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Perception of Idah dwellers on the quality of drinking water; Kogi State, Nigeria.

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Abstract

The need for water is immeasurable. It spans through every facet of life and is a very important substance for sustaining life. Access to safe and potable drinking water is a very crucial issue of concern. This paper is domiciled on the premise of the perception of the people of Idah on the quality of drinking and the impact on their health. The study involved the application of quantitative (respondents' analysis) and qualitative (social survey-information from respondents) data and the analytical presentation of empirical research (assessment of variables under investigation).three neighborhoods were selected (Angwa, Ofiji and Inachalo) based on their closeness to a water source. Pearson's Correlation Analysis was used to analyze the perception of the residents of Idah on the relationship between drinking water from various sources and the impacts on their health. The Principal Component Analysis was adopted to determine the residents' perception on the drinking water source that is most vulnerable and possible water-related diseases. The result however revealed that all inter-correlations were positive which may indicate that the severity of one illness may increase with another. Specifically a high and positive correlation was obtained between typhoid fever and vomiting (r = 0.91), gastroenteritis and dysentery (r = 0.76), gastroenteritis and diarrhea (r = 0.53) and vomiting and diarrhea (r = 0.58). The matrix of the un-rotated component loadings showed that component 1 loaded high on dysentery – gastroenteritis – gradient. This component alone accounted for about 45% of the total variance in the data set. Component II loaded high on vomiting and typhoid fever. This implied that the people were more likely to be affected by typhoid fever by drinking water from the various sources identified. Amongst the recommendations made from the study was that the people should adopt the boiling and filtering treatment method and drink more from packaged water, and the government at all levels should expedite action in reviving the pipe-borne system as a source of drinking water.

Keywords: Drinking water; Perception; Residents; Neighborhoods; Health.

Introduction

Water is an essential substance that is very vital for life. Its usage spans across so many facet of life – domestic, industrial, agricultural, health, consumption, power generation, and more. The concept of sustainable water management explains the management of water resources to meet the needs of both current and future generations [1, 2]. Water supply can only be sustainable if it possesses the under listed attributes – effective, reliable, consistent and does not negatively impact the environment [3, 1].

Access to safe and potable drinking water is a basic need of mankind and a human right, including health and food [4]. The need for water is universal and inevitable. It does not take into cognizance ones' orientation as well as nationality, tribe, religion, race or social status. It is a major component of human body system. In spite of its importance, [5, 6] noted that its quality is often compromised considering the increasing need of the resource due to rapid urbanization, increased agricultural production, natural resource extraction and mining, industrialization [7, 5].

Issues of water quality sustainability encompasses the physicochemical properties, microbial and radiological elements of the water component [8]. To address these concerns, Tyagi *et al*, [9] noted that the Water Quality Index is a very important tool being a unit less number, it expresses the overall quality of water as a single number by classifying it according to its suitability for domestic purposes. A study by Atalawei *et al*, [10]

revealed that water from Olugbobiri and Ogboinbiri creeks in the Niger Delta were not suitable for drinking due to high levels of Iron (Fe) and polycyclic aromatic hydrocarbons in them. This occurrence according to Egun and Oboh [11] severe contamination were found in Ikpoba reservoir from heavy metals like Iron (Fe), Lead (Pb) and Calcium and leading to the deterioration of the water quality. This scenario is attributed to leachates from dumpsites, industrial discharges and corrosion of Iron among other factors [13].

Drinking water quality and its sustainability is of great concern in Idah. Studies have shown the high aquifer vulnerability resulting from poor natural protection and activities like dumpsites and open defecation in the area [14]. The basic requirements for drinking water according to Jegede [15] are that it should be clear (low turbidity), not salty, free from offensive taste or smell, free from chemicals that may cause corrosion or encrustation, free of heavy metals, with not excessive sodium, sulphate and nitrate but above all free from pathogenic organisms as bacteria and viruses which may cause diseases. In Idah, accessing potable drinking water and the sustainability is becoming a major issue of concern. This research however, focuses on the perception of the inhabitants of Idah town on the quality of drinking water as well as its health implication on the people.

