



Assessment of Water, Sanitation and Hygiene Conditions in Selected Markets in Benin City, Nigeria

IMARHIAGBE, EE; *EGHOMWANRE, AF

Department of Environmental Management and Toxicology, Faculty of Life Sciences, University of Benin, Benin City, Nigeria

*Corresponding Author Email: frank.eghomwanre@uniben.edu, Phone: +2348078676606
Co-Author Email: esosa.imarhiagbe@uniben.edu

ABSTRACT: People selling and buying in the market environment could be vulnerable to preventable water, sanitation and hygiene (WASH) related diseases, but the market has been neglected in WASH-related research and policies, particularly in Nigeria. This study evaluates the water, sanitation and hygiene situation in selected markets in Benin City, Nigeria, using structured questionnaires and analysis of water samples by standard procedures. Data revealed that seventy-seven percent (n = 200) of the respondents had access to potable water with boreholes (83.5%) being the predominant source of water. Thirty-three percent (n = 200) lack access to potable water due to maintenance problems and resort to the use of sachet water. Seventy-nine percent of the participants had functional toilets with forty percent using the flush-to-sewer type, but sixty-six percent of the respondents lack handwashing facilities. Although the marketers do not drink the water from the market borehole, the pH of the water (4.6-5.7) fell below the recommended WHO standard for drinking water. It is therefore pertinent that sanitary enforcement agencies including market managers should create awareness of safe hygienic practices such as treatment of water and overall handwashing among the traders. Maintenance of boreholes and toilet facilities in the markets and timely provision of handwashing facilities such as soap should be the priority of policies that cover the delivery of WASH services in the markets.

DOI: <https://dx.doi.org/10.4314/jasem.v27i6.25>

Open Access Policy: All articles published by JASEM are open access articles under PKP powered by AJOL. The articles are made immediately available worldwide after publication. No special permission is required to reuse all or part of the article published by JASEM, including plates, figures and tables.

Copyright Policy: © 2023 by the Authors. This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution 4.0 International \(CC-BY- 4.0\)](https://creativecommons.org/licenses/by/4.0/) license. Any part of the article may be reused without permission provided that the original article is clearly cited.

Cite this paper as: IMARHIAGBE, EE; EGHOMWANRE, A. F. (2023). Assessment of Water, Sanitation and Hygiene Conditions in Selected Markets in Benin City, Nigeria. *J. Appl. Sci. Environ. Manage.* 27 (6) 1229-1235

Dates: Received: 17 May 2023; Revised: 08 June 2023; Accepted: 16 June 2023 Published: 30 June 2023

Keywords: Environmental sanitation; public hygiene; access to quality water; environmental management.

One of the necessities for the sustenance of well-being is unrestricted access to water, sanitation and hygiene (Yaya *et al.*, 2018). Globally, 2.3 billion people lack access to basic portable water while about 844 million individuals do not have access to sanitation facilities (WHO, 2017). This has resulted in approximately 842,000 deaths annually (WHO, 2017). Millions of people in developing nations depend on markets for affordable food and commodities and as a source of livelihood; hence it is a key determinant factor for economic prosperity, social and cultural well-being (World Vision, 2020). Despite the importance of the market, policymakers and researchers must prioritize the associated health risks. The market is one of the major public places described as a potential hotspot for disease

transmission. This is due to the high density of people, inaccessibility of quality WASH service and low capacity to enforce hygiene measures (Petrikova and Farlow, 2020). Lack of toilets and handwashing facilities could result in the contamination of foods and meat with pathogens associated with the faecal-oral route of transmission such as *Escherichia coli* and multi-drug resistant organisms by vendors (Harris *et al.*, 2016; Nadimpalli *et al.*, 2020). In Africa, approximately half of the population in urban centres is linked with poor access to water sanitation and hygiene (UNICEF, 2017). This has contributed to the spread and increased vulnerability to diarrheal and enteric diseases such as cholera, typhoid fever, and malaria (National Planning Committee, 2004). Generally, water sources in most of the markets in

