Tap Water Scarcity and Alternative Water Sources Used at Household Level in Morogoro Municipality, Tanzania

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Abstract

This study investigates the household-level response to tap water scarcity in Lukobe Ward, Morogoro Municipality, Tanzania, focusing on the adoption of alternative water sources and the resultant water acquisition. Employing a cross-sectional research design with a mixed-method approach, it integrates quantitative analysis, including descriptive statistics and one-way Analysis of Variance (ANOVA), with qualitative data subjected to content analysis. Data were collected through a household survey of 120 respondents, key-informant interviews (KIIs), and Focus Group Discussions (FGDs) conducted across three streets. Results reveal a heavy reliance on purchased water from vendors (100%), fetching water from private sources (63.1%), utilizing shallow wells (61.1%), and harvesting rainwater (100%). The mean daily water acquisition per household was 81.5 liters. While no significant disparity in daily water consumption was observed among the streets ($F=2.335$, $p=0.101$), a notable difference was found in water procurement from shallow wells and vendors between Lukobe Juu and Mgudeni streets ($p=0.035$). This study underscores the incomplete implementation of the 2002 National Water Policy in the area, suggesting a need for enhanced collaboration between stakeholders, including households and private sectors, to safeguard and manage water sources effectively. Recommendations are made to align local practices with national policy objectives to ensure sustainable water service delivery in Lukobe Ward and similar contexts.

Keywords: Tap Water Scarcity, Alternative Water Sources, Household Approaches, Sustainable Water Management, Morogoro Region

Introduction

By 2025, it is projected that 1.8 billion people will be living with absolute water scarcity, and two-thirds of the world's population could be living under water-stressed conditions (UN-Water, 2007). Another report projects that by 2030, water demand will exceed supply by 50% in most developing regions of the world (Negoianu and Goldfaid, 2008). Climate changes act as a changing pattern of weather and water around the world (https://www.worldwildlife.org). In Sub-Saharan Africa, various empirical studies have documented the inability of cities to provide satisfactory water as basic urban services to the rapidly growing populations (Abubakar and Doan, 2010). According to WHO, two out of every five persons in Sub-Saharan Africa do not have access to safe drinking water and seven out of ten are using unimproved means of sanitation (WHO, 2012). This trend is influenced by different factors. For instance, Garduno (2011), reports that 97% of the accessible freshwater in Sub-Saharan African countries is groundwater sources. Until now, the importance of coping strategies is recognized in many Sub-Saharan African countries. Normally people use drilled shallow wells, dug or deep wells as their coping strategies for tap water scarcity to access groundwater resources. Literature reveal that the diminishing water is enhanced by several factors including human population, urbanization and industrial development (Kashaigili, 2010; URT, 2012).

In Tanzania, citizens are considered customers of water supply, with access determined by their ability and willingness to pay for services. Privatizing urban water utilities posed significant challenges for the country. Pigeon (2012) conducted a study on the private management of city water supply in Dar es Salaam, revealing that it did not result in improved service delivery. Later, Smiley (2016) criticized Tanzania's water staging, highlighting its unjust, inequitable, and uneven nature. Despite these challenges, the United Nations recognized access to water and sanitation as human rights (WHO, 2012), emphasizing the importance of equitable access to clean water for all citizens.Groundwater sources played a crucial role in Tanzania, with citizens utilizing them as coping strategies for various purposes. Approximately 25% of groundwater sources were used for domestic purposes, agriculture, and sustaining the ecosystem (Water Resource Group, 2014). This reliance on groundwater underscores the significance of alternative water sources in meeting the diverse needs of Tanzanian communities, particularly in areas facing challenges with traditional water supply systems.

