

## Assessment of Non-skeletal fluorosis in children of Jaipur district of Rajasthan, India



### Medical Science

**KEYWORDS:** Non- skeletal fluorosis, ALP, SGOT, SGPT, Jaipur District, Biochemical Parameters

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### ABSTRACT

Assessment of non skeletal fluorosis in the children (6-14 years) was conducted in the two blocks (a) Palera, Heerawala, Nayabas, Saipur and Birasana of Jamwaramgarh block, (b) Chitanukalan, Jugalpura, Sunder ka bas, Peelwa and Sirsali of Amber of Jaipur district of Rajasthan, India of the children of the study villages. Serum samples of these children showed elevated levels of alkaline phosphatase (ALP), serum glutamic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), and serum Bilirubin. Thus our data shows that High fluoride concentration in serum level affect the liver function. This finding is also associated with impaired liver function as assessed by biochemical parameters. Increased fluoride concentration in drinking water is also responsible for the increased the disease pattern.

### Introduction:

In India, Fluorosis (due to consumption of excess fluoride) is the most prevalent endemic disease which coexists in certain regions in the country. Fluorine is the most abundant element in nature, and about 96% of fluoride in the human body is found in bones and teeth (1). Fluorosis is mainly three types i.e., dental, skeletal and non skeletal fluorosis. Dental fluorosis is a global multifactorial disease is not new to India, the reason being the shortage of good quality potable water and consumption of fluoride enriched water by people both in the urban and rural areas. Fluorides are mainly found in ground water when derived by the solvent action of water on the rocks and the soil of the earth's crust (2). Higher fluoride concentration exerts a negative effect on the course of metabolic processes and an individual may suffer from skeletal fluorosis, dental fluorosis, non-skeletal manifestation or a combination of the above (3). There is a risk of endemic fluorosis where the fluoride level is more than 1.0 mg L-1 in drinking water (4). The available data suggest that 15 States in India are endemic for Fluorosis (fluoride level in drinking water >1.5 mg/l), and about 62 million people in India suffer from dental, skeletal and non-skeletal fluorosis. Out of these; 6 million are children below the age of 14 years (5).

The estimated range of safe and adequate intake of fluorides for adults is 1.5 to 4.0 mg per day and it is less for children and those with renal disease (6). Drinking water is the main source of fluoride, the causative factor for dental mottling. Low precipitation rate, unlimited use of ground water leads to the enrichment of various minerals including fluoride in the sub-soil structure (7). In addition to drinking water, fluoride enters the human body through air, food, beverages, fluoride enriched medicines, dental products like dentifrices and mouth rinses, sea fish, cheese and tea (8-12). Fluorosis has been found to cause severe side effects, not only to skeletal parts of the body (13-14) but also to the soft tissues like brain, liver, kidney and spinal cord (15-16). Earlier studies (17) reported that 50-80% of the absorbed fluorides are eliminated by the kidneys indicating the chances of kidney damages due to fluorosis. Liver is the main organ for fluoride detoxification and, therefore, is highly susceptible to the fluoride intoxication (18). Various studies demonstrated that elevated levels of serum hepatic and renal enzymes have been found following fluoride intoxication indicating degenerative and inflammatory damages to the liver and kidney (19-20).

Rajasthan is highly affected from fluorosis. All the 33 districts have

been declared as fluorosis prone area. Very little study has been published in the field of fluorosis. Hence, the objectives of present study are to assess the non-skeletal fluorosis in endemic fluoridated areas of Jaipur district of Rajasthan.

### MATERIALS AND METHODS

**Study areas:** The study was conducted in the two blocks (a) Palera, Heerawala, Nayabas, Saipur and Birasana of Jamwaramgarh block, (b) Chitanukalan, Jugalpura, Sunder ka bas, Peelwa and Sirsali of Amber of Jaipur district of Rajasthan, India with drinking water F levels of more than 1.5 ppm, respectively (Ministry of Drinking water and sanitation, Government of India and Public Health and Engineering Department, Government of Rajasthan, Jaipur). Except for the drinking water, there were no other sources of F exposure in the villages.

