



Household Water Sources, Accessibility and Consumption Patterns in Selected Rural Communities of Taraba State, Nigeria

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KEYWORDS

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ABSTRACT

Rural water insecurity remains a persistent development challenge in Nigeria, particularly in communities with limited access to reliable water infrastructure. This study assessed water supply, household water consumption patterns, and factors influencing water use in ten rural communities of Taraba State, northeastern Nigeria. The communities were purposively selected based on their rural characteristics and varying access to functional water infrastructure, after which households were sampled systematically. A cross-sectional household survey was conducted among 500 respondents, producing allocations ranging from 40 to 62 respondents in each community. Data were collected using structured questionnaires and analysed using descriptive statistics, Pearson correlation, and multiple linear regression. Results showed that rivers and streams were the principal sources of domestic water (39.0%), followed by rainwater harvesting (34.0%) and hand-dug wells (23.4%), while only 3.6% of households used private or public boreholes. Distance to water source, collection time, and water cost were negatively associated with household water consumption, whereas household income and household size showed positive associations. The regression model explained 53.4% of the variation in household water consumption (adjusted $R^2 = 0.529$; $p < 0.001$). Distance to the water source had the largest absolute standardised regression coefficient in the reported model ($\beta = -0.396$). However, distance, collection time, income and other categorical or range-based variables were represented using numerical codes for ordered categories; therefore, coefficients should be interpreted as associations with coded categories rather than necessarily as effects per continuous unit. The findings highlight physical accessibility, affordability and socioeconomic conditions as important dimensions of rural water insecurity and underscore the need for improved water infrastructure and maintenance.

CITATION

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INTRODUCTION

Water is essential for human survival, household welfare, livelihoods and socioeconomic development. In rural communities, water serves both domestic and productive purposes, including drinking, cooking, sanitation, agriculture and small-scale economic activities. However, water security extends beyond the physical presence of a water source (Pacheco-Treviño & Manzano-Camarillo, 2024) and includes availability, physical accessibility, affordability, reliability and quality (Ngayaga, 2025). The WHO/UNICEF Joint Monitoring Programme (JMP) defines safely managed drinking water as an improved source that is accessible on premises, available when needed and free from contamination. Thus, a household may have access to a water source without necessarily having access to safe or reliable drinking water (Yusuf, Jidauna & Ndabula, 2026).

Globally, inequalities in drinking-water access remain substantial. The latest WHO/UNICEF JMP estimates indicate that in 2024, 74% of the global population used safely managed drinking-water services, compared with 60% in rural areas and 83% in urban areas. Approximately 2.1 billion people remained without safely managed drinking water, including households dependent on surface water. These disparities are particularly important in rural settings where households may rely on rivers, streams, rainwater and shallow wells because formal water services are limited or unreliable. In Nigeria, rural water insecurity is reflected not only in the availability of water facilities but also in the effort required to obtain water (Adeyeye et al., 2020; Cominola et al., 2023). Distance to water sources, time spent collecting water and the cost of acquisition can influence the quantity of water households obtain, while household income and size can affect both purchasing capacity and domestic demand. These factors may therefore interact to shape household water consumption and the broader socioeconomic consequences of inadequate access.

The selected rural communities of Taraba State provide an appropriate setting for examining these relationships. Households in the study area depend on a combination of rivers, streams, rainwater harvesting and hand-dug wells, while access to functional boreholes remains limited (Srinivasan et al., 2012; Ovwah & Hymore, 2001). Consequently, the physical distance to water sources, time required for collection and associated costs may impose constraints on household water use. At the same time, differences in household income and size may influence the capacity and demand for water.

Despite existing studies on rural water supply in Nigeria (Bazaanah & Mothapo, 2024; Egwom et al., 2025; Israilova, Voronina & Shatila, 2023; Damania et al., 2017), limited empirical evidence has examined the combined relationship between physical accessibility, collection burden, water cost and household socioeconomic

characteristics and household water consumption in selected rural communities of Taraba State. This study therefore investigates water supply, accessibility and household consumption patterns in ten selected rural communities of Taraba State. Specifically, it examines constraints on effective water supply, the cost and time associated with obtaining water, the social implications of inadequate access, and the factors associated with household water consumption. The study further proposes measures for improving sustainable rural water supply and contributing to Sustainable Development Goal 6.

Conceptual Framework

This study is anchored primarily in the Basic Needs Approach to development and complemented by the Sustainable Livelihoods Framework (SLF). The Basic Needs Approach emerged within development policy debates of the 1970s, particularly through the International Labour Organization's World Employment Programme, and subsequently received substantial development-policy attention through the work of Streeten and colleagues (Streeten, et al., 1981). It focuses on ensuring minimum levels of essential goods and services required for an acceptable standard of living, including food, health, education, sanitation, housing and water supply. The Basic Needs Approach is therefore distinct from Basic Psychological Needs Theory, which concerns psychological needs such as autonomy, competence and relatedness. The present study uses the development-oriented Basic Needs perspective because water is treated as an essential service whose availability and accessibility influence household welfare and productive capacity. Streeten and Burki's development-oriented formulation particularly emphasizes access to essential goods and public services and the conditions through which basic needs are satisfied. (Streeten & Burki, 1978; Van den Broeck et al., 2008)

Applied to this study, the Basic Needs Approach suggests that household water security depends not simply on the existence of a water source but on whether households can obtain sufficient water at an acceptable physical and economic cost. This provides the conceptual basis for examining distance to water source, time spent collecting water and water cost as dimensions of accessibility. It also provides a basis for examining household water consumption as an outcome reflecting the extent to which households can obtain water for domestic needs. The approach is therefore directly connected to the study's analysis of the relationship between accessibility constraints and household water consumption. The Sustainable Livelihoods Framework complements this perspective by emphasizing the resources and capacities through which households pursue their livelihoods. Livelihood outcomes are influenced by human, natural, physical, financial and social assets. Within this

framework, household income represents an important financial resource that can influence the ability to obtain water, while household size represents a household-level characteristic that can influence water demand. Distance and collection time are also relevant because they impose demands on household labour and time that may otherwise be devoted to farming, trading, education and other livelihood activities.

