# Household Water Treatment Practice and Associated Factors in Gibe District Southern Ethiopia: A Community Based Cross-Sectional Study

Authors: Tafesse, Bereket, Gobena, Tesfaye, Baraki, Negga, Alemeshet Asefa, Yohanis, and Adare Mengistu, Dechasa

Source: Environmental Health Insights, 15(1)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/11786302211060150

# Household Water Treatment Practice and Associated Factors in Gibe District Southern Ethiopia: A Community Based Cross-Sectional Study

Environmental Health Insights
Volume 15: 1–8

DOI: 10.1177/11786302211060150
SAGE

Bereket Tafesse[1], Tesfaye Gobena[2], Negga Baraki[2], Yohanis Alemeshet Asefa[2] and Dechasa Adare Mengistu[2]

[1]Gibe Woreda Enterprise and Industry Development Office, Hadiya, Ethiopia. [2]Department of Environmental Health, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia.

ABSTRACT

**BACKGROUND:** Household water treatment practice or managing water at the point-of-use provides a means of improving drinking water quality and preventing diarrheal diseases. However, evidence regarding household water treatment practice and associated factors in Ethiopia, particularly in Southern Ethiopia are limited. This study was, therefore, designed to assess household water treatment practice and associated factors among households in Southern Ethiopia.

**METHODS:** A community-based cross-sectional study design was conducted among 627 households in Southern Ethiopia. A stratified random sampling technique was used in this study and a pre-tested structured questionnaire was used to collect data about household water treatment practice and associated factors among selected households through face-to-face interviews. The data were analyzed using descriptive statistical tests and binary logistic regression was performed to assess the association between independent and dependent variables. Odds ratio with 95% confidence intervals were used to determine the level of association.

**RESULTS:** This study revealed that the level of household water treatment practice was 34.3% with 95% CI (30.7-38.1) and boiling was the most common method of household water treatment in the study area. Educational status of having formal education (AOR = 2.01, 95% CI = 1.34-3), withdrawing water from storage vessel by dipping (AOR = 1.86, 95% CI = 1.2-2.87) and frequency of fetching water 3 or more times and above a day (AOR = 2.65, 95% CI = 1.45-4.88) were significantly associated with household water treatment practice.

**CONCLUSION:** Household water treatment practice is low in the study area. Educational status of having a formal education, drawing water by dipping, and those who collect their drinking water 3 or more times a day were predictors of household water treatment practice. Thus, efforts should be made to increase the level of household water treatment practice especially among those with no formal education and further studies should be conducted to understand the behavioral factors associated with household water treatment practice.

**KEYWORDS:** Point-of-use water treatment, household, Ethiopia

**RECEIVED:** June 30, 2021. **ACCEPTED:** October 25, 2021.

**TYPE:** Original Research

**FUNDING:** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**CORRESPONDING AUTHOR:** Yohanis Alemeshet Asefa, Department of Environmental Health, College of Health and Medical Sciences, Haramaya University, P.O. Box, 235, Harar, Ethiopia. Email: yohanalem7@gmail.com

## Introduction

Household water treatment and safe storage (HWTS) is the term used to describe the process of treating and safely storing water in home. Household water treatment practice is defined as the use of at least one of household water treatment and safe storage technologies include a variety of devices or methods for treating water in the home, such as boiling, filtration, or chemical disinfection, which are also known as point-of-use (POU) water treatment technologies.[1,2]

When drinking water sources are unsafe, the practice of HWTS can help improve water quality at the point of consumption.[3] The microbial quality of drinking water after collection and storage in the home is deteriorated and there is high possibility of microbial recontamination of drinking water in the household.[4,5] Since household water recontamination can occurred by storage methods after collection, this indicates that the relatively poor effectiveness of water source treatment interventions.[6]

It is estimated that globally every day, diarrheal disease kills 2195 children, outnumbering AIDS, malaria, and measles combined which makes it the second leading cause of death in children under 5 years of age.[7] A significant proportion of diarrheal disease can be prevented through safe drinking water and adequate sanitation and hygiene (WASH).[8-11]

