THE IMPACT OF FLUOROSIS ON EDUCATION IN THE ETHIOPIAN RIFT VALLEY: THE CASE OF WONJI/SHOA ARE

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SEPTEMBER 24, 2013
PRESENTATION OUTLINE

1. Introduction
2. Description of the study area
3. Methodology
4. Results and discussion
5. Conclusion and Recommendations
1. INTRODUCTION

Background

- Fluorine is the most electronegative and reactive of all elements & thus in nature is rarely found in its elemental state and is thirteen in abundance. It exists in the form of fluorides in a number of minerals. It is found in significant amount in volcanic rocks & a trace element in water.

- Fluorosis describes a state of toxicity of the trace element, Fluorine (commonly referred to in its ionic state as Fluoride) within an organism.

- It is estimated that more than 200 million people worldwide rely on drinking water with fluoride concentrations that exceed the present WHO guideline of 1.5mg/l [WHO 1984b].

- According to Redda (2005), over 11 million Ethiopians (14%) are potentially affected by the endemic fluorosis and over 80% of the children in the rift valley have developed varying degrees of dental fluorosis.
• Fluoride in groundwater in Ethiopia (MoWE, 2011)

Major water quality problem, mainly in the Ethiopian Rift Valley Regions

Several wells failed to supply drinking water due to the presence of high fluoride

Estimated population of 11 million is living in the RV (14 % of total)

Area of the Rift valley = 3300 km²
The population is more at risk of developing fluorosis. This is due to the higher concentration of fluorides in Wonji-Shoa and the longer use of its well water by the population.

Oromia Regional State is the most affected by the fluoride problem as it occupies 42% of the rift valley area followed by the Southern Nations, Nationalities and peoples (30%) and Afar (12%).

Water and beverage, food, medicines and toothpaste were considered to be the source of fluorosis in the Main Ethiopian Rift Valley.

In Groundwater much higher concentrations of fluoride may be found, due to the weathering of fluoride-bearing minerals and rocks (Daw, 2004).

Excessive fluoride intake in Ethiopian Rift valley ground water is the main water quality problem and causing serious negative impacts on the socio-economic status of the country.
Fluoride Distribution Map of the RV (MoWE, 2011)

Plenty of Ground water, but heavily loaded with fluoride
Justifications for the study

• The genesis, source, general water chemistry and distribution of fluorosis have been studied by different researchers in the MER.

• The area is known for endemic fluorosis and the problem is very acute and needs immediate solution to curve for it and the problem in the area is also more serious than any other place in the MER.

• Fluorosis has several socio economic impacts
  ✓ Health
  ✓ Education
  ✓ Productivity
  ✓ Marriage
  ✓ Job opportunity
The impact of fluorosis on education and the true magnitude of the problem have not been studied yet.

• The students residing for long period in two villages with high and low fluoride concentration areas are available to compare and contrast the impact of fluorosis on the education of students.

Therefore, this study is trying to fill the gap on the impact of fluorosis on education of students in Wonji/Shoa to bring the attention of concerned bodies to tackle the problems of the students.
Statement of the problem

- The first cases of dental fluorosis in Ethiopia were officially recognized in the 1960s in Wonji sugar estate. The worst cases of skeletal fluorosis are also recorded at Wonji/Shoa. Subsequently dental and skeletal fluorosis became endemic problems of the sugar estate.

- The problem is being worsening because of the very low economic status problem of the country and absence of appropriate local technology for defluoridation.

- Medical expenses in dental care and the rehabilitation of those suffering from skeletal fluorosis with its neurological complications would be very taxing on the economy of the country.

- Dental caries have a negative impact on the quality of life, psychological and social aspects of children’s life.

- 1976 – 1984 Wonji retired 530 workers due to disability. People were forced to seek early retirement.
Both deficiency and excess of fluoride have negative health impacts.

Deficiency of fluoride causes tooth decay or dental caries. Dental caries have a negative impact on the quality of life, psychological and social aspects of children’s lives.

