Maintaining clean water: contamination during water collection and storage in Addis Ababa

Microbiological comparison of water quality at source and point-of-use

Briefing Note (WA Ethiopia)

Johanna Crampton
Water Aid
Ethiopia

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Summary: This briefing Note aims to examine the problems resulting from collection and water storage as well as hygiene education on water bacteria levels. This research examines how clean drinking water at water source can be contaminated before human consumption. The impacts of water collection, storage type and hygiene education on water bacteria levels are examined using the Oxfam DelAgua kit. The overall goal is to establish which water handling practices are linked to increased risk to consumers, in order to improve the safety of domestic point-of-use water supplies.

Keywords:

Water storage
Water collection
Microbiological contamination
NGO action

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Introduction

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The overall goal is to establish which water handling practices are linked to increased risk to consumers, in order to improve the safety of domestic point-of-use water supplies.

Water is vulnerable to contamination by bacteria at many points in its journey from reservoir to mouth. In the urban environment a high concentration of bacteria is present and can easily contaminate water after collection but before consumption

In Addis Ababa most people are dependent on public water points and in-house storage of water. This research aims to examine the problems resulting from collection and water storage.

1) Assess the variation of bacteriological contamination increase as measured by Total Fecal bacteria per 100ml water sample, between water source and point-of-use in the home.

2) Examine the water collection, transport and storage practices of homes using shared public water taps, and how this affects bacteriological water quality.

3) Test the levels of chlorination in the municipal water network and reveal the extent of variation across Addis Ababa and the extent to which the chlorination is protecting the quality of the water.

NGO (Godanow) water point in Kirkos

Background

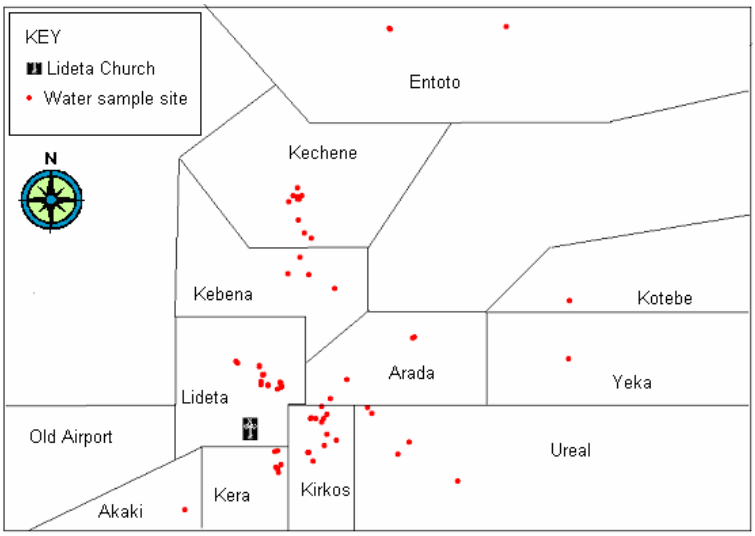
Ethiopia's largest city has grown at a rapid pace since it was founded and until recently there was no urban planning; the city simply grew in a natural organic way, unforced and unstructured. This unmanaged expansion of Addis Ababa has put pressure on services such as municipal water supply and sewerage systems. The more people arrive the less the city can cope.The Addis Ababa urban water supply system is characterised by a low output capacity, inadequate networks and high system losses.

Public water taps are either installed by NGO organisations or by AAWSA who charge users either via co-operative organisations or at the tap based on a price per 20 litre jerry can. In general, water provided by this municipal network is safe and free from coliform contamination. Problems emerge via lack of efficient tap maintenance as the taps represent a commons which no one takes responsibility for and illegal connection to the piped network opening the water stream up to contamination by mobilised contaminated groundwater.

Methodology

The study took place in Addis Ababa between June 7th and July 11th 2004 and used several different methods. Primary data consisted of information on the chlorine concentration and bacteriological quality of water samples taken from public water points, natural water sources and at the point-of-use. Data was also collected via questionnaires regarding household water collection, treatment and storage practices.

Four districts of Addis Ababa were selected for study. The four areas were visited twice with a one week gap between visits. These locations form the majority of water samples collected. The remaining twenty six samples were collected from points around the city to put the four key areas in the context of general Addis Ababa water quality.



This image shows the distribution through the city of the testing sites. Samples cluster in four kebeles of Kechene, Lideta, Kera and Kirkos. Samples taken in the Entoto region are from a rural environment with the use of spring water contrasted with urban water management.

The existence of faecal bacteria in drinking water is used as an indication of a risk from disease presented to consumers. In an urban environment faeces can enter drinking water when pit latrines contaminate groundwater or enter through a ruptured pipe network. When source water is clean yet contamination is present in household storage it indicates that bacteria were either present in the storage container before water was added, water collection contaminated water or the method of water extraction is unhygienic.