Some recent findings indicated that WASH interventions are unlikely to decrease diarrheal disease and child stunting.[12] However, a wide range of studies indicated that HWTS can improve drinking water quality prior to consumption and it has been found as a cost-effective method that can reduce the risk of diarrhea significantly.[13-16] Even though the benefit of household water treatment practice to decrease the risk of enteric infection is well understood in different studies, there are different hurdles that prevent consistent practice; which includes psychosocial, contextual, and technology-related factors.[17-19]

According to a study based on 67 national surveys, 33.0% of households in these countries treat their drinking water at home and the most common method of household water treatment is boiling, which is used by 21.0% of the study households (598 million people). The practice is more common in the Western Pacific (66.8%) and Southeast Asia (45.4%) regions, while it is less common in the Eastern Mediterranean (13.6%) and Africa (18.2%).[20]

Evidence from Demographic and Health Survey of Sub-Saharan Africa also showed that only 18% of households treat their drinking water appropriately.[21] In Ethiopia, various studies found that efforts to minimize water-borne diseases by treating drinking water at the source were insufficient to reduce water-borne diseases in the country unless drinking water was treated and sanitary handling is practiced at home.[22]

According to Ethiopian demographic and health survey (EDHS) (2016) 97% of urban households and 57% of rural households have access to an improved source of drinking water and the most common sources of drinking water for urban and rural households were piped water in household's yard and public tap respectively.[23] Furthermore, Although the Ethiopian national policy on HWTS plans to achieve safe household water treatment practice by 77% of the households by 2015, the EDHS (2016) report showed only 7% of households in Ethiopia (11% in urban areas and 6% in rural areas) are using appropriate household water treatment methods which includes boiling, adding bleach/chlorine, straining through a cloth, filtering, solar disinfecting, and letting it stand and settle,[23] and there are few studies conducted on household water treatment practice and its associated factors in developing countries particularly in Ethiopia. Therefore the main aim of this study is to fill this gap by identifying the level of household water treatment practice and associated factors among households in Southern Ethiopia and it will enrich literatures available on household water treatment practice and may trigger other researcher to conduct related studies in various parts of the globe.

## Methods

### *Study design and setting*

A community-based cross-sectional study design was employed to study the level of household water treatment practice and associated factors among households of Gibe district, Southern Ethiopia. The district has 22 Kebeles (the smallest administration unit), of these 4 of them are urban kebeles and 18 of them are rural kebeles. Regarding water sources, there are 10 ponds, 2 boreholes, 14 shallow wells, 24 protected, and unprotected springs, 3 pipe water, 40 rivers, and 29 stream waters. The improved water supply coverage of the district is 46.14%.[24,25]

The study was conducted during the period of February 1 to February 20, 2020. All households in the district were the source population and all randomly selected households from the selected kebeles were the study population. Respondents whose age is 18 years and above (preferably female), and who have been living for at least 6 months in the district were included in the study. Whereas, respondents who were seriously ill and could not communicate to give information were excluded from the study.

### *Sample size determination*

The sample size was determined using the formula for a single population proportion with the assumptions that 50% proportion ($P$) of households with water treatment practice (due to absence of previous study in Southern Ethiopia), 5% margin of error ($d$), 95% CI ($Z = 1.96$), design effect ($D$) of 1.5 and 10 non response rate. Thus, the sample size $n = [Z\alpha/2^2 \; P \; (1-P)/d^2] \times D$[26]

$n = [1.96^2 \times 0.5 \; (1-0.5)/(0.05)^2] \times 1.5 = 576$

Therefore, the final sample size after adding 10% non response rate was 633 households (HH).

### *Sampling procedure*

A stratified random sampling technique was used in this study. There were 22 Kebeles in Gibe Woreda, and these kebeles were stratified into 4 urban and 18 rural kebeles. Thus from stratified 18 rural kebeles, 4 kebeles were selected randomly (Haadara = 1285 HH,Halilcho = 1185 HH,Astekarkar = 1239 HH, Sooda = 1340 HH, and Hadaye = 1060 HH) and from stratified 4 urban kebeles 1 kebele (Homecho = 1467 HH) was selected randomly. Then from randomly selected kebeles the total sample size allocated to each kebeles was proportional to the size of households in that specific kebele and we select 121 households from Homecho kebele, 108, 99, 104, 112, and 89 households were selected from Haadara, Halilcho, Astekarkar, Sooda, and Hadaye kebeles respectively. Finally households from each Kebele were selected by systematic sampling method using the health extension family folder as a sampling frame and from each selected household females whose age is above 18 years were interviewed.

