



Household Water Use and Management Practices in Jema'a LGA: Challenges and Sustainability Issues

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Abstract

Ensuring clean and reliable water is essential for public health and household well-being, yet many communities still face significant water-related challenges. This study examines household water sources, usage patterns, and the difficulties experienced in Jema'a Local Government Area, Kaduna State, Nigeria. Using a mixed-method approach with structured surveys and direct observations from 100 households selected via stratified random sampling data were analyzed through descriptive statistics and chi-square tests. The findings reveal that households rely mainly on boreholes, hand-dug wells, rivers, and water vendors. Major challenges include water quality concerns, high costs, and seasonal shortages. Chi-square analyses provided nuanced insights: although the test for overall household income versus water access was non-significant ($p = 0.539$), a separate analysis assessing the effect of income on access to reliable water produced significant results ($p = 0.000$). This suggests that while income may not determine water access in all aspects, financial capacity plays a critical role in securing safe and dependable water sources. Households cope with shortages by rationing water, purchasing from vendors, and using covered storage containers. To improve water security, the study recommends expanding government-funded borehole projects, promoting rainwater harvesting, enhancing community water management, and adopting affordable pricing mechanisms. Strengthening water infrastructure and raising awareness are crucial for achieving sustainable, safe, and equitable water access for all households in the region.

Keywords: household water access, water sources, water scarcity, water management, Jema'a LGA.

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Introduction

Water is a fundamental resource for human survival, agriculture, and industrial activities. Globally, more than two billion people experience water stress due to climate change, rapid population growth, and inadequate water management systems (UN Water, 2023). This widespread scarcity has spurred international efforts toward sustainable water use through efficient policies, technological advancements, and conservation strategies that are essential for long-term water security.

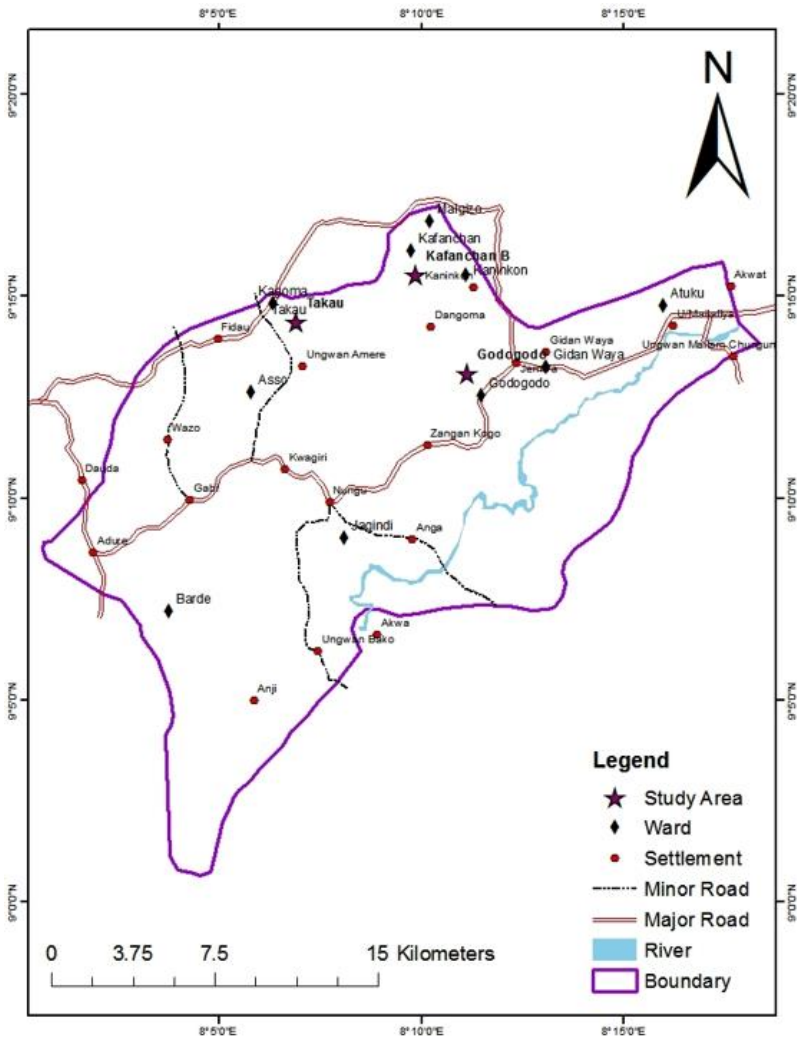
In Africa, water scarcity is compounded by erratic rainfall, rapid urbanization, and limited infrastructure investment. Many households depend on surface water sources that are vulnerable to contamination, contributing to the spread of waterborne diseases such as cholera and typhoid (WHO, 2022). In response, measures such as borehole drilling, dam construction and policy-driven management strategies have been introduced. However, inadequate funding and ineffective implementation continue to hinder sustainable water management across the continent.

