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COMMUNITY KNOWLEDGE, ATTITUDE AND PRACTICES (KAP) ON FLUOROSIS AND ITS MITIGATION IN ENDEMIC AREAS OF ETHIOPIA

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ABSTRACT

Optimum fluoride intake plays an essential role in the prevention of dental caries while fluoride consumption above recommended level interferes with the normal formation of tooth enamel and bones and may increase risk of dental and skeletal fluorosis. The knowledge and practices of endemic communities on etiology of fluorosis will help in its mitigation and prevention. The objective of this study was to investigate the knowledge, attitude and practices of endemic community on fluoride contamination, fluorosis and prevention practices in order to devise coordinated and targeted prevention mechanisms. Focus group discussions (FGD) and key-informant interview were conducted in three dietary areas to collect knowledge, attitude and practices (KAP) of the endemic community in July 2013.The results indicated that health consequences of fluoride contaminated water are fairly understood. None of the discussants mentioned the word "fluoride". The knowledge and perception of the community on fluoride ingestion is poor. Health extension workers (HEWs) did not teach about fluoride and related health consequences. Dental fluorosis was reported to start at early ages and not commonly perceived as a major problem. However, adolescents worried and felt that they might be singled out when going to other areas. Older people have a skeletal fluorosis, which interferes with their day to day activities. In severely affected people, the teeth were weak and fragile and thus create difficulty in chewing hard foods like unfermented dry flat bread, sugar cane and toasted grains. People prefer rain water rather than water from borehole because of the inconvenient taste of the latter. The endemic communities have no sufficient knowledge and skills on potential sources of fluoride intake, the debilitating effect of high fluoride ingestion, and preventive and mitigatory measures to reduce fluoride intake. The effect of fluoride contamination and mitigatory methods should get sufficient attention by the community, health workers and concerned governmental bodies. The trend of harvesting and using rain water should be encouraged as it reduces fluoride intake. Future studies should focus on information communication on possible fluoride risks, intervention and evaluation studies on defluoridation, rain water harvesting and mitigatory techniques.

Key words: Fluoride, Contamination, Fluorosis, Mitigation, Endemic, Perception and Ethiopian Rift Valley

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INTRODUCTION

Optimum fluoride intake plays an essential role in the prevention of dental caries while fluoride consumption above the guideline level interferes with the normal formation of tooth enamel and bones [1, 2] and may increase risk of dental and skeletal fluorosis [3, 4]. The major sources of fluoride intake include water, beverages and foods prepared with fluoride contaminated water [5-8]. Endemic fluorosis has been described in many parts of the world [9], including Ethiopia [10]. Several studies in African countries have found a high prevalence of dental fluorosis even among populations that consume drinking water with relatively low fluoride content [11 - 14].

In view of the increased emphasis on safety of drinking water, public health and water managers in developing countries give less emphasis to fluorosis in the presence of other highly prevalent life-threatening health problems [15]. World Health Organization (WHO) [3] recommends a guideline value of 1.5 mg fluoride (F)/L in naturally fluorinated drinking water. However, where intakes are likely to exceed 6 mg F/day, it is appropriate to consider a local guideline of fluoride concentration lower than 1.5 mg/L [3].

Among 23 developed and developing nations that are endemic to fluorosis Ethiopia is of particular interest due to the predominance of extensive volcanic basalt flows [16], low socio-economic level, recurring famine and malnutrition which might exacerbate the problem. Both skeletal and dental fluorosis is widely distributed in the Rift Valley [17]. Reports indicate that more than 14 million Ethiopians may be potentially at risk. A recent assessment of fluoride, fluorosis and defluoridation issues reported that, out of those at risk, approximately 85% may have already been exposed to high fluoride contamination [17]. In the Ethiopian Rift Valley, 41% of the drinking water sources have a fluoride concentration exceeding the WHO guideline value of 1.5 mg F/L [18]. Excessive fluoride is the most serious water sanitation problem, mainly in the Ethiopian Rift Valley system affecting areas in East (Afar), Central (Oromia), the south-west (South Nations Nationalities People Region, SNNPR) including some parts of Gambela and few high land areas of the country.

