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Water Quality and Management Practices among Residents and Households in Kaptimbor Slum –Kabarnet Town, Baringo County, Kenya

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Abstract:
Treating water at the household level has been shown to be one of the most effective and cost-effective means of preventing water-borne disease. Promoting household water treatment and safe storage (HWTS) ensures vulnerable populations to take charge of their own water security by providing them with the knowledge and tools required to treat their drinking water.
The aim of the study was to assess household water quality management practices among residents and households of Kaptimbor slum in Kabarnet town. The specific objectives were; to establish community's perspective and initiative towards improving water quality and to determine if there is biological contamination of household water. Interviews and administered questionnaires were used to collect data needed for the study. On socio-demographic characteristics of residents' level of education, occupation, income, marital status, number of children, age range of children, and household water quality management practices: training on water safety practices, place of training, major source of drinking water for children, practices for water safety and reasons for not practicing water safety. Water samples were collected and analysed for biological contamination. Data was coded and entered using SPSS. A correlation analysis was done between socio-demographic lifestyle behaviours, and water quality management practice and also relationship between faecal contamination of water and household water quality management practices. Data were analysed and presented in tables, graphs and pie charts. A total of 112 households participated in the study. 97.2% of the respondents were married, 58.6% had attained primary education while 51% indicated they were unemployed, 85.4% earned an income of less than USD 10 a month, 52% had less than five children. 65.2% had undergone some form of training on water safety. 42.7% of households practiced boiling, 8.1% chemical treatment, 0.8 % hand washing before handling drinking water. Most households (90.7% in the slum used stored water collected from communal piped water points. The samples collected from the communal water points tested negative for coliform bacteria. At the household level, 11.2% samples of water had coliform bacteria contamination above 10 counts/100ml which is not fit for drinking while 18% of water samples tested positive for E. coli. There was a strong positive correlation between socio-demographic lifestyle behaviours and household water quality management practices variables whereby Pearson's r was 0.778. There was a moderately strong positive and significant correlation between Community's perspective and Household water quality management practices (r=0.601, p= 0.000).
The study concluded that the households in Kaptimbor with children aged under six years (pre-school going and below) had parents/guardians who were married, had primary level of education, were either unemployed or in business with an income of less than USD 10. Majority of parents/guardians had received training on water safety but few practiced water treatments. There was post-source contamination of water.
It was recommended that Parents/guardians should embrace initiatives of promoting household water treatment and safe storage in collaboration with the community. Health education should be provided to the community on the importance of treating water at point of use.

Keywords: *Acute respiratory infection, confidence interval, national water quality management strategy, population services international, shallow water active kit, safe water system, volatile organic compounds, water sanitation and hygiene*

1. Introduction

The main aim of water management practices in the local communities is to promote access to clean water among the local people. This is in-line with the Millennium Development Goals related to poverty reduction, lowering of child mortality rates, and improvement of maternal health. As part of its Millennium Development Goals, the United Nations expressed its commitment to reduce by one half the number of people without sustainable access to safe drinking water by the year 2015. Current estimates are that there are still over a billion people who cannot access clean water (WHO/UNICEF 2006). Studies show that at the household level, contamination of stored water is even more common. Only 43.6% of samples from stored water were in compliance with the WHO guideline value and national standards, and more than half of household samples showed post-source contamination. Drinking water which is safe at the source is subject to frequent and extensive faecal contamination during collection, storage and use in the home (Wright, 2004).

Treating water at the household level and promoting household water treatment and safe storage helps vulnerable populations to take charge of their own water security by providing them with the knowledge and tools to treat their own drinking water (Daniele & Mintz, 2011)

Water treatment should remove existing water contaminants or so reduce their concentration so that water becomes fit for its desired end-use (Boisson & Clasen, 2013). According to Columbia Basin Trust (2013), Water quality is the term used to describe the condition of water—its physical, chemical and biological characteristics. Measuring the level of these conditions tells us if water is suitable for human consumption or any other purposive use.

Water management practices include the activity of planning, developing, distributing and managing the optimum use of water resources (Chemuliti & Njeru, 2002).

