

## Endemic Fluorosis & Non-Ulcer Dyspepsia in J&K State

Inder Gupta, M. K. Jyoti, Shashi Kant



### Abstract

The study was carried out to investigate the prevalence of endemic fluorosis in J&K State and cause of non-ulcer dyspepsia. A total of 1,61,790 individuals in the age range of 5 to 70 years were studied. In district, Doda 90% of the population studied were suffering from dental fluorosis, 12% were having skeletal deformities as well as bony pains and 60% of the population above the age of 25 years were suffering from dyspepsia. In other districts only 26% of the population studied were having dental fluorosis, 7% had skeletal deformities and 42% were suffering from dyspepsia. The fluoride content in water of different sources ranged from 1.153 to 27.216 PPM.

Two hundred patients suffering from dental and skeletal fluorosis, having severe symptoms of upper gastrointestinal tract like retrosternal burning distention of abdomen, pain epigastrium, sour eructations and excessive flatulence or constipation were studied alongwith 10 control normal subjects. Upper gastrointestinal endoscopy studies showed that 82 patients had mild to moderate antritis and pyloritis, 35 had multiple erosions in stomach, 36 had duodenitis and 47 had normal study. Histopathological examination of biopsies of stomach and jejunum revealed non-specific changes but scanning electron microscopic examination showed scanty microvilli or bald epithelium of the mucosa, surface abrasions, desquamated epithelium and classical cracked clay appearance. This study concludes that fluorosis is in endemic form in J&K State and non-ulcer dyspepsia is very common in these patients because of drinking of highly fluoridated water.

### Key Words

Non-ulcer dyspepsia, Fluoridated water, Osteofluorosis, Cracked clay appearance.

### Introduction

Poisoning from both organic and inorganic fluoride compounds was recognized as a clinical entity in the early part of this century. Over 112 fatal cases were reported in 1935 most of them occurring from suicide attempts with rodent poison or when sodium fluoride was mistaken for sugar, salt or baking soda (1).

Excess fluoride in drinking water can lead to fluorosis, a disease that surfaces in a variety of symptoms and can cripple a person. The magnitude of environmental pollution with fluoride is greatly enhanced by the use of fluoride-contaminated water, certain foods, cosmetics like toothpastes and even certain drugs. Occupational

From the Postgraduate Deptt. of Medicine, Govt. Medical College, Jammu & Postgraduate Deptt. of Bio-Science, University of Jammu.  
Correspondence to: Dr. Inder Gupta, 18-Below Purani Mandi, Jammu-180001 J&K, India.

hazards of aluminium industry, welding industry etc. and inhaling fluoride fumes, dust and fluoride mouth rinses during early childhood are other sources of fluoride entry into the body.

Fluorosis is a global problem. Many countries are having endemic fluorosis. In India, fifteen states have been declared endemic for fluorosis. In addition to dental and skeletal involvement, gastro-intestinal tract is also affected in the form of acute abdominal pain, diarrhoea, constipation, blood in stool, distention of abdomen, mouth sores and anorexia (2). This study was done to investigate the prevalence of endemic fluorosis and associated gastro-intestinal diseases (Non-ulcer dyspepsia) in Jammu & Kashmir State.

#### Material & Methods

This study was conducted from January 1991 to December 1994 :-

1. Twenty-six blocks of six districts of Jammu Province like districts Doda, Udhampur, Jammu, Kathua, Rajouri and Poonch were surveyed for the presence of endemic fluorosis and screening of the population for dental, skeletal and gut fluorosis besides sources of drinking water as well as physico-chemical analysis of drinking water.
2. Estimation of fluoride in drinking water.
3. Non-ulcer dyspepsia patients: Two hundred patients with skeletal and dental fluorosis having non-ulcer dyspepsia as per standard criteria of Johnson, presenting with one or more complaints of gastrointestinal tract like burning in the epigastrium, pain abdomen, sour eructations, distention of abdomen, flatulence, nausea or vomiting were taken up for detailed study to confirm fluorosis and changes in the gut mucosa.
4. Control group: Ten healthy volunteers having no gastro-intestinal complaints were studied as control.

