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ORIGINAL ARTICLE

Assessment of Household Management Practices of Drinking Water in Two Selected Rural Communities of Plateau State

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Keywords

Household management; Drinking water; Rural; Plateau State

ABSTRACT

Background: Understanding how drinking water is managed in rural households that lack access to improved water sources is necessary for designing effective strategies that can meet their drinking water requirements. This study aimed to assess the drinking water management practices of rural households in two selected communities of Plateau State.

Methods: A descriptive cross-sectional study was carried out in Plateau State among 202 female caregivers of under-five children residing in households of two rural communities who were selected using a multistage sampling technique. An interviewer-administered questionnaire and an observational checklist were used to obtain information on water sources, collection, storage and treatment practices. Data were analyzed using SPSS 23.0. Bivariate analysis was done to identify factors associated with household water treatment practice followed by logistic regression to determine predictors. Level of significance was set at $p<0.05$.

Results: Mean age of respondents was 32.5±12.3 years. Nearly half (48%) of the households obtained drinking water from unimproved sources and 18.3% treated water at home which were mainly inappropriate methods. About 75% always stored drinking water separately from other uses while 64% stored water for over 3days. Only 51% were observed to store water in clean containers. Independent predictors of household water treatment were perception of drinking water safety (AOR=4.6; 95%CI: 2.1–10.3) and encouragement to treat water within the community (AOR=16.7; 95%CI: 2.1 – 28.5).

Conclusion: There is a need to educate and encourage the rural populace on appropriate water management methods while efforts are being made to increase access to improved sources.

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INTRODUCTION

Water should be safe and readily available for everyone for domestic uses including drinking. One of the targets of the sixth Sustainable Development Goal (SDG) of ensuring availability and sustainable management of water and sanitation for all is universal access to safe and affordable drinking water by the year 2030.[1] An important measure that is used

to determine access to safe drinking water is access to an improved water source. This was also used by the United Nations, as part of its Millennium Development Goals (MDGs), when it expressed its commitment to reduce by half, the population without sustainable access to improved water supply by 2015.[2] These improved water sources include household connections to municipal water supply, public standpipe or tap, tube well or borehole, protected dug well, protected spring, rainwater and bottled water. Unimproved sources include unprotected wells, unprotected springs, vendor-provided water, tanker truck-provided water, surface water, sachet water and other sources.[3]

Although the MDG drinking water target (i.e. increasing access to 88%) was met on a global scale as it increased from 76% in 1990 to 90% in 2015,[4,5] up to 785 million of people especially populations in developing countries, still lack access to improved drinking water sources.[6] Huge disparities in drinking water access still exist between the various regions, between and within countries, between the rich and poor, and between urban and rural populations. Among those who have access to improved sources, 206 million still take over 30 minutes to collect water. Approximately 144 million people use surface water as their main source of drinking water and 435 million use water from unprotected wells.[6] Two billion people worldwide drink water that is contaminated with faeces. Consumption of water that is contaminated by micro-organisms is estimated to cause up to 485,000 diarrhoeal deaths every year.[6] Up to 4 billion cases of diarrhoea are recorded every year and about 88% of these cases are attributed to the consumption of unsafe water and poor sanitation.[7]

The situation is worse in developing countries, especially in the rural areas where access to improved water sources remains low and those who have some form of access still have to walk long distances to get water, thereby increasing the risk of contamination during transportation. Population growth in urban areas also presents a huge challenge in further decreasing improved drinking water coverage.[8,9] Out of the estimated 663 million people worldwide who lacked access to improved sources of drinking water in 2015, majority of them lived in sub-Saharan Africa and in Southern Asia.[10] Although improved drinking water coverage has been observed to be

increasing in sub-Saharan Africa, this increase is occurring very slowly. It increased from 47% between 1990 and 1995 to 60% between 2000 and 2005 and then to 74% between 2010 and 2015. The increase observed has been much higher in urban compared to rural areas.[11] In 2017, 61% of the sub-Sahara African population used at least basic drinking water services which was a 15% increase from the year 2000.[12]

