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Assessment of the Household Practices of Drinking Water Collection, Transportation and Storage in Fako Division, South-West Region of Cameroon

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ABSTRACT

Introduction: The supply of potable water in low resource countries has been a public health concern, with frequent water interruptions, leaving the population vulnerable to access to potable water in households, which renders the population at risk of waterborne diseases like cholera. Our objectives were to assess the household practices of drinking water collection, transportation and storage in the Fako Division of the Southwest Region of Cameroon.

Methods: This was a cross-sectional study with a mixed-method approach. Focus Group Discussions were done to get an inside of the observed practices and a quasi-experimental study with education as an intervention. A total of 394 households were randomly selected and issued a pretested questionnaire. A multistage random sampling technique was used to recruit the participants in the households in the four health districts of Fako. For the quasi-experiment, 50 water samples from 50 homes were tested before and after the intervention to measure the mean microbial score in stored household drinking water. A one-sample t-test was used to compare the mean microbial colony count at baseline and 3 months post-intervention. Data were analyzed using SPSS version 23. Crude and adjusted odds ratios and confidence intervals were reported at a significance level of 0.05.

Results: Assessing the participants' practice in drinking water collection and transportation, 273 (69.3%) of the participants reported public taps as their primary source of drinking water. The main alternative source of drinking water was spring 233 (59.1%). More than half (56.3%) of the respondents reported that they take more than 30 minutes to fetch water, done mostly by children (62.2%), and the majority (89.1%) do this by trekking. Over half, 268 (68%) of the participants used buckets with lids, and 119 (30.2%), use jerry cans to fetch water. A total of 184 (46.7%) reported a bucket with a lid as the water storage container meanwhile 34 (8.6%) and 176 (44.7%) stored water in a bucket with no lid and jerry cans respectively. Almost a half 180 (46.9%) store their drinking water for more than 2 days. The mean bacterial colony count (29.72 ± 40.07) after the intervention was significantly lower than the mean bacterial colony at baseline (71.4 ± 68.38, t (50) = 6.846, P < 0.001).

Conclusion: The primary source of drinking water in Fako is public tap, alternative source being a spring. More than half of the participants trek to fetch water and almost half of the participants store drinking water for more than 2 days. Intervention with health education significantly lowered the mean bacterial colony count in household drinking water.

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KEYWORD: *Drinking water, collection, transportation, storage, Fako, Water Safety Plan (WSP) model, Cameroon*

Background

The Water Safety Plan (WSP) model is an approach that is adopted by various countries to mitigate the risks in water, by implementing best practices to ensure continuous supply of safe water from the source to the consumer [1,2] Almost every region in the world today, have implemented the WSP. The main reason being to "manage and control the activities within the water chain system; implement and identify the opportunities for low cost improvements on operation practices that enhance water safety; prevent water deterioration during distribution, handling and storage in households; improve the stakeholder communications and collaboration within water sector and give understanding to water users on complete water chain and its vulnerability" [3]. However, the monitoring of risks at household level in poor and rural households is inadequate, although sustainable water delivery services and provision of water that is safe could not be guaranteed in most developing countries [4, 5].

In Cameroon, this regulation indicates government commitment to providing safe potable water to its communities [6, 7].It is unlikely that the focus dwells much on the tap and not extended to the point of use. The mitigation of risks given to these communities is not consistent and dwells on the water source to the tap on the street or yard, hence it is well proven that there is a challenge of water quality access and deterioration in the household at the point of use which may render the treatment at the source less reliable [8]. Due to water scarcity in some rural and informal settlements, there is a need for the country to shift its focus from the street tap to the household by encouraging good water practices at domestic level. If hazards are identified, it informs stakeholders that the water is not potable and will become more dangerous than its original state. The assessment of physical parameters is also important in assuring provision of safe water to the communities [9].

The principal health risk associated with household water storage is the ease of recontamination during transport and storage, particularly where the members of a family or community do not all follow good hygiene practice. Good hygienic measures include the following: Careful storage of household water and regular cleaning of all household water-storage facilities, Regular hand-washing, especially after defecation and before touching the drinking water container, Water that is clean from the supply or has been treated in the household needs to be protected from recontaminations,[10].

The storage vessel should be placed above ground level to restrict access by children and animals. It is better to use a ladle that is stored permanently inside the container; this reduces the risk of contamination while the ladle is not in use. However, the ladle should be used only to transfer water to a cup or other vessel. Drinking from it directly may cause contamination of the water [10]. Water should be transported in a covered container, stored in vessels that are covered and regularly cleaned and in a separate container from other domestic water wherever possible [10].

Through Sustainable Development Goal (SDG) Target 6.1, countries around the world have expressed the will to ensure drinking water is universally safe [11-12].

Our objective therefore is to identify the practices of drinking water collection, transportation, storage and point of use and to carry out a quasi experiment for mean microbial score in 50 drinking water samples from 50 households in Fako Division, Cameroon.

