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EFFECTS OF SOCIO-ECONOMIC CHARACTERISTCS ON DOMESTIC WATER DEMAND IN YELWA AREA OF BAUCHI METROPOLIS

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Abstract

The demand for domestic water is a collective outcome. Thus, a number of factors determine the quantity of water demand for domestic activities. This study investigates effects of socio economic characteristics on domestic water demand in Yelwa area of Bauchi metropolis. A random sampling technique was used for the study. 365 questionnaires were used for collection of data in the study area. The study found out that 36% of households are Muslims while 64 % are Christians, 51 % have tertiary education and 5 % have primary education, 36% are secondary and 8% have informal education 41% of the respondents are employed, 34% of the respondents self-employed, 16% of the respondents are unemployed while 95 of the respondents fall under others such as farmers. 47% of the respondents are civil servants, 36% of the respondents are Traders / Business and 17% of the respondents are artisans. 13 % live in single rooms, 46% in room and parlor while 41% live in flats. 59% obtain water from wells, 21 % from public boreholes and 12 % from public tap. 68 % of households are married while 32% are not married and so on.

Key words: household, water, demand, characteristics.

Introduction

Water is essential to human life. Domestic water demand varies widely from place to place as higher standards of living, changes in lifestyle and socio-economic activities rise, (Istifanus, 2017). The term "domestic water demand" is usually taken to mean the amount of water required for various domestic purposes which may include water for drinking, food preparation and cooking washing cloth and utensils, house cleaning and polishing vegetable gardening, livestock watering and other uses, (Amin, 2017).

Water demand for domestic purposes are often in the form of drinking; preparation of food as well as cooking; dish washing, household laundry; cleaning the house and polishing vegetable gardening; rearing of domestic livestock among other uses, Bada, *et.al* (2021). Consequently, the amount of water demand by a household is greatly determined by the size of the family or the household size, the nature of water consuming appliances that are being utilized within the household and the amount of income earned by the household, David (2007).

Globally the extensive demand for domestic water has increased which is not balanced with the supply as a result of higher standards of living, changes in lifestyle and socio-economic activities which resulted to increase in continuous for the supply (Al-Amin, 2011). Domestic water demand varies from one community to another also higher standards of living are changing water patterns which are reflected mainly in increased domestic water demand especially for personal hygiene, (Istifanus, 2017).

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In developed countries like Spain, Carbella and Pujol (2009), found out that the domestic water demand includes water for bathing, cooking, clothes washing, toilet flushing. In Los Angeles, U.S.A, Mini, (2013), found out that the domestic water demand includes water for bathing, toilet flushing, cloth washing, dish washing and landscape greening. In India, Shaban and Sharma (2007) found out that the domestic water demand includes water for bathing which consumes the highest amount of water with about 28% of total consumption, toilets 20%, washing clothes 18.6% and washing utensil 16.3%. In Melbourne Australia, an average family domestic water demands 19% of their total water for flushing toilets and 35% for garden and lawn watering; 26% in bathroom, 15% laundry, kitchen 4%, 1% drinking, (Abrashinsky, 2004).

In developing countries, Ali and Terfa (2010), found out that in Nakemate town Ethiopia the domestic water demand includes water for drinking and cooking where they stood at 12.5 liters per day as the largest users, followed by utensils cleaning, bathing, cloth washing, house cleaning and gardening, toilet and others. Ayanshola and Salami (2010) found out the pattern of domestic water demand in Ilorin includes water for cooking laundry, dish washing, toilet flushing. Kagu *et al*., (2013), showed that the patterns of domestic water demand in Maiduguri which includes bathing, washing, food preparation and others. Uzoamaka (2010) in a study of Qualitative Analysis of Drinking Water in Enugu urban areas found the pattern of domestic water demand includes bathing, cooking, cloth washing, dish washing, and toilet flushing. In Bauchi, Istifanus (2017) found out the pattern of water demand in

the domestic sector which includes water for bathing, cooking, car wash, drinking, washing clothes, washing dishes and other socio-cultural activities.

