An Assessment of Domestic Water Consumption Pattern in Lokoja Metropolis, Kogi State

by

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Abstract
The sources of water supply and household water consumption pattern in Lokoja metropolis were investigated. Primary data on water supply and consumption was obtained through the interview and questionnaire methods. Copies of the questionnaires were administered to 236 households using the systematic random sampling method. The methods of data analysis involved descriptive and inferential statistics. The study revealed that residents of GRA, Lokongoma Phase 1 and Kabawa areas depended majorly on pipe borne water supplied from the state water board (81.8%, 88.3% and 65.6% respectively). Per capital water consumption was highest in GRA 181.1 litres per day and lowest in Zango Daji with 75litres. The largest percentage of total water consumption (53%) was used for washing clothes. ANOVA showed that variation existed in water consumption pattern in the study area which could be attributed to the differences in economic status of residents as well as access and availability of water to residents. It was, therefore, recommended that a standard of 80 litres per person per day should be used by state water board to supply water to residents.

Keywords: water use, per capita water consumption, household consumption pattern, water supply.

1. Introduction
Water is essential to life and it serves as the base for social and economic development of any country in the world (Omvir and Sushila, 2013). The United Nations has projected world population would increase by an additional two billion \(2 \times 10^9\) people by the year 2030 (Postel, 2000). The World Health Organisation (WHO) defined domestic water as water used for all domestic purposes including drinking, bathing and food preparation. Domestic water consumption is a significant component of the total water use and it varies according to living standards of the consumers in urban and rural areas (Mohammed and Sanaullah, 2017). With the rapid rate of urbanisation as a result of influx of people into urban centres, more water is likely to be demanded for domestic purposes. Population growth, expansion of business activity, urbandevelopment, water
pollution, climate change and drought have contributed to increased water scarcity in many parts of the world (Shan, Perren and Zhang, 2015). Water scarcity affects more than 1.1 billion people globally. It is estimated that a fifth of the world’s population live in areas of physical water scarcity, where there is no enough water to meet all demands (Shan, et. al., 2015). A further one third of the world’s population does not have access to clean drinking water.

In Africa today, water scarcity is a menace and it has been estimated that by 2030, 75 to 250 million people will be living in water stressed areas. In Nigeria, about 57 million people do not have access to safe water. The scarcity of water in Nigeria is taking a new dimension as residents of many urban and semi-urban areas do not have access to a readily available source of domestic water (Ojo, 2014). Nigeria is experiencing an increase in the rate of changes in her population coupled with urbanisation and living standards. This results in the need for water for domestic and other uses thereby placing an increasing demand on the country’s water resources (Ajadi, 2010).

Various studies from different parts of Nigeria and the entire world have been conducted on the pattern of domestic water use. These studies have shown that domestic water consumption in households varies considerably according to the living standards of rural and urban dwellers. Per capita water use is the total volume of water used by all households divided by the total population. In otherwords, per capita water use is the quantity of water used per person per day. Per capita water consumption was found to be 83.17 litres per person per day in Bangladesh with a positive correlation with socio economic factors such as household size, income, e.t.c. (Al Amin, Mahmud, Hosen, and Islam, 2011). Fan et. al (2013) studied water use patterns in households of Wei River Basin, China where per capita water consumption stands at an average of 70 litres.

Oyegun (1985) asserted that water use pattern in Ilorin at that time was majorly as a result of socio-economic characteristics where residents of GRA consumed about 82 litres per capita per day (lcpd) while low income earners in indigenous areas used about 37 litres per capita per day (lcpd). Ojo (2014) reported in a study of domestic water use in Osiele area of Ogun State that about 83.6% of the people used less than 40 litres per capita per day. Elizondo (2010) and Ifabiyi (2011) attributed domestic water use pattern to consumers’ behavioural and cultural attributes while Ajadi (2010), Fan et. al (2013), Khosh – Chashm (2000) considered socio – economic factors such as household size, standard of living and income, climatic factors like precipitation and temperature.

There is a wide variation in recommendations/prescriptions for domestic water use. For instance, the World Health Organisation has classified per capita water use on the basis of access and supply. They include below 5 lpcd where there is no access, 20 lpcd for basic access, an average of 50 lpcd for intermediate access and 100 - 200 lpcd (WHO 2003). Gleick (1996) recommended 50 lpcd as a basic water requirement standard for human use. Shaban and Sharma (2007) have recommended 100 lpcd as basic quantity of water required for domestic use. In Nigeria, the standard minimum water requirement is 80 litres per capita per day (Olasumbo, 2001). In a fast growing urban centre like Lokoja, it is important to study the rate and pattern of domestic water use. This is to enable a
comparison with the recommended minimum quantity by World Health Organisation and
the minimum requirement in Nigeria.