Despite the lack of access to improved water sources in most developing countries, the practice of Household Water Treatment (HWT) remains poor. Only 33% of households in these countries engage in HWT (36.6% for urban and 30.1% for rural dwellers).[13] The practice of HWT is most common in the Western Pacific region of the World Health Organization (WHO) accounting for 66.8% and least common in the African (18.2%) and Eastern Mediterranean (13.6%) regions.[13] Boiling is known to be the most common method of HWT in these countries, as practiced by 21% of households. About 5.6% of the households treat drinking water with chlorine or bleach (most prevalent in Latin America and the Caribbeans), 4.3% filter their water (highest in South-East Asia and Latin America, but rare in Africa), and 0.2% use solar disinfection.[13] Some households also engage in inappropriate methods of HWT (8.2%) such as straining water through a cloth (more prevalent in Africa and South-East Asia) and allowing the water settle before consumption (common in Eastern Europe). These inappropriate HWT practices are more common in rural (8.6%) than urban areas (7.2%). Appropriate methods of HWT, such as boiling, chlorination, filtration and solar disinfection, are least practiced among the poorest households who are also the ones more at risk of water-borne diseases.[13]

In 2010, Nigeria ranked third among countries globally with the largest populations without access to improved drinking water source.[4] Even though the MDG target for Nigeria was for 77% of residents to have access to improved drinking water sources by 2015, 61% of Nigerians had access to improved drinking water sources by 2013.[3] By 2018, this figure barely increased to 66%.[14] This was much higher in urban areas (with 74% access) compared to rural areas (with 58% access).[14] The most common source of improved drinking water in Nigeria is borehole or tube-well which is used by 41% of urban dwellers and 34% of rural

dwellers.[14] Up to 92% of households in Nigeria do not treat their water before drinking and out of those that do, only about 5% of households (7% of urban households and 3% of rural household) use an appropriate water treatment method such as boiling, adding bleach or chlorine, solar disinfection and use of ceramic, sand, or other filters. About 6% of urban and 8% of rural households travel 30 minutes or longer to obtain drinking water which may affect the quality of the drinking water because water that is obtained, even from an improved source, may become contaminated during transportation or storage.[14] Lack of access to safe drinking water may have contributed to the rise in prevalence of childhood diarrheoa observed in Nigeria from 10% in 2013[3] to 13% in 2018[14] and also in Plateau State from 5.6% in 2013[3] to 13.3% in 2018.[14]

Since many rural communities do not have access to pipe-borne water at premises and lack access to other improved sources of water, it is important to understand how drinking water is managed or handled at the household level so as to design effective and contextualized strategies to meet their drinking water requirements. Therefore, this study aimed to assess household management practices (sources, collection, storage and treatment) of drinking water and factors that affect household treatment of drinking water in two selected rural communities of Plateau State.

METHODOLOGY

The study was carried out in Plateau State which is one of the 36 states in Nigeria and conducted between February to April 2016. The state is divided into 17 Local Government Areas (LGAs) of which 15 LGAs are predominantly rural. Two of the predominantly rural LGAs, Bassa and Jos East LGAs, were purposively selected for the study. This study was a community-based cross-sectional study involving adult female care-givers of under-fives who resided in households of the selected rural communities. This was mainly because females are mostly involved in household drinking water management which is very crucial to child health. It was part of a larger study that was carried out to assess bacteriological water quality in rural communities.

The sample size formula for cross-sectional studies, $n = Z_\alpha^2 p(1-p)/d^2$ [15] was used where Z_α = 95% confidence level at 1.96, d = precision at 0.05 and p = proportion of Nigerian households who

engaged in HWT (12%).[3] A minimum sample size of 163 was calculated which was adjusted to 180 after considering a non-response rate of 10%. Participants were selected using a multi-stage sampling technique. Stage 1 involved selecting two LGAs out of the 15 predominantly rural LGAs in the State. Jos East and Bassa LGAs were selected purposively due to their proximity to the central laboratory at NVRI Vom (Jos South LGA) where water testing was being done for a bigger study of which this study was a part of. In stage 2, selection of wards was done by selecting one ward from a list of wards for each of the selected LGAs using simple random sampling by balloting. In stage 3 (selection of communities), one community was selected from the 7 communities in each ward (Foda Fobur and Igbak communities from Jos East and Bassa respectively) using simple random sampling by balloting. In stage 4 (selection of respondents), all eligible participants were selected in both communities, which amounted to 202 participants in total.