METHODS

STUDY AREA

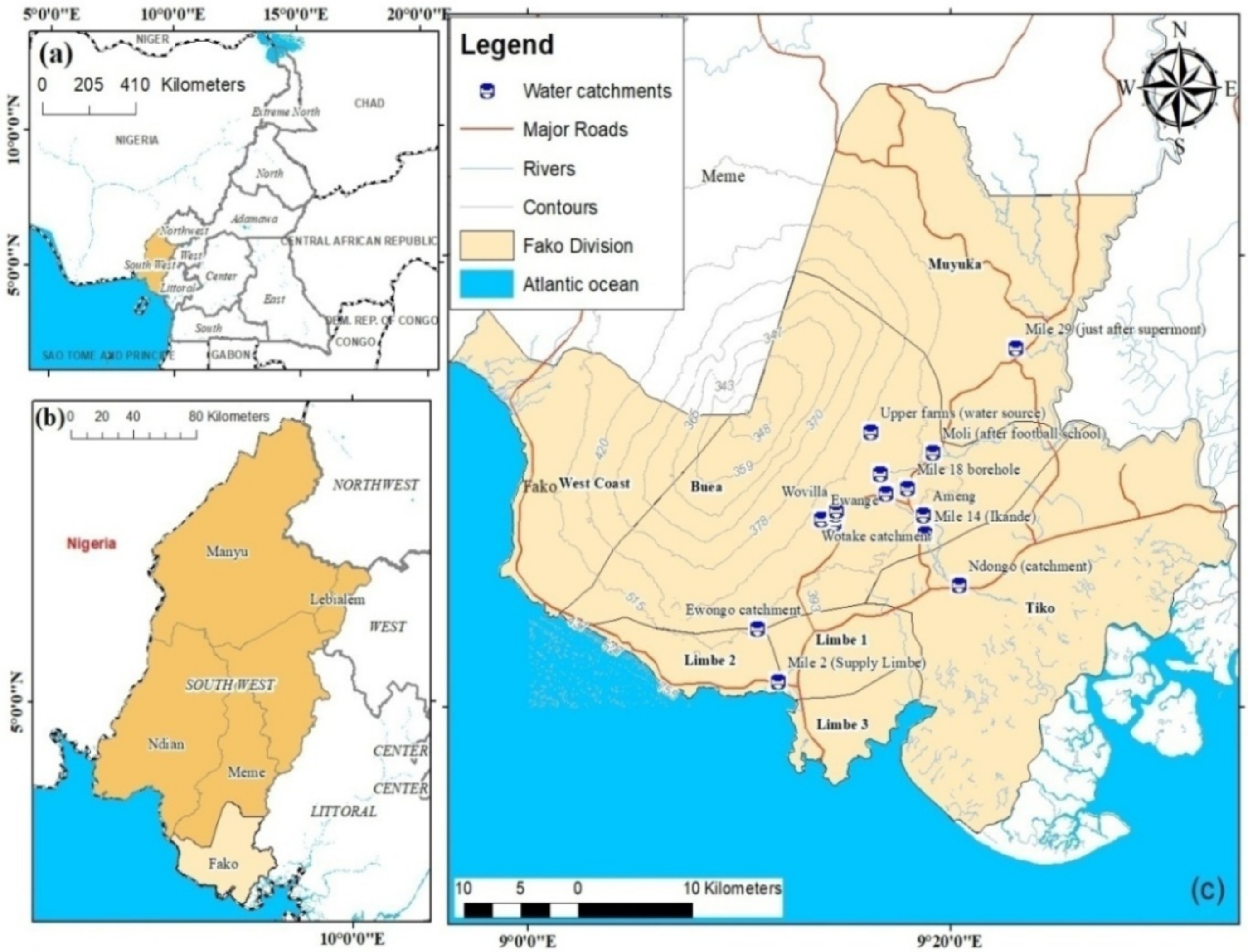

FIGURE 1: MAP OF FAKO, SOUTH-WEST REGION. CAMEROON [13]

STUDY DESIGN:

We conducted a cross sectional study design to ascertain the practices of the study population regarding water management from point of collection through storage and point of final consumption. We used a blend of qualitative and quantitative methods. For the qualitative method, we conducted three Focus Group Discussion (FGDs) with members of three Health districts in our study area. A standardized questionnaire from previous studies was pretested and modified [14-15]. Variables considered were: source of drinking water, distance to and from point of collection, which family member/s is involved to fetch drinking water, mode of transportation, mode of storage and duration of storage and finally, point of use treatment. It was pretested in Kumba. In the field, the study was introduced to the respondents by the interviewer and after a signed informed consent form; the questionnaire was presented to the respondent. Those who could neither write nor read English had their questionnaires read for them by the interviewer in pidgin or French or dialect. The first section of the questionnaire was socio-demographic characteristics; age, sex, nationality, educational level, marital and employment status and type of house. The second section was aimed at collecting information on self-reporting aspects of respondents' of sources of drinking water collection, transportation, storage and point of use. A probability proportionate to size was used to get the total number of participants from each community involved, after a multistage random sampling to get the number of communities from each town in Fako (Fig 2).

