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| RESEARCH ARTICLE

Assessing Household Potable Water Accessibility of Residents of Katsina-Ala Town in Benue State, Nigeria

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| ABSTRACT

The study assessed household potable water accessibility of residents of Katsina- ala town in Benue state, Nigeria. The researcher used a survey research design combining quantitative and qualitative data collection methods. The study also employed multi-stage sampling technique which combined systematic, stratified and simple random sampling techniques. Three hundred and eighty-seven (387) copies of questionnaire were administered to housewives or female head or any most senior adult of each household. The research findings revealed little improvements in access to potable water, lack of public water supply and that much of the water supplied in the town was through untreated hand dug wells and to a little extent by boreholes which confirmed the water supplied in the town was unsafe. The study recommended the rehabilitation of Katsina-Ala water works, development of climate adaptation and resilience strategies, public-private partnership investment in water infrastructure development, maintenance and service delivery and strengthening of water regulatory agencies to monitor and control the proliferation and sale of unsafe water sources.

| KEYWORDS

Potable water, accessibility, household water, water sanitation, hygiene.

| ARTICLE INFORMATION

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1. Introduction

Potable water is water that is safe for human consumption and other domestic uses, meeting strict regulatory standards to ensure it is free from harmful contaminants and pathogens. This water is obtained from surface and underground sources, and treated to remove impurities such as micro-organisms, bacteria and toxic chemicals making it suitable for drinking and other domestic uses. It is universally accepted that adequate water supply for drinking, personal hygiene and other domestic purposes is essential to public health, economic development and human well-being (Adejumo, 2019). Potable water shortage is more pronounced in developing countries. About 319 people in sub-saharan Africa live without adequate access to safe and improved drinking water sources (WHO 2015, Adejumo, 2019). Nigeria is among countries in Africa that are facing water insecurity problem.

Pressures on water resources are increasing mainly as a result of human activities, such as urbanization, population growth, increased living standard, growing competition for water and pollution. These are aggravated by climate change and variations in natural condition (World Bank, 2009 cited in Dangana & Muhammad, 2016). Water accessibility "means" availability of water for use by individual or by a family or household for household purposes;

for farm and domestic animals up to normal grazing capacity of the land whether or not the animals are actually owned by such individual or family, and for the irrigation of land (Dangana & Muhammad, 2016).

Globally, access to water can be categorized into four levels of supply, namely: no access, basic access, intermediate access and optimal access (WHO 2015). Under the no access level of water supply, quantity of water consumed is below five litres per capita per day and the distance travelled to collect water is more than 1000m or 30 minutes total collection time. On the basic access level, the quantity of water consumed should not exceed 20l/c/d and the distance is between 100 and 1000m or 5 to 30 minutes total collection time. The third level, which is the intermediate access, entails that the quantity of water consumed should not exceed 50l/c/d and water delivered through one tap on-plot or within 100m of 5 minutes total collection time. While the optimal access level emphasizes that the quantity of water consumed should be 100l/c/d and supplied through multiple taps continuously to the household.

According to Imam, Yunusa & Ohida (2023), almost half of the urban population in Nigeria suffer from at least one disease attributable to lack of safe water and adequate sanitation. Contaminated water spreads diarrhea, typhoid fever, cholera/water borne worm infections and other diseases. Lack of water creates difficulties in carrying out basic hygiene around the house. In addition, lack of convenient access to drinking water means that many hours each day may be wasted on carrying water from distant sources, especially by women and girls. Access to potable drinking water is posing a serious challenge for the inhabitants of Third World cities especially those living in the informal settlements. Water is an important resource that plays a vital role in the existence of human beings as it helps in the effective functioning of human metabolic system. This is due to the fact that it is a basic necessity for humans and non-substitutable resource on which the health of ecosystems depends (Umeakuka, 2021).

Accessibility to safe drinking water therefore, is of fundamental significance to lowering the faecal risk and frequency of associated diseases and its association with other socioeconomic characteristics like education, income, household size makes it a good universal indicator of human development. When broken down by neighbourhood, social or demographic or economic criteria, it provides useful data on inequity. It has close links to other water indicators such as time, distance, quantity consumed and quality (WHO, 2021).

In view of the above, the paper examines water provision in the various households of Katsina-Ala town of Benue state of Nigeria with a view to ascertaining whether the inhabitants of the town have access to water in line with international standards.

