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Perceptions, Adoption, and Safe Water Handling Practices among Households in Borama District, Somaliland: A Community-Based Cross-Sectional Study

yasin Ali

yasinmaxamed050@amoud.edu.so

Amoud University

vitalis Okoth

Amoud University

Mirrium Mutuku

Amoud University

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Abstract

Background

Unsafe drinking water remains a major public health challenge globally, particularly in low- and middle-income countries where access to safely managed drinking water services is limited. Household water treatment (HWT) has been recognized as an effective intervention for improving water quality and reducing the transmission of waterborne diseases. However, adoption of household water treatment methods is often influenced by community perceptions, awareness, and behavioral factors. This study assessed perceptions and adoption of household water treatment methods among households in Borama District, Somaliland.

Methods

A community-based cross-sectional study was conducted among 165 households selected from Sheikh Osman, Sheikh A. Salan, and Qoorgaab villages in Borama District, Somaliland. Data were collected using a structured interviewer-administered questionnaire. Information was obtained on awareness of waterborne diseases, knowledge of household water treatment methods, perceptions regarding water treatment, motivations for treatment, treatment practices, water storage practices, and willingness to receive training. Data were analyzed using SPSS version 26 and summarized using frequencies and percentages.

Results

Among the respondents, 70.9% had heard about waterborne diseases, while 96.4% were aware of at least one household water treatment method. Boiling was the most recognized treatment method (83.6%) and was perceived as the safest method by 82.4% of respondents. Most participants (92.1%) considered treating drinking water very important, and 70.3% agreed that water should be treated even when the source appears clean. Disease prevention was the primary motivation for household water treatment (90.9%). Although 55.2% reported treating their drinking water, only 17.0% indicated that they always treated water before consumption. Boiling was the most commonly used treatment method. Most households stored drinking water in covered containers (69.1%) and reported cleaning storage containers weekly (80.0%). Furthermore, 93.3% expressed willingness to receive training on safe water treatment.

Conclusion

Households in Borama District demonstrated substantial awareness of household water treatment methods and generally perceived water treatment as important for preventing disease. However,

consistent adoption of water treatment practices remained limited. Strengthening community-based education and practical training programs may improve uptake and sustained use of effective household water treatment methods and contribute to reducing the burden of waterborne diseases in Somaliland.

Trial Registration

Not applicable. This study was a cross-sectional observational study and did not involve any clinical intervention, randomization, or trial registration.

Introduction

Access to safe drinking water is a fundamental requirement for human health and well-being. Despite considerable global progress in water supply coverage, unsafe drinking water remains a major contributor to the burden of infectious diseases, particularly in low- and middle-income countries. Contaminated drinking water is associated with a wide range of waterborne diseases, including cholera, typhoid fever, hepatitis A, and other gastrointestinal infections. The World Health Organization (WHO) estimates that unsafe water, sanitation, and hygiene contribute substantially to preventable morbidity and mortality worldwide, especially among vulnerable populations such as children and rural communities [1]

Household water treatment (HWT) has emerged as an important public health intervention for improving drinking water quality at the point of use. Common household water treatment methods include boiling, chlorination, filtration, and solar disinfection. These methods can reduce microbial contamination and provide an additional barrier against waterborne pathogens when access to safely managed water supplies is limited. Studies conducted in various low-resource settings have demonstrated that appropriate household water treatment practices can significantly reduce the risk of diarrheal diseases and improve overall household health outcomes [2]

Although awareness of household water treatment methods has increased in many developing countries, adoption and consistent use of these methods remain suboptimal. Research has shown that knowledge alone is often insufficient to promote sustained behavioral change. Household perceptions regarding treatment effectiveness, convenience, cost, and necessity play a critical role in influencing adoption decisions. Understanding community perceptions and preferences is therefore essential for designing interventions that encourage safe drinking water practices [3].

In sub-Saharan Africa, access to safe drinking water continues to be a major public health concern. Several studies have reported gaps between awareness of household water treatment methods and their actual use. While households may recognize the importance of water treatment, practical, social, and behavioral factors frequently limit consistent implementation. Furthermore, preferences for specific treatment methods vary across communities and may influence treatment uptake and long-term sustainability [4].

