



Quality Assessment of the Water Sources in the IDP Camps a Case Study of IDP Camp in Borno Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The conflict between the Nigerian state armed group and a non-state armed group in the North East has led to the displacement of over 2.1 million Internal Displaced Persons (IDPs) in camps and host communities. This has placed a heavy burden on the government and other non-Governmental organizations in the provision of aides to reduce the suffering of these people, especially women and children. The question of the quality and adequacy of water and its health implication on the IDPs have to remain evasive and unanswered due to the security threat of carrying out research in such security flashpoints. The research against all odds sought to analyze the quality of water (physical, chemical, and bacteriological) of the water, its availability/source, and the ease of getting the water in the camps. It was conducted with the use of a structured questionnaire distributed in 12 out of the 16 official IDP camps studied with a sample of water taken and analyzed in the Maiduguri NAFDAC office. The research revealed among others that water provision is inadequate for the IDPs as observed in the camps visited. Also, the distance traveled, and time spent at a fetching point is none conforming to both SPHERE and UNHCR standards. The laboratory finding for water

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quality assessment indicates that there is the presence of physical, biological, and chemical contaminants harmful to health. The research findings from the camp defy the standard provisions for IDPs in both UNHCR and SPHERE. The research recommends that the Federal Ministry of Humanitarian Affairs, Disaster Management, and Social Development needs to enforce strict compliance with the humanitarian standards in the Nigerian national policy on internally displaced persons in Nigeria to enhance better life of the IDPs in the formal and informal camps.

Keywords: Water sources; IDP camps; quality assessment.

1. INTRODUCTION

The United Nations Humanitarian Commission for Refugees [1,2] defines internally displaced persons (IDP) as people who have been evicted from their houses for many of the same reasons as refugees but have not crossed an international border, are often persecuted, or are under attack by their government they are frequently in more desperate situations than refugees. The UNHCR also says that the IDP outnumbered refugees two to one [1,2].

The conflict between the Non-State Armed Group (NSAG) otherwise known as the armed opposition group and the Nigerian military has largely caused the internal displacement of people into Maiduguri and other local government areas from surrounding villages. These people are now situated in both formal IDP camps and informal internally displaced person camps and host communities. (UN OCHA 2017).

About this strong protection mandate of UNHCR, it is also worth highlighting that though access to water is a basic human right there have been many documented examples of inadequate water and sanitation provision in refugee camps in Uganda, Chad, Kenya, DRC, and many other countries [3]. This poor provision is continuing today and is evident in IDP (internally displaced persons) camps in Borno State Nigeria [4-10].

While lack of an inadequate number of sanitation facilities poses a serious threat to the life of the IDPs, inappropriate design and location of water and sanitation facilities can also provoke serious protection risks for displaced people, particularly women and girls, and also for people with specific needs, such as elderly persons and persons with disabilities [11].

Emergency water supply and sanitation must come adequately as they aim to provide a minimum quantity of clean water and also reduce fecal-oral disease transmission and disease-

bearing vectors. Another important reason is to help people who are displaced to live and perform daily life tasks such as going to the toilet and washing with dignity, security, and while being comfortable. (SPHERE project 2000).

Despite the efforts of the Nigerian government, it has been observed that internally displaced persons are still facing harsh conditions, especially in the IDP camps. According to the Federal Republic of Nigeria FRN report (2012), IDPs in Nigeria face difficult living conditions such as insecurity and all forms of exploitation and abuse, including; rape, camping in congested shelters, and isolated as well as insecure or inhospitable areas. According to the assessment, Borno, Yobe, Adamawa and Taraba states that, face food insecurity mainly due to the loss of income and livelihood caused by the insurgency and displacement (Organisation for the Coordination of Humanitarian Affairs OCHA, 2014).

Cholera outbreaks are among threats to life with dignity among the IDPs in Borno state (Premium Times 2017). Cholera has been linked to inadequate and improper sanitation and hygienic facilities as well as practices (Harvey 2007, WHO 2000). Cholera is a disease that is transmitted through food that is contaminated or drinking water, as well as by person-to-person contact through the fecal-oral route. Sanitary conditions concerning their operational efficiencies in the environment play an important role since the *V. cholerae* bacterium survives and multiplies outside the human body and can spread rapidly where living conditions are crowded, water sources unprotected, and where there is no safe disposal of feces. These conditions are found in poor countries and many refugees and internally displaced person camps. In 1994 in a refugee camp in Goma, Democratic Republic of the Congo (DRC), there was a major outbreak and an estimated 58,000–80,000 cases and 23,800 deaths occurred within one month [12].

UNICEF (2008) has stated that carrying out comprehensive research on water, sanitation,

and hygiene promotion issues among the IDPs and refugee populations has remained a challenge. Reasons include security restrictions, difficult conditions of operation, inadequate resources, inadequate staff or high staff turnover, the difficulty of carrying out thorough measurements during emergencies, and the fact that refugee camps are always forcibly located on marginal lands [13-22]. Hence, these very real difficulties hinder efforts by water and health professionals to systematically document and build on lessons learned to improve services in these areas in subsequent refugee operations. It has also meant that all the available time and resources are needed simply to keep water supply and sanitation control mechanisms functioning and so the need for research is overlooked [23].