The integration of the two frameworks therefore establishes a direct conceptual pathway for the variables analysed in this study. The Basic Needs Approach explains why adequate and accessible water is an essential component of household welfare, while the Sustainable Livelihoods Framework explains how household resources and characteristics shape the capacity to obtain and use water. Accordingly, distance to water source, collection time and water cost represent physical and economic accessibility constraints; household income and household size represent socioeconomic characteristics; and household water consumption represents the principal outcome examined. The framework consequently supports the use of correlation and multiple regression to assess the associations between these variables while recognizing that the cross-sectional design does not establish causality.

MATERIALS AND METHODS

The study was conducted in ten rural communities in Taraba State, northeastern Nigeria. The ten study communities were purposively selected from rural settlements in Taraba State to capture communities characterized by rural household dependence on a range of domestic water sources and varying levels of access to functional water infrastructure. The selection was guided by the availability of identifiable household populations,

accessibility for field data collection, and the relevance of the communities to the study of rural water supply, accessibility and household consumption. The communities are Chonku, Gindin Waya, Jibu, Kumbo, Kwararafa, Kumgana, Mai Hula, Jaruo Yinu, Lankaviri, and Yakoko. Taraba State lies between latitudes 6°25' and 9°30' N and longitudes 9°30' and 11°45' E. It covers approximately 54,473 km² and shares boundaries with Bauchi, Gombe, Adamawa, Benue, Nasarawa, and Plateau States, while its eastern boundary extends to the Republic of Cameroon. The state is characterized by diverse physical features that include extensive plains, rolling hills, river valleys, and the Mambilla Plateau, which rises to about 1,800 m above sea level. The Benue, Taraba, Donga, and Ibi rivers constitute the principal drainage network and provide important sources of water for domestic, agricultural, and economic activities. The climate is tropical with distinct wet and dry seasons. Annual rainfall ranges from about 1,000 mm in the northern savanna to over 2,000 mm in the southern forest zone, while mean annual temperatures range between 26 °C and 33 °C. Vegetation consists predominantly of Guinea savanna in the north and lowland rainforest in the south. Agriculture is the main source of livelihood in the study area. Rural households cultivate maize, rice, cassava, yam, millet, sorghum, and vegetables, while cash crops such as coffee, tea, cotton, and groundnuts contribute to household income. Livestock production, fishing, food processing, and petty trading also provide important sources of employment. These activities depend heavily on reliable water supplies for crop irrigation, livestock watering, fish harvesting, food preparation, processing, and sanitation. Water is therefore both a household necessity and a productive resource that sustains rural livelihoods and local economic development.

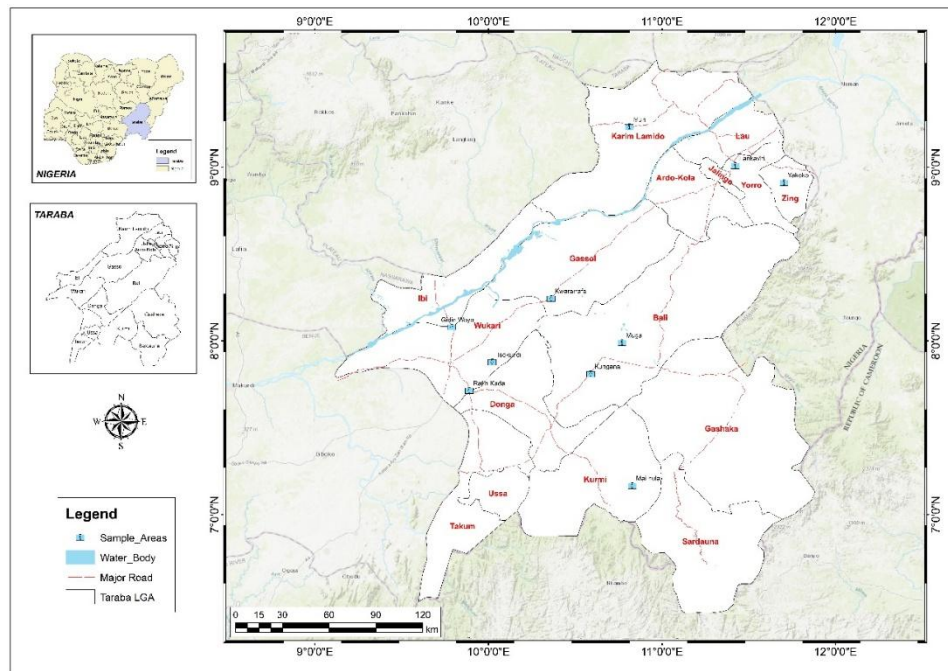


Figure 1: Map of Taraba State showing the sample study areas

Despite the availability of major rivers and seasonal rainfall, many communities experience limited access to safe and reliable potable water because of inadequate infrastructure, poor maintenance of existing facilities, seasonal fluctuations in water availability, and rapid population growth. Consequently, households rely largely on streams, shallow wells, rivers, and rainwater harvesting for domestic use. This dependence on unimproved water sources affects household consumption patterns, public health, agricultural productivity, and income generation, making the study area suitable for investigating the status of rural water supply and consumption.

