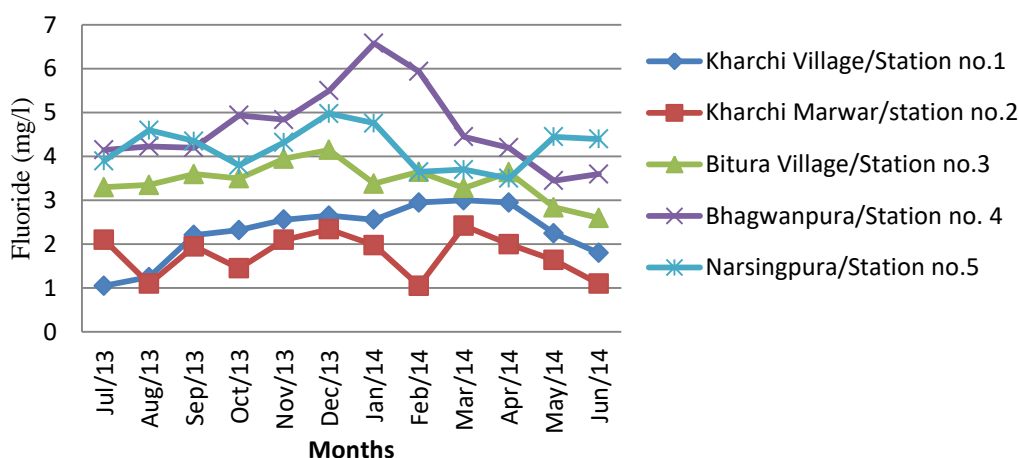
**Table No. 1 Showing monthly fluoride concentration (mg/l) of different sampling stations.**

Months	Sampling Station				
	Kharchi Village (Station No.1)	Kharchi Marwar Village (station No.2)	Bitura Village (Station No. 3)	Bhagwanpura Village (Station No.4)	Narsingpura Village (station No.5)
Jul 13	1.05	2.10	3.30	4.15	3.90
Aug 13	1.25	1.10	3.35	4.23	4.60
Sep 13	2.21	1.95	3.60	4.20	4.35
Oct13	2.32	1.45	3.50	4.94	3.80
Nov13	2.56	2.10	3.95	4.84	4.32
Dec 13	2.65	2.34	4.15	5.50	4.98
Jan 14	2.56	1.98	3.38	6.58	4.76
Feb 14	2.95	1.05	3.65	5.94	3.65
Mar14	3.0	2.42	3.28	4.45	3.70
Apr14	2.95	2.0	3.64	4.20	3.50
May 14	2.25	1.64	2.84	3.45	4.45
Jun 14	1.80	1.10	2.60	3.60	4.40

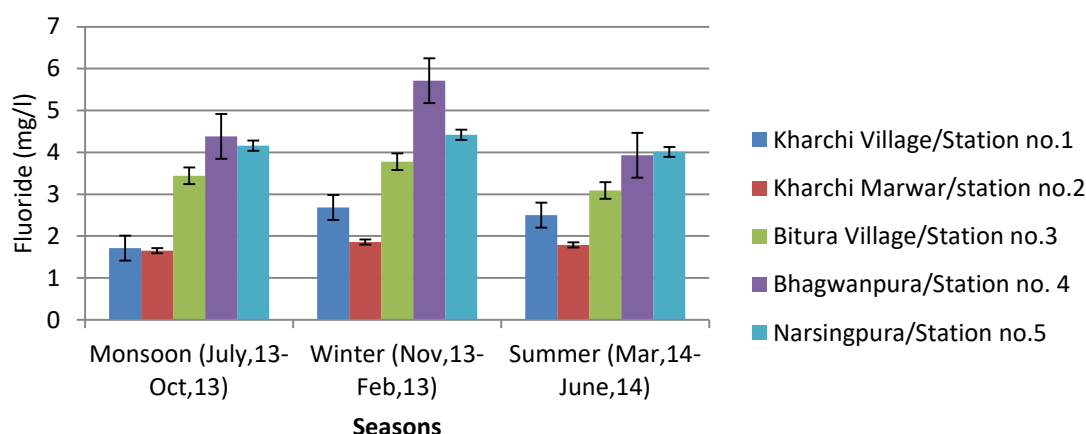
**Table No. 2: Seasonal mean of fluoride concentration (mg/l) of different sampling stations**