According to Arnold, and Colford, (2007), Prior to the introduction of Water-Guard in 2003, household treatment of water was virtually unknown in Kenya. Less than 10 percent of the population had ever used water treatment product.

Drinking water can be easily treated and many non-governmental organizations (NGOs) are working on water treatment programs. A very popular focus of these programs is the treatment of water at the point of use. This differs from the centralized treatment commonn in developed countries, where the water is treated in a central treatment facility and then delivered via a piped infrastructure (Doocy & Burhnam, 2006).

Unsafe drinking water, along with poor sanitation and hygiene, are the main contributors to an estimated 4 billion cases of diarrhoeal disease annually, causing more than 1.5 million deaths, mostly among children under 5 years of age (WHO 2005).

The main aim therefore is to highlight the importance of household water treatment even when the source is expected to be good.

1.1. Statement of the Problem

Kabarnet town gets its water from Kirdam Dam in Kituro location. The source produce over 20,200m^3 of water per day. It is operated and maintained by Kabarnet Water and Sewerage Company. While most of the water distributed to consumers is treated, water from wells remains untreated. The water system is inadequate with only about 60,000 households within the municipality being covered. Areas that are relatively well covered include; Central Business District and its environs, Kapropita and Kaprogonya. Areas underserved include;

Kaptimbor, Show ground area and Kapkuut. The chosen area has been having water related problems despite the efforts of the Kabarnet Municipal Council and the Kabarnet Water supply and Sewerage Company trying to improve water access and sanitation in the area.

According to the Water Act (2002), the government should be able to manage and conserve water resources and also provide sewerage services to its citizen. This has not been the case for the poor and this study therefore establish the gaps in such social classes.

1.2. Justification

Access to safe drinking-water is important as a health and development issue at the national, regional and local level. In some regions, it has been shown that investments in water supply and sanitation can yield a net economic benefit, since the reductions in adverse health effects and health care costs outweigh the costs of undertaking the interventions (WHO, 2008).

Safe drinking-water does not present any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Those at greatest risk of waterborne disease are infants and young children, people who are debilitated or living under unsanitary conditions and the elderly (WHO, 2008). Therefore, children being vulnerable, it is logical to study children under five (pre-school and infants). Moreover, Kaptimbor area is unsanitary in terms of physical hygiene whereby sometimes latrines get flooded during long rainy seasons.

According to study in India testing household based drinking water chlorination on diarrhoea among children under five, the results indicate that the prevalence of diarrhoea among intervention children was 1.69% compared to 1.74% among controls (Boisson *et al*., 2013). Also, among intervention's households, only 32% of water samples tested positive for residual chlorine. This is a clear indication that the study findings were marginally significant at 95%. and there was no evidence in saying that water chlorination decreases diarrhoeal diseases. Therefore, there is need for household interventions to ensure water safety rather than totally relying on municipal chlorine treated water as in the Kenyan context.

Access to sanitation, such as simple latrines in communities, prevents water contamination from human waste and reduces infection. High tech public health measures are not necessarily the best: frequent hand-washing with soap and safe storage of drinking water are high impact practices (WHO, 2008)

Since slums depict general characteristics such as dumping and unsanitary conditions, Kaptimbor slum was chosen. Also, no research has been done on water quality in regards to household practices in the area. Studies on water quality in slums in the past have not captured the said area, probably it is thought that having piped water in the area then there is minimal need to research on water quality. Therefore, there is need to study the area since it depicts the general characteristics of a slum.

1.3. Research Objective

The study was guided by the following research objectives:
To establish socio-demographic characteristics of parents /guardians in households with children aged under five years.
To establish community's perspective and initiative towards water quality management practices
To assess biological quality of water in Kaptimbor slum

1.4. Research Questions

The study was guided by the following research questions:
What are the socio-demographic characteristics of parents /guardians with children under five in relation to household water quality?
What is the community's perspective and initiative towards improving water quality?
Is there biological contamination of household water?