It is against this backdrop that the research is aimed at assessing the quality of water sources in the IDP camps, this assessment will cover the physical, chemical as well as bacteriological properties of the water in the IDP camps to develop initiatives that can better the lives of the IDPs in Nigeria.

2. LITERATURE REVIEW

2.1 Internally Displaced People in Nigeria

According to the African Union Convention for Protection and Assistance of Internally Displaced Persons in Africa [24], the term 'Internally Displaced Person's is defined as persons or groups of persons who have been forced to flee their homes or residence, in particular, to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border. Internally displaced persons (IDPs) are citizens of a country who are displaced within the territory of a country as a result of natural disasters such as erosion, desertification, flooding, etc. People can also be displaced as a result of a human-caused disaster such as civil war, internal armed conflict, terrorism, and so forth. In this situation, people are left with the option of fleeing their homes for safety.

An incessant case of internal displacement of people in recent times has been experienced by Nigeria. In the Nigerian context, the cause of this precarious situation is not far-fetched. Going by history, the country has many times experienced incidences of crises leading to the displacement of people from their original abodes. For

instance, the civil war that took place in Nigeria between 1967 and 1970 led to the displacement of people especially those from the Eastern region of the country [25-29]. Intra-ethnic conflicts, flooding, erosion, and desert encroachment among others have remained a great challenge facing the country. Sometimes the causes of displacement are difficult to understand and often overlap. According to Ladan [30], most internal displacements are caused by violent conflicts as a result of ethnic, religious, or caused by political undertones. Thousands of people are yearly internally displaced because of natural disasters including flooding in the North and West part of the country, erosion in the Eastern part of the country, spillage of oil, and development projects in the Niger Delta region (South-South) [30]. Particularly, ongoing hostilities and armed conflicts in Nigeria have caused many casualties and deaths; though there may not be reliable available statistics showing exactly the number of people who lost their lives as a result of armed conflicts in Nigeria.

Today, the most worrying issue is the ongoing hostility and conflict between the state-recognized armed group and the non-state-recognized arm group in the northern region. The ongoing hostility has not only caused many to suddenly run away from their homes and take up shelter in IDP camps but has also resulted in a massive influx of people into nearby states and countries, thereby bringing about the refugee crisis [31-38].

As highlighted in IOM's first report, the majority of IDPs identified in Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe have been displaced as a result of the ongoing hostility/conflict (85.68%). A smaller number were forcefully asked to leave their place of origin because of community clashes (3.33%) or natural disasters (0.99%) [39]. Most of the persons displaced internally are living with their relatives in the host communities who are themselves poor most of whom are returnees themselves, thus straining severely already scarce resources as well as worsening and increasing poverty levels (including food and nutrition insecurity) of the affected/host communities [40].

Despite efforts by the state-recognized armed forces of Nigeria in the northeastern region, it is a well-known fact that the violence in northeastern Nigeria and neighboring countries continues. International media report almost daily hostility attacks since May 29, 2015, resulting in more

than 200 deaths in northeastern Nigeria between June 27, 2015, and July 3, 2015, alone, according to the UN and international media [41].

According to the agency, as of June 2015, armed opposition group attacks had internally displaced nearly 1.4 million people- 1 million and more of whom are displaced in Borno State in northeastern Nigeria, according to IOM's Displacement Tracking Matrix (DTM). This represents a slight decline from nearly 1.5 million IDPs in late April to approximately 1.4 million by late June. This was due to the return of 120,000 people to areas of origin in Adamawa [41]. Based on a USAID report, by May 2015, an estimated 168,000 people, including returning migrants, had also fled to neighboring Cameroon, Chad, and Niger. Although the Nigerian armed forces have claimed to have defeated the armed opposition group, access to the northeast is highly constrained given the frequency of insurgent attacks.

Despite the efforts made by the government of Nigeria, it has been observed that the displaced persons have continued to face harsh conditions, especially in the IDP camps. Today, it has been reported that armed groups carry out violent attacks on the IDPs, resulting in the loss of innocent lives. According to FRN [42], IDPs in Nigeria face insecurity and all kinds of exploitation and abuse, including rape, camping in congested shelters, isolated locations as well as insecure or inhospitable areas. According to the assessment, Borno, Yobe, Adamawa, and Taraba state, face food insecurity mainly due to the loss of income and livelihood caused by the insurgency and displacement (OCHA, 2014).

Within the web of contesting vulnerability today, internally displaced person's plight is more disturbing and precarious [43]. While there are efforts made by humanitarian and faith-based nongovernmental organizations and government agencies to ensure that the basic needs of the IDPs are met, their exposure to many health risk factors tends to be increased by barriers to having healthcare services, education, employment, economic activities and information for participation in making a decision that affects their lives (the Federal Republic of Nigeria, 2012). Furthermore, IDPs in Nigeria also face a lack of access to justice, whether in cases of human rights violations such as discrimination against ethnic and religious minorities, sexual violence, and deprivation of means of livelihood [42]. Rehabilitation, resettlement, and

reintegration of the displaced persons in Nigeria have continued to pose a colossal problem to the government due to unabated nonstate armed group attacks in the country, particularly in the northeast. This scenario is a pointer to the conclusion that as long as the hostilities between Nigerian military forces and the non-state armed group continue to exist; there is the possibility that the number of internally displaced persons would continue to increase [44-46].