1.1 Statement of Problem

Nigeria in general and Benue State in particular is blessed with abundant water resources that if well harnessed could provide potable water to the communities without difficulties. However, despite the abundance of water in Benue State and particularly, Katsina-Ala town where you have the second biggest river in the state, this resource is not being harnessed efficiently to satisfy the needs of her inhabitants. Katsina-Ala town is one of the most densely populated towns in Benue State with a total projected population of 63,128 persons by the year 2024 (projected from the 1991 population census). The population growth rate of 3.0 percent per year is also very rapid and the land area is just 84.98 square kilometres (National Population Commission, 2006). This rapid increase puts serious pressure on available resources and facilities.

As a consequence of the rapid urbanization process in the town, the provision of critical infrastructure such as good road network, electricity, stable water supply among other things that add value to human life becomes a herculean task. The reasons for the rapid urbanization of Katsina-Ala town relate to its status as the headquarters of Katsina-Ala Local Government Area (LGA). Katsina-Ala town as a Local Government Area headquarters play host to civil service activities, banking, educational institutions and other governmental organizations. The population made up mainly of civil servants, students, traders and others have brought about tremendous pressure on existing infrastructure and services. The influx of displaced persons from the various rural farming communities into the

town is another factor contributing to the increasing population of the town. This rapid population growth has led to serious pressure on the available basic amenities, prominent among which is water supply.

As population of the town continues to grow rapidly, more pressure is placed on the available water sources thus making water a scarce commodity and this necessitated this study. Access to water which is defined by Maurice (2023), as "the availability of 20litres per capita per day at a distance no longer than 1000metres," appears to be a mirage to the inhabitants of Katsina-Ala town. This is with a view to ascertaining whether the residents of the town enjoy water supply at the basic access level, which the World Health Organization (2023) established as the minimum threshold which citizens of any nation can attain to be classified as having improved access to water supply. This "basic service level" is also the primary objective of the Sustainable Development Goals target 6, which aims at ensuring improved access to water supply by the year 2030.

1.2 Objectives of the Study

The objectives of the study are to:

1. Ascertain the sources of water available to the residents of Katsina-Ala town.
2. Determine the time in minute spent by the residents of Katsina-Ala town to access water from a facility.
3. Ascertain the distance travelled by the residents of the town to fetch water at the nearest facility;
4. Ascertain the quantity of water consumed per day by the residents of Katsina-Ala town.

2. Literature Review

Urban water governance is a rising challenge across third world countries where the population is increasingly combating with water crisis (Seijger *et al*., 2018; Navaneeth, *et al.,* 2021). Rapid population growth has not only increased the demand for water and sanitation services for a large and diverse urban population but also revealed that a rapidly growing, vulnerable segment of the population is being underserved**.** The growing demographic trend can be an opportunity for cities to better articulate urban water policies with broader strategic pathways at local and national levels. While water challenges have long been seen through a rural lens given their implications on agriculture and food security, they have increasingly become a prominent urban issue (Ahmad, 2025). In Sub-Saharan Africa, only 24% of the population has access to safe sources of drinking water and water quality deterioration is a major threat among communities. It is estimated that thousands of people in Africa die from diseases linked to improper hygiene, poor sanitation, and contaminated water yearly (Oluwasanya, *et al*., 2022).

There are several definitions regarding what constitutes access to potable water. To some authors, access to safe water is measured by the proportion of population with access to an adequate amount of safe drinking water located within a convenient distance from the users' dwelling. The most frequently used definition is that of the United Nations Development Programme, UNDP (2002) in Umeakuka (2021) which states that those with access comprise: "The proportion of the population using any piped water, public tap, borehole with pump, protected well and springs or rainwater". The World Bank (2021) provides various definitions dependent on the type of residential area being assessed: "In urban areas such a source (of safe water) may be a public fountain or standpoint located not more than 200metres away and in rural areas, access implies that members of the household do not have to spend a disproportionate part of the day fetching water".

The 2030 Water Resources Group Report (2009) which is based upon national estimates of the rural and urban households says reasonable access to improved water supplies means that at least 20litres of water per person per day are available from a piped water connection, public standpipe, borehole, protected dug well, protected spring or rain water collection within a distance of one kilometre from home. What is noticeable, however is that definition of access varies from country to country depending on the level of urbanization. Even within a country what is obtainable in one city may not be feasible in another city as the level of urban growth can never be the same. Access to water is further defined by the World Health Organization as "the availability of 20litres per capita per day at a distance not longer than 1,000metres" (Maurice, 2023). From WHO's definition, various countries adopt their own definition. Nigerian Institute for Social and Economic Research, NISER (1988) quoted by Maurice (2023)

observed that most households' daily water consumption varies greatly. Majority of the households, who are low income earners use about 32-80litres and middle income earners, 80-125litres daily, while others range between 120-240litres per day for high income earners. It is a widely held view that long distance to water supply is a deterrent to the use of water in desirable quantities and of the alternative sources such as hand-dug wells, streams, ponds and water from water vendors are prone to easy contamination; consumers are readily exposed to water-borne diseases such as typhoid, dysentery, cholera and guinea worm. In formulating country-specific definitions, such factors as quantity, time, distance, reliability and potential cost are taken into consideration.

