Short Communication

An Epidemiological Study on Fluorosis in an Urban Slum Area of Nalgonda, Andhra Pradesh, India

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Summary

Fluorosis is an important public health problem in certain parts of India. Nalgonda is one of the fluorosis endemic districts of Andhra Pradesh. A cross-sectional study was undertaken to assess the prevalence of dental and skeletal fluorosis in Panagal, one of the urban slum areas of Nalgonda town of Andhra Pradesh. 265 individuals residing in 92 households of five colonies of Panagal were selected by multi-stage random sampling. Fluorosis was assessed by standard clinical methods and water samples were tested for fluoride level. It was observed that mean fluoride level in ground water samples in the area was 4.01 mg/l and that of Nagarjunsagar water was 0.74 mg/l. The mean age of the study subjects in the area was 34.73 years. The overall prevalence of skeletal fluorosis was 24.9% and that of dental fluorosis was 30.6%. The prevalence increased with age. Skeletal and dental fluorosis is endemic in the study area.

Key words: Cross-sectional study, Dental fluorosis, Skeletal fluorosis, Prevalence

Fluoride has beneficial effect on teeth at low concentrations in drinking water; but excessive exposure to fluoride in drinking water or in combination with exposure to fluoride from other sources can give rise to a number of adverse effects.[1] The World Health Organization guideline recommendation for maximum limit of fluoride in drinking water is 1.5 mg/l.[2] The epidemiological evidence that concentrations above this value carry an increasing risk of dental fluorosis and progressively higher concentrations lead to increasing risks of skeletal fluorosis forms the basis of guideline derivation.[2] The guideline value is higher than that recommended for artificial fluoridation of water supplies, which is usually 0.5–1.0 mg/l.

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Fluorosis is endemic in 20 out of 35 states and union territories of Indian Republic.[3] In Andhra Pradesh, Gujarat and Rajasthan, 70–100% of the districts are affected. Fluoride levels in water in Andhra Pradesh vary from 0.4 mg/l to very high level of 29 mg/l.[4]

However, since May 2007, new water source was established (River Krishna water from Nagarjunsagar dam) to provide water with permissible limits of fluoride. This calls for re-establishment of the current levels of fluoride in water supplies, the current prevalence of fluorosis and the associated epidemiological factors by undertaking a survey.

The present cross-sectional study was carried out from June 2008 to April 2009 in Panagal, an urban slum area of Nalgonda, which is one of the highly endemic districts of Andhra Pradesh. The study area constitutes 14 residential colonies under 8th, 9th and 10th wards of Nalgonda. Five colonies were randomly selected for the study, with a population of 4021 persons residing in 964 households. From each colony, households were selected by systematic random sampling by including every 10th household in order to cover 10% of households. 92 households were selected. All the persons residing in

these 92 households, after applying inclusion/exclusion criteria, formed the study subjects.

Individuals who could perform three diagnostic tests (physical signs) for clinical assessment of skeletal fluorosis were included in the study. All those who could not perform three diagnostic tests (small children and sick individuals) and/or not available after two home visits were not included in the study. Accordingly, 265 persons were finally included in the study. Informed consent was taken from the study subjects or from the parents in case of children. Data were collected by two of the four authors of the study. A pre-tested structured schedule was used for interviewing all study subjects/ adult informers incase of children.

Skeletal fluorosis was assessed by three simple diagnostic tests: 1) touching the toes without bending the knees; 2) touching the chest with the chin; and 3) stretching the arms sideways and folding the arms to touch the back of the head.[5,6] If there is pain or stiffness in the backbone, hip and joints; or pain or stiffness in the neck; or pain or stiffness in the shoulder joint and backbone, respectively, these three exercises cannot be performed. Dental fluorosis was assessed on the basis of discoloration of teeth such as yellow-brown discoloration, brown horizontal streaks and blackening/ pitting/chipping/loss of teeth (edentate).[7,8] Seven samples from all the existing ground water sources in the area and two samples from Nagarjunsagar water were collected to assess the fluoride level.

Data were compiled and analyzed by using statistical software package Epiinfo version 6.04. Prevalence was computed as percentages, and to establish association, chi-square tests were applied.

Out of 265 study subjects, 151 (57%) were females and the rest were males. Majority of the females in the study were in the age group of 25–39 years, whereas most of the males were in the age group of 40–60 years. As per modified BG Prasad's classification, majority of the participants belonged to upper lower socioeconomic class (41.5%), followed by lower middle class (29.8%). 35.1% of the participants were illiterates. The main occupation and source of income of the residents was manual labor (30.6%).

