**Socio-Economic Status in Public view Associated with the Fluoride in Drinking Water**

Suresh B

Department of Civil Engineering, Bapuji Institute of Engineering & Technology, Davangere-577 005, Karnataka, India

**ABSTRACT**

*The aim of this chapter is to understand the socio-economic conditions of rural region of the Harihar taluk of Davangere district, associated with the effect of fluoride in drinking water. Research Approaches: to develop and create an awareness water quality with reference to fluoride content and significance of fluorosis disease. Some innovative and best practices have been adopted in and around the study area keeping in mind that “Supply of good quality of water”. The present study was conducted to figure out the association between the socio-economic differences of defendants and fluorosis in out of twenty five fluorosis-identified villages of Davangere district in Karnataka. It was noticed that 100 percent of the defendants were suffering from skeletal and dental fluorosis. Davangere taluk of Davangere district is more affected by fluoride where 3.20 mg/litre level of fluoride polluted tube well is identified and by using such polluted water a comfortable of people are suffering fluorosis diseases. In the present study, group of family survey has been conducted to find out socio-economic properties of the affected communities and the type of fluorosis diseases associated by the public. The survey results predict that out of total fluorosis patients, dental and skeletal fluorosis is maximum which are 53% and 47% respectively. Statistical approach indicates that people of less than 20 years age are more suffering from dental fluorosis and people above 20 years age group are more suffering by skeletal and dissimilar non skeletal fluorosis diseases.*

**Outline of the Chapter**

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**Preamble**

Fluorosis is a medical disorder, It caused by usage of fluoride in water and food gradients in excessive form [4] It directly affect the lungs, cells and limbs in the human body. Over consumption of fluoride contents reveals, overlapping the other diseases [12]. Consumption of fluoride in water is the major problem and it may causes joints and deep back pain modifications in the inflexibility and vertebral problem like Regardless of the cause, your neck may hurt or be harder to move (Susheela, 2001 and WHO, 2006).

Suthar, et al., (2007) reported, in India contains about 0.12 billion tons of fluoride enters as per that 14% of total fluoride. UNICEF, (1999) and previous studies published in India about 12 states of ground water table indicating high fluoride during period 1991 later increased upto 17 states due to natural available in the geological structures during 1999 [5, 7]. List of states contaminated by fluoride content are given in Table 1.

As per survey conducted by Government of India, In India about 66 million people were suffering from Fluorosis, out of 6 million are below 14 years age children’s [16]. This measures about 5% of total population in India. Currently, fluoride in ground water has a serious problem and 65% of villages are exposed fluoride risk in India (UNICEF, 1999).

Gopalakrishnan [5] reported about 90% rural people are consuming fluoride contaminated ground water it measures 50% of the people are depending on fluoride contaminated water in India, this may be due to metamorphic and igneous rocks like gneisses and granite [3, 8] and WHO 2006). If the fluoride contaminated (1.0 ppm) water is used for long time in cooking purpose it also cause fluorosis [10]. According to BIS-2003 and ICMR-1975, the maximum desirable limit of fluoride [1.0 mg/L] and the highest accessible limit is 1.5 mg/L. As per WHO (1997), the accessible limit for fluoride is 1.5 mg/L. During 1930s in Nellore district of AP state first case of flourosis disease was identified in India later other symptoms like head ache and joints pains in most of the villages. First medical appraisal was reported during 1937 in “Indian Journal of Medical Research” fluoride affected villages [14]. The current survey is to investigate the causes for fluorosis. Effects and socio-economic problems related fluorosis and suggest the remedies to eradicate those problems.

**Study area**

The study region Harihar taluk (Figure. 1) is situated at [14.507°N 75.8°E](https://geohack.toolforge.org/geohack.php?pagename=Harihar&params=14.507_N_75.8_E_type:city_region:IN-KA) Harihar is a Taluk and a municipality in Davangere district, Karnataka state of India. Harihar is adjacent to two area headquarters, being 20 kms (13 miles) from Davangere 57 kms (36 miles) from Haveri. It is 132 kilometers from Hubbali.  Most of the villages in the study region are consuming the ground water for drinking.

