SOURCES OF DRINKING WATER AND UNDER-FIVE WELLBEING IN KADUNA STATE

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Abstract

Water is life, as it goes in everyday saying. However, the same water could be a profound source of illnesses, diseases, and in some cases even death when unsafe is consumed especially by the under-five children who are considered the most vulnerable due to their delicate bodies. The main objective of this study is to examine the sources of drinking water and under-five wellbeing in Kaduna State. The study reviewed Germ Theoryof Disease as theoretical framework. Methodologically, the study utilized a cross-sectional research design and data were collected through questionnaire. The target population of this study was ever married women of childbearing ages with children 0-4 years. A total sample size of 1000 sample was used for the study. The study adopted a multi-stage sampling. Cluster sampling was first utilized to group the state into three clusters (zones). Stratified sampling was later utilized to group the Local Governments into strata; rural and urban strata, and the wards were also selected. Purposive sampling was utilized to arrive at the target respondents. Findings indicate the strong relationship between source of drinking water (.709) and under-five wellbeing.The study concludes that there are different unsafe sources of drinking water in the state which may account for the high cases of water borne diseases and subsequently the high level of under-five mortality in the state. The study recommends that the government should make safe drinking water more available and accessible in the state.

Key words: Drinking water, Under-five, Wellbeing**.**

1. INTRODUCTION

According to UN-Water (2022), safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources, can boost countries' economic growth and can contribute greatly to poverty reduction. Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks. United States Environmental Protection Agency (EPA) (2023) observed that, if drinking water contains unsafe levels of contaminants, it can cause health effects, such as gastrointestinal illnesses, nervous system or reproductive effects, and chronic diseases such as cancer. Factors that can influence whether a contaminant will lead

to health effects include the type of contaminant, its concentration in the water, individual susceptibility, the amount of water consumed, and the duration of exposure (ibid).

Although, as an international authority on public health and water quality, WHO led global efforts to prevent water-related disease, advising governments on the development of health-based targets and regulations. It also produces a series of water quality guidelines, including the one on drinking-water, safe use of wastewater, and recreational water quality. The water quality guidelines are based on managing risks, and since 2004 the guidelines for drinking-water quality promote the framework for safe drinking-water. The Framework recommends establishment of health-based targets, the development and implementation of water safety plans by water suppliers to most effectively identify and manage risks from catchment to consumer, and independent surveillance to ensure that water safety plans are effective and health-based targets are being met. Yet, globally, 1 million people are estimated to die each year from diarrhea as a result of unsafe drinking-water, sanitation and hand hygiene (WHO, 2023). In Nigeria, UNICEF (2023) observed that poor access to safe drinking water remains a major contributing factor to high morbidity and mortality rates among children under five. The use of contaminated drinking water result in increased vulnerability to water-borne diseases, including diarrhea which leads to deaths of more than 70,000 children under five annually.

WHO (2023) reports that diarrhea is the most widely known disease linked to contaminated food and water but there are other hazards. In 2021, over 251.4 million people required preventative treatment for schistosomiasis – an acute and chronic disease caused by parasitic worms contracted through exposure to infested water. Additionally, the deaths of 395 000 children aged under 5 years could be avoided each year if these risk factors were addressed. Where water is not readily available, people may decide hand washing is not a priority, thereby adding to the likelihood of diarrhea and other diseases.

Kaduna State is a state with a projected population of 9,032,200 as at 2022 (City Population, 2024), indigenes and several non-indigenes, living across the twenty-three (23) Local Government Areas of the State. This may be so, due to its long history of being the Headquarters of the then Northern Region and also being one of the major centers of education of all types (Qur'anic and Western). People usually migrate to Kaduna in search of knowledge or greener pastures which contribute in making Kaduna a small Nigeria having several ethnic groups within the state. The aftermath of this concentration includes shortages and inadequacies of the basic essential needs such as safe drinking water, decent housing with adequate physical infrastructures, social amenities, hygienic neighbourhood etc. Over the decades, despite Government's efforts to tackle the situation, Kaduna State has been without adequate safe drinking water. This situation prompted the residence of the state to resort to the ones mostly available which include water from water vendors, public well, public borehole, rain water, sachet water commonly called pure water, etc. This could be detrimental to under-five survival as unsafe drinking water causes several deadly illnesses and diseases like diarrhea, cholera, typhoid etc. Mohammed and Onyinye (2024) equally reported that residents of Kano, Sokoto, Zamfara and Kaduna resort to different sources of drinking water due to its inadequacies which led to increase cases of water related diseases in the States. As submitted by Mallick (2020) safe and sufficient water facilitates the practice of hygiene, which is a key measure to prevent not

