



## Status of drinking water in the mega city Delhi

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DRINKING WATER CONTAMINATION with Fluoride and prevalence of Fluorosis and associated issues are dealt with. The Mega City of Delhi is referred to as the National Capital Territory of Delhi. It has 1485 sq. km. area with a population of 9 million. The density of population is 6319 per sq. km. The temperature varies as follows. January 3°C - 15°C; April - May 27.5° - 46°C; July 30 - 32.5°C; October below 25°C. The annual rainfall ranges from 40 cm - 200 cm. The Mega City has dry winter, hot summer, followed by heavy rains. The only major river flows through is Yamuna, which is the main source of drinking water for the population.

The drinking water supply uptil now is through Municipal Corporation/New Delhi Water Supply & Sewage Disposal Undertaking. The City can be arbitrarily classified into a few zones, depending upon the type/nature of water supply. Zone 1: water is available in the tap 24 hrs. of the day and is treated water. Zone 2: water is rationed and is available approximately for a total 6 hrs/day during morning, noon and evening. Zone 3: as water supplied by the Municipality is grossly inadequate for the population living in an area, tube well water is mixed with the Municipal supply in overhead tanks and this water is supplied through pipelines for a few hours in the day. Mixed water invariably is not tested for quality. Zone 4: In peri-urban areas, tube well water stored in overhead tanks are supplied through pipelines, invariably not tested for quality, besides individual households dig their own tube well, hand pumps as Municipal supply is inadequate. Zone 5: In the urban slums, there is no organized water supply as the water tankers provide water during certain hours of the day and the community has to collect and store water for the day's requirement. The slum dwellers dig shallow wells fitted with hand pumps and draw subsoil water where animals and human beings live together under extremely unhygienic conditions. The concept of water quality testing does not prevail.

### Material and methods

Drinking water samples have been collected from 45 sources in the Mega City and tested for Fluoride at the Fluorosis Control Cell.

The fluoride content of drinking water, collected in plastic bottles, was quantitated on an ION 85 Ion analyzer (Radiometer, Copenhagen)<sup>1</sup>. 36 individuals, young and old, men and women living in the Mega City and afflicted with Fluorosis, and who are patients of the All India

Institute of Medical Sciences, have been investigated for the circulating levels of fluoride by testing fluoride in blood and excreting levels of fluoride by testing urinary fluoride levels. Fluoride levels of 24-hours urine samples collected in plastic containers and of sera were estimated using an ION 85 Ion Analyzer according to the method of Hall et al. (1972)<sup>2</sup>.

### Results

#### Fluoride contamination of drinking water and prevalence of fluorosis

The Mega City of Delhi is endemic for Fluorosis, where the people are drinking water naturally contaminated with fluoride upto 32.46 ppm. Unlike certain other Nations, in India drinking water is not fluoridated; but fluoride is being removed from drinking water to a permissible limit of 10 ppm (1 mg/litre of water).

This approach of defluoridation of water applies to the community who are living in rural areas of a State where Fluorosis is an endemic disease.

The Mega City of Delhi, as it does not fall under the "Rural" category, the community who are dependent on Municipal water, which is mixed with tube well water samples/shallow hand pumps/owning their own tube wells, are the victims of Fluorosis. The information provided in Table 1 reveals the status of drinking water sources in Palam Village in the Mega City of Delhi.

### Discussion

The 36 patients investigated at the Hospital of the All India Institute of Medical Sciences are those who came through the Out-patient Department with complaints viz. (1) Aches & pain in the neck; backbone, hip region and other joints; and/or (2) Non-ulcer dyspeptic complaints (i.e. pain in the stomach, bloated stomach, nausea, loss of appetite, constipation with intermittent diarrhoea (Susheela et al. 1993, 1994)<sup>3,4</sup> and/or (3) unable to walk due to pain below the hip and paralysis. There may be large number of patients, who may be switching over from one hospital to another for getting the disease diagnosed in the Mega City and equally large number may be resorting to some home remedies and may not seek hospital intervention. Therefore, the number of patients reported through this presentation is only a fraction of the total number of individuals who are actually the victims of Fluorosis in the Mega City of Delhi (Table 2). The data reveals an important message and that is in Central Delhi,

**Table 1. Revealing the status of drinking water sources in Palam Village (near Indira Gandhi International Airport)**

Total source + Tube wells	Hand pumps	Open well Fluoride	Range of Safe water content in water (ppm)	No. of contaminated sources with Fluoride upto 1.0 ppm	No. of Fluoride investigated sources
45	36 + 8 = 44	1	0.24 - 32.46	19	26

drinking fluoride contaminated water is a later event, as is evident from the age of the afflicted people. The disease onset is at a relatively older age group, compared to peripheral part where even children of 4-6 years are victims of Fluorosis.

The major issue is to create awareness among the population that, drinking water, although being drawn from the earth's crust, not necessarily be pure, but need to be tested for water quality and it is likely to be contaminated with chemicals in excess than the prescribed limit viz. Fluoride, Iron, Arsenic and even Salinity and can cause serious healthy problems. Too much of Fluoride is known to cause crippling (Susheela & Ghosh, 1990)<sup>5</sup>.

One of the major concerns is that there are very few water testing laboratories in the Mega City of Delhi, as well as in other regions where Fluoride testing is carried out as a routine, and quality control procedures are followed. The need for setting-up additional water quality testing laboratories in the Mega City of Delhi and in other parts of the country, is perhaps one of the most urgent requirements that need to be attended to.