Fluoride when consumed in excess can cause several health problems.
- Dental, Systemic and skeletal fluorosis
- Neurological manifestation
- Kidney problem
- Tendency to urinate more frequently
- Ageing
- Muscular weakness
- Cardiac problems, associated with Alzheimer’s disease, genetic damage and change in DNA.

It should not be misunderstood that these complaints are always due to fluoride toxicity. Fluoride is one of the factors, which can cause such manifestations (Bulusu and Nawlakhe, 1992).

Manifestations of fluorosis develop slowly and affect soft tissue and organs.
Objectives of the study

General Objective

The general objective of the study is to investigate the extent of the impact of fluorosis on education of students of Wonji/Shoa area.

Specific Objectives

- To assess the impact of fluorosis on academic performance of students.
- To assess the impact of fluorosis on absenteeism of students.
- To evaluate the impact of fluorosis on drop out of students.
- To examine the impact of fluorosis on the learning teaching process.
- To generate possible solutions to address the problem and give recommendations to the problem.
significance of the Study

- Contributes to current efforts by governments, NGOs and private companies which are involved on the issue in finding and implementing lasting solutions to the problem & to design policy and preventive strategies for endemic fluorosis.

- The findings of the study will contribute to enhance the education by bringing issues to be considered to the concerned school masters, teachers and other concerned bodies.

- The result of this study might serve as baseline information for those who are interested to conduct further research on the impact of fluorosis on socio-economic status in the Ethiopian Rift Valley.
2. Description of the study area

- The study area is located in Wonji/Shoa, Adama Woreda, Eastern Shoa Zone, Oromia Regional State & is located 107 km South East of Addis Ababa.

- The area lies within $8^0 26' 59''$ North latitude and $39^0 16' 48''$ East longitude.

- The study area will be carried out in the Ethiopian Rift Valley in two villages within the Wonji Shoa Sugar Estate (WSSE).

- WSSE has 30,000 inhabitants and is organized in two factory villages (Wonji and Shoa), and 15 plantation villages.

- Commercial irrigational agriculture is developing fast and the presence of Wonji-Shoa Sugar Factory, the Ethiopian Pulp and Paper S.C, Wonji Confectionery Sweet Factory and Elfora Agro Industries PLC are the major income generating industries in the area.

- The average annual temperature varies from 20 to $26^0C$ over the region.

- The annual rainfall in the rift varies widely from around 650 in the rift to over 1,100 mm in large parts of the highlands. In high peaks, to the east the mean annual rainfall reaches as high as 1,500 mm.
Figure: Location Map of the study area
3. Methodology
Source of data

- **Primary:**
  - Questionnaire, FGD (Students, Teachers, parents) Interview with key informants, Story telling and Personal observation.

- **Secondary**
  - Published and unpublished sources, Books, Reports, Journals, Internet sources and others.

- **Key Informant Interview**
  - Head of Water Supply Department in Wonji/Shoa Sugar Factory
  - School principal of Wonji/Shoa Secondary School
  - School principal of Wonji Preparatory School
  - Students of Wonji/Shoa Secondary and Preparatory School
  - Medical Director of Wonji Hospital
  - Department head of the Laboratory of Wonji Hospital
  - Water and Sanitation Manager of Catholic Relief Service and
  - Heads of Adama Woreda Water and Health office.
Selection of respondents & Study villages

• I purposively selected students of Wonji-Shoa Secondary School (Grade 9-10) and Wonji Preparatory School (Grade 11-12) for the study because most of the students are drawn from all the plantation villages.

• A total of 160 students (12% sample size of the total) residing for long period in two villages with high and low fluoride concentration areas has been taken to compare and contrast the impacts of fluorosis on education of students by using simple random sampling technique.

• Two villages namely, Village A and Village K were selected purposively out of the 15 plantation villages in Wonji-Shoa Sugar Estate.

• Village A is inhabited by the indigenous population where the water source is exclusively surface water from Koka Reservoirs with a very low level of fluoride concentration (1.3 mg F/l).

