



Original Research Article

Fluorosis in Rural Area of Marathwada Region of Maharashtra

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ABSTRACT

Introduction: The district Nanded from Marathwada region (Maharashtra) has been cited as an endemic fluoride belt but there is no detailed epidemiological and clinical study available in literature for this district. Hence the present study was conducted with the following objectives.

Aim and Objectives:

1. To assess the prevalence of fluorosis in the selected two villages.
2. To study some epidemiological factors related to fluorosis.
3. To study disease pattern of fluorosis.

Material and Methods: During the period between August 2010 to July 2012, 334 subjects from Mahagaon and 811 from Sawarkhed village from Nanded District were surveyed for assessment of clinical and epidemiological factors of fluorosis by using a predesigned questionnaire. Detailed clinical examination of all those interviewed were performed specially dental, skeletal and neurological examination.

Statistical analysis: Chi- Square test was applied to test the significance wherever indicated.

Results: Age distribution showed the maximum population in the age group of 5 - 14 years both in Mahagaon (30.5 %) and Sawarkhed (26.7 %). Male - female distribution was almost equal.

Sources of drinking water in both the villages were ground water i.e. wells and bore wells. Fluoride content in water ranged from 2.8 to 10 ppm in Mahagaon and 5 to 8.5 ppm in Sawarkhed. In Mahagaon, the overall prevalence was 53.0 % and in Sawarkhed, it was 22.4 %. Prevalence of dental fluorosis was 50.3 % in Mahagaon and 22.4 % in Sawarkhed, whereas the prevalence of skeletal fluorosis was 12.9 % in Mahagaon and 0.1% in Sawarkhed. This difference was probably due to the difference in the fluoride concentration of water in the two villages.

The severity of dental fluorosis was more in the adult age group but no significant sex difference found in the severity of dental fluorosis cases.

Key words: fluorosis, dental fluorosis, skeletal fluorosis, Dean's index

INTRODUCTION

“Fluoride is often termed as a double edged weapon”- the optimal and judicious

use of which offers maximum caries protection, whereas injudicious and excessive systemic consumption may lead to

chronic fluoride toxicity, which manifest as dental and skeletal fluorosis. [1] These harmful effects being permanent and irreversible in nature are detrimental to health of an individual and the community, which in turn has an impact on growth, economy and human resource development of the country. [2] Our daily fluoride requirement is 0.05 to 0.07 mg. per kg Body weight. [3] The permissible level of fluoride in drinking water in India is 0.5 to 0.8 ppm. [4]

In Indian subcontinent, a total of 19 states have been declared endemic for fluorosis. Gujarat is one of the most severely affected states in the country considered to be endemic to fluorosis. It is found that in India, 66.62 million people are at risk to the problem of fluoride, of which 6 million are children below the age of 14 years.

The lowest fluoride concentration in drinking water in India associated with dental fluorosis was 0.5 ppm, found near Varanasi, Uttar Pradesh. The highest figure of fluoride concentration of drinking water in India was 25 ppm as reported from Punjab. [5]

In Maharashtra, ten districts are declared endemic for fluorosis. These are Bhandara, Chandrapur, Buldhana, Jalgaon, Nagpur, Akola, Amravati, Nanded, Solapur and Yavatmal. [6] Endemic fluoride belts serve as natural laboratories to study the effect of fluoride concentration on dental and skeletal fluorosis simultaneously. [7]

The district Nanded from Marathwada region (Maharashtra) has been cited as an endemic fluoride belt but there is no detailed epidemiological and clinical study available in literature for this district. Hence the present study was conducted with an objective of determining the prevalence of dental and skeletal fluorosis in this area.

Aims and Objectives:

1. To assess the prevalence of fluorosis in the selected two villages.

2. To study some epidemiological factors related to fluorosis.
3. To study disease pattern of fluorosis.

MATERIALS AND METHODS

The present study is a cross-sectional survey of two villages i.e. Mahagaon and Sawarkhed from Nanded District carried out for assessment of clinical and epidemiological factors of fluorosis. The study was carried out during the period of August 2010 to July 2012.