**Sampling and Selection of Locations**

Twelve villages were selected from the study area: Water fluoridation conditions, residence remoteness, and socio-economic status were collected for each family recorded residential postcode area. Four locations from Dambal, three from Narayanpur, Kalkeri village respectively, two from Hirewaddatti, Mundargi respectively and one in Harogeri, Mushtiikoppa, Chikkavaddati, Guddada Budiihal, Virupapura and Meundi respective village, which are shown more than 1.5 ppm fluoride are represented in Table 1.

**Selection of Participants**

The response decisions were collected for each question: “Yes”, “No” and “Don’t know”. A range of population data was collected during the survey period and interview period, including age, gender, existence of children in the family, and the postcode of the habitation (W. Kerry Mummery, et al., 2007 and APHA, 2004). For the door-to-door survey using questionnaire, 5 participants were choosing from small villages and 10 respondents from big villages. In total, 90 respondents (male: 43; female: 47). The majority of households had female heads may be because of their husband’s death. Very few male heads had higher education in colleges. Percentages of female heads attending senior secondary classes were low compared to male heads in the study area were identified for the door-to-door review. The selection was done randomly from all directions of the village [15]. The participants are only adults and each member was confined to only one household. Both quantitative and qualitative methods used in the current survey.

**Quantitative - Door to door survey**

Door-to-door survey is research interviewing is a form of qualitative research whereby a respondent is asked questions on their doorstep, face-to-face. Door to-door survey may be adopted for several aims. The most common aim for undertaking this technique is to understand problem by discussion with specific person. Authors conducted the door-to-door survey. In the door-to-door survey, each respondent was approached at their doorstep and was interviewed with the help of a prepared questionnaire. Each meeting conducted about 12-15 minutes; the respondent was asked questions with respect to three chief fields viz. socio-economic situation, sources for drinking and presence of fluorosis sign. For identifying the signs of fluorosis, the respondents were asked to perform certain physical movements, which are known to detect symptoms of skeletal fluorosis (Susheela, 2001).

**Qualitative - Group Discussion**

Group discussion was conducted and is helpful tool that employ guided, interactional discussion to generate the rich details of complex practices and the reckoning behind actions, thinking, awareness, opinions, and attitude [13]. A minimum of one and a maximum of 3 groups were conducted for discussion by personally by selected twenty villages. The purpose was to realize the awareness and opinions of families about the different ways to fluorosis has affected their socio-economic status and vice-versa. The quality of questions asked in a group can make a large dissimilarity in the kind of information collected [13].

**Questionnaire**

Hence, a simple generated questionnaire asked in the group discussion. Each group discussion for about 45-60 minutes until data saturation was attained. Data saturation presents when no new themes are emerging from successive focus groups and interviews [6]. Notes were taken simultaneously in order to increase the quality of data management.

**Survey Report**

In Mundaragi taluk, more than 45% bore wells are contaminated with fluoride and above the level of 1.5 mg/liter. Out of 25 locations during the survey period 11 locations of 48% locations namely MGK-9, MGK-13, MGK-14, MGK-15, MGK-16, MGK-17, MGK-18, MGK-19 and MGK-20 are fluoride polluted. During the survey time out of 25 location MGK-20 (Mushtikoppa cross) location shown maximum 4.63 mg/L and minimum (0.98 mg/L) in Doni (MGT-24) (Srinivasamoorthy et al. 2007).

The 90 respondents studied here have 21 family members with 275 depending on agriculture practice in the family. Farming is the primary source of revenue, followed by agricultural labour and few persons are occupied as skilled workers such as small selling seeds, services etc. Among the 90 households, only 37 households own land with normal of 2.3 acres per household. Of the total 90 households, 40 (44%) houses have assets [16]. The scoring approach indicates that 40, 28 and 22 respondents are suffering with mild, moderate and severe forms of fluorosis respectively (Figure 2).