Material and Methods

The study area

Idah town is one of the urban centers in Kogi State and also one of the oldest settlements in Igala land. It is the traditional and cultural headquarters of the Igala people as it holds the seat of the Monarch (Attah of Igala Kingdom). It is geographically located at the south eastern part of the State and on the eastern bank of River Niger on Latitude 7.1138^0N and Longitude 6.7440^0E. It is lying beside the middle course of the River Niger. It is the Headquarter of Idah local government area of Kogi State. It has commercial routes (waterways) on the River Niger linking Lokoja to the north of the country; Onitsha in Anambra State to the south; Agenebode in Edo State to the west; and Enugu to the east. It is a homogeneous community dominated by the Igala's and few of other tribes.

The area has a high lying soil of the Plateau which is shallow and sandy. The town is under-laid by a false-bedded sand stone formation (sedimentary rock) which could provide a source of ground water through the tapping of aquifer. The population of the area from the 2006 census figure put it at 79,755 [16] and by projection using the geometric growth model ($P_t = P_0 (1+r)^t$ where r is the constant rate of change; P_0 is the initial population; P_t is the final population sought for) puts it at 108,698 for 2015. The climate and vegetation of Idah encourage agricultural practices. Hence much of cultivation is practiced along the flood plains. It lies within the warm humid climate zone of Nigeria. The vegetation type is that of guinea savannah. The topography of the area is gently undulating and it slopes downstream (River Niger).

Climate and Hydrology

The tropical wet climate of Idah in Kogi State is influenced by the guinea savannah vegetation under which it lies and is characterised by two distinct seasons. The wet season which occurs roughly between 6-7 months of the year with moderate rainfall of about 200-300mm and the dry season which occurs within 5-6 months in a year. It has high temperature of over 27^{o}C during hot season and an annual range of temperature of about 6^{o}C [17].

