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Domestic Water Sources in Northern Region, Ghana

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Abstract

The study was designed to assess households' perception of the use of different water sources in Northern Ghana. The mixed-method approach was used for the study. Using a multi-stage sampling technique, the study collected cross-sectional data from 356 households in the Region for the study. Descriptive statistics and computation of perception index were used to analysed data for the study. The study revealed that households in the study area use water from both improved (boreholes and taps) and unimproved (rivers, well, and rain collection) sources for various domestic purposes such as cooking, drinking, livestock watering, and cleaning. Improved water was perceived as safe and thus used for drinking and cooking. The study revealed that 35 %, 24 %, 28 %, and 13 % use wells, boreholes, taps, and rivers, respectively. About 47 % of households use unimproved water sources as their main source of water. The study recommends that government and non-governmental organizations should provide adequate improved water for use at all times.

Keywords: domestic water sources, improved water, perception, Northern Ghana.

1. Introduction

Globally, water is considered a vital commodity to human lives and it is essential for development. Its importance can be related to the quality and quantity of the water. To achieve good personal and domestic hygiene practices, it is critical to gain access to the required quantity of water needed for sustenance. Water quality is needed, especially for the maintenance of health. Water is the most-searched-for commodity on the planet and many are dying due to its non-availability or poor quality. Lack of access to safe water has become a problem of pressing global importance (UNICEF/WHO, 2008). Presently, more than two billion people around the world (between 1990 and 2010) have gained access to improved water for the first time. Through the activities of various stakeholders (including both private and public institutions), most developing countries gained access to improved water for drinking. The water sector in Ghana has not been static either; there has since 1990 been a significant improvement in water coverage. These have been succeeded by a series of reforms and they have had significant influences on the level of water supply recorded in the country. The access to improved water sources has contributed to the achievement of the Millenium Development Goals (MDGs) in the country (Asiedu, 2010; UNICEF/WHO, 2015).

In most communities, the main sources of drinking water are surface and groundwater

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(Abanyie et al., 2020). It is therefore perceived that access to improved water sources can lead to development and reduction in disease burden in rural communities. However, these sources stand the risk of contamination with chemicals and microbes since they threaten human lives. Water treatment for domestic use by households in Ghana is also not a common practice (Amoah, 2020). These issues can be attested by several studies that have indicated that the provision of improved water can translate to the usage of improved water (Abanyie et al., 2020; Amoah, 2020; de França Doria, 2010).

Other studies revealed that user perceptions regarding their water services were related to the long-term sustainability of water services (Herbst et al., 2009; Ramos da Silva et al., 2010; Francis et al., 2015). This is because many people are often guided by their perception of water quality and not physico-chemical and bacteriological qualities that are often the most important parameters for measuring access to improved water sources (UNICEF/WHO, 2012). By depending on perceptions, users hold different views about the aesthetic values of water quality (de França Doria, 2010). Improved water systems are generally provided to enhance lives, hence, must be established appropriately, effectively, and sustainably for use by beneficiary communities. User perceptions, preferences, and determinants of these improved water systems are necessary for evaluating the quality of the water sources as part of the efforts to achieve overall safe water coverage in the country (UNICEF/WHO, 2012). This would play an important role when trying to undertake preventive measures against water-related diseases. It has been reported that poor perception of water quality can prevent people from taking any water quality treatment measure before drinking and this could be deleterious to human health (Ramos da Silva et al., 2010).

The goal of ensuring water quality in Ghana is to improve the livelihood and health of citizens in different regions by improving access to potable water and safe sanitation and hygiene (Abanyie et al., 2020; Essumang et al., 2017; Keraita et al., 2003). Notwithstanding, the indirect effect of environmental and water quality-related risk on mortality adds more than 40 % to the cost of directly caused mortality in Ghana (Bartram, Cairncross, 2010). Aside from this, there exists a dearth of evidence supporting the situation of water quality assessment in Ghana, especially at the household level. Consequently, little has been done on households' perception and use of improved water sources in Ghana. This study, therefore, seeks to illuminate the various community perceptions and preferences related to the use of different sources of water services in the Northern Region of Ghana.