Analysis of hydrochemical, economic and demographic factors in the spatial distribution of high-fluoride domestic water sources indicates that fluorosis problem has become more serious in the Rift Valley in recent decades [17]. The problem is further aggravated by limited budgets, which restricted the feasibility of defluoridation technologies, running cost of those established ones and inability of provision of alternative water sources. In addition, since the economic cost of endemic fluorosis to human beings is largely indirect and the disease is not acute, it is unlikely that fluorosis would be recognized as an area of immediate need by the government and stakeholders in developing countries. In some places in Ethiopian rift valley, whatever the chemical content is, the presence of water is considered as a blessing.

Fluoride poisoning can be prevented or minimized by using alternate water sources, removing excess fluoride (defluoridation) from drinking water and by supplementation

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of nutrients that can bind fluoride for excretion [19]. The knowledge, attitude and practices of the community about the problem might help in the mitigatory processes [20]. The objective of the study was therefore, to assess the knowledge, attitude and perception of the community about fluorosis, related health problems, techniques and measures taken to tackle fluoride contamination and possible solutions to mitigate ingested fluoride.

METHODOLOGY

Study areas and design: The three study areas Benti (8`54`N / 40`00``E), in Fentale (F = 6.2 mg/L), Halaku (7`52``N/ 38`40``E) in Adamitulu (F = 4.9 mg/L), and Qobochobare (7` 17``N/38` 06``E) in Alaba (F = 6.9 mg/L) in the Ethiopian Rift Valley (Figure 1) were selected based on fluoride level of water and dietary habits. The staple food in Fentale community is dairy products and corn. Adamitulu communities mainly depend on wheat and corn while those in Alaba depend on finger millet and maize.

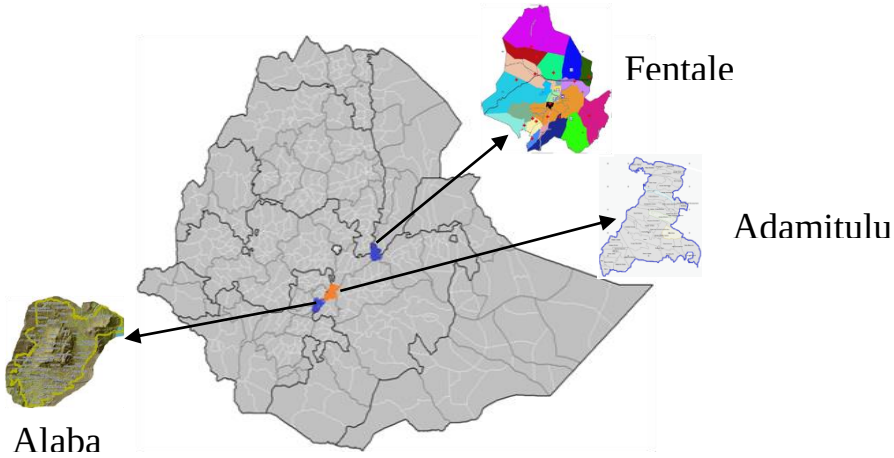

Figure1: Study sites for knowledge, attitude and practices assessment

The study was designed to collect data on knowledge, attitude and practices of fluorosis endemic community on fluoride contamination, fluorosis and mitigatory measures as it helps to device targeted and concerted interventions [21 -22]. Focus Group discussion (FGD) was used to collect the information from three dietary areas [23]. Secondary data were collected from water resource offices of the three districts (Table 1).

Ethics: The discussants were briefed on the objective of the study and requested for informed consent to be part of the discussion. The study was approved by research ethical clearance committee of the Ethiopian Public Health Institute (EPHI).

Data collection: Participants of the focus groups were selected from the community based on the years they lived in the area, age, social activity and sex. In each group, community administrators, elders (both women and men), gate keepers (influential persons) and health extension workers participated. Generally, 5-7 persons were used as

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discussants. Structured questionnaire was presented to the discussants. The discussion was facilitated by principal investigator of the study and district water resource expert who assisted on guiding, co-facilitating and translating the question when needed during the discussion. Three focus group discussions were conducted with one in each dietary area. The participants were briefed about the study and the possible outcomes for their community. They were maximally stimulated to discuss their opinions freely. The discussions were held in the local languages (Afan, Oromo and Alaba language).

A pre-structured questionnaire was used for the discussion [15]. The discussion focused on knowledge and perception of the residents on fluoride contamination, defluoridation, fluorosis and related health problems and dietary habits. In addition, district information on future plan in the water sector and secondary data regarding the study areas were collected. The data were transcribed, restructured and summarized.