There is a wide variation in domestic water demand for instance; (Shaban & Sharna, 2007) reported water demand variations among 7 major cities in India. The highest was in Kolkata (116 l/p/c/d), Mumbai (90 l/p/c/d), Madurai (88 l/p/c/d) while Kampur (77 l/p/c/d). In the United States household per capita domestic water demand range from 200 l/p/c/d in Wisconsin to 80 l/p/c/d in Idaho (Donnelly & Coolley, 2015). Abrashinsky, (2004), reported 156 l/p/c/d in Australia, In Nigerian urban centers per capita domestic water demand in Ilorin is 86.22 l/p/c/d (Ayanshola *et al.,* 2010) and in Maiduguri 100 l/p/c/d, Kagu, *et al.* (2013). In Bauchi, Istifanus, (2017) found out that quantity of domestic water demand varies within densities. At household level 878 l/p/d, 439 l/p/d and 458 l/p/d is used in the low, medium and high of density areas. On per capita basis the average water demand in Bauchi is102 l/p/c/d 71 l/p/c/d and 57 l/p/c/d in the low, medium and high density areas respectively.

Despite this domestic water demands, the World Health Organization (WHO, 2009) and Nigeria National Water Policy (NWP, 2004) recommends 120 l/p/c/d to maintain healthy living conditions in urban centers. The study area is among those where there is domestic water demand where both men and women spend a lot of their time in search for alternative water. This research intends to determine the domestic water demand in Yelwa area of Bauchi metropolis with a view of identifying alternative water sources and the challenges faced as a result of the domestic water demand.

METHODOLOGY

Location of the Study Area

Yelwa area is one of the largest settlements in Bauchi town, located south of the metropolis along Dass to Tafawa Balewa road. The early settlers were Gerawa and Fulani who settled for cattle rearing and farming purposes. The founder Nde Waziri said to have migrated from Inkil a surb of Bauchi town in 1966. He is Ngas by tribe that is why the central settlement of the area is described as Ngas ward literally called "Angwan Ngas". Because of its vast land, it is described as institutional land use where many institutions are located today these include: General Hassan Usman Katsina Unity College; Bauchi College of Agriculture; Federal Polytechnic Bauchi; Abubakar Tafawa Balewa University Yelwa Campus, and Police Training School. Yelwa sector is made of ethnic diversity that include but not limited to the following tribes: Hausa-fulani; Sayawa; Jarawa; Ngas; Tangle-waja; Igbo; Yoruba; and other minority tribes. Yelwa area of Bauchi metropolis comprises of Tudu, Makaranta, Laborer, Kagadama, Tsakani, Lushi, Rafin-zurfi, Birshin Gandu, and Gwalameji neighborhoods, Dukku (2018) and is one of the largest settlements in Bauchi metropolis, located south of the