In 200 patients with dyspepsia, a complete clinical and personal history including source of drinking water, tobacco and supari chewing was taken in each case and a full physical examination was done to rule out other associated diseases. The routine laboratory tests included.

1. Haemoglobin, total and differential leucocyte count and erythrocyte sedimentation rate.
2. Routine urine examination.
3. Stool examination for ova or cyst by concentration method.
4. Blood sugar, Blood urea nitrogen.
5. Serum calcium and phosphorus, amylase, electrolytes, acid phosphatase and alkaline phosphatase and liver function tests.
6. Skeletal survey of lumbosacral spine, pelvis, hands and feet including wrists & elbow joints as well as lower third of forearms and legs radiologically to look for bone density, calcification of ligaments and fractures.
7. Abdominal ultra-sonography to scan liver gallbladder, common bile duct, portal and splenic veins as well as pancreas.
8. Upper gastrointestinal Endoscopy was undertaken using Olympus GIFQ 10 fiberoptic endoscope to look for any macroscopic structural abnormality. Multiple punch biopsies were taken from the gastric antrum as well as the duodenum and jejunum.
9. Histopathological examination. Haematoxylin and eosin stained sections were examined.
10. Scanning electron microscopic examination. The tissues obtained from the antrum, duodenum and jejunum were initially washed gently in saline solution to remove debris and mucus. A second rinse was in 0.1 M phosphate buffer, followed by fixation in Karnovskys fluid for 6 hours. The specimens were again washed in 0.1 M phosphate buffer and fixed in 0.5 percent aqueous OsO<sub>4</sub> for an hour. After further washes in 0.1 M

phosphate buffer the specimens were dehydrated through a graded series of acetone. The tissues were then in critical point dried followed by sputter coating with gold and examined under a scanning electron microscope (Philips 501B) at 15KV.

11. Ionic fluoride levels in serum, urine and drinking water were determined for each of the patients and control subjects by ION85 ION ANALYSER (Radiometer, Copenhagen).

### Results

A total of 1,61,790 individuals in the age range of 5 to 70 years were studied for fluorosis in six districts of Jammu Province (Table-1). Males constituted 60 percent i.e. 97074 of the population while females were 40 % i.e. 64,716. In district Doda, 90 percent of the population studied were suffering from dental fluorosis in the form of discolouration of teeth, patch formation of reddish brown or white and yellow on the central incisors, lateral incisors and molars. In most of the patients, teeth were dull and lustreless with streaks in horizontal position. Only 2% of young persons had early fall of teeth. Sixty per cent of persons above the age of 25 years (22,200) were suffering from dyspepsia in the form of pain abdomen, nausea, vomiting, sour eructations, retrosternal burning (heart burn), distension of abdomen, fullness after meals, decreased appetite.

**TABLE-1**

Areas and population surveyed for determination of fluorosis.

S.No	District.	Male Population		Female Population	
		Adults	Children	Adults	Children
1	Doda	30833	20554	20555	13704
2	Udhampur.	7092	4728	4728	3152
3	Jammu	17315	10722	13193	5498
4	Kathua	2952	1968	1968	1312
5	Rajouri	154	102	102	68
6	Poonch	392	262	262	174
	Total	58738	38376	40808	23908

Twelve percent of the population studied (30,277) were having complaints of skeletal system in the form of aches and pains over limbs, stiffness of back, difficulty in getting up and walking, weakness of the limbs and crippling deformity of spine and limbs. The different sources of drinking water were springs, tube-wells, nallahs, river Chenab in district Doda. The fluoride contents in water of different sources ranged from 1.153 to 27.216 ppm (Table-II).

**TABLE -11**

Fluoride levels in drinking water of different sources.