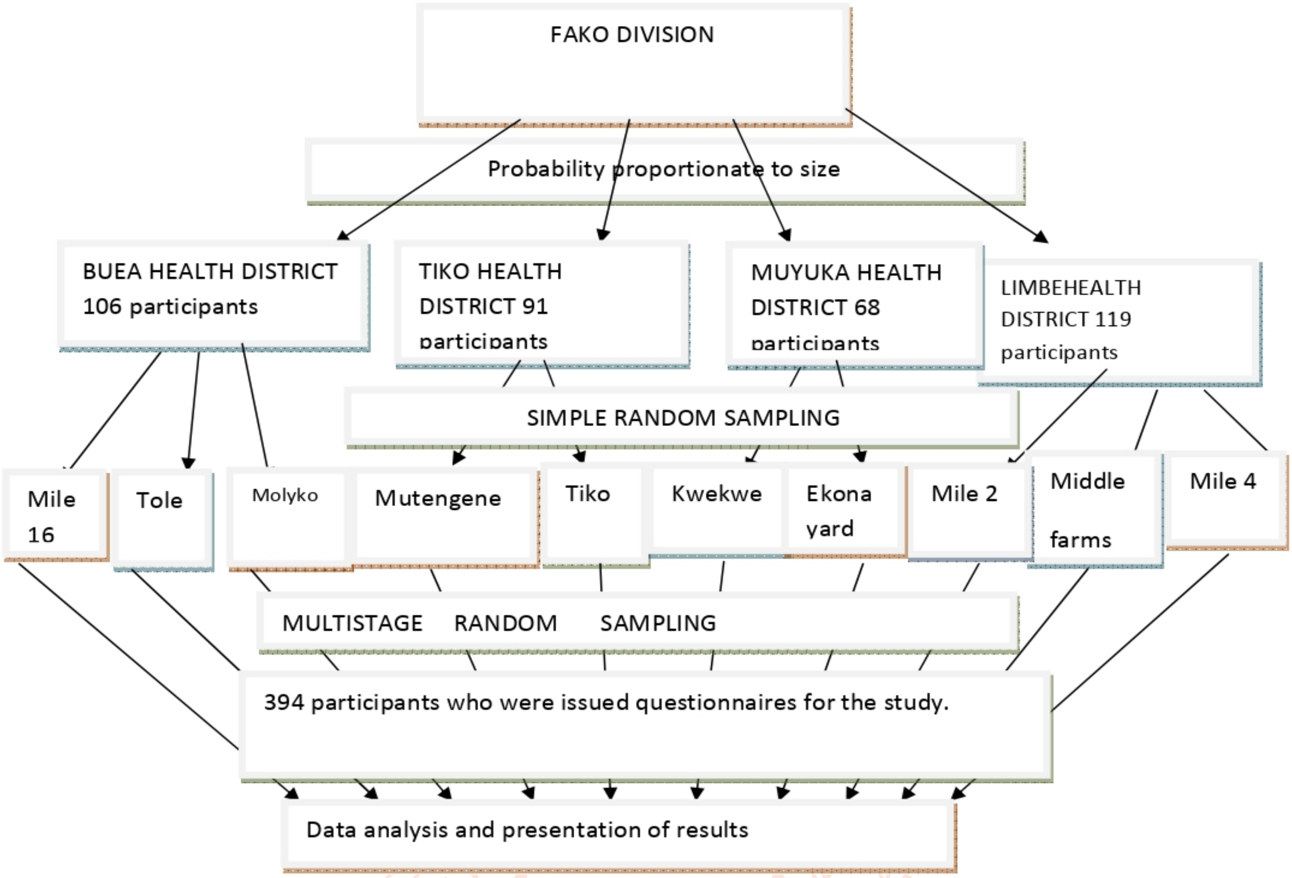

Figure 2: Flow Chart for Cross Sectional Study (household water management) in Fako, 2019

Sample size for the study

With the different water users, the sample size (n) was calculated as shown below [16].

$$n = \frac{Z^2 * p * (1-p)}{e^2} = 384$$

2% non-response rate=394

n=Sample size

Z=Z-value (1.96 for a 95% confidence level)

P=Prevalence of population using safely managed water (0.5).

e=Confidence interval expressed as decimal (.05)

We equally used probability proportionate to size of the health districts to recruit participants for the study, (table 1).

Table 1: Sample size for each health district for cross sectional study

HEALTH DISTRICT	POPULATION	SAMPLE SIZE
BUEA	173,526	109
LIMBE	198,516	123
TIKO	151,400	93
MUYUKA	113,491	69
TOTAL	636,933	394

Intervention through health education

For the quasi experiment, we collected drinking water samples from 50 randomly selected households and calculated mean total bacterial colony count. Then used an intervention (education on good practices of drinking water collection, transportation and storage), for three months and tested samples from same households at baseline and calculated the mean bacterial colony count post intervention. To test the water samples, drinking water collected at households were taken to the laboratory within 8 hours. Plate Count Agar (PCA) (Liofilchem, Italy) was prepared following manufacturer's instruction and allowed to solidify on a flat vibration-free work surface. Decimal dilutions of the water samples were prepared in sterile peptone water up to 10^4dilutions.

Approximately 0.1ml of well mixed diluted samples each was aseptically inoculated on to the PCA agar surface. Using a sterile spreader, the inoculums were evenly distributed over the surface of the medium. Plates were incubated aerobically for 24-48 hours at 37ºC.After incubation, the plates containing between 30-300 colonies (quick visual appreciation) were selected and their respective dilution factors noted. The colonies were counted from these plates, and the following formula was used to calculate the CFU/ml using the formula below [17]:

$$CFU/ml = \text{Number of colonies counted} \times \frac{Dilution\ factor}{\text{Volume of sample inoculated}}$$

Bolifamba community was purposively chosen for intervention, following its consistent highest microbial load in drinking water at household level in the dry and rainy season [13]. We randomly selected 50 households and did a before and after study with education on hygiene and sanitation. A multistage random sampling technique was employed. Five quarters were randomly selected from the 11quarters in Bolifamba. A probability proportionate to size was used to select 50 households from the 5 randomly selected quarters in Bolifamba. From the 50 households, we collected 50 samples of drinking water containers before and after health education. We collected baseline point of use drinking water samples for laboratory analysis. We administered health education talks on water management from catchment to point of use (attitude and practices on water collection, transportation, storage and point of use).The content of the health education talk comprised the following; Stop defecating in drinking water sources, change stored water at most two days, wash storage containers at least twice a week, elevate drinking water storage containers on a slap and not on the floor, use of jar to scoop drinking water and not drinking cups, cover drinking cups.

We did this for 2 months on weekly basis, and then we decided to continue with SMS for a month as the community became unstable. We sent SMSs every Tuesday, Thursday and Saturday at 6am and 5pm as we observed that these are the peak periods when drinking water was fetched. Below is the flow chart for the intervention with education on hygienic practices (Figure 3).