A cross-sectional household survey design was adopted. The sample size of 500 respondents was determined from the estimated population of 4,000 households using the Yamane (1967) formula:

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

Where n = sample size, N = total population size, e = level of precision (sampling error), usually 0.05 for 95% confidence

With a sampling frame of approximately 4,000 households and a 5% precision level, the calculated sample size was approximately 364 households. However, the sample was increased to 500 respondents to improve representation across the ten communities and provide sufficient observations for the multivariate statistical analysis.

Proportional allocation was used to distribute the 500 respondents according to the estimated household population of each community.

Table 1: Proportional Allocation of Respondents across the Ten Study Communities

S/N	Community	Estimated Households	Allocated Respondents
1	Chonku	492	62
2	Gindin Waya	396	50
3	Jibu	468	59
4	Kumbo	352	44
5	Kwararafa	436	55
6	Kumgana	324	41
7	Mai Hula	424	53
8	Jaruo Yinu	316	40
9	Lankaviri	346	43
10	Yakoko	446	53
Total	10 communities	4,000	500

Within each community, systematic sampling was employed using an operational sampling interval of eight

households, calculated as $(K=N/n=4,000/500=8)$. Following a random starting point between the first and

eighth household, every eighth household was subsequently selected until the required allocation for each community was attained. Where a selected household was unavailable, a repeat visit was made where practicable. Where the household remained unavailable, replacement was undertaken using the next eligible household according to the field replacement protocol. This procedure was documented to minimize arbitrary substitution and reduce potential selection bias.

Data were collected through a structured household questionnaire administered to household heads or responsible adult household members in the ten selected communities. The questionnaire obtained information on household socioeconomic characteristics, domestic water sources, accessibility, reliability of supply, water-collection time, water cost and household water-use practices. Household water consumption was recorded as the quantity of water reportedly used by each household within a typical day during the survey period. Respondents reported the quantities of water used based on the containers commonly used by their households, and the reported quantities were converted to litres using the corresponding container capacities. The resulting values were used to represent daily household water consumption in the statistical analysis. The treatment of missing responses involved identifying unanswered items during data screening and excluding them from the analysis for the affected variables. Cases with substantial missing information were excluded from the relevant analysis, while valid responses were retained for all other variables. No values were imputed or replaced, and the analysis was based on the available valid responses for each variable.

Prior to the main survey, the questionnaire was pretested among 30 respondents from a rural community outside the selected study communities but with comparable socioeconomic and water-supply characteristics. The pretest assessed the clarity, sequence and comprehensibility of the questionnaire items. Necessary modifications were made before the final administration. Internal consistency was assessed using Cronbach's alpha, which produced a coefficient of 0.82, indicating satisfactory reliability for the survey instrument. The collected questionnaires were checked for completeness, coded and analyzed using descriptive and inferential statistics. Frequencies, percentages, means and standard deviations were used to summarize respondents' characteristics and household water-source patterns. The questionnaire contained both single-item variables and multi-item Likert-scale constructs. The multi-item section assessing factors affecting effective water supply comprised eight items, while the section assessing the social effects of inadequate water supply comprised six items. The questionnaire was pretested among 30 respondents from a comparable rural community outside

the study area, and necessary modifications were made following the pretest. Internal consistency was assessed using Cronbach's alpha, and the previously reported overall coefficient was $\alpha = 0.82$. Because the original reliability output did not provide construct-specific coefficients, the overall alpha is interpreted only as an indication of the internal consistency of the items included in the overall reliability analysis and is not taken as evidence that each distinct construct independently achieved the same level of reliability. Multiple linear regression was employed to examine the influence of selected socioeconomic and household factors on domestic water-supply conditions. Statistical significance was evaluated at the 5% level ($p < 0.05$). The regression model produced $R = 0.731$, $R^2 = 0.534$ and adjusted $R^2 = 0.529$, indicating that the explanatory variables accounted for approximately 52.9% of the adjusted variance in the dependent variable.

Completed questionnaires were coded and analysed using IBM SPSS Statistics Version 29. Descriptive statistics, including frequencies, percentages, means and standard deviations, were used to summarize respondents' characteristics and household water-supply conditions. Distance to the household water source, household income and water-collection time were recorded as ordered categories. For the primary analysis, these categories were assigned sequential ordinal codes, with increasing values representing greater distance, higher income and longer collection time, respectively. This coding treats the variables as approximately linear ordered predictors and does not imply that the numerical difference between adjacent categories represents an equal physical, monetary or temporal difference.

Pearson correlation analysis was used to examine linear associations among the coded variables, while multiple ordinary least-squares regression was used to estimate the independent statistical association of distance, collection time, household income, household size and water cost with household water consumption. The regression model was specified as:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 T_i + \beta_3 I_i + \beta_4 H_i + \beta_5 C_i + \varepsilon_i$$

where Y_i represents household water consumption; D_i represents distance to the water source; T_i represents water-collection time; I_i represents household income; H_i represents household size; C_i represents water cost; β_0 is the intercept; β_1 – β_5 are the regression coefficients; and ε_i is the error term.

The assumptions underlying ordinary least-squares regression included linearity of the predictor-outcome relationships, independence of observations, approximately normally distributed residuals, homoscedasticity of residuals and absence of problematic multicollinearity. Multicollinearity was assessed using tolerance and variance inflation factor (VIF) statistics. The regression results were reported with

unstandardized coefficients, standard errors, standardized coefficients, t statistics, p values and 95% confidence intervals. Statistical significance was evaluated at $\alpha = .05$. Because distance, income and collection time were originally recorded as ordered categories, a categorical sensitivity specification should also be used to examine whether the substantive conclusions are dependent on the assumption of equal spacing between ordinal codes. In this specification, each ordered variable is represented by indicator variables, with the lowest category serving as the reference category. The sensitivity results are interpreted by comparing the estimated effects and their 95% confidence intervals with those obtained from the ordinal-score specification.

