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## Quantification of *Escherichia Coli* Concentration in Water in Some Selected Households in Namanyonyi Sub-County, Mbale District, Uganda

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### **Abstract:**

*The purpose of this study was to investigate the presence of Escherichia Coli in water samples. A total of 40 water samples were collected from five household for four weeks using 2 different days of the week, at each household eight water samples were collected and analysed for the presence of Escherichia Coli. Results for the microbial analysis revealed that the mean values of Escherichia coli in household water samples were above the WHO and Ugandan recommended guidelines. The study concludes that improvement in the hygienic conditions and water handling practices will play a pivotal role to prevent water contamination and reduce the waterborne disease burden in the study area.*

**Keyword:** *Escherichia Coli, Waterborne diseases, water sampling*

### **1. Introduction**

Water is a critical component of life on earth, safe drinking water and sanitation is essential for good public health. An estimated 884 million people lack access to safe drinking water and contaminated water is responsible for 1.6 million deaths per year, primarily in children under 5 years (Global Water and Sanitation, 2012). World Health Organization (WHO 2012) reported that more than 1 billion people in developing countries lack access to safe water and sanitation. Drinking water quality is an issue of concern for human health, but risks arise from infectious agents, toxic chemicals and radiological hazards.

In developing countries many people lack access to safe water in the household, and are forced to collect water from unsafe water sources outside the household where water quality often is poor (UNICEF, 2008). Inadequate water and sanitation affect human health, especially the health of children. Improvements in water supply and sanitation have historically been documented to benefit health and improve life expectancy (Hrudey *et al.*, 2007). The poor quality of drinking water has been implicated in the spread of waterborne diseases such as cholera, dysentery, hepatitis A and E, giardiasis, and haemolytic uremic syndrome (Montgomery and Elimelech, 2007).

In Uganda, less than 60% of the 26 million people have access to safe water supply or sanitation services (WHO, 2006), over half of the major rivers and associated lakes, wetlands and groundwater or aquifers are contaminated by pollutants implying severe problems for human (UNEP, 2008).

According to the Uganda's Ministry of Water and Environment Report (June, 2012) access to safe water within 1km in the rural areas was 64% (which is a slight decline from 65% which was reported in 2011) mainly as a result of overhead expenditures (from the rural water grant) on the start-up cost in the new districts and reduction in the budget for the fourth quarter of FY2011/12.

According to CEEPA report (2010), 30% of households in Uganda use boreholes as the main source of drinking water. The families that use boreholes are predominantly in rural areas. Piped water is mainly used in urban areas with at least 56% of urban households using water that they get from the tap. Another study also observed that the use of unsafe water sources (unprotected springs and wells and streams, rivers and lakes) is most common in western and central Uganda.

In Namanyonyi Sub County, many people suffered from a lack of access to safe drinking water from improved sources and to adequate sanitation services. As a result, people are still dependent on unprotected water sources such as rivers, streams, springs and hand dug wells. Since these sources are open, they are highly susceptible to flood and contamination due to disposal of wastewater and solid waste which may results into the prevalence of waterborne diseases in the study area as observed during the field survey.

The study aims to quantify *Escherichia Coli* concentration in water in some selected households in Namanyonyi Subcounty, Mbale District

## 2. Materials and Methods

### 2.1. Study Area

The study was conducted in Namanyonyi Sub County. The sub county is located in Mbale District in the eastern part of Uganda (Figure 1). The Sub-county is located in the north of Mbale Municipality where it borders with the northern division between the latitudes 32° 11" E to 34° 14" E and longitudes 1° 6" N to 1° 10" N at an elevation of 1143 metres above the sea level.