*Corresponding Author Email: frank.eghomwanre@uniben.edu

urban centres in the sub-Sahara areas are borehole types (Price, 2019). Most of the implemented projects that brought about the installation of these boreholes in the market have been abandoned; hence lack of maintenance of the boreholes is a major challenge (Scanlon, 2016). The lack of sanitary facilities including portable water sources, bathrooms, toilets and disposal bins is associated with Nigerian markets. The attitude of assigned sanitary officers to monitor the markets for compliance is appalling as they are either non-functional or compromised. The overcrowding of markets in Nigeria occasioned by rural migration to urban centres could further strain the already stressed WASH facilities, thereby increasing the risk of transmission of diseases. Despite the health risks associated with poor WASH practices in the market, a lack of advocacy for major sanitation and hygiene improvement in the market could worsen the case. Inadequate knowledge of WASH and poor attitudes regarding WASH facilities are determinant factors of the prevalence of waterborne diseases in communities (Gebreeyessus and Adem, 2018; Berhe *et al.*, 2020). Gizaw (2019) found that awareness creation of WASH in communities was linked with significant improvement in WASH performance and a consequent decrease in the occurrence of parasitic-related intestinal infections. Therefore, an encompassing understanding of the water, sanitation and hygiene conditions in the market will help in targeting resources towards improving the market's sanitary infrastructures and establishing hygiene guidelines appropriate for each region. In Nigeria, studies on WASH have been centred on public places such as schools, motor parks, automobile spare-parts markets, hospitals and communities (Eneji *et al.*, 2015; Inah *et al.*, 2020; Olukanni *et al.*, 2021; Ugwu *et al.*, 2021; Onoh *et al.*, 2022; Imarhiagbe *et al.*,

2023), while there are paucity of WASH- related studies in markets in Nigeria, hence, the objective of this study is to evaluate the water, sanitation and hygiene situation in selected markets in Benin City, Nigeria.

MATERIALS AND METHODS

Study Area: Benin City is located in Edo state, in southern Nigeria. Its geographic location is latitudes 6° 11' and 6° 29'N, and longitudes 5° 33' and 5° 47'E. Benin City has an average elevation of 77.8m above sea level in the humid tropical rainforest belt of Nigeria. This study was conducted in four different markets namely Aduwawa, Oregbeni, Ekiosa and Oka markets at Ikpoba Okha Local Government area in Benin City. The markets are strategically located and host a Major Park for travellers to the Northern parts and Eastern parts of Nigeria. The markets have been in operation for decades and are located along major highways namely Benin-Agbor, Murtala Mohammed Road and Upper Sakponba Road, with heavy traffic congestion. The markets are owned and managed by the Edo State Government and consist of various buildings and kiosks where foodstuffs such as rice and beans are imported from other parts of the country and as well as locally grown food crops such as yams and vegetables are sold. They are an everyday market and open from 6 am to 10 pm daily. The markets experience high amounts of commercial activity which generates heaps of waste in the markets. There is a borehole which serves as the main source of water and a block of toilet for the traders. The boreholes and toilet facilities were provided by the Local Government authorities and managed by the leadership of the market unions.



Fig 1: Water and toilet facilities in the selected markets in the study area

Data Collection: The data for this study were obtained from the physicochemical analysis of water samples from the boreholes in the selected market and self-reported information was obtained from the respondents through a structured questionnaire survey. Physicochemical Analysis

Triplicate samples of water were collected from the borehole access point (tap) at the four selected markets and analysed using standard procedures for evaluating water quality parameters. The water samples were collected monthly for three months between February and April 2022. The pH and nitrate content of the water samples were analysed using calibrated bench Hanna pH meter and ultraviolet-visible spectrophotometry respectively. Questionnaire Survey.

A descriptive cross-sectional study was carried out using a structured questionnaire. Two hundred respondents mainly traders/vendors in the respective markets were selected randomly in the study area. Fifty questionnaires were administered in each of the markets. The questionnaires were pretested and the questions were clarified with additional explanations in pidgin and Bini language by the interviewers. Four interviewers, one per market were recruited and trained for questionnaire administration and data review after each day to discuss discrepancies and ensure uniformity throughout the study. The questionnaire consists of different sections such as Section A; socio-demographics of respondents, Section B; availability of water source and its location,

and Section C; Availability of toilet facilities and hygiene conditions in the markets.