An interviewer-administered questionnaire was used to collect data on sociodemographic characteristics, drinking water collection from source, storage and treatment practices from respondents. An observational checklist was used to collect data on type and sanitary condition of the vessel used for water storage as well as method of fetching water from the vessel. Six research assistants made up of resident doctors and community health officers in Community Medicine Department of Jos University Teaching Hospital (JUTH) were trained for four hours over a period of two days at JUTH on data collection methods. Information was obtained from the respondents using the questionnaires and checklists were filled while making observations on the condition of drinking water storage vessels (type, cleanliness, covering of vessel with a lid) and method of fetching water from storage vessel. Pipe-borne water, borehole, spring, protected well and rain water were considered to be improved water sources while unprotected well, surface water, sachet water and vendor-provided water were considered as unimproved sources. Furthermore, water treatment methods such as boiling, use of alum, filtration, chemical (with chlorine) and solar disinfection were considered appropriate water treatment methods while straining through cloth and letting water stand to settle were considered inappropriate water treatment methods. Perception of water safety/

quality was assessed by asking respondents if they felt their water was safe to drink without treatment. Respondents were also asked if they received any form of encouragement for household water treatment within their communities (from friends, family, neighbors, health workers, leaders or government) such as through health education or provision of resources like cash or water treatment products.

Data were analysed using IBM SPSS version 23.0. Mean, median and standard deviation were used to summarize quantitative variables such as age and time spent to make a round trip of fetching water, while qualitative variables such as sociodemographic variables (occupation, marital status, ethnicity and educational level), water treatment and storage practices were summarized using tables and proportions. Chi square analysis was carried out to determine factors associated with household water treatment while logistic regression was used to determine independent predictors of water treatment. A p-value of < 0.05 was considered significant at a 95% confidence level. Ethical clearance was obtained from the Health Research Ethics Committee of the Jos University Teaching Hospital with a protocol number of JUTH/DCS/ADM /127/XIX/6260. Permission for the study was obtained from LGA chairmen as well as heads of wards and communities. Permission was also sought from household heads especially if a participant was not a household head. Written informed consent was obtained from the participants before data collection was carried out. Confidentiality and anonymity were assured.

RESULTS

Socio-demographic characteristics

A total of 202 respondents participated in the study who had a mean age of 32.5 ± 12.3 years and an age range of 18 to 90 years. Table 1 shows that a higher proportion of respondents 175 (86.6%) were married, 91 (45.0%) had primary education and 129 (63.8%) were either farmers or petty traders.

Household water collection and treatment practices

Table 2 shows that the main source of drinking water for the majority of respondents 193 (95.5%) was well water with 88 (43.5%) having access to mainly unprotected well.

Table 1: Respondent and household characteristics

Characteristics	Frequency (n=202)	Percent
Age group (years)		
18-25	66	32.7
26-35	84	41.6
36-45	28	13.9
46-55	12	5.9
56-65	5	2.5
66 and above	7	3.5
Marital status		
Married	175	86.6
Single	10	5.0
Widowed	8	4.0
Separated/Divorced	9	4.4
Ethnicity		
Plateau Indigenous tribes	172	85.1
Non indigenous tribes	30	14.9
Level of education		
No formal education	26	12.9
Primary	91	45.0
Secondary	73	36.1
Tertiary	12	6.0
Occupation		
None	43	21.3
Farming	75	37.1
Petty trading	54	26.7
Artisan	21	10.4
Others**	9	4.5
Monthly household income (₦)		
≤ 20,000	138	68.3
> 20,000	64	31.7
Household size		
1-5 persons	89	44.0
≥ 6 persons	113	56.0

***Teaching, Religious order*

Although more respondents 139 (68.8%) had to fetch water from outside their household yards, only 14 (6.9%) spent 30 minutes or more on a round trip of fetching water. The median time spent on a round trip was 6 minutes. A large proportion of the studied households 165 (81.7%) did not practice any method of household water treatment. Among the 37 (18.3%) respondents that did, only 8 (21.6%) engaged in appropriate methods. Straining/filtering through cloth was the most common among the treatment methods mentioned by 27 (73%) respondents and boiling was the most common appropriate method observed among 5 (13.5%) respondents that treat their water.

