Short Communication

Water insecurity among rural households of West Cameroon: lessons learned from the field
Carole Debora Nounkeu and Jigna Morarji Dharod

ABSTRACT

The objective of this study was to assess and compare water access and sanitation-related behaviors with self-reported water insecurity among women. The cross-sectional study involved household observations and in-person interviews with women living in rural areas of West Cameroon (n = 134). Water insecurity was prevalent with 37% of women having affirmative responses to the statement ‘being worried about household not having enough water.’ Only 7% of the women reported having any water source (well/pump) in the household compound, and water insecurity was more common among those who did not have an ‘on premise’ water source (p = 0.038). Additionally, women walking more than 10 minutes to reach the water source were more insecure than their counterparts (p = 0.022). Amount of water stored at home was lower in water insecure households (37.07 liters) compared to secure households (58.93 liters, p = 0.042). Sanitation rate was low in the study area, with 20% of women reporting open defecation for their children. Water insecurity is associated with long distance to water source and limited water availability at the household level. Future research is needed to understand the association between water insecurity and daily water intake and related dietary behaviors.

Key words | children, diarrhea, hygiene, sanitation, water insecurity

INTRODUCTION

Water is an essential nutrient, a critical component for agricultural production and livestock husbandry, and holds significant implications in addressing gender equity and promoting optimal growth and development of children (Mercy Corps 2009). In 2015, 844 million people still lacked basic drinking water services and 892 million people worldwide still practiced open defecation. Furthermore, 159 million people were collecting their drinking water from surface water sources with 58% of them living in sub-Saharan Africa (World Health Organization (WHO)/United Nations International Children’s Emergency Fund (UNICEF) 2017). Predictions show that by the year 2025, a total of 1.8 billion people worldwide will be expected to experience absolute water scarcity and two-thirds of the world’s population will be likely to face water stress conditions (World Water Assessment Programme 2006). Nevertheless, in most countries of sub-Saharan Africa, poor water access does not result from lack of water resources but, from lack of infrastructures and poor reliability on existing improved water sources. For instance, Cameroon has a dense network of rivers, a high annual rainfall volume, and an annual available water per inhabitant of 21,000 m³ (three times the world’s average), but water scarcity remains a huge issue among its inhabitants with only 47% of its rural population having access to improved sources of water (WHO/UNICEF 2008; Ako et al. 2010a).
The United Nations – Water proposed the following definition of water security:

‘The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability’ (United Nations University 2013).

Hence, water insecurity can be referred to as a situation when the sustainable access to adequate quantities and acceptable quality of water is compromised (United Nations University 2013).

In 2017, the WHO/UNICEF’s report recognized off-premise access to water as a critical issue and incorporated location of water source and water fetching times as indicators of water access (WHO/UNICEF 2017). However, focusing only on these indicators does not capture the seasonal variation, psychosocial issues, and changes in water use that occur at the household level because of water shortage (Ako et al. 2016b; Adank et al. 2016). For instance, in Dschang, West Cameroon, 54% of households often experience interruption of their piped water supply averaging 12 days per month (Nkamedjie et al. 2016). Similarly, Adank et al. (2016) reported that in Amhara, Ethiopia, only 32% of households had their own private water source, which included on premise wells, water pumps, or private taps.

Recognizing the role of water in promoting economy, peace, and health, the reduction of water insecurity status has become the central piece of several milestone agreements such as the Agenda for 2030 Sustainable Development Goals (United Nations Department of Economic and Social Affairs 2015). Further, it is recognized that the establishment of a validated scale to measure water insecurity at the household level is vital to assess the predictors and causes of poor health among children (Mercy Corps 2009; WHO/UNICEF 2017). Mirroring food insecurity measurement, researchers studying water insecurity indicated that its scale should capture: (1) individual perceptions of water availability; (2) anxiety and stress that occur due to water uncertainty, and (3) coping behaviors and compromises people do to manage poor water access (Hadley & Wutich 2009; Stevenson et al. 2012; Workman & Ureksoy 2017). In particular, all these studies indicated that psychosocial distress, a very common phenomenon related to water insecurity, should be included in the assessment. However, it is unclear how psychological distress is related to water access behaviors and what should be the other key components of the scale considering that water is a nutrient and its reduced intake could be detrimental for health.

