



Prevalence of dental Fluorosis among residents of nine villages in and around mundaragi of Gadag district in Karnataka, India

C.B.Shivayogimath¹ M.N.Hiremath² and S.N.Shivalingappa³

¹Department of Civil Engineering, B.E.C.Bagalkot, Karnataka.

²Department of Civil Engineering, Anjuman Institute of Technology & Management, Bhatkal, Karnataka.

³STJIT, Ranebennur, Karnataka.

ARTICLE INFO

Article history:

Received: 29 July 2012;

Received in revised form:

5 September 2012;

Accepted: 11 September 2012;

Keywords

Fluoride,
Fluorosis,
Sample survey,
Dean's index.

ABSTRACT

The present study was conducted to assess the health impact of, high fluoride content in ground water among the inhabitants of nine fluoride affected villages in and around Mundaragi of Gadag district in Karnataka, India. The study area, where sample survey was conducted includes Mukampur, Kalakeri, Virupapur, Bennihalli, Mushtikoppa, Hirewaddatti, Mevundi, and Budihal villages including Mundaragi town. Research articles by many researchers revealed that, fluoride distribution in these villages was found higher than the prescribed limits. Sample survey was conducted, by randomly selecting fifty families in each village comprising total population of 2001, in the month of April 2012. Dean's index codes were used to assess the severity of dental fluorosis. The results revealed that 42.12% found normal, 14.34% found questionable, 28.18% found with very mild fluorosis, 13.80% found with mild fluorosis, 0.15% with moderate fluorosis and only 0.05% found with severe fluorosis. It was also revealed that people also suffering from pain in neck, back, joint, etc.

© 2012 Elixir All rights reserved.

Introduction

Water is the most abundant molecule of earth's surface constituting about 70% of planet's surface. But water is necessary for most life on earth. Humans can survive for several weeks without food, but can hardly survive only for a few days without water. The exact amount of water a human need is highly individual, as it depends on the condition of the subject, the amount of physical exercise, and on the environmental temperature and humidity. Water is a ubiquitous chemical substance that is composed of hydrogen and oxygen and is vital for all known forms of life. In nature it exists in liquid, solid, and gaseous states. All these three forms of water are extremely useful to man, providing him the luxuries and comforts, in addition to fulfilling his basic necessities of life. Every one of us knows how important and precious the water is? At room temperature, it is nearly colourless with a hint of blue, tasteless and odourless liquid. Many substances dissolve in water and it is commonly referred to as the universal solvent. Water usually makes up 55% to 78% of the human body.

Fluoride is a salt of the element fluorine; fluorine is the most highly reactive element of halogen family. Fluoride is the one of the very few chemicals that has been shown to cause significant effects in people through drinking water. High concentrations of fluoride cause mottling of teeth initially and dental fluorosis diseases to crippling skeletal fluorosis with continued use of fluoride rich waters. Fluoride is attracted by positively charged calcium in teeth and bones due to its electro-negativity, which results in dental, skeletal, non skeletal forms of fluorosis in children as well as adults [1, 2].

Fluorine is highly reactive and is found naturally as CaF_2 . It is an essential constituent in minerals like topaz, fluorite, fluapatite, cryolite, phosphorite, theopapatite, etc. [3]. The Fluoride is found in the atmosphere, soil and water. It enters the soil through the weathering action of rocks, precipitation or water runoff. It has been observed that low calcium and high bicarbonate alkalinity favour high fluoride content in ground water [4, 5], other sources of fluoride poisoning include food, industrial exposure, drugs, cosmetics, etc. [6].

Ground water in many parts of India is found to contain very high concentrations of fluorides. A total of 17 states are reported to have endemic fluorosis in India. [7], it was estimated that 62 million people including six million children, suffering from fluorosis [8]. The states which are affected by high fluoride levels in drinking water include Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Jammu and Kashmir, Karnataka, Kerala, Madhyapradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh and West Bengal. These have been progressively identified since the first report by Short *et.al* 1937 [9]. In Karnataka Dharwad, Gadag, Bellary, Belgaum, Raichur, Bijapur, Gulbarga, Chitradurga, Tumkur, Chikmagalur, Mandya, Bangalore and Mysore districts are identified to be endemic for Fluoride [10], and the range of fluoride concentration varies from 0.2 to 18.0mg/L in these districts. As per Central Ground Water Boards report (2009), a Government of India organization under the Ministry of Water Resources, the ground water in major parts of Gadag, Ron and south central parts of Mundaragi taluka have been found to contain high fluoride levels. Therefore nine villages in Mundaragi taluka of Gadag district [11] were selected for

the investigation of prevalence of dental fluorosis in the present study.

