Quest Journals
Journal of Medical and Dental Science Research
Volume 4~ Issue 4 (2017) pp: 05-09
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

A Study on the Epidemiological Aspects Among the Population Living in the Area of Endemic Fluorosis

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Received 23 May, 2017; **A**ccepted 25 Mar, 2017 © The author(s) 2017. **P**ublished with open access at **www.questjournals.org**

ABSTRACT: *Fluorides are cumulative toxins, even after boiling, food processing, filtration or digestion will not remove fluoride. The aim of the present study is to assess epidemiological profile of endemic fluorosis and the magnitude of the problem in terms of prevalence of various types of fluorosis. 102 households covering the 500 population residing in the endemic fluorotic area have been selected by systematic random technique at Anantapuram district. Each of the subject was studied, information regarding various epidemiological characteristics and examined to notice clinical features related to fluorosis. Out of 500 selected individuals, 453 (90.6%) members have fluorosis related clinical features. On assessing dietary habits it was significant (p≤0.04) among vegetarians (24%) and non vegetarians (76%). Prevalence of fluorosis was higher among those who consumed >5 liters of water (69.6%) than those who consumed <5 liters of water/day (30.4%). Parameters such as usage of fertilizers, tea intake, consumption of milk and milk products, tobacco and staple diet shown statistically significant in relation to various types of fluorosis. Awareness to be created among population and they are encouraged to consume food/water with fluoride as low as possible (<1.0mg/L) and consume a diet rich in calcium, iron, vitamin C &E and other antioxidants.*

Keywords: *Endemic Fluorosis, Epidemiological characteristics, Water.*

I. INTRODUCTION

Fluorosis is caused by an element known as Fluorine. Fluorine ranks 13th among the elements in the order of abundance in the earth's crust [1] and represents 0.06 to 0.09% of the earth crust [2] found as complex fluoride. Fluorosis is an endemic disease. It is a slow progressive crippling malady, affects young and old, poor and rich, rural and urban population. Fluorosis is not limited to humans and can affect any aspect of the ecosystem. Fluorides are cumulative toxins even after boiling, food processing, filtration or digestion will not remove fluoride.

In 1971, the WHO stated: "In the assessment of the safety of a water supply with respect to the fluoride concentration, the total daily fluoride in take by the individual must be considered." The WHO guideline value for fluoirde in drinking water of 1.5 mg/L (ppm) is the "desirable upper limit"[3]. As per UNICEF Fluorosis is a public health problem endemic in 25 countries across the globe, the total number of victims would run in tens of millions. Fluorosis is an important critical public health problem in several parts of the world [4].

The magnitude of the problem of Fluorosis in India is roughly estimated to the tune of 66.62 million people at risk in 20 endemic states either afflicted or under high risk, of which estimated 6 millions are children below the age of 14 years. The study was done at Begarlapalli village of Anantapuram district which is located in Andhra Pradesh state of India. As per Internal Water Quality Monitoring Laboratory the maximum extent of fluoride in drinking water is 4.00 PPM. The aim of the present study is to assess epidemiological profile of endemic fluorosis and the magnitude of the problem in terms of prevalence of various types of fluorosis.

II. MATERIALS AND METHODS

The present study is a prospective randomized study was undertaken in Begarlapalli village of madakasira mandal of Anantapuram district from January to April 2017. An Institutional ethical committee approval and informed consent has taken before doing this study. The study population includes residents of endemic area who have underground water (>450 feet) as their chief source of consumption. 102 households covering the 500 population residing in the endemic fluorotic area have been selected by systematic random technique. Each of the subject was studied and examined to notice clinical features related to fluorosis.

Patient details including age, sex, address, socioeconomic status, tooth paste, habit of chewing tobacco products or drinking tea/toddy, veg/non veg diet [5]. Details regarding water source, type of staple food, agricultural practice using fluoride rich pesticide, any past history of carcinogenic/ teratogenic/ mutagenic effects occurred in their family [6]. Water samples were sent to laboratory for testing fluoride content using Ion-Selective Electrode Technology to find the precise concentration, the most common procedure to quantify free fluoride anion.