To further add to the current literature and examine what other socio-cultural and experiential based factors might play a role in predicting water insecurity, the objective of our study was to assess and compare water access and sanitation-related behaviors with the self-reported water insecurity among women living in rural areas of the West Region of Cameroon.

METHODS

From January 2017 to April 2017, a cross-sectional semi-quantitative study involving household observations and in-person interviews with caretakers was conducted in a village of the Menoua division, one of the eight divisions of the West Region of Cameroon (Figure 1). The Menoua division includes 22 villages, covers an area of 1,380 km², and consists of a population of about 372,244 inhabitants with agriculture and animal rearing constituting the main source of the economy (Yemele et al. 2015). The climate encountered there has two main seasons: dry season (from mid-November to mid-March) and rainy season (mid-March to mid-November). The average temperatures range from 13.66 °C to 25.35 °C with annual average rainfall of 1,717.7 mm (Yemele et al. 2015).

Approvals were obtained from both Cameroon National Committee of Ethics for Human Research and the University of North Carolina at Greensboro Institutional Review Board. We used a three-step approach to make the survey questionnaire appropriate and relevant for the study area and participants of West Cameroon. The questionnaire was translated from English to French, and back translated by a third party. The survey guide was available in both English and French and administered to the participants in their preferred language by the student investigator, who is fluent in both languages. Considering the α level of 0.05, power of 80%, absolute error of 5%, the sample size of 134 participants was estimated based on the prevalence of food...
insecurity among rural populations of Cameroon. Even though water insecurity assessment was a primary goal, food insecurity rate was used to calculate sample size, for two reasons: (1) there were no published data available on water-use and (2) the other objective of the study was to assess the relationship between food and water insecurity. Women meeting the selection criteria (Table 1) were recruited using either a door-to-door approach or by going to places where we expected to find them.

We conducted face-to-face interviews at the participants’ homes or in a private setting and collected information on the following:

1. Socio-demographics such as age, household size, number of children, marital status, religion, and education level of caretakers.
2. A six-item water insecurity scale adapted from Aihara et al. (2016) was used with ‘past 30 days’ as reference period. The scale was divided into the following three domains of water insecurity: (1) anxiety and worries about water access at the household level (one item); (2) availability of sufficient quantity and quality of water (four items); and (3) health consequences due to water scarcity (one item).
3. Water access-related behaviors such as sources of water, distance to the sources of water, and frequency of water collection activities.
4. Sanitation facility at the household level both for the caretaker and for the 2–5-years-old index child.

Similarly, community and household observations were conducted by the investigator to collect information on daily lifestyle, conditions of water sources, walking distance, and use of types of water containers.

Both interview and observation data were analyzed in English using SPSS 23 (IBM Corporation, NY, USA). Descriptive statistics were conducted to describe socio-demographic and economic characteristics and water security and sanitation status. Bivariate tests (chi-square, one-way analysis of variance (ANOVA)) were conducted to detect differences in water-related behaviors by water security versus insecurity status. Results were considered significant at a probability value of ≤0.05. Additionally, observation
assessment in the form of pictures and notes was used to understand water-related conditions of the study area.

RESULTS

Socio-demographics

Of the total 134 interviews with caretakers, 63% of them were conducted during the dry season and the rest during the first month of the rainy season. The caretakers were on average 36 ± 11 years old. The mean household size was 6 ± 2 with the number of children living in the household ranging from one to six. Most of the participants (83%) reported receiving less than high school education. In terms of economic assets, 95% of caretakers reported having a farm while 76% reported owning livestock. Farms were used to grow a large variety of food items including beans, peanuts, maize, tubers, vegetables, and even coffee. Most of the participants (78%) were married, and 72% were Christian (Table 2).

In terms of distribution of their daily routine, caretakers were spending most of the time at the farm, along with taking care of different household activities including cooking, child rearing, and conducting and/or supervising water fetching activities. In managing several responsibilities, cooking food in bulk for several meals together, i.e., cooking food for lunch, dinner, and next day breakfast, was very common. Approximately one-fifth of the caretakers (22%) were involved in small scale food business to generate income, involving selling items such as salt, Maggi, palm and refined oil, and ‘beignets’, or even ready-to-eat food. Results are not shown, but no significant association was found between socio-demographics and water insecurity.