### *Variables*

*Outcome variable.* The outcome variable for this study was household water treatment practice (Yes/No) which is dictated as "Yes" if at least one of the following options is practiced at the household; such as boil, add bleach/chlorine, strain through a cloth, use water filter, solar disinfection, let it stand and settle and it is measured by self report.[23]

*Explanatory variables.* The explanatory variables included socio-demographic (Age, sex, educational status, and religion, marital status, occupational status, family size, head of a household, and monthly income), water supply, storage, and hygiene factors.

*Data collection procedures.* The data was collected using a structured and pretested questionnaire which was adapted and modified from similar pieces of literatures.[23,27-34] The adapted questionnaires were modified and contextualized to fit the local situation and the research objective. The questionnaire was composed of 4 parts namely: Socio-demographic and economic, water supply, storage, and hygiene, household water treatment practice, and knowledge on household water treatment practice. The questionnaires were initially prepared in English and then translated into the local language of Hadiyigna by a fluent translator. Again another individual with similar skills translated the Hadiyigna version tool back to English to check for its original meaning. It was then pretested on 5% of households of Gomibora district before actual data collection. The tool was modified based on the findings from the pre-test.

Four college graduates, who can speak the Hadiyigna language, were involved in data collection; and 2 supervisors; Mr. Dereje Tamirat and Mr. Abdulhakim Nesru were recruited. Data were collected through face to face interview method by using a structured questionnaire. The supervisors have supervised the data collection on daily basis, and they also checked the completeness of the filled questionnaires.

*Data quality control.* The quality of data was ensured by proper designing and pre-testing of the questionnaire. Two days of intensive training was also given to the data collectors and supervisors on the data collection process. All data were checked for completeness, clarity, and consistency by the principal investigator and supervisors on daily basis. All of the data was double entered to assure the validity of the data. Simple frequency tables and cross-tabulation was done for missing, outlier, and improvable values and variable.

*Operational definitions.* Knowledge of respondents on household water treatment practice: was respondents' score over total knowledge questions multiplied by 100 and respondents with knowledge score of 70% and above were deemed to have good knowledge, whereas 50% to 69% fair and <50% as poor knowledge.[35]

*Data processing and analysis.* The collected data were checked for completeness and entered into EpiData version 3.01 and exported to SPSS (Statistical Package for Social Science) version 20.0 software packages for data processing and analysis. Descriptive statistical tests such as mean, frequency, and standard deviation were computed. A normality test of the data was done using Kolmogorov Smirnov test. Variables with collinearity coefficients of $\geqslant$.8 were excluded from the model. The independent variables are selected based on previous knowledge from literature review and the final mode is created by using Enter method. Binary logistic regression was done to identify candidate variables for multivariable logistic regression. Crude odds ratio and its 95% confidence intervals of the independent and dependent variables was calculated; and those variables with $P$-value <.25 in binary logistic regression were considered as a candidate for the final model.[36] Multivariable logistic regression analysis with Adjusted Odds Ratio (AOR) was used to control possible confounders and to determine factors associated with household water treatment practice. Model fitness was checked by using the Hosmer-Lemeshow goodness of model fit test and all statistical analysis was set at 5% level of significance (ie, $P < .05$). The interaction between independent variables was checked and Collinearity diagnostics was done by checking the standard error <2 and Variance Inflation Factor (VIF) <10.

*Ethical statement.* Ethical approval was obtained from the Institutional Health Research Ethics Review Committee of Haramaya University, College of Health and Medical sciences. The study participant was informed about the purpose of the study and the importance of their participation in the study then informed, voluntary written and signed consent was obtained. To protect the confidentiality, the data was anonymized and de-identified before being analyzed.

## Results

*Socio-demographic and economic characteristics*

Out of 633 study participants initially sampled in this study, 627 participants responded to a questionnaire making a response rate of 99%. The mean age of respondents was 40.38 (±11.20) years. Among the total respondents, 351 (56%), of them were male-headed household, and the majority of the respondent 368 (58.7%) were not able to read and write. More than half 334 (53.3%), of households, had a family size of $\geqslant$5 members. Regarding the occupational status of respondents, nearly half 324 (51.7%) were farmers, 175 (27.9%), 85 (13.6%), and 43 (6.9%) of them were merchant, government employer, and unemployed respectively and 333 (53.1%) of the respondents monthly average income was between 501 and 999 ETB (Table 1).