The following research questions guided the study:

1. What sources of water are available and used by households in Northern Ghana?
2. Do households have access to improved water?
3. What are the reasons for the choice of main water sources?
4. What are the perceptions of households regarding the provision and use of improved water sources?
5. What are the perceptions of stakeholders regarding the provision and use of improved water sources?

2. Materials and methods

The study area was the Northern Region of Ghana. Specifically, respondents were selected from the Bunkpurugu-Nakpanduri District in the Northern Region. The study employed a cross-sectional research design. The mixed-method (quantitative and qualitative) was employed to provide a better presentation of the data and increase validity by providing the participants with the ability to expand on ideas not offered in the quantitative questions. Thus, the approach complemented each other and created valuable information on households' perceptions of the use of different water sources in Bunkpurugu-Nakpanduri District.

The study population comprised households (household heads) within four (4) communities in Bunkpurugu District. A mathematical method by Glaser (1965) was used to estimate the sample size. The sampling frame for this study was then the lists of households in Bunkpurugu-Nakpanduri District was calculated using the following formula:

$$n = \frac{N}{1 + N(\propto)^2}$$

Where:

n = Sample size, N = Sample frame = 17,621 households, Confidence interval (α) = 0.05. Using the formula above, the sample size arrived at was 395 households (respondents).

The multistage sampling technique was used to select the respondents for the study. This technique enabled the researcher to design a convenient sampling frame to make the study practicable. This study combined five sampling stages, namely, purposive sampling, cluster sampling, simple random sampling, quota sampling, and systematic sampling. Primary data was gathered from household heads and focus group participants (women and youth groups). Two sets of instruments were used to solicit data; one for households and the other for water managers and the interview guide for women and youth groups.

The quantitative and qualitative raw data were cross-checked, edited to check inconsistencies and errors, and coded (group responses into a limited number of categories, strings, or themes). Quantitatively, the Statistical Package for Social Scientist version 21, STATA 13, Microsoft Word, and Excel were used to analyse the edited data. Qualitatively, data were transcribed, cross-checked and edited. Afterward, they were organized into themes and analyzed. The final output was presented in the form of texts and direct quotes by respondents under the stated objectives of the study. Descriptive statistics such as frequencies and percentages, pie charts, and bar charts were used to summarize results on available water sources, use of various water sources for different domestic purposes, sources that constitute their main water sources as well as the reason for that choice.

Households' perception of improved water was measured using the perception index score. The assumption is that the agreement level corresponds directly to the contributions, either positive or negative. To calculate the perception index score, the respondents rated each statement using one of a five-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree). Each of the scales was respectively assigned a value of 1, 2, 3, 4, and 5. The summation of the perception score for each statement was obtained through the addition of the product of responses for each scale and the respective values. The average score of each statement was derived by dividing the perception statement score by the total responses (respondents) to each of the twenty-four (24) statements.

Mathematically, this is expressed as: $AveragePerceptionScore = \Sigma\Sigma\ PSS_i\ V_i / \Sigma\ p_i$

Where: PSS_i is the summation of the frequency of a Particular Statement Scale (PSS)

V_i is the value of assigned to each scale

P_i is the total number of Persons (P) who answered the questions

3. Results and discussion

Water sources available and used by households in the study area

Water sources available in the study area for use by households are reported in Table 1. An analysis of the multi-response question on the available water sources in the study area revealed that 37 % of respondents had tap water in their communities; 68 % also confirmed the availability of boreholes in their area of stay. About 64 % and 57 % of the respondents confirmed the availability of rivers and wells respectively. All (100 %) respondents revealed that they had access to water from rain seasonally since the district finds itself within the savannah zone of the country which experiences a single maxima rainfall called the rainy/wet season, from June to September.