However, it is essential to ensure that access to water remains equitable and sustainable. While privatization has been explored as a potential solution to improve service delivery, its implementation in Tanzania has not always yielded the desired results. Addressing issues of injustice, inequality, and uneven access to water resources requires a multifaceted approach that considers both social and economic factors. By recognizing water and sanitation as fundamental human rights, Tanzania can work towards ensuring that all citizens have access to clean and safe water, regardless of their ability to pay.Freshwater availability is a critical concern in Morogoro Municipality, with evidence suggesting a decline over recent years (Uisso, 2013). While several studies had explored into water service provision in and around Morogoro, there remained a notable gap in the literature concerning tap water scarcity specifically within the municipality. For instance, Kapinga (2015) examined the accessibility of domestic water supply in Sangasanga, Lubungo, and Mafuru villages within the Mvomero District, shedding light on rural water access dynamics. Similarly, Maro (2015) explored client perceptions of water service delivery in Morogoro Urban, offering insights into the quality and effectiveness of urban water management systems. Furthermore, Nthenge (2016) investigated the challenges facing water service delivery and coping strategies in selected sites of Makueni County, Kenya, providing comparative perspectives on water resource management in East Africa.

However, despite these valuable contributions, a literature gap persisted regarding the specific issue of tap water scarcity in Morogoro Municipality. This gap was significant not only for academic understanding but also for practical policy formulation and implementation. Addressing tap water scarcity required a nuanced understanding of its drivers, impacts, and potential mitigation strategies. Lukobe Ward epitomized the challenges faced, grappling with a widening disparity between water demand and supply, primarily stemming from insufficient tap water availability compounded by population growth (Santos et al., 2017).Consequently, Lukobe Ward households had been compelled to seek alternative water sources to meet their daily needs. Rainwater harvesting and purchasing water from vendors had emerged as primary coping mechanisms in the face of tap water scarcity. However, the extent to which these alternative sources adequately fulfilled household water requirements remained empirically underexplored. This knowledge gap underscored the importance of the present study, which aimed to address two pivotal questions: firstly, how did households in Lukobe Ward navigate the challenges posed by inadequate tap water service delivery? And secondly, what alternative water sources were utilized at the household level to mitigate the tap water scarcity problem?

Henceforth, by answering these questions, the study not only contributed to academic scholarship by filling a gap in the literature but also offered actionable insights for policymakers and stakeholders tasked with addressing water scarcity challenges in Morogoro Municipality and beyond. The findings of this research would inform evidence-based decision-

making, facilitating the formulation of targeted interventions aimed at enhancing water accessibility, equity, and sustainability within the study area and similar contexts.

Materials and Methods

Study Area

This study was conducted in Lukobe Ward, Morogoro Municipality. Lukobe Ward was selected because of the failure of the public tap water supply system which is widely perceived as the major cause of tap water scarcity. Morogoro Municipal lies between latitude 5058" and 1000" to the South of the Equator and longitude 35025" and 35030" to the East. The altitude lies at 495m above sea level, the climate here is Tropical and the temperature averages 24.60C/76.30F (URT, 2004). According to Tanzania's 2012 Population and Housing Census, Morogoro Municipality in the year 2012 had a total population of 315 866 people including 151 700 males and 164 166 females (NBS, 2012).

Research Design, Sampling and Data Collection Techniques

The study employed a cross-sectional research design, facilitating data collection at a single point in time (Pandis, 2014). A mixed-method approach was utilized, integrating both quantitative and qualitative data collection techniques. Qualitative data were initially gathered through key informant interviews (KIIs) and focus group discussions (FGDs), guided by a checklist and FGD guide respectively. Subsequently, quantitative data were collected through a household survey using a structured questionnaire. The study population comprised household heads, both male and female. Probability and non-probability sampling techniques were employed. Simple random sampling was used to select household respondents based on various criteria, including age criteria of 18 years and above. Additionally, non-probability sampling, specifically purposive sampling, was employed to select three streets highly affected by tap water scarcity. These streets, namely Lukobe Kambi Tano, Lukobe Juu, and Mgudeni, were identified due to insufficient connection to tap water (Doreen and Rose, 2016). A total of 120 respondents were randomly selected from these streets to participate in the study.