In South Africa, despite the effort made by the government in terms of the provision of clean water for all and the stipulations of “access to safe drinking water for all” in the South African Constitution, access to a sustainable potable water supply is still lacking, especially in rural areas. In spite of reports highlighting that the country achieved the Millennium Development Goal (MDG) 7, which aimed to halve the number of people without access to safe drinking water, the survey conducted by Statistics South Africa in 2016 showed that almost 2.6 million of the 16.8 million households surveyed did not have acceptable access to safe drinking water. The South African communities without an adequate water supply are left with no choice but to collect water from any available sources, which may pose a health risk to their lives. The aim of the United Nations Sustainable Development Goal (SDG) 6 is to ensure the availability and sustainable management of water and sanitation for all; however, water that meets the international standards for quality might not be achieved due to financial, infrastructure, and human capital constraints [5]

Several outbreaks of illnesses have resulted from microbiological drinking water pollution, including in Ethiopia. In Ethiopia, a legally binding drinking water quality standard was established by the National Quality and Standards Authority in 2001.This Act mandates drinking water suppliers to monitor drinking water; enforce a water protection plan, and take all practical measures to ensure safe water supply. Despite these robust set of standards, a subset of the population remains for whom no such drinking water quality and safety legislation exists. Rural households relying on self-supplied drinking water, such as bores (also referred to as ‘wells’) and rainwater must take full responsibility for the development, including investment in the construction, upgrading, and upkeep of their water sources, lifting devices, storage facilities, and treatment of their drinking water [6].

In Somaliland, evidence regarding household perceptions and adoption of water treatment methods remains limited. Existing studies have primarily focused on general knowledge, attitudes, and practices related to water treatment, with limited attention to specific treatment preferences, motivations for treatment, and household adoption patterns. Understanding how households perceive available water treatment options and which methods they choose to use is important for informing water, sanitation, and hygiene interventions aimed at improving drinking water safety [7].

Despite the recognized effectiveness of household water treatment methods, their adoption remains inconsistent in many low-resource settings. In Somaliland, access to safe drinking water continues to be a public health concern, particularly in rapidly growing urban and peri-urban communities. Although households may be aware of water treatment methods, little is known about how they perceive these methods, which methods they prefer, and the extent to which they adopt them in daily practice. The limited availability of evidence on household perceptions and adoption of water treatment methods constrains the development of targeted interventions aimed at improving drinking water safety and preventing waterborne diseases.

Therefore, this study aimed to assess perceptions, adoption, and household water handling practices related to drinking water treatment among households in Borama District, Somaliland.

Study Objectives

General Objective

To assess perceptions and adoption of household water treatment methods among households in Borama District, Somaliland.

Specific Objectives

1. To assess awareness of waterborne diseases among households in Borama District.
2. To determine awareness of household water treatment methods.
3. To identify household perceptions regarding the safest water treatment methods.
4. To assess motivations for household water treatment.
5. To determine the adoption of household water treatment methods.
6. To assess household water storage and cleaning practices.
7. To determine willingness to receive training on safe household water treatment.

Methods

Study Design

A community-based cross-sectional study was conducted to assess perceptions and adoption of household water treatment methods among households in Borama District, Somaliland.

Study Area

The study was conducted in Borama District, Awdal Region, Somaliland. Borama is one of the major urban centers in Somaliland and serves as the administrative capital of the Awdal Region. The district comprises urban and peri-urban communities that rely on various water sources for domestic use. The study was carried out in three selected villages, namely Sheikh Osman, Sheikh A. Salan, and Qoorgaab.

Study Population

The study population consisted of households residing in Sheikh Osman, Sheikh A. Salan, and Qoorgaab villages in Borama District. Household heads or adult household representatives aged 18 years and above who were available during the data collection period were interviewed.

Inclusion and Exclusion Criteria

Households that had resided in the selected villages for at least six months and whose household head or an adult representative was willing to participate were included in the study. Visitors and individuals

who were unable to provide informed consent were excluded.

Sample Size and Sampling Procedure

The sample size for this study was determined using the single population proportion formula:

[n = \ frac {Z^2 p (1-p)}{d^2}] where:

n = required sample size

Z = standard normal value corresponding to a 95% confidence level (1.96)

p = estimated proportion of households practicing household water treatment. In the absence of a reliable local estimate, a proportion of 50% was used to obtain the maximum sample size

d = margin of error set at 5%

Using these assumptions, the minimum sample size was calculated as 384. Because the study was conducted within selected communities and under limited time and logistical resources, a feasible sample of 165 households was included in the study. The sample was proportionally allocated across the three selected villages based on household availability and the planned field distribution.