Table 2: Drinking water collection and treatment practices in households

Practices	Frequency	Percent
Main drinking water source (n=202)		
Protected well	105	52.0
Unprotected well	88	43.5
Surface water	4	2.0
Sachet water	5	2.5
Location of source (n=202)		
Outside household yard	139	68.8
Within household yard	63	31.2
Duration for a round trip (n=202)		
<30 minutes	188	93.1
≥30 minutes	14	6.9
Practice of HWT (n=202)		
Yes	37	18.3
No	165	81.7
Most common method of HWT (n=37)		
Straining through cloth	27	73.0
Boiling	5	13.5
Use of chlorine/Water Guard	1	2.7
Letting water stand to settle	2	5.4
Use of alum	2	5.4
Appropriateness of HWT (n=37)		
Inappropriate	29	78.4
Appropriate	8	21.6

Household water storage practices

Water storage was regularly practiced among 190 (94.1%) households especially the use of wide-mouthed vessels 195 (96.5%). Most households, 196 (97.0%) were observed to have covered their storage containers, however only half 103 (51%) of those containers were visibly clean. Use of a permanent fetcher was observed in 104 (51.5%) households. Storage duration was more than 3 days for 129 (64%) of households (Table 3).

Predictors of household water treatment

Factors that were found to be associated with water treatment on bivariate analysis included respondent's perception of drinking water safety/quality (χ^2=18.214; p<0.001), encouragement for water treatment by family, friends, health workers in the community (χ^2=13.534; p<0.001) and willingness to pay for water treatment (χ^2=5.954; p=0.015) as depicted in Table 4.

Table 3: Water storage practices of rural households

Practices	Frequency (n=202)	Percent
Frequency of storage		
Always	190	94.1
Occasionally	12	5.9
Drinking water stored separately from other uses		
Always	152	75.2
Occasionally	24	11.9
Never	26	12.9
Type of water storage vessel		
Plastic bucket without spigot	92	45.5
Earthen pot	66	32.7
Drum	37	18.3
Jerricans/sachets	7	3.5
Type of storage vessel		
Wide-mouthed (>10cm) vessel	195	96.5
Narrow-mouthed (≤10cm) vessel	7	3.5
Vessel covered with lid		
Covered	196	97.0
Not covered	6	3.0
Condition of storage vessel		
Clean	103	51.0
Not clean	99	49.0
Method of fetching water from vessel		
Permanent fetcher	104	51.5
Any fetcher	89	44.0
Pour directly	5	2.5
Drink directly	4	2.0
Duration of drinking water storage (days)		
1 – 3	73	36.1
≥4	129	63.9

When multivariate analysis (logistic regression) was carried out, respondents who perceived that their water sources were not safe to drink without treatment had a higher likelihood of treating their water at home compared to those who thought their drinking water sources were safe to drink (Adjusted OR=4.6; 95% CI = 2.1–10.3). Likewise, those who had some form of encouragement from within their community (friends, health workers, relatives, neighbors) for household water

Table 4: Factors associated with water treatment in rural households

Factors	Water Treatment		χ^2	p-value
	Yes (n = 37) n (%)	No (n =165) n (%)		
Age group (years)**				
≤ 33	21 (15.7)	113 (84.3)		
> 33	16 (23.5)	53 (76.5)	1.862	0.172
Educational Status				
No formal education	4 (15.4)	22 (84.6)		
Formal education	33 (18.8)	143 (81.3)	0.171	0.679
Household income (Naira)				
≤ 20,000	24 (17.4)	114 (82.6)		
> 20,000	13 (20.3)	51 (79.7)	0.248	0.618
Household size				
1-5 persons	15 (16.9)	74 (83.1)		
6 or more persons	22 (19.5)	91 (80.5)	0.228	0.633
Perceives water to be safe without treatment				
Yes	16 (11.0)	129 (89.0)		
No	21 (36.8)	36 (63.2)	18.214	<0.001*
Willing to pay for water treatment at home				
Yes	3 (60.0)	2 (40.0)		
No	34 (17.3)	163 (82.7)	5.954	0.015*
Encouraged to treat water within the community				
Yes	36 (24.3)	112 (75.7)		
No	1 (1.9)	53 (98.1)	13.534	<0.001*

Statistically significant; **Mean age

treatment were more likely to practice water treatment compared to those who did not (Adjusted OR=16.7; 95% CI=2.1–28.5). (Table 5)