RESULTS

Knowledge and source of information about fluoride and fluorosis:

All the discussants mentioned that the cause of the mottled and brown teeth and skeletal problems is the "water" which they believe to contain "bad mineral". None of the discussants mentioned the word fluoride.

Health extension workers and health development armies have given lots of health education at health post level. The majorities were concerned about points outlined in health extension program like sanitation, tuberculosis, vaccination, family planning and malaria. Most of the discussants attested that education on fluoride related problems had never been raised. They mentioned that it probably was not a point of attention. Almost all the discussants in all the areas said that they have not been actively taught about fluoride related problems at all, especially by health workers.

Health extension workers in Halaku and Benti mentioned that the water caused no significant health problem although the test was not plausible. They also use the same water as the community. They neither understood nor had any information about the cumulative effect of consuming fluoride-contaminated water. Most people did not consider the effect of fluoride beyond teeth cosmetics.

Perceived health, social and economic consequences due to fluoride

Most of the focus group participants did not lay emphasis on teeth discoloration. Adolescents felt that they were singled out when going to other areas and particularly girls "felt a bit ashamed of having discolored teeth". They often had to cover their mouth while laughing. Some mentioned that their teeth smelled foul, were very fragile and painful when they ate hard foods. Older people had fear of bowing down and stiffness of the back, neck and the joints, which interfered with their day to day activities. The participants in all the three areas were not comfortable staying in the community unless the water source is changed or something is done by the government. The male discussants had fear of bowing down of the back bone, being less efficient in day to day

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activity including sexual relationship. Some even further explained that their cattle have serious health problems because of the excessive level of the chemical.

The community associated most of the health problems particularly dental and skeletal ones with the water they get from borehole. According to the discussants all people in the communities were aware of the existence of dental and skeletal problems arising from the drinking water from the borehole. Generally, across all groups it was felt that the treated pipe water was very safe for consumption. Hence, they would prefer to drink water from such treated source. But the water source in Adamitulu town also contains fluoride level above WHO (2008) recommendation.

The teeth problems were reported to start at early ages and are highly prevalent. Yet, it is not commonly perceived as a major problem. The only concern of the community was that in those severely affected, the teeth were weak and fragile and this creates difficulty in chewing hard food such as “Kolo” - toasted grain, "Kitta" -hard bread and sugar cane. Discussants in Halaku further said that it's so distressing not to chew Kolo and Kitta. The inhabitants felt that they miss something which people in other areas can do. They wondered why some members of the households didn’t get mottled teeth even though they were raised in the community. In some families few have completely white teeth while others have mottled teeth like the rest of the people in the localities.

Food taboos and dietary habits:
In all the three dietary areas, the communities are Muslims and have no special diet to eat or not to eat. There are no such forbidden foods, unless the economic status and availability of food items on local market limit dietary habits. In all the three areas maize, coffee, legumes and milk are common. Consumption of milk in Alaba and Adamitulu was limited because of absence of cattle in most of the households. In Fentale, all sorts of cattle including camel and goat are available and consumption of milk is common. The consumption of vegetables and fruits is almost none except onion and potato. Kale is commonly consumed in Alaba and Adamitulu. Food is prepared in metallic pan in almost all households. Water is kept in a plastic container called “Jerican” in all the study areas.

Trend of harvesting rain water:
The communities prefer rain water to water from the bore hole due to better taste. According to the discussants, rain water is the safest water if harvested and handled hygienically. Good facilities are needed in order to collect in safe way. In Alaba and Fentale there is a trend of harvesting rain water. In Fentale, water is collected from a pond made by the flood. In Alaba people usually harvest rain water from the roof.

Suggestions and willingness to participate in preventive measures:
The Fentale and Halaku community have a chance of getting water from river Awash and Lake Ziway, respectively. The communities in Qobochobare have no such option, although river Bilate originates in the area, which is seasonal. All the discussants expressed willingness to participate in any public health activity intended to provide the community with a safe water supply on a sustainable basis.

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DISCUSSION

Even though the participants failed to mention the word "fluoride" as a cause of fluorosis, they had a good understanding that the problem is related to the consumption of water containing “bad minerals”. Dental fluorosis was mainly accepted as a cosmetic and only given emphasis by adolescents. Some who were severely affected by dental fluorosis were also concerned because of the pain and inability to chew hard foods [15]. Adults mentioned that restricted mobility and flexibility in back bone, neck and forearms made them unable to perform their day to day activities [25]. As observed during the discussion the male seemed to be more affected than their female counterparts. Some of the discussants had concerns regarding the economic consequences due to skeletal fluorosis and parallel effect of fluoride on children, particularly on mental activity [17].