Lokoja, like many other capital cities in Nigeria has in recent times witnessed
heavy influx of people. The rapid rate of urbanisation especially since the creation of
Kogi State in 1991 which has earned the city a double status of a Local Government
Headquarters and State Capital exerted more pressure on the available water resources in
the town. With the timely intervention of UNICEF in partnership with the State
Government, the Greater Lokoja Water Project was commissioned in 2011 with a
production capacity of 45 million litres per day which alleviates to a great extent the water
problem in the town. In Lokoja, as a result of population increase and city expansion, the
demand for water for domestic purposes is increasing thereby increasing pressure on
available water resources. The objective of this paper therefore is to examine the pattern
of household water consumption in different areas of the town as well as sources of water
supply in the area.

2. The Study Area

Lokoja is an ancient town that once housed the headquarters of the Lord Lugard –
led administration in Nigeria. It is located at the Niger – Benue confluence between
latitude 7°45¹ N – 7° 51¹ N of the equator and longitude 6° 41¹ E – 6°45¹ E (Ifatimehin and
Ufuah, 2006). Lokoja is underlain by basement complex rocks consisting of granite,
gneiss and schist. The area lies at an altitude of 45 – 125 metres above sea level and is
drained by the River Niger and the River Benue.

Using the Koppen’s climate classification scheme, Lokoja falls between the
tropical wet and dry climate class (AW) with annual rainfall of 1000 – 1500 mm and a
mean temperature slightly below 27.7°C. In 1991, Lokoja became the state capital of Kogi
State. The town witnessed tremendous influx of people and the population increased to
45,122 according to the 1991 National Population Census. Lokoja now has a population
of 181,369 (NPC Projection, 2017). The land use is mainly for commercial, residential
and administrative purposes. The inhabitants of the core traditional settlements are
predominantly traders, farmers and fishermen while the modern sector is occupied
predominantly by immigrants belonging to the middle and high income groups who are
civil servants, traders that engage in industrial activities.
3. Materials and Methods

Data used for this research included socio-economic characteristics of the residents, sources of water supply, domestic water consumption pattern. Data was collected directly from the field with the use of questionnaires, personal interview and observation methods.

Lokoja was divided into four residential zones based on Oyegun (1985) residential divisions of the developing cities in Nigeria. These divisions are Government Reserved Area (GRA), old or traditional areas, the modern private areas, and the uncontrolled and unplanned fringe.

Systematic random sampling was used to sample households in the four residential zones. A total of two hundred and sixty (260) copies of the questionnaire were administered to selected households. In return, 236 responses were received from households in all the residential areas (Table 1). The respondents were targeted to be the women (mothers or wives) of the house as women are known to engage in most of the domestic activities in the house. A representative was chosen (preferably a female) to answer the questions where mothers/wives were not available. Oral interview was conducted to collect data from the management of Kogi State Water Board.
Table 1: Total Number of Respondents.

<table>
<thead>
<tr>
<th></th>
<th>Number questionnaires</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRA</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Lokongoma Phase One</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>Zango Daji</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>Kabawa</td>
<td>65</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>260</strong></td>
<td><strong>236</strong></td>
</tr>
</tbody>
</table>

*Source: Author’s Fieldwork, 2015*

To ascertain the volume of water consumption for these different purposes, a standard size bucket of 15 litres was shown to the respondents to be used as a standard measurement. Statistics used in this study included simple percentages, mean, standard deviation and Analysis of Variance (ANOVA).

4. Results and Discussion

Demographic characteristics

Out of the 236 respondents surveyed from selected households in the study area, 79 (33%) of them were male while 157 (67%) were females. About 29% of the respondents were between the ages of 31 – 40 years while only 5% were above 60 years. From the survey, 59% of household respondents had obtained tertiary education, 24% were secondary school graduates, and 13% completed only primary school while 4% had other educational qualifications. Level of education is believed to play an important role in daily per capita household water use as households with more educated occupants are likely to check the pattern of water consumption for domestic uses. As regards the occupational structure of the respondents, disparity existed in the type of occupation practised by residents in the four residential divisions that were identified. In GRA, Lokongoma Phase 1 and Zango Daji residents were largely civil servants with 60%, 56.7% and 53.3% respectively, who were working in different government parastatals. Kabawa residents who used to be mainly fishermen and women have now become majorly traders as 45.9% of the respondents were traders. By implication, it is expected that the quantity of water consumed in areas dominated with civil servants is higher than the other areas.