The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) has in the 2025 update estimated that 27% of the global population (2.2 billion people) lacked "safely managed drinking water" meaning water at home, available, and safe. Between 2000 and 2024, the global population increased from 6.2 billion to 8.2 billion. Over this period, a quarter of the world's population (2.2 billion) gained access to safely managed drinking water. The distribution of unserved populations has also changed since 2015. While the total population lacking safely managed drinking water services has declined, the number of people without has actually increased in urban areas and in low-income countries.

3. Methodology

The study area, Katsina-Ala town is the administrative headquarters of Katsina-Ala Local Government Area of Benue State. It lies approximately between latitude $7^0 23' 30''$ to $7^0 12^1 30''$ North of the equator and longitude $9^0 15' 0''$ to $7^0 23' 30''$ East of the Greenwich Meridian. The town covers an area of about 84.98 square kilometers and has an elevation of between 105-185 metres above sea level. Katsina-Ala town had a projected population of 63,128 persons by the year 2024 (projected from the 1991 population census). The projection was based on the National Population Commission's recommended annual exponential population growth rate of 3.0 percent. It is located at the loop of the flood plains of the bank of river Katsina-Ala, which indicates that the area is endowed with abundant water resources. (see fig.1). Katsina-Ala is the most densely populated and fastest growing settlement in Katsina-Ala local government area. The high population concentration in the town also has implication on water demand. The prevailing tropical wet and dry climate as well as the hydrographic condition of the area has a lot of influence on surface and ground water recharge in the study area (Hundu et al, 2021). Katsina-Ala town is underlain by the sedimentary rock deposits of the Lower Benue Trough and the basement complex rock formation of North Central Nigeria. The location is underlain by top formation, clay, mudstone and clayey sandstone at depth. This underlying geologic formation affects aquifer recharge and overall volume of ground water transmission in the town. The residents of Katsina-Ala town depend largely on boreholes, hand dug wells, rain water, packaged water and water from river Katsina-ala hawked by water vendors for their domestic water supply. The Katsina-Ala Water works which is charged with the responsibility to provide potable water has gone moribund.

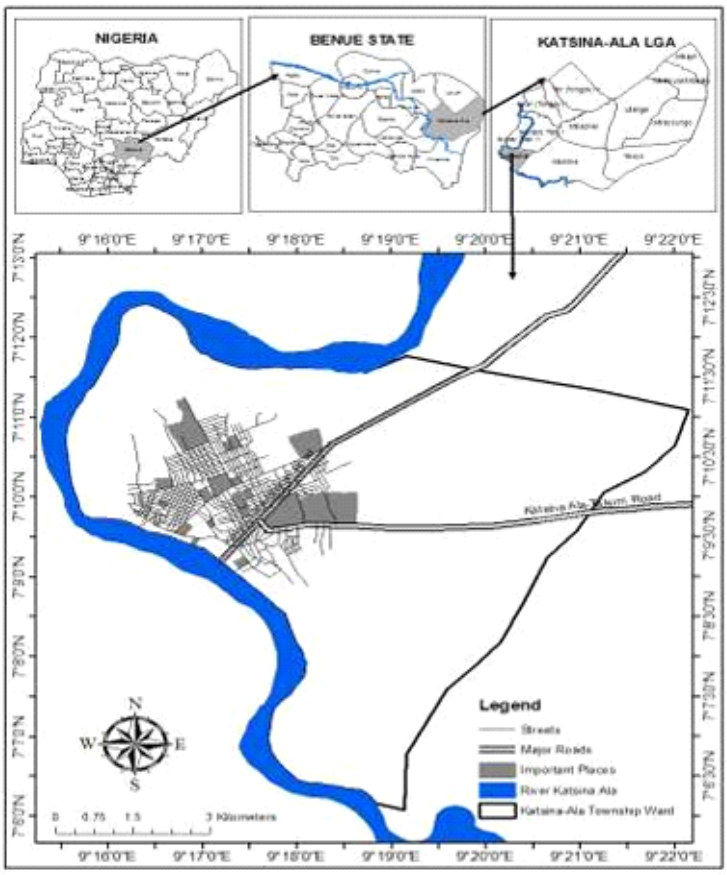

Fig 1: Map of Katsina-Ala Township
Source: GIS Laboratory Benue State University, Makurdi .