In the study, dental fluorosis was not considered as a major and priority health problem by most of the groups including health extension workers. This may be due to the progressive nature of the medical problem and the fact that often it is painless and non-life threatening as well as due to the fact that it affects the majority of people.

According to the focus group discussants in the three study areas there were no dietary restriction and taboos other than those written in Islam books. People do not have information on dietary risk factors for fluorosis or any food that might help to mitigate ingested fluoride. In Alaba, the communities have information on defluoridation technologies due to its implementation in nearby Kebeles (smallest administrative unit in the government structure). The people in Fentale (Kereyu) are much concerned on cleaning teeth by a stick made from selected plants to prevent teeth discoloration [25].

Lack of knowledge concerning fluoride and its health consequences in women deserves attention and action. Since most of the women are in child-bearing age, educating them would have a great impact on the success of future intervention programs. Therefore, fluoride contamination and mitigatory measures should be incorporated into the routine health extension workers program package. Another concern coming out of the study is that health workers seem to have avoided teaching about fluoride contamination and fluorosis and measures to be taken for mitigation. Many respondents said that they were told nothing about fluorosis from professionals may be because of absence of guideline and absence of developed and adapted mitigation measures given by regional as well as Federal Ministry of Health.

Other studies in Africa have shown that the more information people got about dental problems from health workers and the media, the more those informational media were trusted and the higher their personal risk appraisal for their dental problems [26]. In India, researchers have become successful in mitigating ingested fluoride and in reversing skeletal fluorosis at young age [20].

The reported economic consequences [17] to persons affected by skeletal fluorosis should also be of concern. From the discussions of the study one can learn that those who

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have lived long enough in the locality have already developed some kind of skeletal fluorosis. The consequences of fluorosis on health, productivity of the nation in general and the household in particular should not be underestimated [17]. The study showed willingness to participate by all the groups in activities directed at improving the provision of safe water supply to the community. Nutrition and health education will at least reduce the effect of ingested fluoride until either defluoridation techniques are employed or the water source is changed.

CONCLUSION

The study showed that the health consequences of fluoride contaminated water were fairly understood. There is still a knowledge gap and wrong perception concerning fluoride and its health consequences among the community including health extension workers. The study communities have no information on prevention methods and mitigation of ingested fluoride.

RECOMMENDATIONS

- The trend of harvesting and using rain water should be encouraged to prevent fluoride contamination.
- The study participants have positive attitude of taking an active part in future efforts in providing the community with safe water, therefore stakeholders and concerned governmental bodies should support and mobilize resources in provision of safe and fluoride free water.
- Future research should focus on interventional studies on defluoridation and mitigatory techniques using nutrient supplementation.
- Information communication works among community, health workers and concerned governmental bodies regarding the effect of fluoride contamination and fluorosis reduction and mitigation should be promoted.

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Table 1: Secondary data collected from district water resources

No	Variable	Study areas (Sub District, District)		
		Qobochobare, Alaba	**Benti, Fentale**	**Halaku, Adamitulu**
1	**Latitude/ Longitude**	7'17" N / 38'06"E	8`54`N / 40`00``E	7`52``N/ 38`40``E
2	**Elevation**	1154-2159 masl, average = 1800masl	Below 1000- 2007 (Fentale mountain) masl, hot and semi arid	1500 – 2000masl
3	**Major problems**	Drought, flood (seasonal)	Drought, absence of potable water	Problem of potable water,
4	**Mean Annual Temperature**	24-29^{o}C	16-38^{o}C	22-28^{o}C
5	**Mean annual rain Fall**	601-1200mm,	500-800mm	750-1000mm
6	**Rain season**	Major season: July-September Minor season; March-April	Major season: June-September Minor season; feb-may	Major: July-September Minor: February – June
7	**Rain Water harvesting trend**	Water harvesting is common but do not last long,	Yes, when flood collected	No
8	**Any past attempt in fluoride mitigation**	Exist in few communities but due to running cost, it is not functioning	None	None
9	**Future plan in fluoride mitigation**	They are waiting for external sources to start defluoridation	Change of water source is underway but took very long.	None

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