Data Collection Instrument and Procedures

Data were collected using a structured interviewer-administered questionnaire developed from relevant literature on household water treatment and waterborne disease prevention. The questionnaire consisted of four sections. Section A collected socio-demographic information, Section B assessed knowledge of waterborne diseases and household water treatment methods, Section C assessed perceptions regarding water treatment, and Section D assessed household water treatment practices, water storage, and cleaning practices. The questionnaire included items on awareness of waterborne diseases, knowledge of water treatment methods, perceptions regarding the importance and safety of water treatment, motivations for treating drinking water, current treatment practices, water storage practices, and willingness to receive training on safe water treatment.

Study Variables

The main outcome variables were household perceptions and adoption of water treatment methods. Perception-related variables included awareness of waterborne diseases, awareness of household water treatment methods, perceived importance of water treatment, trust in water sources, perceived safest water treatment method, motivations for water treatment, and willingness to receive training on safe water treatment. Adoption-related variables included current household water treatment practices,

frequency of water treatment, treatment methods used, drinking water storage practices, and cleaning frequency of water storage containers.

Data Quality Assurance

The questionnaire was reviewed for clarity and completeness before data collection. Data collectors were oriented on the objectives of the study and administration of the questionnaire. Completed questionnaires were checked daily for completeness and consistency before data entry and analysis.

Data Management and Analysis

Data were entered, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize the study findings. Frequencies and percentages were calculated and presented in tables and narratives to describe respondents' perceptions and adoption of household water treatment methods.

Ethical Considerations

Ethical approval

for the study was obtained from the relevant institutional ethics review prior to data collection. Permission to conduct the study was obtained from local administrative authorities. Written informed consent was obtained from all participants before participation. Confidentiality and anonymity of respondents were maintained throughout the study by ensuring that no personal identifiers were recorded. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Results

Table 1
Sociodemographic Characteristics of Respondents (N = 165)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)			
	18–25	65	39.4
	26–35	56	33.9
	36–45	23	13.9
	Above 50	21	12.7
Gender	Male	75	45.5
	Female	90	54.5
Level of Education	No formal education	22	13.3
	Primary	17	10.3
	Secondary	43	26.1
	Tertiary	83	50.3
Marital Status	Single	100	60.6
	Married	60	36.4
	Divorced	5	3.0
Residency	Sheikh Osman	64	38.8
	Sheikh Ahmed Salan	61	37.0
	Qoorgaab	40	24.2

Table 1 presents the sociodemographic characteristics of the respondents. The majority of respondents were aged 18–25 years (39.4%, n = 65), followed by those aged 26–35 years (33.9%, n = 56). Female respondents constituted 54.5% (n = 90) of the sample, while males accounted for 45.5% (n = 75). Half of the respondents had attained tertiary education (50.3%, n = 83), whereas 26.1% (n = 43) had secondary education. Most participants were single (60.6%, n = 100), while 36.4% (n = 60) were married. Regarding residency, respondents were relatively evenly distributed across the study areas, with 38.8% (n = 64) residing in Sheikh Osman, 37.0% (n = 61) in Sheikh Ahmed Salan, and 24.2% (n = 40) in Qoorgaab

Table 2
Awareness of Waterborne Diseases among Households (N = 165)

Variable	Frequency (n)	Percentage (%)
Heard about waterborne diseases (Yes)	117	70.9%
Heard about waterborne diseases (No)	48	29.1%
Cholera	142	86.1%
Typhoid	15	9.1%
Hepatitis A	8	4.8%

Table 2 shows the level of awareness of waterborne diseases among households in Borama District. More than two-thirds of respondents (70.9%, n = 117) reported having heard about waterborne diseases, while 29.1% (n = 48) had not. Among those aware of waterborne diseases, cholera was the most commonly identified disease (86.1%, n = 142), followed by typhoid (9.1%, n = 15) and hepatitis A (4.8%, n = 8). These findings suggest that awareness of waterborne diseases was relatively high among households, with cholera being the most recognized waterborne disease in the study area.

Table 3
Awareness of Household Water Treatment Methods (N = 165)

Variable	Frequency (n)	Percentage (%)
Aware of at least one treatment method	159	96.4%
Not aware of treatment methods	6	3.6%
Boiling	138	83.6%
Chlorination	10	6.1%
Filtration	12	7.3%
Solar disinfection (SODIS)	5	3.0%

Table 3 presents respondents' awareness of household water treatment methods. Nearly all households (96.4%, n = 159) were aware of at least one method of treating drinking water, while only 3.6% (n = 6) reported no awareness of any treatment method. Boiling was the most commonly recognized household water treatment method (83.6%, n = 138), followed by filtration (7.3%, n = 12), chlorination (6.1%, n = 10), and solar disinfection (3.0%, n = 5). These findings indicate a high level of awareness of household water treatment methods among respondents, with boiling being the predominant method known within the community.