A sample group of 150 male and female children 6 to 14 years old exhibiting dental, skeletal and non-skeletal fluorosis consuming fluoride-contaminated water in endemic fluorosis areas of Jaipur district of Rajasthan, India were selected through a village level survey was conducted.

A detailed questionnaire regarding their demographic details, written consent was taken and duration of F exposure.

**Fluoride sample collection and analysis:** A 4 ml venous blood sample was collected from each selected subject after overnight fasting in a plain plastic Vacutainer (BD) tubes without any anticoagulant. A 24 hr urine sample and source of drinking water Tube well and Hand pump. Drinking water were collected in plastic falcon (Tarsons) tubes and investigated for fluoride levels. F concentration in each of the prepared solutions was estimated with the help of a F ion specific electrode (Thermo Scientific Orion Star A329). De ionized water was used for all measurements. For calibration, four standard solutions of 10, 1, 0.1 and 0.01 ppm F concentration were prepared by serial dilution.

1 mL of TISAB III was added to each 10 mL of standard solution and the instrument was calibrated. When calibrating, it was assumed that the added TISAB III had no effect on the standard concentration. Fluoride determination in the drinking water was carried out potentiometrically with a fluoride ion specific electrode (Thermo Scientific Orion Star A329). Urinary fluoride was estimated by the method of Hall et al (21).

Blood samples were left to clot at room temperature, and serum was separated by centrifugation. Serum fluoride was also estimated by the method of Hall et al (21). Using the Thermo Scientific Orion Star A329.

**Assessment of Non skeletal fluorosis:**

Biochemical analysis of clinical test is liver and renal function test performed to assess the Non skeletal fluorosis.

**I. Evaluation of renal function test**

Serum sample was used for the usual tests and the remainder was conserved at -20°C (22). e.g. Serum Creatinine, Blood Urea

**(I). Estimation of serum creatinine:**

The creatinine in test serum was estimated by standard enzymatic method (Picric acid method) (23). In to a series of test tubes equal volume of 1 mL reagent and 0.1 mL of test serum added and mixed gently by using semi auto analyser (ADONIS).

**(II). Estimation Blood Urea:**

Blood urea in test serum was determined by standard enzymatic method (UV KINETIC/GLDH) (24) and later modified (25). Add 0.1 mL of test serum sample to 1 mL of reagent in test tubes kept in a series, mixed gently by using semi auto analyser.

**2. Evaluation of liver function test**

Serum sample was used for the usual tests and the remainder was conserved at -20°C. (22). e.g. SGOT, SGPT, ALP and Total bilirubin

**(I). Estimation of serum glutamic transaminase (SGOT)**

The Serum glutamic transaminase in test serum was estimated by (26). Add 0.1 mL of test serum to 1 mL of SGOT reagent in test tubes kept in series mixed gently and aspirated and results were recorded.

**(II). Estimation of serum glutamic pyruvic transaminase (SGPT)**

The serum glutamic pyruvic transaminase was determined by (26). Add 0.1 mL of test serum to 1 mL of SGPT reagent in test tubes kept in series, mixed gently and aspirated and the results were recorded.

**(III). Estimation of alkaline phosphatase:**

Alkaline Phosphatase was determined by (26). Add 20µl of test serum to 1 mL reagent test tubes kept in series, mixed gently and aspirated and results were recorded.

**(IV). Estimation of total bilirubin:**

The total bilirubin was determined by standard enzymatic method (27). In to a series of test tubes containing 1 mL total bilirubin reagent, 0.1 mL of test serum was added, mixed gently and incubated for 5 min. at 37°C and then aspirated. The results obtained were recorded.

**Ethical approval:** The protocol for this study was approved from the Ethical Committee of Desert Medicine Research Centre (ICMR), Jodhpur. All work was performed according to the ICMR guidelines, New Delhi, India for human experimentation in biomedical research. Before the sample collection a written consent was obtained from each participants or their parents or legal guardians.