*Water supply, storage, and hygiene*

Among the total participants, more than half of them 353 (56.3%) were getting water from piped water source, and a majority of the respondents 588 (93.8%) store their drinking water for 3 or more days; from these households 216 (34.4%), 207 (33%), and 165 (26.3%) of them store their drinking water in a bucket, jerrycan, and clay-pot, respectively. Besides, more than half of respondents 317 (50.6%) reported that they washed their water storage container before storing water, but only 99 (15.8%) of them used detergent/soap for cleansing their water storage container. Out of 627 households, nearly three fourth

**Table 1.** Socio-demographic and economic characteristics of respondents in Gibe district, Southern Ethiopia, February, 2018, $n=627$.

| VARIABLE | CATEGORY | FREQUENCY | PERCENT |
|---|---|---|---|
| Head of the household | Male | 351 | 56.0 |
| | Female | 276 | 44.0 |
| Age (y) | 18-30 | 137 | 21.9 |
| | 31-45 | 323 | 51.5 |
| | ⩾46 | 167 | 26.6 |
| Types of respondents | Mothers | 399 | 63.6 |
| | Female adult members | 228 | 36.4 |
| Religion | Protestant | 527 | 84 |
| | Orthodox | 100 | 16 |
| Educational status | Not able to read and write | 368 | 58.7 |
| | Formal education | 259 | 41.3 |
| Marital status | Single | 139 | 22.2 |
| | Married | 469 | 74.8 |
| | Divorced | 6 | 1.0 |
| | Widowed | 13 | 2.1 |
| Monthly income in Ethiopian Birr (ETB) | ⩽500 | 91 | 14.5 |
| | 501-999 | 333 | 53.1 |
| | ⩾1000 | 203 | 32.4 |

459 (73.2%) of respondents stated that their water storage container is easily accessible to children. Furthermore, most of the participants 500 (79.7%) wash their hands before collecting drinking water, but from these only 197 (39.4%) of them used soap to wash their hands (Table 2).

### *Knowledge on household water treatment practice*

Knowledge of respondents on household water treatment practice was scored as <50% were poor knowledge, 50% to 69% were fair knowledge, and ⩾70 were good knowledge; according to the above scoring 486 (77.5%), 76 (12.1%), and 65 (10.4%) of respondents had poor, fair, and good knowledge on household water treatment practice respectively.

### *Household water treatment practice*

This study showed that 215 (34.3%) households practiced household water treatment. From those respondents who treat water in their home, 91 (42.3%) used boiling as a household water treatment method, whereas 50 (23.3%), and 74 (34.4%) of them strain through a cloth and add chlorine chemical (Weha Agar) respectively.

### *Factors associated with household water treatment practice*

In bivariate logistic regression analysis the following factors; head of household, educational status, type of water source, frequency of water collection, covering drinking water storage vessels, cleaning drinking water storage vessels, and method to withdraw water from storage vessel were associated with household water treatment practice (*P*-value <.25) (Table 3).

In multivariable logistic regression, the odds of practicing household water treatment were 2 times higher (AOR = 2.01, 95% CI = 1.34-3.0) among respondents who have formal education than those who are not able to read and write. Participants who used dipping to withdraw water from their storage vessel were 1.86 times more likely to practice household water treatment than participants who used pouring (AOR = 1.86, 95% CI = 1.2-2.87). Besides, those who collect water 3 or more times a day were 2.65 times more likely to practice household water treatment than those who collect once daily (AOR = 2.65, 95% CI = 1.45-4.88) (Table 4).