To gather more in-depth information about water sources and usage patterns, one FGD was conducted in each street, totaling three FGDs. Each FGD comprised 6-8 participants, with women aged between 18-45 years selected based on their significant role in water fetching activities within the study area. Women constituted more than 50% of participants in each FGD, reflecting their predominant responsibility for domestic water collection. FGD discussions focused on identifying sources and availability of water, as well as the quantity obtained by households on a daily basis. Additionally, three key informants were purposively selected from the three streets to provide insights into alternative water sources and the quality of water used by households. Key informants played a vital role in supplementing the data gathered through FGDs and household surveys. The household surveys, conducted using questionnaires, aimed to collect information on households' demographic characteristics, types of water sources utilized, quantity of water obtained, and the price paid for purchasing water.

Data Analysis

Quantitative data were analyzed using the IBM Statistical Package for Social Sciences (IBM SPSS) version 25, with descriptive statistics computed to obtain frequencies and percentage distributions of responses. Descriptive statistics facilitated the analysis of water sources utilized and the quantity obtained by households. Additionally, one-way ANOVA was employed to compare the quantity of water obtained in liters among streets at the household level. This statistical test is particularly useful for comparing mean differences on continuous variables between two or more groups that are normally distributed (Pallant, 2007).The utilization of one-way ANOVA allowed for the examination of potential variations in water quantity among different streets within the study area, providing valuable insights into the distribution of water availability. By employing this statistical analysis, the study aimed to identify any significant differences in water

access levels among households residing in various streets of Lukobe Ward.

Qualitative data were analyzed using content analysis, a systematic method for summarizing and interpreting field data based on the objectives of the study. Content analysis facilitated the extraction of meaningful themes and patterns from the qualitative data obtained through key informant interviews and focus group discussions. This approach enabled the researchers to identify commonalities, differences, and emerging trends in households' water usage patterns and coping strategies in response to tap water scarcity.

Therefore, by utilizing both quantitative and qualitative data analysis techniques, the study aimed to provide a comprehensive understanding of the tap water scarcity problem and the utilization of alternative water sources at the household level in Lukobe Ward, Morogoro Municipality, Tanzania. Integrating quantitative and qualitative findings allowed for a nuanced exploration of the complex dynamics surrounding water access and utilization within the study area.

Results and Discussion

Respondents' Socio-demographic Characteristics

The socio-demographic characteristics of the respondents, as presented in Table 1, provide valuable insights into the composition and dynamics of households in Lukobe Ward, Morogoro Municipality, Tanzania. The predominance of female-headed households (61.8%) aligns with findings from previous studies in Tanzania, which have highlighted the increasing role of women as household heads and primary decision-makers (Kabeer, 1999). This demographic trend reflects broader shifts in gender dynamics within Tanzanian society, with women assuming greater responsibility for household management and economic activities. Similarly, the distribution of respondents across different age groups underscores the prevalence of middle-aged household heads (48.4%), reflecting the demographic profile of the study area. This finding is consistent with research by Mrema *et al*. (2018), who observed a similar age distribution among household heads in urban areas of Tanzania. The concentration of married couples, particularly in Mgudeni Street (68.7%), suggests the importance of family units and marital relationships in shaping household dynamics and decision-making processes (Bove *et al.*, 2012).Furthermore, the reported household sizes of 4-6 family members, with a mean size of 4.4 persons, indicate moderate-sized households in the study area. This finding is in line with national averages but slightly below the reported national average of 4.9 persons per household (URT, 2012), suggesting a relatively smaller household size in Lukobe Ward compared to the national average. This may have implications for resource allocation and intra-household dynamics, influencing water usage patterns and demand within households.

In terms of education, the majority of respondents (58.1%) had attained primary education, indicating a basic level of educational attainment among household heads. This finding is consistent with research by Mosha and colleagues (2016), who reported similar educational profiles among urban households in Tanzania. Education plays a crucial role in shaping socio-economic opportunities and empowerment, with higher levels of education often associated with improved access to resources and decision-making autonomy (Lloyd and Blanc, 1996).

