FACTORS AFFECTING SUPPLY OF PIPE-BORNE WATER TO HOUSEHOLDS IN CALABAR METROPOLIS, CROSS RIVER STATE, NIGERIA

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Abstract

This study examined water consumption patterns and the factors influencing water supply in Calabar Metropolis, Cross River State, Nigeria. The research assesses the impact of demographic variables such as age, household size, occupation, and income levels on water usage. Data from respondents indicate that younger individuals (18-30 years) and larger households have higher water consumption, while civil/public servants constitute the largest occupational group. Water use is particularly high in households with businesses related to food processing or cleaning services. Boreholes are the primary water source for 89.11% of households, while pipe-borne water is largely unavailable due to infrastructural shortcomings. The study further reveals that income levels significantly affect water consumption, with higher-income households using more water. The tested hypothesis using Analysis of Variance (ANOVA), confirmed a significant difference in consumption across income groups ($p < 0.05$). Water storage practices are common, with 89.67% of respondents storing water in drums or jerry cans due to unreliable supply. Additionally, water affordability is a key issue, with 73.06% of households reporting that portable water is unaffordable, and weekly water expenses varying between ₦260 and ₦2000. The study identifies institutional and governmental failures as major barriers to consistent pipe-borne water supply. Recommendations include expanding water distribution kiosks, enhancing water infrastructure, and implementing strategies to address governance challenges. These measures are crucial to improving equitable water distribution and ensuring affordable access to safe water across all income groups in the study area.

Key Words: Water consumption, Water supply, Borehole usage, Household water demand, Water Affordability

1. Introduction

Water is fundamental to all forms of life and human activities, making it essential to health, ecosystem functioning, food production, and various economic activities. It supports drinking, food preparation, laundering services, hygiene, power generation, and recreation. Gray

(2005) emphasized that reliable water supply is crucial for sanitation, environmental cleanliness, industrial production, quality of life, and sustainable development. Arunkumar & Nethaji Mariappan (2011) reported that water plays a critical role in sustaining life and civilization, with increasing living standards driving higher water consumption.

In 2015, about 91% of the global population had access to improved water sources, surpassing the Millennium Development Goals (MDG) target of half the number of people without access to improved water (UNICEF/WHO, 2015). However, the post-MDG focus is on addressing regional, ethnic, and socioeconomic inequalities in water access and supply, with disparities widening in some regions (Abubakar & Dano, 2018; Mulenga et al., 2017; UNICEF/WHO, 2017).

The United Nations World Water Development Report (United Nations, 2024) was very revealing. The report highlights critical global water challenges, particularly the rising demand for freshwater driven by socio-economic development and changing consumption patterns (Zucchinelli et al., 2021). Agriculture remains the dominant sector for water use, accounting for 70% of global withdrawals, followed by industrial and domestic uses (United Nations, 2022). Groundwater supplies 25% of irrigation and half of domestic water. Despite economic growth in emerging regions, half of the world's population faces severe water scarcity for at least part of the year (IPCC, 2023), impacting social stability and migration patterns (Zaveri et al., 2021). There is no direct link between a country's GDP and water availability; however, economic development often leads to increased water use, especially through agriculture, before stabilizing in mature economies (Duarte et al., 2013; Miglietta et al., 2017). This stabilization can be misleading, as water-intensive industries are outsourced to developing nations, exacerbating water stress (Hernández et al., 2020). Pollution evolves with income levels, from wastewater in low-income countries to agricultural runoff in wealthier ones (Desbureaux et al., 2022). Climate change is expected to intensify extreme weather events, further stressing water availability and increasing risks to human health and ecosystems (IPCC, 2023).

Approximately 67% of Nigeria's population had access to improved domestic water supplies, which is similar to the 69% average for less developed countries but significantly below the global average of 91% (World Bank, 2016). The 2013 Nigeria Demographic and Health Surveys (NDHS) reported that 50.8% of rural and 14.4% of urban households in Nigeria used unimproved water sources, with surface water being the primary source for 20.9% of rural and 3.7% of urban households (NPC and ICF International, 2014).

Given the increasing rate of natural water pollution, as pointed out by Digha & Akintoye, 2017 and Akintoye, Digha & Egbe, 2018, the need to reduce household dependence on unimproved water may become necessary. Unimproved water sources include unprotected hand-dug wells, that are not covered or protected from surface runoff or debris; natural springs not protected from contamination by animals or human activity; Surface water collected from rivers, lakes, ponds, streams, and dams; vendor-provided water from unregulated water vendors, which may not be treated or safe; cart with small tank/drum, often without proper sanitation or testing; bottled water (for non-drinking use). Though bottled water is generally safe for drinking when used for other household purposes, it is not considered a sustainable or improved source; rainwater collection (without safe storage) can become contaminated if not properly stored or treated.