**RESULTS AND DISCUSSION**

Fluorosis is major problem in India as well as in Rajasthan. Study area is Jaipur District of Rajasthan. Age of the children is 6-14 years old school going children.

total 150 subjects are involved from the two Blocks of rural area of Jaipur District. Each Block is divide in 5 village. Total 10 villages are involved in the study. From each village 15 children are involved in the study protocol. Biochemical analysis of clinical test is renal function and liver function test performed to assess the non skeletal fluorosis. Village wise biochemical analysis of renal function test carried out for estimate the blood urea and serum creatinine content in the blood of the children in the Jamwaramgarh block of the Jaipur district of Rajasthan. Blood urea and serum creatinine content in the blood was found in children of the Birasana village (20.5-36.1 MG/DL ), (0.76-0.98 MG/DL) followed by Saipur (18.4-27.1 MG/DL), (0.78-0.98 MG/DL) Palera (18.4-29.4 MG/DL), (0.78-0.93 MG/DL), Heerawala (19-34.1 MG/DL), (0.77-1.10 MG/DL) and Nayabas (18.4-39.4

MG/DL), (0.79-1.00 MG/DL). Liver function test carried out for estimate the serum bilirubin, S.G.O.T, S.G.P.T and Serum Alkaline Phosphatase content in the blood was found in children of the Birasana village (0.75-0.96 MG/DL), (10.8-36.8 U/L), (9.0-35.7 U/L), (5-11 KAU/L) followed by Saipur (0.69-1.00 MG/DL), (11.5-46.7 U/L), (8.3-41.4 U/L), (6-11 KAU/L), Palera (0.67-0.97 MG/DL), (12.4-31.6 U/L), (8.2-24.7 U/L), (6-11 KAU/L), Heerawala (0.45-0.89 MG/DL), (12.9-24.4 U/L), (7.40-20.5 U/L), (6-11 KAU/L) and Nayabas (0.72-0.96 MG/DL), (20.1-37.8 U/L), (11.8-30.6 U/L), (6-11 KAU/L) in Jamwaramgarh block of the Jaipur district Table.1. Village wise biochemical analysis of renal function test also carried out Amber block of Jaipur district for estimate the blood urea and serum creatinine content in the blood of the children in the Amber block of the Jaipur district of Rajasthan. Blood urea and serum creatinine content in the blood was found in children of the Sirsali village (22.1-40.2 MG/DL ), (0.80-1.00 MG/DL) followed by Peelwa (22.5-40.2 MG/DL), (0.82-1.20 MG/DL) Sunder ka bas (22.2-40.1 MG/DL), (0.80-1.00 MG/DL), Jugalpura (20.8-38.2 MG/DL), (0.75-1.00 MG/DL) and Chitanukalan (26.3-38.8 MG/DL), (0.76-0.97 MG/DL). Liver function test carried out for estimate the serum bilirubin, S.G.O.T, S.G.P.T and Serum Alkaline Phosphatase content in the blood was found in children of the Sirsali village (0.70-0.98 MG/DL), (14.2-48.1U/L), (7.10-40.2 U/L), (7-11 KAU/L) followed by Peelwa (0.72-1.10 MG/DL), (12.8-48.2 U/L), (16.9-43.8 U/L), (7-13 KAU/L), Sunder ka bas (0.74-1.10 MG/DL), (22.1-42.1 U/L), (15.3-35.1 U/L), (6-12 KAU/L), Jugalpura (0.70-1.15 MG/DL), (14.7-58.3 U/L), (15.8-66.3 U/L), (7-14 KAU/L) and Chitanukalan (0.65-1.00 MG/DL), (15.1-54.6 U/L), (10.1-42.4 U/L), (6-11 KAU/L) Table.2. The F concentration found in blood by using biochemical analysis of clinical test is renal function and liver function test performed to assess the non skeletal fluorosis (Table.1-2).