only diarrheal diseases, but acute respiratory infections and numerous neglected tropical diseases. This study is an attempt to examine the sources of drinking water and under-five wellbeing in Kaduna State.

2. LITERATURE REVIEW

2.1 Conceptual Literature

2.1.1Under-five Wellbeing

UNICEF (2025) defined under-five wellbeing as encompassing the overall health and well-being of children from birth to their fifth birthday, focusing on factors that contribute to their survival, growth, and development. It is a crucial indicator of a nation's progress in ensuring children's rights, including life, health, nutrition, and protection. A key metric for assessing this is the under-five mortality rate, which reflects the risk of death before the age of five.

Exemplars (2025) submitted that; 'number of underlying factors contribute to a child's ability to fight off and recover from diseases. Malnutrition is the largest underlying driver of under-five mortality, making sick children more likely to succumb to otherwise non-lethal illnesses, and is estimated to underlie 45 percent of all child deaths. When children die of these illnesses, it generally reflects multiple failures in the health system—failures in prevention and timely quality treatment. Addressing these challenges require Evidence-Based Interventions (EBIs), combined with implementation strategies that ensure successful rollout and uptake among the population. In addition, successful implementation involves accounting for contextual factors, such as female empowerment, nutrition, and availability of health systems resources. It is for this reason that the under-five wellbeing is an indicator of overall child health and is often used as a proxy indicator of more general social and economic development.

Center for Disease Control and Prevention (2022) submitted that, while there is no single definition of under-five well-being, there is a general agreement that it includes having positive emotions (for example, contentment, happiness), not having negative emotions (such as, depression, anxiety), satisfaction with life, fulfillment, and positive functioning. They further added, in simple terms however, well-being can be described as judging life positively and feeling good. For public health purposes, physical well-being (such as, feeling very healthy and full of energy) is also viewed as critical to overall well-being.

2.1.2 Drinking Water and Under-five Wellbeing

According to UN-Water (2022), safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources, can boost countries' economic growth and can contribute greatly to poverty reduction. Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks. United States Environmental Protection Agency (EPA) (2023) observed that, if drinking water contains unsafe levels of contaminants, it can

cause health effects, such as gastrointestinal illnesses, nervous system or reproductive effects, and chronic diseases such as cancer. Factors that can influence whether a contaminant will lead to health effects include the type of contaminant, its concentration in the water, individual susceptibility, the amount of water consumed, and the duration of exposure (ibid).

UN-Water (2022) submitted, in many parts of the world, insects that live or breed in water carry and transmit diseases such as dengue fever. Some of these insects, known as vectors, breed in clean, rather than dirty water, and household drinking water containers can serve as breeding grounds. The simple intervention of covering water storage containers can reduce vector breeding and may also reduce fecal contamination of water at the household. Also, exposure to high levels of nitrates in drinking water can lead to the development of goiter in children. Hassan (2024) observed that water contamination is a major contributor to the prevalence of pediatric illnesses with the cumulative consequences of the global mortality of children due to soil, water, and air pollution amounted to 940,000 in 2022, where children under the age of five made up around two thirds (2/3) of these deaths, and the majority happened in nations with low to moderate incomes.

A study by Gaffan, et al (2023) revealed that children living in households using unimproved water facilities or surfaced water were more likely to die than those from households with basic water facilities. This according to research by WHO (2024) is because surfaced water or water from improved source is more likely to be contaminated with pathogens than water from a limited or basic source. As such, using water from improved sources to prepare weaning foods or drink can promote the transmission of pathogens associated with diarrheal disease to children under-five.