In Nigeria, despite government interventions like the National Water Supply and Sanitation Policy, significant disparities persist. Rural and semi-urban areas, in particular, suffer from poor infrastructure, over-reliance on groundwater, and pervasive pollution, undermining both public health and economic productivity. Kaduna State is no exception; numerous communities face seasonal shortages and rely on unsafe water sources due to neglected maintenance of water facilities (Nwankwo & Okeke, 2021).

Households in Jema'a local government area (LGA) especially in Kafanchan B, Takau, and Godogodo grapple with multiple challenges in accessing and managing water resources. While they depend on boreholes, hand-dug wells, and rivers for their water supply, these sources are often affected by seasonal fluctuations, contamination risks, and inadequate storage practices. Furthermore, socio-economic factors, particularly among low-income house-

holds, further limit access to clean water. Without timely and effective interventions, these issues jeopardize household well-being and the long-term sustainability of water resources in the region. Against this backdrop, sustainable water management emerges as a critical imperative. This study aims to analyze household water use patterns and the specific challenges faced in Jema'a LGA, and to propose strategic interventions that enhance water access, conservation, and overall community well-being.

This study aims to examine household water sources and usage patterns in Kafanchan B, Takau, and Godogodo, assess the challenges households face in accessing and managing water resources, determine the relationship between household income and water access using the chi-square test, and propose sustainable water management strategies for improved household access and conservation.



Study Area and Environmental Features

Jema'a is situated in Kaduna State, Nigeria, and comprises both urban and rural communities. It lies between latitudes 9°15'N and 9°35'N and longitudes 8°00'E and 8°30'E. The area's elevation influences its drainage system, while its diverse topography plays a significant role in water resource availability.

Jema'a LGA experiences a tropical savanna climate (Aw), with annual

rainfall between 1,000 mm and 1,500 mm. The rainy season extends from April to October, and the dry season lasts from November to March. Temperature variations are common, with the highest heat levels recorded between March and April. Seasonal water shortages result from drying rivers and streams, which pose significant challenges for the residents. The region is part of Nigeria's Basement Complex, composed mainly of granite and metamorphic rocks. The predominant soil type, ferruginous tropical soil, supports agricultural activities, while the Guinea Savannah vegetation consists of scattered trees such as *Isobertinia doka*, *Daniellia oliveri*, and African locust bean trees. However, land degradation due to deforestation and farming remains a pressing concern.

Literature Review

Water Availability and Household Dependence

Water is a fundamental resource that drives domestic use, agricultural productivity, and the sustainability of small-scale businesses in Jema'a LGA. Households primarily obtain water from rivers, boreholes, and wells; water vendors play a supplementary role during periods of shortage. The region's agricultural activities cultivating crops such as maize, yam, millet, and groundnuts face significant setbacks due to irregular water supply, ultimately affecting food security and economic development (Adeyemi and Yusuf, 2023). Although previous studies have documented water scarcity impacts in Nigeria, there remains a notable gap in understanding how these dynamics specifically affect rural households in northern Nigeria. Recent work (Bello and Ajayi, 2023) points to unique challenges in these areas, yet a comprehensive synthesis are still lacking.

Challenges in Household Water Management

Sustainable water management lies at the heart of improving agricultural

productivity, sanitation, and economic stability in Jema'a LGA; however, significant challenges persist, including inadequate infrastructure characterized by poor maintenance, limited funding, and fragmented water distribution systems, an over-reliance on groundwater that exposes households to seasonal shortages due to its dwindling availability, and insufficient government intervention where weak policy implementation and oversight further exacerbate water scarcity and contamination issues (Eze and Mohammed, 2021; Aluko, 2023).