Table 4
Household Perceptions Regarding Water Treatment (N = 165)

Variable	Frequency (n)	Percentage (%)
Untreated water can cause illness (Yes)	120	72.7%
Untreated water can cause illness (No/Not sure)	45	27.3%
Water treatment is very important	152	92.1%
Water treatment is somewhat/not important	13	7.9%
Treatment is necessary even when water appears clean (Yes)	116	70.3%
Treatment is not necessary/not sure	49	29.7%

Table 4 summarizes household perceptions regarding water treatment. The majority of respondents (72.7%, n = 120) believed that untreated water can cause illness, while 27.3% (n = 45) either disagreed or were uncertain. Most households (92.1%, n = 152) considered water treatment to be very important, whereas only 7.9% (n = 13) viewed it as somewhat important or not important. Additionally, 70.3% (n = 116) agreed that drinking water should be treated even when it appears clean, while 29.7% (n = 49) believed treatment was unnecessary or were unsure. These findings indicate generally positive perceptions toward household water treatment and recognition of its importance in preventing waterborne diseases.

Table 5
Perceived Safest Household Water Treatment Method (N = 165)

Method	Frequency (n)	Percentage (%)
Boiling	136	82.4%
Chlorination	12	7.3%
Filtration	8	4.8%
Solar disinfection (SODIS)	1	0.6%
Do not know	8	4.8%

Table 5 presents respondents' perceptions of the safest household water treatment method. The majority of households (82.4%, n = 136) identified boiling as the safest method for treating drinking water. Smaller proportions considered chlorination (7.3%, n = 12), filtration (4.8%, n = 8), and solar disinfection (0.6%, n = 1) to be the safest options. Additionally, 4.8% (n = 8) of respondents were unsure of the safest water treatment method. These findings indicate a strong preference for boiling as the most trusted and perceived effective household water treatment method among respondents.

Table 6
Motivations for Household Water Treatment (N = 165)

Motivation	Frequency (n)	Percentage (%)
Disease prevention	150	90.9%
Advice from health workers	5	3.0%
Affordable	4	2.4%
Because others do it	5	3.0%
Other	1	0.6%

Table 6 presents the motivations reported by households for treating their drinking water. Disease prevention was overwhelmingly the primary motivation, cited by 90.9% (n = 150) of respondents. A small proportion reported being motivated by advice from health workers (3.0%, n = 5), social influence because others treat their water (3.0%, n = 5), and affordability of treatment methods (2.4%, n = 4). Only 0.6% (n = 1) reported other motivations. These findings suggest that the prevention of waterborne diseases is the dominant factor influencing household water treatment practices in the study area.

Table 7
Adoption of Household Water Treatment Methods (N = 165)

Variable	Frequency (n)	Percentage (%)
Currently treat drinking water (Yes)	91	55.2%
Currently treat drinking water (No)	74	44.8%
Always treat water	28	17.0%
Sometimes treat water	46	28.0%
Rarely treat water	17	10.3%
Boiling	60	36.4%
Chlorine tablets/liquid	19	11.5%
Filtration	20	12.1%
Solar disinfection (SODIS)	0	0%
Other	0	0%

Table 7 presents the adoption of household water treatment methods among respondents. More than half of the households (55.2%, n = 91) reported currently treating their drinking water, while 44.8% (n = 74) did not practice any form of water treatment. Regarding the frequency of treatment, 17.0% (n = 28) reported always treating their water, 28.0% (n = 46) treated water sometimes, and 10.3% (n = 17) treated water rarely. Among households that practiced water treatment, boiling was the most commonly used

method (36.4%, n = 60), followed by chlorine tablets or liquid (11.5%, n = 19) and filtration (12.1%, n = 20). None of the respondents reported using solar disinfection or other treatment methods. These findings indicate that while awareness and positive perceptions of water treatment were high, consistent adoption and regular use of household water treatment methods remained relatively limited.