In Cross River State, many local government headquarters and urban centers still lack adequate water supply. The local authorities struggle with insufficient resources to meet the demands of a growing population. Calabar, despite its abundant surface and groundwater resources, faces significant water supply challenges. Institutional and physical issues impede the supply of pipe-borne water, which

makes residents rely on alternative sources. Despite the Cross River State government's efforts to enhance water infrastructure and increase borehole facilities, Calabar Metropolis still faces significant water supply issues, underscoring the need for focused policy and research. Numerous studies have addressed global and local water supply and demand issues, including access to pipe-borne water.

Research has highlighted the challenges cities face in providing improved water supply (Haddout et al., 2020; Chinwendu et al., 2017) and stressed water's critical role and the complexities of water supply management (Shin et al., 2023). These studies often recommend infrastructure improvements and informed decision-making to enhance water supply. Additionally, research by Mutune & Maingi (2017), Molden et al. (2020), Jepson et al. (2017), and Wutich et al. (2017) have suggested the need for pragmatic measures to be put in place to improve water access. Abubakar (2018) &Achore et al. (2020) explored household coping strategies and factors influencing these strategies in response to water supply inadequacies. Despite all these, water supply especially as it relates to pipe-borne water supply remains a serious problem. This calls for more empirical data on water service provision, coping strategies, and satisfaction with improved water in Nigerian informal settlements.

Key factors affecting the water supply in Calabar are likely to include population growth, inadequate and inequitable water distribution networks, maintenance issues, and insufficient funding. For instance, the Bread of Life Development Foundation (2010) report highlights that the Cross River Water Board Limited (CRSWBL), responsible for water supply in Calabar and surrounding areas, operates at only 40% of its production capacity due to an inadequate distribution system.

Cross River State Water Board (CRSWB) is generally perceived to be facing several challenges, like outdated and inadequate infrastructure requiring refurbishment, reliance on inconsistent generating plants, obsolete treatment facilities, and equipment that no longer meets current demands. Additionally, the rapid population growth has outpaced the expansion of water infrastructure, exacerbating water shortages. The inequitable distribution of water services across different income groups and the deteriorated state of the water pipes which over the years have become crooked, rusty, and perforated, further disrupts supply.

Thus, this study is aimed at identifying factors affecting the supply of pipe-borne water to households across low, middle, and high-income groups in Calabar Metropolis. The research objectives were to determine the water sources in Calabar, investigate household water demand patterns, assess factors impacting pipe-borne water supply, and propose strategies to address these issues and enhance future water supply performance.

2. Study Area

The study area is Calabar Metropolis, also known as Canaan City (Falola & Warnock, 2007), located in the southern part of Cross River State, Calabar lies at longitude 08°19'30" East and latitude 04°57'00" North, covering an approximate area of 1,480 km². It encompasses Calabar Municipality and Calabar South Local Government Area. Positioned within the tropics, Calabar borders Akpabuyo to the east, Odukpani Local Government Area to the north, and the Atlantic Ocean to the south. The city is connected to other regions by road, sea, and air. It is flanked by the Great Kwa River to the east and the Calabar River to the west. A map of the study area is provided in Figure 1.

Figure 1: Map of Calabar Metropolis

Source: Office of the surveyor general, Cross River State, 2023

The current projected population of the area is approximately 657,000 (Nigeria Metro Area Population, 2024). The area is predominantly flat, with notable changes in relief only at the northern edge, where badlands and ravines are present. Calabar's topography is moderately undulating, reaching up to 70 meters above sea level, with a steep descent toward the Calabar River and a gradual slope towards the Kwa River (Eja, 2011). The drainage system consists of 6 major basins and 73 sub-basins connected to the Calabar River, influenced by the city's coastal location and tropical climate. The city experiences heavy rainfall and occasional flooding, particularly in poorly drained, low-lying areas.

Calabar has a hot and oppressive climate all year round, with temperatures ranging from 64°F to 92°F, rarely below 58°F or above 96°F. During the dry season, potable water is scarce, while hand-dug wells are almost often dry, and rainfalls are limited. The combination of these climatic factors has resulted in Calabar being located in the tropical rainforest region.