Analysis was done. The statistical tests used such as chi square are done with relevant software like Epiinfo 2000. The results were tabulated interpreted and reported with relation to the available literature and discussed.

III. RESULTS

A Total of 500 individuals were selected to do this study. Most of them were in the age group of 15-45 years, was 260 (52%) followed by 117 (23.4%) were 5-15 years, 88 (17.6%) were >45 years, 35 (7%)were <5 years. Out of 500 selected population 342 (68.4%)were illiterates and 158 (31.6%) were literates. Out of 500 selected individuals, 453 (90.6%) members have fluorosis related clinical features. On assessing different types of fluorosis, most commonest presentation was Dental fluorosis (37.6%), followed by 22.2% non skeletal fluorosis, 21.2% Mixed type, 11.6% skeletal fluorosis (Fig. 1&2).

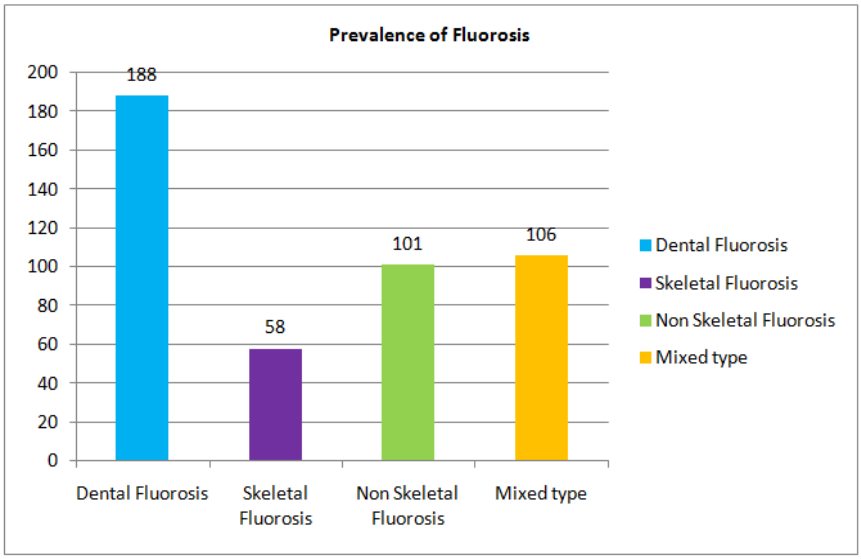

Fig..1 Distribution of Various types of Fluorosis

Fig.2 Showing a Person with skeletal fluorosis

A higher prevalence of fluorosis was seen among males 91.4% than females 89.7%, this difference was statistically significant (p≤0.002). Among Males, 44.8% had dental fluorosis and 12.3% had skeletal fluorosis whereas in females 29.3% had dental fluorosis and 10.8% had skeletal fluorosis (Table.1).

Table .1 Distribution of types of Fluorosis according to Sex.

Sex	Dental Fluorosis	Skeletal Fluorosis	Non Skeletal Fluorosis	Mixed type of Fluorosis	Normal Persons	Total
Male	120 (44.8%)	33 (12.3%)	49 (16%)	23 (8.6%)	23 (8.6%)	268 (100%)
Female	68 (10.8%)	25 (10.8%)	52 (22.4%)	63 (27.2%)	24 (10.3%)	232 (100%)
Total	188 (37.6%)	58 (11.6%)	101 (20.2%)	106 (21.2%)	47 (9.4%)	500

The highest Prevalence (78.6%) dental fluorosis was seen in children in 6-15 years, whereas in age group 16-45 years - mixed fluorosis revealed higher prevalence (31.9%). As age increases prevalence of fluorosis increases. No Manifestations of fluorosis was seen in children below 5 years (Table.2).

Table. 2 Distribution of types of Fluorosis according to Age.