S.No.	Block	Type of source	Village	Fluoride (ppm)
1.	Ghat	Spring	Ghat	2.046
2.	Ghat	Spring	Ghat	2.254
3.	Ghat	Spring	Paraswal	2.353
4.	Bhagwa	Spring	Malwas	1.153
5.	Bhagwa	Nallah	Malwas	4.214
6.	Bhagwa	Spring	Moukhli	3.670
7.	Bhagwa	Spring	Gramigarh	1.484
8.	Assar	Spring	Hub Batroo	1.482
9.	Ramban	River	Ramban	5.204
10.	Ramban	Stream	Savani	3.240
11.	Banihal	Spring	Chamelwas	27.216
12.	Banihal	Spring	Maḥumangat	22.402
13.	Thathri	Spring	Baja	18.678
14.	Basantgarh	Spring	Basantgarh	8.126
15.	Panchairi	Spring	Panchairi	6.048
16.	Ramgarh	Tubewell	Nanga	8.486
17.	Bani	Spring	Bani	4.216
18.	Billawar	Spring	Billawar	3.826
19.	Mandi	Spring	Mandi	3.282
20.	Kandi	Spring	Kandi	7.702

In other districts only 26 percent of the population, examined was having dental fluorosis in the form of discolouration of teeth, stippling of teeth or horizontal streaks in the teeth or caries of teeth. Out of 19,797



affected individuals only 3792 were children and rest were adults. Only 7 percent of the population studied had skeletal deformities and 42% were suffering from dyspepsia.

### Patient Group (Non-Ulcer Dyspepsia)

Two hundred patients of dental and skeletal fluorosis having severe symptoms of upper gastro-intestinal tract diseases like retrosternal burning, pain epigastrium, sour eructations distension of abdomen and excessive flatulence were studied from different areas. All these two hundred patients were free of gall stones, pancreatic diseases, peptic ulcers and worms. They had not been taking any drug for the last six months.

Out of these two hundred patients 120 were males in the age range of 25 to 52 years with a mean of  $36 \pm 2.6$  and 80 were females in the age range of 26 to 56 years with mean of  $38 \pm 3.1$ . Except dental, skeletal and gut symptoms, they had no other complaints. One hundred and seventy-six patients were consuming untreated water from the springs, nallahs, river, hand pump or tubewells, while 24 patients were drinking tap water. Thirty-two patients were regular users of snuff and twelve others were regular chewers of panparag and supari (Areca nuts).

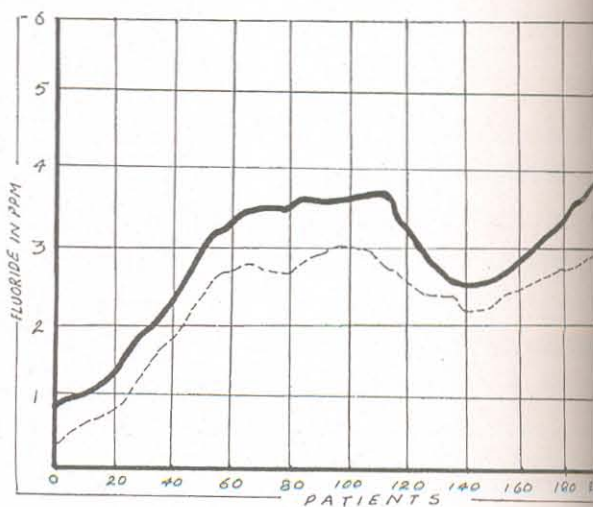
Routine laboratory tests like haemoglobin, total and differential leucocytic counts as well as erythrocytic sedimentation rates were within normal limits. Blood sugar, blood urea nitrogen (BUN), serum amylase and electrolytes were normal. Urine and stool examinations were normal. In 60% of the patients, serum calcium and phosphorus were below normal values. Serum acid phosphatase was significantly raised in 73% of the patients, liver function tests were normal.

### Fluoride Estimation

Fluoride levels of drinking water were above the normal permissible limits (Table-II). Serum and urine fluoride levels were above the normal value in 88% of the patients (Graph I).

GRAPH - I

Showing Serum & Urine Fluoride in 200 Patients



Serum Fluoride.....  
Urine Fluoride.....

A total of 108 water samples from different sources were analysed. Widespread bacteriological contamination was observed. Only 11 samples had faecal coliform counts less than 10 per 100 ml while 70 samples had more than 10 per 100 ml. Metal analysis revealed that 60 samples had cadmium, 32 had chromium, 22 had iron, 8 had lead and 7 had calcium above maximum permissible limits.