According to the participated members, the common problem is fluorosis suffering by the villagers in the study region is pain and stiffness in the body joints, gastro-intestinal problems, incapacity to do sit ups, and difficulty in stretch their arms. In some severe problem, members were expressed unable to walk without stick and any other support. Few members are expressed depending upon wheel chair.

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| --- | --- | --- | --- | --- |
| Sl. No | Sampling Locations | Code | Fluoride (mg/L) | Effect |
| 1 | Bannikodu | MGK-1 | 0.98 | Promotes dental health  Prevents tooth decay |
| 2 | Belludi | MGK -2 | 0.98 |
| 3 | Budhal | MGK -3 | 0.98 |
| 4 | Bullapura | MGK -4 | 0.97 |
| 5 | Byaladahalli | MGK -5 | 1.03 |
| 6 | Chikkabidare | MGK -6 | 1.02 |
| 7 | Gangarasi | MGK -7 | 1.28 |
| 8 | Govinal | MGK -8 | 1.10 |
| 9 | Jigali | MGK -9 | 2.00 | Dental Fluorosis |
| 10 | Kamalapura | MGK -10 | 1.33 | Promotes dental health |
| 11 | Kumbluru | MGK -11 | 1.90 | Dental Fluorosis |
| 12 | Malebennu | MGK -12 | 1.78 |
| 13 | Nittur | MGK -13 | 2.17 |
| 14 | Kunebelekere | MGK -14 | 3.14 |
| 15 | Kunebelekere road | MGK -15 | 2.14 |
| 16 | Bevinahalli | MGK -16 | 2.99 |
| 17 | Deverabelekere | MGK -17 | 2.53 |
| 18 | Hanagawadi | MGK -18 | 2.33 |
| 19 | Mittlakatte | MGK -19 | 2.14 |
| 20 | Rajanahalli | MGK -20 | 1.63 | Skeletal Fluorosis |
| 21 | Salakatte | MGK -21 | 1.55 | Dental Fluorosis |
| 22 | Thmlapura | MGK -22 | 0.98 | Prevents tooth decay |
| 23 | Ukkadagatri | MGK -23 | 1.00 |
| 24 | Sarati | MGK -24 | 0.86 |
| 25 | Yelavatti | MGK -25 | 0.96 |

**Figure 2. Self-reports of respondents' drinking water sources**

The majority of the individuals associated in the survey in selected area are alert of the fact that their health is being affected by ground water due to presence of fluoride content in drinking sources. Moreover, many of the associated individuals are alert that the ground water sources in their villages have been appraised for fluoride in the recent past. However, it is appealing to aware that very few participants are articulated that there is no solution for fluorosis. Hence, due to lack of awareness on this ground, they continue to spend amounts on medical treatments rather than paying for clean water. Most of the participants held the opinion that the rich people do not suffer an equal amount of risk because they can give to use filters for de-fluoridation techniques for ground water.

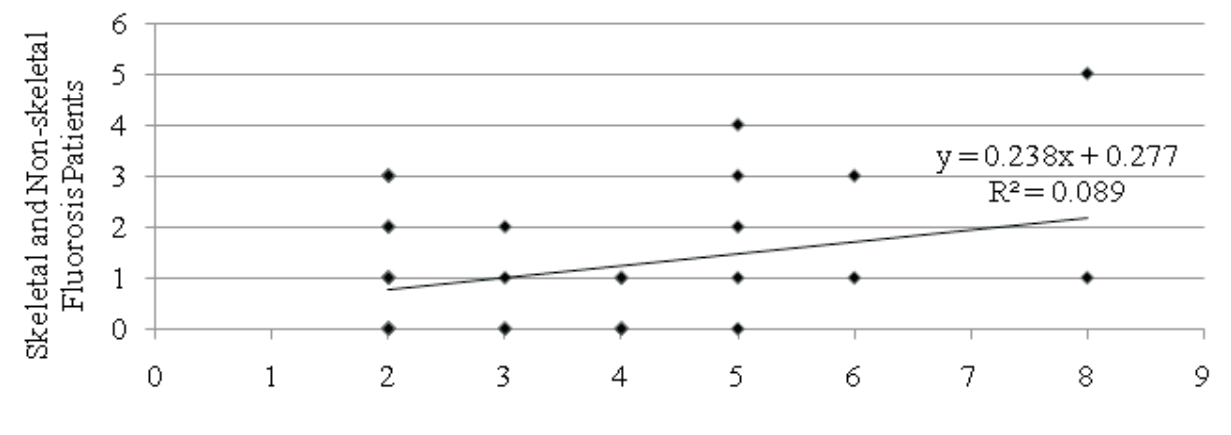
82% respondents, about 74 individuals are depended on bore wells for drinking water purpose followed by only [14%] 13 individuals are depend on pipeline water supply. The remaining [4%] about 4 individuals are depend other source for drinking such as open wells [11] of the 82% individuals adopting bore wells, 44%, 32% and 23% individuals have mild, moderate and sever fluorosis respectively. Furthermore, the 14% respondents depending on pipe line water supply, only 86%, 11% and 3% respondents have mild, moderate and severe fluorosis correspondingly [17].