Ethical Approval and Informed Consent

Ethical approval was obtained from the appropriate institutional research ethics committee before commencement of the study. Permission was also obtained from relevant community authorities and leaders in the selected rural communities. The study was conducted in accordance with the ethical principles of voluntary participation, confidentiality, anonymity, and

respect for participants’ rights. Respondents were informed about the purpose of the study, the nature of the information required, and their right to decline participation or withdraw from the study at any stage without penalty. No personally identifying information was included in the research database or reported in the findings.

Before administration of the questionnaire, each respondent was provided with a clear explanation of the purpose of the study, the expected duration of participation, the type of information to be collected, and the intended use of the findings. Respondents were informed that participation was entirely voluntary and that refusal to participate would have no consequences. Verbal informed consent was obtained from participants before the questionnaire was administered. For respondents who could not read or write, the information was explained in an understandable manner, and consent was obtained verbally in the presence of an appropriate witness. Participants were assured that the information provided would be treated confidentially and used strictly for academic and research purposes.

RESULTS AND DISCUSSION

Table 2: Socio-economic Characteristics of Respondents (N = 500)

Variable	Category	Frequency	Percentage (%)
Gender	Male	284	56.8
	Female	216	43.2
Age (Years)	18–30	112	22.4
	31–40	154	30.8
	41–50	119	23.8
	51–60	71	14.2
	Above 60	44	8.8
Education	No Formal Education	108	21.6
	Primary	139	27.8
	Secondary	176	35.2
	Tertiary	77	15.4
Occupation	Farming	248	49.6
	Trading	98	19.6
	Civil Service	46	9.2
	Artisan	67	13.4
	Others	41	8.2

Of the 500 respondents, 284 (56.8%) were male and 216 (43.2%) were female. Respondents aged 18–50 years constituted 77.0% of the sample, indicating that the survey was predominantly represented by adults within the economically active age groups, with substantial water needs for domestic and livelihood activities. Secondary education was the highest educational attainment (35.2%), suggesting moderate literacy that may enhance awareness of improved water management practices.

Farming was the dominant occupation (49.6%), followed by trading (19.6%), highlighting the dependence of rural livelihoods on reliable water supplies. These findings are consistent with the observations of Efe (2006), Bain et al. (2014), and Adeyeye et al. (2020), who reported that rural households in developing countries depend heavily on water for domestic use, agriculture, and income generation, while inadequate access constrains productivity and household welfare.

Table 3: Major Sources of Domestic Water Supply

Water Source	Frequency	Percentage (%)
Rivers/Streams	195	39.0
Hand-dug Wells	117	23.4
Rainwater Harvesting	170	34.0
Private Boreholes	14	2.8
Public Boreholes	4	0.8
Total	500	100.0

Households were classified according to the principal source of domestic water reported for the survey period. Thus, the categories in Table 3 represent one principal source per household rather than all water sources used. Rainwater harvesting was retained as a separate category because its use may vary seasonally. Table 3 indicates that rivers and streams were the principal sources of domestic water (39.0%), followed by rainwater harvesting (34.0%) and hand dug wells (23.4%). Only a small proportion of households relied on private (2.8%) and public boreholes

(0.8%), indicating limited access to improved water infrastructure. The predominance of unimproved water sources reflects inadequate rural water supply systems and increases the risk of waterborne diseases. This finding agrees with Efe (2006), Bain et al. (2014), and the World Health Organization and UNICEF (2023), who reported that many rural households in developing countries continue to depend on unsafe surface water because of inadequate potable water facilities.

Time and Distance Travelled to Water Source

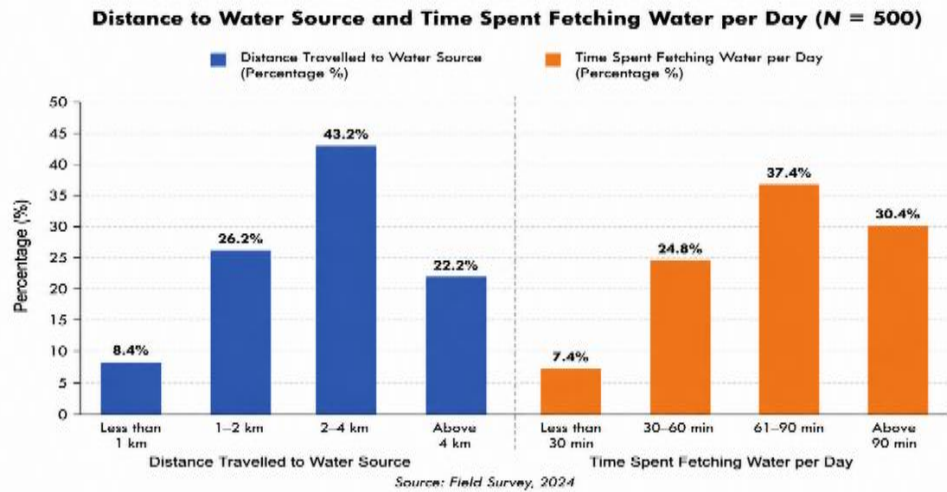


Figure 2: Time and distance travelled to water source

Figure 2 shows that most households travelled long distances to obtain domestic water and consequently spent considerable time collecting it. The largest proportion of respondents (43.2%) travelled between 2 and 4 km to the nearest water source, while 22.2% travelled more than 4 km. Similarly, 37.4% spent between 61 and 90minutes fetching water daily, and 30.4% spent more than 90 minutes. Only 8.4% travelled less than 1 km, whereas 7.4% spent less than 30 minutes collecting water. The close correspondence between travel distance and collection time indicates that limited proximity to potable water substantially increases the time burden on rural

households. This situation reduces the time available for farming, trading, education, and other productive activities, particularly among women and children who are often responsible for water collection. The findings corroborate those of Cook et al., (2024), Bain et al. (2014), Efe (2006), and Adeyeye et al. (2020), who reported that long distances to water sources are associated with lower household water consumption, reduced productivity, and greater vulnerability to water insecurity in rural communities. Daily Household Water Consumption and Average Daily Cost of Water (N = 500)