Table 1. Water availability and use by households

Water sources	Availability	Use	Cooking	Drinking	Livestock	Washing
Borehole	242 (67.98 %)	242 (100 %)	241 (99.59 %)	242 (100 %)	185 (76.45 %)	172 (71.07 %)
Tap	133 (37.36 %)	129 (96.99 %)	129 (100 %)	129 (100 %)	73 (56.59 %)	106 (82.54 %)
River	226 (63.48 %)	226 (100 %)	171 (75.66 %)	153 (67.70 %)	200 (88.49 %)	226 (100 %)

Well	202 (56.74 %)	202 (100 %)	197 (97.52 %)	187 (92.57 %)	184 (91.09 %)	201 (99.50 %)
Rain	356 (92.13 %)	356 (100 %)	301 (84.55 %)	256 (71.91 %)	291 (81.74 %)	328 (92.13 %)

Source: Field Survey, 2019

From the result, all households have access to at least one water source regardless of its reliability or quality, with the tap water (best-treated option) recording the least available percentage (37 %). However, its presence signifies the likelihood of future expansion to cover a greater part of the District given public education on improved water is stepped up and subsidies initiated to attract households to get connected. Concerning the use of these available water sources by households, all the other water sources (borehole, river, well, and rain) recorded 100 % use except for tap water. This reduction in use by households (from 100-96.99 %) could be because the other water sources were freely supplied. This confirms studies that indicated that water beneficiaries are usually reluctant to pay for improved water services. (Agyenim, Gupta, 2010; Hope, 2015).

In general, households used these sources for domestic purposes such as cooking, drinking, washing/cleaning purpose, and livestock watering. Livestock watering fell under domestic as the people practiced a semi-intensive kind of animal rearing where animals such as goats, sheep, donkeys, chicken, and others spend a good amount of time in the house fed and watered by owners. The majority of households that used boreholes and taps used them for drinking and cooking. 99.60 % and 100 % used water from boreholes for cooking and drinking respectively whiles all (100 %) respondents who used taps used it for both cooking and drinking. The results also showed reduced use of these (borehole and taps) sources for purposes such as livestock watering (borehole: 76.45 %, tap: 56.59) and washing/cleaning (borehole: 71 %, tap: 82.54 %). The reverse also holds for river users, where the majority of respondents who used the river would use it for livestock watering and washing than respondents would use it for cooking and drinking. The use of river water by households for cooking, drinking, livestock watering, and washing was therefore recorded as 75.66 %, 67.70 %, 88.49 %, and 100 % respectively.

Meanwhile, the use of wells and rainwater by respondents did not vary as almost the same percentage of use (wells and rain) was recorded across all purposes. For well the use was in this order cooking (97.52 %), drinking (92.57 %), livestock watering (91.09 %) and washing (99.50) whilst rain, on the other hand, recorded the following percentages for the different purposes cooking (84.55 %), drinking (71.91 %), livestock watering (81.74 %) and washing (92.13 %). The reason for the pattern of water use is that some household heads perceived boreholes, taps, and wells as a safer source for human consumption even though they felt there was relatively more cost (in the form of monetary and time) associated with its use. For instance, one 53 years female household head during the focused group discussion who reported using tap and borehole mainly for drinking and cooking explained that: *"Even though I would prefer my household to use water from borehole and tap for every activity, water from these sources are difficult to come by, so why will I waste it on activities that do not really matter* (referring to washing and livestock watering)."

Another respondent who consented with the earlier statement put it that: *"I will rather waste money on human beings than inanimate things, that's why my households depend on borehole and tap for drinking and cooking and water from free sources for washing/cleaning and livestock watering". N*onetheless, this finding agrees with that of Mahama (2013) who found that 11.3 % of households used unimproved water sources for other purposes either than drinking. From Table 1 above it can be seen that apart from tap and borehole that recorded 100 % use for drinking, all the others recorded a reduced percentage. Well as a source which was seen as the best alternative in the absence of tap and borehole recorded 92.57 % used for drinking, rain recorded 71.91 % and river recorded the least (67.70 %).