## Discussion

Although a recent finding showed that 44.7% and 50.9% of drinking water sources in the region were contaminated with

**Table 2.** Water supply, storage, and hygiene of respondents in Southern Ethiopia, 2018.

| VARIABLES | CATEGORY | FREQUENCY | PERCENT |
|---|---|---|---|
| Source of drinking water | Piped water | 353 | 56.3 |
| | Spring water | 133 | 21.2 |
| | River water | 141 | 22.5 |
| Time taken to fetch the water (min) | 30-45 | 459 | 73.2 |
| | 46-60 | 168 | 26.8 |
| Person who fetch water for household | Adult woman | 291 | 46.4 |
| | Adult man | 52 | 8.3 |
| | Female child under 15 y | 143 | 22.8 |
| | Male child under 15 y | 141 | 22.5 |
| Storing water for 3 d or more | Yes | 588 | 93.8 |
| | No | 39 | 6.2 |
| Frequency of collecting water for household | Once a day | 131 | 20.9 |
| | Twice a day | 155 | 24.7 |
| | 3 times and above a day | 302 | 48.2 |
| Cleaning of the water storage container before storing drinking water in home | Yes | 317 | 50.6 |
| | No | 271 | 43.2 |
| Materials used for washing the container water | Only water | 218 | 34.8 |
| | Detergent/soap | 99 | 15.8 |
| Times of washing water storing container | Daily | 180 | 28.7 |
| | Every 3 d | 57 | 9.1 |
| | Weekly | 80 | 12.8 |
| Covering water storage vessel | Yes | 419 | 66.8 |
| | No | 169 | 27 |

Escherichia coli and enterococci respectively,[37] the level of household water treatment practice was found to be 34.3%; (95% CI 30.7-38.1). This finding is consistent with the study done in Biye community, Kaduna State of Nigeria 32.4%.[35] Whereas, it was lower than studies done in Zambia (72.6%)[38] and Northwest Ethiopia (44.8%),[31] but It was higher than the findings from Ethiopian demographic health survey 2016 which is 7%.[23] The possible explanations for this difference might be related with households' perception difference across different contexts.

Respondents who had formal education were 2 times more likely to practice household water treatment compared to those who had not (AOR = 2.01, 95% CI = 1.34-3.0). This finding was similar with the study done in Egypt,[39] Northwest Ethiopia,[31] and Sidama zone southern Ethiopia.[27] The possible explanation for this finding might be due to the fact that those who are educated might know different types of water treatment methods from media and they might be better in understanding the health risks of drinking contaminated water by reading posters, brochures, and leaflets.

This study revealed that participants who draw their water from storage vessel by dipping were 1.86 times more likely to practice household water treatment than those who draw their water by pouring (AOR = 1.86, 95% CI = 1.2-2.87). This finding is in line with the study done in Northwest Ethiopia.[31] The possible reason for this result might be the fact that those who withdraw water from the storage container by dipping thought that dipping the container for drawing water increases the risk of contamination, and they may also get information from health professionals on the possible ways of water contamination.

This study also showed a strong association between collecting water 3 or more times a day and household water treatment practice. Respondents who fetch their water 3 or more times a day were 2.65 times more likely to practice household

**Table 3.** Bivariate logistic regression of factors associated with household water treatment practice in Southern Ethiopia, 2018.

| VARIABLE | CATEGORY | WATER TREATMENT PRACTICE | | COR (95% CI) | *P*-VALUE |
|---|---|---|---|---|---|
| | | YES | NO | | |
| Head of HH | Male | 108 | 246 | 1 | |
| | Female | 107 | 166 | 1.47 (1.05-2.05) | .023 |
| Age | 18-30 | 51 | 86 | 1 | |
| | 31-45 | 108 | 215 | 0.84 (0.55-1.28) | .435 |
| | ⩾46 | 56 | 111 | 0.85 (0.53-1.36) | .502 |
| Occupation | Farmer | 108 | 216 | 1.29 (0.64-2.61) | .47 |
| | Merchant | 63 | 112 | 1.45 (0.69-3.02) | .319 |
| | Government employer | 32 | 53 | 1.56 (0.7-3.46) | .275 |
| | Unemployed | 12 | 31 | 1 | |
| Educational status | Not able to read and write | 85 | 283 | 1 | |
| | Have formal education | 130 | 129 | 3.36 (2.38-4.73) | .00 |
| Household monthly income | <500 | 29 | 62 | 1 | |
| | 501-999 | 109 | 224 | 1.04 (0.63-1.71) | .876 |
| | ⩾1000 | 77 | 126 | 1.3 (0.77-2.207) | .317 |
| Method of withdrawing water from storage vessel | Pouring | 47 | 181 | 1 | |
| | Dipping | 168 | 231 | 2.8 (1.92-4.08) | .000 |
| Family size | <5 | 107 | 186 | 1 | |
| | ⩾5 | 108 | 226 | 0.831 (0.59-1.15) | .271 |
| Covering water storage vessels | Yes | 168 | 290 | 1.5 (1.02-2.21) | .039 |
| | No | 47 | 122 | 1 | |
| Frequency of collecting water | Once a day | 26 | 124 | 1 | |
| | Twice a day | 44 | 131 | 1.6 (0.93-2.76) | .089 |
| | 3 and above a day | 145 | 157 | 4.4 (2.72-7.11) | .000 |
| Cleaning storage vessels | Yes | 120 | 197 | 1.44 (1.03-2.02) | .033 |
| | No | 80 | 191 | 1 | |
| Water source | Pipe water | 112 | 241 | 1 | |
| | Spring water | 45 | 88 | 1.1 (0.7-1.7) | .65 |
| | River water | 58 | 83 | 1.5 (1.0-2.25) | .04 |
| Knowledge on household water treatment practice | Poor | 161 | 325 | 1 | |
| | Fair | 29 | 47 | 1.2 (0.76-2.05) | .389 |
| | Good | 25 | 40 | 1.26 (0.73-2.15) | .394 |