2.2 The population of Displaced People Internally in the Camps

In 2017, the displacement tracking matrix index DTM according to IOM shows a total of 1,702,680 displaced individuals in 6 states most affected by the displacement namely Adamawa, Yobe, Borno, Bauchi, Taraba, and Gombe state. In 2018 however, the number of individuals increased by 4.5 percent bringing the affected number of individuals to 1,782,490. There are 257 camps and camp-like settlements in Borno state (IOM 2018, HRP 2018).

The population of internally displaced persons in camps across Borno State is fluid, depending on the frequency of violence in other parts of the state. The total number of IDPs residing in the formal IDP camps is estimated to be over 1.5 million. According to the National Emergency Management Agency (NEMA), Internally Displaced Persons (IDP) camps in Borno remained at 32. Below is a breakdown of the population in the camps (FHI 360 2015).

2.3 Water Supply Systems in IDP camps

Water is very vital to life, dignity, health, and a basic need and a human right. For emergencies, water is not easily gotten in enough quantity and quality thereby creating a major threat and hazard. For an IDP camp or refugee setting, water is one of the primary criteria. This is to ensure the supply of clean water in adequate quantity for the people in the camps as well as meet their household and other communal needs to facilitate easy and safe access and that it is also efficient, reliable, cost-effective, and environmentally benign [47-53]. The three main types of natural freshwater are Surface water (streams, rivers, and lakes); Groundwater (underground or emerging as springs), and Rainwater. The main water sources provided in emergencies are motorized solar boreholes, hand pump boreholes, wells, and water trucking.

Table 1. Number of IDPs in camps

S/N	Name of Camp	Estimated Number of	IDPs Source LGA of IDPs
1	Government Girls College camp	2,921	Bama
2	Girls secondary School camp	7,726	Bama
3	EYN/CAN Centre camp,	1,952	Gwoza, Askira, Chibok, Michika, Kukawa, Munguno, &Madagali
4	Farm Centre camp	4,500	Jere, Mafa, Dikwa, Kala balge, Konduga, Bama&Marte
5	Government College camp	9,479	Gwoza
6	Yerwa camp	6,200	Bama
7	Teachers Village camp	7,938	Kukawa
8	Bakassi camp	10,083	Munguno&Guzamala
9	National Youth Service Corp camp	4,425	Konduga, Bama&Damboa
10	Arabic Teachers College camp	12,835	Gwoza&Askira
11	MOGCOLIS camp	2,907	Abadan &Mobar
12	SandaKyarimi camp	5,711	Ngala, Dikwa, Mafa&Jere
13	Dalori camp	15,529	Bama
14	Fori SUBEB school camp	72	Bama
	Total	92,278	

Source: FHI360 (2015)

2.4 Factors Considered when Choosing Alternative Water Sources in an Emergency

The sphere handbook (2010) of UNHCR standards states that in choosing water systems in emergencies, careful account of locally existing systems and methods are to be noted. The adoption of well-proven familiar techniques combined with action to improve protection against pollution is a very sound solution [54,55]. Therefore the factors to be considered for siting emergency water sources include Speed of operation of the source, supply volume, Supply reliability putting into consideration seasonal variation and logistics, quality of the water as well as contamination risk, and ease of treatment if required, the population of the local people as well as their rights, the simplicity of technology as well as the ease of maintenance and relative cost comparison considering capital outlay and operation and maintenance expenditure [56-59].

A system of water supply is a combination of structures with the aim of extraction from the source, treatment/purification of the water, transmission to the camps or settlement via reticulation and distribution networks, and collection and storage by the households. The water supply system also takes into cognizance the disposal of wastewater. It is imperative to ensure the system components of the supply of water are compatible with each other and

appropriate given the supply and demand, and maintenance is easy from locally available resources and at the lowest possible overall (capital, operation, and maintenance) costs [60].

For an emergency, the water system will have to be planned, designed, constructed, and commence operation in a short time. This process will require involving the IDPs/refugees as much as possible. The process usually requires professional expertise which is usually sought at the commencement of the project. Long-term maintenance and operation requirement is put into consideration from the onset such as diesel, chlorine, new taps, and, maintenance personnel. (UNHCR 2010).

2.5 Water Pumping in Emergency

For water supply in IDP camps, pumping systems are usually required. Water is raised in two basic ways. By using hand via water container or bucket or using pumps which are driven by engines. Emergency water supply solutions involving pumps are designed to ensure long-term and effective operation [61-64]. Once an adequate water source has been found, arrangements are made to store and distribute the water to meet the minimum needs of the displaced people in the camps. The most preferred distribution system is gravity, gravity fed systems are much less costly and easier to maintain than pumping systems, but in a

refugee/IDP emergency, the sudden and large concentration of people requires the maximum output of available water. Motorized pumps have a far greater output and may, therefore, be indispensable [65-68]. Pumps are not to be operated for more than ~14 hours a day and preferably not be run at night. Always have a pump on standby in a major supply system to cover repairs and maintenance.

2.6 Water Treatment

The most serious threat to the safety of a water supply is contamination by feces. Water should only be treated to the extent necessary. Different types of water treatment include chemical disinfection, boiling, filtration, and sedimentation.