Study Area

In this part the study area with reference to its location, geographical features, and hydro geological features are discussed.

About Mundaragi

Mundaragi is a panchayat town in Gadag district in the Indian state of Karnataka. Mundaragi is very near to two district head quarters (Gadag and Koppal); it is 36 km from Gadag and 50km from Koppal. Mundaragi-this name came from hill station Mrudagiri. This is combination of two words mruda (means Shiva) giri (means hill) later it became Mundaragi .one can see a single stone big hill attached to this place (around 7km).

As per Central Ground Water Board report (2009), a central government organization under the Ministry of Water Resources, the ground water in major parts of Gadag,Ron and south central parts of Mundaragi taluka have been found to contain high fluoride levels,[11], it was also revealed by many researchers that, fluoride distribution in these villages was found higher than the prescribed limits i.e. from 2.6mg/L to 6.9mg/L, [13,14], therefore the area of Mundaragi taluk of Gadag district is selected for the investigation prevalence of dental fluorosis in the present study.

Geography of the Study Area

Mundaragi is located at 15.22 degree N 75.9 degree E, it has an average elevation of 528 mts(1732ft) surrounded by Kappadgiri range of hills, Mundaragi is primarily a drought hit area.

Hydrogeology of Study Area

The district is underlain by hard rock formations like granites, gneisses, and schists. These rocks have no primary porosity or permeability. Ground water occurs under phreatic conditions in weathered zone of these formations. At higher depths ground water occurs under confined to semi confined conditions in fractures and joints as well as formation contacts, its movement is controlled by the inter connectivity and geometry of the structurally weak zones called lineaments.[11].

Rainfall and Climate

The district falls under semi arid region of the state and it is categorized as draught prone; the normal rainfall is 613 mm. The North-East monsoon contributes nearly 24.8% and prevails from October to early December. And about 54.7% precipitation takes place during South-West monsoon period from June to September, and remaining 20.5% takes place during rest of the year. In the district, from December to February month is winter season, During April to May temperature reaches up to 42°C and December and January temperature will go down up to 16°C. The standard deviation of rainfall in the district varies from 1.3 to 263.5mm from west to east. The average standard deviation for the district is about 146 mm. South West monsoon is dominant followed by north east monsoon. [11]

Materials and Methods: In this present investigation, prevalence of dental fluorosis in and around Mundaragi of Gadag district in Karnataka, India was carried out. The study area includes, Mukampur, Kalakeri, Virupapur, Bennihalli, Mushtikoppa, Hirewaddatti, Mevundi, and Budihal villages including Mundaragi town. Sample survey was conducted, by randomly selecting fifty families in each village comprising total

population of 2001, in the month of April 2012.



Fig.1. Location Map of the Study area.

Dean's index codes shown in table No.1. [12], were used to assess the severity of dental fluorosis. Data were collected using Questionnaire format which is shown in fig.2, to obtain the socio-economical status, occupation and source of drinking water, change in drinking water source; etc. by oral/physical examination. Different groups comprising age between 1-7, 8-15, 16-30, 31-45, 46-60, 61-75 and 76-90 were formed to assess the severity of dental fluorosis.

Table.No.1.Dean's Index Table for Recording Dental Fluorosis

Normal	The enamel represents the usual translucent semivitriform type of structure. The surface is smooth, glossy, and usually of a pale creamy white colour
Questionable	The enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few white flecks to occasional white spots. This classification is utilized in those instances where a definite diagnosis of the mildest form of fluorosis is not warranted and a classification of "normal" not justified.
Very mild	Small, opaque, paper white area scattered irregularly over the tooth but not involving as much as approximately 25% of the tooth surface. Frequently included in this classification are teeth showing no more than about 1-2 mm of white opacity at the tip of the summit of the cusps of the bicuspid or second molars.
Mild	The white opaque areas in the enamel of the teeth are more extensive but do not involve as much as 50% of the tooth
Moderate	All enamel surfaces of the teeth are affected, and surfaces subject to attrition show marked wear. Brown stain is frequently a disfiguring feature
Severe	Includes teeth formerly classified as "moderately severe" and "severe." All enamel surfaces are affected and hyperplasia