Awareness-cum-update programmes on Fluorosis, focusing on fluoride action on body tissues and the functional derangements need to be incorporated to Medical/Dental curricula. Diagnostic protocols for Hospital based laboratories and for Field based environment, which are recent developments (Susheela & Majumdar, 1992)<sup>6</sup>, need to be popularized among the professionals as well as among the public. It is equally important to create awareness among the public that Fluorosis, although there is no treatment, but can be prevented, provided the disease is

recognized at very early stages (Susheela 1993, 1995, Susheela et al. 1993)<sup>7,8,9</sup>. There are also techniques and procedures, adequately field tested, for removing fluoride from drinking water, either using (1) Lime and Alum (Nalgonda Technique) (2) Activated Alumina (Prasanti technique) or by using Ion Exchange resin, so that safe water is available for consumption (Bulusu & Biswas, 1993)<sup>10</sup>.

Dental Fluorosis profile in school children is an excellent method for identifying endemic areas/families consuming fluoride contaminated water and school teachers to be sensitized for detecting the disease is inexpensive, less time consuming exercises for detecting the fluoridated areas.

Public Health Engineers, specially the Junior/Assistant Engineers and Junior doctors need to be updated on the subject to deal with issues on fluoride and fluorosis effectively, so that those posted in peripheral hospitals, primary health centres, sub-centres & dispensaries, are aware of the manifestations of the disease and correct diagnosis is made at the very early stages. It is not uncommon for patients of Fluorosis, being diagnosed as arthritis, spondylitis, ankylosing spondylosis, non-specific backache etc. and being treated with no relief. After having the disease diagnosed, it is necessary to identify the source of fluoride entry into the body, so that the source is withdrawn and simultaneously enrich the diet with calcium and Vitamin C for the bones to grow into the normal texture. If one can follow these recipes, there is no reason why an individual has to be fluorosed and lead a painful and vegetative life.

**Table 2. The prevalence of fluorosis in the Mega City of Delhi**

Location	No. of patients investigated	Age range	No. of Female patients	No. of Male patients	Drinking* Water	Range of Fluoride in ppm	
						Urine**	Serum***
Palam Village	09	4 - 50	03	06	1.2 - 32.5	2.00 - 8.5	0.05 - 0.33
Sagarpur	06	6 - 48	02	04	3.4 - 24.6	0.30 - 24.1	0.10 - 0.63
Nangloi	06	18 - 40	03	03	1.7 - 13.6	0.39 - 10.5	0.16 - 0.27
Peripheral areas	10	6 - 50	04	06	1.3 - 14.0	0.66 - 7.5	0.06 - 0.29
Central Delhi	05	28 - 65	02	03	1.5 - 19.3	1.25 - 5.2	0.06 - 0.60

\* Sources are : Tube well, Hand pump, Open well.

\*\* Normal upper limit = 0.1 ppm.

\*\*\* Normal upper limit = 0.02 ppm.

## References:

- <sup>1</sup> Application : Fluoride in water. Users handbook for ION 85 Ion Analyzer, Radiometer Copenhagen.
- <sup>2</sup> L.L. Hall, F.A. Smith, O.H. Delopez , D.E. Gardner (1972). Direct potentiometric determination of total ionic fluoride in biological fluids. Clin. Chem. 18: 1455 - 8.
- <sup>3</sup> A.K. Susheela, Taposh K. Das, I.P. Gupta, R.K. Tandon, S.K. Kacker, P. Ghosh and R.C. Deka (1992). Fluoride ingestion and its correlation with Gastro-intestinal discomfort. Fluoride, 25 (1), 5-22.
- <sup>4</sup> I.P. Gupta, T.K. Das, A.K. Susheela, S. Dasrathy and R.K. Tandon (1992). Alimentary tract and pancreas : Fluoride as a possible aetiological factor in non-ulcer dyspepsia. Journal of Gastroenterology & Hepatology, 7, 355-359.
- <sup>5</sup> A.K. Susheela and G. Ghosh (1990). Fluoride : Too much can cripple you. Health for the millions. 48-52 (Sept. - Oct. issue).
- <sup>6</sup> A.K. Susheela and K. Majumdar. Fluorosis Control Programme in India. Proceedings of the 18th WEDC (Water, Environment and Management Conference), Kathmandu, Nepal, 1992: 229-231.
- <sup>7</sup> A.K. Susheela (1993). Prevention and control of fluorosis - Health Aspects. Vol. I. Published by Ministry of Rural Development, Government of India.
- <sup>8</sup> A.K. Susheela, Arbind Kumar, Madhu Bhatnagar and R. Bahadur (1993). Prevalence of endemic fluorosis with gastro-intestinal manifestations in people living in some North-Indian villages. Fluoride, 26(2), 97-104.
- <sup>9</sup> A.K. Susheela (1995). Epidemiological studies of health risks from drinking water naturally contaminated with fluoride. 123-134. In: Proceedings of the Rome Symposium, September 1994 - Assessing and managing health risks from drinking water contamination : Approaches and Applications. Edi. ERIC G. Reichard & Giovanni A.Z. Apponi.
- <sup>10</sup> K.R. Bulusu and S.K. Biswas (1993). Prevention and control of Fluorosis - Water Quality & Defluoridation Techniques. Vol. II. Published by Ministry of Rural Development, Government of India.