While these studies offer valuable insights into structural limitations, they often stop short of addressing the specific operational difficulties encountered by rural households in northern regions. Recent investigations (Adetola et al., 2023; Nwachukwu and Adewale, 2024) highlight that rural household water management challenges such as limited access to safe storage options and inadequate local maintenance protocols remain underexplored. This study aims to fill that critical gap by combining both quantitative and qualitative assessments, thus contributing a more nuanced analysis to the existing literature.

Theoretical Framework: Integrated Water Resource Management (IWRM)

The Integrated Water Resource Management (IWRM) framework provides a structured and holistic approach for coordinating the management of water, land, and related resources. Its goal is to balance economic and social benefits while protecting the environment. IWRM is particularly useful for examining the multifaceted impacts of water scarcity on households, agriculture, and public health in settings like Jema'a LGA.

By grounding this study in the IWRM framework, we aim to develop policies that not only enhance water conservation and infrastructure but also address the local socio-economic and environmental challenges identified in recent literature. Although foundational studies such as Oke et al. (2022) have paved the way in understanding regional water management, newer research

(Bello and Ajayi, 2023) underscores the need for integrated strategies that specifically reflect rural household experiences in northern Nigeria. This study thereby contributes uniquely to the discourse by focusing on practical, community-driven interventions and addressing gaps in the existing scholarly synthesis of household water management in the region.

Methodology

This study adopted a mixed-method approach, combining structured surveys and direct observations to examine household water access and management. The total household population across Kafanchan B, Takau, and Godogodo is approximately 5,630. A sample size of 100 households was determined using Yamane's formula with a 10% margin of error, and selection was carried out via stratified random sampling to ensure a fair and representative distribution across different community segments. Data were collected using a pre-tested, structured questionnaire that covered key areas such as household demographics, water sources, usage patterns, storage methods, and challenges in accessing clean water. Additionally, direct observations were conducted using a standardized checklist to document the on-site conditions of water access and storage facilities. Income data were categorized into low, middle, and high brackets based on monthly earnings to facilitate meaningful chi-square analysis of the relationship between household income and water access.

Descriptive statistics were employed to analyze quantitative data, and a chi-square test was conducted to assess the relationship between household income and water access. The results are presented using tables and charts for clarity and to support evidence-based policy recommendations. Ethical considerations were carefully observed throughout the study. Ethical approval was obtained from the relevant institutional review board, and written informed consent was secured from all participants before data collection commenced.

Results and Discussion

Demographic characteristics of respondents

Table 1: Demographic characteristics of respondents

Variable	Frequency	Percentage (%)
Gender of respondents		
Male	50	51
Female	48	49
Total	98	100
Age Group		
18–30 years	40	41
31–45 years	35	36
46–60 years	20	20
Above 60 years	3	3
Total	98	100
Educational Level		
No formal education	15	15
Primary education	30	31
Secondary education	35	36
Tertiary education	18	18
Total	98	100
Occupation		
Farming	30	31
Trading	25	26
Civil service	20	20
Other occupations	23	23
Total	98	100

Source: Authors's analysis, 2025

Table 1 show that there are 51% males and 49% females, meaning both genders are almost equally represented. Most respondents are young adults (41% aged 18–30 years) and middle-aged individuals (36% aged 31–45 years), which suggests that a large portion of the population is in their working years.

The education level varies, with 36% having secondary education, 31% completing primary education, and 15% having no formal education. This indicates that while some respondents may have basic knowledge of water management, others may have limited awareness of safe water practices. In terms of occupation, 31% are farmers, 26% are traders, and 20% work in civil service, showing that many depend on water not just for household use but also for their jobs. The reliance on water for both domestic and economic activities makes access to clean water essential in the study area.

The findings suggest that education and occupation affect water use and management. Farmers and traders need steady access to water, and those with less education may have limited awareness of safe water practices. Studies like Oke et al. (2022) and Adeyemi and Yusuf (2021) found that occupation influences water demand, while education affects water safety practices. To improve water access and management, there is a need for better water infrastructure, awareness programs, and government support in the study area.

Household Water Sources and Usage Patterns in the Area

Table 2: Primary source of household water

Variable	Frequency	Percentage (%)
Borehole	34	35
Hand-dug well	22	22
River/stream	16	16
Water vendor	26	27
Total	98	100

Source: Authors's analysis, 2025

Table 2 reveals that the most common water source is boreholes (35%), followed by water vendors (27%), hand-dug wells (22%), and rivers/streams (16%). This indicates that while some households have access to groundwater sources, a significant number rely on commercial water vendors, which may increase household expenses. A study by Bello et al. (2021) found that reliance

on vendors often leads to higher costs and inconsistent supply, affecting household water security.