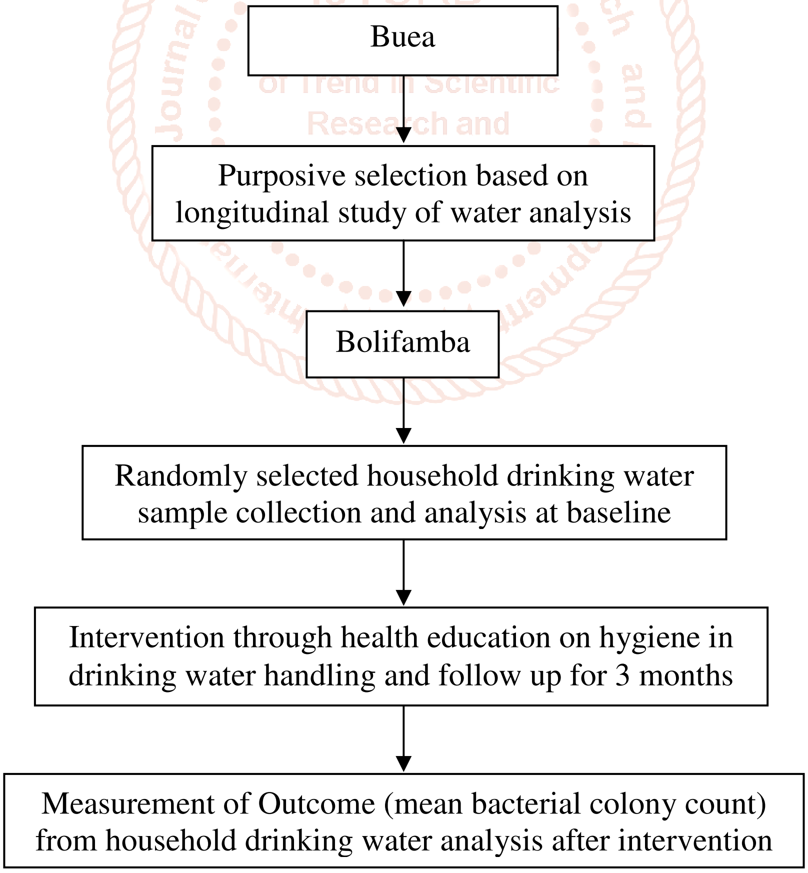

Figure 3 Flow Chart for Intervention through Health Education

Data analysis: Using SPSS version 23, descriptive statistics of respondents' practices regarding drinking water collection, transportation, storage and treatment at point of use that were reported were analyzed. In determining the overall perception of participants on source of good drinking water, sources of water contamination, participant who had correct perception were scored 1 and those who had poor perception were scored zero. The overall scores for each participant were calculated and the mean score determined. Participants who scored below the mean score were considered to have poor perception and those scoring above the mean score were considered to have good perception. Data from the FGDs was analyzed using the Atlas Ti software. For the quasi experiment. (Community trial), an intervention through education was done; this was analyzed by comparing; the mean of total bacterial colony count before and after the intervention with education.

RESULTS

Socio demographic Characteristics of Study Participants

This study constituted a total of 394 participants, among which were 230 (58.4%) females and 164 (41.6%) males. The mean age of the participants was 36.2years with a standard deviation of 11.2. More than half 211(53.6%) were employed. Educationally, 109 (27%) of them had gone to primary school, secondary and high school level made of 146 (37.3%) and 74 (19%) of the study population respectively. However, only 63 (16%) of them had tertiary education level, (Table 2).

Table 2 Socio demographic characteristics of community members in Fako, 2019 (n = 394)

Variables	Frequency (%)
Gender	
Females	230 (58.4)
Males	164 (41.6)
Age	Mean ± SD (36.2 ± 11.2)
18-30	138 (35.0)
31-43	165 (41.9)
44-56	66 (16.8)
57+	25 (6.3)
Marital status	
Married	248 (62.9)
Unmarried	114 (28.9)
Divorce	10 (2.5)
Widow/widower	22 (5.6)
Occupation	
Employed	211 (53.6)
Unemployed	183 (46.4)
Educational level	
Primary school	109 (27)
Secondary school	147 (37.3)
High school	75 (19.6)
University	63 (16.0)
Nationality	
Cameroonian	385 (97.7)
Non Cameroonian	9 (2.3)
Communities	
Buea	112 (28.4)
Ekona	32 (8.1)
Limbe	125 (31.7)
Mutengene	35 (8.9)
Muyuka	34 (8.6)
Tiko	56 (14.3)

Perception of good source of drinking water, quality of good drinking water and sources of water contamination by community members of Fako, 2019.

Sources of drinking water

Majority 123(31.2%) reported that piped water and closed spring were the best source of drinking water. This was closely followed by piped borne water alone where 99(24.9%) of the respondents reported as best source of drinking water. However, 37 (9.4%) of the participants also reported piped water, closed spring and open spring as best sources of drinking water whereas only 17(4.3%) reported closed and open spring as good sources of drinking water (Figure 4).