Abbreviations: CI, confidence interval; COR, crude odds ratio.

water treatment than those who fetching water once a day (AOR = 2.65, 95% CI = 1.45-4.88). This finding is in line with the study done in North West Ethiopia.[31] The possible reasons for this may be those who fetched water more frequently may have higher tendency to store their water which in turn empowers them to treat their water by storing.

**Table 4.** Multivariable logistic regression of factors associated with household water treatment practice in Southern Ethiopia, 2018.

| VARIABLE | CATEGORY | WATER TREATMENT PRACTICE | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|
| | | YES | NO | | |
| Head of HH | Male | 108 | 246 | 1 | 1 |
| | Female | 107 | 166 | 1.47 (1.05-2.05) | 0.74 (0.48-1.13) |
| Educational status | Not able to read and write | 85 | 283 | 1 | 1 |
| | Have formal education | 130 | 129 | 3.36 (2.38-4.73) | 2.01 (1.34-3.0)* |
| Method of withdrawing water from storage vessel | Pouring | 47 | 181 | 1 | 1 |
| | Dipping | 168 | 231 | 2.8 (1.92-4.08) | 1.86 (1.2-2.87)* |
| Covering water storage vessels | Yes | 168 | 290 | 1.5 (1.02-2.21) | 1.22 (0.76-1.98) |
| | No | 47 | 122 | 1 | 1 |
| Frequency of collecting water | Once a day | 26 | 124 | 1 | 1 |
| | Twice a day | 44 | 131 | 1.6 (0.93-2.76) | 1.74 (0.91-3.3) |
| | 3 or more times a day | 145 | 157 | 4.4 (2.72-7.11) | 2.65 (1.45-4.88)* |
| Cleaning storage vessels | Yes | 134 | 220 | 1.44 (1.03-2.02) | 0.88 (0.56-1.4) |
| | No | 81 | 192 | 1 | 1 |
| Water source | Pipe water | 112 | 241 | 1 | 1 |
| | Spring water | 45 | 88 | 1.1 (0.7-1.7) | 1.33 (0.81-2.19) |
| | River water | 58 | 83 | 1.5 (1.0-2.25) | 1.18 (0.74-1.87) |

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio.
*Significant at *P*-value <.05.

### *Limitations of the study*

Since the information for this study was collected mainly through interviews and self reports, there is a possibility that some of the responses might suffer from social desirability bias and to avoid this we add an observation method as a method of data collection besides the interview. Moreover, since the study employed cross sectional study design, it may be difficult to establish temporal relationship between the outcome and response variables.

## Conclusion

This study was conducted to determine the level of household water treatment practice and the factors associated with it. The result showed that household water treatment practice was low in the study area. Educational status of having a formal education, dipping method of withdrawing water, and collecting water 3 or more times a day were found to be the factors significantly associated with household water treatment practice. Therefore, for those with no primary education efforts should be made through health education by zonal health office and community health workers to increase the level of household water treatment practice. Apart from this, further studies especially qualitative studies should be conducted to understand the hurdles of household water treatment practice particularly the behavioral factors.