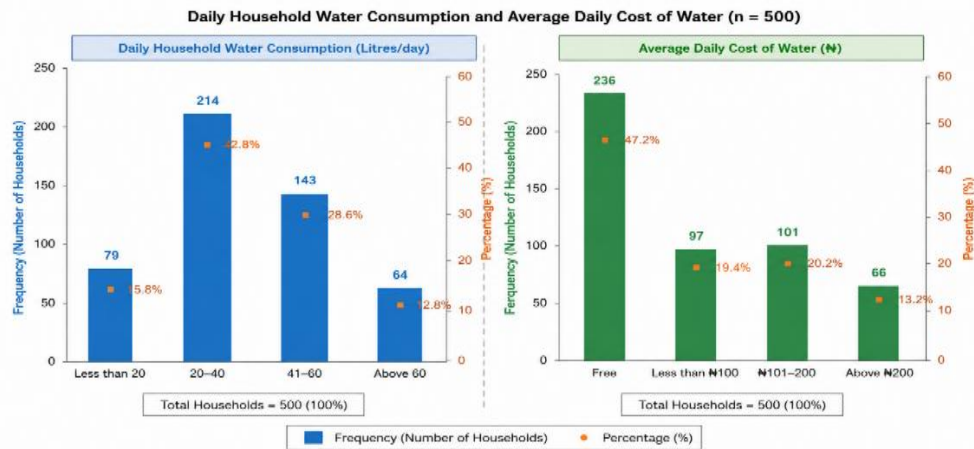


Figure 3: Daily household water consumption and average daily cost

Figure 3 shows that the largest proportion of households (42.8%) consumed between 20 and 40 litres of water daily, while only 12.8% consumed more than 60 litres. Nearly half of the respondents (47.2%) obtained water free of charge, whereas 20.2% spent ₦101–200 daily and 13.2% spent above ₦200. The predominance of moderate water consumption despite widespread access to free water suggests that factors such as distance to water sources,

collection time, and limited water infrastructure constrain household water use rather than cost alone. These findings are consistent with Bartram and Howard (2003), Bain et al. (2014), and the World Health Organization and UNICEF (2023), who reported that accessibility and reliability of water sources exert greater influence on domestic water consumption than direct financial costs in many rural communities.

Table 4: Factors Affecting Effective Water Supply

Factor	Mean Score	Rank
Inadequate Boreholes	4.56	1
Long Distance to Water Source	4.43	2
Poor Government Intervention	4.28	3
Seasonal Drying of Streams	4.12	4
Poor Maintenance Culture	3.98	5
Erratic Electricity Supply	3.82	6
Population Growth	3.65	7
Poor Road Network	3.51	8

(5-point Likert scale: 1 = Strongly Disagree to 5 = Strongly Agree.)

Table 4 shows that all the identified factors recorded mean scores above the benchmark of 3.00, indicating respondents' agreement that they significantly affect effective water supply. Inadequate boreholes (mean = 4.56) emerged as the most critical constraint, followed by long distance to water sources (4.43) and poor government intervention (4.28), highlighting deficiencies in water infrastructure and institutional support. Environmental

factors, including seasonal drying of streams (4.12), and operational challenges such as poor maintenance (3.98) and erratic electricity supply (3.82), further constrain water availability. These findings agree with WHO and UNICEF (2023), emphasizing that sustainable investment in water infrastructure and governance is essential for improving household water access.

Table 5: Water-related Health Problems

Disease	Frequency	Percentage (%)
Typhoid Fever	138	27.6
Diarrhoea	112	22.4
Cholera	39	7.8
Skin Diseases	66	13.2
No Major Illness	145	29.0
Total	500	100.0

Table 5 presents the distribution of water-related health problems among the respondents. The findings show that 29.0% of the respondents reported no major illness, indicating that a considerable proportion of households did not experience significant water-related diseases during the study period. The survey further indicated that approximately 71% of respondents reported having experienced one or more self-reported water-related health conditions. This finding reflects respondents' perceptions and reported experiences rather than clinically diagnosed illnesses.

Among the reported illnesses, typhoid fever was the most prevalent, accounting for 27.6% of responses, followed by diarrhoea (22.4%). Skin diseases constituted 13.2%, while cholera had the lowest occurrence (7.8%). The predominance of typhoid fever and diarrhoea indicates that many households are exposed to contaminated water and poor sanitation conditions. These findings are

consistent with the World Health Organization (2023), which identified contaminated drinking water as a major source of waterborne diseases in developing countries. The relatively high proportion of respondents reporting water-related health conditions highlights an important perceived health concern associated with household water access and use. However, this result should be interpreted cautiously because the information was self-reported and was not supported by clinical diagnosis or laboratory assessment of water quality. Consequently, the finding indicates the prevalence of reported health experiences among respondents rather than a confirmed epidemiological relationship between water quality and illness. Further investigation involving microbiological and physicochemical water-quality assessment, together with clinically verified health data, would be required to establish such an association.