Households Access to Improved and Unimproved Water Sources

To create a clearer picture of this data and also find out the number of households who depended mainly on improved sources, the sources of water identified were further categorized into two groups (improved source and unimproved source). Using the WHO definition, in consideration of what pertains in the area, improved sources of water included pipe and

boreholes whiles unimproved comprised river and wells. With this knowledge, it can be realised from Figure 1 that even though a majority of households constituting 53 % used improved sources as their main source, 47 % also depended on unimproved water sources. This finding confirms that of Engel et al. (2005) who established that households with access to improved water still used unimproved water as their main domestic water source; either from hand-dug wells or surface sources from rivers, ponds, and streams.

Table 2. Categorization of the main source into improved and unimproved

Access	Frequency	Percent
Improved	204	52.0
Unimproved	191	48.0
Total	395	100.0

Source: Field Survey, 2019

Access to improved water sources is very critical to the health of the citizens. However, in Ghana, this has been the usual challenge to rural residents (Amenga-Etego, 2003). The situation may even be more serious among people living in areas where wells often dried up in the dry seasons (Peloso, Morinville, 2014). Good water promotes good health and enhances national development (Stoler et al., 2015). For that matter, safe drinking water and sanitation are considered indispensable to sustain life and promote health as well as enhance the fundamental to the dignity of all (Peloso, Morinville, 2014).

Reasons for Use of Main Water Source

There was also a need to know why a household selected a particular source as its main source. The respondents were allowed to provide multiple responses using indicators such as reliability of the source, affordability, closeness to household, and quality of water. Out of the 87 who selected boreholes as their main source, 84 gave the reason as reliability and all respondents (87) gave a reason as affordability, closeness as well as quality. Meanwhile average rank for these reasons stood at 2 signifying medium reliability, affordability, closeness, and quality.

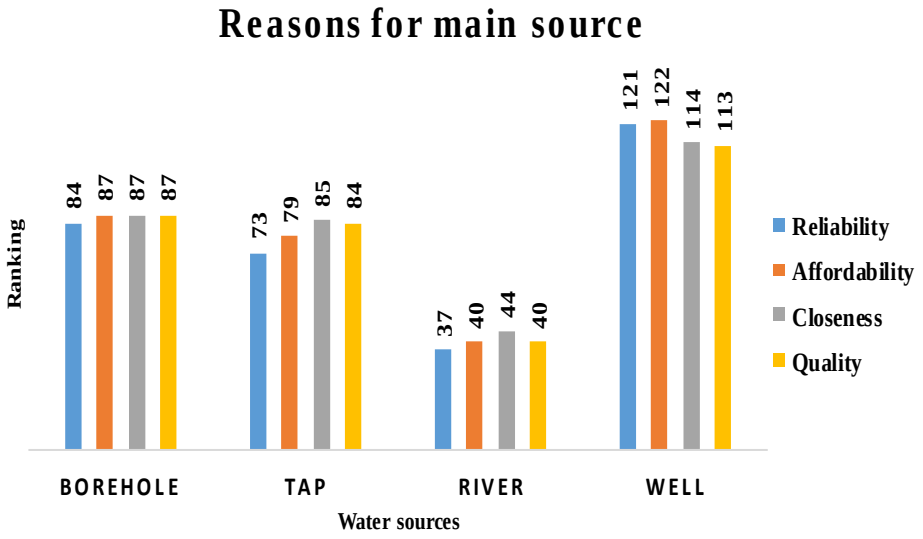

Fig. 1. Reasons for Use of Main Water Source (Multiple Responses)
Source: Field Survey, 2019

Again, out of the respondents who selected tap as the main water source, 73 of them said it is because of its reliability, about 79 said it was because it is affordable, 85 also said it was based on closeness to home, and finally 84 because of quality. For tap source, the average rank for reasons was medium (2) reliability, affordability, closeness, except quality that was ranked high (3) by most respondents. With the river, 45 households used it as their main source and the number of people

with their reason for that choice was as follows; 37 people mentioned reliability, 40 people went for affordability, 44 closeness, and 40 quality. The average rank for the river recorded a high (3) rank for reliability and affordability while closeness and quality for the river had a medium (2) average rank. Lastly, the 124 people who used well as their main water source, had 121 of them giving the reason as being reliable, 122 said is because water from that source is affordable, 114 mentioned closeness to home and 113 gave the quality of water from that source as their reason for patronizing wells more frequently. Also, the majority of the respondents giving these reasons for the use of wells ranked all reasons a medium (medium reliability, affordability, closeness, and quality). UNICEF/WHO (2015) confirms the indicators used by the households respondents because it is believed adequacy, quality, reliability, and convenience of the water to the users are very critical in the choice of water sources for domestic purposes.