## Acknowledgements

We are glad to acknowledge study participants, data collectors, supervisors, Haramaya University Department of Environmental Health, and Gibe Woreda water and mine energy for their invaluable contribution to the accomplishment of this study.


## Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.


## ORCID iD

Yohanis Alemeshet Asefa https://orcid.org/0000-0003-1209-4289


## Data Availability

The data generated during this study are included in this published article and additional data will be made available upon request to the corresponding author.

## Supplemental Material

Supplemental material for this article is available online.

## REFERENCES


1. WHO. Household water treatment and safe storage western pacific. 2010. Accessed October 4, 2020. http://apps.who.int/iris/handle/10665/206916
2. Cotruvo JA, Sobsey MD. Point-of-use water treatment for home and travel. *Water Health*. 2006;2:103.
3. UNICEF and WHO. Drinking water equity, safety and sustainability: thematic report on drinking water. 2011. Accessed October 4, 2020. https://data.unicef.org/resources/drinking-water-equity-safety-and-sustainability-2011-thematic-report/
4. Schriewer A, Odagiri M, Wuertz S, et al. Human and animal fecal contamination of community water sources, stored drinking water and hands in rural India measured with validated microbial source tracking assays. *Am J Trop Med Hyg*. 2015;93:509-516.
5. Raju N, Roopavathi N, Ramachandra K, Niranjana I, eds. The future of water, sanitation and hygiene: innovation, adaptation and engement in a changing world: assessment of coliform contamination in drinking water from source to point of use in Mysore city of Karnataka, India. Paper presented at: Proceedings of Third WEDC International Conference; July 6-8, 2011; Loughborough, UK. Accessed October 7, 2020. http://wedc.lboro.ac.uk/resources/conference/35/Raju-N-1047.pdf
6. Clasen TF, Alexander KT, Sinclair D, et al. Interventions to improve water quality for preventing diarrhoea. *Cochrane Database Syst Rev*. 2015;10:CD004794.
7. Centers for Disease Control and Prevention. Common illness, global killer. 2013. Accessed October 4, 2020. https://www.cdc.gov/healthywater/pdf/global/programs/globaldiarrhea508c.pdf
8. WHO. Diarrheal disease fact sheet. 2015. Accessed October 4, 2020. https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease
9. WHO. Preventing diarrhea through better water sanitation and hygiene: exposures and impacts in low-middle-income countries. 2014. Accessed October 4, 2020. http://apps.who.int/iris/bitstream/10665/150112/1/9789241564823_eng.pdf/
10. Fewtrell L, Kaufmann RB, Kay D, Enanoria W, Haller L, Colford JM Jr. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infect Dis*. 2005;5:42-52.
11. Darvesh N, Das JK, Vaivada T, et al.; Social Determinants of Health Study Team. Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the lives saved tool. *BMC Public Health*. 2017;17:776.
12. Pickering AJ, Null C, Winch PJ, et al. The WASH benefits and SHINE trials: interpretation of WASH intervention effects on linear growth and diarrhoea. *Lancet Glob Health*. 2019;7:e1139-e1146.
13. Verhougstraete M, Reynolds KA, Pearce-Walker J, Gerba C. Cost-benefit analysis of point-of-use devices for health risks reduction from pathogens in drinking water. *J Water Health*. 2020;18:968-982.
14. Mokoena MM, Mudau LS, Mokgobu MI, Mukhola MS. The use of sodium hypochlorite at point-of-use to remove microcystins from water containers. *Toxins*. 2021;13:207.
15. Hill CL, McCain K, Nyathi ME, et al. Impact of low-cost point-of-use water treatment technologies on enteric infections and growth among children in Limpopo, South Africa. *Am J Trop Med Hyg*. 2020;103:1405-1415.
16. Mengistie B, Berhane Y, Worku A. Household water chlorination reduces incidence of diarrhea among under-five children in rural Ethiopia: a cluster randomized controlled trial. *PLoS One*. 2013;8:e77887.
17. Waddington H, Snilstveit B, White H, et al. *Water, Sanitation and Hygiene Interventions to Combat Childhood Diarrhea in Developing Countries*. International Initiative for Impact Evaluation; 2009.