2. Literature Review

More than 3.4 million people die each year from water sanitation and hygiene-related causes. Nearly 99 percent of them occur in the developing world. Unsafe water for drinking and bathing and lack of basic sanitation and hygiene are estimated to claim the lives of 1.5 million children under five years of age every year. Water sanitation and personal hygiene are also linked to many other diseases that kill children and adults living with HIV/AIDS. Because of their weakened immune systems, they are especially susceptible to the debilitating effects of persistent waterborne related diseases (UNICEF, 2007). Interventions to improve the quality of drinking-water provide significant benefits to health (WHO, 2008)

2.1. Sources of Water

In areas where there is a piped water infrastructure, services might be lacking. According to Owuor & Foeken (2009) many of the water utility systems in Kenya are characterized by high water losses, insufficient revenues to cover operating costs, dilapidated and poor functioning infrastructure, lack of investments, low billing and bill collection efficiency, chronic water shortages and failure to meet the existing demand, low coverage and corruption.

Consequently, the urban poor population often use pit latrines and at the same time may fetch domestic water from nearby wells. Overcrowding in slums limits the adequate distance between wells and pit latrines so that micro-organisms migrate from latrines to water sources. Sanitary practices in these overcrowded slums are also poor, leading to contamination of these wells (Chemuliti & Njeru, 2002). Furthermore, poor sanitary practices (for example, disposal of human excreta) in these slums lead to contamination of water and consequently water-borne diseases.

Fodgen (2009), indicates that source of microbial pollution may result from pathogens such as bacteria, viruses and protozo *Escherichia coli*. This may enter drinking water through faecal contamination or may grow in water itself. Drinking water can also become contaminated by chemical pollutants which can enter the water from agricultural and household sources.

Contamination of treated and pipe distributed water was related with distance of the collection point from a utility station. Faults in pipelines increased the rate of contamination ($p<0.5$) and this occurred mostly in densely populated areas with dilapidated infrastructure. Shallow wells were more contaminated than deep wells and boreholes and contamination was higher during period of heavy rainfall ($p<0.05$). and enteric pathogens were isolated from contaminated supplies. A study by (Chindo *et al.2013*) indicates that water samples of wells are heavily contaminated with faecal matter, boreholes also showed significant coliform count.

2.2. Classes of Contaminants

The main classes of contaminants are the physical, biological and chemical contaminants. According to Clasen *et al.,* (2007), these contaminants make water unsafe for consumption

2.3. Physical Contamination

Suspended solids: These are basically earth or dirt that is in the water. Suspended solids affect how the water looks, giving it a cloudy or muddy appearance (known formally as "turbidity"). In addition, other contaminants may be attached to the suspended sediment particles, including both microbes and chemical contaminants such as the agricultural and industrial pollutants described below. Suspended solids are mainly a problem in surface waters such as rivers.

<u>2.3.1. Salinity</u>

This refers to how salty the water is by measuring the amount of major salts such as sodium, potassium, calcium, magnesium, chloride, sulphate, and carbonate. Salinity is also known as TDS (total dissolved solids). Water with high salinity is not suitable for drinking. Salinity is usually low in surface waters but can be higher in groundwater, particularly along the coastal belt and in dry regions.

<u>2.3.2. Naturally Occurring Trace Contaminants</u>

These include chemicals such as arsenic and fluoride that are harmful for human health when consumed over long periods of time.

Industrial contaminants: These include both heavy metals such as mercury and lead as well as many of the chemicals used in fuels, manufacturing, and processing. Industrial chemicals are more likely to be found in groundwater but also may be found in rivers adjacent to or downstream of zones of heavy industry.

2.3.3. Agricultural Contaminants

The agricultural materials of concern in regard to human health are pesticides, herbicides, and fungicides. These contaminants generally are not immediately dangerous, but if people drink water contaminated with them in high concentrations over long periods of time, they may increase the likelihood of some diseases, including cancers. Agricultural contaminants are primarily found in groundwater from intensively farmed regions and in rivers that are downstream of these areas.