Mean fluoride level of presently available ground water sources of study area was found to be 4.01 mg/l. Mean fluoride level in Nagarjunsagar water supplies was found to be 0.74 mg/l which is within acceptable limits for drinking water. Narayana *et al.* in their study in villages of Nalgonda district[9] found mean fluoride level in drinking water to be 3.8 mg/l in Anthampet and 3.7 mg/l in Battalapally. Siddiqui in his study in three villages of Nalgonda district found the fluoride level in drinking water in the range of 5.2–11.8 mg/l.[10]

Prevalence of dental fluorosis was found to be 30.6% [Table 1]. Choubisa in his study in southern Rajasthan[11] found the overall prevalence of dental fluorosis to be 45.7%. Another study carried out in Gudag and Bagalkot districts of Karnataka found the prevalence of dental fluorosis to be 35%.[12] In the present study, yellowish-brown discoloration of teeth with horizontal streaks was the most common (28.7%) symptom of dental fluorosis, followed by blackening/pitting/chipping of teeth (8.7%). Pushpa Bharati *et al*. reported browning of teeth in 64.29% and pitting of teeth in 32.42% subjects.[12]

Prevalence of skeletal fluorosis was found to be 24.9% [Table 1]. Pushpa Bharati *et al*. in their study in Gadag and Bagalkot districts of Karnataka found the prevalence of skeletal fluorosis to be 17% and that of both types to be 12.67%.[12] Choubisa in his study in southern Rajasthan found that the overall prevalence of skeletal fluorosis was 22%.[11] In the present study, pain or stiffness in the backbone and hip was the most common symptom (16.2%) of skeletal fluorosis, followed by pain or stiffness in joints and backbone (15.5%). Joint pain was found in 31.87% subjects in a study done by Pushpa Bharati *et al.*[12] Narayana *et al*. reported joint pain and neck stiffness in 50–70% of cases.[9] Shashi *et al*. in their study in three endemic areas of Punjab state observed back pain (73%) and neck pain (34%) as skeletal fluorosis symptoms.[13]

Prevalence of skeletal and dental fluorosis increasing with age was found by Jolly *et al*. and Choubisa in

Table 1: Age wise distribution of study subjects and prevalence of fluorosis (n=265)

Age group (Years)	Number Examined	Skeletal fluorosis* No (%)	Dental fluorosis** No (%)
<5	04	Nil	Nil
5-14	25	03(12)	07(28)
15-24	53	02(3.8)	10(18.9)
25-39	80	14(17.5)	16(20)
40-60	84	35(41.67)	37(44.04)
>60	19	12(63.15)	11(57.9)
Total	265	66(24.9)	81(30.6)

*X^2 for linear trend =37.76 $P < 0.00001$. **X^2 for linear trend = 14.301 $p < 0.0001$

their studies in Punjab and Rajasthan, respectively.[11,14] It was observed in the present study that skeletal and dental fluorosis prevalence increased with age and this association was found to be statistically significant by chi-square for linear trend ($P < 0.00001$ and $P < 0.0001$, respectively) as seen in Table 1. However, due to limitations of the study design, the possibility of the confounding effect of age on duration of exposure and occurrence of fluorosis cannot be ruled out in this study.

In the present study, tobacco consumption in any form was found in 16.6% of subjects and alcohol consumption was found in 30.2% of subjects. Skeletal fluorosis and dental fluorosis were observed more in tobacco users (52.3% and 54.54%, respectively) than in non-users (19.45% and 25.79%, respectively), and the association in both skeletal and dental fluorosis and tobacco use was found to be statistically significant ($P < 0.001$). Skeletal fluorosis and dental fluorosis were observed more in alcohol users (37.5% and 38.7%j, respectively) than in non-users (19.4% and 27%, respectively), and the association between skeletal fluorosis and alcohol use was found to be statistically significant ($P < 0.005$). However, no significant association was seen between alcohol use and dental fluorosis. Annapoorna Kubakaddi *et al.* observed that 40% of the tobacco chewers were suffering from dental and skeletal fluorosis.[15]

Skeletal and dental fluorosis was observed to be more common among males (34.1% and 67.6%, respectively), lower socioeconomic status subjects (75.7% and 69.1%, respectively), illiterates (47.3% and 37.6%, respectively), and laborers and farmers (39.7% and 35.6%, respectively). A study done by Jolly *et al*. reported that fluorosis was far more common in laborers and farmers who do hard manual work.[14]

Based on the findings of the present study, it is concluded that people of the Panagal urban slum area of Nalgonda are being supplied with Nagarjunsagar water with permissible fluoride level. The prevalence of skeletal and dental fluorosis in the study area is 24.9% and 30.6%, respectively. The levels of fluoride in drinking water and the prevalence of skeletal and dental fluorosis established in this study would be useful for follow-up studies in future.

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