Sources of Water Supply in Lokoja

The source of water supply to the people of Lokoja as revealed in table 3 was mainly through the Kogi State Water Board. The Water Board was established by the State Government with definite mandate to develop and distribute water to the people. Boreholes, wells and river/streams also constitute important sources for residents of Kabawa and Lokongoma phase 1 areas. This study revealed that households in GRA, Lokongoma Phase 1 housing Estate and Kabawa depended mainly on water supplied from Water Board with 45(81.8%), 53 (88.3%) and 40 (65.6%) responses respectively. About 42 (70%) households sampled in Zango Daji had boreholes drilled in their residences as their major source of water supply. A total of 18 (30%) sampled households depended on
wells located in their compounds or in neighbouring houses. However, households still combined two or more sources together. They also had alternative sources of water such as purchase from water tankers, purchase from water hawkers (Mairuwa), and rain water harvesting in order to have sufficient water for use.

**Table 2: Sources of Water Supply**

<table>
<thead>
<tr>
<th>Sample Locations</th>
<th>Pipe Borne water Freq</th>
<th>%</th>
<th>Borehole Freq</th>
<th>%</th>
<th>Well Freq</th>
<th>%</th>
<th>River/Stream Freq</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRA</td>
<td>45</td>
<td>81.8</td>
<td>9</td>
<td>16.4</td>
<td>1</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phase 1 estate</td>
<td>53</td>
<td>88.3</td>
<td>7</td>
<td>11.7</td>
<td>-</td>
<td>-</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>Kabawa</td>
<td>40</td>
<td>65.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>ZangoDaji</td>
<td>-</td>
<td>-</td>
<td>42</td>
<td>70</td>
<td>18</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: Author’s Field Survey, 2015*

**Household Daily Water Use Pattern**

Water is used for various indoor purposes among which are bathing, washing clothes, drinking, flushing the toilets, washing plates, washing fruits and vegetables, brushing of teeth, cooking, performing ablution and shaving (Olasumbo, 2006). However, for easy analysis the various purposes for water consumption was classified into six. These are bathing, washing of clothes, toilet, kitchen (washing plates and utensils, washing fruits and vegetables and cooking), drinking and personal hygiene (brushing of teeth, performing ablution, washing of hands and feet and shaving). The total daily household water use for bathing in all four sample areas as revealed by this study varied a great deal. Table 3 showed the quantity of water used per day for all household activities in all the sampled households in the four sample areas. The daily average household water used for bathing in GRA was 208.38 litres while total household daily water use for bathing for all sampled households in GRA stood at 11,641 litres per day. In Lokongoma Phase 1 Estate a total of 9,890 litres was used per day for bathing in all sampled households with an average of 164.33 litres per household. In Kabawa and ZangoDaji areas, a total of 6,941 litres and 5,115 litres respectively were consumed per day in all sampled households and a daily average of 113.78 litres and 85.25 litres per household per day respectively. Water use for washing clothes and bathing accounted for the largest quantity of household water consumption per day with 53% and 25% respectively of total daily water consumption (Figure 2).
Figure 2: Typical Indoor Household Domestic Water Use in Lokoja Metropolis.  
**Source:** Author’s Field survey, 2015

Analysis on table 3 revealed that on the average, a household in GRA was discovered to use 875.90 litres of water per day for indoor domestic activities. In Lokongoma Phase 1 housing Estate, an average of 705.33 litres was used per household per day. There was a significant downward trend in Kabawa and Zango Daji areas which had an average of 409.64 and 337.98 litres of water per day respectively (Table 3). Average household water use per day was highest in GRA and Lokongoma Phase 1 because of their socio-economic status where income was above 50,000 per month thereby enabling them have more water consuming activities like the use of washing machine, baths, showers among others. This is in line with a similar study by Ajadi (2010) in Ilorin metropolis where it was stated that GRA, Modern Residential Layout and Housing Estates where monthly income is above N80,000 have more water consuming activities as their main water guzzlers such as washing machines, baths, and showering. The smallest quantity of water was used in Zango Daji area with a household use of 337.98 litres per day. This was attributed to the fact that residents in Zango Daji area did not have access to pipe borne water from the State Water Board, most of them had to buy water for their daily activities.

**Table 3:**  
**Average water consumption per household per day.**

<table>
<thead>
<tr>
<th>Sample area</th>
<th>Total sampled Household Water Use (litres)</th>
<th>Mean (Litres) $\bar{X}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRA</td>
<td>48174.75</td>
<td>875.90</td>
</tr>
<tr>
<td>Lokongoma Phase 1</td>
<td>42320.15</td>
<td>705.33</td>
</tr>
<tr>
<td>Kabawa</td>
<td>24988.6</td>
<td>409.64</td>
</tr>
<tr>
<td>Zango Daji</td>
<td>20278.8</td>
<td>337.98</td>
</tr>
</tbody>
</table>

**Source:** Author’s field survey computation, 2015
Per Capita Water Use

The per capita water consumption is presented in Table 4. Analysis revealed that per capita water consumption varied within different locations in the study area. GRA had the highest (181.1L) per capita water use, followed by Lokongoma Phase 1 with a total of 147.4L per capita water use. The per capita water use in Kabawa and Zango Daji was 85.3L and 75.1L respectively.

