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REGULAR ARTICLE

Household safe water management in Kisii County, Kenya

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Abstract
Objective Contaminated drinking water can lead to the risk of intestinal and other infectious diseases that lead to high morbidity. Therefore, determining household safe water management practices will benefit billions of people by ensuring there is no recontamination.
Methods A cross-sectional study design was used and a sample of 346 households was selected through systematic random sampling. A questionnaire was then used which was based on the core questions on drinking water and sanitation for household surveys and descriptive analyses were performed for the collected data using SPSS.
Results Springs were predominantly used as the main source of water (97 %). Approximately, over half (58 %) of the sampled households never treated their drinking water to ensure that it was safe for drinking. Mostly (56 %), the households used jerricans for the storage of water with a majority of the households (95 %) covering their containers which were elevated from the reach of children in 52 % of the households.
Conclusions The risks included lack of water treatment, not covering the water container, risk of permitting dipping for those containers, lacking narrow neck and the risk of container being accessible to children. Basic treatment of the water at the household level by use of chemicals, filtration and boiling may have a great impact on the drinking water quality and health of the inhabitants of Kisii County. Also, creation of awareness on the possibilities of spring water being contaminated should be carried because of the assumption that spring water is safe and does not need to be treated.

Keywords Safe water management · Drinking water · Contamination · Recontamination · Household water management

Introduction

Safe and clean drinking water and sanitation was declared a human right on the 28th July 2010 by the United Nations general assembly who voiced their deep concern over 900 million people who lacked access to safe drinking water [1, 2] because of the dangers this poses to the public health. Contaminated drinking water can lead to the risk of intestinal and other infectious diseases that can cause high morbidity [3]. Globally, 80 % of diarrheal cases are due to unsafe water, inadequate sanitation and insufficient hygiene, which result in 1.5 million deaths each year. In developing countries, the total DALYs due to unsafe water is more than 20 % [4]. Point-of-use water quality interventions involving effective household water treatment and safe storage will benefit billions of people by ensuring there is no recontamination and statistics have shown that this can reduce diarrheal episodes by 39 % [5]. Furthermore, improved household water management enhances water quality through simple, acceptable, low-cost interventions at the household and community level which has proved to reduce risks of diarrheal disease and death [6, 7].

The recent WHO and UNICEF joint monitoring programme [8] update puts the figure of people still lacking access to improved sources of drinking water at 700 million, nearly half of which are in the sub-Saharan Africa. However, the number of those without access to safe

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drinking water might be higher because of the recontamination of safe water due to unhygienic handling of water during transport or within the home [5].

A study done in Kisii established that diarrheal illnesses affected up to 35 % of the population [9]. It is, therefore, important to put interventions involving safe storage and residual disinfection among others at the household level. This will prevent recontamination and maintaining the microbiological quality of safe drinking water [7]. The study of household water management will form a baseline in determining household level water quality interventions which will go a great way to help improve the health of those vulnerable [5].

There is commitment to safe household water treatment and storage which has led to the formation of the WHO-sponsored international network promotion that has brought together several stakeholders to improve household water management as a component in water, sanitation and hygiene programmes [7]. The research, therefore, focused on the assessment of household water management in Kisii County, Kenya to understand the practices carried out and shortcomings to inform intervention appropriate strategies.

Materials and methods

Study site

Kisii Central Subcounty is located in Kisii County, Kenya, which is southeast of Lake Victoria (latitude 00 41′0S and longitude 340 46′0E) with a population of 1,152,282. Average rainfall in Kisii is 1500 mm annually, which recharges springs (http://kisii.com/counties accessed 8th July 2014) (Fig. 1).

Study design

A cross-sectional study design was used and a sample of 346 households was selected through systematic random sampling. The households were selected starting from one randomly selected household, then picking every sixth household because of the nature of the water sources whereby several households shared the same water source. For each of the sampled households, the person who was present at the time of visit was interviewed. Informed consent was obtained from all individual participants included in the study. A questionnaire was then used which was based on the core questions on drinking water and sanitation for household surveys [10]. The questions aimed at determining the following key issues:

1. Determining the main source of drinking water.
2. Assessing the closeness or accessibility of the water source and determining who fetches water.
3. To determine whether the water is treated and the methods used.

