

## ASSESSMENT OF SACHET WATER QUALITY AND CONSUMER PREFERENCES IN IKPOBA-OKHA LOCAL GOVERNMENT AREA, BENIN CITY, NIGERIA.

<sup>\*1</sup>Oseghale, Omosefe Edith; <sup>1</sup>Imelda Iyorah-Elliot, <sup>2</sup>Odigie Precious Ekihalo

<sup>1</sup>Department of Environmental Management and Toxicology, Faculty of Life Sciences, University of Benin, PMB 1154, Benin City, Nigeria

<sup>2</sup>Department of Environmental Science and Resource Management, Faculty of science, National Open University of Nigeria.

Correspondence: Oseghale, Omosefe Edith,

Department of Environmental Management and Toxicology, Faculty of Life Sciences, University of Benin, PMB 1154, Benin City, Nigeria

E-mail: [edith.oseghale@uniben.edu](mailto:edith.oseghale@uniben.edu)

DOI: <https://doi.org/10.5281/zenodo.15681563>

### Abstract

*Sachet water plays a vital role in providing accessible and affordable potable water to low-income populations, particularly due to its widespread accessibility. This study aimed to evaluate the quality of sachet water and investigate consumer preferences within the selected local government area. Using a convenience sampling approach, 100 questionnaires were randomly administered across various locations to capture consumer insights. A mixed-methods approach, combining descriptive and experimental analyses, was employed to ensure a robust assessment of both qualitative and quantitative data. The study effectively evaluated the physicochemical properties of three leading sachet water brands available in the area, offering a comprehensive overview of their quality and consumer acceptance. The analysis revealed that the pH levels of all sachet water samples ranged from 6.98 to 7.0, aligning with the permissible limits established by the World Health Organization (WHO). Similarly, other physicochemical parameters, including electrical conductivity, total dissolved solids, dissolved oxygen, turbidity, salinity, and total suspended solids were all within the acceptable standards set by WHO. These findings demonstrate that the examined sachet water brands conform to internationally recognized safety benchmarks. However, the study underscores the critical need for enhanced quality control measures within the sachet water industry to ensure the protection of public health. It recommends routine regulatory inspections, mandatory medical screening for producers, and transparent reporting of violations. Furthermore, the study contributes to the broader discourse on equitable access to safe drinking water, emphasizing the pivotal role of consumer education and public awareness in promoting informed choices and improving health outcomes.*

**Keywords:** Sachet water quality. Consumer preference, Physicochemical properties

### INTRODUCTION

Access to safe drinking water is crucial for health and sustaining life, requiring a sufficient, safe, and accessible supply for all. An average adult (53–63 kg) needs approximately 3 litres of water daily from liquids and food to maintain well-being (Okorafor *et al.*, 2012). Water is vital to human survival, as one can live longer without food than without it (Popkin *et al.*, 2010, Dargaville *et al.*, 2022). Water is essential for drinking, cooking, washing, agriculture, and industrial activities. This undeniable reality explains why water is considered an essential element for life. Water may seem abundant, but access to clean, drinkable water remains limited (UNWWAP, 2023). “Most of the human body is made up of water, with an average of roughly 60%,

in addition, the amount of water in the body can change slightly with age, sex, and hydration levels” (Chan *et al.*, 2016, Sissons, 2020). The World Health Organization (WHO, 2003) reports that 88% of global diarrhoeal illnesses result from the consumption of unsafe drinking water, affecting over 1.1 billion people worldwide. While progress has been made in improving access to potable water, many populations particularly in developing countries still face significant barriers (WHO, 2019). Ideally, drinking water should be colourless, tasteless, and odourless, yet it is often contaminated by physical, chemical, or microbial pollutants (Singh *et al.*, 2003; Cabral, 2010).