Table 6: Social Effects of Inadequate Water Supply

Social Impact	Mean Score	Rank
Loss of Productive Time	4.48	1
Physical Stress	4.32	2
School Absenteeism	4.11	3
Reduced Farm Productivity	3.97	4
Increased Household Expenditure	3.76	5
Family Conflicts	3.41	6

Table 6 presents the perceived social effects of inadequate water supply in the study area. All the identified impacts recorded mean scores above the benchmark of 3.00, indicating respondents' agreement that inadequate water supply has significant social consequences. Loss of productive time ranked first (mean = 4.48), suggesting that households spend substantial time searching for water, thereby reducing time available for economic and domestic activities. Physical stress ranked second (mean = 4.32), reflecting the burden associated with transporting water over long distances. School absenteeism (mean =

4.11) further indicates that inadequate water access negatively affects children's education. Other notable impacts include reduced farm productivity (3.97), increased household expenditure (3.76), and family conflicts (3.41). These findings highlight that inadequate water supply adversely affects livelihoods, education, household welfare, and social well-being, consistent with Miller et al. (2024) and WHO (2025), which emphasize that limited access to safe water undermines sustainable development and quality of life.

Table 7: Respondents' Suggested Solutions

Recommendation	Frequency	Percentage (%)
Construction of Boreholes	191	38.2
Rehabilitation of Existing Facilities	113	22.6
Government Funding	86	17.2
Solar-powered Water Schemes	54	10.8
Community Participation	35	7.0
NGO Intervention	21	4.2
Total	500	100.0

Table 7 presents respondents' suggested measures for improving water supply in the study area. The results show that construction of boreholes was the most preferred recommendation, accounting for 38.2% of responses, indicating a strong demand for expanded groundwater

infrastructure to meet household water needs. Rehabilitation of existing facilities ranked second (22.6%), reflecting the need to restore non-functional water schemes. Government funding (17.2%) was also considered essential, highlighting the importance of

increased public investment in the water sector. Other recommendations included solar-powered water schemes (10.8%), community participation (7.0%), and NGO intervention (4.2%). Overall, the findings suggest that respondents favour a combination of infrastructure

development, effective maintenance, institutional support, and community involvement to ensure sustainable and reliable water supply, consistent with the recommendations of World Health Organization [WHO] and United Nations Children's Fund [UNICEF] (2025).

Table 8: Correlation Matrix

Variable	Water Consumption	Distance	Cost	Time	Household size	Income
Water consumption	1.000					
Distance to source	-0.512**	1.000				
Cost of water	-0.438**	0.396**	1.000			
Time spent	-0.574**	0.641**	0.421**	1.000		
Household size	0.176***	0.162***	0.204***	0.285***	1.000	
Household income	0.318**	-0.245**	-0.287**	-0.261**	0.318	1.000

Note: * $p < .05$; ** $p < .01$; *** $p < .001$. Unmarked coefficients are not statistically significant at the 5% level

Table 8 presents the Pearson correlation coefficients among household water consumption, distance to water source, cost of water, time spent collecting water, and household income. The results indicate that water consumption is significantly and negatively correlated with distance to water source ($r = -0.512$, $p < 0.01$), cost of water ($r = -0.438$, $p < 0.01$), and time spent collecting water ($r = -0.574$, $p < 0.01$). This implies that as distance, cost, and collection time increase, household water consumption declines. Conversely, household income shows a

significant positive relationship with water consumption ($r = 0.318$, $p < 0.01$), suggesting that higher-income households are able to access and consume more water. The positive correlations among distance, cost, and time further indicate that households located farther from water sources spend more time and money obtaining water. Overall, the findings demonstrate that physical accessibility and economic capacity are key determinants of household water consumption.

Table 9: Multiple Linear Regression Predicting Household Water Consumption

Predictor	B	SE	β	t	p	95% CI for B	Tolerance	VIF
Constant	58.436	4.211	—	13.88	<.001	50.16–66.71	—	—
Distance to water source	-4.831	0.581	-.396	-8.31	<.001	-5.97–-3.69	0.568	1.761
Collection time	-3.925	0.503	-.351	-7.80	<.001	-4.91–-2.94	0.508	1.969
Household income	2.416	0.421	.228	5.74	<.001	1.59–3.24	0.704	1.420
Household size	1.237	0.328	.146	3.77	<.001	0.59–1.88	0.719	1.391
Water cost	-1.814	0.492	-.163	-3.69	<.001	-2.78–-0.85	0.735	1.361

Model statistics: $R = .731$; $R^2 = .534$; adjusted $R^2 = .529$; $F(5, 494) = 113.24$, $p < .001$.

Note: B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; CI = confidence interval; VIF = variance inflation factor. Tolerance values are the reciprocal of VIF. The VIF values are all below the commonly used threshold of 5.00, indicating no evidence of problematic multicollinearity.

Tables 9 and 10 present the multiple regression results and model summary for the determinants of household water consumption. The multiple regression model containing five predictors was statistically significant, $F(5, 494) = 113.24$, $p < .001$, based on 500 observations. The model explained 53.4% of the variance in the dependent variable ($R^2 = 0.534$), while the adjusted $R^2 = 0.529$. The results indicate that the set of predictors jointly accounted for a substantial proportion of the observed variation in the

dependent variable. These findings indicate that physical accessibility, the time required to obtain water, household economic circumstances and household composition were statistically associated with household water consumption within the study population (Oyerinde & Jacobs, 2022). The results represent statistical associations and should not be interpreted as evidence of causation.