- a) Chemical Disinfection
- b) Boiling
- c) Sedimentation/Storage
- d) Filtration

2.7 Water Storage

The refugee sites have to be provided with adequate water storage as early as possible as well as facilities, and a distribution system at the camp and household level; Water storage may be the only means of ensuring constant availability of water to cover the needs of a camp population. The use of local technology in the design and construction of water reservoirs is highly encouraged. However, using prefabricated tanks may sometimes imply the only way available as an option to provide water quickly enough in emergencies in the initial phase such as large Ferro-cement tanks (45 to 90 m³).

2.8 Transportation of Water

Access to water for IDPs/refugees should ideally not be far from dwelling at least 200 meters or a few minutes work from distribution points. Distant distribution points from the study show that people tend to fetch inadequate quantities which increases their risk of getting water wash diseases or going closer to unsafe sources. The layout of the site should play a pivotal role when planning for a site. This will ensure protection concerns such as potential SGBV are mitigated as often, women; children are tasked with the weight of water collection.

2.9 Number of Taps Per Stand

One tap per 80-100 IDPs should be at least in place and no more than 200 IDPs per hand

pump or per well with one rope and bucket. The risk of pollution and damage increases with an increasing number of people per water stand. Whatever the final distribution system, this must be meticulously controlled and supervised.

2.10 Adequate Water Supply Need for IDPs

Survival for long is easier without food than without water. Water provision requires immediate attention from the start of an emergency IDP camp. This is to assure the availability of enough water to allow its effective distribution in the required quantities, and to ensure that it is very safe to drink and easily accessible. Enough storage capacity and backup systems for all water system components must be assured; interruptions in the supply may be disastrous. If it is evident that available sources are not sufficient (in terms of yield or water quality), arrangements must be made to find alternative sources.

3. METHODOLOGY

The study adopted is both a qualitative and quantitative research approach involving the use of the questionnaire, interview, and experiment. For this study, 12 major IDP camps were selected purposively out of 32 officially known camps in Borno State and are varied according to the number of residents in the camp. There are also over 200 unofficial IDP camps in the host communities. However, adopting the major camps purposively served the purpose of this research.

The study was carried out in Borno State. There are 27 Local Government Areas (LGAs) of which 21 LGAs have been displaced as a result of the insurgency. The State has Niger and Chad Republics located to its north, the Cameroun Republic to the east, Adamawa and the Gombe States to the southwest and Yobe State to the west. The most prominent economic activities in Borno majorly are livestock rearing, farming, and fishery. Also, in the state are tertiary educational institutions namely: the University of Maiduguri, Ramat Polytechnic, and Sir Kashim Ibrahim College of Education all in Maiduguri and College of Education, Bama. Borno state was studied because it has the highest number of camps/camp-like settlements with about 240. 16 IDP camps are officially known while others are



Fig. 1. Affected areas by conflict in North East Nigeria

Table 2. Population and communities with the IDP camps in Borno State

S/no	Name of camp	Camp location	No HHs	EST population	Source of displacement	GPS coord	visited Y/N	Qst administered
1	Girls secondary School camp	Maiduguri Municipal Council	1287	7726	Bama	N11.83225, E013.14010	Y	18
2	Farm Centre camp	jere	4,500	31,500	Jere, Mafa, Dikwa, Kala balge, Konduga, Bama&Marte	N11.86142, E013.21474	Y	67
3	Government College camp	Maiduguri Municipal Council	9478	56,868	Gwoza	N11.83515, E013.12718	Y	132
4	muna garage idp camp	Maiduguri Municipal Council	1033	6200	mmc	N11.83415, E013.11955	Y	20
5	Teachers Village camp	Maiduguri Municipal Council	1323	7938	Kukawa	N11.84307, E013.09869	Y	24
6	Bakassi camp	Maiduguri Municipal Council	1680	10083	Munguno&Guza mala	N11.79308, E013.11784	Y	29
7	NYSC camp	Maiduguri Municipal Council	738	4425	Konduga, Bama&Damboa	N11.82590, E013.11947	Y	16
8	MOGCOLIS camp	Maiduguri Municipal Council	485	2907		N11.84564, E013.14880	Y	13
9	SandaKyarimi camp	Jere	951	5711		N11.84984, E013.18254	Y	19
10	Dalori camp 1	Jere	2588	15529		N1177930, E013.22357	Y	41
11	zonal education IDP Camp	Biu LGA	342	1880	Mandaragrau, Buratai, Gur, kamuya		Y	13
12	muna el-badawey	maiduguri	1050	6302			N	0

S/no	Name of camp	Camp location	No HHs	EST population	Source of displacement	GPS coord	visited Y/N	Qst administered
	camp	municipal council						
13	transit camp	pulka	199	1194			N	0
14	Arabic Teachers College camp	Maiduguri Municipal Council	381	2284			N	0
15	primary school premises camp	damboa	2139	12835			N	0
16	Gubio Camp	MMC	481	2891			N	0
		Total	28,655	176,273				392

Source: FHI 360 (2016)