In the last decade, Calabar's rapid urban growth and increased socio-economic activity have been driven by an influx of people seeking job opportunities. Also, the city features diverse land uses which include residential usage, such as the Federal Housing estate, State Housing estate, Parliamentary estate and its extension, 8 Miles, Ekorinim, and Mount Zion. Commercial areas include what and Etim Edem market, Marian Road shops, and retail outlets which are concentrated in the City center, particularly along Calabar Road and Marian Road; institutional areas comprise banks, Schools, Office complexes, and hospitals; Industrial areas include notable sites like the Export Processing Zone (EPZ) and Niger Mills. Recreational and major attractions include the Tinapa Business and Leisure Resort, Marina Resort, Cultural Center, Calabar Slavery Museum, and various hotels and bars. The Calabar Carnival, known as "Africa's biggest street party," draws thousands of international visitors annually. All these require the need for increasing water utilization.

3. Method of study

3.1 Research Design

The research adopted the survey research method. This required the design of a structured questionnaire and interview format to collect the required data from the targeted population. The

primary data sources exploited in gathering information for this study include primary and secondary data sources. For the primary data, oral interviews, questionnaire administrations, and direct observation were utilized.

Residents were interviewed to know their personal views on the water supply in their area. Questions asked were on water supply problems, sources of water, realistic solutions, condition of water facilities, the effect of inadequate water supply, and water management methods. Personal observations of relevant attributes, phenomena, processes, and events as regards this study were made. Brief inspections of the residential areas and accessible water infrastructures were carried out.

Households within the study area, that were willing to measure and record the quantity of water utilized daily, were purposively selected. They were requested to utilize 5, 10, 15, 20, 25, and 50 liters containers, for measuring water for cooking, bathing, drinking, and washing. This excluded water for flushing toilets (especially for low-income and some middle-income households) because several households were reusing washing water and so on for flushing toilets. Weekly these households are contacted to retrieve data on recorded water utilization. This exercise was tedious, but very productive in the production of reliable primary data necessary for the testing of the hull hypothesis.

3.2 Sample population of the study

The sample population was 6 (six) major streets in Calabar Metropolis, including Edibe-Edibe, EwaEnshaw, Mount Zion, Etta-Agbor, State housing, and Federal housing[WU6] (Table 1). The sample population includes streets in Calabar South and Calabar Municipality, such as:- Anantigha, Atakpa, Bassey Duke, Atamunu, Bedwell, Chambley, Edgely, Goldie, Inyang, Mbukpa, Effanga Offiong, Hewett, Ekpo Abasi, Hawkins, Nelson Mandela, Howell, Mount Zion, Okon Edet, White House, Oyo Ita, White House, New Airport, Target, Orok, Orok, Marian, Parliamentary, Mount Zion, Etta Agbo, State Housing, Federal Housing, IBB road, IBB, , Akpandem,, Atimbo, Akai Effa, , Ediba, and Atekong roads.

3.3 Sampling Technique

Two sampling techniques were employed. Firstly, a stratified sampling technique was used to select such streets as Edibe-Edibe, Ewa Henshaw (Low Income), Mount Zion, Etta-Agbor (Middle Income), and State Housing and Federal Housing estates (High income) based on pre-research reconnaissance surveys and literature review. Secondly, a simple random sampling technique was employed for questionnaire administration (table 1 presents the sampling framework).

3.4 Techniques of Data Analysis

The techniques used in data analysis were tables, frequencies, averages, percentages, Pearson's Product Moment Correlation, and the Analysis of Variance (ANOVA). The analysis of variance (ANOVA) compares the means of a continuous variable in two or more independent comparison groups. The ANOVA procedure was used to compare the means of the comparison groups (low, middle, and high-income areas). Pearson's Product Moment Correlation was used to specifically describe the strength and direction of the linear relationship between the household income, quantity of water used, and household size of the respondents.

Hypothesis 1:

(H0): *There is no significant variation in the quantity of pipe-borne water consumed* [WU8] *by households in the low, middle, and high-income areas of Calabar Metropolis***.**

Hypothesis II

(H0): *There is no significant relationship between household income and quantity of portable water used by households and household size in Calabar Metropolis*.

Table 1: Sampling Framework

S/N	Name of Street	Total Estimated Population	Estimate Average Household Size	Estimated Household Number	Percentage of Households	No. of Distributed Questionnaire	No. of Retrieved Questionnaire from Sampled Household	Percentage of Retrieved Questionnaire
1	Edibe-Edibe	3461	6	577	10%	58	54	93.10
2	EwaEnshaw	2284	5	457	10%	46	43	93.47
3	Mount Zion	5241	4	1310	10%	131	127	96.94
4	Etta-Agbor	5921	4	1480	10%	148	144	97.29
5	State housing	4112	4	1028	10%	102	98	96.07
6	Federal housing	3141	4	786	10%	79	76	96.20
	Total	24,160		5,638		564	542	100

Source: Field work (2023)

4. Discussion of Findings

The findings of this study are presented as follows:-

4.1.1 Demographic Characteristics of respondents

Table 2 (A), presents data on the gender of respondents. The table reveals that out of the 542 responses from the questionnaire administered, a total of 321 respondents representing 59.23% were males, while 221 (40.77%) were females. It can be deduced that the majority of the respondents were males. In most African cities, the population of male adults may be higher than that of females, because of the out-migration of adult males from rural areas in search of white-collar or self-employment jobs.