Interview and observation results on water access-related behaviors

Self-reported assessment of water insecurity

By continuous measure, the average water insecurity score was 1.37 (±1.58), with three (2%) participants earning a maximum score of 6. Based on the scoring scheme of affirming to at least one of the six statements of the scale, as indicated in Table 3, 58% of participants confirmed some level of water insecurity in the past 30 days. The maximum affirmative response was for the anxiety related to water access (37%). In reference to the domain of the availability of sufficient quantity/quality of water and ability to maintain adequate hygiene practices, a quarter of the participants (24%) expressed concerns. Borrowing water was not considered a common practice among participants. In enquiring about the health issues due to water, only 4% provided an affirmative response for the statement enquiring on whether the water they used was causing potential health issues.

Water sources

According to the interview results, for drinking water, public standpipes (44%) represented the main water source, followed by springs (28%) and rivers (18%). On the other hand, river water (31%) represented the main water source for household chores, followed by individual wells (28%) and public standpipes (25%) (Figure 2). The use of these water sources was more prevalent during the dry season.
Based on the observations, it was noted that most of the aforementioned sources were not improved and did not offer a clean and safe source of water for drinking.

Water access

Only 7% of households had water on premise in the form of either piped water connection or individual wells. The rest of the households fetched water off premise (Table 3). Additionally, it was seen that the water insecurity score was significantly higher for households who were using water sources off premise in comparison to households with an on-premise water source (water insecurity score: off premise = 1.61; on premise = 0.56, f(2, 128) = 3.345, p = 0.038). For 55% of households, the average walking time (one way) to reach the water source exceeded 10 minutes (Table 3). Water insecurity was significantly higher for a group of women who reported walking for more than 10 minutes to reach the water source than those who reported walking 10 minutes or less one-way to the water source (69% versus 49%, respectively, p = 0.022).

In examining who was involved in water-fetching activities, the caretakers noted that, excepting the adult male-head of the household, all other members were involved in fetching water. Participants reported they often went early in the morning to fetch water either because of the owner schedule (private standpipes), to avoid long queuing times (public standpipes and springs), or before people started using the source for washing clothes, bathing, and other purposes (rivers). Based on the observation data, it was noted that water fetching was a group activity, and all the household members, including old and young children worked together to bring water for the household using varying sizes of plastic containers (Figure 3). It was also observed that school-age children were required to bring water to school on a weekly basis to clean their classroom (Figure 4).

Water availability at the household level

Of the total participants, 60% reported using a separate source of water for drinking and household chores' purposes and keeping them in separate storage containers at the household level. Participants reported separating chores and drinking water sources when they felt the source they chose for drinking water was cleaner or had a better taste compared to other sources. For these households, there was an average of 15 ± 15 liters of drinking

---

**Table 3**  Water security and water-related behaviors (n = 134)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount of water available in the household at the moment of the interview (liters)</td>
<td>46 ± 61*</td>
</tr>
<tr>
<td>Amount of drinking water available (liters)*</td>
<td>15 ± 15</td>
</tr>
<tr>
<td>Amount of water available for chores (liters)*</td>
<td>37 ± 72</td>
</tr>
<tr>
<td>Location of water source</td>
<td></td>
</tr>
<tr>
<td>On premise (piped connection/individual wells)</td>
<td>9 (7%)*</td>
</tr>
<tr>
<td>Either the chores or drinking water sources was off-premise</td>
<td>32 (24%)*</td>
</tr>
<tr>
<td>Off-premise</td>
<td>90 (69%)*</td>
</tr>
<tr>
<td>Walking more than 10 minutes to the water source</td>
<td>75 (55%)*</td>
</tr>
<tr>
<td>Total number of affirmative responses on the water insecurity scale (water insecurity prevalence)</td>
<td>78 (58%)*</td>
</tr>
<tr>
<td>Affirmative responses on the six items of water insecurity scale</td>
<td></td>
</tr>
<tr>
<td>Worries about household not having enough water</td>
<td>49 (37%)*</td>
</tr>
<tr>
<td>Used just a little water day after day because of lack of resources</td>
<td>29 (22%)*</td>
</tr>
<tr>
<td>Not able to maintain good hygiene because of lack of resources</td>
<td>30 (23%)*</td>
</tr>
<tr>
<td>Drank poor quality water because of lack of resources</td>
<td>36 (27%)*</td>
</tr>
<tr>
<td>Borrowed water from somebody in the village for daily chores</td>
<td>13 (10%)*</td>
</tr>
<tr>
<td>Health concerns</td>
<td>5 (4%)*</td>
</tr>
<tr>
<td>Sanitation facilities</td>
<td></td>
</tr>
<tr>
<td>Modern flushing toilets</td>
<td>32 (24%)*</td>
</tr>
<tr>
<td>Simple pit latrines</td>
<td>89 (66%)*</td>
</tr>
<tr>
<td>Latrines with wooden platform</td>
<td>13 (10%)*</td>
</tr>
<tr>
<td>Where does the child defecate?</td>
<td></td>
</tr>
<tr>
<td>Latrines</td>
<td>67 (50%)*</td>
</tr>
<tr>
<td>Child stool bowl</td>
<td>37 (28%)*</td>
</tr>
<tr>
<td>Child defecates around the house</td>
<td>30 (22%)*</td>
</tr>
</tbody>
</table>