Perception of Households on Improved Water

It is evident from the results that the majority of the respondents agreed to positive statements under administrative (3.5), reliability (3.5), and quality (4.1). This can be explained that the respondents had a positive perception of improved water. Respondents, however, remained neutral on participation (3.3) in the planning and implementation of improved water systems. The overall index for all the perception statements leaned towards agreeing (3.6) signifying that respondents have a positive perception of improved water which may translate into the use of such sources. Table 3 describes the perception of the households on improved water sources.

Table 3. Perception of households on improved water

Perceptions on improved water	**SD=1 N(%)**	**D=2 N(%)**	**N=3 N(%)**	**A=4 N(%)**	**SA=5 N(%)**	**Mean**
Participation						**3.3**
Water users were consulted on the type of design and planning	56(15.7)	17(4.8)	50(14.0)	110(30.9)	123(34.6)	**3.6**
Water users were consulted on the location of the water	71(19.9)	24(6.7)	72(20.2)	105(29.5)	84(23.6)	3.3
Water users decided on billing mechanism, if any	51(14.3)	49(13.8)	106(29.8)	73(20.5)	77(21.6)	3.2
Water users determine prices of water, if paid	60(16.9)	58(16.3)	81(22.8)	70(19.7)	87(24.4)	3.2
Water management team ask for suggestions about how to improve services	66(18.5)	23(6.5)	68(19.1)	99(27.8)	100(28.1)	3.4
Administrative						**3.5**
Decisions of users are accounted for in the planning of the improved water system	40(11.2)	19(5.3)	82(23.0)	133(37.4)	82(23.0)	**3.6**
Suggestions of users are seriously considered in the management of improved water systems	39(11.0)	32(9.0)	71(19.9)	122(34.3)	92(25.8)	**3.6**
3.Decision taken with regards to the water is favourable to everyone	43(12.1)	54(15.2)	66(18.5)	155(32.3)	78(21.9)	3.4

Water managers have the required training in water management	56(15.7)	16(4.5)	72(20.2)	121(34.0)	91(25.6)	**3.5**
Water managers are given on the job training on water management	50(14.0)	22(6.2)	112(31.5)	117(32.9)	55(15.4)	3.3
Revenue accrued from water source is managed properly	30(8.4)	52(14.6)	95(26.7)	94(26.6)	85(23.9)	3.4
Accessibility						**3.5**
Water facility is constantly maintained and is functioning	51(14.3)	49(13.8)	25(7.0)	113(31.7)	118(33.1)	3.6
Water system is opened at all-time everyday	49(13.8)	53(14.9)	15(4.2)	93(26.1)	146(41.0)	**3.7**
Relatively, less time is needed/spent to draw water from improved sources	49(13.8)	59(16.6)	62(17.4)	105(29.5)	81(22.8)	3.3
Price for improved water is reasonable	16(4.5)	34(9.6)	36(10.1)	153(43.0)	117(32.9)	**3.9**
Water source is close to household	36(10.1)	54(15.2)	52(14.6)	72(20.2)	142(39.9)	**3.7**
Queues are managed at water points to avoid quarrels and enhance access	49(13.8)	40(11.2)	68(19.1)	104(29.2)	95(26.7)	3.4
Water is adequate for all households	29(8.1)	46(12.9)	60(16.9)	116(32.6)	105(29.5)	**3.6**
Seasonal reliability of water	95(26.7)	48(13.5)	28(7.9)	110(30.9)	75(21.1)	3.1
Quality						**4.1**
Water from improved source lathers easily with soup	64(18.0)	61(17.1)	64(18.0)	78(21.9)	89(25.0)	3.2
Water from improved source is odourless	3(0.8)	37(10.4)	1(0.3)	136(38.2)	179(50.3)	**4.3**
Water contains no particles/clear	3(0.8)	23(6.5)	52(14.6)	118(33.1)	160(44.9)	**4.2**
Water has no taste	2(0.6)	26(7.3)	29(8.1)	94(26.4)	205(57.6)	**4.3**
Water from improved source is relatively safe	5(1.4)	21(5.9)	36(10.1)	96(27.0)	198(55.6)	**4.3**
Total	**356**		**Perception Index Score=**			**3.6**