According to data available with district health office department of Nanded district, there are total fifty two villages which are affected with fluorosis and having fluoride level above 1 ppm. No detailed epidemiological study was performed previously in these villages.

From these villages, two villages viz. Mahagaon and Sawarkhed were selected by simple random sampling technique for the present study. Total population of these two villages was 1240 i.e. population of Mahagaon and Sawarkhed was 400 and 840 respectively.

In Mahagaon, out of 400 population, 334 (83.50%) and in Sawarkhed out of 840 population, 811 (96.50%) population was surveyed. Infants under the age of six months were excluded from the study because they did not have dentition. To have maximum coverage repeated visits were given to those houses where some members were found absent in the prior visit. Reasons for drop out were; subjects gone to out station, serving outside and houses locked.

Information was collected regarding demographic characteristics such as age, sex, occupation, literacy status, economic status, marital status, duration of stay in the village etc. using a predesigned questionnaire. Also detailed information about their common food habits, sources of water, personal habits, and daily water consumption was collected.

Information regarding their food intake during the past 24 hours was collected by recall method. Their complaints were noted. Detailed clinical examination of all those interviewed were performed specially dental, skeletal and neurological examination.

Statistical analysis:

The Percentage and Chi- Square test were applied to test the significance wherever indicated. The statistical significance was set at 0.05.

RESULTS AND DISCUSSION

Table 1: Age and sex wise distribution of population.

Age/ group (years)	Mahagaon			Sawarkhed		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
1/2 -4	27(15.3)	15(9.5)	42(12.6)	39(9.5)	38(9.4)	77(9.5)
5 -14	51(29.0)	51(32.3)	102(30.5)	110(26.9)	107(26.6)	217(26.7)
15 - 24	25(14.2)	24(15.2)	49(14.7)	63(15.4)	53(13.2)	116(14.3)
25 - 34	25(14.2)	27(17.1)	52(15.5)	60(14.7)	71(17.7)	131(16.2)
35-44	27(15.3)	18(11.4)	45(13.5)	52(12.7)	37(9.2)	89(11.0)
45 +	21(12.0)	23(14.5)	44(13.2)	85(20.8)	96(23.9)	181(22.3)
Total	176(100.0)	158(100.0)	334(100.0)	409(100.0)	402(100.0)	811(100.0)

Out of total 334 subjects examined in Mahagaon, 176(52.7%) were males and 158(47.3%) were females. In village Sawarkhed out of 811 subjects examined, 409 (50.4%) were males and 402 (49.6%) were females.

It was observed that the majority of people belonged to the age group 5 – 14 years in both the villages, i.e. in Mahagaon 102 (30.5 %) and Sawarkhed 217 (26.7%) respectively. Least subjects were in the age group 6 months to 4 years i.e. 42 (12.6 %) in Mahagaon and 77 (9.5 %) in Sawarkhed.

Table 2: Distribution of Complaints suggestive of fluorosis

Complaints	Mahagaon			Sawarkhed		
	Male (176)	Female(158)	Total (334)	Male (409)	Female(402)	Total (811)
Discoloration of teeth	72(40.09)	30(19)	102(30.5)	60(14.7)	15(3.7)	75(9.2)
Pain in back	34(18.3)	28(17.7)	62(18.6)	5(1.2)	3(0.7)	8(1)
Pain in joint extremities	22(12.5)	14(8.9)	36(10.8)	3(0.7)	-	3(0.4)
Forward bending	11(6.3)	6(3.8)	17(5.1)	1(0.2)	-	1(0.1)
Swelling of joints	7(4.0)	2(1.3)	9(2.7)	-	-	-
Difficulty in rising from sitting position	4(2.3)	2(1.3)	6(1.8)	1(0.2)	-	1(0.1)
Dyspnea on moderate exertion	4(2.3)	2(1.3)	6(1.8)	-	-	-
Tingling & numbness at lower extremities	4(2.3)	2(1.3)	6(1.8)	1(0.2)	3(0.7)	10(1.2)