Regarding sources of income, the reliance on petty businesses (45.7%) and registered businesses (18.6%) highlights the prevalence of small-scale entrepreneurship and informal economic activities within the community. This finding resonates with studies by Ismail (2014) and Mkenda *et al*. (2019), which have documented the importance of informal sector activities for livelihoods and income generation in urban areas of Tanzania. Additionally, the reported income distribution, with the majority of respondents earning between 50,000-300,000 Tanzanian Shillings per month, underscores the prevalence of lower-income households in the study area. This income profile may influence households' ability to access and afford alternative water sources, potentially exacerbating water scarcity challenges in the community (Birner *et al*., 2017).

Table 1: Respondents' Socio-economic and demographic characteristics (n=120)

Variables	Lukobe Kambi Tano	Lukobe Juu	Mgudeni	Total
Sex				
Male	14(35.0)	15(45.5)	16(34.0)	45(38.2)
Female	26(65.0)	18(54.5)	31(66.0)	75(61.8)
Age(years)				
18 - 35	19(47.5)	12(36.4)	16(34.0)	47(39.3)
36 - 54	17(42.5)	17(51.5)	24(51.1)	58(48.4)
55+	4(10.0)	4(12.1)	7(14.9)	15(12.3)
Marital Status				
Single	9(22.5)	11(33.3)	5(10.6)	25(22.1)
Married	27(67.5)	19(57.6)	38(80.9)	84(68.7)
Widowed/widower	4(10.0)	3(9.1)	4(8.5)	11(9.2)
Family size				
1-3	7(17.5)	10(30.3)	13(27.6)	30(25.2)
4-6	25(62.5)	17(51.5)	24(51.1)	66(55.0)
7-11	8(20.0)	6(18.2)	10(21.3)	24(19.8)
Education level				
Non-formal	2(5.0)	2(6.1)	3(6.4)	7(5.8)
Primary	26(65.0)	15(45.4)	30(63.8)	71(58.1)
Secondary	8(20.0)	9(27.3)	12(25.5)	29(24.3)
Tertiary	4(10.0)	7(21.2)	2(4.3)	13(11.8)
Hh/ head occupation				
Agriculture	8(20.0)	2(6.1)	7(14.9)	13(11.8)
Employed	4(10.0)	8(24.2)	7(14.9)	19(16.4)
Registered business	3(7.5)	11(33.3)	7(14.9)	21(18.6)
Petty business	22(55.0)	11(33.3)	23(48.9)	56(45.7)
Homemaker	3(7.5)	1(3.0)	3(6.4)	7(5.6)
Hh/monthly income(Tshs)				
92(76.7)	32(80.0)	29(87.9)	31(65.9)	92(76.7)
19(15.8)	6(15.0)	3(9.1)	10(21.3)	19(15.8)
9(7.5)	2(5.0)	1(3.0)	6(12.8)	9(7.5)

Note: Numbers in brackets are percentages

Extent of Water Availability per Household per Day in Litres

The findings presented in Table 2 highlight the extent of water availability per household per day in Lukobe Ward, Morogoro Municipality, Tanzania. The majority of respondents (88.2%) reported obtaining 40-100 litres of water per household per day. However, this quantity falls below the recommendations set forth by the United Nations (UN) for water access, which suggest that a sufficient amount of water is at least 50 to 100 litres per person per day (United Nations, 2012; Akoteyon, 2016). Thus, it is evident that the amount of water used at the household level in the study area did not meet the minimum requirements outlined by international standards.

These findings resonate with previous

research conducted by Simon (2008) in Dar es Salaam, which similarly observed that a significant proportion of individuals in Buguruni used up to 100 litres of water per day. Simon's findings parallel those of the current study, indicating that a substantial portion of households in urban Tanzania face challenges in accessing an adequate supply of water for daily needs. Additionally, the observation that only a few households consume more than 100 litres of water per day underscores the widespread inadequacy of water availability within the community.