Table 8
Water Storage and Cleaning Practices (N = 165)

Variable	Frequency (n)	Percentage (%)
Covered container	114	69.1%
Open container	36	21.8%
Bottled water	13	7.9%
Other	2	1.2%
Daily cleaning	22	13.3%
Weekly cleaning	132	80.0%
Monthly cleaning	6	3.6%
Rarely cleaning	5	3.0%

Table 8 summarizes household water storage and cleaning practices among respondents. The majority of households (69.1%, n = 114) stored their drinking water in covered containers, while 21.8% (n = 36) used open containers. Smaller proportions relied on bottled water (7.9%, n = 13) or other storage methods (1.2%, n = 2). Regarding container hygiene, most households (80.0%, n = 132) reported cleaning their water storage containers weekly. In contrast, 13.3% (n = 22) cleaned containers daily, 3.6% (n = 6) cleaned them monthly, and 3.0% (n = 5) rarely cleaned them. These findings indicate generally favorable water storage and handling practices, with most households using covered containers and regularly cleaning their water storage containers.

Table 9
Willingness to Receive Training on Safe Water Treatment (N = 165)

Response	Frequency (n)	Percentage (%)
Yes	154	93.3
No	11	6.7

Table 9 presents respondents' willingness to receive training on safe household water treatment. The vast majority of households (93.3%, n = 154) expressed willingness to receive training on safe water treatment practices, while only 6.7% (n = 11) were not willing to participate in such training. These findings indicate a high level of interest among households in acquiring additional knowledge and skills

related to safe water treatment, highlighting an opportunity for community-based education and capacity-building interventions to improve drinking water safety.

Overall, the findings indicate that households in Borama District demonstrated high awareness of waterborne diseases and household water treatment methods. Most respondents had heard of waterborne diseases, with cholera being the most recognized disease, and nearly all households were aware of at least one water treatment method, particularly boiling. Perceptions toward water treatment were generally positive, as the majority believed that untreated water can cause illness, considered water treatment very important, and supported treating water even when it appears clean.

Boiling was widely perceived as the safest household water treatment method and was also the most commonly practiced treatment method. Disease prevention emerged as the primary motivation for treating drinking water. Although more than half of households reported treating their drinking water, only a relatively small proportion consistently treated water before consumption. Most households practiced safe water storage by using covered containers and regularly cleaning storage containers. Furthermore, there was a strong willingness among respondents to receive training on safe water treatment practices. Collectively, these findings suggest that while awareness and perceptions regarding household water treatment are favorable, efforts are needed to improve the consistent adoption of water treatment practices among households in Borama District.

Discussion

This study assessed perceptions and adoption of household water treatment methods among households in Borama District, Somaliland. The findings showed high awareness of waterborne diseases and household water treatment methods, generally positive perceptions toward water treatment, moderate adoption of household water treatment practices, relatively favorable water storage and handling practices, and a strong willingness among households to receive training on safe water treatment.

The study found that most respondents were aware of waterborne diseases and household water treatment methods, with cholera being the most commonly recognized waterborne disease and boiling being the most widely known treatment method. This finding is consistent with evidence from Ethiopia, where household awareness of water treatment options has also been reported to be high. For example, a study in Southern Ethiopia reported substantial awareness of household water treatment methods, with boiling being the most commonly recognized and practiced option [8], while a study in Burie Zuria, Northwest Ethiopia similarly found that many rural households were familiar with household water treatment approaches[9].The high level of awareness observed in the present study suggests that households in Borama District may have been exposed to health information related to water safety and waterborne disease prevention; however, awareness alone does not necessarily guarantee the regular adoption of safe water treatment practices.

Households in the present study also demonstrated generally positive perceptions regarding water treatment. Most respondents believed that untreated water can cause illness, considered water treatment to be very important, and agreed that drinking water should be treated even when it appears clean. In addition, boiling was overwhelmingly perceived as the safest household water treatment method. These findings suggest that respondents recognized the health benefits of treating drinking water and had confidence in the effectiveness of boiling as a preventive measure against waterborne disease. Similar findings have been reported in Ethiopia and Nigeria, where households recognized household water treatment as an important strategy for improving drinking water safety, and where boiling was among the most trusted or commonly used methods [8], [10]. The strong preference for boiling in this study may be explained by its familiarity, perceived effectiveness, and low technological requirements compared with other treatment methods such as filtration or solar disinfection.