*We only considered those of the households who had a separate source for drinking and for water for chores (60%).

*Three households which used bottled water as a primary water source were excluded from the analysis.

*The reference period for each item used was the ‘past 30 days’. The response of ‘sometimes’ or ‘always’ was considered as an affirmative response.

*Analyses were conducted to assess the correlation between these variables and water security status and p < 0.05.
water and 37 ± 72 liters of water used for chores available in households at the time of the interview. Overall, the total amount of water available at the time of the interview was 46 ± 61 liters. In comparison, water insecurity (having affirmed experiencing at least one of the six statements) was associated with lower amount of water available at the household level (water secure: 58.93 liters of water versus water insecure: 37.07 liters of water, \( f(1, 132) = 4.210, p = 0.042 \)). The total amount of water for drinking/chores was divided by the total

![Figure 2](image1.png)  
**Figure 2** | Main water sources in the study area.

![Figure 3](image2.png)  
**Figure 3** | Water storage containers: (a) small plastic barrel and 10–20 L plastic cans and (b) buckets used for water storage at the household level.
household size and it was found that, on average, each individual from each household had 7.95 liters of water available for use per day. As indicated in Figure 3, water at home was fetched and stored in mid-size (10-20 liters) plastic can containers, buckets, and large barrels. Additionally, large plastic/metal barrels were also used, especially to collect and store rainwater (Figure 5). In general, participants did not fetch water on a daily basis, even the drinking water. The frequency of water fetching activities increased during the dry season, since most of the water sources were drying up (dry season: 1.4 days versus rainy season: 2.4 days, $F_{(1, 105)} = 5.303, p = 0.023$).

**Excreta disposal at the household level**

Improved sanitation facilities were available in 119 households (88%). Fifteen households (12%) still used unimproved wooden sanitation facilities (Table 3). The average amount of water available at the household was significantly different depending on the type of sanitation (modern flushing toilets = 71.28 liters versus simple pit latrines = 39.87 liters versus wooden latrines = 28 liters, $F_{(2, 131)} = 3,862, p = 0.023$). Based on the observation report, open defecation among children was seen in 30 households (22%). In comparison, open defecation among children was common in households with wooden sanitation facilities (69%) compared to those who used simple pit latrines (19%) or modern flushing toilets (13%, $p < 0.001$).
DISCUSSION

The information on water use and observation results indicated that the study area was characterized by poor water access, with a limited availability of water at the household level, and widely practiced open defecation among children. Based on the self-reported results, water insecurity was experienced by about half of the households in the study area.

Several authors have conducted studies on assessment of water quality in the different regions of Cameroon (Yongsi 2010; Nkamedjie et al. 2016). Results of the microbiological testing of hundreds of randomly collected drinking water samples from improved water sources showed that more than 95% of them were of low quality (Yongsi 2010; Nkamedjie et al. 2016). Considering that, the participants in our study are highly likely to develop water-related diseases, especially when all the water sources commonly used were not in the improved category. In our study, water-fetching activity was more frequent during the dry season, indicating potential seasonal variation in water insecurity, with it becoming severe during the dry season. Other studies have shown that water insecurity level decreased during the rainy season due to the availability of rainwater as an additional water source (Hadley & Wutich 2009; Hamdiyah & Kwakwa 2014).