**Figure 3. % of Individuals suffering from Fluorosis**

**Figure 4. % of male and female members suffering fluorosis at different age group**

Figure 3 and 4 predicts that the percentage of individuals with severe fluorosis enhances steeply along with age, especially after attainment of 35 age. However, it has a severe double more than 55 age. The largest number of worried people is found in the age group of 41 to 50, accounting for 53.6% of males and 46.4% of female of the total group of members in specific age group. Furthermore, fluoride weakness are more amongst females with (57.5%) in the age group of 21-40 whereas at the age of 45, the problems are more among males (62.6%), however, after attainment of age 65, there are insignificant with respect to fluorosis among females (0.8%) [25.26,27].

Statistical correlation was also plotted with age group and proportion of fluorosis indicates, the positive relationship between the higher the numbers of people of above 30 years age maximum is the proportion [1] of skeletal and non-skeletal fluorosis patients in the family (Figure 5). Correlation relationship between total percentage of fluorosis victims per family and number of male, female and total family member of more than 30 years age indicates positive significant relationship that means the skeletal and non-skeletal fluorosis patients are found in age group between 30-50 years.



**Figure 5. Relationship between number of skeletal and non-skeletal fluorosis disease found in between 30 to 50 age.**

**Suggestions**

There are many problems which area stands in the way of the agenda. Large numbers of people of Harihar taluk are caused by skeletal fluorosis due to usage of ground water sources for drinking since long time. Hence, people face many problems connecting to their health and socio-economic situations of their families. To solve the burning problems, Water from the tube wells are tested frequently to know the fluoride and variables. Dental checking to be done at Primary level using UNICEF along with PHE section, Gadag. Contaminated bore well locations have to mark in Red colour indicating danger sign. Fluoride free water to be provided and taps to be created at different parts of the village. One water filtration plant to initiated, medical measures to introduce to check patents who are suffering from basic indicators of Fluorosis. Finally awareness programmes to be conducted to educate the public.

**Conclusion drawn from the Survey**

From the study determinants, that the dental and skeletal fluorosis may play a critical role in the prevention and control of fluorosis in the community. The unavailability of fresh drinking water, people are forced to drink the fluoride polluted ground water above the accessible limit. As a part of the analytical values, most of the respondents are affected with various degree of dental and skeletal fluorosis. According to community perception, fluorosis has deteriorated their health, thereby changing their work efficiency, income and quality of life and on another hand, the fluoride impact severity changed according to sex, age, weight, education and income of the respondents. So, distribution of alternate safe drinking water, remedial treatment, provide fluoride filter, create awareness among them and implementation of alternative treatment for fluoride content. Involvement of Doctors, NGOs, and local societies may help the acute problem of the communities of the area. Present work predicts, determining factors while introducing de-fluoridation programs in the study area also with the traditional ones. This calls for a vital need of establishment of safe and fluoride-free drinking water through pipeline and other practicable alternatives.

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