Table 2: Gender distribution of sampled respondents in the study area

A	**Gender distribution of sampled respondents in the study area**		
1	**Gender distribution of sampled respondents in the study area**		
1	GENDER	FREQUENCY	PERCENTAGE
2	Male	321	59.23
3	Female	221	40.77
	Total	**54**	**100**
B	**Ages distribution of sampled of respondents in the study area**		
	Age Range	FREQUENCY	PERCENTAGE
	18 – 30 Years	157	28.97
	31 – 40 Years	132	24.35
	41 – 50 Years	93	17.16
	51 – 60 Years	112	20.66
	60 Years and above	48	8.86
	Total	**542**	**100**
C	**Marital Status of sampled respondents in the study area**		
	Marital Status	FREQUENCY	PERCENTAGE
	Single	171	31.55
	Engaged	55	10.15
	Married	232	42.80
	Divorced	36	6.64
	Widowed	48	8.86
	Total	**542**	**100**

D	**Household Sizes of sampled respondents**		
	Household Size	FREQUENCY	PERCENTAGE
	1 – 2 persons	56	10.33
	3 – 4 persons	311	57.38
	5 – 6 persons	123	22.69
	7 – 8 persons	37	6.83
	More than 10 persons	15	2.77
	Total	**542**	**100**
E	**Occupational distribution of respondents**		
	Occupations	**FREQUENCY**	**PERCENTAGE**
1	Farming	45	8.30
2	Trading/marketing	131	24.17
3	Civil/public servant	153	28.23
4	Student	98	18.23
5	Artisans/Technicians	21	3.87
6	Food processing	24	4.43
7	Unemployed	28	5.17
8	Retirees	42	7.75
9	Others	0	0.00
	Total	**542**	**100**
F	**Respondents source of household water supply**		
	Sources of water	**FREQUENCY**	**PERCENTAGE %**
1	Stream/ River	32	5.90%
2	Pipe- borne water	0	0.00%
3	Hand-dug well	27	4.98%
4	Borehole	483	89.11%
5	Others	0	0.00
	Total	**542**	**100.00%**

Source: Field work, 2023

Concerning the age range of the respondents (Table 2 (B)), it is shown that a large number of the respondents were between the age limits of 18-30 years (28.97%) and the least years were 60 years and above (8.86%). The use of water tends to vary by age. Babies need lots of water for washing soiled clothes, while youths need a lot of water for bathing and drinking. Baking, cooking, and shops attached to residential houses, such as those engaged in hairdressing and food processing, tend to use more water.

Contained in Table 2 (C), is data on the marital status of the respondents. It shows that a good number of the respondents were single with a frequency of 171 (31.55%). Constituting the highest observation in marital status are the married respondents as indicated by 232 respondents (42.80%). A total of 55 respondents (10.15%) were engaged, while 36 respondents (6.64%) were divorced. Water consumption levels among household members can be influenced by age and number of individuals.

Table 2 (D), shows the household sizes of respondents. Households of 3-4 persons were more, with a frequency of 311 (57.38%), while households with more than 10 persons had the lowest frequency of 15 (2.77%). The sizes of households were revealed from interviews to be able to influence the quantity of water consumption.

4.1.2 Occupation of Respondents

Table 2 (E), presents data on the occupation of the respondents. It was observed that a large number of the respondents were