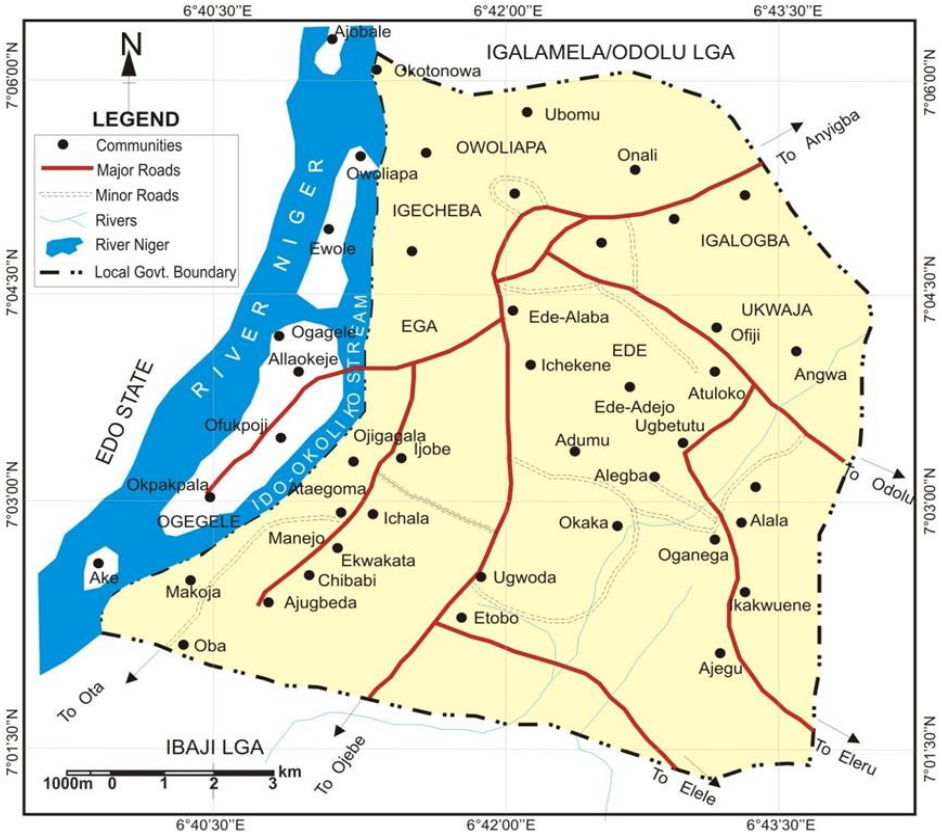

Fig.1: Map of Idah Local Government Area showing the Neighborhoods

Source: GIS Lab, Department of Geography and Environmental Studies, KSU, Anyigba.

Research Design

This study was designed to involve both field survey (field research design). Two different sets of questionnaire were administered for the study. Table water (bottled and sachet water) manufacturing industries and the inhabitants of Idah community. Three neighborhoods were selected from the town (Idah) based on their nearness to the source of water – Angwa, Inachalo and Ofiji.

The study involved the application of quantitative data (respondents' analysis) and qualitative data (social survey) and the analytical presentation of empirical research (assessment of variables under investigation). This of course aided the determination of the perception of the inhabitants of Idah town on the quality of drinking water. This also gave room to explore ways of improving on the quality of the drinking water by addressing the research questions from different perspectives.

Data Requirements

The socio-economic and demographic data required for this study are household size of the inhabitants, marital status, sex, employment status, income level, and population, cultural, attitudinal and historical traits of the people. The ecological data requirement include data on water sources - river, rain, packaged water, groundwater from surface well and boreholes.

Table 1: Sources of Drinking Water by Respondents

Sources	Frequency	Percent	Cumulative Percent
Stream	17	5.1	5.1
Borehole	178	54.6	59.7
Well	42	12.8	72.5
Table water	11	3.3	75.8
Rain	32	10.0	85.8
Vendors	46	14.2	100
Total	326	100	

Source: Researcher's Field Survey, 2025.

Plate1: Inachalo Stream as a Source of Drinking Water in Idah

According to Njosi [18], most water sources are contaminated especially as a result of human activities. Plate 1 shows Inachalo stream as a source of drinking water in Idah and the human activities (such as bathing, washing, pouring of liberations, urinating, defecating) leading to the contamination of this source. These contaminations are attributed predominantly to natural phenomenon with only occasional or relatively minor or diffuse effects caused by human activities. Table 1 shows the distribution of sources of drinking water in Idah. Borehole is the major source of drinking water as shown in the above table. A greater percentage (54.6%) of the sampled population drink water from borehole because the people feel safe drinking from borehole. Another boosting factor is the proximity of the borehole locations (privately owned but commercialized) to the people. The study from the primary data collected revealed that within every 300metres distance there is a borehole of which are majorly owned by private individuals in the study area. Other sources from the survey include well, since borehole is covered it is therefore more hygienic and also most convenient to explore. Table 1 reveals that 5.1% of the respondents get their water from stream; these are people living around the stream and source their drinking water for the family from the stream. Those that source their drinking water from rain are 10% of the respondents. Water vendor account for 14.2%.The study also revealed that public taps in the entire town of Idah no longer dispense water to the people due to poor maintenance and negligence on the part of the government and the people. Plate 2 shows outlet of tap connected to borehole where water from the borehole is being collected in the study area (Ofiji).

Plate 2: Tap connected from Borehole in Ofiji

Table 2: Residents' Perception on the occurrence of Diseases from various Water Sources

Locations	Sources	Treated Water		Diseases (occurrence)	
		Frequency	%	Frequency	%
Angwa	Groundwater	186	57.1	46	14.1
Ofiji		174	56.8	42	13.7
Inachalo		168	56.4	40	13.4
Angwa	Rain water	62	19	78	23.9
Ofiji		46	15	66	21.6
Inachalo		39	13.1	50	16.8
Angwa	River water	32	9.8	126	38.7
Ofiji		32	10.1	125	40.8
Inachalo		49	31.5	130	43.6
Angwa	Table water	46	14.1	28	8.6
Ofiji		54	17.6	32	10.5
Inachalo		42	14.1	22	7.4

Author's Field Survey, 2025.