Table 10: Model summary

Model statistic	Sample size (N)	Number of predictors	R	R ²	Adjusted R ²	Standard Error of Estimate	F-statistic	df1	df2	Sig.
Value	500	5	0.731	0.534	0.529	0.681	113.24	5	49	< .001

Discussion

The findings indicate that household water insecurity in the study area is strongly associated with accessibility and time burdens, rather than being explained solely by monetary cost. Rivers/streams (39.0%), rainwater (34.0%) and hand-dug wells (23.4%) accounted for most household water sources, while only 3.6% of households used private or public boreholes. In addition, 65.4% of households travelled at least 2 km to obtain water, while 67.8% spent more than 60 minutes collecting it. Distance to the water source had the strongest negative association with household water consumption ($\beta = -0.396$), followed by collection time ($\beta = -0.351$) and cost ($\beta = -0.163$; all $p < 0.001$). Similarly, water consumption was more strongly correlated with collection time ($r = -0.574$) and distance ($r = -0.512$) than with cost ($r = -0.438$). These findings suggest that physical accessibility and time requirements are important correlates of household water consumption. However, given the cross-sectional design, these relationships should be interpreted as statistical associations rather than evidence that distance, collection time or cost independently determines consumption.

The findings are consistent with Basic Needs Theory, which considers access to essential services in terms of availability and the ability to obtain them adequately and conveniently. They also support the Sustainable Livelihoods Framework, as household income was positively associated with water consumption ($\beta = 0.228$), while household size also showed a positive association ($\beta = 0.146$). The substantial time required for water collection may nevertheless represent a competing demand on household labour and productive resources. Similar concerns have been reported by Uzomah & Scholz (2002). In Katsina, Nigeria, approximately 90% of households reportedly obtained water from sources at least 1 km away (Sani & Tukur, 2026), illustrating persistent physical accessibility constraints in rural communities. Recent evidence from Ghana also identifies geographical and socioeconomic differences in water-collection burdens (Amankwaa et al., 2024), while experimental evidence from Kenya indicates that reducing approximately two hours of daily water collection can release household time for other activities. These studies reinforce the relevance of distance and collection time when assessing rural water insecurity, although differences in definitions of household consumption, source distance and collection time require caution when making direct comparisons.

The ten study communities may differ in water infrastructure, source characteristics and physical

accessibility, but the pooled analysis does not provide sufficient community-level evidence to establish statistically significant differences among them. The findings should therefore be interpreted as an overall pattern for the surveyed communities rather than evidence of community-specific differences. Inadequate boreholes (mean = 4.56) and long distance to water sources (mean = 4.43) were the leading perceived constraints. Although 71.0% of respondents reported at least one illness, these were self-reported health experiences and were not clinically confirmed. Thus, the findings do not demonstrate that contaminated water caused the reported illnesses, particularly because no microbiological or physicochemical water-quality measurements or clinical assessments were undertaken.

Study Limitations

This study has several limitations. Its cross-sectional design limits causal inference between water-access conditions and reported social, livelihood or health outcomes. Several measures, including health conditions, collection burdens and social effects, were self-reported and may therefore be affected by recall or reporting bias. In addition, microbiological and physicochemical analyses of household water sources were not undertaken, preventing direct assessment of water-quality conditions or attribution of reported illnesses to water contamination. Finally, the aggregate analysis limits detailed statistical comparison among the ten communities. Nevertheless, the sample of 500 households provides useful empirical evidence on the accessibility, time and socioeconomic dimensions of rural water insecurity in the study area.

CONCLUSION

This study shows that household water insecurity is an important concern among the surveyed rural communities in Taraba State, with households relying mainly on rivers, streams, rainwater and hand-dug wells. Long distances to water sources and extended collection times were prominent constraints, and both distance and collection time showed significant negative associations with household water consumption, while income and household size were positively associated with consumption. Respondents also reported health and social burdens, including typhoid fever, diarrhoea, loss of productive time, physical stress, school absenteeism and reduced agricultural productivity. However, these findings represent self-reported experiences and statistical associations rather than independently measured

outcomes. The cross-sectional design, absence of microbiological and physicochemical water-quality assessment, and lack of clinical confirmation prevent causal attribution of reported illnesses or other social outcomes to inadequate or contaminated water. The findings therefore indicate that water insecurity in the surveyed communities is multidimensional, involving accessibility, collection time, infrastructure and socioeconomic conditions. The results should not be generalised to all rural communities in Taraba State because the study communities were purposively selected and analysed as a pooled sample.

Policy Implications

The findings support interventions that improve the proximity, reliability and functionality of rural water infrastructure in the surveyed communities. Government agencies and relevant stakeholders should prioritise the rehabilitation and maintenance of existing boreholes and consider additional water facilities where substantial access gaps are identified. Solar-powered systems may be considered where technically and economically appropriate, but their effectiveness should be evaluated rather than assumed. Community participation in facility management may support local ownership, routine maintenance and sustainability. Rural water planning should also consider the spatial distribution of households to reduce excessive travel distances and collection times. Because this study did not directly test intervention outcomes, claims that improved water access would reduce disease prevalence or increase productivity should be treated as hypotheses requiring further evaluation. Future research should incorporate microbiological and physicochemical water-quality testing, clinical or health-record evidence where feasible, and community-level comparisons to assess the effects of water interventions more directly. These measures would also support progress towards Sustainable Development Goal 6.