The pH, turbidity, conductivity, total hardness, alkalinity, nitrates, chloride, phosphate, sulphate measurement revealed that 10 samples had turbidity more than 25 NTU, 6 samples had hardness more than 600, 10 samples had sulphate more than 400 ppm.

### Radiological Examination

Skeletal survey of all 200 patients revealed classical features of osteofluorosis in the form of interosseous membrane calcification with fusion and pelvic ligament calcifications besides increased bone density and bone mass. Four patients revealed pseudo-fractures. Seven patients had calcification of large vessels (aorta and femoral artery).



Fig-I. Skigram of Tibia and Fibula showing osteosclerosis, calcification of interosseous membranes.

### Upper Gastro-Intestinal Endoscopy

In forty-seven patients upper gastro-intestinal tract was found to be normal by endoscopic examination. Eighty-two patients had mild to moderate antritis and pyloritis, 35 had multiple erosions in stomach and 36 had duodenitis.

### Jejunal Aspirate Examination

In all the 200 patients examined, giardia lamblia was not present

### Histopathological Examination

Forty-three patients had abnormal histopathological changes in the form of non-specific gastritis and or jejunitis.

### Scanning Electron Microscopic Studies (SEM)

The mucosal layers of antrum and jejunum of all the two hundred patients when scanned for surface morphology revealed some classical abnormalities, which were broadly grouped into four categories:

- (a) Scanty microvilli or bald epithelium of the mucosa.
- (b) Surface abrasions.
- (c) Desquamated epithelium.
- (d) Cracked clay appearance.

Ninety four percent of the patients studied revealed the above mentioned abnormalities in both antral and jejunal mucosa. Ten patients had changes only in the antral mucosa but no change in jejunal mucosa. Two patients did not show any significant change in antral or jejunal mucosa probably because of decomposition of the tissues.

The above mentioned morphological abnormalities are reported in comparison to the observations made in the biopsies obtained from normal healthy controls.

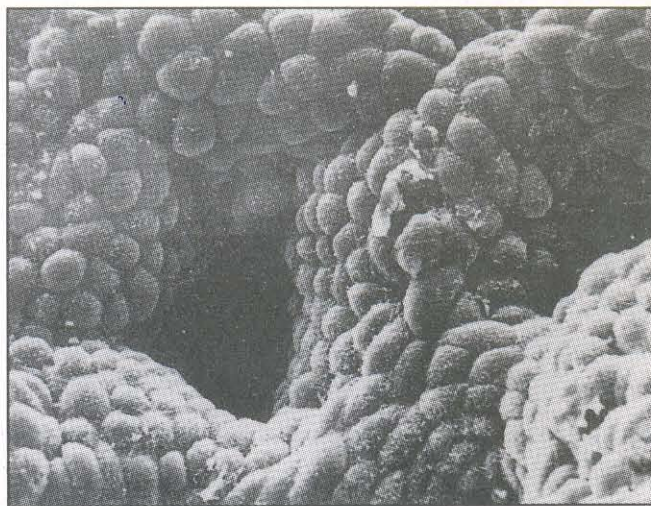


Fig-II. SEM micrograph of normal gastric mucosa showing normal epithelium with gastric pits (x696).

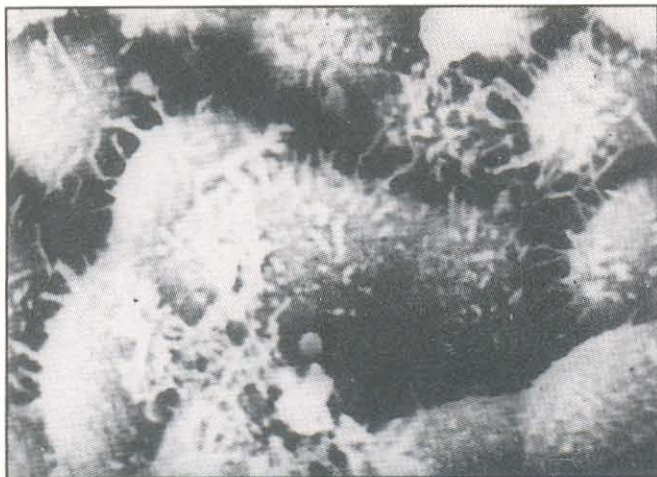


Fig-III. SEM micrograph of gastric mucosa revealing bald appearance due to loss of microvilli as observed in non-ulcer dyspepsia patients (x5250).