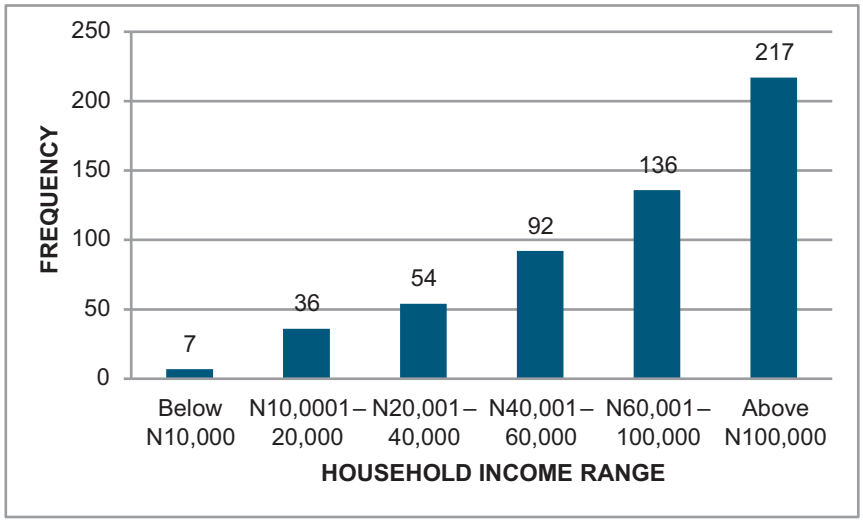

Figure 2: Average Monthly Income of Households as Reported by Respondents
Source: Field work, 2023

civil/public servants as indicated by 153 respondents (28.23%). This is followed by trading/marketing, with a frequency of 131 (24.17%), while artisans/technicians had the lowest frequency of 21 (3.87). Occupations like food processing and cleaning services may require large quantities of water usage almost daily.

4.1.3 Average Monthly Income of Respondents

The income range of the households of respondents is shown in Figure 2. Respondents who reported household earnings below ₦10,000 were 7 (1.29%). The number of respondents whose households earn from ₦40,001 to ₦70,000 was 92 (16.97%), while respondents whose households earn above ₦100,000 were 217 (40.04%).

4.2 Sources of Water Supply

The result in Table 7, provides vital information on the sources of water supply in the area. The table shows that a larger number of the respondents utilize borehole water, as their main water source(89.11%), while the non-utilized and consumed water source was pipe-borne water (0.00%). This is due to the lack of provision of pipe-borne water by the Cross River State Water Board to the study area.

4.2.2 Duration of time for water collection away from household residence

Table 3 displays the duration of time spent on water collection by sampled households. The table shows that the majority of the households spent less than 5 minutes to access water and none spent over 40 minutes. Water collection from water sources within their residential households and compound areas was indicated by 102 respondents (18.82%) This suggests easy access to water sources.

Table 3: Respondents duration of water collection

DURATION (minutes)	FREQUENCY	PERCENTAGE %
Less than 5	195	35.98
5 – 10	183	33.76
11 – 20	31	5.72
21 – 30	25	4.61
31 – 40	6	1.11
Above 40	0	0.00
Within household	102	18.82
TOTAL	**542**	**100**

Source: Field work, 2023

4.2.4 Preferred water source

Figure 4, displays the water source that is most preferable to the respondents. Borehole with the highest range of 336 (61.99%), followed by pipe-borne water with a range of 124 (22.88%), followed by hand-dug well 57 (10.52%), lastly river/stream with a range of 25 (4.61%). This shows that the most common source of water is borehole water. Most water-selling locations depend on this source

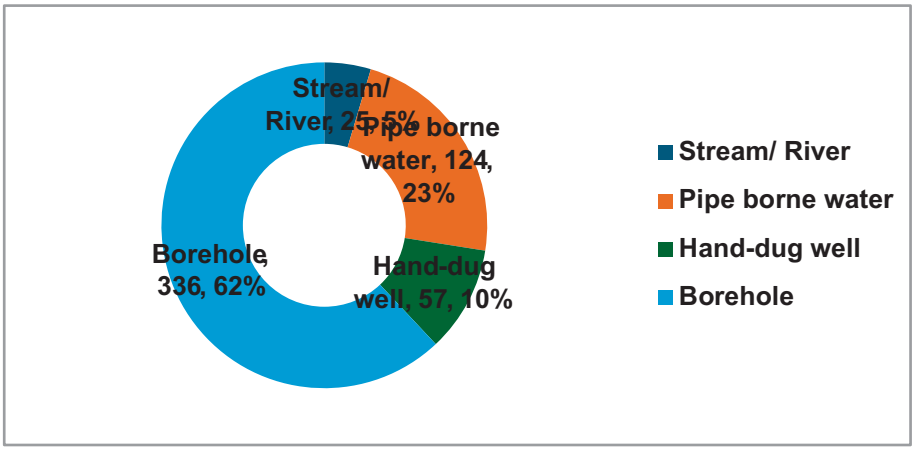

Figure 3: Respondents' preferred water source
Source: Field work, 2023

4.3: Water Demand

Table 4, shows how frequently the households of respondents fetch water as indicated by 233 respondents (42.99%); Households that fetch water every 3 days include the families of 198 respondents (36.53%). The table also indicates that some families fetch water every 2 days indicated by 198 respondents (36.53%).