3.1 Sample Size and Sampling Technique

Katsina-Ala Local Government Area in 1991 had a population of 161,281 persons distributed in 29,628 households representing 18.37 percent of the population per household which therefore means that 63,128 persons living in Katsina-Ala town by 2024 were living in 11,597 households. Using the Taro Yamane's sample size determination formula, a sample size of 387 households was derived from the 11,597 households that make up Katsina-Ala town.

The research employed multi-stage sampling technique which combined systematic, stratified and simple random sampling techniques. Twenty streets within the town were selected by simple random sampling. This was done by writing names of the major streets on pieces of paper, folded, mixed up and twenty persons were asked to pick one each. The streets that were picked formed streets that were used for the study.

Systematic sampling technique was used to select houses for the interview. Applying this technique, the third houses were skipped after a house has been sampled. That is every third house starting from the first house on the street was picked (1st, 4th, 8th, etc.). Having used systematic sampling technique to select houses, in a house where more than one household existed, simple random sampling method was used to select household for the study. One 'Yes' and several 'No' corresponding to the number of households in the building, were written on separate pieces of papers, folded, mixed together. Participants were then asked to pick a piece of paper, and the household that picked 'Yes' was subsequently interviewed. Quantitative and qualitative data were obtained from 387 female household heads from the projected population of 63,128. The questionnaire was administered to the housewife or female head of each household because the women usually stay at home more than the men and carryout more domestic activities. In cases where the female household head was not available, an adult that is the most senior was taken as the key respondent. An adult here was any body from 18years and above.

4. Data Presentation and Discussion of Findings

4.1 Socio-Demographic Characteristics of the Respondents

The demographic characteristics of respondents as presented in Table 1, shows that 17% of respondents were male while 83% were female. It also indicated that 53% of respondents were married, 19% were single, 12% separated 9% were widows/widowers while 7% were divorced. On the basis of age, 38% of respondents fell within the age group of 28-37years, 22% were 38-47years, 19% fell within 18-27years, 13% were within the ages of 48-57years while 8% were within 58years and above.

Majority of the respondents (75%) had secondary and tertiary education, 21% had primary education while 4% had no formal education. About 35% of respondents were civil servants, 21% were farmers, 18% were traders, 9% engaged in commercial driving, 14% were students while 3% were engaged in other occupations. With respect to religion, 93% of the respondents were Christians, 5% were Moslems while 2% practiced traditional religion. In terms of household size, 30% of the respondents had an average household size of 6 members, 20% of the respondents had a household size of 5 members, 22% of the households had 4 members, 11% of the respondents had 3 members, 7% were made up of two members, 2% were one member households while 8% had an average household size of 6 persons and above.

Table 1: Socio-demographic characteristics of the respondents

Demographic Variables	**Frequency**	**Percentage**
Age		
18-27	74	19
28-37	147	38
38-47	85	22
48-57	50	13
58 and above	31	8
Total	387	100
Sex		
Male	66	17
Female	321	83
Total	387	100

Marital Status	**Frequency**	**Percentage**
Single	74	19
Married	205	53
Divorced	27	7
Separated	46	12
Widow/Widower	35	9
Total	387	100

Religion

Religion	**Frequency**	**Percentage**
Christianity	360	93
Islam	19	5
Traditional Religion	8	2
Total	387	100

Education		
Educational Status	**Frequency**	**Percentage**
No Formal Education	15	4
Primary	81	21
Secondary	128	33
Tertiary	163	42
Total	387	100

Occupation		
Occupation	**Frequency**	**Percentage**
Farming	81	21
Civil Servant	135	35
Trading	70	18
Commercial Driving	35	9
Student	54	14
Others	12	3
Total	387	100

Household Size (persons)	**Frequency**	**Percentage**
1	8	2
2	27	7
3	43	11
4	85	22
5	77	20
6	116	30
Above 6	31	8
Total	387	100