HEALTH SURVEY REPORT OF FLUORIDE AFFECTED VILLAGES IN MUNDARGI TALUK OF GADAG DISTRICT							
Name of village :		Survey sample no.:		Population			
Name of head of family:		Occupation:		Period of stay:			
Drinking water source:		1) Bore well		2) Open well		3) Municipal supply	
Members of family	Sex	Age	Dental fluorosis				
			Normal	Questionable	Very mild	Mild	Moderate

Fig.2. Sample Health Survey Questionnaire Format

Results:

Study sample survey of 2001 population comprising residents of Mukampur, Kalakeri, Virupapur, Bennihalli, Mushtikoppa, Hirewaddatti, Mevundi, and Budihal villages

including Mundaragi town was carried out in the April 2012, and the results were tabulated below.

Table.2. Village wise Assessment of Dental Fluorosis

Name of village	No. of persons surveyed	Normal	Questionable	Very mild	Mild	Moderate	Severe
Mundargi	221	99	25	60	30	07	Nil
	%	44.79	11.31	27.14	13.57	3.16	Nil
Muktampur	231	54	22	94	46	15	Nil
	%	23.37	9.52	40.69	19.91	6.49	Nil
Kalakeri	237	77	36	91	33	Nil	Nil
	%	32.48	15.18	38.39	13.92	Nil	Nil
Virupapur	207	113	30	32	32	Nil	Nil
	%	54.58	14.49	15.45	15.45	Nil	Nil
Bennihalli	176	75	16	64	21	Nil	Nil
	%	42.61	9.09	36.36	11.93	Nil	Nil
Mustikoppa	202	79	12	81	29	01	Nil
	%	39.10	5.94	40.09	14.35	0.5	Nil
Hirewaddatti	237	123	54	48	12	Nil	Nil
	%	51.89	22.78	20.25	5.06	Nil	Nil
Mevundi	244	115	58	41	22	07	01
	%	47.13	23.77	16.80	9.01	2.86	0.40
Budihal	246	108	34	53	51	Nil	Nil
	%	43.90	13.82	21.54	20.73	Nil	Nil
Total	2001	843	287	564	276	30	01
	%	42.12	14.34	28.18	13.80	0.15	0.05

Table.3. Age Group wise Assessment of Dental Fluorosis

Age Group	Total No. of Persons Surveyed	Nature of Dental Fluorosis					
		Normal	Questionable	Very mild	Mild	Moderate	Severe
0-7	198	187	2	7	2	0	0
	%	94.44	1.01	3.54	1.01	0	0
8-15	225	87	47	71	19	01	0
	%	38.67	20.89	31.55	8.44	0.44	0
16-30	734	329	113	195	87	10	0
	%	44.82	15.60	26.56	11.85	1.36	0
31-45	438	150	69	141	71	7	0
	%	28.99	15.75	36.99	16.67	1.6	0
46-60	288	74	43	113	52	5	1
	%	20.49	20.13	39.24	18.06	1.74	0.35
61-75	98	14	12	31	37	4	0
	%	14.28	12.24	31.63	37.75	4.08	0
76-90	20	2	1	6	8	3	0
	%	10	5	30	40	15	0
Total Numbers	2001	843	287	564	276	30	1
Total Percentage	100	40.23	15.09	29.24	13.89	1.5	0.05



Fig.3. Images of Dental Fluorosis cases from Study Area.

Discussion: From the present study on health survey and above tables it was revealed that, majority of population i.e. 90% of population mainly depends on agriculture as their major occupation and remaining 10% depends on government and private sector jobs. Till the end of last 5-6 years all the people of surveyed villages were used to consume ground water for drinking purpose, during survey it was observed that from the last 5-6 years, people of all these villages are getting treated river water supplied by local government. From the study it was revealed that out of 2001 people surveyed, 42.12% found normal, 14.34% found questionable, 28.18% found with very mild fluorosis, 13.80% found with mild fluorosis, 0.15% with moderate fluorosis and only 0.05 % found with severe fluorosis. It was also revealed that, 94.49% and 87% of population under the age of 7 and 15 have no symptoms of any dental fluorosis, this is because of younger generation are getting treated river water supply by the local government.