UNICEF and Water Mission (2023) observed that open water sources like rivers, ponds, lakes and open wells get contaminated when people wash clothes, dirty utensils, bathe animals and themselves as well as defecate near these sources. When this contaminated water is used for drinking it can cause diseases like diarrhoea, cholera, typhoid, hepatitis and dysentery. Water from sources like hand pumps, taps and sanitary wells are safe as these sources are protected. However, even the safe water from these protected sources can get contaminated if it is not handled properly. The water contaminated due to improper handling can also lead to many kinds of diseases same as the ones mentioned above. It is therefore important to keep water safe right from its collection to consumption. This calls for adoption of proper collection, storage, and handling practices.

WHO (2023) reports that diarrhea is the most widely known disease linked to contaminated food and water but there are other hazards. Where water is not readily available, people may decide hand washing is not a priority, thereby adding to the likelihood of diarrhea and other diseases. As submitted by Mallick (2020) safe and sufficient water facilitates the practice of hygiene, which is a key measure to prevent not only diarrheal diseases, but acute respiratory infections and numerous neglected tropical diseases. UNICEF and Water Mission (2023) identified some of the measures to reduce contamination of water and keep it safe for drinking. These include the following;

i. Drinking water must always be collected from a safe protected source. Safe sources include a properly installed, hand pump; a sanitary, protected open-well and piped water supply through taps. Open sources such as wells, rivers and ponds are not safe as they can easily be contaminated.

ii. People should be motivated to use the hand-pump water wherever available. It is one of the safest sources of drinking water.

iii. Water should be collected in clean containers. The containers used to collect drinking water should be cleaned daily before filling them with water. Even while collecting water, hands should not be dipped into it. After collection, the container should be covered immediately.

iv. In order to maintain the drinking water safe until consumption it should be stored in a clean container above the ground level. The storage pot should always be kept covered to protect the water from contamination by insects and pets.

v. A ladle should be used to take the water out from the storage containers. Fingers and hands should not be dipped into the drinking water. A long-necked surai can also be used for storing drinking water.

vi. Drinking water must be kept safe from the time it is collected till the time it is consumed.

vii. In the absence of a safe water source, drinking water collected from an unsafe source should be made safe before it is used for drinking purposes.

The UNICEF and Water Mission (2023) further identified two methods that can be used to make drinking water safer for drinking even in the absence of a safe water source. The two methods are;

i. Boiling - boiling the water rapidly for about twenty minutes destroys the disease-causing organisms. Stirring the boiled water with a dirty spoon or pouring it into a dirty container should be avoided.

ii. Chlorination - Chlorine is an effective, easy -to -use, relatively inexpensive chemical, commonly used to clean drinking water from an unsafe source like a well, river or pond. Chlorine tablets can be obtained from the local primary health center or the local shop.

2.2 THEORETICAL FRAMEWORK:

2.2.1 Germ Theory of Disease

The theory was invented by Louis Pasteur in 1861, in his work swan-neck flask experiments disproved the theory of spontaneous generation by showing that microorganisms come from the environment. The theory was refined by a German Physician who provided scientific proof in 1884. The central argument of this theory is that sickness is caused by microscopic living things (like bacteria and viruses) that invade the body. They postulated that germs are invisible creatures that exist everywhere in the environment and that if specific germ gets inside one's body, it makes him sick with a specific illness (Absolon, Absolon, and Ralph, 2012).

Driving from this theoretical position, unsafe drinking water contains different kinds of germs that cause different kinds of diseases when consumed which is detrimental to the person's wellbeing especially under-five. The implication of this theoretical position is that, children under-five in the state are in high risk of having water borne diseases due to availability of different unsafe sources of drinking water. Thus, the need for the government and Non-Governmental Organizations to do anything possible to make safe drinking water readily available in the state, and also for the parents (mothers) to always try to make the water available safer to drink, especially for the under-five in Kaduna State.