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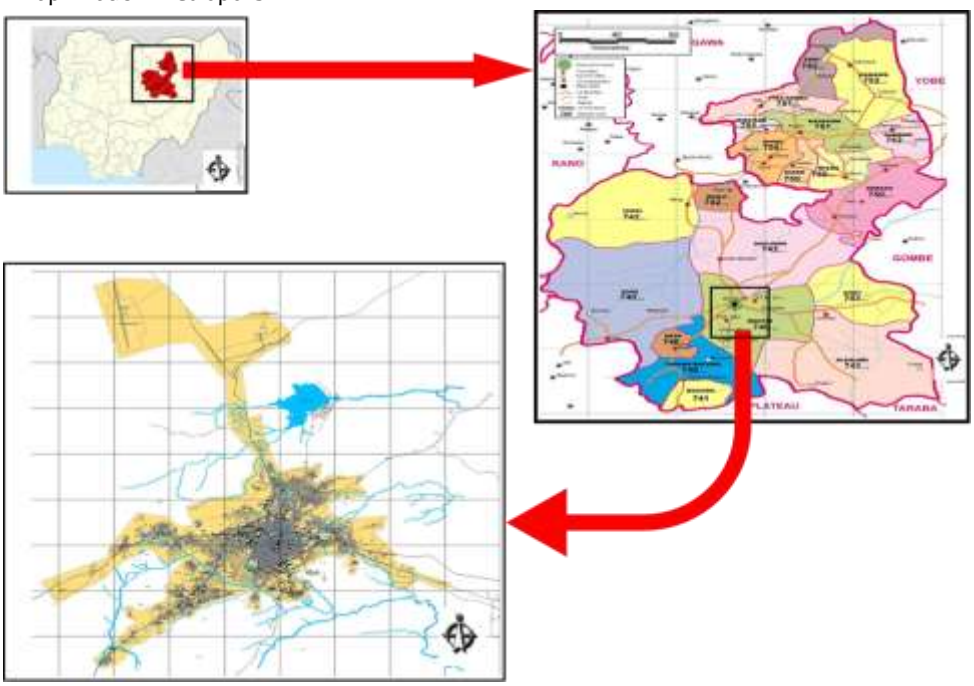
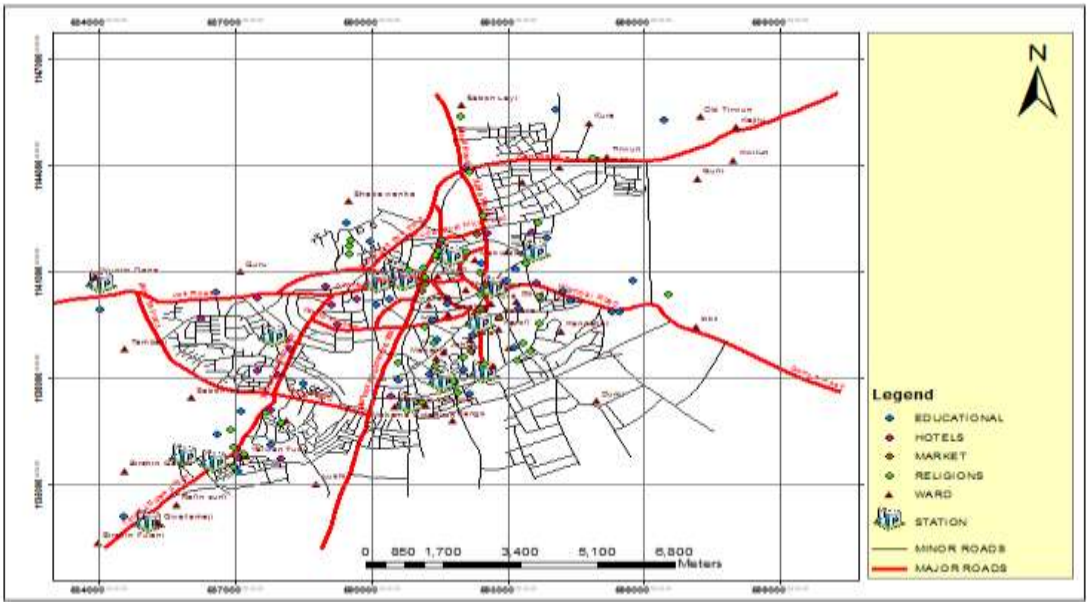
metropolis along Dass road. The physical terrain is characterized by marshy and dry land. The structure of the settlement is compacted of poor quality urban design and streetscape that are narrow mostly less than 2.0 meters wide with many structures constructed on and under utility lines.

Map1. Bauchi Metropolis



Map 2. Bauchi Metropolis



Population and Economic Activities

The population of the study area, according to the 2006 population census, the result stood at sixty-six thousand, three hundred and eighty-two (66,382) persons, (NPC, 2006). Agricultural practices for production

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of both food and cash crops have captured the life of the inhabitants of the study area. The ethnic groups in the area include Hausa-fulani, Sayawa, Jarawa, Ngas, Tangle-waja, Igbo, Yoruba, and other tribes. The area is mostly predominantly dominated by students of Abubakar Tafawa Balewa University, Federal Polytechnic and other institutions of higher learning within the metropolis. Dukku, (2018)