  ▪ Village K has high fluoride content in the drinking water (12 mg F/l) and the residents use well water sources for their domestic supply.
4. Results and Discussion

4.1. Sex and Age Composition of the Respondents

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>96</td>
<td>60</td>
</tr>
<tr>
<td>Female</td>
<td>64</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-16</td>
<td>59</td>
<td>36.9</td>
</tr>
<tr>
<td>17-19</td>
<td>72</td>
<td>45</td>
</tr>
<tr>
<td>20-22</td>
<td>19</td>
<td>11.9</td>
</tr>
<tr>
<td>23-28</td>
<td>10</td>
<td>6.2</td>
</tr>
</tbody>
</table>

- The ages of students of the study areas range from 14 to 28.
- The highest number of students is at the age group of 17 to 19 years.
4.2 Family Educational Status and Occupation

- The occupation of student’s parents reflects the status of their families.

<table>
<thead>
<tr>
<th>Family occupation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Factory worker</td>
<td>99</td>
<td>61.7</td>
</tr>
<tr>
<td>2. Agricultural labourers</td>
<td>22</td>
<td>13.6</td>
</tr>
<tr>
<td>3. Civil servant</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>4. Business</td>
<td>10</td>
<td>6.9</td>
</tr>
<tr>
<td>5. Farming</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>6. Others</td>
<td>13</td>
<td>8</td>
</tr>
</tbody>
</table>

- 71 (44.4%) parents of the students have attended regular education
- 65 (40.6%) of them who can read and write;
- 11 (6.9%) are illiterate;
- 9 (5.6%) parents can only read a simple letter
- 4 (2.5%) are others.

Advantage

- They can at least follow up the attendance of students and additional care would be taken by their family such as providing good nutrition.
4.3 Source of drinking water

- 73 (45.6%) uses high fluoride wells and boreholes,
- 61 (38.1%) tape water, 13 (8.1%) river, 10 (6.3%) stream,
- 2 (1.3%) rain water and 1 (0.6%) spring water.
- 129 (80.6%) respondents are using the same source of water throughout the year
- 31 (19.4%) are using different sources.

<table>
<thead>
<tr>
<th>Source of drinking water</th>
<th>Village A</th>
<th>Village K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Well (Borehole)</td>
<td>2 (1.3%)</td>
<td>71 (44.3%)</td>
</tr>
<tr>
<td>2. River</td>
<td>10 (6.2%)</td>
<td>3 (1.9%)</td>
</tr>
<tr>
<td>3. Rain water</td>
<td>1 (0.6%)</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>4. Stream</td>
<td>8 (5%)</td>
<td>2 (1.3%)</td>
</tr>
<tr>
<td>5. Tap (pipe)</td>
<td>59 (36.9%)</td>
<td>2 (1.3%)</td>
</tr>
<tr>
<td>6. Spring</td>
<td>-</td>
<td>1 (0.6%)</td>
</tr>
</tbody>
</table>

However, the residents of Village K students drink water with fluoride level of 12 mg/l.

Thus, the intake of fluoride with elevated concentrations like village K can easily lead to problems associated to health (Dental, skeletal and skeletal crippling).
4.4 Respondents type of fluorosis

<table>
<thead>
<tr>
<th>Type of fluorosis</th>
<th>Frequency</th>
<th>Village A</th>
<th>Village K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental</td>
<td>125</td>
<td>49</td>
<td>78</td>
</tr>
<tr>
<td>Skeletal</td>
<td>34</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>Systemic</td>
<td>28</td>
<td>_</td>
<td>28</td>
</tr>
<tr>
<td>Free of the disease</td>
<td>35</td>
<td>31</td>
<td>2</td>
</tr>
</tbody>
</table>

4.4.1 Dental fluorosis

The symptom DF is high (70 (56%) at the age group of 7-9 years old children; 30 (24%) at the age group of 10-12 years old children; 19 (15.2%) at the age group of 4-6 years old; 4 (3.2%) at the age group of 13-15 years old and 2 (1.6%) at the age group of 16-18 years old children.
The occurrence of dental fluorosis at latter age group of 16 to 18 years could possibly be because the cumulative effect of fluoride ingested is in very low dose which take more time to be reflected in the severity of dental fluorosis or may be that most of those groups were born outside the area and have developed their permanent teeth elsewhere.

