

## Consequences of Fluoride Amassing on Growth of Vegetables and Crops in Sanganer-Jaipur, Rajasthan, India

\*Dr. Prakash Narayan

\*\*Prem Singh Bugasara

\*\*\*Malti Rotwar

### Abstract

Water makes up the majority of the fluoride consumed in locations where fluorosis is widespread, while some dietary items make up a sizeable portion of the total consumption. Fluoride is absorbed by plants from irrigation waters, and various inorganic elements in the water and soil can affect this uptake. In the Sanganer Jaipur district of Rajasthan, India, the accumulation of fluoride in vegetables and cereal crops produced in potentially fluoridated areas was assessed in the current study. It was once thought that food wasn't a significant source of fluoride for humans, however it is now well known that some foods can contain a lot of fluoride. Food items from the Sanganer region of Jaipur were gathered and evaluated for the current inquiry. Wheat and vegetables accumulate fluoride in varying degrees (potato and tomato). It was discovered that cereal crops have a greater fluoride level than vegetables. Wheat had the highest level of fluoride, 12.98 g/g, whereas water samples had the lowest level of fluoride, 6.42 ppm.

**Keywords:** Fluoride; Exposure; Assessment; Vegetables; cereals; Fluorosis

### Introduction:

A significant issue in many regions of the world is ground water that contains fluoride in excess of what is recommended (0.5-1.5 ppm). The amount of fluoride ion absorbed by roots depends significantly on the soil's type and fluoride ion concentration. Because fluoride is more soluble in acidic soils, plant absorption is improved. The fluoride ion is present in most foods, whether they are made from plants or animals, at least in trace amounts. Even amongst samples of the same

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*Dr. Prakash Narayan, Prem Singh Bugasara & Malti Rotwar*

type of food, fluoride ions levels can differ significantly. Some foods concentrate extra fluoride ions as a result of processing, contamination, or boiling. Some foods, like fruits and vegetables, typically contain fluoride at low concentrations (0.1 mg/kg–0.4 mg/kg), which helps people consume fluoride. Fluoride may have complicated impacts on growth, ranging from benefits to drawbacks. Serious reviews have been conducted on the subject of fluoride and its impact on plants. Fluoride levels in water must not exceed the recommended range of 0.8 to 1.5 mg/L. Fluoride overexposure causes observable leaf damage, fruit damage, and changes in yield in vegetation [1]. Numerous researchers have characterised the pathways and patterns of fluoride excretion connected to varying fluoride intakes [2,3,4].

The composition of vegetables grown in various regions varies greatly, with leafy plants being especially sensitive to fluoride ions in the air. Fluoride levels in cereals are typically less than 1 ppm, and fluoride tends to concentrate in the grain's outer layer and in the embryo [5]. Up to 75% of the total fluoride in the entire tuber-enriched drinks can be found in potato peeling. The main source of fluoride in agricultural fields is phosphoric fertilisers, particularly super phosphates [6,7].

Although fluoride in water is an important part of an individual's overall exposure to this element, it is not the only source. The way fluoride exposure manifests depends on a person's diet, overall health, and body's capacity to eliminate fluoride [8].

Sanganer Tehsil is an examination region situated inside the Jaipur District of Rajasthan, India. The geographic space of Jaipur locale is 11,061.44 sq km and stretches between 26° 25' north scopes. Moreover, 27° 51' and east longitude 74° 55' and 76° 15' cover the east-focal piece of Rajasthan, isolating 13 areas into tehsils and 13 squares for managerial accommodation. Sanganer Tehsil is associated with the downtown area of Jaipur. Its elevation goes from 26° 49'N to 26° 51'N. It is between 75° 46'E and 75° 51'E. Its territory is 635.5 ch. Km, the environment of this district is semi-dry and warm with power. Temperature (15–45 °C) and precipitation 650 mm (26 inches). The number of inhabitants in Sanganer Tehsil is 573171 according to the 2011 registration.