Table 2 displays the perception of residents on the occurrence of diseases from the various sources of water in the study area. It is gathered from the study that in spite of the treatment of the water, there are still incidences of ailments resulting from the drinking water. Despite the treatment of groundwater (borehole and well), 14.1% of the respondents from Angwa are affected by the drinking water, while 13.7% from Ofiji and 13.4% from Inachalo. This is a pointer to the fact that the measures adopted for treatment are not sufficient to address the kind of coliform present in the drinking water in the areas. Rain water appears to have more negative impacts on the health of the people than the ground water possibly because of the method of storage of the water and the roofing sheet where the water drop from. The survey revealed that 19% of the respondents from Angwa who treat and drink rain water have water related health issues, (23.9%), in Ofiji 15% of rain water drinking respondents are challenged by water related ailments while in Inachalo, 13.1% of the respondents treat and drink rain water and still suffer from drinking water-related diseases. This may be due to some collection points being unhygienic and could attract bacteria which could be resistant to the kind of treatment. Drinking water from the rivers seems to the most polluted as 38.7% of the respondents in Angwa are affected by water related diseases after treating the water. 40.8% are affected in Ofiji, while 43.6% of the

respondents in Inachalo drink treated river water and are still affected by water related ailments. The study also showed that drinking table water that has been treated from the factory majorly by the use of chemicals like chlorine or ozone, is not a guarantee for free health issues though it has less incidences. 8.6% of the respondents from Angwa in spite of drinking treated packaged (table) water record health issues from water. In Ofiji and Inachalo, 10.5% and 7.4% respectively drink packaged as well as table water yet fell ill.

Table 3: Perception of Residents on Method of Water Treatment and Ailment

Method of Treatment	Frequency	Percentage %	Ailment (water-related)			
			Yes	%	No	%
Boiling only	97	29.9	25	25.5	72	74.5
Filtering only	55	16.8	25	45.9	30	54.1
Boiling/Filtering (both)	32	9.6	5	15.7	27	84.3
Addition of chemical (chlorine, ozone)	31	9.4	6	18.4	25	81.6
Sedimentation	38	11.7	31	80.7	7	19.3
Freezing	11	3.4	6	56.3	5	43.7
No action	62	19.1	54	87.6	8	12.4
Total	326	100	152	46.8	174	53.2

Author's Field Survey, 2025.

Boiling of water is the most adopted treatment by the respondents in the study area with a frequency of 97 (representing 29.9%) of all respondents in the study area. Boiling water seems easy, at boiling point, a greater percentage of the coliforms present in the water can no longer survive, and 74.5% of the respondents that boil their water before drinking have no water-related ailment. According to WHO [19] water needs to be heated until the appearance of the first big bubbles to ensure that it is pathogen free. Many organizations recommend boiling both for treatment in developing countries and to provide safe drinking water in emergency situations throughout the world. Boiling only kills pathogens and does not remove turbidity or chemical pollution (e.g. arsenic) from drinking water [15]. Although boiling is easy to use and microbiologically effective, as with other household water treatment methods, its effectiveness depends on correct and consistent use. Clasen [20], also noted that boiled water is susceptible to recontamination and no randomized controlled trials have been conducted to evaluate boiling.

A frequency of 55 (16.8%) of the respondents filter their water before drinking while 45.9% of these respondents treat their drinking water by filtering alone and still suffer water related ailment, 54.1% of the respondents drink the filtered water and are free from water related disease. This is because filtering may help to eliminate the particles present in the water, but does not totally destroy or neutralize the effects of the microscopic organism present in the water. It only requires the filter, so those who can afford the filter adopt this method. It is fast and less tedious than the boiling method. The effectiveness of the filtering method of water treatment is dependent on the type of filter used. Boiling and filtering is a very effective method as it destroys the pathogens and still eliminates them from the water before drinking. The survey revealed that 9.6% of the respondent practice this method, 84.3% of which are not affected by any water related disease while 15.7% still have water related health issues. For this population, their health challenges may result from other food items that they use the water to prepare. WHO [19], noted that microbial hazards invisibly contaminate the water with bacteria, viruses and parasitic organisms that cause disease. It also noted that much of this contamination occurs by water coming into contact with animal and human waste, just one gram of feces can contain up to 100 billion microbes.