REFERENCES

- Adeyeye, K., Gibberd, J., & Chakwizira, J. (2020). Water marginality in rural and peri-urban communities. *Journal of Cleaner Production*, 273, 122594. <https://doi.org/10.1016/j.jclepro.2020.122594>
- Amankwaa, G., Abrefa Busia, K., Agbadi, P., Duah, H. O., & Arthur-Holmes, F. (2024). Access heterogeneities and collection time inequalities of drinking water sources in Ghana: Implications for water and development policy. *Local Environment*, 29(3), 263–278.
- Bain, R., Cronk, R., Hossain, R., Bonjour, S., Onda, K., Wright, J., Yang, H., Slaymaker, T., Hunter, P., Prüss-Ustün, A., & Bartram, J. (2014). Global assessment of exposure to faecal contamination through drinking water based on a systematic review. *Tropical Medicine & International Health*, 19(8), 917–927. <https://doi.org/10.1111/tmi.12334>
- Bartram, J., & Howard, G. (2003). Drinking-water standards for the developing world. In *Handbook of water and wastewater microbiology* (pp. 221–240).
- Bazaanah, P., & Mothapo, R. A. (2024). Sustainability of drinking water and sanitation delivery systems in rural communities of the Lepelle-Nkumpi Local Municipality, South Africa. *Environment, Development and Sustainability*, 26(6), 14223–14255.
- Cominola, A., Preiss, L., Thyer, M., Maier, H. R., Prevos, P., Stewart, R. A., & Castelletti, A. (2023). The determinants of household water consumption: A review and assessment framework for research and practice. *npj Clean Water*, 6, Article 11. <https://doi.org/10.1038/s41545-022-00208-8>
- Cook, J., Kabubo-Mariara, J., & Kimuyu, P. (2024). Short-run impacts of reducing water collection times on time use, well-being, and education in rural Kenya. *Economic Development and Cultural Change*, 73(1), 273–306. <https://doi.org/10.1086/727342>
- Damanian, R., Desbureaux, S., Hyland, M., Islam, A., Moore, S., Rodella, A. S., Russ, J., & Zaveri, E. (2017). *Uncharted waters: The new economics of water scarcity and variability*. World Bank.
- Efe, S. I. (2006). Quality of rainwater harvesting for rural communities of Delta State, Nigeria. *Environmentalist*, 26(3), 175–181.
- Efe, S. I., Ogban, F. E., Horsfall, M., Jr., & Akporhonor, E. E. (2005). Seasonal variations of physico-chemical characteristics in water resources quality in western Niger Delta region, Nigeria. *Journal of Applied Sciences and Environmental Management*, 9(1), 191–195. <https://doi.org/10.4314/jasem.v9i1.17282>
- Egwom, O. J., Godwin, A. I., Ogar, M. O., & John, G. (2025). Digital solution for seamless water supply management in Wukari metropolis. *Journal of Science Research and Reviews*, 2(1), 62-75.
- Israilova, E., Voronina, A., & Shatila, K. (2023). Impact of water scarcity on socio-economic development. *E3S Web of Conferences*, 458, 08027.
- Miller, J. D., Young, S. L., Bryan, E., & Ringler, C. (2024). Water insecurity is associated with greater food insecurity and lower dietary diversity: Panel data from sub-Saharan Africa during the COVID-19 pandemic. *Food Security*, 16(1), 149–160.

Ngayaga, M. (2025). *Socioeconomic determinants of household access to clean water: A case study of a selected peri-urban ward in northern Tanzania* [Doctoral dissertation, Nelson Mandela African Institution of Science and Technology].

Ovrawah, L., & Hymore, F. K. (2001). Quality of water from hand-dug wells in the Warri environs of Niger Delta region. *African Journal of Environmental Studies*, 2(2), 169–173.

Oyerinde, A. O., & Jacobs, H. E. (2022). Determinants of household water demand: A cross-sectional study in South West Nigeria. *Journal of Water, Sanitation and Hygiene for Development*, 12(2), 200–207.

Pacheco-Treviño, S., & Manzano-Camarillo, M. G. F. (2024). Review of water scarcity assessments: Highlights of Mexico's water situation. *WIREs Water*, 11(4), e1721.

Sani, Y., & Tukur, A. (2026). Rural water supply management and sustainability: A case study of Katsina State, Nigeria. *ISA Journal of Multidisciplinary*, 3(4). <https://doi.org/10.5281/zenodo.21109173>

Srinivasan, V., Lambin, E. F., Gorelick, S. M., Thompson, B. H., & Rozelle, S. (2012). The nature and causes of the global water crisis: Syndromes from a meta-analysis of coupled human-water studies. *Water Resources Research*, 48(10), Article W10516.

Streeten, P., & Burki, S. J. (1978). Basic needs: Some issues. *World Development*, 6(3), 411–421. [https://doi.org/10.1016/0305-750X\(78\)90116-X](https://doi.org/10.1016/0305-750X(78)90116-X)

Streeten, P., Burki, S. J., Haq, M. ul, Hicks, N., & Stewart, F. (1981). *First things first: Meeting basic human needs in the developing countries*. Oxford University Press.

Van den Broeck, A., Vansteenkiste, M., De Witte, H., & Lens, W. (2008). Explaining the relationships between job characteristics, burnout, and engagement: The role of basic psychological need satisfaction. *Work & Stress*, 22(3), 277–294.

Vansteenkiste, M., Soenens, B., & Ryan, R. M. (2023). Basic psychological needs theory: A conceptual and empirical review of key criteria. In *The Oxford handbook of self-determination theory* (pp. 84–123).

World Health Organization & United Nations Children's Fund. (2025). *Progress on household drinking water, sanitation and hygiene 2000–2024: Special focus on inequalities*. World Health Organization. <https://www.who.int/publications/i/item/9789240115149>

Yusuf, W. O., Jidauna, G. G., & Ndabula, C. (2026). Domestic water supply sources and household utilization of rainwater harvesting in Dutsin-Ma Town, Katsina State, Nigeria. *FUDMA Journal of Earth and Environmental Sciences*, 3(1), 176–190.