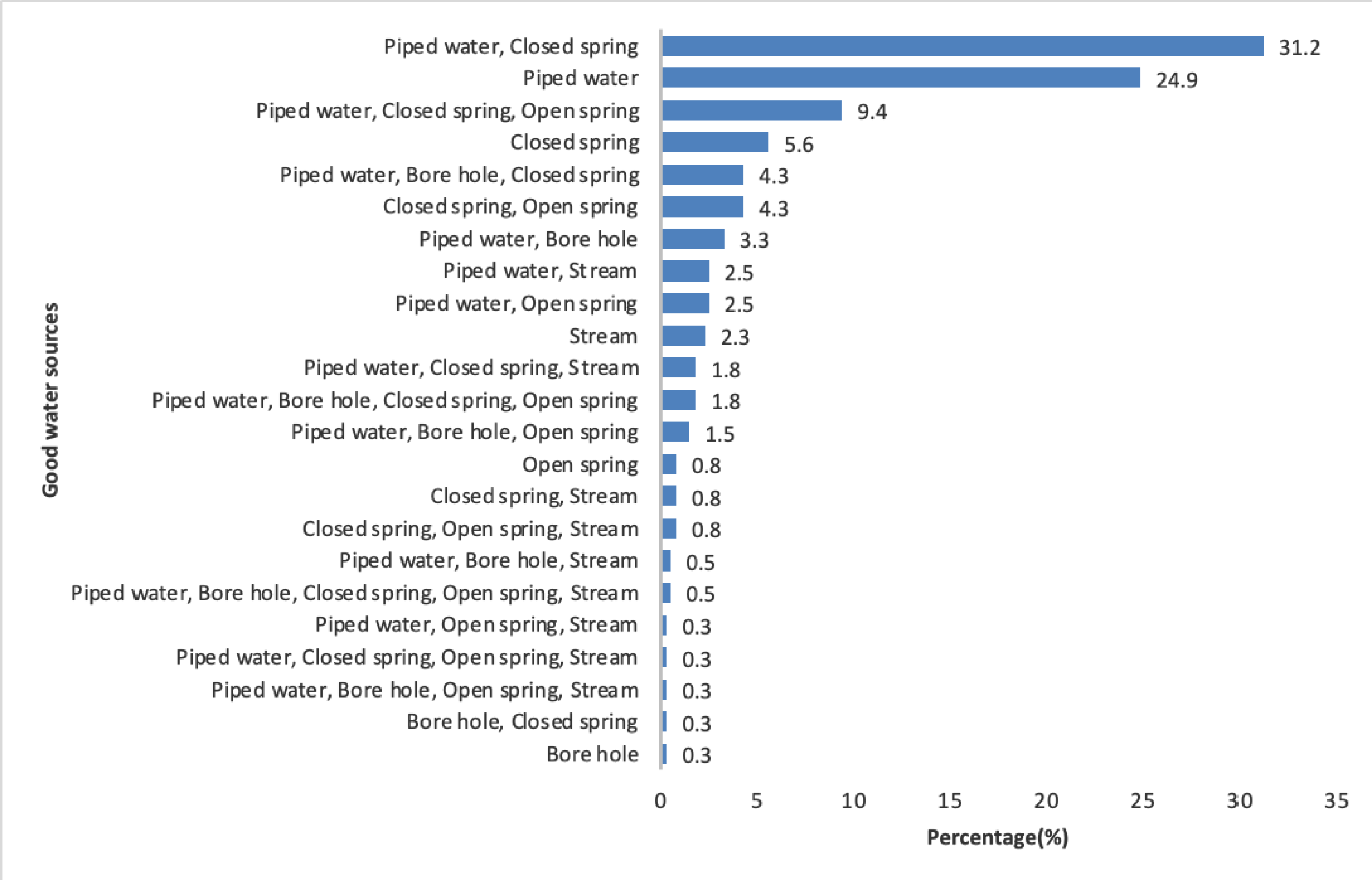

Figure 4 Sources of good drinking water in the Fako community, 2018

Water contamination and quality of good drinking water

In assessing participants perception on water contamination and quality of good drinking water, a vast majority 375(95.2%) agreed that water can be contaminated and as to what should be the quality of good drinking water, majority 326(82.7%) of them said that good drinking water is one which should be clean or clear, no taste and no color. Those who reported that good drinking water should be clean and clear and have not taste were 23(5.8%), meanwhile, 5(1.3%) of them said good drinking water should have no taste and 29(7.4%) said good drinking water should been clear and clean(Table 3).

Table 1: Community members perception on water contamination and quality of good drinking water in Fako, 2019.

variable	Frequency (%)
Can water be contaminated?	
yes	375 (95.2)
No	19 (4.8)
Total	394 (100)
What is the quality of good drinking water?	
Clean or clear, No taste	23 (5.8)
Clean or clear, No taste, No odour	326 (82.7)
No taste	5 (1.3)
Clean or clear, No odour	7 (1.8)
Clean or clear	29 (7.4)
No taste, No odour	4 (1.0)
Total	394 (100)

Sources of water contaminations

In identifying the sources of water contamination, four sources of contamination were identified for this study. A majority 172(43.6%) of the participants said germs is the source of water contamination. This was closely followed by dirty containers with 107(42.6%). Faeces 38(9.6%) and fertilizers 16(9.6%), (Fig 5).

