Original article

Perception on fluoride related health problems in an area of endemic fluorosis in Ethiopia: An exploratory qualitative study

Zenebe Melaku[1], Shabbir Ismail[2]

Abstract

Objective: This exploratory study was conducted to describe the knowledge, attitude and perception of the community regarding fluoride and related health problems in an area with endemic fluorosis.

Methods: The study was carried out in Wonji-Shoa Sugar Estate, an agro-industrial community in south-eastern Ethiopia. Qualitative research techniques were used. Six focus groups were identified representing the various segments of the population in the area in terms of age, gender, and socio-economic status. A series of six Focus Group Discussions (FGDs) were conducted in a community setting led by the investigators.

Results & Conclusion: the results showed that the health consequences of consuming untreated water is fairly understood but still there is a knowledge gap and wrong perception concerning fluoride related health problems particularly among women from the lower socio-economic segment of the community, hence health education should be given to the community with emphasis to this group. This study has also showed a positive attitude of the community towards taking active part (by idea generation, contributing labour and support upcoming initiatives) in future efforts in providing the community with a safe water supply.

Recommendation: further studies, are recommended to address the issues using a mixture of qualitative and quantitative methods. [*Ethiop. J. Health Dev.* 2002;16(1):85-93]

Introduction

Exposure to excessive fluoride in drinking water has been known to cause dental fluorosis in children and skeletal fluorosis in Adults, which has been also called endemic fluorosis. Endemic fluorosis has been described in many parts of the world (1), and particularly extensive reports have come from India (2-4). In the African continent, it has been reported from several countries, the majority of the reports coming from East Africa (5-8).

Studies on endemic fluorosis in Ethiopia have been carried out since the 1970s (6,8). In the most extensive study of endemic fluorosis in Ethiopia, among 1,456 individuals in 14 communities in the central Rift Valley, Tekle Haimanot and colleagues (5) reported a dental fluorosis prevalence rate between 69% and 98% (mean 84%) in the groups sampled.

The great public health and economic impacts of skeletal fluorosis in Wonji (and presumably in other commercial farming and industrial firms) is indicated by the early retirement of 244 local workers between 1976 and 1984 due to this disease (9,8). The neurological complications among those affected by advanced skeletal fluorosis include myelopathy, with or without radiculopathy.

In Ethiopia, by 1990, about 150 communities and natural water bodies had been tested for fluoride levels by the Ethiopian Water Supply and Sewerage Authority (WSSA) and several other institutions and individual researchers.

[1]Department of Internal Medicine, Faculty of Medicine, Addis Ababa University, P.O. Box 9086, Addis Ababa, Ethiopia; [2]Department of Community Health, Faculty of Medicine, Addis Ababa University

Of the 65 localities studied in the Rift Valley, 47 had fluoride levels above 1.5 ppm, 31 of them with concentrations of 5.0 ppm and above, and 7 between 20 ppm and 177 ppm (9). Studies on Endemic fluorosis in the Ethiopian Rift Valley have shown that both dental fluorosis and skeletal fluorosis are important public health problems (6-8).

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. Moreover, going by the WHO recommendation of 1.5mg/l as the maximum permissible concentration of fluoride in drinking water (10), most of the boreholes in the affected regions should have been closed down. The problem is further aggravated by limited budgets which restricted the feasibility of established deflouridating technologies or provision of alternative water sources. In addition, since the economic cost of endemic fluorosis to human beings is largely indirect, it is unlikely that fluorosis would be recognised as an area of immediate need by the less developed countries. However, given that endemic fluorosis is an important public health concern in the area (6-8) as a prelude to introduction of preventive intervention among affected communities and for planning short term and long term strategies, public health workers should explore the possibilities of mobilising the community at risk to use appropriate low-cost methods to protect themselves. For this to be feasible, some understanding of the knowledge, attitude and perception of the affected communities is required.