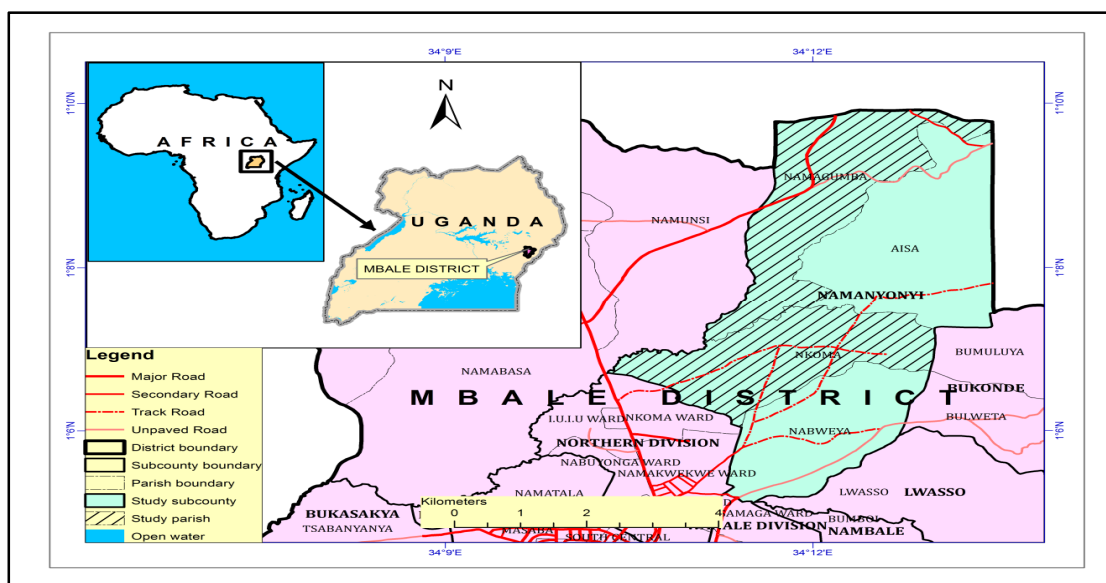


Figure 1: Location of Namanyonyi Sub county in Mbale District

### 2.2. Research Design

An experimental research design was used in this study in other to investigate the presence of *Escherichia Coli* in water.

## 3. Data Collection Methods

### 3.1. Water Sampling procedure

Forty water samples were randomly collected from five households. At each household, eight water samples were collected for two different days of the week for four weeks. Samples were collected in accordance with the Directorate of Water Resources Management, Uganda sampling guide (DWRMU, 2015). The water samples were collected using sterile 250ml glass bottles and transported to the Ministry of Water and Environment Mbale Uganda in ice packs to retain water samples at 4 °C for the laboratory analysis.

### 3.2. Laboratory Water Analysis Method

The samples were analysed for the presence of *Escherichia Coli* using Membrane Filter Method. The method is based on the filtration of knowing volume of water through a membrane filter consisting of a cellulose compound with a uniform pore diameter of 0.45 µm. The bacteria are retained on the surface of the membrane filter after the membrane containing the bacteria is incubated for 18 hours in a sterile container (petri dishes) at appropriate temperature of 37°C or 44°C with a selective culture medium (membrane lauryl sulphate broth) and the colony density is calculated manually using the formula below (APHA, 2005).

$$\frac{\text{Colony forming unit}}{100\text{ml}} = \frac{\text{Number of colonies counted}}{\text{vol.samples used}} \times 100$$

## 4. Methods of Data Analysis

Results from the laboratory analysis were organized in excel sheets and were compared to the standards set by the World Health Organization (WHO) and Uganda's Directorate of Water Resource Management Uganda.

## 5. Results and Discussion

The results indicated microbiological contamination of water quality for the household's storage containers exceeded the World Health Organization and Directorate of Water Resource management recommended guideline value of 0 cfu/100 ml for *Escherichia Coli* counts in drinking water (DWRMU, 2015), this was presented in the Table 1.

Households (n=40)			WHO/100ml	DWRMU/100ml
<b>Household one</b>	Max	9200	0	0
	Min	0		
	Std. dev.	3915.84		
	Mean	2587.5		
<b>Household two</b>	Max	1550	0	0
	Min	180		
	Std. dev.	570.03		
	Mean	622.50		
<b>Household three</b>	Max	2140	0	0
	Min	10		
	Std. dev.	850.08		
	Mean	956.88		
<b>Household four</b>	Max	8120	0	0
	Min	80		
	Std. dev.	3299.90		
	Mean	2041.88		
<b>Household five</b>	Max	9750	0	0
	Min	0		
	Std. dev.	3477.68		
	Mean	2193.25		

Table 1: *Escherichia coli* (cfu/100ml) in Water Samples Collected from the Households  
Source: Field survey (2015).

The table above shows that household one had the highest mean counts of *Escherichia Coli* with 2587.5 cfu/100ml followed by the household five with 2193.25 cfu/100ml and the household four 2041.88 cfu/100ml. It was also observed that households three and two have the lowest mean counts among the households with 956.88 cfu/100ml and 622.50/100ml. This agrees with the study conducted by Monique (2012) which showed that water at home is likely to be contaminated due to the poor storage conditions of the containers. It also agree with the finding published by Gundry *et al* (Gundry *et al*,2004) which indicated that water from the household storage was more contaminated than water from the water source. The results showed that 12% of source samples were contaminated while in the households storage more than 40% of samples were contaminated.

## 6. Conclusion and Recommendations

The results of the study confirmed the presence of *Escherichia coli* in household drinking water in levels which are higher than the recommended guidelines of World Health Organisation and Directorate of Water Resource and Managements Uganda which increases the risk of waterborne diseases. Factors that increase contamination of water in the households include the following size of the storage containers, transfer of water between containers from collection to storage, hand-water contact and dipping of utensil and bacterial growth within storage containers. The study recommends that improvement in the hygienic conditions and water handling practices will play a pivotal role to prevent water contamination and reduce the waterborne disease burden in the study area.

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