2.4. Biological

Microbes: Waterborne microbes are small organisms that can be harmful to human health. They are divided into three main classes: bacteria (for example, those causing typhoid, cholera, and dysentery), protozoan parasites (such as Giardia and Cryptosporidium), and viruses (such as rotavirus and norovirus). Water contaminated with microbes can cause disease among consumers within a few days of drinking. This can be very dangerous for infants and children. Microbes are likely to be found in all surface waters and shallow groundwater, as well as in poorly operated and maintained municipal water systems. It is rare to find microbes in borehole water, but if the borehole is connected to a poorly managed storage facility or piped network, the water can be contaminated with microbes during storage or distribution.

2.5. Escherichia coli

According to WHO 2014, *Escherichia coli* is a bacterium that is commonly found in the gut of humans and other warm blooded animals. While most strains are harmless, some can cause severe food borne disease. *E-coli* infection is usually transmitted through contaminated water or food, such as undercooked meat products and raw milk.

Enteric *E. coli* are part of the natural flora of many animals, however not all the strains are harmless; some can cause debilitating and sometimes fatal diseases in humans. *E. coli* pathogenic strains are divided into intestinal pathogens causing diarrhoea and extra-intestinal causing a variety of infections. (Kaper *et al.,* 2004). Some types of *E-coli* can cause diarrhoea while others cause urinary tract infections, respiratory illnesses, pneumonia and other related illnesses (CDC 2014). Diarrhoea is a symptom of infection caused by a host of bacterial, viral and parasitic organisms, most of which are spread by faeces in contaminated water. Infections is more when there is shortage of adequate sanitation and hygiene and safe water for drinking, cooking and cleaning. Rotavirus and *Escherichia coli* are two most common etiological agents of diarrhoea in developing countries (WHO 2013).

2.6. Challenges Faced by Slum Residents in Ensuring Household Water Quality Management Practices

The exploding urban population growth creates unprecedented challenges, among which provision for water and sanitation have been the most pressing and painfully felt when lacking. (United Nations-water fact sheet, 2005-2015). However, there is compelling evidence of the health impact of improving microbiological water quality with no accompanying change in water quantity and access (Cutler and Miller, 2005).

Slum's sewerage system is generally poor, and the waste and disposal system dysfunctional. But even this system is not available to residents of settlements as they have limited or no access to the public sewer lines and waste disposal systems. Rudimentary hand-constructed earthen channels acting as open sewers are common in all the settlements. (Amnesty international ,2009)

In these channels, the sewage often comes into contact with drinking water pipes and many times passes right in front of houses. The smell of human waste is always present in flat parts of settlements where the sewage pools and stagnates. Toilets and latrines are limited in all the slum areas. Most residents use the few available pit latrines, often shared by a number of households. There is no system for removing this waste, and people are often forced to pay for the waste to be taken away manually. In some areas in slum settlement, there are no toilets at all. Residents mostly resort to "flying toilets" (small plastic bags used to throw out toilet waste). This is the more reasons why several researchers, in their documents advocate for point of use water treatment. Whereby (Fewtrell, 2005) puts it that point of use water treatment may be more effective than source water quality interventions because of recontamination during transportation and storage.

2.7. Water Treatment Options at Point of Use

To remove or kill the different classes of contaminants, water treatment relies on three levels of water treatment. Technologies and approaches that are used for the microbiological treatment of drinking water in the home notably; disinfection and Chlorination, Filtration and Boiling and Solar Disinfection (Sobsey 2002).

Disinfection is the act of ridding off infection. This is done by killing microorganisms in water, air, on surfaces, etc. Chlorination is the most widely-practised means of treating water at the community level and at the household level. The source of chlorine can be sodium hypochlorite (such as household bleach or electronically generated from a solution of salt and water), chlorinated lime, or high test hypochlorite (chlorine tablets) which are usually available and affordable.

Filtration is a medium for a variety of pathogens or "vectors" of pathogens (like mosquitoes) that are harmful to humans. These include microsporidia, mosquitoes, bacteria, viruses, amoeba, etc., which cause a range of water-related diseases including cholera, dysentery, diarrhea, giardiasis, typhoid, malaria, etc. Waterborne diseases like cholera and diarrhea are contracted when contaminated water is ingested. The only way to make water safe is to filter out or kill the microorganisms that are in the water (Hodges & Ravinder, 2010).