The authors of this study were able to locate only a handful of studies dealing with knowledge, attitudes, practices and behaviours related to fluorosis. One study reported in 1998 in Quebec City in Canada assessed the knowledge, perception and behaviour of the general public concerning the addition of fluoride in drinking water (11). A qualitative study among the Chinese living in West Yorkshire in Leeds, the UK assessed the oral health beliefs and attitudes (12). Perceptions of dental fluorosis among Western Australians was studied by asking lay people what they felt about the appearance of teeth of children with varying degrees of fluorosis (13). Apart from these, to our knowledge so far, there are no studies reported describing knowledge perception, attitude and health seeking behaviour of inhabitants residing in areas where fluorosis is endemic, especially in Ethiopia.

The objective of this study is, therefore, to assess the knowledge, attitude and perception of the community about fluoride and fluoride related health problems with a view of identifying entry points for preventive intervention.

Methods and Subjects

The study utilized a qualitative method to collect relevant information. It was conducted in June 2000 in Wonji Shoa Sugar Estate (WSSE).

The WSSE is an agro-industrial community situated 110 kms south-east of Addis Ababa (the capital city) and 10 kms south of Nazareth. At present the estate stretches over an area of 50 square kms within the Great East African Rift Valley. The community of the estate largely depend on well water with high fluoride content ranging from 1.7 ppm to 17.7 ppm. The WSSE community has an estimated population of around 20,000 organized in sixteen villages two factory villages and fourteen plantation villages. Both dental and skeletal fluorosis have been reported from WSSE (6-8).

The qualitative research method utilized Focus Group Discussions (FGDs) as a technique of data collection. One very knowledgeable person who has lived for a long time in the community was nominated by the Medical director of Wonji Hospital and other health workers as a key informant and this person

identified the persons to participate in the group discussions. First, focus groups were separated based on their socio-economic background because it was anticipated that the economically better ones are the educated ones and will obviously have better knowledge, favourable attitudes and lesser risky practices. In this country, less educated ones and relatively poorer ones do not tend to speak in the presence of better offs. The same with men and women issues. It's usually better to separate men and women because women tend to keep quiet and not express their views in the presence of men in such a group discussion.

Six focus groups were identified representing the various segments of the population in the area. We took six focus groups thinking of enrolling three pairs of men and women groups and planning to include more if "relative saturation" does not occur. But with the 3 pairs of focus groups the information was more or less similar hence, we decided to limit ourselves with the 6 groups only. The FGDs were conducted in three groups of men and three groups of women. The tow groups of women and tow groups of men were from plantation sites representing the low socio-economic segments of the community, while one group of women and one group of men were from factory villages representing the higher socio-economic or educated segment of the community. Participants were invited to take part on a voluntary basis.

In each focus group, 8-10 persons participated. The co-investigators of the study moderated the discussions. The discussions took place in community settings, where the participants were comfortable. Quiet and private locations were selected for this purpose. Participants were maximally stimulated to discuss their opinions freely. The discussions were conducted in the local language (Amharic).

A pre-structured discussion guide was used to lead the discussion (Annex- 1). The discussion focused on: major and priority health problems in the locality, knowledge and perception of the residents on fluoride and related health problems including their recognition of the problem; suggestions and willingness to actively participate in preventive measures to tackle the problem in the locality. All discussions were tape-recorded and later transcribed. "Line-by-line" analysis method (14) was used by the principal investigators. The transcribed information was categorised and summarised for presentation in the narrative form. Additionally, some quotations were also selected and included in the findings.

Results

Major and priority health problems in the locality: Across all the groups malaria stood as the most important health problem. This was then followed by either water-borne parasitic diseases (i.e, amoebiasis, bilharziasis, giardiasis) and respiratory problems. Teeth discoloration, bowing and stiffness of the back, stiffness of the joints were mentioned next to these as priority health problems by the men groups and the women from the higher socio-economic segment of the community. The women groups from the plantation villages did not mention teeth discoloration, bowing of the back and difficulty in turning the head as important health problems spontaneously. From the discussion with men it was repeatedly mentioned that signs and symptoms of skeletal fluorosis are very common in men especially among those working in the factories.