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**Material Methods:**

The effects of the F pollution were assessed using samples of crops and vegetables that were gathered at random from seven communities in the research area. Due to the minimal rainfall in this study location, the fluoridated ground water used to irrigate the vegetables and grains in these villages was tested for fluoride using an ion-selective electrode technique. These sites have fluoride concentrations that were higher than the permitted limit ( $>1.5$  ppm) [9]. Wheat and tomatoes, two locally cultivated crops, can readily absorb, translocate, and accumulate fluoride in the research area. Food products that were harvested from these plants were dried at  $80^{\circ}\text{C}$  for 40 hours. Grinded to pass through a No. 40 sieve and kept in plastic bottles that are clean, dry, and tightly closed. Before taking aliquots, bottles were completely mixed with the sample by being spun. Additionally, these samples were pulverised and subjected to a potentiometric analysis in the lab to determine their fluoride content [10].  $\text{HNO}_3$  and aqueous  $\text{KOH}$  are used to remove fluoride from dry, ground-up leaves. For the determination of fluoride in food samples, it was shown that the potentiometric approach using an ion selective electrode produced more accurate findings.

**Result and Discussion:**

Table 1 displays the amount of fluoride present in the food products gathered from several villages in the Sanganer tehsil of the Jaipur district. Fluoride levels were found to range from 3.7 ppm to 6.89 ppm in ground water samples taken from seven villages using hand pumps and open wells (Table 1). According to the current study, fluoride levels in wheat crops ranged from 12.98 to 11.78 g/g. Fluoride levels in tomato and potato were estimated to range from 1.12 g/g to 4.78 g/g and from 1.90 g/g to 4.79 g/g, respectively, in the research area.

**Table 1: Fluoride content in crops and vegetables in study area, Sanganer Tehsil Jaipur**

S. No.	Name of the village	Fluoride content (ppm)	Fluoride content ( $\mu\text{g/g}$ ) in food items
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*Dr. Prakash Narayan, Prem Singh Bugasara & Malti Rotwar*

			Wheat	Tomato	Potato
1	Pratap Nagar	6.42	12.98	3.42	2.98
2	Chimanpura	5.98	8.23	4.56	2.98
3	Mahal	4.65	6.89	3.34	1.90
4	Surajpura	3.98	4.67	2.78	1.98
5	Nagallabhata	4.3	5.98	1.12	1.56
6	Jaitpura	3.7	3.87	1.45	1.87
7	Mangyawas	6.89	11.78	4.78	4.79

### Discussion:

Similar to the current research, past studies have also demonstrated how fluoride tends to build in vegetable leaves and negatively impacts crop growth and yield [2, 11, 12, 13]. Similar to this, Gautam et al. [6] investigated the accumulation of fluoride in vegetables and crops grown in the nawa tehsil of the Nagaur district and found that spinach had the highest fluoride concentration (25.70 g/g) among leafy vegetables, and that methi and chawla had the highest fluoride concentration (18.98 g/g) among cereals.

Bhargava and Bhardwaj [14] assert that consumption of tea, wheat, cabbage, carrots, and other Indian foods leads to an increase in fluoride into the human food and beverage chain. Numerous research conducted in China suggested that food intake can greatly contribute to the body's overall uptake of fluoride [15, 1]. It's important to consider the fluoride content of food when estimating overall fluoride intake. Plants absorb fluoride ions from contaminated air and soil. Through its leaves and roots, a plant absorbs fluoride ions from the air and the soil.

After evaluating the data of the present study it was observed that fluoride not only enters through water but also with many edible items. Fluoride of food items depends upon the fluoride contents of soil and water used for irrigation. Fluoride in water contributes significantly to the total exposure of an individual to this element but is not the only source of exposure. Fluoride in food plays a vital role in causing fluorosis whereas fluoride in drinking water plays major role. Fluoride content of the food items vary from place to place. Fluoride level vary widely even between samples of the same kind of food.

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Thus, it can be concluded that role of diet in fluorosis has a double sword action so fluoride content in food should not be disregarded in assessing the total fluoride uptake.

### Conclusion :

From the above studies, in order to reduce the risk of human exposure to fluoride, the use of F-contaminated irrigation water, especially for crops that tend to accumulate fluoride, should be reduced as much as possible. It is therefore very important, if possible, not to irrigated crops with fluoride contaminated irrigation water. However, in areas fluoride contaminated irrigation water, it is advisable to grow crops with relatively low capacities to enrich fluoride, such as those with seeds or tubers as the main edible parts.

**\*Department of Botany SBRM Govt. College Nagaur (Raj.)**

**\*\*Department of Zoology SBRM Govt. College Nagaur (Raj.)**

**\*\*\*S.S. Jain Subodh P.G. College Rambagh Circle Jaipur(Raj.)**

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Consequences of Fluoride Amassing on Growth of Vegetables andCrops in Sanganer-Jaipur, Rajasthan, India

*Dr.Prakash Narayan ,Prem Singh Bugasara & Malti Rotwar*

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