It was also revealed from the study that population in the age group of 30 to 60 have more symptoms of dental fluorosis of very mild, mild and moderate nature. This clearly indicates that these people have consumed fluoride rich water, since their birth to till the end of last 5-6 years from then they changed to treated river water supply.

From the study it was also revealed that people of Mundaragi, Hirewaddatti and Mevundi have more cases of mild to moderate dental fluorosis compared to other villages

Conclusions:

Following were the conclusions drawn from the Study of, sample survey of 2001 population comprising residents of Muktampur, Kalakeri, Virupapur, Bennihalli, Mushtikoppa, Hirewaddatti, Mevundi, and Budihal villages including Mundaragi town which was carried out in the April 2012.

- People above the age of 30 years have the symptoms of dental fluorosis of very mild, mild to moderate nature.
- 42.12% found normal, 14.34% found questionable, 28.18% found with very mild fluorosis, 13.80% found with mild fluorosis, 0.15% with moderate fluorosis and only 0.05 % found with severe fluorosis.
- 94.49% and 87% of population under the age of 7 and 15 respectively, have no symptoms of any dental fluorosis.
- Mundaragi, Hirewaddatti and Mevundi have more cases of mild to moderate dental fluorosis compared to other villages
- From the study it was also revealed during interrogation that,

people of the study area were also affected from pain in joints, neck, hip, and backbone, this clearly indicates the prevalence of skeletal fluorosis.

- The present study acts as informative tool to district administration, public health officials to undertake epidemiological investigation in district level to evaluate the risk factors associated with the condition of the study region.

References

- [1]. Ayoob.S, Gupta.A.K Fluoride in drinking water: a review on the status and stress effects. *Crit. Rev. Environ. Sci.technol.*36 (2006) 433-487.
- [2]. Shusheela.A.K, Kumar.A, Betnagar,M, Prevalence of endemic fluorosis with gastro-intestinal manifestation in people living in some north-Indian villages, *Fluoride* 26 (1993) 97-104.
- [3]. Singh.R, Maheswari R.C, Defluoridation of drinking water-a review, *Ind. J. Environ. Protec.* 21 (11) (2001) 983-991.
- [4]. Bulusu.K.R, PathakB.N, Discussion on water defluoridation with activated alumina, *J. Environ. Eng. Div.* 106 (2), (1980)466-469
- [5]. Hem.J.O, Study and interpretation of chemical characteristics of natural water, U.G. Geological Survey Water Supply Paper, 1959, p. 1473.
- [6]. Meenekshi, V.K, Garg, Kavita, Renuka and Malik.A, Ground water quality in some villages of Haryana, India: focus on fluoride and fluorosis, *J. Haz.Mater.* B 106 (2004) 85-97.
- [7]. Meenekshi Arora, Garg, V.K., Kavita, Renuka and A. Malik (2004). Ground water quality in some villages of Haryana, India: focus on fluoride and fluorosis, *J. Haz. Mater.* 106: 85-97.
- [8]. Susheela, A.K. (1999). Management programme in India. *Curr. Sci.*, 77(10): 1250-1256.
- [9]. Short, H.E., Mc Robert, G.R., Bernard, T.W. and Mannadinayar.A.S, (1937). Endemic fluorosis in the Madras Presidency. *Indian J. Medical Res.*, 25: 553:561.
- [10]. A.K. Susheela, Fluorosis management programme in India. *Curr. Sci.*, 77(10) (1999) 1250-1256.
- [11]. Central Ground Water information booklet of Gadag district, Karnataka, (2009), Ministry of Human Resources, Government of India MRC 2002.
- [12]. Dean.H.T, The investigation of physiological effects by the epidemiological method, In Moulton. F.R, Editor. *Fluorine and dental health.* Washington, DC: American Association Advancement Science, 1942, pp. 23-7 1.36.
- [13] Pushpa Bharathi, Annapoorna Kubakaddi et.al (2005), Clinical symptoms of dental and skeletal fluorosis in Gadag and Bagalkot districts of Karnataka, *Journal of human ecology*, 18(2), pg 105-107.
- [14] Sudhir .K.M, Prashant. G.M ,et.al(2009), Prevalence and severity of dental fluorosis among 13 to15 year old school children of an area known for endemic fluorosis:Nalgonda district of Andhra Pradesh, *Journal of Indian Soc Pedod Prevent Dent*, Vol 27, pg 190-197.