Table 4: Respondent's frequency of fetching water for household use

DURATION	FREQUENCY	PERCENTAGE %
Daily	72	13.28
Every 2 days	198	36.53
Every 3 days	233	42.99
Weekly	39	7.20
TOTAL	**542**	**100**

Source: Field work 2023

4.3.2 Respondent's daily household water consumption in liters

Table 5 showcases the water consumption rate of respondents in liters. It was observed that more respondents consume water above 200 liters, with a range of 259 (47.79%), followed by 151 – 200 liters, with a range of 164 (30.26%). The lowest quantity consumed a day is below 50 liters (1.11%).

Table 5: Respondent's daily household water consumption

WATER CONSUMPTION RATE (litres)	FREQUENCY	PERCENTAGE %
Below 50	6	1.11
51 – 100	31	5.72
101 – 150	82	15.13
151 – 200	164	30.26
Above 200	259	47.79
TOTAL	**542**	**100**

Source: Field work, 2023

4.4: Factors Affecting Water Supply

Table 6 presents data on respondents who store and do not store water. Respondents whose households store water have a higher indication of 486 (89.67%), while those who do not store water have a frequency of 56 (10.33%).

Table 6: Respondents who store water

STORE WATER	FREQUENCY	PERCENTAGE %
Yes	486	89.67
No	56	10.33
TOTAL	**542**	**100**

Source: Field work, 2023

4.4.2 Storage of watermeant for household use

Table 7 shows the different ways respondents store water. Storage in drums has the highest range of 279 (51.48%), followed by jerry cans at 166 (30.63%), overhead tanks were indicated by 85 respondents (15.68%), while underground tanks used for water storage are used by the households of 12 respondents (2.21%).

Table 7: Method of water storage

STORAGE TYPE	FREQUENCY	PERCENTAGE %
Drums	279	51.48
Overhead tank	85	15.68
Underground tanks	12	2.21
Jerry cans	166	30.63
TOTAL	**542**	**100**

Source: Field work 2023

4.4.3 Affirmation of paying for pipe-borne water

Table 8 shows that 517 respondents (95.39%) pay for water while 25 respondents (4.61%) do not pay for water. Some households in the study area were found to have private boreholes in their compounds. Water from such boreholes is also sold to the public by a few households for money. Access to such water from bore-holes depends on electricity supply. Most often there is high dependence on electricity generators since solar-powered pumps are expensive and consequently uncommon.

Table 8: Affirmation by Respondents paying for water

WATER PAYMENT	FREQUENCY	PERCENTAGE %
Yes	517	95.39
No	25	4.61
TOTAL	**542**	**100**

Source: Field work, 2023

4.4.4 Weekly expenses on portable water

As depicted in table 9, weekly cost of water is ₦510 – ₦1000 for 249 respondents (45.94%). A range of ₦1010 – ₦2000 was indicated by 134 respondents (24.72%). Also between ₦260 – ₦500 was usually spent by the households of 93 respondents (17.16%). Increasing cost of water may become a burden on household members, resulting in unhealthy reduction of water usage, in the study area.

Table 9: Respondents weekly cost of water

COST (₦)	FREQUENCY	PERCENTAGE %
Below 250	51	9.41
251 – 500	93	17.16
501 – 1,000	249	45.94
1,001 – 2,000	134	24.72
Above 2,000	15	2.77
TOTAL	**542**	**100**

Source: Field work 2023

4.4.5 Portable water affordability

The data in Table 10 shows that cost-wise, water is affordable to the households of 146 respondents (26.94%), while 396 respondents (73.06%) complained about portable water not being affordable. The inadequate usage of water in cleaning, washing, and drinking by household members, can result in mild or severe infections and associated diseases.

Table 10: Water Affordability

WATER AFFORDABILITY	FREQUENCY	PERCENTAGE %
Yes	146	26.94
No	396	73.06
TOTAL	**542**	**100**

Source: Field work 2023

4.4.6 Factors affecting the supply of portable water to households

Table 11 shows that the highest factor affecting the supply of potable water to households in Calabar Metropolis is Government/Institution problems, as indicated by 316 respondents (58.30%) and the lowest factor is location/distance, as pointed out by 0 (0.00%). That is, it is not indicated by any respondent.