This information as part of the water quality data was useful in assessing risks related to household water management. Strict observations were made to ensure information given in the household questionnaire corresponded to the actual observations in the surrounding.

Data analysis

Data were entered into SPSS (version 17) and statistical analyses were performed. Descriptive statistics were done in terms of percentages.

Results

Demographic characteristics

The mean age of the respondents was 39.99 years with a majority of the respondents being wives and married at 67.6 and 67.5 %, respectively. The major occupation of the respondents was farming with 65.9 % being farmers and most of them had attained primary level education at 61.8 % with only 13.5 % who were uneducated (Fig. 2).

Water quality in Kisii County

A total of 106 water samples were collected. The types of water sources sampled consisted of 25 springs, 20 wells and 16 rainwater tanks. All the 34 water samples from the wells tested positive for fecal coliforms. Most of the water samples from springs (95.1 %) tested positive for fecal coliforms and samples from rainwater tanks gave the highest water quality with 19 of the 31 water samples (61.3 %) testing positive (Table 1).

The log fecal coliform counts of wells were the highest with a median of 2.4 CFU/100 ml followed by springs (1.9 CFU/100 ml), and then rainwater tanks at 0.5 CFU/100 ml. The variability of fecal coliform concentration in springs was high compared to rain water tanks and wells (Fig. 3).

Water management in the households

Springs were predominantly used as the main source of water with 97 % of the households using them (Fig. 4). The majority of the water sources (92 %) were less than a kilometre and mothers predominantly at 65 % were the ones responsible for fetching water. Approximately, over half (58 %) of the sampled households never treated their drinking water to ensure that it was safe for drinking.