Data Analysis: The data obtained were analysed using SPSS version 21.0. The pH and Nitrate levels of the obtained water samples from the markets were subjected to descriptive (mean and standard deviation). The questionnaire responses were analysed using descriptive analysis; frequency, percentages and charts.

RESULTS AND DISCUSSION

Socio-demographic Characteristics of Respondents:

The survey showed that the market was predominantly made up of female vendors with a percentage proportion ranging from 56 to 60% across the sampled markets (Table 1). The highest proportion of female vendors was reported in the Oka market while the lowest was found in Aduwawa site. The proportion of male participants was below fifty percent in all the markets except at Aduwawa market with 44% percent of men respondents. This is due to the dominance of the Hausa traders in this market. The age of the respondents was between 18-30 years in Oka and Ekiosa markets while respondents between 31 – 50 years were more at Oregbeni and Aduwawa markets. Of the 200 respondents, more than 30 percent across the sampled markets indicated that they had primary and vocational education while less than 10 percent had tertiary education. Table 1 also revealed that more than 60 percent of the respondents were married.

Table 1: Socio-demographics of respondents at the sampled markets (n = 200)

	Category	Frequency (%)			
		Oregbeni	Aduwawa	Oka	Ekiosa
Gender	Female	35(70)	28(56)	40(80)	35(70)
	Male	15(30)	22(44)	10(20)	15(30)
Age	18-30yrs	23(46)	15(30)	34(68)	31(62)
	31-50yrs	25(50)	29(58)	13(26)	15(30)
	>50yrs	2(4)	6(12)	3(6)	4(8)
Educational level	Primary	14(28)	19(38)	23(46)	34(68)
	Secondary	12(24)	4(8)	15(30)	10(20)
	Tertiary	4(8)	4(8)	4(8)	4(8)
	Vocational	15(30)	23(46)	8(16)	2(4)
Marital status	None	5(10)	0(0)	0(0)	0(0)
	Married	35(70)	32(64)	34(68)	35(70)
	Single	15(30)	18(36)	16(32)	15(30)

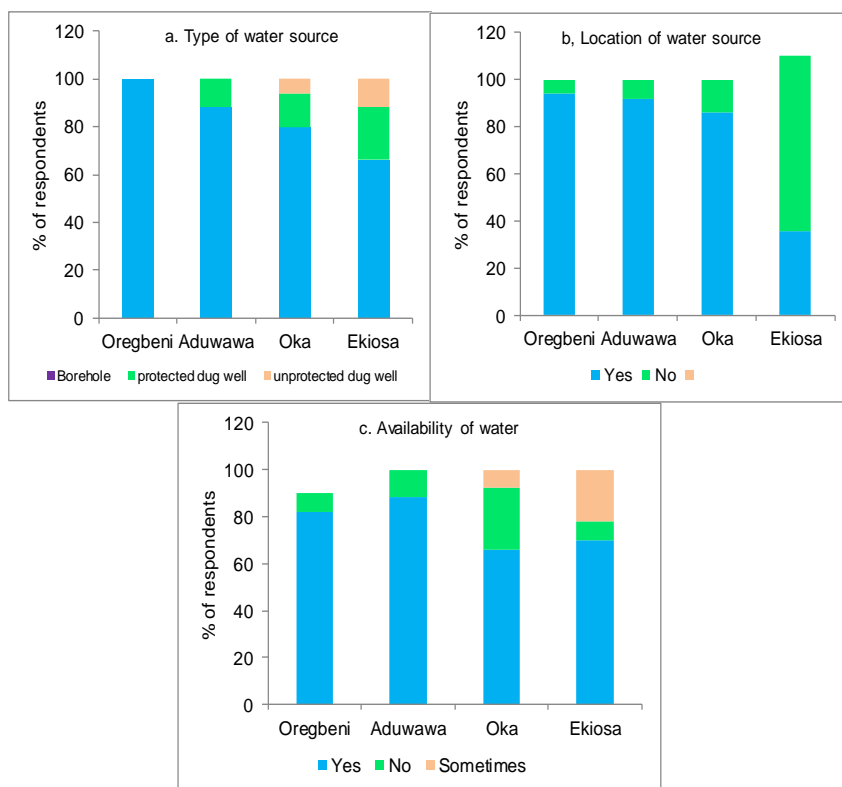
Source, Location and Availability of Water Supply in the Markets

One of the essential ingredients to practising good hygiene is regular access to portable and reliable water sources. Findings from this study revealed that all the markets have different sources of water supply. The predominant source of water across the markets was boreholes (83.5%) with taps as access points (Fig 2a). Only 77% of the respondents had access to water from the available water sources due to factors such as incessant power supply, and poor maintenance culture.