Community perception towards adequacy, quality and safety of drinking water: all groups mentioned three sources of drinking water. These were treated pipe water from boreholes, untreated pipe water from boreholes ("*Shakiso*") and from irrigation canals ("*Arjin*"). It was emphasised that the treated water supply was often discontinued and people are forced to consume from the other two sources - mainly from the untreated pipe water, which is supposed to be used only for washing purposes. Water supply was often discontinued for treatment purposes. The discontinuation sometimes lasts for months and

even years in some camps.

Regarding this issue one man said, "... *treated and safe water is continuously available in few camps only, in the rest the pipes often are out of order and sometimes it takes months before it is repaired. So for us - the poor, we have to go back and use the problematic water - even for drinking, which is supposed to be used for washing only.*" There were some emotions and even anger among participants saying that unfairly water was discontinued for a long time. It could be felt that there was some uneven treatment in the camps.

Regarding adequacy, apart from the intermittent availability of the treated water, it was generally mentioned to be sufficient. Women groups from the plantation sites, particularly emphasised that "water" was not at all problem in their locality. They went to such an extent that they said, *"one can never choose water like one can not choose his-her mother"*. These women seemed very desperate and were not concerned about the quality of water. There was a sharp contrast with women who were from relatively better to do ones. Women from the higher socio-economic segment of the community complained about the unavailability of treated and safe water continuously. They incriminated the other sources to cause diarrhoeal diseases. They also attributed the teeth problem and bowing of the back to the use of untreated pipe water ("*Shakiso*") however, they did not associate these problems with the use of river water (irrigation water "*Arjin*") as well as the treated pipe water. The two groups from higher socio-economic segment of the community said that in order to protect their children from teeth discoloration whenever possible they bring water from Addis Ababa.

Perceived problems as a result of water use - all health related and particularly dental and skeletal ones: 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 since this supply is usually discontinued in some camps either for treatment purposes or mechanical failure it is not always available and hence people are forced to drink water from the untreated source. Various diseases that were identified to be caused by consumption of water from the other two sources were mentioned. The water coming along the irrigation canals from the Awash River was assumed to cause bilharziasis and malaria. The untreated pipe water ("*Shakiso*") was assumed to cause amoebiasis, giardiasis, bloody and other intestinal problems as well as discoloration, fragility and loosing of teeth, bowing and stiffness of the back. Problems related to fluorosis were said to be very much prevalent among the factory workers and among the old.

Except the women from the plantation sites all others were knowledgeable on the existence of dental and skeletal problems arising due to drinking water from the untreated sources. Among women from the plantation sites there was a clear ignorance regarding the problem.

There was a consensus in most groups from the plantation sites that tooth discoloration is so rampant that it has never been considered as something abnormal in their communities. The teeth problems were reported to start at early ages and are highly prevalent. Yet, it is not commonly perceived as a major problem because of the wide spread prevalence to the extent that it has become the identity of being a resident of Wonji.

Some younger participants even said, "... *the teeth colour of Wonji residents is just like the ID plate of a car.*"

Their only concern was that in those severely affected, the teeth were weak and fragile and this creates difficulty in chewing hard food such as "Kolo", hard bread ("Kitta") and sugar cane. One of the men participant said that "... *it's so distressing not to be able to chew Kolo and even the Kitta, while people living in other areas can do so ....*" The

investigators were able to observe lots of grief and disappointment on the face of participants when they were discussing about these issues.

On the other hand, those groups from the higher socio-economic segment of the community had a clear concern and worry that their and their children's teeth were discoloured and were not aesthetically good looking. They also said that there are adults as well as children who have lived for long time in this locality and yet they do have purely white teeth. In some families some of them has completely white teeth while others have mottled teeth like the rest of the people in the localities. Why teeth of these persons remained white is difficult to explain. That is why some of the residents particularly those with a higher socio-economic status bring drinking water from places as far as Addis Ababa. These are the few households who can afford to do so. For most this was just unthinkable. Con-cerning functionality, all agreed that healthy teeth should be able to chew "anything edible" be it soft or hard food, such as "Kolo", hard bread ("Kitta"), sugar cane and so on.