Researcher's field work, 2025

4.2 Water supply and access

4.2.1 Sources of water

The result shows that 22% of respondents used borehole as their main source of water, 56% used hand dug wells, 8% reported they used water from river Katsina-Ala, 3% indicated they used packaged water while 6% and 5% used streams and rainwater collection respectively. No respondent indicated pipe/tap as their source of water which corroborates the fact that Katsina-Ala water treatment plant is no longer in operation. Findings from the survey show that water supply in the study area is dominated by hand dug wells and boreholes. The result also revealed that 86% of the household water was sourced from improved sources (borehole, hand dug wells, rain water and packaged water) while 14% of the domestic water supply was sourced from unimproved sources (river and streams). This result according to WHO (2023) and UNICEF (2025) shows that water sources in the town are not safe, since even the safety of the improved sources cannot be guaranteed because not all are accessible on the premises, available when needed and free from faecal and priority chemical contamination.

Table 2: Distribution of Respondents by Source of Water

Source of Water	Frequency	Percentage
Piped/Tap	00	00
Borehole	85	22
Hand- dug Well	217	56
River	31	8
Stream	23	6
Rain Water	19	5
Packaged Water	12	3
Total	387	100

Researcher's field work, 2025

4.2.2 Household Water Treatment Method

According to the data collected 29% of the respondents treat their data by allowing it to stand and settle, allow their water to stand and settle, 15% use filtration, 8% use boiling method, 3% use Alum/Chlorination while 45% of the respondents reported that they do not treat their water before use. Protected and improved water sources do not guarantee that water is safe. The low quality water treatment methods adopted by households coupled with a large percentage of the population that do not treat their water before use confirms the fact that much of the water used by the households in the study area is not safe. This is made worse because of the absence of tap water supply within the town because of the non-operation of the Katsina-Ala water treatment plant. This is at variance with the WHO/UNICEF (2025) Joint Monitoring Programme (JMP), prescription for safe drinking water which stated must be an improved source that is located on the premises available when needed, and free from faecal and priority chemical contamination.

Table 3: Household Water Treatment Method

Treatment Method	Frequency	Percentage
Boiling	31	8
Use of Filter	58	15
Alum/Chlorine Tablet	12	3
Let it Stand and Settle	112	29
No Treatment	174	45
Total	387	100

Researcher's field work, 2025

4.2.3 Distance travelled to access water

Data presented in Table 6 shows that 41% of the respondents travel below 100metres to get water from the nearest source, 30% of the respondents collect their water within a distance of 100metres - 500meters, 9% of respondents cover between 501metres – 1000metres to fetch water, 20% of the respondents reported getting their water at no distance while no respondent indicated travelling above 1km to obtain water. That is 20% of the residents have optimal access to water supply, 41% have intermediate access to water supply while 39% have basic access to water supply. This shows that on the basis of distance travelled to obtain water, the residents had access to water as all respondents travelled within the WHO (2023) recommended distance of 1000metres to collect water at the nearest facility. Relying on the WHO/UNICEF (2000) definition which states that access to water is "the availability of 20litres per capita per day at a distance not longer than 1,000metres", one can categorically conclude that the residents of the town have good access to water, and this goes to prove that the study area is on track in meeting the Sustainable Development Goal on water as far as distance travelled to collect water is concerned. The preponderance of boreholes and hand dug wells in the study area may have greatly contributed to this easy access. However, residents travel longer distances to access water during the dry season than during the rainy season.

Table 6: Distance Travelled to Obtain Water

Distance Travelled	Frequency	Percentage
No Distance	77	20
Below 100metres	159	41
100metres – 500metres	116	30
501metres - 1000metres	23	9
Above 1km	12	0
Total	387	100

Researcher's field work, 2025

4.2.4 Time spent to access water

The result on time taken to collect water, which includes time travelling to and from the water point and queuing as presented in Table 7, shows that 3% of the respondents use zero minute to collect water, 12% reported taking less than 5 minutes to access water, 29% stated they used between 5 – 9 minutes to fetch water, 39% used 10 -30 minutes to access water from the nearest facility, 15% of the respondents accessed water from the nearest point within 31 – 60 minutes while 2% of the population use more than an hour to collect water. This result, according to WHO (2023) recommended time for accessing water, 3% of the residents have optimal access to water (0 minutes), 12% have intermediate access to water supply (less than 5 minutes), 68% have basic access to water supply (5 – 30 minutes), while 17% have no access to water supply (more than 30 minutes). On the whole a large proportion (83%) of the residents of the study area are accessing water within the WHO (2023) recommended collection time. However, the collection time varies with season.

Table 7: Time Spent to Collect Water at the Nearest Source.