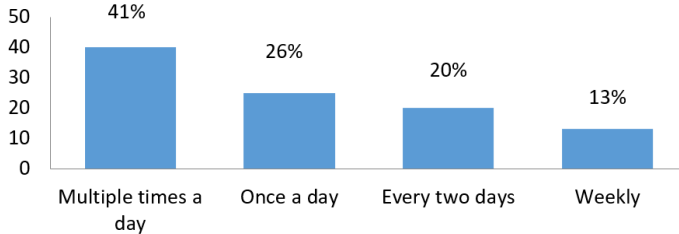


Fig. 2: *Frequency of daily water access. Source: Authors's analysis, 2025*

Figure 2 shows that 41% of household's access water multiple times a day, highlighting a significant disparity in daily water availability, while a notable portion of 26% relies solely on a once-daily access schedule. This finding is consistent with Akinbile and Omoniyi (2022), who observed that water scarcity in some regions forces households to ration their consumption, leading to reduced access, particularly in rural communities.

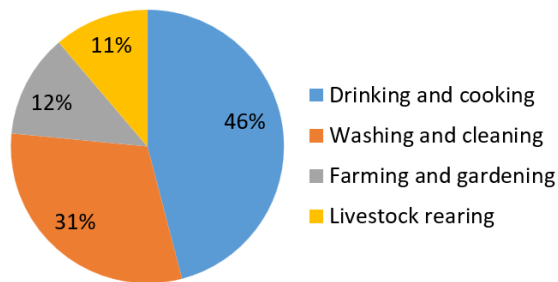


Fig. 3: *Main use of water at home. Source: Authors's analysis, 2025*

Figure 3 shows that significant proportion of households (46%), primarily use water for drinking and cooking, followed by washing and cleaning (31%). Meanwhile, 12% of households use water for farming and gardening, while 11% allocate it to livestock rearing. This aligns with Ogundipe et al. (2020), who found that drinking and cooking remain the top household water priorities, especially in areas with uncertain supply, while agricultural use is secondary due to its high consumption demand.

Table 3: How water is stored

Variable	Frequency	Percentage (%)
Covered containers	50	51
Open containers	18	18
Tanks and reservoirs	20	20
No storage method	10	11
Total	98	100

Source: Authors's analysis, 2025

Table 3 shows that majority of households (51%) use covered containers, while 20% store water in tanks and reservoirs. However, 18% use open containers, and 11% do not have a storage method, increasing the risk of water contamination. These findings align with Akinbile and Omoniyi (2022), who noted that improper storage contributes to waterborne diseases in rural areas.

Challenges Faced by Households in Accessing and Managing Water Resources

Table 4: Biggest challenge in accessing water

Variable	Frequency	Percentage (%)
Distance to water sources	28	29
Poor water quality	35	36
High cost of water	22	22
Seasonal shortages	13	13
Total	98	100

Source: Authors's analysis, 2025

Table 4 shows that most reported challenge is poor water quality (36%), followed by distance to water sources (29%), high cost of water (22%), and seasonal shortages (13%). These results suggest that even when water is available, quality remains a major concern. This aligns with Ogundipe et al. (2020), who emphasized that inadequate water treatment affects household health.

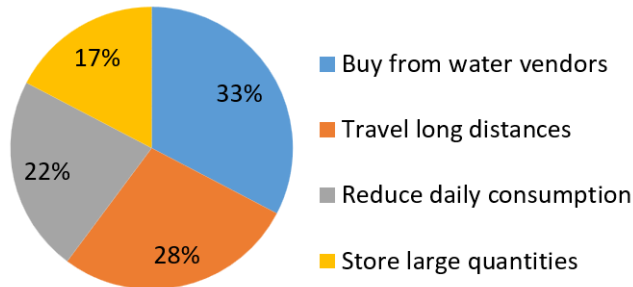


Fig. 4: Coping strategies employed during water shortages. Source: Authors's analysis, 2025

Figure 4 shows that a significant coping strategy among households is purchasing from water vendors (33%), followed by traveling long distances (28%), which underscores the challenges faced during periods of scarcity. These findings support Ademola and Yusuf (2019), who noted that in water-scarce communities, reliance on expensive water vendors and long-distance water collection are common adaptation measures, often impacting household finances and time management.