In Nigeria, outbreaks of waterborne diseases remain a public health concern. For instance, a cholera

outbreak in Lagos State in June 2024 resulted in over 1,661 cases and 58 deaths, marking the country's largest recorded outbreak to date (UNICEF, 2024). In response to increasing demand and limited access to municipal water supplies, sachet water commonly referred to as “pure water” has emerged as a popular alternative for many Nigerians (Kwakyie-Nuako *et al.*, 2007). Sachet water production has experienced explosive growth over the past two decades. In urban centres such as Benin City, thousands of small- to medium-scale sachet water producers operate, often without formal registration or quality monitoring. A study by Olumide and Olayemi (2020) identified over 200 registered sachet water companies in Lagos State, Nigeria alone, with an estimated daily production exceeding 3 million sachets. However, informal producers far outnumber those licensed by the National Agency for Food and Drug Administration and Control (NAFDAC), leading to a saturated market with inconsistent quality standards. The relatively low production cost, high consumer demand, and weak enforcement of existing regulations have incentivized mass production, especially in peri-urban and densely populated neighborhoods. In Benin City, Edo State, sachet water remains the most consumed source of drinking water, particularly in low-income communities where access to piped water is minimal. Despite state-level efforts to monitor water quality, gaps in enforcement mean that many producers operate with limited oversight, relying on borehole sources that may themselves be contaminated. However, the rapid expansion of the sachet water industry, fuelled by its profitability, has raised serious concerns about quality and safety. Inadequate treatment procedures and weak regulatory oversight have led to the widespread distribution of substandard products, posing health risks to consumers (Obadare, 1995; Solomon *et al.*, 2018). This study aims to evaluate the quality of sachet water brands sold in Benin City, Nigeria, and to explore consumer preferences in choosing one brand over another.