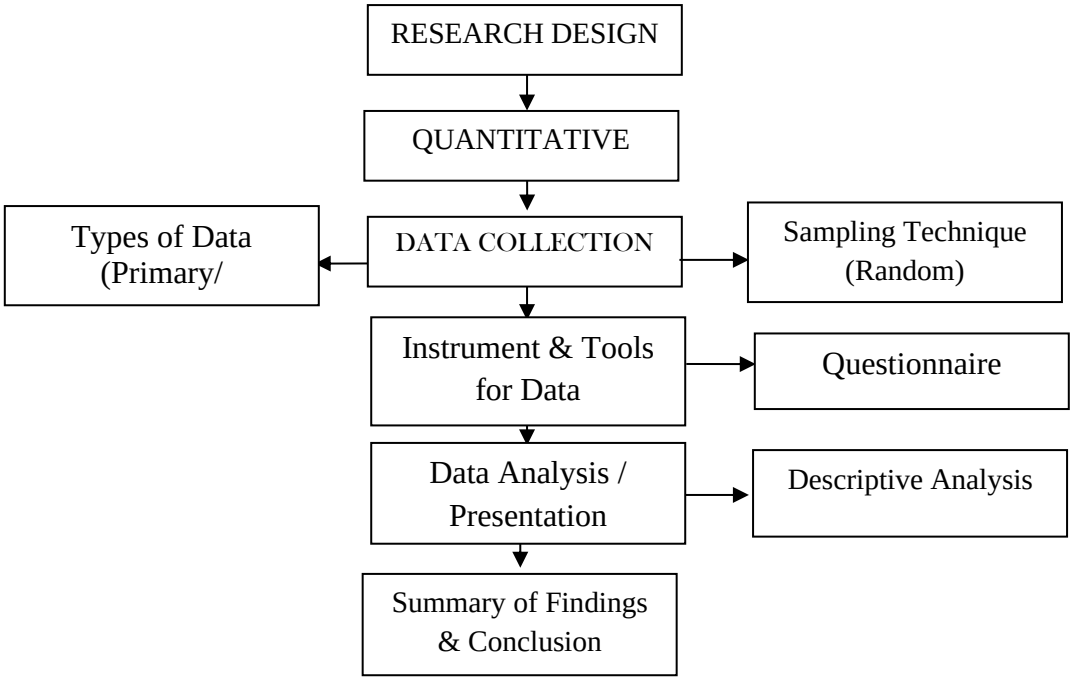
Climate and Rainfall

The climatic condition of the study area can be as: Temperature ranges from high (maximum) to low (minimum) in every month within a year. These will be determined either by a raining or dry season. The mean daily maximum high of temperature range is 36.6°C in April and it decreases to 28.2°C in August. While the mean daily minimum range of temperature range is about 13.3°C in December to about 22.1°C in April and May. Bauchi experience it is raining season right from mid-June to mid - October, with August recording the highest amount of rainfall of 340 mm. the total mean annual rainfall stands at 1,091.4 mm (BASG, 2012). There are two major seasons in Bauchi i.e. rainy and dry seasons. The rainy season months are May to September, when humidity ranges from about 37% to 68%. The onset of the rains has been often in March and they end virtually October while the dry season starts from November to May (Musa, Hashim & Reba, 2017).

Research Design

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data, Vaus, (2006). The researcher therefore intends to adopt quantitative research because it is used in obtaining information concerning the current status of the phenomena and to describe "what exists" with respect to variables or conditions in a situation and descriptive research is often used as a pre-cursor to more quantitative research designs with the general overview giving some valuable pointers as to what variables are worth testing quantitatively. The choice of this research design was considered appropriate because of its advantage of identifying attributes of a large population from a group of individuals

Fig. 1 Research Design



Source: Author, 2022.

Population of the Study

Population of a study is a total of items about which information is desired or a group of persons, aggregate items or things the researcher is interested in getting information from (Kabir, 2016). Therefore, target audience of the study is the household heads in Yelwa area who must have stayed for long and have knowledge on the water issues in the area and also the management of Bauchi State Urban Water and Sewerage Corporation (BSUWSC) on the other hand on the issues of water supply. The major languages commonly spoken in the area are: Hausa-Fulani, Sayawa, Jarawa, Ngas, Tangle-Waja, Igbo, Yoruba and other tribes.

Sampling Design

Sample design refers to the plans and methods to be followed in selecting sample from the target population and the estimation technique formula for computing the sample statistics (Kabir, 2016). Random sampling design will be adopted for the research and the population of the study area is sixty-six thousand, three hundred and eighty-two (66,382) persons based on an annual urban growth rate of 2.55% (NPC, 2006 projected).

Sample Size

The sample size of a study can be obtained using a census for a small population, imitating a sample size of similar studies, using published sample size determination tables and applying formula to calculate sample size, (Israel, 1992). The Krejcie and Morgan (1970) method of determining sample size will be used where 381 questionnaires will be set as the number of questionnaires for a population of fifty thousand to seventy-four thousand (50, 000 – 74, 000) of population **(see table 1)**. The questionnaire will be designed to collate respondent's socio economic data and response on domestic water and the volume of water supply from the Bauchi State Urban Water Sewerage Corporation (BSUWSC).

Table 1: Methods of Determining Sampling Size

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

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Sampling Techniques

A sampling technique is the name or other identification of the specific process by which the entities of the sample have been selected. The researcher intends to employ the random sampling technique for the data collection because it allows all the units in the population to have an equal chance of being selected. The technique will be applied where respondents will be selected at intervals and the sampling technique will be used to select the required sample size in the study area to assess the domestic water and supply in the study area.

