IJEP 26 (6) : 528 - 530 (2006) (Received on January 21, 2006)

Effect of Fluoride Level in Drinking Water and Socioeconomic Status on the Prevalence of Fluorosis in Mundargi Taluk

T.R. Shashi Shekhar, K. Harish Babu, Vijaya Kumara and E.T. Puttaiah

Kuvempu University, Department of Environmental Science, Shankaraghatta - 577 451

The present study deals with the physico-chemical parameters of ground water quality in Mundargi taluk, of Gadag district, Karnataka state, the study has been carried out during september 2003. Research findings for fluoride content in drinking water reveals that more than 90 % of the total sample analysed were found to be exceeded the WHO 1995 drinking water standards and it reflects on health status of the consumers.

KEYWORD

Ground water quality, Fluorosis, Mundargi taluk.

INTRODUCTION

Fluorosis is one of the most crippling endemic diseases affecting millions of people in different parts of the world (Aggarwal *et al.*, 1982; Susheela, 1993). In India, the disease was first discovered in the Madras Province in 1937. Later, the disease was also identified from different states. At present, more than 30 million people in 13 states are to be affected by this disease. Till today, the disease is making it does appearance in newer non-fluorotic area owe to geo-environmental conditions. Fluorine is widely dispersed in nature and is a common constituent of most soils and rocks, plants and animals (Fleischer and Robinson, 1963) and also in association with the minerals, like calcium as a fluorite or fluorosper (CaF_2), calcium and phosphorous as pleuoropetite ($CaF_2\ 3Ca_3(PO_4)_2$ and aluminum as cryolite (Na_3AlF_6). These compounds are widely distributed in the earth crust by virtue of dissolution of rocks. In karnataka, fluorosis has been identified in 8 districts, namely Dharwar, Gadag, Raichur, Gulbarga, Kolar, Chikmagalur and Chitradurga. Realising the damages caused by high content of fluoride in drinking water sources the present study was undertaken in Mundargi taluk during the year September 2003.

MATERIAL AND METHOD

Study area

Mundargi is a taluk head quarter is located 35 km to the east of Gadag district. The taluk comprises 48 villages and 6 hobalis (grampanchayat). For this effective study 5 villages, that is Kalkeri, Virupapura, Mustikoppa, Tippapura, Virupapura tanda were selected. There are no major surface water sources in the study area, however, main sources of drinking water in selected area are open wells, hand pumps and borewells.

Climate and hydrogeology

The study area receives on an average annual rainfall of about 489 mm. The temperature varies between 12 ± 1 to 40 ± 1, the area from which endemic fluorosis has been reported is under northern dry zone. The predominant soil types of the study area are alfisol. The area is occupied by biotite gneiss traversed by dolerite dykes with amphibolites and to the west of Mundargi consists of metavolcanic and metasedimentary rocks with the associated bands of ferruginous quartzite. Further, hornblende and biotite of the country rock contain a high level of fluoride.

Sampling analysis

A total of 20 water samples from various drinking water sources were collected in polythene bottles, which were cleaned and finally washed with acid water, followed by rinsing twice with distilled water. The water samples collected were chemically analyzed. The analysis of water was done using procedure of standard methods (APHA, 1995) and all analysis was done in triplicate. Fluoride concentration was determined spectrophotometrically using Alizarin red-S and SPADNS reagents. The Alizarin red-S method was found useful in higher fluoride range while SPADNS reagent was employed in low fluoride range (Gupta *et al.*, 1993).

© 2006 - Kalpana Corporation

Table 1. *Physico-chemical characteristics of water quality in selected villages of Mundargi, in mg/L*

Code	pH	TDS	EC, µmhos/cm	Alk	TH	Ca	Mg	Cl	Fluoride
VTOW-1	7	1000	1660	42	504	76.8	75.7	208.4	2.0
VTB-2	7	600	1000	40	344	55.2	50.5	99.9	4.7
VTHP-3	7.5	400	666	40	524	91.5	59.7	168.5	3.2
VTHP-4	8	800	1332	46	400	73.2	40.4	111.2	2.4
VTHP-5	7.5	600	995	46	388	77.3	28.6	108.5	1.6
VTHP-6	8	800	1330	42	260	46.1	28.6	62.8	3.55
VPRHP-7	7.5	600	1000	26	228	46.6	15.15	51.4	3.3
VPROW-8	7	820	1400	34	464	28	23.5	37.1	3.6
VPROW-9	7.5	800	1325	34	240	46.2	20.2	34.2	3.5
VPROW-10	6.9	600	1002	36	252	52.7	14.3	59.9	2.1
VPRHP-11	7	400	655	32	200	23.18	12	31.4	3.3
MSKB-12	7.1	1400	2330	60	284	44.4	41.2	179.9	1.3
MSKB-13	6.9	1200	1996	54	236	38.1	31.9	139.9	2.7
MSKB-14	7.5	1000	1666	56	280	44.7	38.7	222.7	3.3
MSKB-15	7.4	1400	2333	46	372	57.4	54.7	254.1	2.1
MSKHB-16	7.2	800	1333	38	176	23.4	21.9	37.12	3.3
KLKHP-17	6.8	1600	2666	44	257	40.6	36.1	162.7	2.7
KLKBW-18	7.3	1400	2333	58	144	19.7	11.2	125.5	2.7
KLKHP-19	7	2000	3333	54	528	95.8	94.2	439.8	3.3
KLKHP-20	6.5	2200	3666	48	552	86.5	79.1	376.9	2.1

Table 2. *Drinking water quality standards (WHO, 1995), in mg/L*

Parameter	Observed values		WHO (1995)	
			P	E
pH	6.5	8.03	6.5	8.5
EC, µmhos/cm	655	3666	–	–
TDS	400	2200	300	600
Total hardness	144	528	–	–
Calcium	19.7	95.8	75	200
Magnesium	11.2	94.2	50	150
Chloride	14.3	94.2	200	600
Alkalinity	26	60	200	600
Fluoride	1.3	4.7	0.5	1.0-1.5

Note : P–Permisstble limit, e–Excessive limit.