Moreover, the current study's findings align with the conclusions drawn by Nkonya (2010), who highlighted the ongoing challenges associated with the delivery of household water in mainland Tanzania. Nkonya's research, alongside the present study, underscores the persistent issues surrounding water access and availability in urban areas of Tanzania, suggesting systemic shortcomings in water service delivery. Despite governmental efforts, as noted by FAO (2010), water scarcity remains a pressing concern, characterized by an imbalance between demand and availability. The quote below emphasizes the above:

"We are not satisfied with the availability of water services. The water situation does seem to have not improved over the last couple of years in our area. Although, in some areas, some of the others were satisfied with the availability of the water services. This implies that, to some extent MORUWASA has poor services".(FGD participant, Lukobe Juu Street, 14th February, 2020).

rely on purchasing water from vendors and harvesting rainwater. This observation aligns with research conducted by Bourque (2010), who similarly found that a significant proportion of households obtain water from vendors. Water vending, often informal and sometimes illegal, serves as a crucial means of accessing water in urban areas where formal water infrastructure may be inadequate or inaccessible (Bourque, 2010). Moreover, the prevalence of rainwater harvesting among respondents resonates with findings reported by Chaminuke and Nyatsanza (2013), who documented the widespread adoption of rainwater harvesting among households in other urban areas. Rainwater harvesting, facilitated by the installation of tanks and containers to collect rainwater from rooftops, offers households a locally available and relatively clean water source, particularly during periods of precipitation scarcity (Chaminuke & Nyatsanza, 2013).Additionally, a significant proportion of respondents (63.1%) reported purchasing water from private sources, while 61.1% utilized shallow wells. The high reliance on private water sources and shallow wells underscores the limitations of formal water supply systems and the need for alternative water sources to meet household needs. These findings are consistent with research conducted by Mangizvo and Kapungu (2010), who observed similar trends of households digging shallow wells in Harare, Zimbabwe, to access water for various purposes.Furthermore, the study identifies Lukobe Juu and Lukobe Kambi Tano as streets where shallow wells were predominantly used, echoing findings

Table 2: Amount of water obtained per household per day in litres (n=120)

Litres	Lukobe Kambi Tano	Lukobe Juu	Mgudeni	Total
40-100	36(90.0)	31(93.9)	38(80.8)	105(88.2)
101-200	3(7.5)	2(6.1)	7(14.9)	12(9.5)
201-240	1(2.5)	0(0)	2(4.3)	3(2.3)

Note: Numbers in brackets are percentages

Water Sources Used at Households' Level

The findings presented in Table 3 shed light on the various water sources utilized at the household level within Lukobe Ward, Morogoro Municipality, Tanzania. The results reveal that 100% of the respondents across all three streets from Starkey (2012), who highlighted the implementation of well-digging initiatives in various parts of the world to address water scarcity. Wells offer a sustainable solution to water access challenges, providing communities with a reliable source of drinking water. This

aligns with the broader recognition of wells as a viable long-term strategy for mitigating water scarcity and enhancing water security in communities (Starkey, 2012). The quotes below emphasize the above:

"…all the time we get water from our public wells. However, we get few litres which do not suffice our household's needs while few others purchase water from vendors. Though, rain season lasts almost 6 months, from November to May so others save water from their tanks during rainy season…" (Key informant from Lukobe Kambi Tano Street, 13th February 2020) In the same vein, one informant from Mgudeni Street said:

"…we have no solution and we don't know when this problem will end. People tend to construct shallow wells around their houses for their daily domestic uses…"

from vendors and use of harvested rainwater, dug shallow wells were commonly used by the respondents as their private sources for various purposes. However, women and girls were responsible for fetching water. Nkonya (2010) reported that, in Tanzania, fetching water is the task of women and girls who spend many hours fetching water for their families. Coping with water scarcity means living in harmony with the environmental conditions specific to and dictated by limited available water resources (Pereira *et al*., 2009). By definition, dug shallow wells are wells excavated and lined by human labour, usually by entering the well with a variety of hand tools. They may be as small as 80 cm in diameter, and can range in depth from about five metres deep (Collins, 2010)]. However, Mvungi *et al*. (2009) stated that "In Africa we have hundreds of millions of poor

Table 3: Water sources used by households (n=120)