The occurrence of dental fluorosis in the lower age group of 4 to 6 years are perhaps that the level of fluoride from well water sources such as village K are so high that students are affected at an early age.

With regards to sex of the students,

- 36 (28.8%) female and 34 (27.2%) male students have dental fluorosis at age group of 7 to 9 years;
- 16 (12.8%) male and 14 (11.2%) female at the age group of 10 to 12 years;
- 10 (8%) female and 9 (7.2%) male at the age group of 4 to 6 years;
- 2 (1.6%) male and 2 (1.6%) female at the age group of 13 to 15 years;
- 2 (1.6%) male students are at the age group of 16 to 18 years

The prevalence of DF in the villages for males was 63%, while it was 62% for females. The two figures are not very far from the average condition calculated for both sexes (62.5%). The male and female prevalence of DF has no statistically significant difference. It can be concluded that both sexes are equally affected by DF in the study area.
4.4.2 Skeletal Fluorosis

- Out of the total 34 students affected by skeletal fluorosis, the occurrence of the problem was high 17 (50%) at the age group of 20 to 22 years old, 10 (29.4%) at the age group of 23 to 28 years old, 5 (14.7%) at the age group of 17 to 19 years old, 2 (5.8%) at the age group of 14 to 16 years old children.

- Out of 34 students who are highly affected by skeletal fluorosis 32 are from village K and 2 students are from village A. In areas with very high fluoride area such as village K the disease affects lower age groups including children with age groups of 14 to 16. The main reason for the occurrence of skeletal fluorosis in village A may be because of tropical climate necessitating high consumption of water.

- Regarding the issue of skeletal fluorosis effect on sex, it is found that, 92 (57.5%) of the students pointed out that males are more affected than females, 45 (28.1%) of the students argue that females are more affected than males, and the remaining 23 (14.4%) students claim that there is no difference between the two sex.

- According to FGD's with students the main reason why males were affected than females in the area was because the males are more exposed to hard work. Males are engaged in cutting the sugar cane and because of high temperatures and high fluoride consumptions of water, the fluoride tends to be concentrated in the body because during evaporation (through skin and lungs) and sweating water is lost without fluoride.
In order to triangulate the above facts the researcher checks sex of the students versus consumption from the data.

51 (31.9%) male and 33 (20.6%) female, consume greater than 1 litre per day/student, 41 (25.6%) male and 26 (16.3%) female consume between $\frac{1}{2}$ to 1 litre per day/student, 3 (1.9%) male and 4 (2.5%) female consume $\frac{1}{2}$ litre per day/student and 1 (0.6%) male and 1 (0.6%) female consumes less than $\frac{1}{2}$ a litre per day/student.

It can be concluded that males consume more water than their female counterparts.
4.4.3 Systemic Fluorosis

- The cause of systemic fluorosis is due to the chemical nature of fluoride and its actions within mammalian systems which are not limited to teeth and bone.

- The appearance of systemic fluorosis was only in village K 12 (7.5%) but none was found in village A.

- 148 (92.5%) of the students did not answer the question. The most likely reason is the disease may not be symptomatic to them and students may not easily describe about it.

- According to the key informant interview made with the Medical Director of Wonji Hospital.

- Systemic fluorosis is a very complex disease which affects people from simple to disability and even death (i.e, cancer and cardiovascular failure for death by acute fluoride poisoning). This would require further studies by highly qualified physicians and the cost is also very high.
4.5 The influence of teachers on victim’s personality

It is found that,
- 27 (16.9%) students say ‘yes’ there is an influence of teachers on the academic performance of student’s whereas 133 (83.1%) of them say there is no any influence by their teachers because most of the teachers are also victims of the problem in the area.

- 27 of them say yes there is an influence. The major reasons of the students were teachers insult us while we are laughing in class and that affects our mind and we feel inferior. This issue was raised during the FGD with teachers. Students who are highly affected by the problem do not keep their hygiene and personality and there is a bad smell in the afternoon class and affects the overall learning teaching process.