Complaints can be divided into three groups i.e. dental, skeletal and neurological complaints. (Table. 2)

Dental complaints:

In Mahagaon, out of 334 subjects 102 (30.5%) complained discoloration of teeth. Among them, 72(40.09%) were males and 30(19%) were females. In Sawarkhed,

out of 811 subjects examined 75(9.2%) complained of discoloration of teeth and among them 60(14.7%) were males and 15(3.7%) were females. Complaints of discoloration of teeth were more common among males as compared to females in both Mahagaon and Sawarkhed villages.

Ray S.K.1983 [8] in their study of dental fluorosis near Varanasi, UP found dental discoloration in males up to 30.4% and 18.08% in females.

Skeletal complaints:

Total persons with skeletal complaints in Mahagaon were 63 (18.9 %) and in Sawarkhed 11 (1.4 %). None of them had solitary skeletal complaint in the present study. There were various combinations of complaints related to bones and joints like pain in back, pain in joint of extremities, difficulty in forward bending, swelling of joints, difficulty in rising from sitting position.

Singh, A. et al [9] observed 46 cases of skeletal fluorosis in Bhatinda district of Punjab and found that stiffness of the back and legs was a universal complaint.

Krishnamachari, K.A.V.R. [10] in his study in three districts of Andhra Pradesh from

southern part of India, described with stiffness and limitation of large joints and stiffness of the spine.

Sidhu, S.S. et al (1985) [11] also found similar symptoms of skeletal fluorosis in their study carried out in the village Khera in Punjab.

Neurological complaints:

Six subjects (1.8%) in Mahagaon and 10(1.2%) in Sawarkhed had neurological complaint in the form of tingling and numbness in the lower extremities.

Singh, A. et al (1961) [12] described symptomatology of neurological manifestations of fluorosis as presence of symptoms of skeletal fluorosis and in addition to that tingling and numbness of the extremities, paraesthesia and motor weakness, precipitancy of micturition.

Table 3: Distribution of Prevalence of different types of fluorosis in Subjects

Types of fluorosis	Mahagaon(n=334)			Sawarkhed (n=811)		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
Dental fluorosis	79(23.7)	55(16.5)	134(40.1)	136(16.8)	45(5.5)	181(22.3)
Dental with skeletal fluorosis	27(8.1)	7(2.1)	34(10.2)	1(0.1)	00	1(0.1)
Skeletal fluorosis	4(1.2)	5(1.5)	9(2.7)	00	00	00
Total	110(32.9)	67(20.1)	177(53.0)	137(16.9)	45(5.5)	182(22.4)

The prevalence of fluorosis in Mahagaon was found to be 53.0 %. Majority of the people from Mahagaon had been using well water for drinking and cooking which had a very high fluoride content of 10.0 ppm. The prevalence of dental fluorosis has been therefore very high in this village viz. 53.0 %. Using this value the 95% confidence interval (C.I.) worked out to be from 47.5 to 58.5%. This shows that in areas where the fluoride content of water is around 10.0 ppm, the prevalence of the disease is expected to range in the above interval.

For Sawarkhed, though the overall prevalence worked out to be 22.4 %. This yields a 95% confidence interval range of

19.5 to 25.3 %. Thus in areas where the fluoride content of water has an extent of 5.0 to 8.5 ppm, the prevalence of the disease is expected to vary in the above range.

Pandit, C.G. et al (1940) [13] conducted the study in several selected areas of the Nellore and adjoining districted of Madras province. They examined 1115 children aged between 5 to 15 years, out of them 74% showed mottled enamel.

Singh, A. et al (1962) [14] carried out the study in Bhatinda district of Punjab, with fluoride content in water 1.1 ppm to 16.2 ppm, dental fluorosis was present in 966 (42.3 %) out of 2282 persons above the age of 30 years.