3. METHODOLOGY

This research adopted a descriptive survey design as its main design. The population for this research consists of ever married women of child bearing ages (15 – 49), with children aged 0 – 4 years. Due to the absence of exact figures on population of ever married women currently with children 0 – 4 years in the State, the sample size was drawn from the total population of females from the selected Local Government Areas of the State, using 2006 Census Report to project 2022 population of the areas, which stood from 841,283 to 1,119,978. For the sample size, Bayero University Postgraduate recommendation of 1000 as minimum sample size for PhD thesis was adopted. The sampling techniques however adopted for this study were cluster, stratified and purposive samplings. The selection process was multi-stage. This became necessary due to the nature of the study. Kaduna State has a total number of twenty-three (23) Local Government Areas across the three senatorial zones which are Zone one, Zone two and Zone three. The division of the state into the three senatorial zones above is by the Federal Government of Nigeria which is meant to ease administration, coordination and power sharing. The division is mostly due proximity of one Local Government to another. As such, the State's Local Government Areas are first among equal clustered into the three senatorial zones.

The second stage is the selection of the sampled Local Government Areas across the zones. Given Kaduna State's twenty-three (23) LGAs spread across three Senatorial Zones (Kaduna North, Central and South) a systematic selection process became essential. The LGAs within each Senatorial District were stratified based on rural and urban classifications to capture varying opinions across the study area. In doing that, the Local Government Areas in each zone were arranged into rural and urban stratum, in which six Local Government Areas were selected; two from each of zone comprising a rural and urban local government each. The six Local

Government Areas selected are; Zaria (urban) and Makarfi (rural) from Zone one, Kaduna North (urban) and Giwa (rural) in Zone two, and Jema'a (urban) and Kauru (rural) from Zone three.

The study further used the Proportionate Formula to determine the number of respondents per Local Government. The formula used was;

$$\text{Sample Size per Local Govt} = \frac{\text{Selected Local Government's Population} \times \text{Sample Size}}{\text{Population of all selected Local Governments}}$$

Using the formula above, sample size of the respondents for each of the selected Local Government was shared proportionately across the selected wards in each Local Government as shown above.

The final stage was the selection of the wards. In selecting the wards, purposive sampling was employed for this purpose. This method ensured the targeted inclusion of wards relevant to the study's focus. The wards were however proportionately selected from each sampled Local Government Area. That is, based on the number of wards in each Local Government. In doing this, 3 wards were selected in each of the urban Local Government and 2 wards in each of the rural Local Government resulting to a total of 15 wards across the sampled Local Government Areas. However, simple random sampling technique was also employed in the selection of households from where purposive sampling was adopted to select women with children 0-4 years to whom the questionnaires were distributed.

4. RESULTS AND DISCUSSION

Table 1: Household main source of drinking water

Response	Frequency	Percentage
Public covered well	31	3.8
Public uncovered well	119	14.5
Private covered well	10	1.2
Private uncovered well	60	7.3
Public borehole	90	11.0
Private borehole	60	7.3
Public tap water	20	2.4
Private tap water	10	1.2
Water vendors	300	36.6
Rain water	100	12.2
Sachet water (pure water)	20	2.4
Total	820	100.00

Source: Field survey, 2024.

Table 1 above indicates the households' main source of drinking water. Higher percentage (36.6%) of the respondents use water purchased from water vendors as their main source of drinking water. This may be detrimental to the health and general wellbeing of the members as several diseases are contracted through the water we consumed. Only 1.2 % of the respondents have private tap water and private covered well respectively. Other sources include public uncovered well with 14.5%, public covered well with only 3.8%, rain with 12.2 % and 2.4% having sachet water as their main source of drinking water. This indicates low existence of safe drinking water in most of the respondents' households may account for high cases of water preventable diseases in the State.

Table 2: Type of water given to respondents' under-five children to drink

Response	Frequency	Percentage
Well water	140	17.1
Borehole water	292	35.6
Tap water	20	2.4
Rain water	20	2.4
Sachet water	208	25.5
Table water	100	12.2
No water	40	4.9
Total	820	100.00

Source: Field survey, 2024.

Table 2shows the type of water given to respondents' under-five children. The table revealed a higher percentage of 35% of the respondents give borehole water to their children which mostly are public borehole, 25% of them give sachet water which in ideal sense may not be as pure as we always assumed. 2.4% give tap and rain water, 12.2 % use table water, only 4.9% do not give water to their children as they are practicing exclusive breastfeeding.