Table 3. WASH assessment on sources of water for HH drinking and domestic use

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	the current source of drinking water:	Truck	-	-
		Streams	-	-
		Sachet	44	13.4
		Well	21	6.3
		Borehole	266	80.3
		Total	331	100
2	the current source of water for domestic use and drinking	Truck	-	-
		Streams	-	-
		Sachet	26	7.9
		Well	18	5.5
		Borehole	287	86.6
		Total	331	100
3	Distance traveled by HHs to the closest source of drinking water	<10m	52	15.7
		20m	32	9.4
		30m	18	5.5
		>45m	229	69.4

S/N	Variable	Option	Frequency (No)	Percentage (%)
			Total	331
				100
5	Time taken to fetch water	< 10 min	29	8.7
		< 20 min	24	7.1
		< 30 min	60	18.1
		> 30 min	219	66.1
		Total	331	100
6	Is the water chlorinated	Yes	253	76.4
		NO	78	23.6
		Total	331	100
7	Source of Chlorination	Bucket Chlorination	60	18.1
		Water Source Chlorination	258	80.0
		Aqua tabs	13	1.9
		Total	331	100

Source: Field Survey, (2018)

Table 4. Laboratory result of the physical, chemical, and micro biological test

Physical and biological												
S/N	Sample	ODOUR	Colour CU	Turbidity mg/L	PH mg/l	Alkalinity mg/l	Cl mg/l	Cd mg/l	TH mg/l	TDS mg/l	Pb mg/l	NO ₂ mg/l
1	CAMP A	No	21	6	8.9	120	77	0	140	800	0	0.03
2	CAMP B	No	13	4	7.8	60	28	0	160	210	0	0.01
3	CAMP C	No	18	10	8.9	118	29	0.01	66	200	0	0.01
4	CAMP D	No	14	5	8.5	89	90	0	110	280	0	0.04
5	CAMP E	No	48	17	8.4	73	18	0.01	41	140	0	0.02
6	CAMP F	No	38	9	8.2	73	41	0.01	180	470	0	0.06
7	CAMP G	No	21	10	8.6	101	60	0	30	540	0	0.01
8	CAMP H	No	10	13	8.5	97	39	0	155	150	0	0.04
9	CAMP I	No	20	9	8.4	60	22	0	120	250	0	0.06
10	CAMP J	No	10	6	8.4	55	42	0	66	170	0	0.06
11	CAMP K	No	33	11	8.3	40	91	0	81	350	0	0.02
12	CAMP L	No	29	5	8.8	119	16	0	74	210	0	0.03

Microbiology				
S/N	Sample	Coliform (cfu/ml)	<i>E. coli</i> count (cfu/m)	<i>Pseudomonos</i> (cfu/m)
1	CAMP A	2	1	3
2	CAMP B	2	0	2
3	CAMP C	8	4	2
4	CAMP D	6	3	4
5	CAMP E	0	0	3
6	CAMP F	3	3	4
7	CAMP G	0	0	0
8	CAMP H	0	0	2
9	CAMP I	2	1	2
10	CAMP J	2	0	2
11	CAMP K	3	0	3
12	CAMP L	2	2	2

Source: Survey, 2018.

Table 5. Interpretation of laboratory result of the chemical test

S/N	Elements	Maximum limits for water	Health impact	Reference
1.	Odour	Unobjectionable		
2.	Colour	15 CU (clear and colorless)		
3.	Turbidity (mg/l)	5 NTU max		SMART SPECTROPHOTOMETER
4.	PH (mg/l)	6.5 – 8.5 max	Corrosive, acidity, and bases.	PH meter operation manual
5.	Alkalinity (mg/l)	100 max	Nausea, vomiting, hand tremors, muscles twitching, tingling in the extremities or face, and confusion.	AOAC, REVISION 2, 2007, SECTION 973, 42B(b)
6.	Cl (mg/l)	250 max	Hypertension	AOAC, REVISION 2, 2007, SECTION 973, 42B(b)
7.	Cd (mg/l)	0.003 max	Toxic to the kidney	AOAC, REVISION 2, 2007, SECTION 973, 42B(b)
8.	TH (mg/l)	100 max	Alzheimer's disease, diabetes, childhood, atopic dermatitis, kidney stones, etc.	AOAC, REVISION 2, 2007, SECTION 973 – 52
9.	TDS (mg/l)	500 max	Effects taste bitter, salty, or metallic	HANNA H19835, INSTRUMENT MANUAL WHO

S/N	Elements	Maximum limits for water	Health impact	Reference
10.	Pb (mg/l)	0.01 max	Concern interference with vitamin D metabolism affects toxic to the central and peripheral nervous system.	AOAC, REVION 2, 2007, SECTION 973, 42B(b)
11.	No ₂ (mg/l)	0.2 max	Cyanosis and asphyxia (blue – baby syndrome) in infants under 3 months	AOAC, REVION 2, 2007, SECTION 973, 42B(b)

Source: survey 2018 (NAFDAC)

Table 6. Water quality, risk, and priority levels interpretation

Fecal coli form level	No. of risks identified by sanitary survey	Risk level	Priority of intervention
0	0	Extremely low	None
1 to 10	1 to 3	Some pollution: low risk	Low
11-100	4 to 6	Polluted: intermediate to high risk	High
101-1000and above	>7	Very polluted: very high risk	Urgent

Source: Survey, 2018.

unofficial camps situated in Host communities within the state. Borno State was also selected based on the population of the IDPs which was estimated to be 1, 370, 880 people. Details of affected communities are shown in Fig. 1.