Data Collection

Data collection is a methodological process of gathering and analyzing specific information to proffer solutions to relevant questions and evaluate the results. In an attempt to elicit relevant data and information for this study, two sources of data will be exploited for the collection of data and information namely;

a. **Primary source:**
   These are materials of statistical investigation which will be collected by the researcher for the study. The primary data and information will be collected directly from the household heads through questionnaire in the study area.
b. **Secondary source:**
   To collect secondary data and information for this study, published books, reputable journals, text, thesis/ dissertation, seminar papers and other relevant documents will be consulted to strengthen the literature review and provide helpful links to the study and the internet facilities.

Data Collection Instrument

Data collection tools or instruments refer to the devices/instruments used to collect data, such as a paper questionnaire. The major research instrument to be used is the questionnaire. The questionnaire will be designed to obtain sufficient and relevant information from the respondents. The primary data will contain information extracted from the questionnaires in which the respondents will be required to give specific answer to a question by ticking in front of an appropriate answer. The questionnaires to be administered to the residents in the study area contained structured questions which will be divided into sections A and B. Section A will contain demographic information of the respondents while section B will contain the water in liters per capita per day (L/P/C/D) of the respondents.

RESULT AND DISSCUSSION

SOCIO- ECONOMIC CHARACTERISTICS OF RESPONDENTS

Table 3: Gender Composition of the households in Yelwa area of Bauchi Metropolis.

GENDER	FREQUENCY	PERCENTAGE
MALE	259	71
FEMALE	106	29
TOTAL	**365**	**100**

Source: Author 2023

The gender composition has influence on domestic water demand sometimes female gender demand more water than male due to personal hygiene and domestic activities The study found out that 71 % of the respondents are male while 29% of the respondents are females. (Table3).

Table 4: Marital Status of the households in Yelwa area of Bauchi Metropolis.

MARITAL STATUS	FREQUENCY	PERCENTAGE
MARRIED	250	68
SINGLE	115	32

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TOTAL	**365**	**100**

Source: Author 2023

The marital status composition has influence on domestic water demand married people demand more water than the unmarried because of their number in the household. The study found out that 68 % of respondents are married while 32 % are unmarried. This explains why the household sizes are relatively larger which demands more water. (Table 4).

Table 5: Religion of the households in Yelwa area of Bauchi Metropolis.

RELIGION	FREQUENCY	PERCENTAGE
CHRISTIAN	235	64
MUSLIM	130	36
TOTAL	**365**	**100**

Source: Author 2023

The study found out that 64 % of households are Christians while 36 % are Muslims. Within the study area, even though the Muslins occupies 36% demands water most especially for prayers that is Ablution. (Table 5).

Table 6: Level of Education of the households in Yelwa area of Bauchi Metropolis.

LEVEL OF EDUCATION	FREQUENCY	PERCENTAGE
PRIMARY	20	5
SECONDARY	132	36
TERTIARY	182	51
INFORMAL	31	8
TOTAL	**365**	**100**

Source: Author 2023

The study found out that 51% of all households in Yelwa area of Bauchi Metropolis have tertiary education. Household with secondary education 36%, informal education 8% while primary education 5%. There are variations within the households. These educational structures have influence on domestic water demand. (Table 6).

Table 7: Employment Status of the households in Yelwa area of Bauchi Metropolis.

EMPLOYMENT STATUS	FREQUENCY	PERCENTAGE
EMPLOYED	149	41
SELF EMPLOYED	124	34
UNEMPLOYED	58	16
OTHERS	34	9
TOTAL	**365**	**100**

Source: Author 2023

The employment status of the respondents has influence on domestic water demand because those employed are saddled with more responsibilities in the household. The study found out that 41 % of the respondents are employed, 34% are self-employed, 16% are unemployed while others while includes the artisans 9%. (Table 7).

Table 8: Occupation of the households in Yelwa area of Bauchi Metropolis.

OCCUPATION	FREQUENCY	PERCENTAGE
CIVIL SERVANT	170	47
TRADE/ BUSINESS	131	36
ARTISANS	64	17

TOTAL	**365**	**100**

Source: Author 2023

The occupation of the respondents has influence on domestic water demand some occupation demands more water than others most especially those that demand the water for business purpose. The study found out that 47 % of the respondents are Civil Servants, 36% of the respondents are into Trade and Business while 17% of the respondents are Artisans. (Table 8).