Time Spent	Frequency	Percentage
0 minute	12	3
Less than 5minutes	46	12
5 – 9minutes	112	29
10 – 30minutes	151	39
31 – 60minutes	58	15
Above 1hour	8	2
Total	387	100

Researcher's field work, 2025

4.2.5 Per Capita Per Day Water Consumption

Data presented in Table 8 shows that 5 % of the respondents consumed less than 20litres of water per person per day, 36% consume between 20 – 49litres per person per day, 47% consumed 40 – 99litres per person per day, 100 - 149litres of water was consumed per person per day by 5% of the population, 2% of the respondents consumed 200 - 249litres of water per person per day while 100 - 149litres of water was consumed per person per day by 2% of residents of the town. Further analysis of this result shows that 5% of the respondents have no access to water supply, 36% of the households have basic access to water supply, 47% have intermediate access to water while 12% of the inhabitants have optimal access to water supply in the study area. A critical review of this result in line with the WHO (2023) globally recommended threshold of 20litres per capita per day shows that 95% of the entire respondents have good access to water supply.

Table 8: Per Capita Per Day Water Consumption

Amount Consumed	Frequency	Percentage
5 – 19litres	19	5
20 - 49litres	139	36
50 - 99litres	182	47
100 - 149litres	19	5
150 - 199litres	12	3
200 - 249litres	8	2
Above 250litres	8	2
Total	387	100

Researcher's field work, 2025

5. Conclusion

The study indicated considerable improvement in access to potable water by the inhabitants of Katsina – Ala town due to the efforts of non-state actors in water service delivery. The state water board whose primary responsibility it is to make water available to the residents of the town is no longer operational as none of the households sampled reported collecting water from the communal standpipes owned by the state water board. The results also revealed little improvements in access to potable water with respect to sources of water, time spent to collect water, distance travelled to collect water and quantity of water consumed per capita per day. The findings further revealed that residents of the town lacked access to public water supply in the form of house connections to tap as lack of access to publicly subsidized water can greatly enhance poverty among the residents of the town since large amount of money and valuable time is spent in accessing water outside one's compound. Non-functioning of the state water treatment plant in katsina-ala town makes the respondents to rely heavily on hand dug wells, which alone accounts for 56% of water source. It was equally discovered that many of the well-to-do residents have either their own boreholes or dug wells with which they meet their daily water needs. Those who have boreholes in their compounds, apart from satisfying their own water needs sell water to other residents within the neighbourhoods, while some dug boreholes purely for commercial purposes. The findings showed that access to water in the town is affected by a variety of factors, prominent among which are facility availability (storage facility), cost and distance travelled to collect water at the nearest facility and waiting time. Even though no laboratory test was carried out to ascertain the quality of water obtained from the various sources, majority (45%) of the respondents reported that they do not treat their water before use. Protected and improved water sources do not guarantee that water is safe. The low quality water treatment methods adopted by households coupled with a large percentage of the population that do not treat their water before use confirms the fact that much of the water used by the households in the study area is not safe. The provision of safe water in the town is also greatly affected by poor urban water management and provision policy as well as poor state of water infrastructure.

5.1 Recommendations

Based on the findings of the study the following recommendations were made:

The Katsina-Ala water treatment plant which is vested with the responsibility of providing water in the town should be rehabilitated to live up to its task by ensuring that water provided to the residents of the study area is safe for human consumption.

Implementation of sustainable urban planning strategies incorporating water infrastructure development and housing and transportation will help alleviate the water crisis in the town.

Government and other relevant stakeholders should develop robust climate adaptation and resilience strategies such as rain harvesting systems and flood control mechanisms to mitigate the impact of climate change on water sources.

Government should stimulate public-private partnership investment in water infrastructure development, maintenance, and service delivery.

Government should strengthen regulatory enforcement agencies such as National Agency for Food Drug Administration and Control (NAFDAC) to monitor and control the proliferation and sale of unsafe water sources.

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Ethical declaration: Not applicable

Consent for publication: Written informed consent for publication of interview data, including anonymized quotations, was obtained from all participants prior to data collection. Participants were informed that their responses would be published in anonymized form and that no identifiable personal information would be disclosed.

Competing interest: Authors have declared that there is no competing interest.

Declaration of Generative AI and AI-Assisted Technologies: In the course of publication of this work, the authors used ChatGPT to paraphrase the original manuscript for improved grammatical clarity. After that, the authors carefully revealed and edited the content and take full responsibility for the publication of the article.

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