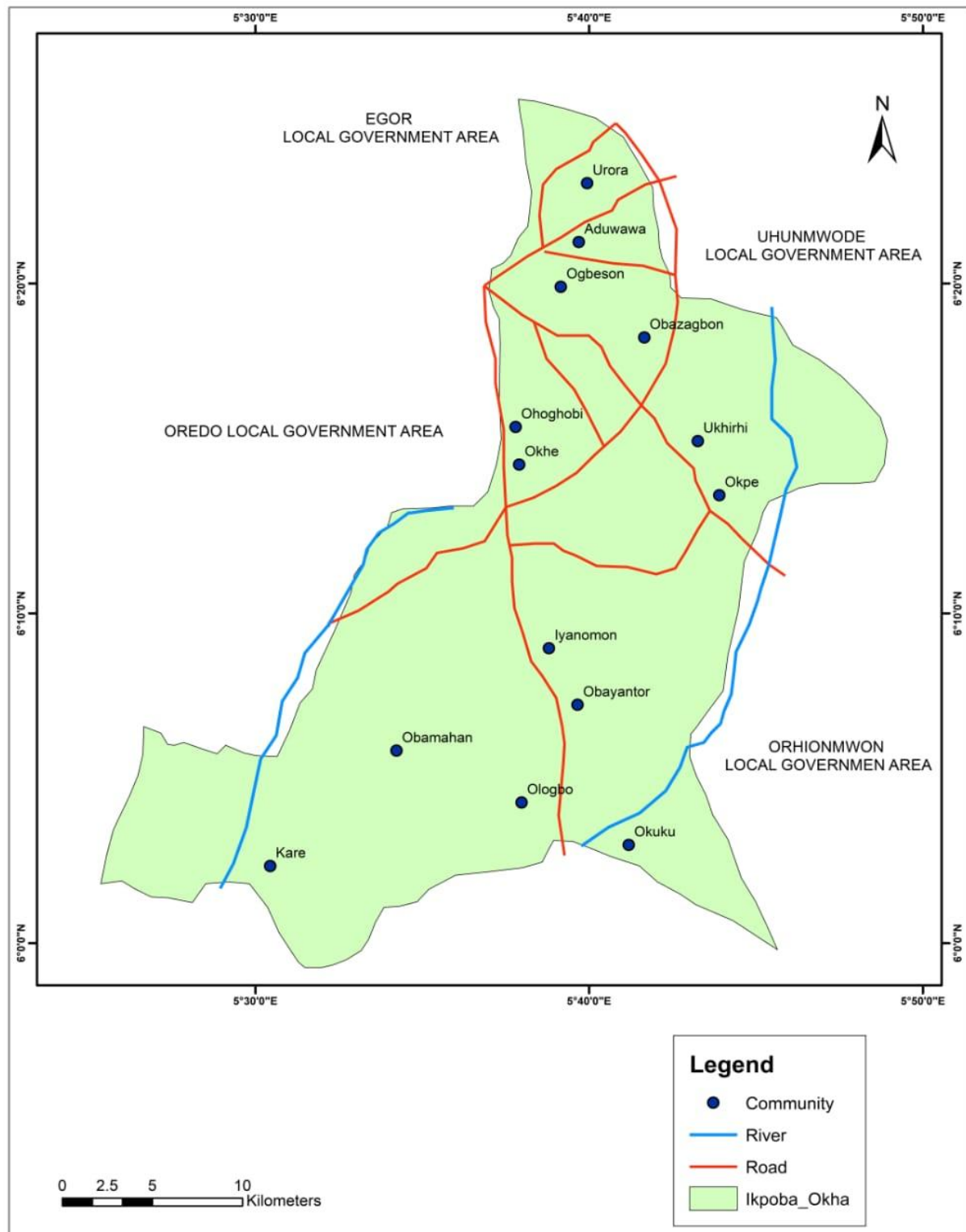
## METHODS AND MATERIALS

### *Study Area*

The study was carried out in Ikpoba-Okha Local Government Area (LGA), with its administrative headquarters in Idogbo, which is situated in Edo South Senatorial District of Edo State as can be seen on Figure 1. It is bordered by Oredo, Ughunmwon, and Orhionmwon LGAs. According to the 2006 National Population Census of Nigeria, it had a population of approximately 37,106. With a growth rate of 2.6%, the projected population as at 2025 is approximately 60,495 (Authors Projection, 2025). It consists of a number of political wards such as; Ologbo, Ogbesun, Urora (Evbuomodu), Utte, Aduwawa, etc., as can be seen on Figure 1 (Obiaks, 2019). The villages and quarters in Ikpoba-Okha Local Government Area are majorly populated by the binis. The local economy is primarily driven by farming, trade, and arts and crafts. There is a wide range of healthcare facilities, including private hospitals, clinics, health centers, and maternity homes, spread across the area. Christianity is the predominant religion, alongside the practice of traditional beliefs (Obiaks, 2019).

### *Methods*

The survey and experimental research design was employed in the carrying out the research, while the convenience sampling technique was utilised for the selection of the target population. Consequently, respondents were selected through a non-probability sampling strategy that which was utilized for the study based on the availability and willingness of respondents to participate in the survey. A total of 100 questionnaires were randomly administered across various locations within the local government area in order to ascertain reasons for consumer's preferences for different brands. Questionnaires were administered to respondents who were 18 years and above and was divided into three sections.



**Figure 1: Ikpoba Okha, showing study area**

*Source: Ministry of Lands and Survey, Edo State.*

Section A consists of respondent's personal information, section B consists of sachet water characteristics, while section C consist of appraisal, with check boxes to elicit answers from respondents. The study utilised both descriptive and experimental methods in order to carefully observe and test the

sachet water samples and to understand their physical and chemical qualities.