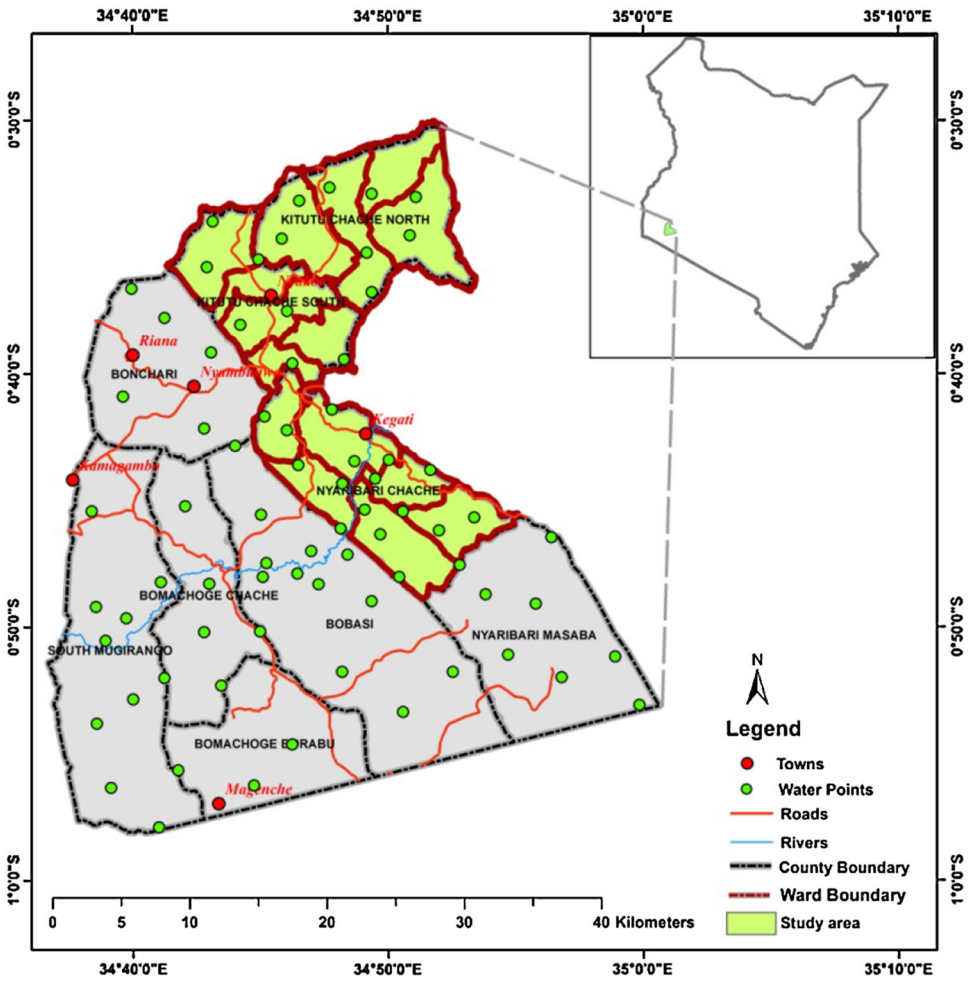

Fig. 1 Kisii County

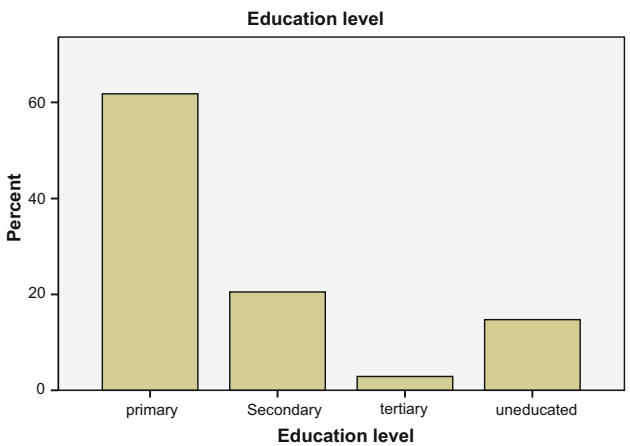

Fig. 2 Level of education of the respondents

Mostly (56 %) the households used jerricans for the storage of water with a majority of the households (95 %) covering their containers which were elevated from the reach of children in 52 % of the households. All the respondents cleaned their containers but the frequency of cleaning the containers differed whereby a majority i.e 62% cleaned them twice in a week (Table 2).

Table 1 Number and percent of water samples positive for fecal coliforms in Kisii County

Facility	Water samples (*n*)	Fecal coliform, *n* (%)
Spring	41	39 (95.1 %)
Well	34	34 (100 %)
Rainwater tank	31	19 (61.3 %)
Overall	106	92 (86.8 %)

Discussion

Most of the households lacked running water; hence, drinking water is usually collected at source and transported to the household where it is stored for consumption. This brings out the importance of understanding the safe water management practices, because this will also determine the quality of water apart from the source characteristic. Water may be of good quality at source but contaminated further or recontaminated at the household. Focusing on community supplies by ensuring they are well