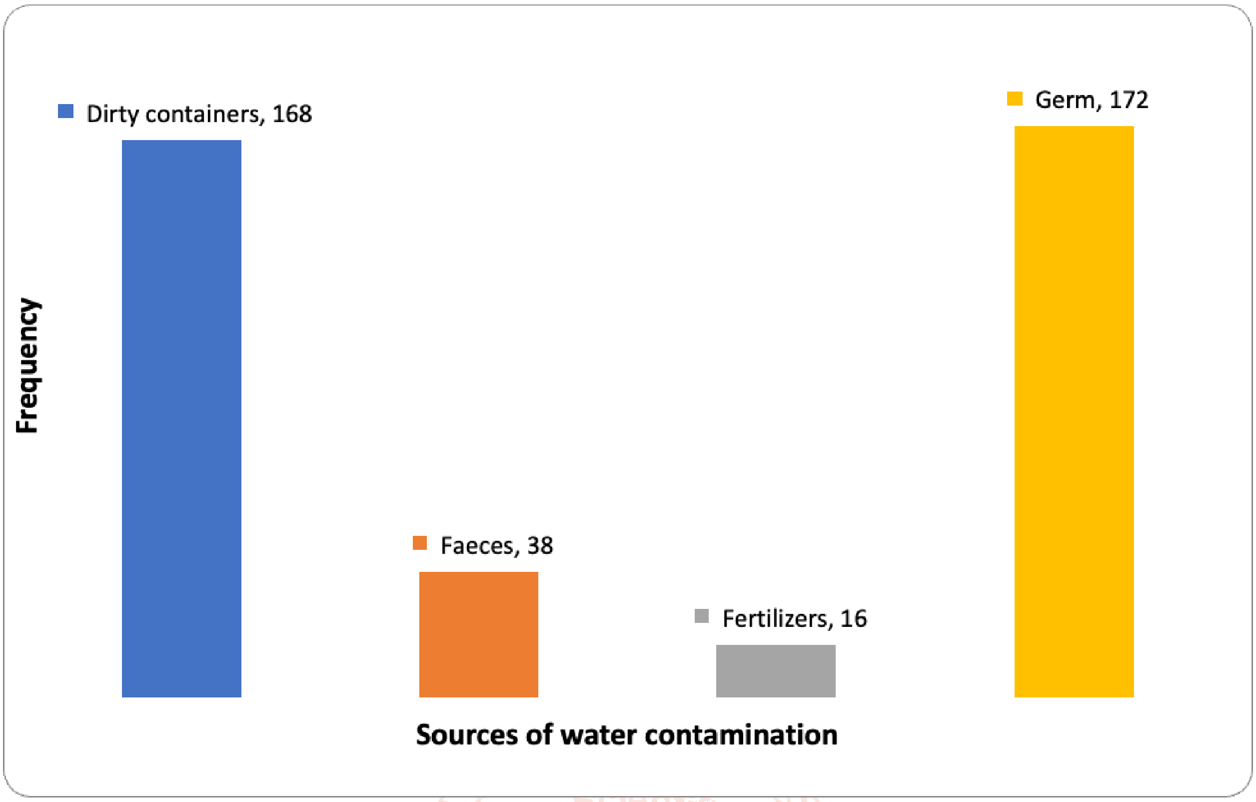

Figure 5: Perception of sources of water contamination, by community members of Fako, 2019.

Practices on Drinking Water Collection and Transportation in Fako, 2019.

Assessing the participants practice on drinking water collection and transportation, 273 (69.3%) of the participants reported public tap as their main source of drinking water, whereas 82(20.6%) reported their main source of drinking water was piped in their premises. However, 37(9.4%) and 3(0.65 %) reported that they fetch their water from springs and streams respectively. With regards to alternative sources of drinking water, 233(59.1%) of the participants reported spring as their alternative source of drinking water whereas those who reported stream and bore hole as the alternative sources of drinking water constituted 69(17.3%) and 93(23.6%) respectively. Pertaining to time spent in fetching water, more than half 222(56.3%) of the respondents reported that they take more than 30mins to fetch water meanwhile 172(43.7%) of them take less than 30mins to fetch water. As to who fetch water in the house, 245(62.2%) of the respondent reported that children are the main set of people that fetch water in the household meanwhile those that said adults fetch water at home made up133 (33.8%) of the study population. 30 (7.6%) of the study population reported bikes as their means of water transportation meanwhile 13 (3.3%) use cars in water transportation, however, a vast majority 351(89.1%) carry their water and trek. As per the container type used in carrying water, 268 (68%) used bucket with lid, 7 (1.8%) and 119 (30.2%) use bucket without lids and jerry can respectively. As concern the container in which drinking water is stored, 184 (46.7%) reported Bucket with a lid as the water storage container meanwhile 34 (8.6%) and 176 (44.7%) stored water in Bucket with no lid and jerry can respectively (Table 4).

Table 4 Practices on drinking water collection and transportation in Fako, 2019

Variable	Frequency (%)
Sources of drinking	
Borehole	1 (0.3)
Piped at premises	81 (20.6)
Public standpipes	273 (69.3)
Spring	37 (9.4)
Stream	2 (0.65)
Total	394 (100)
Alternative sources of water	
Borehole	68 (17.3)
Spring	233 (59.1)
Stream	93 (23.6)
Total	394 (100)

Duration to fetch water	
Less than 30 minutes	172 (43.7)
More than 30minutes	222 (56.3)
Total	394 (100)
Person that fetch water	
Children	261 (62.2)
Adults	I43 (33.8)
Total	394 (100)
Means of water transportation	
Bike	30 (7.6)
Car	13 (3.3)
Trekking	351 (89.1)
Total	394 (100)
Container type used to fetch water	
Bucket with a lid	268 (68.0)
Bucket with no lid	7 (1.8)
Jerry cans	119 (30.2)
Total	394 (100)
How do you store your drinking water	
Bucket with a lid	184 (46.7)
Bucket with no lid	34 (8.6)
Jerry cans	176 (44.7)
Available when needed	205 (52)

Overall proportion of Fako community, with good practice towards water collection and transportation, 2018.

In determining the overall percentage of participants with good and poor practice towards water collection, and transportation, the questions on the questionnaires were scored. Close to three quarters 288(73.2%) of the participants' had good practice towards water collection and transportation respectively.

We observed the practice of community members of mile 2, Limbe entering with feet and dipping of drinking water containers in open springs to fetch drinking water (Figure 6).