#### ***Physicochemical analysis***

Three popular sachet water brands were collected from various sales points in Benin City and labelled as samples 1, 2 and 3. The various water brands collected were taken to the laboratory and the

physico-chemical properties were analysed, to ascertain the Hydrogen determination (pH), Electrical Conductivity (EC), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Turbidity (NTU) and salinity. Measurement of pH was determined using an automatic digital pH meter, which was calibrated with standard buffer solutions. The glass electrode was rinsed with distilled water and immersed in the water sample until the reading stabilized. The pH value was recorded. Electrical Conductivity and Total Dissolved Solids (TDS) was measured using a digital conductivity/TDS meter which was calibrated with a 0.01N Potassium chloride solution. The sensors were immersed in the water sample, and the readings were noted. Turbidity was measured using the Nephelometric method, where the intensity of scattered light by the sample was compared to a standard reference suspension. A Jenway-6035 Turbidity meter was calibrated with distilled water and standard solutions of 100 NTU and 40 NTU before measuring the sample's turbidity in Nephelometric units. Dissolved Oxygen (DO) was measured using a JENWAY-3405 dissolved oxygen meter, which was used to measure DO directly on-site by immersing the probe in the water sample and recording the readings. Total Suspended Solids (TSS) was measured using a 100ml water sample, which was passed through an ash-free filter paper

and the filtered sample was placed in a platinum dish, dried in an oven at 100°C, and reweighed to determine the TSS.

## RESULTS AND DISCUSSION

In developing countries such as Nigeria, access to clean water source is a challenge. Packaged water commonly referred to as pure sachet water has emerged as a significant drinking water source (Guzmán & Stoler, 2018). This study looked at what influenced customers choice on the brand of sachet water they purchased and consumed and its quality. Table 1 depicts the socio-demographic characteristics of the respondents, showing that 33% were female and 67% were male. This distribution may suggest that a greater proportion of sachet water consumers or at least those who participated in the study were men. This gender disparity could imply that men in the surveyed areas may play an active role in household or personal decisions regarding the purchase of sachet water, particularly in urban settings where traditional gender roles are evolving but still influential (Afolabi & Dada, 2010). It is also possible that men were more available or willing to participate in the survey, a trend often observed in field studies conducted in public spaces or during working hours (Ajayi & Olanrewaju, 2014).

**Table 1: Socio-Demographic Data of Respondent**

Characteristics	Categories	Frequency	Percentages
Gender	Male	67	67%
	Female	33	33%
Age	Under 20	24	24%
	21 -40	36	36%
	41- 50	19	19%
	51-60	21	21%
	Students	64	64%
Occupation	Trader	12	12%
	Farmer	2	2%
	Public Servants	9	9%
	Others	13	13%

**Source: Field work, 2024**

The age distribution of respondents (Table 1) indicated that 24% were under 20 years, 36% were aged 21–40, 19% were aged 41–50, and 21% were aged 51–60. The findings suggest that younger respondents (under 20–40 years) represented the majority of sachet water consumers. This trend may be attributed to their involvement in physically and mentally demanding activities such as schooling, job hunting, or full-time employment, which increases water requirements and encourages more frequent

water intake (Popkin et al., 2010). Furthermore, the convenience, portability, and affordability of sachet water make it especially appealing to younger and itinerant individuals in urban environments (Olusegun et al., 2015).

On the other hand, respondents aged 41–60 years consumed comparatively less sachet water, which could be due to age-related physiological changes, including reduced thirst sensitivity, slower metabolic rates, and decreased physical activity

levels (Kenney & Chiu, 2001; Begum et al., 2010). Aging is also associated with a decline in renal function and a diminished ability to concentrate urine, which influences fluid consumption patterns and can result in lower water intake among older adults (Manz & Wentz, 2005). The occupational distribution (Table 1) was categorized into students, traders, farmers, public servants, and others. The majority of respondents were students at 64%, followed by traders at 12%, farmers at 2%, public servants at 9%, and those whose occupations could not be determined at 13%. The high percentage of students may be attributed to their increased mobility, active lifestyles, and limited access to alternative sources of potable water, especially within school campuses or hostels. Sachet water offers an affordable and accessible option to meet their hydration needs (Dada, 2009; Olusegun et al., 2015). Additionally, many educational institutions in