Singh, Amarjit et al (1961) [12] have reported 46 (2.71 %) cases of skeletal

fluorosis, when they examined 1696 people in Punjab.

Table 4: Distribution according to age and sex of dental fluorosis cases.

Age (years)	Mahagaon			Sawarkhed		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
1/2 -4	0	0	0	0	0	0
5 -14	36(70.6)	38(74.5)	74(72.5)	41(37.3)	22(20.6)	63(29.0)
15 - 24	21(84.0)	6(25.0)	27(55.1)	37(58.7)	11(20.7)	48(41.4)
25 - 34	17(68.0)	6(22.2)	23(44.2)	17(28.3)	4(5.6)	21(16.0)
35 -44	21(77.8)	7(38.9)	28(62.2)	14(26.9)	1(2.7)	15(16.8)
45 +	11(52.4)	5(21.7)	16(36.4)	28(32.9)	7(7.3)	35(19.3)
Total	106(60.2)	62(39.2)	168(50.3)	137(33.5)	45(11.2)	182(22.4)

(Chi square value for Mahagaon = 14.67; d.f. = 1; p < 0.001 and Sawarkhed = 57.93; d.f. = 1; p < 0.001)

There were no cases of dental fluorosis under the age of five years. Maximum cases were in the age group of 5 – 14 years in Mahagaon i.e. 74 (72.5 %). In Sawarkhed, maximum cases were in the age group of 15 – 24 years i.e. 48 (41.4%).

In general the prevalence of the disease was much lower in females as compared to males. For example in Mahagaon, the overall prevalence in males was 60.2 % whereas that in females was 39.2%. The difference is highly significant (chi square = 14.67; d. f. = 1; p < 0.001)

Similarly in Sawarkhed, overall prevalence in males was 33.5% and in females 11.2%. The difference is highly significant (chi square = 57.93; d. f. = 1; p < 0.001).

Ray, S.K. et al [8] observed overall prevalence in males 30.40 % whereas in females 18.08 %. They further observed that there was almost no difference in the prevalence rate between males and females up to 15 years of age but it was significantly lower among females beyond 15 years of age, as observed in the present study.

Tamboli, B.L. et al [15] observed 78.64 % of cases of dental fluorosis in the age group of 5 – 14 years. This value was quite similar to the present study. But they observed a linear relationship of prevalence of dental fluorosis with age which was not found in the present study. This can be because of very high value of fluoride concentration of water in their study namely, 14.3 and 13.9 ppm.

Table 5: Sex wise distribution of the severity of dental fluorosis subjects (Dean's classification).

Grade	Mahagaon			Sawarkhed		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
Question-Able	7(6.6)	7(11.3)	14(8.3)	21(15.3)	7(15.6)	28(15.4)
Very mild	13(12.3)	11(17.7)	24(14.3)	29(21.2)	6(13.3)	35(19.2)
Mild	25(23.6)	15(24.2)	40(23.8)	37(27.0)	19(42.2)	56(30.8)
Moderate	48(45.2)	23(37.1)	71(42.3)	33(24.1)	9(20.0)	42(23.1)
Severe	13(12.3)	6(9.7)	19(11.3)	17(12.4)	4(8.9)	21(11.5)
Total	106(100.0)	62(100.0)	168(100.0)	137(100.0)	45(100.0)	182(100.0)

Out of total 168 cases with dental fluorosis in Mahagaon, highest i.e. 71 (42.3 %) were of moderate grade as per Dean Classification followed by mild i.e.40 (23.8%), very mild 24 (14.3%), severe 19 (11.3%) and questionable 14 (8.3%). In Sawarkhed, maximum cases i.e. 56 (30.8%) were in mild

grade followed by moderate grade 42 (23.1%), very mild 35 (19.2%), questionable grade 28 (15.4%) and severe grade 21 (11.5%).

Study conducted by Spira Leo [16] reported very mild cases i.e. 43 %, mild 37

%, moderate 37 % and 4 % severe cases according to Dean's scale.