18. Daniel D, Sirait M, Pande S. A hierarchical Bayesian belief network model of household water treatment behaviour in a suburban area: a case study of Palu-Indonesia. *PLoS One*. 2020;15:e0241904.
19. Lilje J, Kessely H, Mosler HJ. Factors determining water treatment behavior for the prevention of cholera in Chad. *Am J Trop Med Hyg*. 2015;93:57-65.
20. Rosa G, Clasen T. Estimating the scope of household water treatment in low- and medium-income countries. *Am J Trop Med Hyg*. 2010;82:289-300.
21. Geremew A, Damtew YT. Household water treatment using adequate methods in sub-Saharan countries: evidence from 2013–2016 demographic and health surveys. *J Water Sanit Hyg Dev*. 2020;10:66-75.
22. Thewodros B, Seyoum L. Water supply and health: drinking water and sanitation coverage in Ethiopia 1990-2015 review. *Int J Environ Agric Biotechnol*. 2015;1:11-24.
23. Central Statistical Agency (CSA) Ethiopia and ICF. *Ethiopia Demographic and Health Survey 2016*. CSA and ICF; 2016. Accessed October 5, 2020. https://dhsprogram.com/pubs/pdf/FR328/FR328.pdf/
24. Central Statistical Agency. *Federal Democratic Republic of Ethiopia Central Statistical Agency Population Projection of Ethiopia for All Regions at Wereda Level From 2014–2017*. Central Statistical Agency; 2014. Accessed October 5, 2020. https://www.statsethiopia.gov.et/population-projection/
25. GWWMEO. Annual report of Gibe Woreda water, mine, and energy office. 2017.
26. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med*. 2013;35:121-126.
27. Berhanu A. Bacteriological and physicochemical quality of drinking water sources and household water handling practice among rural communities of Bona District, Sidama Zone-Zouthern, Ethiopia. *Sci J Public Health*. 2015;3:782-789.
28. Koskei EC, Koskei RC, Koske MC, Koech HK. Effect of socio-economic factors on access to improved water sources and basic sanitation in Bomet municipality, Kenya. *Res J Environ Earth Sci*. 2013;5:714-719.
29. Tabor M, Kibret M, Abera B. Bacteriological and physicochemical quality of drinking water and hygiene-sanitation practices of the consumers in Bahir Dar city, Ethiopia. *Ethiop J Health Sci*. 2011;21:19-26.
30. Bolatito O, Iyang A, Chiedu FM, et al. Assessment of sanitation and water handling practices in rural communities of Ogun state, southwestern Nigeria. *Public Health Res*. 2014;2:4453.
31. Belay H, Dagnew Z, Abebe N. Small scale water treatment practice and associated factors at Burie Zuria Woreda rural households, northwest Ethiopia, 2015: cross sectional study. *BMC Public Health*. 2016;16:887.
32. Hardeep RS, Worku W, Hassen M, et al. Water handling practices and level of contamination between source and point-of-use in Kloladiba town, Ethiopia. *Environ Int J Sci Technol*. 2013;8:25-35.
33. Singh U, Lutchmanariyan R, Wright J, et al. Microbial quality of drinking water from groundtanks and tankers at source and point-of-use in eThekwini municipality, South Africa, and its relationship to health outcomes. *Water Res*. 2013;39:663.
34. Miner CA, Dakhin AP, Zoakah AI, et al. Household drinking water; knowledge and practice of purification in a community of Lamingo, Plateau state, Nigeria. *J Environ Res Manag*. 2015;6:230-236.
35. Ibrahim JM, Sufiyan MB, Olorukooba AA, et al. Knowledge, attitudes, and practices of household water purification among caregivers of under-five children in biye community, Kaduna state. *Arch Med Surg*. 2016;1:35-41.
36. Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. *Source Code Biol Med*. 2008;3:17.
37. Alemayehu TA, Weldetinsae A, Dinssa DA, et al. Sanitary condition and its microbiological quality of improved water sources in the southern region of Ethiopia. *Environ Monit Assess*. 2020;192:319.
38. Rosa G, Clasen T, Kelly P. Consistency of use and effectiveness of household water treatment practices among urban and rural populations claiming to treat their drinking water at home: a case study in Zambia. *Am J Trop Med Hyg*. 2016;94:445-455.
39. Wright J, Gundry S, Conroy R. Household drinking water in developing countries: a systematic review of microbiological contamination between source and point-of-use. *Trop Med Int Health*. 2004;9:106-117.