Figure 6 Community members fetching water in Mile 2, Limbe Fako, 2019.

Practices on Water Storage and Point Of Use in Fako, 2019

Concerning participants practices toward water storage and point of use,329(83.1%) of the participants reported that they placed their drinking water containers on the floor meanwhile those who placed their drinking water containers on the slap constituted 67(16.9%) of the study population. As to how water is collected for drinking, 68(17.9%) of the participants said they drank their water directly from the bottle, 122(30.8%) said they carried from drinking jar to cup before drinking, whereas more than half 202(51.5%) said they used cup placed directly on bucket to drink water. As concerns the position in which drinking cup were kept, 185(46.7%) of the respondents placed their drinking cups on the drinking bucket whereas 171(43.7%) placed their drinking cups in an open basket in the kitchen and just 38(9.6%) placed their drinking cups on a tray covered with cloths. As to whether, the storage containers are routinely washed, 342(86.4%) agreed that these storage containers were routinely washed meanwhile 50(12.6%) said these storage containers were only washed sometimes and not routinely (Table 5).

Table 5: Practices on water storage and point of use in Fako, 2019.

Variables	Frequency (%)
Placement of drinking water	
On a slap	65 (16.9)
On the floor	329 (83.1)
Total	394 (100)
How water is collected for drinking	
Directly from bottle	68 (17.9)
From drinking jar to cup	122 (30.8)
Used cup placed on bucket	204 (51.5)
Total	394 (100)
Position of drinking cups	
(kitchen in open baskets	171 (43.7)
On a tray covered with a cloth	38 (9.6)
On the drinking buckets	185 (46.7)
Number of storage days of Drinking water	
1 – 3 days	209 (53.1)
4 - 7 days	185 (46.9)
Routinely wash storage containers	
No	2 (1.0)
Sometimes	50 (12.6)
Yes	332 (96.4)
Total	394 (100)

Based on the findings, we carried out two homogenous FGDs to have detail explanations on the practices of household drinking water management. The first with women and the second with youths.

In our findings, a vast majority of more than three quarters of the study participants had good perception of sources of drinking water.

"The water has no odor, no taste and it's very clear and clean. We were told by some whites that we should not add chlorine in our reservoir because our water is of good standard".(**Participant number 3 of FGD 2***)*

"At first we used to treat the water from our catchment. This decision for not treating the water from the drinking water catchment was adopted because they did not master the dose of chlorine in water treatment; hence the chlorinated water had an odor due to probably an overdose".(**Participant number 2 of FGD 1***)*

It was also observed that though more than three quarters of the community members of Fako said they routinely wash their drinking water containers, some members had these to say;

'As for me, we only wash our containers when we realized coloration at the sides of the jerrycan. **(Participant number 1 of FGD 2).**

'Sometimes we realize our storage containers are dirty only when by chance it's taken outside, because habitually, we simply refill fresh water carried from the drinking water source by our children. **Participant number 1 of FGD 1).**

*'I usually wash my drinking water containers with sand or soap each time I realize the sides of the containers are stained with some greenish substances. At times we can't fully have access to all the surface areas of the jerrycan, especially the upper section of the jerry cans, even with the introduction of a sponge aided with a stick'. (***Participant number 3 of FGD 1).**

Only closely more than a quarter of the community members of Fako use drinking jars to serve drinking water to cups.

*'We use the drinking cups to scoop drinking water from storage containers. We usually instruct our younger siblings not to use these cups with dirty hands, which most often it's difficult because they usually drink water intermittently when playing'(***Participant number 2 of FGD 2***).*

'Close to half of the community members of Fako placed their drinking cups on the drinking buckets'

*'We usually place our drinking cups in an open basket in the kitchen. We place ours on top of the drinking bucket' (***Participant number 2 and 3 of FGD 2***).*

Closely half of the community members of Fako store their drinking water for more than three days

*'We drink stored drinking water till we have the next flow of water which may take sometime up to a week' (***Participant number 4 of FGD 1***).*

Quasi experiment with education as intervention in Bolifamba community

A total of 50 samples from 50 households were collected at baseline and after 3 months of health education, 50 samples from same households were collected and laboratory analysis done to determine the total *bacterial colony* count .Out of the 50 samples at baseline, growth occurred on 43 samples whereas growth occurred in 39 of the 50 samples post intervention. A one sample t- test was used to compare the mean total bacterial colony count at baseline and 3 months post intervention. The mean total bacterial colony counts (29.72±40.071CFU/ml) after the intervention was significantly lower compared to baseline (71.4 ± 68.378, t (50) = 6.846, P < 0.001) (Table 6).

Table 6: The impact of health education on drinking water quality in Bolifamba community in Fako division, 2018

Variables	N	Mean (CFU/ml	Std. Deviation	t (50)	95% Confidence Interval		*P*-Value
					Lower	Upper	
Total CFC baseline	43	71.4	68.387	6.846	50.35	92.44	**< 0.001**
Total CFC at 3 months post intervention	39	29.72	40.071	4.631	16.73	42.71	

Discussion:

Most communities in Fako are not accessing sufficient water for all domestic uses and so become reliant on alternate sources (mostly springs and boreholes) [18]**.**