Ray, S.K. et al [8] in Ledhpur and Rustampur villages near Varanasi found no severe case of dental fluorosis. 14.40 % cases were in questionable grade, 5.60 % very mild, 2.73 % mild and 2.17 % moderate. They observed a declining trend of severity.

Tamboli, B.L. et al [15] observed increased percentage of cases with increasing severity in two villages of Rajasthan. They found 2.38 % cases of grade I, 7.76 % cases of grade II, 15.32 % cases grade III, 17.91 % cases of grade IV and 40.29 % cases of grade V.

Skeletal Fluorosis

Prevalence:-

Clinically 43 (12.9 %) cases of skeletal fluorosis were found out of 334 subjects examined in Mahagaon. Only one case (0.1 %) out of 811 examined in Sawarkhed showed skeletal fluorosis.

Jolly, S.S. et al [4] in their epidemiological studies of fluorosis in ten villages of Punjab found 2.4 % to 70.7 % cases of skeletal fluorosis.

Raman, T.K. et al [17] observed 30.55 % in Visakhapatnam whereas Tamboli, B.L. et al [15] found 26.9 % in two villages in Rajasthan.

Table 6: Age and sex wise distribution of skeletal fluorosis cases from Mahagaon village.

Age group (in years)	Male	Female	Total
5-14	12(23.5)	4(7.8)	16(15.7)
15-24	2(8.0)	0	2(4.1)
25-34	2(8.0)	0	2(3.8)
35-44	4(14.8)	0	4(8.9)
45+	10(47.6)	9(39.1)	19(43.2)
Total	30(17.0)	13(8.2)	43(12.9)

In Mahagaon, out of 43(12.87%) subjects with skeletal fluorosis, 26 (15.7%) subjects were below the age of 15 years. This constitutes 15.7 % subjects in that age

group. No case was detected below the age of 7 years.

19 (43.2 %) subjects above the age of 45 years had skeletal fluorosis. All 23 cases with spinal involvement were above the age of 35 years, whereas 20 cases in the age group 7 – 34 years had genu-valgum or deformities of joints of lower extremities.

Singh, A et al [14] reported age group between 35 years and 75 years in their study of skeletal fluorosis in Punjab. As found from this study the lower age limit of 35 years for spinal involvement.

Krishnamachari, K.A.V.R. [10] reported the earliest evidence of genu-valgum in association with fluorosis was observed among children around 8 to 10 years. Here a case of genu- valgum was found in a boy of seven years. In the present study 13 (8.2 %) out of 158 females and 30 (17%) males out of 176 had skeletal fluorosis. Thus males were more affected.

Different authors have also reported about the male predominance of skeletal fluorosis. Of which Singh, A. et al [14] reported 43 (93.5 %) males out of 46 cases in Bhatinda district of Punjab.

Jolly, S.S. et al [4] observed 70 % non-crippled cases, 92 % crippled cases and 94% cases with neurological manifestations were males as against 30% , 8 % and 6 % females respectively.

Krishnamachari, K.A.V.R. [10] mentioned male: female ratio as 10.1; whereas Tamboli, B.L. et al [15] found 55 (57.3%) cases out of 96 were males in Ajmer district in Rajasthan.

CONCLUSION

In Mahagaon, the overall prevalence of fluorosis was 53.0 % and in Sawarkhed, it was 22.4 %. Prevalence of dental fluorosis was 50.3 % in Mahagaon and 22.4 % in Sawarkhed, whereas the prevalence of skeletal fluorosis was 12.9 % in Mahagaon and 0.1% in Sawarkhed.

For prevention and control of problem of fluorosis in both the villages, community intervention in the form of de-fluoridation of water should be done immediately by the public health authority. Meanwhile people of these villages should be trained and motivated to adopt household technique of de-fluoridation like Nalgonda technique developed by NEERI, Nagpur. Health education about inclusion of green leafy vegetables in diet, avoidance of fluoride rich food items e.g. tea fish, meat etc., avoidance of fluoride tooth paste should be imparted to the people.

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