Table 11: Major factors affecting the supply of pipe borne water to households

FACTORS	FREQUENCY	PERCENTAGE %
Population	36	6.64
Cost/Affordability	63	11.62
Location/Distance	0	0.00
Inequitable distribution of water to households	10	1.85
Government/Institutional problems	316	58.30
Damaged pipes	117	21.59
Others	0	0.00
TOTAL	**542**	**100.00**

Source: Field work 2023

Table 12: Results of Analysis of Variance (ANOVA) for data on average household pipe-borne water consumption in low, medium and high income areas

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
household water usage_Edibe-Edibe	29	7851.83	270.7528	8441.81
household water usage_EwaHenshaw	29	8737.88	301.3062	11777.83
household water usage_Mount Zion	29	9903.14	341.4876	19758.49
household water usage_EttaAgbor	29	13170.35	454.15	36549.22
household water usage_State housing	29	9877.86	340.6159	22267.08
household water usage_Federal housing	29	11130.83	383.8217	31526.81

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	602984.1	5	120596.8	5.552287	0.000092547	2.26794
Within Groups	3648994	168	21720.2			
Total	**4251978**	**173**				

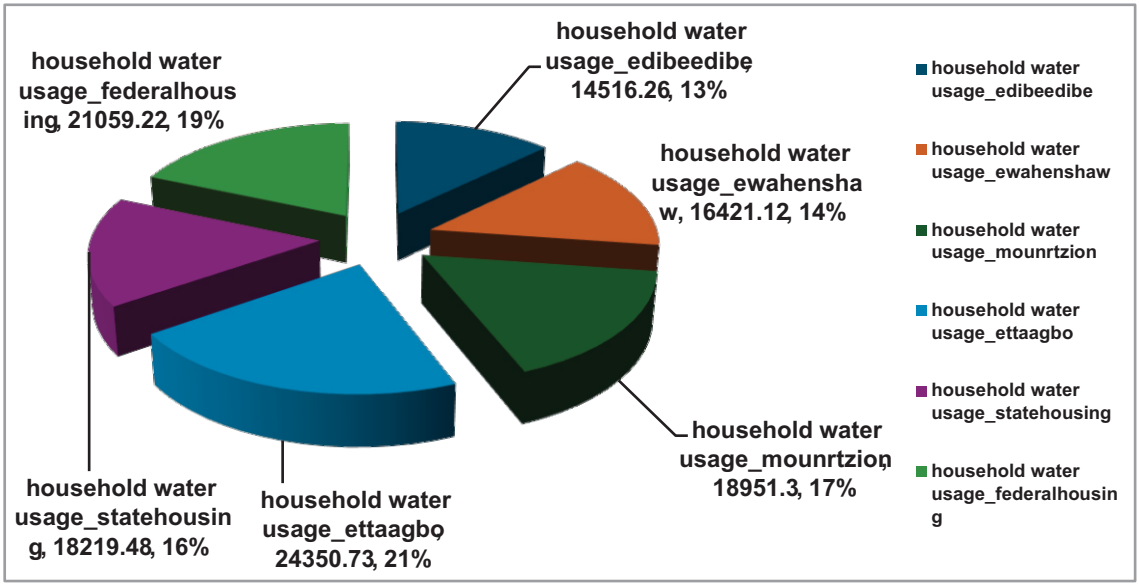

Figure 5 : Distribution ofportable water consumptionby households in low income, medium income and high income areas

Table 13: Pearson correlation results on household incomes and water consumption patterns

Correlations

		Household_income	Water_consum
Household_income	Pearson Correlation	1	.266
	Sig. (2-tailed)		.257
	Sum of Squares and Cross-products	297486914596.513	210499603.283
	Covariance	15657206031.395	11078926.489
	N	20	20
Water_consum	Pearson Correlation	.266	1
	Sig. (2-tailed)	.257	
	Sum of Squares and Cross-products	210499603.283	2103672.040
	Covariance	11078926.489	110719.581
	N	20	20

In table 14; the result of Pearson correlation analysis of data in table 4.5.3. We observed that the Pearson correlation value is 0.266. This is a positive, but weak correlation. Since the significant level is 0.257 (P<0.05). Consequently, there is no significant relationship. Based on the foregoing, we accept the null hypothesis, and as such reject the alternative hypothesis.

4.6 Ways of solving problems of inadequate water supply in the study area

In table 15, data on recommendations proffered by respondents to solve problems of inadequate water supply in the study area can be perused. A total of 233 respondents (42.99%) agreed that the problems can be solved by the "construction of more water distribution kiosks", while the lowest frequency for any suggestion is "storage of water", with the frequency of 22 respondents (4.06%).