urban centres such as Benin City lack centralized drinking water systems, making sachet water a default choice for students (Oyebode et al., 2012). Traders (12%) also constitute a notable portion of consumers. Their frequent outdoor activity and exposure to heat during market hours necessitate regular water intake, for which sachet water is a convenient option (Oloruntoba et al., 2013). Farmers, who represented only 2% of respondents, likely constituted a smaller portion due to the urban-focused nature of the study, as farming populations are typically located in more rural or peri-urban settings. Public servants (9%) and those in the "others" category (13%) which may include artisans, unemployed individuals, and informal workers demonstrate that sachet water consumption cuts across different socio-economic groups, although affordability and accessibility remain primary drivers.

**Table 2: Respondents' Preferences of a Particular Brand of Sachet Water**

	Sample A	Sample B	Sample C	Other brands
General public preferred brand	9%	13%	76%	2%
Individual preferred brand to consume	19%	25%	56%	
<b>Reasons of choice</b>				
Have taste	5%	2%	6%	
Perceived odour	5%	6%	7%	
Presences of physical particles	----	2%	-----	
Others (Price, Availability, Packaging)	9%	13%	76%	

**Source: Field work, 2024**

Respondents showed distinct preferences for certain brands of sachet water, as illustrated in Table 2. Nine percent of the respondents identified sample A as the least consumed brand in the study area, while 13% preferred sample B, 76% favored sample C, and 2% chose other brands. When asked about individual brand preferences, 56% of respondents preferred sample C, 25% favored sample B, and 19% chose sample A. Regarding the reasons for selecting a particular brand, 2% of respondents noted that sample B contained physical particles. In terms of taste and odor, 6% and 7% of respondents rated sample C, while 2% and 6% rated sample B, and 5% and 5% rated sample A, respectively. Overall, 9% of respondents preferred sample A, 13% preferred sample B, and 76% preferred sample C, primarily due to its price, availability, and packaging. The three sampled sachet water in this study are relatively cheap, which makes it more attractive to

low-income earners, students, and traders. However, in terms of availability and packaging it was observed that sample C was widely distributed in the study area and easy to find across schools, markets, and residential areas. Its consistent supply made it more reliable. Packaging, the leak-proof, double-sealed sachets with clear labels showing production date, NAFDAC number, and contact details boost consumer trust. These factors gave sample C a clear market edge. It also elicits the need for producers to focus on low cost, strong distribution, and good packaging as this can drive consumer preference and increase sales. The reasons for the preference of sachet water align with those reported by respondents in Plateau State, Nigeria, and the Bono region of Ghana (Miner et al., 2014; Addo et al., 2020). Key factors influencing these preferences include the relative cost, availability, and packaging of the product.

**Table 3: Sachet water quality assessment**

Characteristics	Categories	Frequency	Percentages
Have you perceived any odour in any of these sachet water?	Yes	-	-
	No	82	82%
	I can't say	18	18%
Have you observed the presence of physical particles inside any of these sachet water	No	52	52%
	Yes	2	2%
	I can't say	46	46%
Aware that sachet water ought to have an expiry date?	Yes	75	75%
	No	25	25%
Do you check for the expiry date of any of the sachet water before drinking?	Yes	12	12%
	No	18	18%

**Source: Field work, 2024**

As presented on Table 3, a visual inspection was conducted to assess the compliance of sachet water with safety standards. The results showed that 82% of respondents reported no noticeable odor in the sachet water samples, while 18% were uncertain. Regarding the presence of physical particles, 52% indicated none were observed, 2% confirmed their presence, and 46% were unsure. These findings imply that consumers generally understand the potential health hazards associated with drinking water that has an unpleasant odor or visible impurities, recognizing that such characteristics could make the water unsuitable for safe consumption. It also indicates that 75% of respondents were aware that sachet water should carry an expiry date, while 25% lacked this awareness, often attributing it to their haste to

quench thirst without inspecting the packaging. When asked about their habit of checking for expiry dates before consumption, only 12% reported doing so, whereas a significant 88% admitted they either do not know about it or do not bother to check. Existing literature emphasizes the critical role of monitoring expiry details such as "Best Before" dates and batch codes as essential for safeguarding public health, in line with regulatory standards. The findings of this study, however, raise concern, as many consumers appear to overlook this important precaution. This highlights the urgent need for public awareness and education on the importance of checking expiry information before purchasing sachet water.