DISCUSSION

This study showed that households collect drinking water mainly from underground sources which were mainly wells. Although almost half of the households obtained their drinking water from unimproved sources in form of unprotected wells, surface water and sachet water, these were mainly located within household premises. Unprotected wells and surface water were found to be the most common unimproved sources in rural households in the 2018 Nigerian Demographic and Health Survey (NDHS).[14] Researchers had sighted a borehole situated within each community, but these were non-functional during the period of the study which seemed to be a common problem not only in the study area, but also in some other rural parts of

Table 5: Predictors of water treatment in rural households

Predictors	*Crude Odds Ratio*	Adjusted Odds Ratio	95% Confidence Interval	P-Value
Perceives water to be safe without treatment				
Yes	*1*	1		
No	*4.7 (2.2-9.9)*	4.6	2.1 – 10.3	<0.001*
Willing to pay for water treatment at home				
Yes	*7.2 (1.2-34.7)*	3.7	0.5 – 16.1	0.196
No	*1*	1		
Encouraged to treat water within the community				
Yes	*17.3 (2.2-27.6)*	16.7	2.1 – 28.5	0.007*
No	*1*	1		

****Statistically significant***

the country.[16, 17] Findings from a study in rural Kaduna also showed that the main sources of water used for domestic activities, including drinking, were yard wells (utilized by 79% of rural dwellers), rivers/streams (by 34%), community wells (by 14%) and boreholes (by 12%).[18] It was also found from a cross-sectional survey in the Niger Delta region of Nigeria, that the most common source of drinking water was surface water (37.9%).[17] These further imply that rural populations in Nigeria, just like many other African countries depend largely on ground and surface water sources for drinking.

The most widely used indicator to monitor the access of a population to safe drinking water is access to improved water supply. Using this indicator to monitor access to safe drinking water is a simple method adopted by the WHO due to the logistic constraint of performing direct water quality testing at regional or national levels.[4] This study demonstrates that almost half of the households obtained their drinking water from unimproved sources which may increase their risk of waterborne diseases. This is because unimproved water sources are prone to outside contamination, particularly with fecal matter and are thus, potential sources of pathogens that cause diarrhea and other water-borne diseases.

Many rural households do not have access to tap or pipe-borne water delivered into their premises hence, resort to travelling some distance to fetch water which is an additional chore that could be of great cost

to household members, depending on the time spent to obtain it. Our findings reveal that very few households spent 30 minutes or more to make a round trip of fetching water. The NDHS 2018 similarly revealed that few households in the rural parts of the country (8%) spent over 30 minutes to obtain drinking water even though many of these rural households largely depend on ground water sources in form of boreholes and wells.[14] This practice increases the chances of recontamination of drinking water, even if the water is obtained from an improved source, thereby decreasing the water quality.[14]

Well has also been found to be a common source of drinking water in rural parts of Plateau State with no access to pipe-borne water.[16, 19] Studies within and outside Plateau State have shown varying results of households drinking water sources located within the premises.[16,18] What was common to most of the studies was that most household dwellers still spent less than 30 minutes for a round trip of water.[16, 17, 20] This shows that many households are making efforts to situate water sources close to their residence and that most rural dwellers do not need to travel far to obtain water, however, this could be season-dependent.

Similar to what was observed in this study, the 2018 NDHS showed that most of households did not treat their drinking water and only 3% of rural households engaged in appropriate methods of household water treatment. Appropriate water treatment methods commonly practiced in Nigeria include boiling, bleaching, filtering, and solar disinfecting. Inappropriate methods include straining through cloth and letting to stand/settle. Straining of water through cloth was found to be the commonest household water treatment method in this study and also among rural households in the NDHS.[14] This method may be preferred probably because it is affordable and it also improves water clarity which is wrongly used as an indicator of water quality as demonstrated in this study.

Boiling was the commonest appropriate treatment method in this study just like was observed among other rural households of developing countries where boiling and use of alum were found to be the most commonly appropriate methods of water treatment. However, these methods were not carried out regularly but done based on certain needs and criteria such as water clarity, odour, taste

and availability of cash for its treatment.[19, 21]

The use of narrow-mouthed vessels (with a diameter of <10cm) to store drinking water discourages unnecessary dipping of hands or fetchers into the stored drinking water and therefore, limit contamination. Storage of drinking water using mainly plastic buckets, clay pots and drums (wide-mouth vessels of 10cm diameter or more) was a common practice in the studied households. This was corroborated in another study of rural households in Plateau State where households utilized wide-mouth vessels for storage more than narrow-mouth vessels like jerricans.[19] In some rural communities in the southern part of Nigeria, the use of jerricans or narrow-mouth storage containers was more common.[17] This practice of water storage at home is an inevitable practice in many households of developing countries mainly because of water scarcity, non-availability of constant water supply such as tap water on premises and the need to constantly have water for future use.

