The Health Effects of Fluoride in the Ethiopian Rift Valley

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A Global Issue

- Key issue: approximately **768 million** people lack access to safe water\(^2\)
- Over **200 million** people globally are drinking water from sources with fluoride concentrations above the WHO’s recommended level of 1.5 mg/L\(^3\)
- Approximately **8 million** people in the Ethiopian Rift Valley are drinking from high fluoride water sources\(^4\)
Introduction: Fluorosis

- Consistent exposure to elevated levels of fluoride results in fluorosis, a chronic metabolic disorder, which can manifest as dental or skeletal fluorosis.
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Dental Fluorosis

- Fluoride levels typically above 1.5 mg/L
- Pitting
- Staining
- Hypoplasia
- Mottling
Introduction: Fluorosis

- Consistent exposure to elevated levels of fluoride results in fluorosis, a chronic metabolic disorder, which can manifest as dental or skeletal fluorosis.

- Dental fluorosis represents excessive exposure to fluoride before the eruption of permanent dentition.

- **Skeletal fluorosis reflects exposure during any prolonged period**
Skeletal Fluorosis

- Symptoms are **variable**
- **Osteosclerosis** – increased bone mineral density
- **Osteopenia** – decreased bone mineral density
- Calcification of interosseous membranes, ligaments, and tendons
- Bone deformities, bone pain, intermittent growth lines, enlarging of the diaphyses diameter, radiculomyelopathies
Study: Summer 2012

Preliminary research was conducted in the Ethiopian Rift Valley during the summer of 2012 in two kebeles

- **Purpose**: With the ambiguous nature of skeletal fluorosis symptoms, conclusive diagnostic techniques are a large gap in the research

- **Goal**: To gain more substantial evidence regarding what skeletal effects consumption of fluoride does or does not cause and then develop a conclusive test for diagnosing skeletal fluorosis
Methods

- **WHO:** 20 women from two kebeles
  - Community A: F≈6.7 mg/L
  - Community B: F>10 mg/L

- **WHY:** The kebeles were chosen for their fluoride content and access or lack thereof to filtration systems

- **WHAT:**
  - **Interview** – health status, pain & pain management, perceptions of water, nutrition, and physical activity
  - **Physical assessment** – simple balance, flexibility and strength exercises
19 of 20 women expressed pain; 17 said it affected their work.

Work was described as washing clothes, preparing food, assisting husband in agricultural responsibilities, taking care of children.

Most of the women exhibited dental fluorosis, but did not have pain associated with their mouth or teeth.

Pain described was joint pain; specifically, lower back, knees, elbows, shoulders, and ankles.
Results Continued

- Women living in the higher fluoridated kebele, B, (>10 mg/L) reported more severe health problems.
  - Additionally, women in kebele B connected the water quality to these health problems.

- The women in kebele B also displayed less flexibility, strength and balance during the exercise portion.
  - None of these women were able to perform the exercises without pain.
Skeletal fluorosis is a problem in the Ethiopian RV

- The data suggests a majority of the women in high fluoride communities have symptoms consistent with fluorosis

The pain described is consistent with previous fluoride research, but still too generalized for good estimates

Limitations:
- Restricted sampling
- Exclusion of men (typically more affected than women)
- Inconsistent exposure for most married women
Future Research

- Larger, more inclusive studies
- Oral exams
- Uniform diagnostic techniques in the field to accurately estimate the extent of this problem
  - Better estimates will hopefully lead to the mobilization of resources towards sustainable filtration research
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References