- The majority of the students (83.1%) say there is no any influence by teachers. This could have been caused by the fact that students are afraid of their teachers not to explain the real situation. However, 16.9% of the students have shown indication of the situations that teachers make influence on the learning teaching process.

*Mayet, a 19 year old girl, was born at Village K and she explains the situation this way: the pressure from teachers is not so easy. When a teacher tells a joke and when we laugh, he says “Why are you laughing as if you are having clean teeth? You are having rotten teeth.” In this way it affects our mind. “It is difficult to socialize freely and I suffer more than boys.” She said.*
Students were also asked if they cover their mouth or not while they are participating in class activity.

- The majority 97 (60.6%) of the students always cover their mouth or shy out during class activity participation,
- 55 (34.4%) of them cover their mouth sometimes during class activity and
- 8 (5%) of the students do not cover their mouth or shy out in the participation of class activity.

The FGDs and interviews

- The students feel inferior when they are with strangers and when they are outside their village like when visiting places outside the rift valley.
- The researcher observed that most of the students do not cover their mouth when they interact with themselves in the school compound or participate in class activity. They only cover their mouth when they are talking with strangers.
Ayalew, a 23-year old student, who was born in village K and a student of Wonji Preparatory School told the researcher: “As long as you are in Wonji/Shoa or in Nazret you are okay. You can smile openly and do not have to cover your mouth with your hands.

However, the situation is quite different when you are outside your turf”. He told me of his recent visit to Debre Berhan. People came to ask him what was wrong with his teeth. “Did you bite or chew something toxic”

“Are you a chain smoker of cigarette at such a young age” were some of the questions that were thrown at him. Throughout our discussion, he continually tried to cover his mouth with his hands.
4.6 Fluorosis impact on drop out students

According to the school principal, The total number of students who dropped out from school from 860 students in the year 2010 in Wonji/Shoa secondary school was 31 (23 Males and 8 Females).

Similarly in 2011, Out of the total 990
- 568 (57.4%) are males and 422 (42.6%) are females.
- the total no of dropped out students were 40.
- Males are 29 (72.5%) more dominant than females 11 (27.5%) in the area.

- 23 students (Male=17, Female=6) are from grade 9 and
- 17 students (Male=12, Female=5) are from grade 10.

- The researcher found 23 of them and the remaining 17 students were not possible to be found. Additional 2 students who dropped out from 2009 were also found during the survey.

- 35 (87.5%) students were dropped out from school due fluorosis problem and 4 (10%) students were due to family problem and 1 (2.5%) student was because of other reasons. Selected case histories are hereby presented.

- The drop out rate has also increased from 3.6 % (1999 E.C) to 4.04 % (2000 E.C)
Kefelegn is a 23 year old young man born in Wonji/Shoa who dropped out from his school when he was a grade 10 student. The reason for his drop out of school was because of great pain of both dental and skeletal fluorosis. He can’t attend his education like other healthy students. He wasn’t able to sit for long hours while studying. Since he feels the pain he couldn’t go for learning so he dropped out his education from school in 2009.

He told to the researcher that he considers himself as hopeless citizens and useless. I have asked him why his teeth are black and unique, his response was since I don’t have job, shelter and land why not I smoke and chew chat. He is one of the chain smokers of cigarettes in the area. He bitterly complained that fluorosis is a real cause for handicap. He also told the researcher of his friends who dropped out from school except God Nobody knows where they are now but what I know is they had already left the area. People never stopped looking at him with surprise, some with disgust. How did that affect him psychologically? However he went on to rationalize. “I have to continue with life. I have developed a thick skin to unpleasant comments from people”
Hailu is a 23 year old young man born in Camp K, Wonji/Shoa who dropped out from his school when he was a grade 10 student. The reasons for his drop out of school were because of parent’s problem.

My mother died while I was a ten year old kid and my father is handicapped with fluorosis, for which he was retired at the age of 47 from Wonji Sugar Factory. Now he is 60 years old. Due to fluorosis, he can’t walk without holding a crunch. He can’t collect his monthly pension and someone has to assist him when he wants to go to the toilet room.