Water sources	Response	Lukobe Kambi Tano	Lukobe Juu	Mgudeni	Total
Water vendors	Yes	40(100)	33(100)	47(100)	120(100)
	No	0(0)	0(0)	0(0)	0(0)
Private sources	Yes	9(22.5)	22(66.7)	47(100)	78(63.1)
	No	31(77.5)	11(33.3)	0(0)	42(36.9)
Shallow wells	Yes	31(77.5)	30(90.9)	7(14.9)	68(61.1)
	No	9(22.5)	3(9.1)	40(85.1)	52(38.9)
Rainwater	Yes	40(100)	33(100)	47(100)	120(100)
	No	0(0)	0(0)	0(0)	0(0)

Note: Numbers in brackets are percentages

According to Mbonite (2002), a household is defined as a person or group of people or those who share food, dwellings, and other essential services and goods, and it is measured by the number of household members. In Table 3, results deviate from the 2012 Population and Housing Census (PHC) report, which shows that shallow wells were the main source of water in Tanzania (URT, 2012). This relates to the study conducted by Starkey (2012) the study found that, currently, a solution being implemented in several parts of the world is digging wells to provide drinking water for the whole community. Hence, wells have been a great resolution to the water crisis problem in most of areas.

This indicates that apart from buying water people in their area whom there is no alternative for other water sources".

In addition, uncertainties on shallow wells especially the public wells are not well protected even though the sources were observed as the main important sources of water for the households. The quote below emphasizes the above:

"Water from wells is not protected. We get health problems due to unprotected groundwater sources. Our children are affected by typhoid but for some others, the risk is too low so we thank God that our health remains safe…" (FGD participant, Lukobe Kambi Tano Street, 13th February, 2020).

Although Water Resource Management Act (WRMA) no 11 and 12 of 2009 directs that all

groundwater sources have to be protected (URT, 2009). Generally, the public wells in terms of protection and hygiene were not well known by street authorities. Thus, users can get diseases such as typhoid and cholera.

Price Paid by Households for Purchasing Water

The findings regarding the prices paid by households for purchasing water shed light on the economic burden and challenges faced by residents in Lukobe Ward, Morogoro Municipality. The study reveals that a significant proportion of households rely on purchasing water from vendors, with 53% of respondents reported buying a 20-litre bucket of water at 400 Tanzanian Shillings (Tshs) per day. Additionally, a considerable percentage of respondents (38.2%) from Lukobe Kambi Tano and Lukobe Juu streets access water from public shallow wells without incurring direct costs (Table 4). However, a small portion (8.8%) of respondents purchase water from private sources, such as neighbors, at a cost of 150 Tshs per bucket per day. The economic implications of these findings are significant, as they highlight the financial strain experienced by households in meeting their basic water needs. The study's calculations indicate that households spending up to 2,000 Tshs per day on water purchases, translating to approximately 60,000 Tshs per month and 730,000 Tshs per year. However, it is noteworthy that these costs vary depending on household size, with larger households likely incurring higher expenses.

These findings resonate with research conducted in other contexts, emphasizing the broader implications of water access on household finances and well-being. For instance, Alaci *et al*. (2013) conducted a study in Nigeria and found that ensuring water supply for households imposes significant time and monetary costs. Similarly, Tereza (2011) argues that household size plays a crucial role in determining water demand, with larger households typically requiring more water resources to meet their needs. The quote below emphasizes the above explanations:

"…we buy a bucket of 20 litres for the price of 400 Tsh from water vendors while in private sources there are few houses not more than six here at Mgudeni which are connected with tap pipes and water released once per week only on Wednesday, hence, we buy water at 150 Tsh per bucket of 20 litres…" (FGD participant, Mgudeni Street, 15th February, 2020).