Where the primary water source is not consistently available, the safety of drinking water in the community is compromised. The inability of the lone national utility body to provide consistent drinking water supply brings a lot of uncertainty to the health risks of the communities, when other unmonitored alternative (spring) water sources are used. In our findings, a vast majority of more than three quarters of the study participants had good perception of sources of drinking water**.** However contrary to [19], where in the study, the participants perceived their sources of water have low quality ,hence treat their drinking water before usage whereas in our findings, the community members instead perceive their sources are of good quality hence requires no treatment which is in collaboration with [20]. From the FGDs, we got information that, "the water has no odor, no taste and it's very clear and clean. They were told by some whites that chlorine should not be added in the reservoir because the water is of good standard". When a water committee personnel in Bolifamba community was approached, he said "this policy was adopted because they did not master the dose of chlorine in water treatment, hence the chlorinated water had an odor due to probably overdose". Although there is a general belief in the safety of spring water in Fako because it is clean and clear, a study carried out revealed that the springs water are vulnerable to contamination due to anthropogenic activities around the drinking water catchments [13]. These therefore makes the water not very fit for drinking purposes according to WHO standards as close to half of the catchments harbor microbes and traces of phosphates in the rainy season due to leaching of fertilizers from farming around [21-22]. Drinking water even from an improved source collected with some unorthodox practices (Fig 6) showing participants entering with feet and dipping of containers in open spring source, which can likely contaminate the drinking water fetched, can expose the safe water to contamination [21].

According to WHO guidelines for drinking water, water collected with roundtrip more than 30 minutes has the likelihood of contamination. In our study, 56.3% use more than 30 minutes roundtrip and done mostly by children (62.2%) ,similar to [23-27],where Women and children, in particular have to travel long distances far from their households looking for water. There are salient reasons for this; the population of Fako has out grown the water storage tanks of the water utility company and there has been no expansion of the tanks for decades. We observed some filtration beds out of use thereby reducing the volume of water filtered per hour. All of these leaves CAMWATER with volume of water which is not commiserate with its population it serves. The only option is to ration distribution either limiting the hours of flow per day and sometimes skips days before the next flow. This leaves the populations that fetch drinking water from public stand taps sometimes punctuated with low pressure to queue for hours, some fight over drinking water containers and will sometimes not have the opportunity to rinse these drinking water containers with the likelihood of contamination. Our results show that 30% of our participants use jerry cans to fetch water. Jerry cans are difficult to wash, as they have a narrow spigot. It is difficult to realize it's even dirty as such the likelihood of contamination [9, 28]. Consequently, we observed bio-film of microorganism adhere by the sides of the jerry cans used to fetch and store drinking water. From our results close to half (46.7%) of our study participants store their drinking water in buckets. Studies have shown that water stored in wide mouth containers are liable to contamination [20], as children frequently with the ladle dip their dirty hands in the drinking water exposing it for contamination. This storage is considered a challenge and an opportunity at the same time. There is therefore the possibility of recontamination of drinking water between source and point-of-use, thereby exposing the household members to water borne diseases like cholera ,similar to the studies in Nigeria[29-34].

We also observed that almost a half of the participants 180(46.9%), practice storing drinking water for up to 4-7days to secure availability of drinking water before the next water flow. From the FGD, Participants said "sometimes water flows at very odd hours (midnight or between 1:00 am – 3:00am), in some communities according to schedule or sometimes skip 2-3days or weeks". "We are therefore most often, bound to store drinking water till the next flow". Drinking water stored above at most three days predisposes it to re-contamination [25, 35]. These results are similar to that of a study done in Sub- Saharan Africa and Senegal, where the drinking water quality changed from catchment to consumer in the rural area indicating higher contamination of total coliform and *E. coli* counts in container water at household compared to the sources [1, 29, 36-39].

From our study, a majority of the households 329(83.5%) placed their drinking water containers on the floor. Some 185(46.7%) of the participants, expose drinking cups either in a basket in the kitchen or on slaps and on the drinking containers, and 201 (51%) of our study participants dip directly in the storage containers these exposed cups in drinking water. These practices predispose stored drinking water to contamination or re-contamination through insects and dust during the day and rodents like rats and cockroaches during the night. This is similar to a study by [40], where unhygienic practices predisposed stored drinking water to contamination.

Following the gaps noticed in the field in the practices of drinking water collection, we decided to carry out an intervention with education to scale up on good practices of drinking water collection, transportation and storage. Environmental health education on safe storage of water and treatment are amongst some of the household water safety management that has been proven to curb the continuation of outbreaks in developing countries [41]. After education for three months, the mean bacterial colony count was significantly lower. This shows that continuous education on good practices of drinking water management at household have a significant impact on the quality of drinking water in our intervention community. This is similar to a study in South Africa where continuous education arrested a cholera epidemic [24].

Conclusion:

The main source of drinking water in Fako is public tap 273(69.3%), alternative source being spring 233(59.1). More than half of the participants 221(56.3%) trek to fetch water and almost a half 180(46.9%) store water for than 3 days. Intervention with health education significantly lowered the mean bacterial colony count in household drinking water.

The institution of an integrated water safety plan including all stakeholders to manage or monitor drinking water from sources of collection, transportation, storage and point of use is paramount. Since it might be difficult to approach the policy of monopoly of CAMWATER that supplies potable water in Cameroon, to mitigate the effects of frequent drinking water interruption and unpredicted community water schedule of tap water flow by the lone water distribution water agency, continuous health education on good practices and the use of point of use water purification agents could help improve on the quality of water used at household levels to reduce the occurrence of waterborne diseases.

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Authors' contributions This work was carried out in collaboration between all authors. Authors ME, KJ, NP and NAL conceived the study, authors ME, GR, SN, VEAE, BFN and KJ designed the study. Authors KJ, NP, PJN, KAT, HDM and NAL, supervised the study and provide major contributions in writing the manuscript. Author ME managed literature search and wrote the first manuscript while author HD and KAT analyzed the data and all authors proofread the manuscript and approved the final manuscript

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