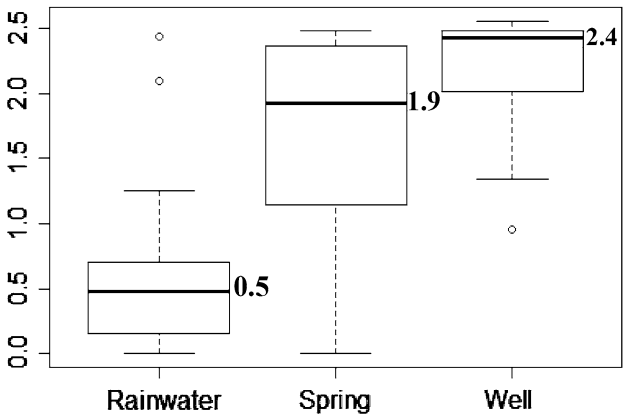

Fig. 3 Contamination levels of the different types of water sources

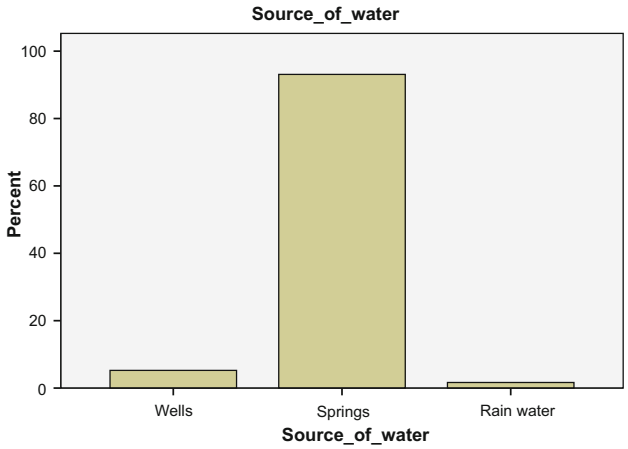

Fig. 4 Type of water source used by the respondents

Table 2 Household water management practices

Household elements	Percentage of households
Water source ($n = 346$)	
Rainwater	4 (1 %)
Springs	336 (97 %)
Wells	6 (2 %)
Water treatment ($n = 345$)	
Boiling	84 (24 %)
Filtering	26 (8 %)
Use of chemicals	34 (10 %)
None	201 (58 %)
Storage of water ($n = 344$)	
Earthen pots	82 (24 %)
Drums	70 (20 %)
Jerricans	192 (56 %)
Covered containers ($n = 339$)	
Yes	322 (95 %)
No	17 (5 %)
Narrow necked containers ($n = 344$)	
Yes	222 (65 %)
No	122 (35 %)
Container elevated ($n = 337$)	
Yes	175 (52 %)
No	162 (48 %)
Cleaning of container ($n = 345$)	
At least daily	53 (15 %)
Twice in a week	215 (62 %)
Once in a week	74 (21 %)
Once in a month	3 (1 %)

protected and making other improvements may be reversed by in-house contamination.

The household questionnaire results showed that there existed several risks at the household. The risk of not treating water for consumption was in 58 % of the households. This may be contributed to the fact that spring water which is a major source of drinking water is viewed as clean and free from any pathogens. Other risks noted included not covering the water container, risk of permitting dipping for those containers, lacking narrow neck and the risk of container being accessible to children. The 48 % of the households where the containers were accessible to children are at risk of contamination since unsupervised children could be pathogen entry route, a fact also observed by Elala [11]. Water that was safe in storage may be contaminated as a result of these risks or unsafe practices, a fact also cited by John [12]. This reinforces the need for safe handling practices at the household level which can be achieved through health education on safe water management practices.

Macharia [13] stated that decline in the microbial quality of water after collection occurred through increased bacterial growth or regrowth in already contaminated water and, therefore, proper water management at the household level is tied to determination of fecal contamination at the source whereby amplification of bacteria occurs, especially where no treatment method is used.

Majority of the households (62 %) cleaned their containers twice in a week which was also observed in another study [12], whereby the frequency of cleaning varied from once a day to once every 2–3 days. This is a good practice of ensuring that there is no growth of bacteria in the container. Simple, acceptable, low-cost interventions at the household level can lead to an improvement of water quality stored at the household which eventually leads to reduction in diarrheal diseases [6, 7].

Conclusion

Household safe water management in Kisii County, Kenya should be improved. This is because of the 58 % respondents who never treated their water. In spite of practicing the other safe water management practices, this may render the drinking water unsafe. Basic treatment of the water at the community or household level by use of chemicals, filtration and boiling should be promoted through the County government of Kisii under the public health department. These interventions may have a great impact on the drinking water quality and, subsequently, on the health of the inhabitants of Kisii County. Creation of awareness on the possibilities of spring water being contaminated should be carried because of the assumption that spring water is safe and does not need to be treated.

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Compliance with ethical standards

Conflict of interest The author declares that he has no conflict of interest.

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