The discrepancy between the intended goals of the Morogoro Urban Water and Sewerage Authority (MORUWASA) and the actual outcomes regarding water access underscores the persistent challenges faced in achieving universal access to clean and safe water in Morogoro Municipality. Despite MORUWASA's strategic plan aiming to increase the percentage of the municipal population with access to clean water to 94% by the end of 2010, these targets have not been met. This observation aligns with broader discussions in the literature regarding the implementation gap between policy intentions and on-the-ground realities in water governance. While MORUWASA may have formulated ambitious plans and strategies to expand water networks and improve service delivery, various factors may hinder their successful implementation. These could include insufficient funding, inadequate infrastructure, institutional constraints, governance issues, and environmental challenges.

The situation described resonates with findings from other studies examining water governance and service delivery in similar contexts. For instance, Pigeon (2012) discusses challenges faced in privatizing urban water utilities in Dar es Salaam, highlighting how such initiatives may not always lead to improvements in service delivery as anticipated. Similarly, Smiley (2016) underscores the unevenness and inequities in water staging in Tanzania, indicating systemic challenges in achieving universal access to water. This discrepancy between policy intentions and outcomes underscores the importance of not only setting ambitious targets but also implementing effective strategies to realize them. It also emphasizes the need for robust monitoring, evaluation, and adaptive management approaches to ensure that water governance initiatives translate into tangible improvements in water access and service delivery for communities.

Table 4: Households' price for purchasing water (n=120)

Water sources	Price (Tshs)	Lukobe Kambi Tano	Lukobe Juu	Mgudeni	Total
Shallow wells	None	24(60.0)	18(54.5)	0(0)	42(38.2)
Water vendors	400	9(22.5)	12(36.4)	47(100)	68(53.0)
Private sources	150	7(17.5)	3(9.1)	0(0)	10(8.8)
Total		**40(100)**	**33(100)**	**47(100)**	**120(100)**

Note: Numbers in brackets are percentages

Differences in Quantity of Water Obtained per Household per Day by Streets

The lack of significant differences in the quantity of water obtained per household per day across different streets in Lukobe Ward, as indicated by the one-way ANOVA results (Table 5), highlights a common challenge faced by households in accessing adequate water supplies. This finding suggests that, regardless of the street, households in Lukobe Ward struggle to obtain sufficient quantities of water to meet their daily needs. This resonates with similar findings reported by Kapinga (2015) in the Mvomero District, where over 50% of households consumed less than 25 liters of water per day, falling below the national water policy's recommended minimum consumption level of 25 liters per person per day.

The discrepancy between the actual water consumption levels and the recommended standards presents a significant challenge for households, impacting their daily activities and overall well-being. Despite the efforts of authorities like MORUWASA, whose mission is to provide adequate clean and safe water to the Morogoro Municipal area, the observed water scarcity persists. This discrepancy between the intended mission of water authorities and the actual water access on the ground underscores the complexity of addressing water scarcity issues and the need for more effective strategies and interventions.

Furthermore, the findings indicating low water consumption levels per person per day, particularly in Mgudeni Street, further highlight the inadequacy of water access in Lukobe Ward. The observed consumption levels fall below the minimum recommended standards, posing risks to public health and well-being. According to international standards set by the United Nations and the World Health Organization, access to 50-100 liters of water per person per day is essential for maintaining health and hygiene standards. However, the findings suggest that many households in Lukobe Ward fall short of these benchmarks, indicating a critical need for improved water infrastructure and service delivery mechanisms. One of the key informants reported that:

"Water is not enough for our households' daily use. We usually get water once per week for very few hours and sometimes during night hours whereby it is not easy for us to stay all night fetching water. Yet, we spend much time walking to fetch water in our public shallow wells. Hence, during dry season we sometimes

Table 5: Differences in the amount of water obtained per household per day among streets (n=120)

Streets	N	Mean (litres)	Sum of squares between and within the group		Df	Mean square	F	Sig (p-value)
Lukobe Kambi Tano	40	80.0	Between groups	6607.8	2	3303.9	2.335	0.101
Lukobe Juu	33	71.5	Within groups	165522.115	117	1414.7		
Mgudeni	47	89.7						
Total	**120**	**81.5**		**172130.0**	**119**			

**The mean difference is significant at the 0.05 level*

get few litres of water which do not cater to our household's needs". (Key informant, Lukobe Juu Street, 14th February, 2020).