The traders often resort to sachet water for drinking and other purposes such as the washing of food items and other wares. The use of sachet water sometimes leads to storage and reuse of water due to the cost involved in its purchase. This unsafe practice is unhygienic and could lead to the transmission of pathogens. Abdalla *et al* (2009) reported that the reuse of water for washing food in the market could enhance the growth of bacteria and consequently food

contamination. This finding is similar to the reports of Mba *et al.* (2022) who found irregular use of boreholes due to poor management resulted in the purchase of water from hawkers and water tankers in markets across Anambra state, Nigeria. Scanion *et al.* (2016) also reported that borehole projects across sub-Saharan countries pose a challenge in terms of maintenance as most of the projects have been poorly managed or even abandoned in some cases. The use of protected dug well was reported in Aduwawa, Oka and Ekiosa markets while only respondents at Oka (14%) and Ekiosa (22%) markets indicated that they use unprotected dug wells (Figure 2b). Studies have shown that water from hand dug well especially the

unprotected type is unsafe for drinking and use for domestic purposes due to proximity to latrines and other sources of pollution (Ndububa and Idowu, 2015). More than 85% of the respondents at Oregbeni, Aduwawa and Oka markets reported that the major source of water supply is cited within the markets, but only 36% of the participants at Ekiosa indicate that they get outside the market premises (Figure 2c). This is far from the position of the World Health Organisation that adequate water sources should be void of pollutants and situated within a reasonable distance while being readily available when needed (Ishaku *et al.*, 2011).



: Fig 2: Type, location and availability of water at the water source

Toilet Facilities and Hygiene Practices in the Markets: Of the 200 respondents more than sixty percent reported that they have functional toilet facilities in the markets (Figure 3a). The highest proportion of respondents who reported that they have access to a toilet was at Oregbeni (82%) while 34% of the respondents at the Oka market reported the absence of functional toilets. Although the majority of the markets have functional toilets, we observed that the toilets were predominantly flush to the pit type. It was also observed that the latrines were not adequate considering the large numbers of patronage in the markets. This contradicts the WHO recommendation

of not more than 20 percent per toilet. Unsanitary toilets in marketplaces could promote an unhealthy environment for contamination displayed through direct contact with pathogens from faeces (Abdalla *et al.*, 2009). There were also reports of septic seepage in Aduwawa market which attracted flies, smelling odours and made food vendors uncomfortable. This finding is similar to the report of Love *et al.* (2021) who reported on the sanitary conditions of the Luganville market in Vanuatu. More than half of the respondents across the selected markets have separate toilets for males and females, while 32, 40, 42 and 24% of the respondents reported the absence of separate toilets at

Oregbeni, Aduwawa, Oka and Ekiosa markets respectively (Figure 3b). Figure 3c shows that less than fifty-five percent of the respondents reported that there is soap in the toilet for hand washing while 37% of the respondents in the Oregbeni, Aduwawa, Oka and Ekiosa markets indicated a lack of soap in the toilets. The lack of toilet facilities such as soap, toiletries and water for hand wash and flushing after use in these toilets could result in bad hygiene practices. Hygiene practices such as handwashing are not effectively practised among the vendors in these markets as users tend to return to the sales of their wares after use. This behaviour was also observed among toilet users in markets in Anambra states by Mba *et al* (2022). Some of the respondents also cited

money as one of the reasons hand washing facilities particularly soap were absent in the toilets as the market. This finding is similar to the report of Love *et al*, (2022). Market managers and other sanitation enforcement agents including market associations and local government officials should devise ways of raising funds to provide hand washing facilities and enforce its strict practice among the traders. The flush-to-pit type of toilet was reportedly predominant in Oregbeni and Aduwawa markets, while 70 and 80% of the respondents indicated that they use the flush-to-sewer toilet in Oka and Ekiosa markets respectively (Fig 3d). Only 2% of the respondents use the pit latrine in 75% of the markets surveyed.