Key Findings

Addis Ababa water contamination is best described as being of *high frequency* but at *low-levels:*

- Of the 127 total water samples collected, 34 % were contaminated with faecal bacteria.
- 33 % of water sources were contaminated (n=72) and 37 % of point-of-use water samples contained faecal bacteria (n=54).
- Although 34 % of samples tested positive for some level of contamination, 52 % of these scores were at a level which would not present a risk to human consumers

Method of water storage can impact on subsequent water quality:

This study has indicated that 'pour' methods of water storage (jerrycan and jug) are more frequently contaminated. However this is a lower level of contamination than 'dip' methods of water storage (bucket and ensera).

The popular 'pour rather than dip' hypothesis is challenged by the problems presented by cleaning inside narrow necked vessels such as the jerrycan. Microorganisms will grow in water and on surfaces in contact with water as 'biofilms.' Therefore water storage containers which are not or can not be effectively cleaned after emptying, store bacteria in the biofilm. When the vessel is refilled bacteria infect the clean water before consumption.

NGO taps can be a source of poor quality water:

NGO built taps were found to be less likely to have contamination but where old taps had received little maintenance water quality degraded. Although both NGO and Government provided taps use water from the same municipal network NGO taps are often in a poor state of repair. Different regions of Addis Ababa are served by different NGOs with varying levels of financial funding, influencing their access to hygiene facilities, education and water point repair.

Water contamination after collection:

It was found that overall increases in contamination were not sufficient to cause human illness. However in 22 cases contamination was found to increase sufficiently to potentially cause sickness. NGO financed water sources although generating a higher risk for users due to poor maintenance is the only water source where better hygiene knowledge reduces contamination between source and point-of-use. This indicates bacteria die off during storage which we can suggest is due to better understanding of hygiene practices

Recommendations

- **Water sources need continued care.**

Contaminated water sources increase the likelihood of contaminated point-of-use water. Many of the older NGO taps serve hundreds of grateful people who are left solely responsible for maintenance that is effectively not being carried out due to lack of funds. On going maintenance of water systems is the exception rather than the norm, and most repair is done only after the system breaks down completely.

- **Teaching basic water collection hygiene.**

Water drawing is the first point at which contamination can enter the collected body of water. Those water drawers using the NGO water points are more likely to have been educated about the importance of hand washing after defecation and avoid touching the tap during water collection. A thorough wash out of the collection vessel should also be encouraged with signs showing the best methods and apparatus to aid good cleaning.

- **Aim to keep water costs low**

This research found little connection between water price mark-up and the quality of water provided. The NGO Progynist provides the best value being cheapest and of best quality. The AAWSA water taps are among the most expensive, as the price is not subsidised by an NGO organisation. Prioritizing low water costs is to be encouraged to reduce the severity and incidence of water-washed diseases and improve general water hygiene through greater water use.

- **Stop unhygienic hose pipes at water points.**

In this research study care was taken to collect water in the same way as local people would have, often through the attached hose pipe to decrease water wastage. NGO tap wardens are advised by the NGO to run chlorine based disinfectant through the taps on a regular basis, however this disinfectant is not provided by the NGO and is a much ignored recommendation. The hose pipe could be a source of bacteriological contamination, although this research study did **not** find increased contamination in those water sources which ran through a hose pipe prior to sampling.

Women using hose pipes to collect water.

- **Buckets or Jerrycans?**

This research questioned if a narrow necked storage vessel is the safest method of water storage. It may be difficult to clean inside a jerrycan yet this balances with the safety of water pouring in comparison to dipping a potentially contaminated cup into buckets. Perhaps the solution is either a covered bucket with a floating cup used simply to decant water into another glass for consumption; or a large yet handheld jug with a lid which can be raised for cleaning.

Case study: Holy water

In Addis Ababa the consumption of holy water to remedy illness by members of the Ethiopian Orthodox Church has been a persistent cause for concern among the medical community. Although not a part of the research question, one water sample was taken from a Lideta church. The water sample was obtained by a monk from a rock pit in the grounds of the monastery using the gold chalice used to collect holy water for consumption.

The holy water sample collected had 31 times the safe level of bacterial contamination, and is therefore unfit for human consumption. Of the 126 other water samples analysed it is one of the most contaminated. The continued drinking of this water for medicinal purposes presents a risk of serious illness.

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Contact Information

Briefing Note: Johanna Crampton, August 2005
Full Report: Johanna Crampton, April 2005

Full report available at www.jocrampton.co.uk

Any questions email: contact@jocrampton.co.uk

WaterAid-water for life

The international NGO dedicated exclusively to the provision of safe domestic water, sanitation and hygiene education to the world's poorest people

For more information, please contact:

WaterAid Ethiopia
Debre Zeit Road
P.O.Box 4812
Addis Ababa
Ethiopia

Tel: 251-1-654374
Fax: 251-1-661679
Email: wateraid@ethionet.et
Website: www.wateraidethiopia.org