S.No.	Age in Years	Dental Fluorosis	Skeletal Fluorosis	Non Skeletal Fluorosis	Mixed type of Fluorosis	Normal Persons	Total
1	0-1	-	-	-	-	5 (100%)	5 (100%)
2	2-5	-	-	-	-	30 (100%)	30 (100%)
3	6-15	92 (78.6%)	4 (3.4%)	7 (5.9%)	6 (5.1%)	8 (6.8%)	117 (100%)
4	16-45	71 (27.3%	34 (13%)	68 (261%)	83 (31.9%)	4 (1.5%)	260 (100%)
5	>45	25 (28.4)	20 (22.7%)	24 (27.3%)	19 (21.6%)	-	88 (100%)
	TOTAL	188 (37.6%)	58 (11.6%)	101 (20.2%)	106 (21.2%)	47 (9.4%)	500

Various Parameters including literacy, dietary habits, water intake, water treatment, usage of fluorinated tooth paste or fertilizers, tea intake etc., were studied. The different types of fluorosis relation to literate (31.6%) and illiterate (61.4%) was not significant (p≤0.56). On assessing dietary habits it was significant (p≤0.04) among vegetarians (24%) and non vegetarians (76%). Prevalence of fluorosis was higher among those who consumed >5 liters of water (69.6%) than those who consumed <5 liters of water/day (30.4%). Parameters such as usage of fertilizers, tea intake, consumption of milk and milk products, tobacco and staple diet shown statistically significant in relation to various types of fluorosis (Table.3).

Table .3 Assessment of various epidemiological parameters among different types of Fluorosis

Parameters	Dental Fluorosis	Skeletal Fluorosis	Non-Skeletal Fluorosis	Mixed type of Fluorosis	Normal Persons	Total
Literacy						
Literate	102(64.6%)	9 (5.7%)	22 (13.9%)	20 (12.6%)	5 (3.2%)	158 (100%)
Illiterate	86 (28.0%)	49 (16.0%)	79 (25.7%)	86 (28%)	7 (2.3%)	307 (100%)
Dietary Habits						
Veg	28 (23.3%)	15 (12.5%)	22 (18.3%)	38(31.7%)	7(5.8)	120 (100%)
Non-Veg	160(42.1%)	43 (11.3%)	79(20.8%)	68(17.8%)	30 (7.9%)	380 (100%)
Water Intake per Person Per day						
< liters	79(52%)	8(5.3%)	19 (12.5%)	22(14.5%)	24 (15.8%)	152 (100%)
> liters	109(31.3%)	50 (14.4%)	82(23.6%)	84(24.1%)	23 (6.6%)	348 (100%)
Water Treatment						
Fluoridated	155(36.5%)	53 (12.5%)	98(23.0%)	87(20.4%)	32(7.5%)	425 (100%)
Defluoridated	33 (44%)	5 (6.7%)	3 (4%)	19(25.3%)	15(20%)	75 (100%)
Tooth Paste						
Fluoridated	50(29.4%)	21(12.4%)	41(24.1%)	41(24.1%)	17(10%)	170 (100%)
Non-Fluoridated	138(41.8%)	37 (11.2%)	60(18.1%)	65(19.7%)	30 (9%)	330 (100%)
Fertilizers Types						
Using Fluoride type	48(35.3%)	18(13.2%)	28(20.5%)	23(16.9%)	19(13.9%)	136 (100%)

Non Fluoride	140(38.5%)	40(11%)	73(20%)	83(22.8%)	28(7.7%)	364 (100%)
Tea Intake						
Intake	178(38.7%)	49(10.6%)	99(21.5%)	105(22.8%)	29(6.3%)	460 (100%)
No Intake	10 (25%)	9(22.5%)	2 (5%)	1(2.5%)	18(45%)	40 (100%)
Milk and Milk Products						
No Consumption	76(34.9%)	31(14.2%)	49(22.5%)	53(24.3%)	9(4.1%)	218 (100%)
consumption	112(39.7%)	27(9.5%)	52(18.4%)	53(18.8%)	38(13.5%)	282 (100%)
Tobacco Usage						
No Intake	63(33.9%)	26(13.9%)	30(16.1%)	31(16.7%)	36(19.3%)	186 (100%)
Intake	125(39.8%)	32(10.2%)	71(22.6%)	75(23.9%)	11(3.5%)	314 (100%)
Staple Diet						
Non Jowar	96 (30%)	28(8.7%)	80 (25%)	76(23.7%)	40(12.5%)	320 (100%)
Jowar (Sorghum)	92 (51.1%)	30(16.7%)	21(11.6%)	30(16.7%)	7(3.9%)	180 (100%)