Household filters potentially present certain advantages over other technologies. They operate under a variety of conditions (temperature, pH, turbidity), introduce no chemicals into the water that may affect use due to objections about taste and odour, are easy to use, and improve the water aesthetically, thus potentially encouraging routine use without extensive intervention to promote behavioural change (Hijnen & Medema, 2004)

Higher quality ceramic filters treated with bacteriostatic silver have been shown to be effective in the lab at reducing waterborne protozoa by more than 99.9% and bacteria by more than 99.9999%, and their potential usefulness as a public health intervention has been shown in development and emergency settings (Clasen 2004; 2006).

3. Methodology

Population, sample size and sampling

Study population

The study sampled parents /guardians with children aged five years and below.

The sample size was calculated using the formula: $n=Z2P(1-P)/d^2$ as adopted by Mugenda and Mugenda (1999), where z is the standard deviate =1.96 for a 95% level of significance, p=50%, is the prevalence rate where are no other studies conducted in the locality and d=0.1, which is the degree of accuracy. and n=1.9620.5(1-0.5)/0.12 = 96.04. Therefore, n = 96

10% was included to cater for non-response giving a sample size of 107 respondents.

Purposive sampling technique was used. The overall response rate was 87%. These response rates were considered good when compared to the recommended response rates to verify consistency of measurements required for analysis (over 60%, Kothari, 2005). The participants were parents/guardians in household with children aged five years and below. However, those who declined to participate in the study as well as those who were not permanent residents of the locality were excluded.

3.1. Research Instrumentation

The study administered questionnaires to collect the data for the study.

Non-participatory observation was used to record what may have been captured in the questionnaire such as environmental hygiene within the community. The data captured by use of questionnaire was on socio-demographic characteristics of parents/guardians: level of education, occupation, level of income, marital status, number of children, age range of children, and household water quality management practices: training on water safety practices, place of training, major source of drinking water for children, practices for water safety and reasons for not practicing water safety.

3.1.1. Water Sample Collection and Testing

Water samples were collected from households of research participants. The samples were then tested for the presence of faecal contamination using the Most Probable Number technique (Cheesbrough, 2000). The research representatives washed their hands carefully with soap and water before collecting water sample. Using a sterile 100ml bottle, the bottle cap was removed and water collected from the storage container ensuring that it was well shaken before pouring into the sterile bottle. The bottle cap was then replaced without touching the inside of cap or the mouth of the bottle. The bottles were then clearly labelled according to household identity. Samples were placed in a cool box filled with ice pack, transported to the lab and tested within 24 hours of collection. The double strength sterile media broth (mackonkey broth) was prepared by measuring 40.01g which was suspended in 1000ml of distilled water. The solution was shaken thoroughly and then distributed into fermentation tubes with inverted Durham tubes then sterilized at 121^0C for 15 minutes.

The researcher mixed thoroughly the sampled water by inverting the bottle several times. The fermentation was labelled according to household codes and then tubes were inoculated with water sample whereby 100 ml water sample was distributed (five 10 ml amounts and one 50 ml amount) in bottles of sterile selective culture broth containing lactose and an indicator and incubated at 44^0C for 24 hours. The results were recorded as positive presumptive if there was both acid and gas in any tube showing change of colour of broth from purple to yellow and bubble in the durham tube.

To confirm the positive test, 1ml of water sample was inoculated in a bijou bottle containing 3ml of sterile tryptone water. The tryptone water was prepared by measuring 15g of the medium in 1000ml of distilled water, distributed into a conical flask and sterilised at 121^0C for 15 minutes. The sample was incubated at 35-37 ^{o}c for 48 hours and tested for indole production by addition 0.5ml of kovac's reagent and shaking the mixture gently. If a red surface layer was observed within ten minutes the test was confirmed as positive.