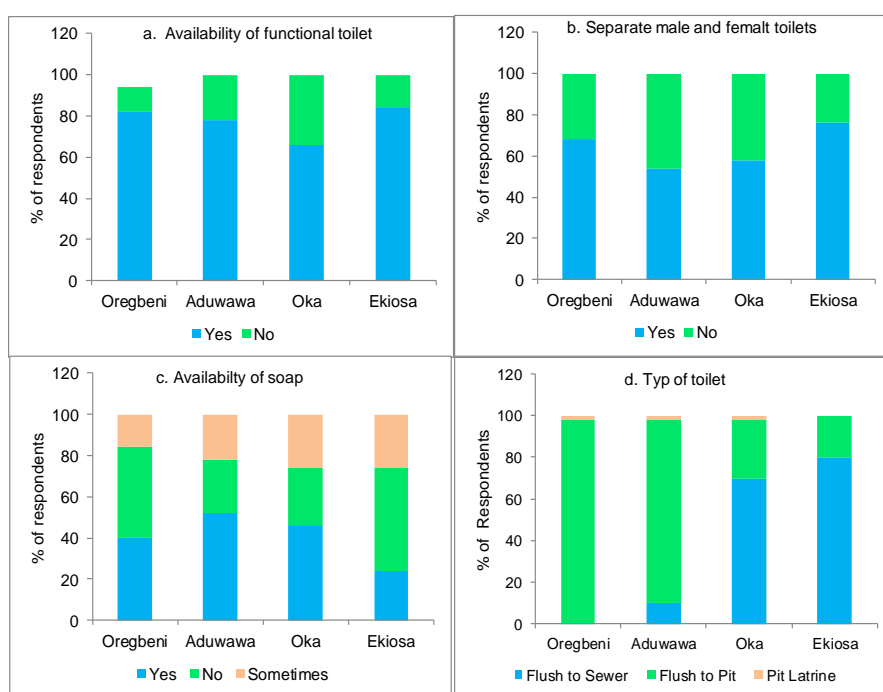


Fig 3: Types and availability of functional toilets and facilities in the markets

pH and Nitrate Levels of Water from the Market: Figure 4 presents the level of pH and nitrate in the water collected from the selected markets in the study area. The pH of the water ranged from 4.6 – 5.7 across the locations. The highest pH was observed at Aduwawa while the lowest was recorded at Ekiosa market. The pH range of water obtained from the markets suggested that the water was slightly acidic and did not fall within the WHO-recommended acceptable limits for drinking water (7.0 – 8.5) (Onoja *et al.*, 2017). A low pH of less than 6.5 could result in the discontinuation of the formation of vitamins in the

human body when consumed (Sudarshan *et al.*, 2019). Although water from the borehole is not utilised for drinking, it is used for other purposes such as washing hands, food and bathing. The concentration of nitrates in the obtained water varied between 1.3 mg/L and 3.0 mg/L, with the highest level of nitrate observed at Ekiosa market while the lowest was at the Oregbeni site. The observed nitrate level of the analysed water samples was below 50mg/L which is the minimum acceptable nitrate level in drinking water according to WHO (Brhane, 2016).