RESULT AND DISCUSSION

The findings of the present investigation are summarized in table 1, was also been made with WHO (1970) drinking water standards (Table 2). The pH value of the study area ranges from 6.5 to 8.03 and it is found to be well with in the permissible limits prescribed for drinking water standards (WHO, 1970). In the present study electrical conductivity values of the samples were found to be 655 to 3666 µmhos/cm. It shows that most of the samples were with in the permissible limits (750-2000 µmhos/cm). However, it is indicating high mineralization in that area. The research finding revealed for TDS values ranges between 400-2200 mg/L. In that 55 % of the total sample numbers for TDS concentration were found to be more than the desirable limit of 1000 mg/L.

The present analytical report reveals for total hardness concentration generally vary from 144-528 mg/L. Nevertheless samples were found to be well with in the desirable limit of 300-600 mg/L as prescribed by WHO (1970). Present investigation data states that for calcium values ranges from 19.7 to 95.8 mg/L and it indicates that they are well with in the permissible limit prescribed for WHO (1970) drinking water quality standards. It is proved from the present research investigation report for magnesium values ranges between 11.2 to 94.2 mg/L, the prescribed drinking water standards for magnesium is 50-150 mg/L. Samples were fall well with in the permissible limits of WHO (1970) prescribed drinking water standard. However, the ground water chemistry is controlled by the composition of its recharge components as well as by geological and hydrological variations (Narayana and Suresh, 1989).

Alkalinity values were well with in the permissible limits as suggested for drinking water standards. He-

© 2006 - Kalpana Corporation

re alkalinity values ranges between 26 to 60 mg/L. From the present research data for chloride levels found to be 14.3 to 94.2 mg/L and are well with in the desirable limit. Flouride levels generally found vary from 1.3 to 4.7 mg/L. However, 5 % of total number of samples were with in the range of 1.5 mg/L and 45 % of total number of samples were fall in the range of 1.5 to 3.0 mg/L, remaining 50 % of the total number of samples were in the range of 3.0 to 4.7 mg/L. Almost all bore wells and hand pumps, which are exclusively used, for drinking and cooking purpose were found to be high in fluoride content.

It is evident from the research analysis data, it is obvious that the fluoride concentration is more than the permissible limit for drinking purpose. Fluoride content of 1 mg/L in drinking water has no biological side effects (Leone *et al.*, 1954). However, in endemic areas arcund the world varicus levels of fluoride in drinking water above 1 mg/L have been recorded. Studies in these areas revealed that fluoride level between 1.5 to 3.0 mg/L in the drinking water and consumed over a period of 5 to 10 year caused mild form of dental fluoroisis. Between 4 to 8 mg/L and consumed over a period of 15 to 20 year caused severe form of dental fluorosis and mild form of skeletal fluorosis: and if it exceeded 8 mg/L and consumed over a period 5 to 10 year or more caused severe form of dental as well as skeletal fluorosis. Therefore, drinking water itself is sufficient to produce severe form of dental fluorosis and mild form of skeletal fluorosis if consumed over a period of 15 to 20 year (Galagon and Lamson, 1953). Health status of the peocle is varied in different villages because of severity of fluorosis, which is a direct reflection of fluoride content of drinking water. Youngsters in the fluorotic area compare their health with counterpart of non-fluorotic area and feel inferior about their health status.

CONCLUSION

From the result and discussion presented above the important role of drinking water in the incidence of fluorosis is obvious. It is, therefore, essential that the villagers affected by fluorosis be supplied with safe drinking water of less than 1 mg/L fluoride, either by changing the water source to safer once or by adopting suitable treatment technique to remove fluoride in the existing sources. Since grains, vegetables and milk are also significant sources of fluoride to man, their fluoride content should be taken into account while fixing the safe level of fluoride in drinking water.

REFERENCE

Aggarwal, A., R. Chopra and K. Shukla. 1982. The state of India's environment. pp 189.

APHA. 1995. Standard methods for the examination of water and wastewater (18th edn). American Public Health Association, New York.

Fleischer, M. and W.D. Robinson. 1963. Some problems of the geochemistry of fluorine. *Roy. Soc. Can. Spec. Pap.*, 6 : 58-75.

Galagon, D.T. and G.G. Lamson. 1953. Climate and endemic dental fluorosis. *Public Health Rep.*, 68 : 497-508.

Gupta, S.C., G.S. Rathore and C.S. Doshi. 1993. Fluoride distribution in ground waters of southeastern Rajasthan. *Indian J. Env. Health.* 35 (2) : 97-109.

Leone, N.C., *et al.* 1954. Medical aspects of excessive fluoride in water supply. *Public Health Rep.*, 69 : 925.

Narayana, A.C. and G.C. Suresh. 1989. Chemical quality of ground water of Mangalore city, Karnataka. *Indian J. Env. Health.* 31 : 228-236.

Susheela, A.K. 1993. Preventive and control of fluorosis in India. Health aspects (vol 1). Ministry of Rural Development, New Delhi.

WHO. 1970. Fluoride and human health. Monograph series no. 59. World Health Organization, Geneva.

© 2006 - Kalpana Corporation