Knowledge and source of information about fluoride and fluorosis: Though water was ascribed to be the cause of the teeth and skeletal problems described by most of the discussants, when the question was raised about the exact aetiology, the opinions were diverse. Some said that it is due to the rusting of the pipes, others said it is just due to the nature of the untreated pipe water of the "Shakiso", many said that they had no idea at all, and a few of them mentioned that it might be because some 'minerals' which are found in water in large amount. The word "fluoride" was hardly known among the various participants, particularly the women and also the men from the plantation sites. Discussants from the plantations particularly the women were completely ignorant about the problem of fluorosis. Most men and women from the higher socio-economic group were well conversant about the term fluoride, problems related to very high levels of it in the water and its health consequences.

Health workers have given lots of health education from the hospital as well as elsewhere. The majority were concerned about malaria, environmental health, tuberculosis, vaccination and so on. But most of the FGD participants said that information on fluoride related problems has either never been heared or rarely mentioned by health workers in the locality. They mentioned that it probably was not a point of attention because they might have thought there is nothing to do about it. Almost none of the discussion groups mentioned having been actively taught about fluoride related problems at all, especially by health workers.

One man said, *"I have lived here for most of my life, but never heard the doctors or nurses working in the hospital talking about the water causing teeth discoloration as well as bringing bone problems. I guess they do not do so because they know that they can't actually help us solve the problem."*

Perceived health, social and economic consequences due to the fluoride related dental and skeletal complications: Most of the focus group participants did not think that the teeth discoloration is a problem, yet the younger ones said that they were singled out when going to other areas as people from Wonji and girls particularly felt a bit ashamed of having such discoloured teeth. They often had to cover their mouth while laughing and so on. There are also many who could not eat hard foods and often their teeth were foul smelling, very fragile and painful. Older people were reported to be at risk of bowing and stiffness of the back and the joints, which interferes with their day-to-day activities. Some also said that many of the residents face the economic consequences beyond the medical complications. In the advanced stages of the problem, factory workers are forced to go into early retirement. This in turn has affected the living standards of many of the residents.

One factory worker said, *"I know that unless I leave this place sooner if I have to stay for the rest of my life here, I will start bowing down, get weaker, be less efficient and eventually thrown out of job. I get so much worried for my family thinking about their fate afterwards".* At some pint the discussions went dead silent and everybody became so sad and it seemed that they were all contemplating their future - the social and economic complications of skeletal fluorosis.

There were some differences among the seasonal workers and the permanent ones regarding their dental health. The seasonal ones said that they were laid-off for some time during summer and hence they went to their families in the countryside where they consumed clean spring water and hence were less likely to develop the teeth and bone problems. Economically, bowing of the back and joints resulted in early retirement in some individuals.

One man working in plantations said that *"I am originally from Kembata, So I go every summer to my relatives there. The rest of the year I stay in Wonji. I have done this the last many years. Look at my teeth they are perfectly okay. There are many others like me and they are very much less affected."*

Suggestions and willingness to participate in preventive measures: Concerning possible solutions, some groups suggested that the water from the river is relatively safe and that water should be pumped, treated and distributed for consumption. As to the other local solutions, some families are bringing drinking water from other places like Addis Ababa, Which every one agreed will not solve the problem. All the discussants have expressed willingness to participate in any public health activity intended to provide the community with a safe water supply on a continuous basis.

One woman said, *"Of course we are willing to do anything possible to solve this problem. Though we don't say it out, it is sad for us to be always in such a stress despite living in such a beautiful place"*

It was evident from all focus groups that they love the place to live yet the problem is making their life difficult. They don't want to leave but also not suffer. It seemed that it was a difficult choice to make among the two. They would do anything to work with anybody who would be trying to solve the dental and skeletal problems they are having.