In this situation, families are also unable to supplement the education of their students and offer basic necessities. For this reason, students are forced to drop out from school. According to Hailu, many students of Wonji/Shoa stop going to school as a result of family problem in the area or to assist their families who are suffering with fluorosis.
W/ro Asnakech, 51, has been a resident of Wonji/Shoa for the last 35 years. W/ro Asnakech and her husband from the Wonji/Shoa Sugar Estate had identical stories to tell. Their disabilities developed insidiously with progressive Difficulties with mobility and walking. They were forced to seek early retirement which resulted in their vacating their houses which were within the sugar estate.

They had to rent rooms in Alem-tena village near Wonji/Shoa and lived on meager retirement benefit. What the family worries most is about their children who are suffering a lot in fluorosis.

Out of the three children
- The older one is forced to drop out his education from school in 2008 in order to assist their families at home.
- The middle in age is currently attending his education in Wonji preparatory school and because of the disease he misses class at least 10 days within a month. If you do not attend school you can’t attain better grades, and the prospect of futurity will be worst and
- The youngest is pursuing his education in Wonji/Shoa secondary school.

The above case study confirmed that family problem is more closely associated with Fluorosis in the Wonji/Shoa.
4.7 Fluorosis impact on absenteeism
The researcher from the one year roster of the school found out that,

Out of the total 160 students,
- 71 (44.4%) did not get absent from school.
- 89 (55.6%) became absent from class with an average for a month.

- 41 (46%) students are absent with an average of 1 to 3 days every month from school.
- 23 (25.84%) students are absent from 4 to 6 days every month from school,
- 15 (16.85%) students are absent from 7 to 9 days, and
- 10 (11.2%) students are absent from 10 to 15 days every month because of the physical pain associated with fluorosis.
Out of 89, 60 boys and 29 are regularly absent from class.

From the roaster absenteeism is more prevalent among boys than girls in the study area. The most likely reason can be more boys are highly affected than girls in the study area.

With regard to the study villages, students of village K were chronic absentees than village A.

<table>
<thead>
<tr>
<th>No. of days absent</th>
<th>Village A</th>
<th>Village K</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>15</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td>4-6</td>
<td>5</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>7-9</td>
<td>4</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>10-15</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>
Fluoride problems have been shown to have a significant negative impact on the physical appearance of students on the learning teaching process.

The experience of Martha, a 23-year-old grade 11 preparatory school student is a good case for the study.

I came from Camp K. I have developed both dental & skeletal fluorosis at this age. Due to the anxiety of the disease, I do not go to school for a minimum of 7 School days from class every month. What really worries me is the prospect of Developing Skeletal fluorosis at an early age. This is something that scares me.

Fluorosis problems negatively impact a student’s ability to attend and participate fully in school. Students with better attendance in school have better peer relations and better grades and conduct in school, and more academic and enrichment opportunities.
4.8 Fluorosis impact on academic performance of students

The researcher tried the academic performance of 89 students roster from the school.

- 33 (20.6%) students from village A
- 56 (35%) students from village K

Out of 56, 52 students decrease their performance for four consecutive years; 4 students do not show any change.

Out of 33, 22 students decrease their overall performance for 4 cons. years; 5 students have performed best for the last two consecutive years. 6 students do not show any change.

During the FGD with students and director of the school, when they stay for time during study time they easily retire, feel the pain of teeth and backbone. The Students cannot do their assignments even if they would like to do; they do it with great effort and with pains.

Students who are residing in the high fluoride affected area are at a greater risk due to excessive fluoride intake and ultimately had poor educational achievements.
Respondents were asked if they are discriminated or isolated in the School compound due to the disease associated with fluorosis.

- Of the total, the majority of the students 100 believe that there is no this much isolation of students in the school compound because most students and teachers are affected by the problem, 60 students believe that students are discriminated by their friends and teachers.

- The major reason is because of bad smell of mouth of some students. many argue that working a group work assignment and study is limited and they prefer to study independently. In this situation, victims of the disease are not able to compute with healthy students and ultimately had weak school performance.
Respondents were asked whether or not they repeat same grade in their life. Accordingly, 84 (52.5%) of the students repeat their grade at different levels, 59 (36.9%) of the students do not repeat same grade in life and 17 (10.6%) have no suggestion about it.