Table 15: Respondents' most applicable recommendation to solving the problems of inadequate water supply to households

RECOMMENDATIONS	FREQUENCY	PERCENTAGE %
Restructuring of the CRSWB complex	233	42.99
Building more storage tanks by CRSWB	41	7.56
Rain water harvesting	56	10.33
Equal distribution of water supply amongst residence	114	21.03
Maintenance and policy improvement	76	14.02
Others	22	4.06
TOTAL	**542**	**100.00**

Source: Field work 2023

5.1 Discussion of Finding

The study reveals that water usage varies by age group, with younger respondents, particularly those between 18 and 30 years old, being the largest group, while older respondents (60 years and above) make up the smallest portion. Water consumption is influenced by different needs: babies require water for washing, youths for bathing and drinking, and activities like baking and food processing increase water use. Household water usage is also influenced by the presence of small businesses, such as hairdressing and food processing, which rely on water heavily.

Marital status plays a role in water usage patterns, with married respondents being the largest group, followed by singles and engaged individuals. Household sizes also influence water consumption, with households of 3-4 persons being the most common, while larger households tend to use more water. Occupation is another factor affecting water consumption, as civil/public servants make up a significant portion of the respondents, and certain occupations like food processing or cleaning require daily large quantities of water. Income levels were shown to have a direct impact on water consumption, with households earning above ₦100,000 being the largest group.

The main source of water for the respondents is boreholes, as pipe-borne water is scarce due to inadequate supply by the state. Most respondents have easy access to water, as the majority spend less than five minutes collecting it from sources like boreholes or wells within their residential areas.

Water storage practices are common among respondents, with drums and jerry cans being the most popular storage options. The cost of water is a concern, with many households spending significant amounts weekly on portable water, and most respondents find access to potable water to be unaffordable. The study identifies government and institutional problems as the key factors affecting the supply of pipe-borne water to households in Calabar Metropolis, with recommendations for improving access through more water distribution kiosks.

Lastly, an analysis of water consumption across income groups shows significant variation in the quantity of water consumed by low, medium, and high-income households. The hypothesis testing confirms that income level significantly affects water consumption. Households with higher incomes consume more water, likely due to greater affordability, while low-income households face more constraints in water access and usage.

5.2 Conclusion

In conclusion, the study highlights the significant factors influencing water consumption in Calabar Metropolis, including age, household size, occupation, income, and the availability of water sources. Boreholes serve as the primary water source, while pipe-borne water is largely unavailable, leaving households to rely on alternative methods of water collection and storage.

Income plays a crucial role in determining water consumption, with higher-income households consuming more water due to greater affordability. The study also underscores the need for improved water infrastructure, particularly the expansion of water distribution kiosks, to address the inadequate supply of pipe-borne water and alleviate the burden on lower-income households. Addressing government and institutional challenges will be key to improving water access and ensuring equitable distribution across all income levels.

5.3 Recommendations

Given the results and observations made through this study, the following recommendations are made:

1. Collaboration between the government, NGOs, and private sector entities to ensure a coordinated and sustainable approach towards the full restarting and restructuring of the Cross River State Water Board .

2. The government should drive the process of providing cost-effective potable water in our urban areas through the provision of water pipelines across the city and the provision of additional standpipes at strategic locations to make the service rendered by the municipal Water Board sustainable.

3. The government should prioritize expanding and upgrading the pipe-borne water network in Calabar Metropolis to reduce over-reliance on boreholes and ensure a more consistent and equitable water supply to all households.

4. To alleviate the water access burden, especially in underserved areas, the construction of additional water distribution kiosks should be implemented. This will help to provide easily accessible water points for households, reducing the time spent on water collection.

5. Effective governance and institutional reform are needed to tackle the issues causing the lack of pipe-borne water supply. A clear, long-term strategy should be developed to enhance coordination among water management agencies and improve service delivery.

6. Efforts should be made to ensure that water is affordable for all income groups. This could involve introducing subsidies or flexible payment plans for low-income households to reduce the financial burden of water consumption.

7. Public awareness campaigns should be launched to encourage water conservation and efficient water usage. Households should be educated on practices like reusing water for non-potable purposes and minimizing wastage during daily activities.

8. Local entrepreneurs engaged in water-related services (e.g., water distribution, and purification) should be supported through grants or low-interest loans. This can stimulate local economies and help expand access to safe water in remote or underserved areas.

9. Households should be encouraged to invest in safe and effective water storage solutions, such as overhead tanks and drums, to ensure continuous access to water during supply interruptions.

10. Regular monitoring of water quality, especially from boreholes and other local sources, should be enforced to ensure that the water consumed by households meets health standards. Government agencies should collaborate with local communities to maintain the safety and cleanliness of water supplies.

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