Comparison of Streets by Amount of Water Obtained per Households per Day

The lack of significant differences in the amount of water obtained per household per day among the streets, as indicated by the one-way ANOVA results (p=0.101) (Table 5), suggests a uniformity in water access challenges across the different areas within Lukobe Ward. This finding underscores the pervasive nature of water scarcity issues, irrespective of the specific location within the ward. It aligns with similar observations made by other researchers, highlighting the widespread prevalence of water access challenges in various communities (Kapinga, 2015). However, upon closer examination using post hoc tests, a significant difference was observed between Lukobe Juu and Mgudeni streets (p=0.035) (Table 6). This finding implies that there are nuanced variations in water access dynamics between these two streets. Specifically, residents of Lukobe Juu rely predominantly on public shallow wells, which are situated in Lukobe Kambi Tano Street. In contrast, residents of Mgudeni Street depend more on purchasing water from vendors, indicating a reliance on private sources due to limited access to public water infrastructure. This disparity in water access patterns between Lukobe Juu and Mgudeni streets underscores the localized nature of water scarcity challenges and the importance of considering specific contextual factors when designing interventions to address them. It reflects the complex interplay of geographical, infrastructural, and socioeconomic factors that influence water access within communities. Such nuanced insights are crucial for developing targeted and effective strategies to improve water access and resilience to scarcity. Key informant interview reported that:

"...households here in Mgudeni Street purchase water from vendors and also there are few houses which are connected with tap water pipes however, water is released once per week..." (Key informant, Mgudeni Street, 15th February, 2020).

Table 6: Comparison of streets on amount of water obtained per household per day (n=120)

Compared street		Mean Difference	Std. Error	P-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Lukobe Kambi Tano	Lukobe Juu	8.48485	8.84524	0.339	-9.0327	26.0024
	Mgudeni	-9.78723	8.09125	0.229	-25.8115	6.2371
Lukobe Juu	Lukobe Kambi Tano	-8.48485	8.84524	0.339	-26.0024	9.0327
	Mgudeni	-18.27208	8.54229	0.035	-35.1896	-1.3545
Mgudeni	Lukobe Kambi Tano	9.78723	8.09125	0.229	-6.2371	25.8115
	Lukobe Juu	18.27208	8.54229	0.035	1.3545	35.1896

******The mean difference is significant at the 0.05 level*

Conclusions and Recommendations

Conclusions

The conclusions drawn from this study shed light on the alternative water sources adopted by households and the challenges posed by tap water scarcity in Lukobe Ward, Morogoro Municipality, Tanzania. The findings indicate a prevailing dissatisfaction among households with tap water supply services, leading to a heavy reliance on alternative sources such as water vendors, shallow wells, and private sources from neighbors. This reliance underscores the absence of viable alternatives for accessing clean and sufficient

water, despite households' willingness to pay for water services. Furthermore, the study's findings underscore the financial burden borne by households in accessing water services. The high costs associated with purchasing water from vendors and privately owned sources, as evidenced by the study's results, pose significant challenges for households already grappling with socioeconomic hardships. Therefore, the findings of this study contribute to the existing body of literature by highlighting the persistent challenges of tap water scarcity and the reliance on alternative water sources among urban households in Tanzania. The conclusions underscore the need for comprehensive policy reforms and interventions to improve water access, affordability, and quality in Lukobe Ward and similar urban communities.

Recommendations

It is recommended that the Urban Water and Sanitation Authorities take proactive measures to ensure compliance with regulations regarding sewerage connections. This includes enforcing regulations stipulating that buildings located within a certain distance from sewerage lines must be connected to the sewerage system.

Moreover, there is a need for comprehensive water conservation programs tailored to the study area. These programs should focus on promoting integrated water resource management practices and raising community awareness about the importance of water conservation and sanitation hygiene. Additionally, efforts to improve water access should prioritize the diversification of water sources to ensure resilience against fluctuations in supply and demand.

Declaration of conflict of interest

The authors have declared that no competing interests exist.

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