There was a significant increase in serum levels of serum glutamic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT) (Table 1) and alkaline phosphatase (ALP), serum glutamic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), and serum Bilirubin levels of fluorotic children (Table 2). No significant difference in serum levels of blood urea and serum creatinine was found (Table 1-2).

Serum ALT and AST, well-known markers of liver function were significantly elevated in the fluorotic children, indicating liver cell damage and disturbed liver function. Similar results have been reported in earlier studies on fluorotic individuals (28-29). Fluoride is known to inhibit protein synthesis mainly due to impairment of peptide chain initiation and by interfering with peptide chains on ribosome's (28-29). In the present study, a slight but significant increase in serum SGOT, SGPT, Serum Alkaline Phosphatase (ALP) and serum bilirubin levels in children of Jaipur district of Rajasthan, India.

**Table. 1. Non-skeletal fluorosis using Serum (Blood) for Renal Function Test and Liver Function Test: ADONIS auto analyzer District: Jaipur 1. Block: Jamwaramgarh**

S.No	Name of Village	No. of children Examined	Age range (years)	Renal Function Test		Liver Function Test				
				Blood Urea range (15-40 MG/DL)	S.Creatininer ange (0.8-1.5 MG/DL)	S.Bilirubin range (0.2-1.0 MG/DL)	S.G.O.Tr ange (08-40 U/L)	S.G.P.Tr ange (5-35 U/L)	S.Alk aline Ptase range (4-11 KAU/L)	

1.	Naya bas	15	7-13	18.4-39.4	0.79-1.00	0.72-0.96	20.1-37.8	11.8-30.6	6-11
2	Heerawala	15	7-14	19-34.1	0.77-1.10	0.45-0.89	12.9-24.4	7.40-20.5	6-11
3	Paleda	15	8-13	18.4-29.4	0.78-0.93	0.67-0.97	12.4-31.6	8.2-24.7	6-11
4	Saipur	15	7-14	18.4-27.1	0.78-0.98	0.69-1.00	11.5-46.7	8.3-41.4	6-11
5	Birasana	15	8-14	20.5-36.1	0.76-0.98	0.75-0.96	10.8-36.8	9.0-35.7	5-11

**Table. 2. Non-skeletal fluorosis using Serum (Blood) for Renal Function Test and Liver Function Test:ADONIS auto analyzer District:Jaipur 2. Block: Amber**

S.No	Name of Village	No. of children Examined	Age range (years)	Renal Function Test		Liver Function Test				
				Blood Urea range (15-40 MG/D L)	S.Creatinine range (0.8-1.5 MG/D L)	S.Bilirubin range (0.2-1.0 MG/D L)	S.G.O.T range (08-40 U/L)	S.G.P.T range (5-35 U/L)	S.Alkaline Phosphate range (4-11 KAU/L)	
1.	Chitanu kalan	15	8-14	26.3-38.8	0.76-0.97	0.65-1.00	15.1-54.6	10.1-42.4	6-11	
2	Jugalpura	15	8-14	20.8-38.2	0.75-1.00	0.70-1.15	14.7-58.3	15.8-66.3	7-14	
3	Sunderka bas	15	7-14	22.2-40.1	0.80-1.00	0.74-1.10	22.1-42.1	15.3-35.1	6-12	
4	Peelwa	15	7-14	22.5-40.2	0.82-1.20	0.72-1.10	12.8-48.2	16.9-43.8	7-13	
5	Sirsali	15	8-14	22.1-40.2	0.80-1.00	0.70-0.98	14.2-48.1	7.10-40.2	7-11	

**Conclusion**

Thus our data shows that High fluoride concentration in serum level affect the liver function.

In addition to typical manifestations of non skeletal fluorosis as an expression of environmental fluoride toxicity. This finding is also associated with impaired liver function as assessed by biochemical parameters. In view of high fluoride content in the water associated fluoride toxicity among the children and I advised the local administration to provide an alternative drinking water supply.

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