Geere & Cortobius (2017) found that assessing the location of the water sources is important to accurately indicate the burden of work that fetching water activities represents among households. Using data from 23 countries, they found that 46.6% of water sources in rural areas were located off premise. Our study showed a slightly higher proportion; and this was associated with higher levels of water insecurity. Additionally, those who walked more than 10 minutes to reach a water source were twice as likely to be water insecure. Similarly, many studies have found a positive correlation between water insecurity and water collection time (Hadley & Wutich 2009; Bisung & Elliott 2018). In fact, a one-minute increase in time spent fetching water was associated with 0.25 increase in water insecurity score (Bisung & Elliott 2018). Further, it is found that long walking time and early water fetching hours pose a safety issue for water gatherers, causing increased cost for rural households (Stevenson et al. 2012; Geere & Cortobius 2017).

Studies found that households experiencing water insecurity chronically tend to reduce their frequency of bathing and washing clothes and that people from water-scarce regions modify their behaviors and carry out water-related tasks with far less water than people from water-rich areas (Hadley & Wutich 2009; Workman & Ureksoy 2017). On average, each individual per household in our study had about 7.6 liters of water available per day. In other African villages, it was found that water use could be as low as 9.7 liters per person per day (Hamdiyah & Kwakwa 2014). Our results show that limited water access was a common issue in the study area, especially access to improved source of water was almost non-existent. However, only 4% of caretakers reported their concerns about health issues due to water. In other words, based on the self-reported responses on water insecurity scale, it could have been concluded that inadequate access to clean and safe water was not a severe problem in the study area. Research related to food insecurity among immigrants and refugees has shown that the perception of people on what should be normal differs based on their experiences and affected accurate measurement of the severity of food insecurity (Caswell & Yaktine 2013; Nunnery & Dharod 2017). For instance, in a study aiming to assess food insecurity levels among different groups of refugees, participants reported that they generally ate once or maximum twice a day, but failed to recognize that they skipped meals when they were asked the question (Nunnery & Dharod 2017). This was because participants had experienced chronic food shortage in camps and skipping meals as a coping strategy became a normal behavior of eating just one or two meals a day. Disparities between observation and self-reported results in our study might be due to a similar phenomenon. Lengthy exposure to a situation, in this case water insecurity, would have led to adaptation and normalization of the situation.

However, the use of a validated experience-based scale to measure water insecurity among women is critical to capture stress, anxiety, and discomfort related to uncertainty and reoccurrence of water shortage, especially in the dry season. This is critical because women are generally
responsible for acquiring and managing water for their household and they also take care of children and play a key role in growing food and ensuring food security for the household (Wutich & Ragsdale 2008; Ako et al. 2010b). Wutich & Ragsdale (2008) indicated that negative emotions due to poor water availability and being preoccupied thinking of how to address water shortage was common among women, resulting in anger or humiliation because their water situation did not conform to normative social expectations. In our study, the maximum response was also noted for the anxiety statement. In qualitative responses, caretakers mentioned that they often had to struggle managing farm work and fetching water, thus had to involve young children in bringing water for the household – representing the opportunity cost and socially unacceptable behavior practiced due to water insecurity.

In our study, 22% of households had children who practiced open defecation. This proportion is twice the prevalence of open defecation (11%) reported in rural areas of Cameroon (WHO/UNICEF 2015). The open defecation among children was more common in households using wooden sanitation facilities. Generally, this type of wooden sanitation facility is not considered safe for children who can easily fall into the hole and it could be because of this risk that caretakers preferred children defecating in the farms or outdoors in the local vicinity.

CONCLUSIONS

Water insecurity is a common issue even in tropical regions where yearly rainfall occurs with plenty of opportunities to conserve natural water. Especially due to poor infrastructure and negligence, limited access to improved water sources and sewage systems has been a persistent and chronic issue in the rural regions of sub-Saharan Africa. In such a situation, the perception of what is normal water access might be distorted, hence, continuing to use environmental indicators such as common water sources, walking distance, per capita water use, and excreta disposal facilities might provide a clear indication of water-related issues. Nevertheless, a valid scale to measure water insecurity at the household level is needed to capture anxiety and changes in water intake behaviors, including opportunity cost that families incur due to water shortage.

REFERENCES


insecurity in 3 dimensions: an anthropological perspective on water and women’s psychosocial distress in Ethiopia. 
Social Science & Medicine 75 (2), 392–400.


First received 14 October 2017; accepted in revised form 29 March 2018. Available online 18 April 2018.