Out of 84,
- 64 (40%) students repeat same grade once in life time,
- 17 (10.6%) students repeat same grade twice in life time and
- 3 (1.9%) students repeat same grade three times in life time.

54 (33.8%) failed at grade 9-11
23 (11.3%) of the students failed at grade 7-8
7 (4.3%) of the students failed at grade 4-6.

The majority of the students have poor academic performance at the latter grade and age.

The major reason might be associated with fluorosis but there can be other reasons for contribution of the poor academic performance.
FGD & key informant interview was conducted with teachers concerning the academic performance;

students who are highly affected by skeletal fluorosis do not play football and other games of sport. In this case the physical education result is weak. Thus, the overall average grade is also not satisfactory.

Teachers treat their students equally whether students are affected by the problem or not. Students are absent during exam time and make up examination are common at the end of the semester and it is common for students to fall asleep in class during the afternoon session. This will not enable students to achieve their academic performance.

According to FGD with KETB members,
- Developed some physical disabilities (like inability to bend forward, and to do sit-ups etc.), which were noticed at the beginning, and
- Disabilities could not perform some activities (like cycling, walking in the field, lifting load, taking care of children and cattle at home became difficult to perform).
Respondents were asked if the problem affects the behaviour of students and teachers.

- Students believe that physical pain of teeth is the worst of all other diseases and causes ill feelings in class.

- This would seriously affect an individual's ability to interact and form relationships with his/her friends and teachers, leading to exclusion, loneliness and long-term depression.

- According to FGD held with teachers and parents of the students:
  - Students develop aggressive behaviour and quarrel with their teachers and families.
  - This is a common phenomenon observed on the Wonji/Shoa area. This requires further research and whether the bad behaviour they developed is from the physical pain associated with the fluoride problem or other reason that makes them develop aggressive behaviour.

- The impact of fluorosis on behaviour of the students should be further investigated.
5. Conclusion and Recommendations

5.1 Conclusion

- The study indicates that there is a major problem of fluorosis in the study area. Fluorosis has significant socio-economic impacts especially in the MER. Persons who develop fluorosis have reduced productivity because of their physical disabilities.

- The male and female prevalence of dental fluorosis has no statistically significance. Hence both sexes are equally affected by dental fluorosis in the study area.

- Unlike the problem of dental fluorosis among the students, the male population is affected more than the females by skeletal fluorosis. The reasons are the males are more exposed to hard work and they also consume more water than their counterparts in the area.

- Drop out and absenteeism of students in males were more dominant than female.

The main reasons for drop out of students of school were mainly because of fluorosis And family problem.

Family problem is closely associated with fluorosis in the study area.
The study found out that the physical pain associated with fluorosis leads to:

- Poor personal hygiene
- Fail to maintain relationship with friends and be more prone to violence.
- Are disruptive in school
- Become regular absent from school
- Show weak participation in class activity and are prone for school leave out.
- Underachieve academically

There is a significant academic difference between students who are born and raised in areas with low and high-fluoride concentrations of drinking water.

Excessive fluoride in Ethiopian Rift valley ground water is the main water quality problem and causing serious negative impacts on educational status of school children.
5.2 Recommendations

On the basis of the results, analysis of the findings and the conclusion reached the following recommendations are forwarded:

- Policy makers should take fluorosis as a serious national problem and develop appropriate preventive strategies.

- The issue need to be put as a national agenda because of the serious impact of fluorosis on the public health of the entire population of the Ethiopian Rift Valley.

- The collaboration of stakeholders in mitigating the problem is highly recommended in the Ethiopian Rift System.

- Further research is required to investigate the socio-economic impact of fluorosis in order to alleviate the problem and to minimize the possible impacts.
To encourage better education, promoting health education through Schools is very important. The school community is especially suited for mass education program because students will serve as a communication media to convey messages to the community.

The community is the centre of all interventions and the school is used as the centre for mind change.
Thank You