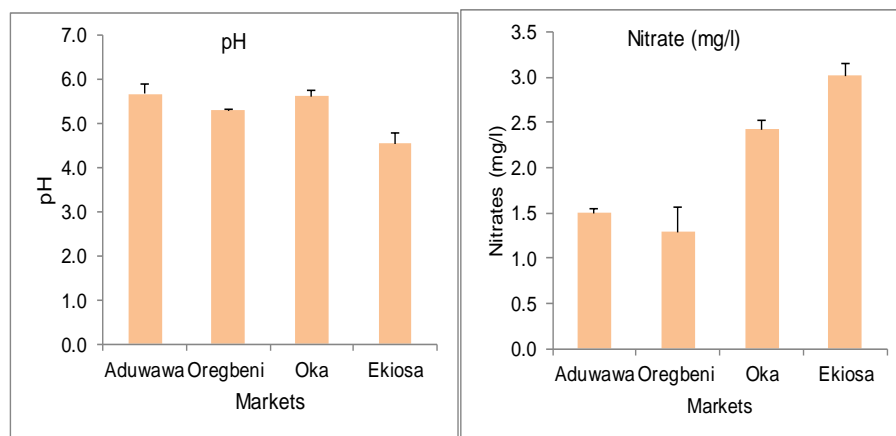


Fig 4: pH and Nitrate level of water in the sampled markets

Conclusion: Although water and toilet facilities were reportedly available in most of the sampled markets in this study, it was observed that these facilities were inadequate. There was also a reported lack of hand washing facilities and non-compliance of water quality with the recommended regulatory standards. It is therefore pertinent that sanitary enforcement agencies including market managers should create awareness of safe hygienic practices by traders and regularly visit the water source and toilets for prompt maintenance and provision of hand washing facilities when necessary.

Acknowledgement: The authors acknowledge the traders, market managers and local Government authorities for their cooperation during this work.

REFERENCES

- Abdalla, MA; Suliman, SE; Bakhiet, AO. (2009). Food safety knowledge and practices of street-food vendors in Atbara City (Naher Elneel State Sudan). *Afric. J. Biotech*, 8(24): 6967-6971.
- Berhe, AA; Aregay, AD; Abreha, AA; Aregay, AB; Gebretsadik, AW; Negash, DZ; Gebreegziabher, EG; Demoz, KG; Fenta, KJ; Mamo, NB. (2020). Knowledge, Attitude, and Practices on Water, Sanitation, and Hygiene among Rural Residents in Tigray Region, Northern Ethiopia. *J. Environ. Public Health*. <https://doi.org/10.1155/2020/5460168>.
- Brhane, GK. (2018). Characterization of hydrochemistry and groundwater quality evaluation for drinking purposes in Adigrat area, Tigray, northern Ethiopia. *Water Sci*, 32(2):213–29.
- Eneji, CVO; Eneji, JEO; Asuquo, I; Ubom, BAE. (2015). Water, sanitation and Hygiene (WASH) in community disease control in Cross River State, Nigeria. *Int. J. Environ. Sci, Toxicol. Res*, 3(9):173- 181.
- Gebreeyessus, GD; Adem, DB. (2018). Knowledge, Attitude, and Practice on Hygiene and Morbidity Status among Tertiary Students: The Case of Kotebe Metropolitan University, Addis Ababa, Ethiopia, *J. Environ. Pub. Health*, Article ID 2094621:9 <https://doi.org/10.1155/2018/2094621>
- Gizaw, Z; Addisu, A; Dagne, H. (2019). Effects of water, sanitation and Hygiene (WASH) education on childhood intestinal parasitic infections in rural Dembiya, northwest Ethiopia: an uncontrolled before and after intervention study. *Environ. Health Prev. Med*, 24:16.
- Harris, AR; Pickering, AJ; Harris, M. (2016). Ruminants contribute to faecal contamination in the urban household environment in Dhaka, Bangladesh. *Environ. Sci. Technol*. 50:4642–4649.
- Imarhiagbe, EE; Oriakhogba, E; Osayande, AG. (2023): Assessment of water, sanitation and hygiene (WaSH) status and water qualities using physicochemical and bacteriological indices at automobile spare-parts Markets in Benin City, Nigeria. *Afri. Scientist* 24 (1): 105 -113
- Inah, A; Ntekim, VE; Nji, EL; Egbonyi, DL; Mbotto, FE. (2020). Assessment of Water Supply and Sanitation Facilities in Public Primary Schools in Calabar South Local Government Area, Cross River State, Nigeria *Simon N.Y. Sci. J*, 13(7):43-51
- Ishaku, H.T; Majid, M.R; Ajayi, A.A; Haruna, A. (2011). Water Supply Dilemma in Nigerian Rural Communities: Looking Towards the Sky for an Answer. *J. Water Resour. Prot*, 3:598–606.