Source: Field Survey, 2019

A critical look at the results also shows that a good number of people, if not the majority, may not use improved water because of the negative perception they have regarding its reliability. On their perception about participation and administration, about 28 % (100) and 40 % (143) disagreed respectively that improved water facilities are constantly maintained (and functioning) and reliable seasonally respectively. On accessibility, about 31.9 % had the view that because the queues that develop at water points are not managed properly, they often breed quarrels. A 33-year female household head during the study reported that: "*Because of the pressure at water point myself and children cannot rely on improved sources as we often leave home in the mornings,*

leaving their cans at the point to enable us to fetch immediately we are back, we end up getting a limited number of buckets not enough for the whole family". Another woman supported her submission by adding that: *"Sometimes leaving your cans there doesn't guarantee you getting water, as you may come to meet some neighbors who will not allow you to fetch giving the reason that they recognize the presence of human beings and not things (water cans)".* Regarding use of water, the perceptions of users are a very important factor to consider (de França Doria, 2010).

Perception of Water Managers on Improved Water

Table 4 describes the perception of the water managers on improved water sources. From the table, respondents (managers) strongly agreed to 1 statement under quality, agreed to 11 statements, remained neutral on 11 statements, and disagreed on 1 statement. Just like the household heads, a good number (40 %) of managers disagreed with the statement that less time is spent to draw water from improved sources. However, a majority (55 %) of managers were of the view that improved water sources are not seasonally reliable. This explains why some households cannot rely mainly on improved water sources but rather depend highly on unimproved sources for their water needs. Other outcomes that explain the water use pattern in District are the fact that 30 % strongly disagreed that improved water systems are always functioning and were also of the view that the inadequacy of these systems generates queues at water points sometimes leading to the outbreak of quarrels when poorly managed. Generally, managers also had a good perception with regards to improve water as the average index stood at 3.5 signifying an agreement to perception statements posted.

Table 4. Perception of water managers on improved water

Perceptions on improved water	**SD=1 N (%)**	**D=2 N (%)**	**N=3 N (%)**	**A=4 N (%)**	**SA=5 N (%)**	**Mean**
Participation						**3.6**
Water users were consulted on the type of design and planning	4(20)	0	0	7(35)	9(45)	**3.9**
Water users were consulted on the location of the water	3(15)	2(10)	0	6(30)	9(45)	**3.8**
Water users decided on billing mechanism, if any	3(15)	1(5)	0	7(35)	9(45)	**3.9**
Water users determine prices of water, if paid	5(25)	1(5)	3(15)	4(20)	7(35)	3.4
Water management team ask for suggestions about how to improve services	8(40)	1(5)	0	6(30)	5(25)	3.0
Administrative						**3.4**
Decisions of users are accounted for in the planning of the improved water system	7(53)	1(5)	1(5)	7(35)	4(20)	3.0
Suggestions of users are seriously considered in the management of improved water systems	3(15)	1(5)	0	11(55)	5(25)	**3.7**
Decision taken with regards to the water is favourable to everyone	6(30)	1(5)	0	5(25)	8(40)	3.4
Water managers have the required training in water management	8(40)	0	0	6(30)	6(30)	3.1