Table 4: per capita water use (litres)

<table>
<thead>
<tr>
<th>Daily activities</th>
<th>GRA</th>
<th>L.Phase 1</th>
<th>Kabawa</th>
<th>Zango Daji</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathing</td>
<td>43.1</td>
<td>34.5</td>
<td>23.7</td>
<td>18.9</td>
</tr>
<tr>
<td>Washing clothes</td>
<td>99.3</td>
<td>82.5</td>
<td>45.3</td>
<td>35.4</td>
</tr>
<tr>
<td>Toilet</td>
<td>18.6</td>
<td>15.1</td>
<td>2.5</td>
<td>9.1</td>
</tr>
<tr>
<td>Drinking</td>
<td>2.4</td>
<td>2.3</td>
<td>2.5</td>
<td>2.2</td>
</tr>
<tr>
<td>Kitchen</td>
<td>12.2</td>
<td>10.1</td>
<td>7.7</td>
<td>7.9</td>
</tr>
<tr>
<td>Personal Hygiene</td>
<td>5.5</td>
<td>3.0</td>
<td>3.6</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Total consumption</strong></td>
<td><strong>181.1</strong></td>
<td><strong>147.5</strong>(SD=3)</td>
<td><strong>85.3</strong>(SD=1)</td>
<td><strong>75</strong>(SD=12.8)</td>
</tr>
</tbody>
</table>

According to Olasumbo, 2001, the standard minimum water requirement in Nigeria is 80 litres per capita per day. The result of this study, however, showed that residents of GRA and Lokongoma Phase 1 Estate consumed more water than the recommended minimum requirement. For instance, about 80 and 67 litres of water were wasted per day in GRA and Lokongoma Phase 1 estate. With 85.3 litres per capita per day in Kabawa area, only about 5 litres was considered as waste and in Zango Daji, residents use below the required quantity of water per capita per day.

Variation in Per Capita Water Use in the Sample Areas

Table 5: Analysis Of Variance on per capita water use

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>27620.726</td>
<td>1</td>
<td>27620.726</td>
<td>21.526</td>
<td>.004</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7698.814</td>
<td>6</td>
<td>1283.136</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35319.540</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Author’s data analysis, 2015.P<0.05

With the use of SPSS 20.0, One – Way Analysis of variance test (ANOVA) was conducted to show if there was a significant difference in per capita water use among the four sample areas. The result of the analysis as shown in table 20 shows that there was a significant difference in per capita water use F(1,6) = 21.53, p = 0.004. at0.05 alpha level for the four sample areas This showed that per capita water consumption was significantly different among residents of Lokoja and that could be attributed to socio-economic characteristics such as monthly income, level of education, household size and even religion.

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5. **Conclusion and Recommendations**

This study investigated domestic water use pattern among four socio economic groups in Lokoja. The various sources of water supply in the area were also assessed. The results showed households in GRA, Lokongoma Phase 1 estate and Kabawa depended mainly on water supplied from Water Board.

Water is a vital resource, the importance of its management, use, and allocation cannot be overemphasised (Ashaolu and Onundi, 2014). Accurate estimate of water uses is, therefore, a very important factor for sustainable water resource development in developing countries. The study of the use and waste of water in Lokoja metropolis has helped to show that water supply system in the town is quite applaud-able as the survey indicated a steady supply of pipe borne water to residents. This study has further shown that variation in domestic water use pattern in the study area could be attributed to the availability of water and economic status of residents. The high rate of domestic water wasting in the high income and middle income groups (GRA and Lokongoma Phase 1 Housing Estate) in the study area was a function of their economic status as well as the easy access to domestic water. Although residents of the traditional areas belonged to the low income group and they may not be able to afford water consuming appliances or engage in water guzzling activities, they also waste a lot of water for domestic purposes as a result of availability, easy accessibility of potable water in the area and large family size. Areas without access to piped water (Zango Daji) used below the recommended 80 lcpd.

Findings from a similar research by Well (1988) from Uganda showed that average water consumption when water is piped into homes is relatively high (155 lcpd), but it decreased to 15.5 lcpd when source was far away from the house. Based on the outcome of the study, it was recommended that the Government in collaboration with Kogi State Water Board should therefore adopt 80 lcpd as the average daily water need. The Board should supply water daily based on the minimum daily water requirement per person thereby providing all households this basic water requirement for maintaining human survival and health. Kogi State Water Board should introduce the use of water meters to measure water used in households as this will provide essential data for charging fees based on actual customer use and ensure that higher tariff is charged on households that use more water than what has been allotted by the Board. However, the haphazard housing pattern in the city centre and other unplanned fringed may mare the metering system, the policy of flat rates can be used in such areas.

References


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