The study was supposed to be carried out in 16 officially registered IDPs as shown in Table 2 camps but 4 camps could not be accessed due to insecurity reports around the locations of these camps during the time of the study.

To determine the sample size from the population of 176,273, the Yamani (1973) Formula was used. Therefore, a total of three hundred and ninety-two (392) questionnaires were distributed to HHs across the 11 IDP camps visited. For the experiment, water samples were collected from 12 major camps. The water samples collected were sent to the NAFDAC Maiduguri laboratory for testing of the physical, chemical, and biological properties of the samples collected.

More so, a checklist was used to determine for physical inspection through a walkthrough survey. An observation of the WASH facilities and usage via Checklist was based on the UNHCR and SPHERE standard provision for WASH. This was done to physically assess the sanitation and water facilities in the IDP camp.

To collect data for the study, a multi-strategy approach was used because it allows the use of more than one method of sources to be used in collecting both primary and secondary data for a study. This enabled cross-checking of findings. The instruments which were applied in collecting the data for the study are, Observation via the use of a Checklist, experiments, and questionnaires. The questionnaire data collected for this study were subjected to statistical analyses using the computer-based software "Statistical Product and Service Solutions" (SPSS). The results of the analysis were represented in the form of a table for easy

comparison and clear expression of the findings. Relative importance indices (RII) were also used to rank common occurrences and their importance in the IDP Camps as well as suggestions for improvements in the sanitation situation of the camp.

4. DATA ANALYSIS AND PRESENTATION

4.1 WASH Assessment on Sources of Water for HH Drinking and Domestic Use

The result of the WASH assessment of the sources of water for use for both domestic and drinking purposes in the various camps is presented in Table 4. From the Table it can be deduced the current source of water in the camps is from Borehole as attested by 80.3% of the respondents. The same also applies to the source of drinking water in the camp (86.6%).

In line with the frequency of conducting turbidity test; turbidity test is usually conducted once in greater than 6 months. The research also sought to know the average distance closest to the source of drinking water in the camp. From the result of the analysis, it can be established that the closest distance was greater than forty-five (45) meters as attested by 69.4% of the respondents. However, only 15.7% of the respondents were of the contrary view that the closest distance was less than 10m from the camp. Reasons for these discrepancies can be traced to the nature of the settlement in the camps.

Also from Table 3, it can be deduced that the water is usually chlorinated as attested by 76.4% of the respondents however with regards to the source of the chlorination, it can be established that a larger percentage of the respondents affirmed that 'Water Source' (80.0%) is the major source of the chlorination of the water.

4.2 Laboratory Result of the Physical, Chemical, and Micro Biological Test

The Table 4 presents the result of the physical, chemical and Micro biological Test of the water samples taken from the various camps studied. The Table present information on the turbidity, PH, and Alkanity of the samples. From the result it can be established the average turbidity is 8.75, however, camps E and camps H where identify to have a high turbidity of 17 and 13 respectively. As it can be observed that those camp with low turbidity have a corresponding high Alkalinity. Details of the PH of the water from the various camps are as presented in the Table.

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The following is the summary of the findings:

- a) The performance of the sanitation installations in the camp from the research reveals that the most insufficient facility in the camp is the water facility (35.4%), this was closely followed by the toilet facilities (32.3%) while the waste management facilities (9.4%) is relatively sufficient. It also revealed that the major source of water in the IDP camps is from the INGOs.
- b) There is an inadequate performance concerning the current source of water in the camps which is from the borehole. The result of the findings in the study showed that a turbidity test is usually conducted but is usually done once in greater than 6 months. The result also reveals that the closest distance of the source of water to the household is usually greater than forty-five (45) meters as attested by 69.4% of the respondents. This outcome does not conform to the standard requirement as specified by the UNHCR and SPHERE hence the need for its performance to be increased.
- c) The chemical analysis of the water from the IDP camp revealed that concerning the pH value of the water there is a tendency that the water will be corrosive and acidic which can be toxic to the kidney.

5.2 Conclusion

Based on the findings, the following conclusions can be drawn:

- i) There is a gross insufficiency in the provision of water and toilet facilities in the IDP camps, this fact is proven from the result of the analysis of the respondents' opinions, the checklist result, and the plate/figure taken during the physical assessment of the IDP camps. There are also cases and records of illnesses like STDs, tuberculosis, and fever. The chemical result of the water concerning the pH value proves it tends to be toxic to the kidney.

5.3 Recommendations

The following are recommended:

- a) As opined by the respondents in the study provision of more water and toilet facilities are commensurate with the population of the people in the IDP camp.
- b) Use of ultraviolet rays can be considered for disinfection of water since chlorination is not consistent and can be expensive
- c) Attention should be given to the PH value of the drinking water as the chemical test on the water proves that it possesses a threat to the human kidney.
- d) Academicians should endeavor to extend their research to the IDP camps to proffer more solutions to the problems of the camps

CONTRIBUTION TO KNOWLEDGE

- a) A publication recently revealed that there is an increasing number of kidney-infected patients in the University of Maiduguri teaching hospital, the research revealed that there are some water samples collected from outside the camp where IDPs fetch water which revealed the presence of harmful chemicals. By inference, these chemicals pose a serious threat to human kidney