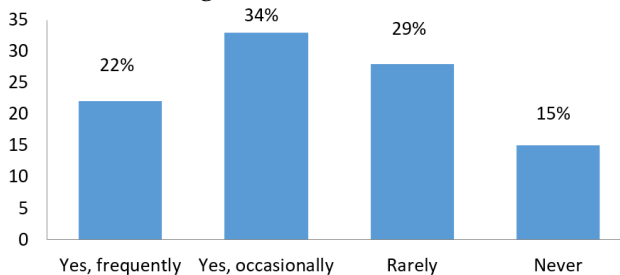


Fig. 5: Experience with water contamination in household. Source: Authors's analysis, 2025

Figure 5 reveals that water contamination is a prevalent issue, with 22% of respondents frequently experiencing it and 34% occasionally facing contamination. Meanwhile, 29% rarely encounter contamination, and 15% report never experiencing it. This supports Eze and Nwankwo (2020), who identi-

fied that poor storage practices, inadequate filtration, and proximity to contaminated sources contribute to household water contamination, increasing the risk of waterborne diseases.

Table 5: Reliability of water source throughout the year

Variable	Frequency	Percentage (%)
Very reliable	30	31
Somewhat reliable	40	41
Unreliable	20	20
Completely unreliable	8	8
Total	98	100

Source: Authors's analysis, 2025

Table 5 shows that only 31% of respondents consider their water source very reliable, while 41% rate it as somewhat reliable. Meanwhile, 20% find it unreliable, and 8% report complete unreliability. This suggests that many households face uncertainty in water supply, requiring alternative measures. Similar studies by Ademola and Yusuf (2019) in northern Nigeria confirm that seasonal variations significantly affect water reliability.

Relationship between Household Income and Water Access

Test of Hypothesis

Table 6: Chi-square test for relationship between household income and water access

Category	Chi-Square	Df	Asymp. Sig.
Household income and water access	2.163	3	0.539
Monthly water expenditure	7.061	3	0.070
Effect of income on water access	21.347	3	0.000
Factors affecting water affordability	2.000	3	0.572

Source: Authors's analysis, 2025

The chi-square test results in Table 6 reveal key insights into the relationship between household income and water access. The test for household income and water access ($\chi^2 = 2.163$, $p = 0.539$) indicates no statistically significant relationship, suggesting that income levels do not strongly determine water access within the study area. However, the test for monthly water expenditure ($\chi^2 = 7.061$, $p = 0.070$) approaches significance, implying that income might influence how much households spend on water, even if it does not directly determine access. In contrast, the effect of income on water access ($\chi^2 = 21.347$, $p = 0.000$) is highly significant, highlighting that financial capacity plays a crucial role in securing reliable and quality water sources. Lastly, the test for factors affecting water affordability ($\chi^2 = 2.000$, $p = 0.572$) suggests that affordability challenges are not solely dictated by income but could be influenced by other factors such as water pricing and availability. These findings align with studies like Eze and Nwankwo (2020), which emphasize that while income affects water expenditure, broader structural issues often determine household water access and affordability.

Sustainable Water Management Strategies for Improved Household Access and Conservation

Table 7: Current water-conservation method

Variable	Frequency	Percentage (%)
Rainwater harvesting	40	41
Recycling wastewater	25	26
Using water-efficient appliances	22	22
None	11	11
Total	98	100

Source: Authors's analysis, 2025

Table 7 depicts that most common conservation method is rainwater harvesting (41%), followed by wastewater recycling (26%), and water-efficient appliances (22%). However, 11% do not use any conservation method, indicating

a need for more awareness. Studies like Ogunbanjo et al. (2023) suggest that promoting household rainwater collection can improve water sustainability.