Table 3: whether anything is added to the water given to under-five to makes it safer

Response	Frequency	Percentage
Yes	258	33.1
No	522	66.9
Total	780	100.00

Source: Field survey, 2024.

Table 3 is a rider to table 2; it indicates whether anything is added to the water given to the respondents' under-five children. Majority of the respondents (66.9%) do not add anything to the water which may account for high level of water related illness among the under-five children in the state. Only 33.1% add or do certain things to the water to make it clean. Question was further asked on what they normally do to make the water safer. Finding on this reveal46.5% of the respondents boil the water as a way of killing any harmful substance contained in the water.

31.8% strain through cloth which may only remove the visible dirt but not purifying it as such cannot remove dissolved contaminants (such as chemicals) or eliminate microorganisms (such as viruses and bacteria). Only 3.9% add chlorine which equally safe when required quantity is used. 10% use solar disinfection and 7.8% use water filter. The implication of the above is that, only half of those that are adding or doing something to their under-five drinking water are using the UNICEF and Water Mission (2023)'s recommendation of boiling and chlorination as the safer methods, the remaining half chose the unsafe methods. All this, may account for the level of incident of water related diseases in the State among the under-five.

Table 4: Correlation between Household Source of Drinking Water and Under-Five Wellbeing

		Under-five wellbeing	Source of household drinking water
Under-five wellbeing	Pearson Correlation	1	.709**
	Sig. (2-tailed)		.000
	N	820	820
Source of household drinking water	Pearson Correlation	.709**	1
	Sig. (2-tailed)	.000	
	N	820	820

Table 5presents the test on the hypothesis which was on the relationship between household source of drinking water and under-five wellbeing. The data used were household main source of drinking water and the whether the under-five child was sick in the last 12 months. The analysis yielded a result showing 0.709 as Pearson correlation value; this depicts a strong positive relationship between source of drinking water and under-five wellbeing at 0.01 significant levels. This implies that the variables have a strong positive relationship, meaning the water that the under-five child drinks affect his wellbeing. This is in a way that contaminated water increases the risk of diarrhea, cholera and other waterborne diseases which are prevalent in Nigeria. The result thus, accepts the alternate directional hypothesis that there is significant relationship between household source of drinking water and under-five wellbeing in Kaduna State.

The major finding is that the main source of drinking water in Kaduna State is the water purchased from water vendors as their main source of drinking water. They however use public borehole for their under-five children without doing or adding anything to make it safer to drink.

They do not see the need to further purify the water for the consumption of their under-five children.

On the main source drinking water, findings reveal the existence of different sources of drinking water some of which are not safe. The main source of drinking water in the study area as indicated by higher percentage of the respondents is water purchased from water vendors. The same water is equally used for other domestic purposes. Findings also reveal that majority of the respondents use public borehole for their under-five children without doing or adding anything to make it safer to drink (as they consider it safer than the one consume by the rest of the members of the household). The finding also accepts the alternate hypothesis that there is strong relationship between source of drinking water and under-five wellbeing. This result affirms Mohammed and Onyinye (2024), where they reported that residents of Kano, Sokoto, Zamfara and Kaduna resort to different sources of drinking water due to its inadequacies. This could be detrimental to the health and general wellbeing of the members as several diseases are contracted through what we consume. Also, as observed by WHO (2023), contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. While absent, inadequate or inappropriately managed water and sanitation services expose individuals to preventable health risks. It can be deduced that the incident of high level of water preventable diseases in the State is a result of low existence of safe drinking water. This is also in line with the assumptions of the Germ Theory of Disease which served as the theoretical framework of this study.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study reveals existence of different sources of drinking water in the state, many of which are not safe. The conclusion made is that an under-five wellbeing in the Kaduna State is threatened by unsafe drinking water which affect his wellbeing.

5.2 Recommendations

i. The government and the Non-Government Organizations need to do more on portable drinking water through construction of more boreholes, covered wells as well as pipe borne water.

ii. There is also the need for proper public awareness and enlightenment bythe government and the Non-Government Organizations on the importance of the two methods (boiling and chlorination) of making water safer to drink in the absence of safer water source as recommended by UNICEF and Water Mission (2023).

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