Table 9: Income Level of the households in Yelwa area of Bauchi Metropolis.

INCOME LEVEL	FREQUENCY	PERCENTAGE
< 5,000	63	17
5,000- 30,000	102	28
31,000- 60,000	111	30
61,000- 100,000	72	20
101,000- 300,000	17	5
>300,000	0	0
TOTAL	**365**	**100**

Source: Author 2023

Income level also plays a vital role in domestic water demand. In Nigeria where the minimum wage is N30, 000 Naira civil servants from grade level 1-5 are referred to as low-income earners. Therefore, people earning 360,000 naira and below a year are low-income earners. The study found that 55 % of the household surveyed earned above 360,000 naira a year while 45% of the household surveyed earn below 360,000 Naira. (Table 9).

Table 10: House Type of the households in Yelwa area of Bauchi Metropolis.

HOUSE TYPE	FREQUENCY	PERCENTAGE
SINGLE ROOM	49	13
ROOM & PARLOUR	167	46
FLAT	149	41
TOTAL	**365**	**100**

Source: Author 2023

The type of house has influence on domestic water demand those that lives in room and parlor or flat demand a lot of water most especially because of their number in the household. The study found out that 46 % of residents live in room & parlor, 41 % in flats, while 13 % in single rooms. Within the study area, 87 % of the households occupy more rooms that their demands for domestic water will be high while 13% of the households with less number of rooms have less domestic water demands. (Table 10).

Table 11: Number of People in the House of the households in Yelwa area of Bauchi Metropolis.

NUMBER OF PEOPLE	FREQUENCY	PERCENTAGE
1- 3	108	30
4- 6	162	44
7- 9	75	21
ABOVE 10	20	5
TOTAL	**365**	**100**

Source: Author 2023

The study found households having 1-3 people constitute 30 %, 4-6 people 44 %,7-9 people 21 % and above 10 people 5 % and of the total household in Yelwa area of Bauchi Metropolis. Households' size between 4-6

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persons constitutes 44 % of the total households which is the highest. This relatively large number of people in households directly influences domestic water demand. (Table 11).

DOMESTIC WATER DEMAND IN LITRES PER CAPITA PER DAY OF RESPONDENTS

Table 12: Domestic Water Demand in Liters per Capita per Day of the households in Yelwa area of Bauchi Metropolis.

ACTIVITY	LITRES	PERCENTAGE
DRINKING	1,633	3
BRUSHING OF TEETH	738	1
BATHING	11,700	20
COOKING	14,358	24
WASHING OF DISHES	9,561	16
WASHING OF CLOTHES	11,631	19
PRAYERS	975	2
OTHER DOMESTIC ACTIVITIES	9,153	15
TOTAL	**59,749**	**100**

Source: Author 2023

ALTERNATIVE SOURCES OF DOMESTIC WATER OF RESPONDENTS

Table 13: Alternative Sources of Domestic Water of the households in Yelwa area of Bauchi Metropolis.

SOURCE OF WATER	FREQUENCY	PERCENTAGE
WELL	215	59
PUBLIC BOREHOLE	75	21
PUBLIC TAP	45	12
OTHER SOURCE	30	8
TOTAL	**365**	**100**

Source: Author 2023

The study found out that 59 % of households obtained water from wells, 26 % from public boreholes 21 % from public tap 12% while other source which include vendors 8 %. (Table 13).

CHALLENGES OF DOMESTIC WATER OF RESPONDENTS

Table 14: Challenges on Domestic Water Demand of the households in Yelwa area of Bauchi Metropolis.

CHALENGE	FREQUENCY	PERCENTAGE
EXPENDITURE OF TIME AND ENERGY	225	62
TIME SPENT QUEEING	110	30
OTHERS	30	8
TOTAL	365	100

Source: Author 2023

CONCLUSION AND RECOMMENDATION

From the above discussion it is obvious that water demand exists in terms of quantity supplied and the NWP standard. For example, when people are faced with shortage of water supply from public source they have no choice but look for alternative sources such as streams, wells, boreholes and water vendors with it numerous problems. It is therefore recommended that policy makers and water supply planners should increase the quantity of water supplied to the metropolis by expanding existing water supply schemes and establish new ones through improved budgetary allocation.

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