Fig-IV. SEM micrograph of gastric mucosa showing cracked clay appearance (x1750).

### Control Group

Five males and five females in the age range of 26 to 50 years with a mean of  $32 \pm 1.8$  were studied. All the ten control subjects were consuming tap water containing fluoride within permissible limits (1.00 ppm). The fluoride levels in 24 hours urinary samples and serum fluoride levels were within normal limits. Except for histopathological examination, all other parameters investigated were normal in all. Histopathological abnormalities were noted in three subjects, out of whom two had chronic non-specific inflammation of the antrum

as well as jejunum (antritis and jejunitis) while one had atrophic gastritis. Scan electron microscopic examination of antral and jejunal biopsies were normal.

### Discussion

Though endemic fluorosis is a global problem affecting more than twenty countries, yet the maximum population affected with this disease is in India where fifteen states have been identified as endemic for fluorosis. The worst affected states are Uttar Pradesh, Rajasthan, Gujrat, Andhra Pradesh and Tamil Nadu. No study had been done in Jammu & Kashmir State in the past to see for the prevalence of this disease. This study conducted for the first time in different districts of Jammu province has highlighted the prevalence of endemic fluorosis in J&K State. A large population of 1,61,790 individuals was studied. The worst affected area, as found out is district Doda, where 90 percent of the population studied is suffering from dental fluorosis in the form of discoloration of teeth, lustreless and dull teeth with horizontal streaks. The children were the worst affected with practically cent percent population revealing dental fluorosis, while 34 per cent had dental caries, which increases with the fluoride intake and dietary calcium deficiency. This is evident from the results of the present study which showed that the maximum content of fluoride in drinking water is in Chamelwas-Batrou area where the children are having the maximum disease and caries of teeth with early fall of teeth.

Different studies have revealed that it takes about 10-30 years for the development of dental fluorosis while living in endemic area and drinking highly fluoridated water (3-6). The present study is not in consonance to their studies and it may be due to high fluoride levels in short period of time to develop severe dental changes in endemic fluorosis area. Teotia and Teotia (7) had described 16 months and above to develop these dental changes. The present study is in agreement with the findings of other studies (8-16).

This study is also in comparison with other studies of Chawla (17) who described radiological changes in endemic fluorosis in the form of osteosclerosis and osteoid formation. These changes were severe in children with dietary calcium deficiency exposed to high intake of fluoride. Jolly and Singh (18) emphasised that higher the doses of fluoride intake, more will be the toxic effects.

The vascular calcification in the major vessels in the form of a ladder type pattern found in some patients of fluorosis on skiagram of legs is consistent with the studies of Chawla *et. al.* (17), Susheela and Kharb (19) and Teotia *et. al.* (20).

Sixty percent of the population in Doda district above the age of 25 years were suffering from upper gastrointestinal tract symptoms in the form of retrosternal burning, nausea, vomiting, pain upper abdomen, sour eructations, distention of abdomen, decreased appetite and fullness after meals; non-ulcer dyspepsia (NUD) a syndrome described by Johnson. This study is compatible with the results of the studies by Clark *et. al.* (21), Rosenquist *et. al.* (22), Waldbott, G.L. (23).

The scanning electron microscopic appearance of the gastric antrum and proximal small intestines revealed abnormalities in 188 out of 200 non-ulcer dyspepsia patients. The classical findings found were cracked clay appearance; surface abrasions, desquamated epithelium and scanty microvilli or bald epithelium of the mucosa. Gupta *et. al.* (24), Susheela and Das (25) and Susheela *et. al.* (26) have reported similar findings. These changes are the results of formation of hydro-fluoric acid by fluoride chemically reacting with gastric hydro-chloric acid. The hydro-fluoric acid is highly corrosive leading to inflammation, erosions and ulcers.

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