FLUORIDE AND ENDEMIC FLUOROSIS IN THE KARBIANGLONG DISTRICT, ASSAM, INDIA

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SUMMARY: The Assam region of NE India has been recognized only recently as a fluoride-affected area. Surveys indicate that one-seventh of the 700,000 people in the Karbianglong district of Assam have either dental or skeletal fluorosis. The high concentration of fluoride in the water resources in some localities such as the Ramsapathar (>20.6 mg/L) and Lungnit (>15.4 mg/L) areas of the district are of great concern. In this report we present available information concerning the waterborne fluoride scenario of Karbianglong.

Keywords: Assam, India; Fluoride water; Fluorosis in Karbianglong; Karbianglong district.

INTRODUCTION

Many of the states of the Indian union (Table 1) have alarmingly high concentrations of fluoride in their water resources as reported in a large volume of literature.[1-7] The situation in Assam in NE India is not different from that of the rest of the country. Excessive intake of fluoride leads to serious effects on the teeth during tooth formation and abnormal hardening of bones, leading to a condition known as fluorosis that is exacerbated by poor diets deficient in calcium and vitamins.

Table 1. Percentage categories of fluorosis in various states of India[2-4]

Category and percentage	Names of states
I (30% of the districts affected)	Jammu and Kashmir, Delhi, Kerala and Orissa
II (30 –50% of the districts affected)	Maharashtra, Karnataka and Bihar
III (50–100% of the districts affected)	Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu

At present, environmental information about fluoride and fluorosis in northeast India and Assam in particular is incomplete. Not until 1998 did geological and health reports show any fluoride impact in this region. Only in the middle of 1999 was fluorosis reported and verified in the Karbianglong district (Figure 1) of Assam. More recently, Meghalaya, located immediately to the west of Karbianglong, has also been found to be a fluoride endemic area.[8] The presence of fluoride up to 6.88 mg/L in drinking water samples of various parts of the capital city of Guwahati (26º 05'–26º 15' N Lat, 91º 35'–91º 55' E Long), Assam, and suburbs has also been reported.[9]

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MATERIALS AND METHODS

Water fluoride information from the Karbianglong district (see Figure) utilized for the present study was collected from survey reports available in newspapers, seminar publications, research articles, personnel surveys, and various communications. Data on fluoride concentration in ground waters, both from shallow (hand dug) tube wells and deep tube wells (public water supplies) were determined according to standard methods.[10,11]

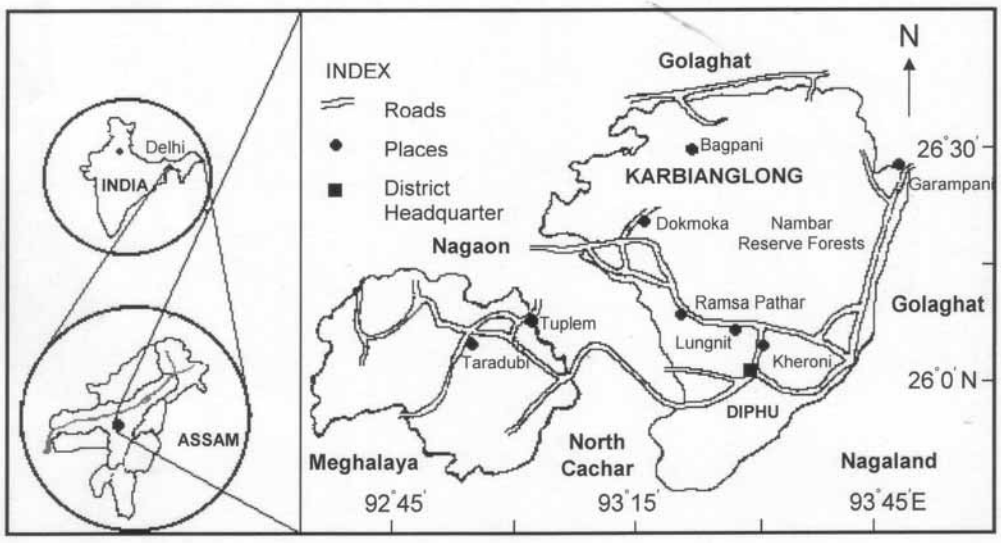

Figure. Map of the Karbianglong district, Assam, India, showing fluoride-affected areas.

RESULTS AND DISCUSSION

Well known for its greenery and scenic beauty, the Karbianglong District, Assam, has only recently been included in the fluoride-affected map of India. Among the 700,000 residents in the district, which has an area of 10,526 km^2, one-seventh of them are suffering from dental or skeletal fluorosis, or both. Thus, in addition to arsenic, West Bengal in India is faced with another serious public health problem.[12]

In terms of their terrain geology, Karbianglong and adjoining areas of Assam have many uneven joints, fractures, and faults, along which rivers and streams have cut their paths to form relatively smooth valleys. Moreover, hot springs of Grampani and Nambar located in the district discharge sulphurous hot water (up to 58ºC) through deep-seated faults between Therria Sandstone and Sylhet Limestone. In terms of geological age, rock assemblages range from Archean to Recent with a significant proportion of economically important limestone, coal, and clay deposits. The pink and purple granite in the district also contains a significant proportion of fluoride-containing minerals, such as apatite.

As seen in Table 2, relatively high levels of fluoride are present in the water resources of the Karbianglong district, and they now have become a matter of major public health concern, especially for dental fluorosis.[12-20] The first reliable report of fluorosis appeared in May 1999 for the Tekelangjun area, where the

fluoride level in the water was found to be 5.23 mg/L,[14,15] considerably in excess of the permissible limit of 1.0 mg/L and 0.6 to 1.2 mg/L.[21,22]

Table 2. Concentration of fluoride in water resources of the Assam Karbianglong district, India

Area	Fluoride (mg/L)	
	Minimum	Maximum
Kheroni [14, 23]	1.53	3.54
Dokmoka[14, 20, 23]	1.67	2.68
Lungnit [8,15, 23]	1.20	15.40
Taradubi[14, 15, 23]	1.78	4.54
Ramsapathar[14, 15, 23]	1.23	20.60
Tuplem[14, 20, 23]	0.95	3.87
Nambar Reserve Forests[14,15, 20,23]	2.35	4.32
Garampani[14, 20, 23]	3.40	8.35

To illustrate the extent of the fluoride problem, a recent survey found that 33% of the population in the Bagpani area of the district is afflicted with hydrofluorosis.[23] Out of 2063 people surveyed in eight villages, 646 (31.3%) were found to have dental fluorosis, and 36 (1.74%) were diagnosed with skeletal fluorosis. Other than water from hand-dug tube wells, the existing public water supply systems also inadvertently distribute fluoride-contaminated water to many of the villages. The study further confirmed that the fluoride concentration has a positive correlation with the calcium and sodium levels in the drinking water. The limestone of the region contains the equivalent of 31 to 52% CaO and 0.06 to 0.28% Na. The strong affinity[24] of F^- for Ca^{2+} can be correlated very well with the existing geology in relation to the distribution of fluoride in the Karbianglong district of Assam. Since the area is free from all types of industrial activities, natural incorporation of fluoride into the water sources is the most plausible explanation for the elevated levels of fluoride in them.

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