IV. DISCUSSION

Fluorosis is a painful and crippling disease which has made lives of millions of rural people in India miserable and unproductive. Endemic fluorosis has emerged as one of the most alarming public health problem all over the country. Fluoride or hypochloric acid enters into the body through drinking water, food-chain, industrial emission, drugs and dental products laced with fluoride. The reason why the food fluoride content is being high lightened is that there are patients of fluorosis whose water is safe, but the cause of whose fluorosis has been due to fluoride entry through food/dietary habits [7]. Morbidity of the dental fluorosis was 44.8% in males and 10.8% in females. skeletal fluorosis was higher in males 12.3% when compared to females 10.8%. Prevalence of fluorosis was found maximum 98.5% in the 16-45 years age group. The prevalence of skeletal fluorosis was relatively higher in males and increased with age, in 16-45 years it was 13% and in >45 years it was 22.7% as per this study. This study correlates with study of Choubisa SL et al [8] in their one endemic fluorosis in Rajasthan. At 1.7 and 6.1 mean fluoride concentration, 70.6% and 100% of children (<18 years) and 68% and 100% adults respectively were found to be affected with dental fluorosis of varying degrees. Most of the males are in their productive age group of 16-45 years and their major occupation was labourers and consuming more fluorinated water in the field, working hours might be the reason for higher prevalence of fluorosis in them. In the present study, 120 respondents (24%) are vegetarians and 380 (76%) are non vegetarians. Dental fluorosis was 42.1% among non vegetarians compared to vegetarian group where it was 23.3%. This study correlate with the study conducted by Awadia AK et al [9] in their study, vegetarianism and dental fluorosis among children in a higher fluoride in the area of Northern Tanzania and also correlates with Sharma Y et al [10] revealed that vegetarian diet does not show wide variation in turn of it fluoride content and therefore in turn provides a constant dose of fluoride. Thus this study implies, non vegetarian diet has sourced of fluorides.

In this study among consumers of jowar 180 (36%) the fluorosis manifestations were more 96% compared to non jowar consumers 87.5%. Among jowar (sorghum) eaters skeletal fluorosis was 16.7% compared to non jowar eaters skeletal fluorosis was 8.7%. This study is similar to Lakshmi AV et al [11]. Both these studies observed that retention of fluoride is influenced by the cereals consumed and sorghum (jowar) consumption leads to higher retention of the fluoride of the body. Our study also correlates well with Reddy NB et al [12] and Grimaldo et al [13] in terms of water intake and water defluoridation techniques. Grimaldo et al [13] concluded that boiling drinking water for regular consumption, increases the fluoride levels also a source of fluoride exposure. Boiling the water increases the fluoride concentration in direct proportion to the loss of volume. Among tea consumers of >10 years duration fluorosis manifestations are more (96.3%) as per this study. Tea intake and tobacco consumption association with fluorosis was supported by Lian-fang Wang et al [14] and Annapurna K et al [15] respectively. Fluoride poisoning and the biological response leading to ill-effects depends on the following factors: Concentration of Fluoride in drinking water, food, cosmetics etc, low calcium and high alkalinity of drinking water, age of the individual, duration of intake, pregnancy, lactating mother, derangement in hormonal profile either as a result of fluoride poisoning or cause, aggravates the disease. The hormones are: calcitonin, parathormone, vitamin D and cortisol are the important hormones for healthy bone formation and bone function.

V. CONCLUSION

There is no treatment or cure for fluorosis other than rehabilitation facilities and therefore prevention and control through management of the patient through interventions is the only approach to mitigate fluorosis. The crux of the problem is early detection. Awareness to be created among population and they are encouraged to consume food/water with fluoride as low as possible (<1.0mg/L) and consume a diet rich in calcium, iron, vitamin C &E and other antioxidants.

ACKNOWLEDGEMENTS

I Would like express my gratitude towards authors and editors of books, journals and thesis which helped in every aspect with various literatures while doing this research work.

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