The practice of covering drinking water in this study as was also demonstrated in other rural areas of Plateau State[19] was high compared to an Indian study which was somewhat low (44%).[22] Other storage practices such as storage in clean containers, use of dedicated/permanent fetcher and short duration of storage were generally not satisfactory among the studied households. Poor storage practices may have a negative impact on microbial water quality. Handling of drinking water by several persons in the household using any fetcher to obtain water from storage containers for example, may increase the likelihood of contamination, especially since over half of the studied households had large household sizes (over 5 persons). This can be detrimental to health posing a risk for water-borne diseases, especially among under-fives.

Perceptions of water quality which is usually influenced by cultural beliefs have been found to affect people's water treatment behavior. In an Indian study for example, respondents perceived that water obtained from within their communities was safe and did not cause sickness unlike water obtained commercially such as bottled water.[23] Another study conducted in Plateau State demonstrated that 67% of respondents perceived sachet water to be safe with over 40% affirming that it is safer than borehole or tap water,[24] while an American study found that more

people (65%) perceived bottled water to be safer than tap water.[25] It is possible to have the perception that water is safe to drink without treatment mainly because it appears clean and when it is obtained from sources generally regarded as clean. The likelihood of water treatment was lower among respondents with this perception compared to those without the perception in this study.

This could also explain why many households in developing regions especially rural households, adopt treatment methods that only make drinking water visibly clear such as cloth filtration and allowing to settle. The perception of drinking water quality has been found to be primarily associated with the use of human sensory systems such as taste, odor and clarity of the water rather than the chemical or microbial compositions of water.[26,27] Such perceptions and misconceptions can negatively influence the adoption and sustainability of water treatment interventions and also serve as impediments for effective control of water-borne diseases. When families, friends, neighbors and other community members practice and encourage household water treatment, the likelihood of adopting the practice among other individuals increases. This was demonstrated in this study and was also found to have influenced the adoption of a water treatment intervention in Haiti.[28]

Most respondents mentioned that they were not willing to pay for water treatment at home. Although not statistically significant, those who were willing to pay had higher odds of treating their water compared to respondents who were not willing to pay. Those who were willing to pay may have been aware of the benefits of water treatment outweighing its costs. Most appropriate water treatment options require some form of payment which includes payment for fuel to boil water, payment for chemicals like chlorine or alum and payment for filters. A large proportion of the rural population in Nigeria cannot afford basic human needs and may thus, probably view spending for household water treatment as a luxury. However, it has been shown that populations of African countries are willing to pay for household water treatment products when backed by good marketing and education. Affordable, simple and fast household water treatment methods such as chlorination has also been

found to be widely used and acceptable to households of developing countries.[21,29]

Limitations of the study: The study was conducted in two purposively selected rural communities of Plateau State and therefore, may not be entirely representative of all rural communities in the state. The use of observational checklist to measure practice is capable of introducing personal bias, as two persons may judge the same phenomenon differently. However, it is hoped that the training of research assistants carried out prior to data collection could have minimized this bias.

Conclusion and recommendations: This study demonstrates that almost half of the households obtained their drinking water from unimproved sources showing poor access to safe drinking water. Despite that, majority of the households did not practice any form of water treatment and among those that did, inappropriate water treatment methods dominated. Perception of water safety and encouragement for water treatment increased the odds of treating drinking water at home. Water storage practices were also not satisfactory. The government should make efforts to increase access of the rural populace to improved drinking water sources. As that is being done, educating them on proper water management practices and increasing their access to appropriate water treatment options can go a long way in addressing their drinking water requirements on the interim.

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Authors' contributions: EOO was involved in the study conceptualization, design, data collection, analysis and interpretation as well as manuscript write up. CAM was involved in study conceptualization, design, data interpretation and manuscript write up. GNO was involved in study design, data collection and analysis. AIZ was involved in study conceptualization, design and manuscript write up.

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