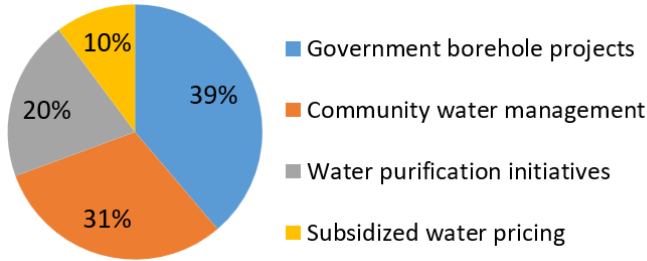


Fig. 6: Strategies to improve household water access. Source: Authors’s analysis, 2025

Figure 6 show that among the suggested strategies to enhance water access, 39% of respondents prefer government borehole projects, while 31% advocate for community water management. Additionally, 20% support water purification initiatives, and 10% favor subsidized water pricing. This aligns with Ogunbanjo et al. (2023), who emphasized that government infrastructure projects and local water management play critical roles in improving access and quality, particularly in underserved communities.

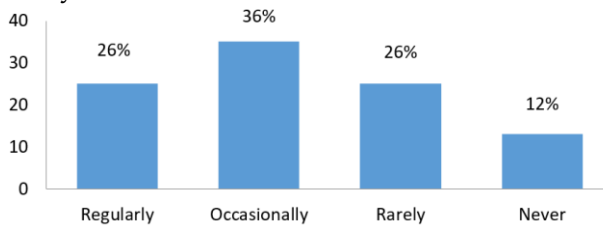


Fig. 7: Frequency of community water management participation. Source: Authors’s analysis, 2025

Figure 7 reveals that community participation in water management varies, with 36% engaging occasionally and 26% participating regularly. Meanwhile, 26% rarely take part, and 12% never engage in management activities. These

findings resonate with studies by Adebayo and Akinola (2021), which highlight that while community involvement is essential for sustainable water governance, participation levels are often inconsistent due to limited awareness, resources, and government support.

Table 8: Role government should play in ensuring sustainable water management

Variable	Frequency	Percentage (%)
Provide more infrastructure	30	31
Regulate water pricing	28	29
Improve water sanitation policies	20	20
All of the above	20	20
Total	98	100

Source: Authors's analysis, 2025

Table 8 reveals that most respondents believe that the government should provide more infrastructures (31%), regulate water pricing (29%), improve water sanitation policies (20%), and implement all these measures (20%). These findings align with Eze and Nwankwo (2020), who emphasized that sustainable water management requires both infrastructure and policy improvements.

Discussion of Findings

The study shows that most households in Jema'a LGA rely on boreholes and water vendors due to high costs, irregular supply, and long travel distances. While some households get water daily, others face shortages and must ration their use or seek alternative sources, and although drinking and cooking are the main uses, poor storage practices increase the risk of contamination and waterborne diseases. Statistical tests reveal that overall income does not significantly affect the frequency of access ($p = 0.539$), but it is crucial for obtaining reliable and quality water ($p = 0.000$), meaning wealthier families are better able to secure clean water during shortages. Women, who are primarily

responsible for fetching water, bear the burden of time poverty, negatively affecting their education and employment opportunities. The limited adoption of innovative solutions like rainwater harvesting indicates significant room for improvement, and these findings underscore the need to meet Sustainable Development Goal 6 (Clean Water and Sanitation) through better infrastructure, enhanced community management, gender-sensitive policies, and stronger government support for long-term water sustainability in the region.

Conclusion and Recommendations

The findings reveal that households in Jema'a LGA face significant challenges in accessing safe and reliable water, with many relying on boreholes and water vendors due to inadequate public water infrastructure. Water scarcity, high costs, and contamination are persistent issues affecting household water security, while coping strategies such as rainwater harvesting and storage, though employed by some, are insufficient to ensure consistent access. The study underscores the need for improved water management practices and sustainable interventions to enhance both water availability and quality, which are critical for better health outcomes and overall living conditions.

To improve water access, the government should invest in borehole drilling, expand public water supply networks, and implement water purification programs. Community-led water management initiatives such as cooperative water storage systems should be encouraged to enhance resilience during shortages and awareness campaigns on water conservation and proper storage methods are essential to reduce contamination risks. Policymakers should also consider subsidizing water costs for low-income households to ease financial burdens, thereby promoting sustainable and equitable access to water resources.

It is important to note that this study has limitations. The scope was confined to selected communities within Jema'a LGA, and seasonal variations

that could affect water availability and management practices were not fully explored. Future research should address these limitations by broadening the geographic scope and examining the impacts of seasonal fluctuations, as well as exploring the gendered dimensions of water fetching and management. Further studies could also assess the long-term effectiveness of community-led initiatives and additional integrated strategies that align with Sustainable Development Goal 6 (Clean Water and Sanitation).

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