Adding chemicals to water for treatment is majorly practiced by water factories and some borehole owners in the study area. They add chemicals like chlorine to improve the quality of the water. This method is expensive, it is adopted for commercial purpose, 9.4% of the respondents agree to the use of this method. It is very effective though with long term side effects. 81.6% of the users of this method are not affected by water related diseases (Table 3). This explains why the people in the study area that drink packaged (table) water are rarely affected by water related diseases. Sedimentation is when the sediments or particles in the water are allowed to settle at the bottom of the water and then the top of it is collected to serve as the drinking water. 109 (11.7%) of the respondents in the study area use this method as treatment for their drinking water. This method is majorly applicable to river water and rain water because they carry a lot of particles. Since not many of the

respondents get their drinking water from river and rain, the percentage of the respondents treating their water with sedimentation is less. The method is easy and does not require any form of expertise. They just fetch their water, leave the dirt or particles to settle and drink as indicated by the respondents. 80.7% fall sick while 19.7% are not sick due to the consumption of the water because the method does not assure the neutralization of the effects of the bacteria present in the water. Freezing is a very unpopular method of water treatment in the study area. Most of the respondents in the study area do not have sufficient supply of electricity to get water to freezing point. This explains why 3.4% of the respondents treat their water by freezing it. 56.3% of the respondents drink frozen water and still fall sick while 43.7% of the respondents drink frozen water and do not fall sick. Drinking cold water has some negative effects on human system as noted in the works of Kent [21] where he identified five ways that drinking chilled water can affect human body – digestion, decrease in heart rate, shocks the body, slows fat breakdown and leads to constipation. All these inclusive make the reason for the 56.3% that fall sick from drinking frozen water. According to Science daily [22], when water reaches freezing point, most of the coliforms present in it will not be able to survive, and as a result, they all die and become harmless to the body system. 19.1% of the respondents drink the water in its natural state while 87.6% of the respondents fall sick from drinking the water without treatment and12.4% are immune to the water hence are not affected.

Interrelationship of water-related diseases and water quality

Table 4 below shows the analysis of the degree of vulnerability of the people of Idah to the possible health problems (typhoid fever, cholera, diarrhea, gastroenteritis, dysentery, vomiting). The result of the Pearson correlation of sources of water is shown on Table 4

Table 4: Correlation Matrix of Water-related Ailment Parameters

	1	2	3	4	5	6
1	1.00					
2	0.02	1.00				
3	0.53	0.04	1.00			
4	0.28	0.08	0.53	1.00		
5	0.31	0.08	0.58	0.91	1.00	
6	0.07	0.05	0.13	0.02	0.22	1.00

Where 1 = Typhoid
2 = Cholera
3 = Diarrhea
4 = Dysentery
5 = Gastroenteritis
6 = Vomiting

Epidemiology of diseases shows that tropical diseases are highly interrelated and such relationship could be complex [23]. In order to elucidate this data on various water-related diseases, the Pearson's correlation analysis and the Principal Component Analysis were used. The Pearson's correlation was used to analyze the simple relationship, the result of this analysis is as shown on table 4. It shows that all inter-correlations are positive which may indicate that the severity of one illness may increase with another. Specifically a high and positive correlation was obtained between 1 and 6 (r = 0.91), 5 and 4 (r = 0.76), 5 and 3 (r = 0.53) and 6 and 3 (r = 0.58).

The relationship also shows low or weak relationships, thus the pattern of interrelationship between the different water-related diseases are not quite directional. This suggests that they may be related to each other in several and complex ways as in Table 4. To enhance the understanding of the structure and underlying pattern, Principal Component Analysis was employed both as a method of achieving data parsimony and to handle possible multi co-linearity problem.