Discussion

This was an exploratory qualitative study; hence a statistically representative sample was not aimed. Thus, the findings should be interpreted with this limitation in mind. However, since the various focus groups are selected in such a way that they represent the different age groups, gender, and socio-economic segment of the community studied, we believe that the study gives a realistic impression of the issues addressed. The main findings of this study were (a) Dental fluorosis was not considered as a major and priority health problem by most of the groups (b). There was lack of knowledge on health consequences of consuming untreated water particularly concerning fluoride and related health problems among women from the lower socio-economic segment of the community (c). There is a positive attitude among the community residents towards taking active part in any intervention in the future, which attempts to provide a safe water supply. And, (d) there is a huge concern among the residents regarding the economic consequences due to skeletal fluorosis.

In our study, dental fluorosis was not considered as a major and priority health problem by most of the groups. 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 living in the area to such an extent that discoloration of the teeth being considered as a "social"

norm in these communities. Nevertheless, it was viewed by some as an embarrassing problem particularly for girls and those from the higher socio-economic segment of the study community. Similar findings were also reported elsewhere in Western Australia (13). Dental fluorosis also becomes a concern for everybody affected when it causes pain and interferes with feeding. Although people from the low socio-economic segment of the locality 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 untreated drinking water.

The groups from the higher socio-economic segment of the community were fairly knowledgeable about fluorosis and its health consequences. On the other hand, lack of knowledge concerning fluoride and its health consequences in women from the lower socio-economic segment of the community deserves due attention and action. Since most of these women are in child-bearing age, educating them would have a great impact on the success of future intervention programmes. This should be incorporated into the routine health education given in the villages. Another concern coming out of this study is that health workers seem to have avoided teaching about to fluorosis and what to do about it. Many respondents said that they were told nothing about fluorosis from professionals. This may have happened out of frustration of the health workers themselves, because most of the defluoridation attempts have not been either fully successful or not sustainable. We believe that the issue should get sufficient attention by the health workers and appropriate health education should be given. 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, the higher their personal risk appraisal for their dental problems (15). In the same study it was reported that health workers played a significant role in influencing women's risk appraisal.

The reported economic consequences to persons affected by skeletal fluorosis should also be of concern. From the discussions of the study one can learn that those who have lived long enough in the locality to develop severe skeletal fluorosis are as a consequence either go to early retirement or are laid-off altogether. It is therefore not difficult to understand the consequences on the family and the community at large. Most of the discussants (particularly plantation workers) said that they are going to end in such situation and we could see the frustration and helplessness they expressed. Moreover, those who are better-off have a choice of reducing the fluoride exposure by using alternatives such as bringing in drinking water from other places such as Addis Ababa, whereas for people with lower economic status, it seems that they do have no other choice.

The study showed willingness to participate by all the groups in activities directed at improving the provision of safe water supply to the community. This supplemented by health education will be an important asset for future defluoridation programs.

The major limitation of the study was that health workers were not included it lacks useful information from the service provider's point of view.

In conclusion, this study indicates that the health consequences of consuming untreated water is fairly understood but still there is a knowledge gap and wrong perception concerning fluoride and its health consequences particularly among women from the lower socio-economic segment of the community. Hence, health education should be given to the community with emphasis to this group. This study was able to demonstrate the differences in perception of the cause and consequences of the problem among the various segments of the population, i.e., by gender, socio-economic status and education. This study has also showed a positive attitude of the community towards taking an active part in future efforts

in providing the community with a safe water supply. To address these issues/further studies using a mixture of qualitative and quantitative methods are recommended. Such studies should be able to determine the actual prevalence of fluoride related problems. Studies should also focus on assessing ways of mitigating the adverse effects of fluorosis in the locality.

Acknowledgments

This study was supported by a grant from NUFU Project 61/96. The authors gratefully acknowledge the assistance received from Dr. Fekadu Audgna and Dr. Neway Gessesse, Medical Director and Physician of Wonji Hospital, respectively.