Water managers are given on the job training on water management	8(40)	1(5)	1(5)	4(20)	6(30)	3.0
Revenue accrued from water source is managed properly	4(20)	0	1(5)	5(25)	10(50)	**3.9**
Accessibility						**3.3**
Water facility is constantly maintained and is functioning	6(30)	0	2(10)	2(10)	10(50)	**3.5**
Water system is opened at all-time everyday	4(20)	5(25)	0	4(20)	7(35)	3.3
Relatively, less time is needed/spent to draw water from improved sources	7(35)	1(5)	3(15)	3(15)	6(30)	3.0
Price for improved water is reasonable	5(25)	4(20)	0	3(15)	8(40)	3.3
Water source is close to household	4(20)	2(10)	0	7(35)	7(35)	**3.6**
Queues are managed at water points to avoid quarrels and enhance access	5(25)	1(5)	1(5)	4(20)	9(45)	**3.6**
Water is adequate for all households	6(30)	3(15)	1(5)	4(20)	6(30)	3.1
Seasonal reliability of water	4(20)	7(35)	1(5)	6(30)	2(10)	2.8
Quality						**3.8**
Water from improved source lathers easily with soup	9(45)	7(35)	1(5)	0	3(15.0)	2.1
Water from improved source is odourless	2(10)	0	0	10(50)	8(40)	**4.1**
Water contains no particles/clear	4(20)	0	0	7(35)	9(45)	**3.9**
Water has no taste	2(10)	2(10)	1(5)	4(20)	11(55)	**4.0**
Water from improved source is relatively safe	0	0	1(5)	5(25)	14(70)	4.7
Total	**20**		**Perception Index Score=**			**3.5**

Source: Field Survey, 2019

These responses did not deviate from that of the households, thereby confirming the index generated from the households responses. The results show that managers' agree (Perception Index Score = 3.6) that water users were involved in the design and execution of improved water systems whiles household's remained neutral (Perception Index Score = 3.3) on user participation. This occurrence may be due to the non-participation of respondents even though platforms were created for user participation. Meanwhile, according to Francis et al. (2015), there is the need to effectively involve communities at important stages of implementation is crucial to ensure a long-term success of water quality interventions. As household heads agreed (Perception Index Score = 3.5) that they were involved in the management of the water systems through the suggestion that they make for the improvement of water systems, water managers were neutral on user involvement in the administration of improved water. On accessibility, households agreed (Perception Index Score = 3.5) that improved water was accessible whiles water manager neither agreed nor disagreed (Perception Index Score = 3.3) to the accessibility of improved water. Finally with perception on improved water quality both respondents agreed that improved water is of high quality and safe for drinking. This explains why the majority (53) of respondents uses improved water as the main source for their household even though some (47) still depended on unimproved water.

4. Conclusion and recommendation

It was found that households in the study area use water from both improved (boreholes and taps) and unimproved (rivers, well, and rain collection) sources for various domestic purposes

(such as cooking, drinking, livestock watering, and leaning). However, when it comes to households' main water source, the study revealed that 35 %, 24 %, 28 %, and 13 % use wells, boreholes, taps, and rivers respectively. By WHO/UNICEF categorization, close to half (47 %) of the respondents relied on unimproved water in the presence of improved water. Further probing revealed the unreliability and affordability issues of unimproved sources to be the main reason. The average perception index of the 24 statements on improved water posed to both household heads and water manager revealed an overall mean of 3.6 (Participation = 3.3; Administrative = 3.5; Accessibility = 3.5; Quality = 4.1) and 3.5 (Participation = 3.6; Administrative = 3.4; Accessibility = 3.3; Quality = 3.8) respectively, signifying that they both agree to the statements have a positive perception about improved water.

The following policy recommendations are made to help promote access and use of improved water in the Bunkpurugu-Nakpanduri District of the Northern Region of Ghana and the long run achieve good health for sustainable development. They are;

- That improved water sources should be adequately provided by the Government and Non-Governmental Organizations to the communities to improve physical access. This will also help to bridge the gap in improved water consumption (53 % of 100 %).
- Water managers should also be trained on the maintenance of improved water systems so that improved water is available regularly. This will help boost the confidence of households in improved water sources at the expense of unimproved sources.

5. Authors contributions

The authors conceived the idea, wrote the manuscript, approved the submitted version, and takes public responsibility for its content.

6. Conflicts of interest

The authors declare no conflict of interests.

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