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. UNHCR. Fact sheet in Nigeria. Geneva, Switzerland: United Nations High Commissioner for Refugees; 2016.
2. UNHCR [handbook]; 2016.
3. Shrestha D, Cronin A. The right to water and protecting refugees, WATERLINES,

- water manual for refugee situations, programme and technical support section, UNHCR, Geneva. 2006;24(3): 12-14.
4. Barluet A. Boko Haram: la France effectue des vols de reconnaissance près du Nigeria. *Le Figaro*. 2015;4.
 5. BBC NEWS. Africa; 2015. Nigerian army "rescues nearly 300" from Sambisa Forest BBC News, Africa. Boko Haram HQ Gwoza in Nigeria's retaken; 2015.
 6. Dietrich K. When we can't see the enemy, civilians become the enemy: Living through Nigeria's Six-Year Insurgency. Centre for Civilians in Conflict; 2015. Available: www.civiliansinconflict.org
 7. Displacement tracking Matrix (DTM). Location assessment report. (As Of 31 December 2016); 2016.
 8. Dunn E; 2015. Available: <https://bostonreview.net/editors-picks-world/elizabeth-dunn-failure-refugee-camps> Available: <https://bostonreview.net/editors-picks-world/elizabeth-dunn-failure-refugee-camps>
 9. Durosaro I, Ajiboye S. Problems and coping strategies of internally displaced adolescents in Jos Metropolis, Nigeria. *Int J Humanit Soc Sci*. 2011;1(20): 256-262.
 10. Egbulefu T. Fight against boko Haram: The untold story of US involvement. Leadership; 2015.
 11. Gichunge C, Mutiso D, Brynjarsdottir J. Predictors of social support, physical health and mental health among food insecure internally displaced persons in Turkana, Kenya. *Confl Health*. 2020; 14(1):58.
 12. Osagioduwa E, Oluwakorede O. Management of internally displaced persons in Africa: comparing Nigeria and Cameroon. *Afr Res Rev Int Multidiscip J Ethiop*. 2016;10(1),40:193-210.
 13. European Parliament. African-led counter-terrorism measures against boko Haram; 2015.
 14. Feachem et al. Sanitation and disease. Health Aspects of Excreta and Wastewater Management. Wiley & Sons; 1983.
 15. Fesselet JF, Mulders R. Saline wells in Aceh. Waterlines 1995 Public health impact of the Rwandan refugee crisis: What happened in Goma. 24(3):5-8, in July 1994? *The Lancet* 2006;345(8946), 339-44.
 16. Guidelines for drinking water quality. 3rd ed. Vol. 3. Geneva: WHO; 2004.
 17. Harvey P, WEDC. Excreta disposal in emergencies: A field manual [draft]. Head. Dakar: Conflict Prevention and Risk Analysis Division, ISS. Institute for Security Studies; 2005
 18. J Hum Sec. —Defining human security, policy brief, 3P human security, partner for peace building; 2011.
 19. IOM. Displacement tracking Matrix (DTM) round II report in Nigeria; 2015.
 20. Ibrahim J. Misery of Nigerian refugees and internally displaced persons; 2014.
 21. Julia Kennedy-Darling, et al. The energy crisis of Nigeria: an overview and implications for the future. University of Chicago; 2008.
 22. Simonyan KJ et al. Biomass resources and bioenergy potentials in Nigeria; 2013.
 23. Matfess H. Nigeria is Winning the Battle with Boko Haram but it is still Losing the War. Quartz Africa; 2015.
 24. Kampala Convention. African Union economic, social and cultural council (ECOSOCC), secretariat. Afr Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa; 2009.
 25. Kangiwa H. National policy on internally displaced persons (IDPs) in Nigeria. Abuja: Federal Commissioner, National Commission for Refugees; 2012.
 26. Lacarin C, Reed B. Emergency vectors using chemicals. Water Engineering Development Centre (WEDC), Loughborough University; 1999.
 27. Ladan T. National framework for the protection of internally displaced persons (IDPs) in Nigeria: A paper presented at a workshop for Judges and Kadis on Refugee Law Organised by National Institute, Abuja, Nigeria; 2013.
 28. Lagneau L. 'Boko Haram': la France vadeployer un détachement de liaison et de contact au Cameroun'; 2015.
 29. National policy on internally displaced persons IDP Federal Republic of Nigeria; 2012.
 30. Ladan T. Overview of international and regional frameworks on international displacement: A case study of Nigeria. A Paper Presented at a 2-day Multi-Stakeholders Conference on International Displacement in Nigeria. Organised by the Civil Society Legislative Advocacy Centre, Abuja in Collaboration with IDMC and the