Annex 1: Focus Group discussion Guide (Discussion Themes)

1. What are the major health problems in your locality?
2. Among the problems mentioned, which ones do you consider are the priority health problems?
3. How do you assess the sources, adequacy, safety and quality of the water supply in your locality?
   a. Mention the sources of water
   b. Is water in adequate supply?
   c. Is the water safe for household consumption including for drinking purposes?
   d. How do you assess the quality of water in terms of its colour, test and appearance?
4. How do you define healthy teeth? Characterise your definitions. Discuss in terms of its appearance, strength, any pain and disfunctionality, etc.
5. What health related problems do exist due to the water that you use in the locality, particularly dental and skeletal complications?
6. Knowledge, perceptions and attitude of the community regarding dental and skeletal problems due to the water use.
7. Discuss any health, social and economic consequences due to the dental and skeletal problems as a result of the water consumption.
8. Are there any persons in this community whose teeth are not discoloured. Explain the reasons why they remained white
9. Did any of you hear about the term "fluoride:? Explain what it does to your health.
10. What measures have been taken so far by the authorities as well as the community themselves to avert the dental and skeletal problems due to the water consumption.
11. Have you ever been taught or informed about fluoride-related problems and their consequences here in the locality? If yes, who did it? What was told? How often was that done?
12. What do you think should be done to solve fluoride-related problems? How far are you ready to participate in any endeavor to find solutions for these problems?

References

1. World Health organization. Fluorides and human health. WHO monograph series, Geneva 1970:No.59.
2. Shortt HE, Pandit CG, Raghavachari TNS. Endemic fluorosis in Nellore district of South India; Ind. Med. Gaz. 1937;72:396.
3. Singh A, Vairani SJ, Jolly SS, Bansal BC. Endemic fluorosis with particular reference to dental and systemic intoxication. Postgrad. Med J., 1962; 38:150-156.
4. Jolly S, Singh BM, Mathur OC, Malhotra KC. Epidemiological, clinical and biochemical study of endemic dental and skeletal fluorosis in Punjab. Brit Med. J. 1968;4:427-429.
5. Grech P. Fluorosis in the northern region of Tanganyika. Trans Roy Soc Trop Med Hyg, 1964;58(6):566-573.
6. Tekle-Haimanot R, Asmerom F, Bushura B. Endemic fluorosis in the Ethiopian Rift Valley. Trop Geogr Med, 1987;39:209-217.
7. Belachew B. The occurrence and distribution of fluoride and fluorosis in Wonji Shoa Sugar Estate and adjacent areas. MA thesis, Department of Geography, Addis Ababa University, 1990.
8. Tekle-Haimanot R. Neurological complications of endemic skeletal fluorosis, with special emphasis on radiculo-myelopathy. Paraplegia 1990;28:244-251.

9. Kloos H and Tekle-Haimanot R. Fluorosis. In: Kloos H and Zein AH (Eds). The Ecology of Health and Disease in Ethiopia. West view press, Boulder, USA, 1993:445-541.
10. Guidelines for Drinking Water Quality. Health criteria and other supporting information. WHO, Geneva, 1984.
11. Levallois P, Grondin J and Gingras S. Knowledge, perception and behaviour of the general public concerning the addition of fluoride in drinking water. Can J Public Health, 1998;89(3):162-165.
12. Kwan S. & Holmes M. An exploration of oral health beliefs and attitudes of Chinese in West Yorkshire: a qualitative investigation. Health Educ Res, 1999;14(4):453-460.
13. Riordan PJ. Perceptions of dental fluorosis. J Dent Res 1993;72:1268-1274.
14. Basics of Qualitative Research. Techniques and Procedures for Developing Grounded Theory. Ed. Straus A & Corbin J. 2nd Ed. Sage Publications. Thousand Oaks, Ca 1998: 57-71.
15. Åstrøm AN, Awadia AK, and Bjorvatn K. Perceptions of susceptibility to oral health hazards: A study of women in different cultures. Community Oral Epidemiol 1999;27: 268-74.