Seasons	Kharchi Village (Station no.1)	Kharchi Marwar (station no.2)	Bitura Village (Station no.3)	Bhagwanpura (Station no. 4)	Narsingpura (Station no.5)
Monsoon (July,13-Oct,13)	1.71	1.65	3.44	4.38	4.16
Winter (Nov,13-Feb,13)	2.68	1.86	3.78	5.71	4.42
Summer (Mar,14-June,14)	2.5	1.79	3.09	3.93	4.01

**Fig. 1: Monthly fluoride concentration (mg/l) in different ground water sampling station**



**Fig. 2: Seasonal mean of fluoride concentration (mg/l) in different sampling stations**



The result shows that the maximum of these endemic areas suffering with fluorosis disease. A total number of 295 persons were interviewed randomly to show the dental, skeletal, and non skeletal fluorosis (Table no. 3). The dental, skeletal and non skeletal fluorosis symptoms in rural persons were identified according to clinical signs and symptoms suggested by control and prevention of fluoride and fluorosis. In present investigation the prevalence of dental fluorosis was (50.85%) more than skeletal fluorosis (8.47%). The dental fluorosis was much prominent in elders than the children. The results shows that out of 150 dental fluorotic patients, 105 (70%) were adults of 25-65 years of age while 45 (30%) patients were children. Higher level of dental fluorosis in children of 5-17 years of age also reported earlier [2], [7]. Excessive intake of fluoride content causes dental, skeletal and non skeletal fluorosis in living beings reported earlier [4], [7], [10]. During the study urine samples and blood samples were taken from few fluorotic patients by medicinal expert to analyses the fluoride in urine and blood samples. Results indicate that level of fluoride in blood serum and urine

sample of fluorotic patient were found high. Mean conc. of serum fluoride of fluoride patient was found  $0.78 \pm 0.11$  mg/l and mean conc. of fluoride in urine sample was found  $22.98 \pm 9.9$  mg/l. It was found that fluoride level significantly increased ( $p \leq 0.001$ ) in fluorotic patient in comparison to non fluorotic persons. Permissible limit of fluoride in serum and urine by WHO is 0.02 mg/l and 0.10 mg/l respectively [13].

In severity of skeletal fluorosis disease, Crippling deformity is associated with rigidity of joints, lateral curvature of vertebral column and deformity of knee joint. Similar results were also shown that exostosis, kyphosis, invalidism and crippling in human beings due to chronic fluoride intoxication [4], [5], [10].

Socio economic survey reveals that maximum population of these areas were below poverty line maximum are engaged in agriculture and labor as a major occupation, people were mostly illiterate, found consuming habit making substances like tobacco at large scale and malnutrition problems was severe in endemic area. Previous study also reveals malnutrition and ill diet problems in fluoride endemic area [3].

**Table No. 3 Showing the cases of fluorosis disease in surveyed villages**

S. No.	Types of Fluorosis	Total no. of persons	Percentage (%)	Adults	Percentage (%)	Child (8-15 years)	Percentage (%)
1	Dental	150	50.85	105	70	45	30
2	Skeletal	25	8.47	25	100	-	-
3	Non Skeletal	75	25.42	70	93.33	5	6.66
4	No Fluorosis	45	15.25	-	-	-	-
	<b>Total</b>	295	100	200	67.79	50	16.39

## CONCLUSION

Present study concluded that the ground water is consumed for drinking water, cooking and other purposes which are the main factor responsible for total fluoride ingestion. Poverty and illiteracy is another factor responsible for sanitation and lack of awareness. Some previously reported food supplement enriched in Vitamin C and Calcium can reduce fluoride toxicity [6]. Defluoridation of water through techniques like Nalgonda, activated alumina adsorption, RO found effective therefore should be used in endemic rural area [11].

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