IMARHIAGBE, EE; EGHOMWANRE, A. F.

- Love, M; Kotra, KK; Souter, R. (2021). *WASH in the market house: A situation analysis of water, sanitation and hygiene services in market places in Vanuatu*. International Water Centre, Griffith University, Nathan, Queensland, Australia / The University of the South Pacific, Emalus Campus, Port Vila, Vanuatu. Pp 36-43.
- Mba, SA; Obikwelu, MC; Obienusi, E (2022). Assessment of the Basic Sanitation Facilities in the Major Markets of Anambra State, Nigeria. *J. Soc. Sci. Humanit*, 7(2):89
- Nadimpalli ML, Marks SJ, Montealegre MC. (2020). Urban informal settlements as hotspots of antimicrobial resistance and the need to curb environmental transmission. *Nat. Microbiol.*5:787–795.
- National Planning Commission (2004). National economic and development strategy. Nigerian National Planning Commission, Abuja.
- Ndububa, OI; Temitope, I. (2015). Sanitary risk assessment of domestic hand-dug wells in Yelwa-Tudu, Bauchi State of Nigeria. *Int. Res. J. Public and Environ, Health*, 2(8):102-111.
- Olukanni. DO; Iyiola, DO; Esu, CO (2021). Water, Sanitation and Hygiene Practices in Ogun State: Impacts and Implications for Post-COVID-19, 2021 IOP Conference. Series.: Mater. Sci. Eng. 1036:012001
- Onoh V, Imarhiagbe E; Ekhaise F. (2022) Improving water, sanitation and hygiene (WASH) services in primary health care facilities in Edo State, Nigeria: A call for action. *Afri. J. of Rep. Health*, 26 (9):13-20
- Onoja, S; Isikwue, M; Malum, J (2017). Physico-chemical characterization of groundwater of Kaltungo, Gombe state, Nigeria and treatment for fluoride removal. *Nigerian J. Technol*, 36(2):655–62.
- Petrikova, I; Cole, J; Farlow A. (2020). COVID-19, wet markets, and planetary health. *Lancet Planet. Health*, 4: e213–14.
- Price, H; Adams, E; Quilliam, RS. (2019). The difference a day can make: The temporal dynamics of drinking water access and quality in urban slums. *Sci. Total Environ*, 671:818–826.
- Scanlon, T; Uguru, O.P; Jafry, T; Chinsinga, B; Mvula, P; Chunga, J; Zimba, LM; Mwape, M; Nyundo, L; Mwiinga, B. (2016). The role of social actors in water access in Sub-Saharan Africa: Evidence from Malawi and Zambia. *Water Resour. Rural Dev*, 8:25–36.
- Sudarshan, P; Ramachandra, T. (2019). Assessment of seasonal variation in water quality and water quality index (WQI) of Hebbal Lake, Bangalore, India. *Environ Ecol*, 37(1b):309–17.
- Ugwu, MC; Onyekwelu, CM; Morikwe, UC; Ezejiegu, KC. (2021). "Bacterial Contamination of Mobile Phones of University Students in Eastern Nigeria: Hand-Phone Hygiene Practices Among Students and Antibigram of Bacterial Contaminants." *J. Antimicrob. Agents*, 7: 1:1-4
- UNICEF (2017). Africa to drastically accelerate progress on water, sanitation and hygiene <https://www.unicef.org/senegal/en/press-releases/africa-drastically-accelerate-progress-water-sanitation-and-hygiene-report> (Accessed March 19, 2023)
- World Health Organisation, (2017). *Guidelines for drinking-water quality*, 4th edition, incorporating the 1st addendum. Geneva, Switzerland: World Health Organization; 2017. (Accessed February 2023).
- World Vision (2020). COVID-19 Impact Assessment, October – November 2020. (Internal report). Prepared by Elsie James and World Vision Vanuatu, Port Vila.
- Yaya, S; Hudani, A; Udenigwe, O; Shah, V; Ekholuenetale, M; Bishwajit, G. (2018), Improving water, sanitation and hygiene practices, and Housing quality to prevent Diarrhea among under-five children in Nigeria. *Trop. Med. Infect. Dis*, 3:41