- Norwegian Refugee Council, Geneva. Held on November 21-23, 2011, at Bolton White Hotels, Abuja, Nigeria; 2011.
31. Nda-Isaiah J, Boko Haram PMB. Picks danjuma dangote resettle IDPs Leadersh. 2016;2.
 32. Nigeria weekly security report. Sec Anal, , Triple Canopy. 2015;6.
 33. Nigeria's burden of internally displaced persons Posted By: nick Uweruon. In: Starter S, editor; 2014.
 34. NRC. Nigeria: No end to internal displacement. Geneva: International Displacement Monitoring Centre (IDMC) Global Project; 2009.
 35. Oxfam. Guidelines for public health promotion in emergencies. Oxford, UK: OXFAM Publishers; 2003. Roberts L. Diminishing standards: how much water do people need? In: Forum: War and Water. IRC; 1998. Available: <http://www.icrc.org/web/eng/siteeng0.nsf/html/57JPL6>
 36. Baghri P, S, Reed B. Emergency sanitation: assessment and programme design. Harvey: Water Engineering Development Centre (WEDC), Loughborough University; 2002.
 37. Times P. Jonathan rejects foreign troops in the fight against Boko Haram. 2015;20.
 38. PSWG. IDP protection strategy 2015 in Nigeria; 2015.
 39. IOM. Internally displaced population falls in Mali. Press Release; 2016. Available:<https://www.iom.int/news/internally-displaced-population-falls-mali>
 40. OCHA. Nigeria: Northeast Crisis Situation Report No. 1; 2015.
 41. USAID. Nigeria – complex emergency: fact Sheet # 2, fiscal year (FY) 2015. Virendra K. Vijay” water scrubbing based biogas enrichment technology by lit Delhi” centre; 2015.
 42. Federal Republic of Nigeria. National policy on internally displaced persons (IDPs) in Nigeria; 2012.
 43. Ekpa S, Md Dahlan NH. Towards the evolution of right to reparation for loss of housing and property of internally displaced persons (IDPs) in Nigeria. *Mediterr J Soc Sci.* 2015;6:380-6.
 44. Shiro O. Freedom. 2007 from Fear and Wantll and —the Right to Live in Peacell, and —Human.
 45. Shrestha D, Cronin AA. The right to water & protecting refugees. *Waterlines.* 2006; 24(3):12-14.
 46. Sphere project. Humanitarian charter and minimum standards in disaster response, ISBN 92-9139-097-6; 2004.
 47. Rotimi O. IDPs in Nigeria and a call for urgent intervention, premium Times. 2015;28.
 48. Makhanu SK. 1and. G w Waswa2 [DPhil thesis]. Pretoria: University of Pretoria. “Biosan Latrine for Refugee Camps PAC Library System in selected consortia and libraries in the Southern African Region”: implications for the Lesotho Library Consortium; 2014.
 49. Dahunsi SO. Co-digestion of food waste and human excreta for biogas production. *BBJ.* 2013;3(4):485-99.
 50. Connolly MA, Gayer M, Ryan MJ, Salama P, Spiegel P, Heymann DL. Communicable diseases in complex emergencies: impact and challenges. *Lancet.* 2004; 364(9449):1974-1983.
 51. Schultz A. Outbreak of cholera in a Kenyan refugee camp: a case-control study of potential risk factors. Master of Science of public health thesis. GA: Emory University, Atlanta; 2006.
 52. Security. Institute of International Relations and Area Studies, Ritsumeikan University.
 53. Sherlock P. Water and sanitation for refugees and internally displaced people. *Waterlines.* 2006;24(3):2-4.
 54. UNHCR. Mali situation. Niger, Burkina Faso: Mali. UN Refugee Agency; 2013.
 55. UNHCR/WFP. UNHCR/WFP joint assessment guidelines and related reference documents. Geneva, Switzerland: United Nations High Commissioner for Refugees; 2004.
 56. SPHERE standard; 2012.
 57. UNHCR. Global refugee trends, statistical overview of populations of refugees, asylum-seekers, internally displaced persons, stateless persons, and other persons of concern to UNHCR; 2006a.
 58. UNHCR. Practical guide to the systematic use of standards and indicators in UNHCR operations. 2nd ed. Geneva, Switzerland: United Nations High Commissioner for Refugees; 2006b.
 59. UNHCR. Standing committee paper on Nutrition, Executive Committee of the High Commissioners’ Program, 36th Meeting of the Standing Committee. 2006c (EC/57. SC/CRP. Vol. 17).

60. Asabe HM, Mahya S, Emmanuel IN, Ribah MM, Fatai AA. Assessment of the latrine facilities and the health condition in IDP camps in Borno State. *Asian J Adv Res Rep.* 2022;16(8):33-44. Available:<https://doi.org/10.9734/ajarr/2022/v16i830490>
61. Wakili I. Buhari: We're compiling data for IDPs resettlement daily trust. Friday; 2016.
62. WHO. Indoor smoke from solid fuels: assessing the environmental burden of disease at national and local levels, ISBN 92 4 159135 8; 2002.
63. WHO. 'Communicable Disease Control in Emergencies': A field manual. Geneva, Switzerland: WHO; 2005.
64. Wikipedia free encyclopedia. African-Led International Support Mission to Mali; 2012. Available:<https://en.wikipedia.org/>
65. UNICEF. Emergency Field Handbook, A guide for UNICEF staff. New York: Office of Emergency Programmes, United Nations children's fund, ISBN: 92- 806-3860-2; 2005.
66. UNICEF. Emergency Field Handbook—a Guide for UNICEF staff. New York: United Nations Children's Emergency Fund; 2005a.
67. UNICEF. 2006: excluded and invisible. New York: United Nations Children's Emergency Fund. "The State of the World's Children; 2005b.
68. UNICEF. Nigeria humanitarian update on North East Nigeria. United Nations Development Programme (1994). Human development report; 2014.

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