Despite the high awareness and favorable perceptions observed in this study, only slightly more than half of households reported currently treating their drinking water, and consistent treatment was even less common. This suggests a gap between awareness and actual practice. Similar discrepancies have been documented in other African settings. In Southern Ethiopia, household water treatment practice was reported at 34.3%[8], while a study in Sodo Zuria District found a prevalence of 44.1%[11]. Likewise, in Osun State, Nigeria, only 27.2% of households reported treating their drinking water[10]. Together, these findings indicate that awareness and positive perceptions do not always translate into sustained household water treatment practice. Possible explanations include the time and fuel required for boiling, limited access to treatment materials such as chlorine products or filters, the perceived cleanliness of source water, and the inconvenience of treating water consistently at household level. Boiling was the dominant treatment method in the present study, both in terms of perceived safety and actual use, which is consistent with findings from Ethiopia and Nigeria where boiling remains one of the most accessible and widely practiced point-of-use treatment methods[8], [10], [11].

The study further showed that disease prevention was the primary motivation for household water treatment, indicating that health concerns remain a major driver of safe water practices. In addition, most households stored drinking water in covered containers and cleaned their storage containers regularly, reflecting generally favorable water handling behaviors. These practices are important because contamination can occur after water collection or even after treatment if water is stored or handled unsafely. Similar evidence from Northwest Ethiopia has shown high use of covered storage containers[12], while studies from Uganda and Ethiopia have emphasized that regular cleaning of storage containers, hygienic water withdrawal, and safe storage are essential components of household drinking water safety[13]. The relatively favorable storage and cleaning practices observed in the present study may therefore help reduce the risk of post-collection contamination, although safe storage alone cannot compensate for inconsistent treatment of microbiologically unsafe water.

A notable finding of this study was the very high willingness among respondents to receive training on safe household water treatment. This suggests a strong demand for community-based education and capacity-building interventions. Although willingness to receive training is not always directly assessed

in comparable household water treatment studies, broader evidence from sub-Saharan Africa indicates that health education, practical demonstrations, and community-level promotion are important for improving household water treatment uptake [9], [14]. A recent systematic review and meta-analysis from sub-Saharan Africa similarly emphasized the need to strengthen household water treatment practices through education and behavior-change strategies [14]. The high willingness to receive training observed in this study presents an important opportunity for public health authorities, non-governmental organizations, and water, sanitation, and hygiene programs to promote consistent water treatment, safe water handling, and the use of appropriate point-of-use treatment methods. Such interventions could help bridge the gap between awareness and practice and contribute to reducing the burden of waterborne diseases in Borama District and similar low-resource settings.

Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional study design limits the ability to establish causal relationships between perceptions and the adoption of household water treatment practices. Second, the study relied on self-reported information, which may have been subject to recall bias or social desirability bias, potentially leading respondents to over report desirable water treatment behaviors. Third, the study was conducted in three selected communities within Borama District; therefore, the findings may not be fully generalizable to all households in Somaliland or other settings with different socio-demographic and environmental characteristics. Finally, the study assessed reported household water treatment and storage practices but did not include microbiological testing of drinking water to verify the effectiveness of the reported practices. Despite these limitations, the study provides valuable insights into household perceptions and adoption of water treatment methods in Borama District and offers evidence that can inform future water, sanitation, and hygiene interventions.

Conclusion

Households in Borama District demonstrated high awareness of waterborne diseases and household water treatment methods, as well as generally positive perceptions toward drinking water treatment. Boiling was the most recognized, most preferred, and most commonly practiced household water treatment method. Nevertheless, the adoption of household water treatment remained only moderate, and consistent treatment of drinking water was not universal despite the high level of awareness and favorable perceptions. Households also reported relatively safe water storage and cleaning practices, while most respondents expressed willingness to receive training on safe water treatment.

The findings indicate that improving household water safety in Borama District will require more than awareness alone. Community-based interventions should focus on translating existing knowledge and favorable perceptions into consistent water treatment behavior through practical training, behavior change communication, and promotion of safe water handling and storage practices. Leveraging the

strong willingness of households to receive training may help improve adoption of household water treatment and reduce the burden of waterborne diseases in similar low-resource settings.

Declarations

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Amoud University Ethics Review Committee. Permission to conduct the study was obtained from the relevant administrative authorities in Borama District, Somaliland. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained throughout the study. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Consent for publication

Not applicable

Competing interests

The authors declare no competing interests.

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Author Contribution

YOA conceptualized the study, developed the study design, collected the data, performed the statistical analysis, interpreted the findings, and drafted the manuscript. VO contributed to the study design, supervised the research process, supported data interpretation, and critically reviewed the manuscript for important intellectual content. MM contributed to the study design, interpretation of the findings, and critical revision of the manuscript. All authors read and approved the final manuscript.

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Data Availability

The data sets used during the current study are available from the corresponding author on reasonable request.

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