Table 5: Component Matrix of Water-Related Diseases

	Component	
	1	2
Degree of Vulnerability (Dysentery)	.919	
Degree of Vulnerability (Gastroenteritis)	.918	-.113
Degree of Vulnerability (Diarrhea)	.745	-.309
Degree of Vulnerability (Typhoid)	.508	-.351
Degree of Vulnerability (Vomiting)		.893
Degree of Vulnerability (Cholera)	.130	.215

Two components were extracted (Table 5), the component matrix showed how each of the two component fared with respect to each of the six water-related diseases considered. The table revealed that dysentery and gastroenteritis are two major diseases resulting from drinking water with a component loading of approximately one.

Residents' Perception on Interrelationship of water-related diseases and water quality

The degree of vulnerability of the people of Idah to the possible health problems (typhoid fever, cholera, diarrhea, gastroenteritis, dysentery, vomiting) has been analyzed, however the perception of the people on the relationship between sources of water and incidences of water-related diseases was done using Correlation and Principal Component Analyses. The result of the Pearson correlation of sources of water is shown on Table 4

The Principal Component Analysis was employed to determine the most vulnerable component in the type of drinking water consumed by the people of Idah.(Table 5)

Table 6: Total Variation of Disease Components (Idah)

	Total	% of Variance	Cumulative %
1 (Typhoid fever)	3.167	45.237	45.237
2 (Cholera)	1.346	19.232	64.468
3 (Diarrhea)	.924	13.198	91.612
4 (Dysentery)	.399	5.707	97.318
5 (Gastroenteritis)	.130	1.857	99.176
6 (Vomiting)	.058	.824	100.000

Table 6 shows the Eigen values associated with the water-related diseases in Idah. The result revealed that out of the six ailments, only two had Eigen value of one (1) and above. As seen from the Table above, the sizes (values) of the Eigen value represent the size of the components which accounted for 64.5% of the variation in the water-related diseases and therefore explained most of the variation in water diseases in Idah.

From Table 5, the matrix of the un-rotated component loadings shows that component 1 loads high dysentery – gastroenteritis – gradient. This component alone accounts for about 45% of the total variance in the data set. Component II loads high on vomiting (+0.89). This component accounts for 19.2% of the total variance in the data set. The component could be referred to as typhoid component since typhoid in most cases is associated with vomiting [24].

The PCA done has shown that water-related diseases can be measured with a limited number of dimensions (diseases) which are adequate to account for majority of variations in water-borne diseases in Idah. Thus, it can said that water-related disease in Idah can be described along these two axes. These two components are the major underlying water-related disease in Idah.

Conclusion

Sources of drinking water are subject to contamination and require appropriate treatment to remove disease-causing contaminants. Contamination of water supplies can occur in the water source as well as in the distribution system after the treatment of the water. There are many sources of water contamination, including naturally occurring chemicals and minerals, local and land use practices, manufacturing processes, and sewer overflows or wastewater releases. The presence of contaminants in water can lead to adverse health effects in both young and old [25]. Contaminated water and poor sanitation are linked to transmission of diseases such as typhoid fever, cholera, diarrhea, dysentery, hepatitis A, skin disease, gastroenteritis, and vomiting. WHO [19] noted that absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

The study has revealed that the people of water are conversant with the sources of their drinking water and the possible health challenges that emanate from them in spite of treatment. Consequent upon this, the following recommendations are put forward to ensure that the risk from drinking water sourced from Idah is reduced to its barest minimum;

- Water from various sources should be properly harvested with clean and safe containers to avoid contamination.
- Better and suited treatment measures should be adopted to ensure that water is safe for drinking.
- Cases of drinking water-related ailments should be promptly treated to avoid degeneration.
- Safer sources of drinking water like packaged water, treatment by boiling and filtering should be encouraged.
- Government should revive the pipe-borne water system so people of Idah can get access to safe drinking water.

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