3.2. Mode of Analysis

Data was coded and edited using SPSS version 19. The two scores from the pilot test data was subjected to Pearson's Product Moment Correlation Coefficient Formula to compute reliability coefficient from the research instrument. The data was prepared for analysis by ensuring it met the minimum requirements for qualitative and quantitative analysis. The questionnaires were therefore checked for missing values and unfilled parts as well as for normality of the distribution.

3.3. Research Findings

The study sought to establish the household water quality management practices among parents/ guardians in the household with children aged five years and below in Kaptimbor slum, Kabarnet Municipality. The findings are presented in terms of the response rate, data preparation and screening, demographic characteristics of respondents, household water quality management practices. The findings include both descriptive and inferential analysis results.

The findings showed that 69% of the respondents had undergone the training while 31% had not undergone any training on water safety practices. Most of the trainings were done at schools, in health centres and through social media.

Major sources for children's drinking water

87.4% had piped stored water while 10.6% had direct piped water and 2% used water kiosks

Children consumption of safe water

3.4. Children Consumption of Safe Water

The study attempted to find out the number of children who take safe water. The study showed that 46.2% indicated yes the take safe water while 36.4 said sometimes they consume the safe water while 17j4% indicated they had not consumed safe water in the past six months.

An attempt was made to find out how the respondents practice safe water. The findings are summarised in the table below.

		Frequency	**Percent**	**Cumulative Percent**
	Boiling	39	40.7	40.7
	Chemical treatment	8	8.2	48.9
	Hand washing before handling drinking water	4	4.1	53.0
	Total	51	53.1	
No response		45	46.9	47
Total		96	100	100

Table 1: Practice for water safety

The findings summarised in the above table showed 40.7% practice water safety through boiling, 8.2% practice water safety through chemical treatment, 4.1% practice water safety through hand washing before handling drinking water. However, 47% didn’t respond to question

3.5. Reason for not Practicing Water Safety

The study made effort to find out reasons for not practicing safe water. the findings were summarized in the table below.

		Frequency	**Percent**	**Cumulative Percent**
	Chemical availability	4	8.9	8.9
	Lack of time	19	42.2	51.1
	Cultural aspects	2	4.4	55.5
	Others	20	44.4	100
	Total	45	46.9	
No	Answer provided	52	53.1	
Total		96	100.0	

Table 2: Reason for not practicing water safety

From the table, the results show that approximately 10% noted availability of the required chemicals while 42.2 noted lack of time. However, 44.4% other reasons. In total, 46.9% indicated they practice water safety.

Estimation of Most Probable Number of Feacal Coliform Bacteria of water samples in Kaptimbor Slum					
Volume of sample in each bottle (ml)	50	10		RESULTS	
Number of bottles Used	1	5		Number of tubes	Percentage of tubes
			MPN/100ml		
	0	0	0	44	45.83%
	0	1	1	2	2.08%
	0	2	2	2	2.08%
Number of tubes giving positive reaction	0	3	4	0	0
	0	4	5	1	1.04%
	0	5	7	0	0
	1	0	2	16	16.67%
	1	1	3	13	13.54%
	1	2	6	2	2.08%
	1	3	9	6	6.25%
	1	4	16	4	4.17%
	1	5	18+	6	6.25%
TOTAL				96	99.99%

Table 3: Bacterial contamination of various water treatment and storage options

Water samples from communal water points were tested and all eight (8) were negative for coliform bacteria (0 Counts /100ml)
Presence of E. coli
From the study 19% of water samples tested positive for E. coli while 81% tested negative
Relationship between socio-demographic lifestyle behaviours and household water quality management practices
Results of Pearson's product moment correlation test on the community's perspective and household water quality management practices

		Household water quality management practices Index
Community's perspective Index	Pearson's Correlation Sig. (2 -tailed) N	0.601 .000 96

Table 4

Correlation significant at the 0.01 level (2-tailed)
The results indicate a moderately strong positive and significant correlation between Community's perspective and the Household water quality management practices (r=0.601, p= 0.000).

4.4.3 Relationship between biological contamination of water and Household water quality management practices.

		Household water quality management practices. Index
Faecal contamination of water Index	Pearson's Correlation Sig. (2 -tailed) N	0.836 .000 203

Table 5: Relationship between biological contamination of water and Household water quality management practices. Correlation significant at the 0.01 level (2-tailed)

The results of the correlation test indicated that faecal contamination of water is affected by the Household water quality management practices (r = 0.836, p= 0.000).

4. Discussion

4.1. Socio Demographic Characteristics

The findings indicated that majority 88.4% were married, 11.6% were single while 1% indicated they were widowed. This means that at least every household must be having a child and therefore the practice for water safety was determined. Most married couples tend to be more responsible in ensuring water quality for their children

4.2. Education Level

The adoption of Household Water Treatment and Storage requires changes in behaviour (Figueora and Kincaid, 2010; Mosler, 2012; Mosler and Kraemer 2012). 46.3% of respondents indicated they had attained primary education, 32.2% stated they had secondary education while 6.2% stated none and 5.3% said they had tertiary education. This implied that quite a good number of parents/ guardians in households had attained basic education. These findings revealed that most of the respondents are fairly educated and they are able to act responsibly in the sense that they can be able to take charge of their drinking water by using the knowledge acquired in school to treat and store drinking water in clean covered containers at household level. Furthermore, information acquired from schools is vital for an educated household to have a changed mindset and perception regarding promotion of HWTS.

4.3. Training on Water Safety Practices

Majority of households 54.8% indicated they had undergone the training while 45.2% stated they had not. It is clear from the findings that a good number of parents/ guardians in households had undergone training of water safety practices hence ensuring clean and safe water consumption hence reduce consumption of contaminated water. (WHO, 2008) recommends that support should be provided by a designated authority to enable community members to be trained so that they are able to assume responsibility for the operation and maintenance of community drinking-water supplies.

4.4. Practice for Water Safety

The findings indicated 41.9% of households' practice indicated through boiling, 8.1% said chemical treatment, 2% stated hand washing before handling drinking water. However, 48% didn't respond to question. The number of households that practiced water safety 48% concurs with the (Kenya national census report, 2009) that approximately 50% of households in Kenya treated their drinking water. The study found out that Water treatment by boiling and chemical treatment were frequently practiced by respondents as methods of water treatment, fewer reported hand washing before handling drinking water. Boiling has been the most common form of water safety practice (Clansen, 2008; Doocy and Burhnam, 2006). The low percentage of chemical treatment concurs with (Harris, 2005) whereby there have been several attempts to utilize a purely commercial approach for household POU water treatment systems, but most have met with low levels of adoption and use. It may be costly for the low income earners to purchase chemical treatment and would rather boil since fire is readily available for cooking.

In comparison with other parts of Africa, there are no much variations. The proportion of water treatment recorded by this study was higher than that was found by study done in Arusha by in 2009, but within the range indicated in the Tanzania Demographic Health Survey of 2010 (Lijima 2001). In Egypt it was found that 5.9% of households treated their water with any method (95%CI 5.2-6.7%) filtration and let it stand and settle were the common methods practiced. Also in study done by Ghislaine Rosa by extracting data from national surveys and reports on scope of HWT in 67 countries indicated that the proportion of water treatment by boiling in Uganda were 39.8% and Zambia (15.2%) whereby in Latin America chlorine is practiced by 17.1% of the households while Guinea Bissau (70.9%) and Mali (24.0%) strain drinking water through cloth

5. Conclusions and Recommendations

5.1. Conclusions

Based on the study objectives, various conclusions were drawn.

Majority of the households in Kaptimbor with children aged under five years were married, had primary level of education, were either unemployed or in business with an income of less than USD10 a month.

Majority of parents/guardians had received training on water safety but few practiced water treatments

There was post-source contamination of water.

5.2. Recommendations

In line with the findings and conclusions arrived at, the study recommends that:

Parents/guardians should embrace initiatives of promoting household water treatment and safe storage in collaboration with the community.

Health education should be provided to the community on the importance of treating water at point of use.

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