**Table 4: Analysis of sachet water sample**

Parameters	Sample A	Sample B	Sample C	WHO, 2004
pH	6.98	7.00	7.01	6.5-8.5
EC. (uS/cm))	14.02	48.03	56.01	<100
TDS (mg/L)	7.00	24.00	28.00	<500
DO (mg/L))	4.30	3.80	4.20	>5
Turbidity (NTU)	0.90	0.00	0.00	< 1.00
Salinity (ppt)	0.00	0.00	0.01	-----
TSS (mg/L))	0.00	0.00	0.00	<10

**Source: Field work, 2024**

The pH levels of all sachet water samples tested as can be seen on Table 4, ranged from 6.98 to 7.00, which are within the acceptable standards set by the World Health Organization (WHO). Although sample A had a pH of 6.98 slightly below the neutral mark of 7.0, nevertheless, it still falls within the permissible WHO range. The remaining samples had pH values close to neutral, indicating generally safe water quality. Electrical

conductivity (EC), an indicator of the presence of dissolved and suspended solids in water (Okpara et al., 2024), varied between 14.02 and 56.01  $\mu\text{S}/\text{cm}$ . These measurements were consistent with previous research on sachet water quality in Nigeria (Opafola et al., 2020; Igbinvebo et al., 2022). All EC values were below the WHO's guideline limit of 100  $\mu\text{S}/\text{cm}$  for drinking water. According to Begum and Harikrishnarai (2007),

conductivity values below  $50 \mu\text{Scm}^{-1}$  are regarded as low, those between  $50 - 600 \mu\text{Scm}^{-1}$  are said to be medium while values above  $600 \mu\text{Scm}^{-1}$  are high. Total dissolved solids (TDS) refer to the overall concentration of dissolved ionic particles, comprising minerals, salts, and metals (Aris *et al.*, 2013). Total dissolved solids of the sampled sachet water analyzed are significantly below the WHO acceptable range ( $100 \text{ mgL}^{-1}$ ) for quality water. This is in line with the results obtained by Akintelu *et al.* (2021). Dissolved oxygen, turbidity, salinity and total suspended Solids were all within the WHO acceptable limits. It is therefore accurate to say that the sampled sachet water analysed is fit for consumption.

### Conclusion

Based on the findings from both the administered questionnaires and the analysis of physico-chemical parameters, the selected sachet water brands produced within Benin City metropolis were found to meet the recommended standards set by the World Health Organization (WHO, 2024). Despite this compliance, there remains a critical need for regular inspections of water production facilities to ensure ongoing adherence to established health and safety regulations. Additionally, targeted consumer sensitization and education campaigns should be conducted periodically to raise awareness about key indicators such as expiry dates, packaging integrity, and product registration that must be checked before consuming any brand of sachet water, thereby safeguarding public health.

### Recommendations

Based on the study's findings, the following robust recommendations are proposed to enhance public health safety and ensure quality control in sachet water production:

1. Routine Regulatory Inspections: Government agencies and relevant health authorities should conduct regular and comprehensive inspections of sachet water production facilities to enforce compliance with established health, hygiene, and safety standards.
2. Mandatory Medical Screening for Staff: Periodic medical examinations should be made compulsory for all personnel working in water production plants. This will help prevent possible contamination from communicable diseases such as Hepatitis and ensure that only medically fit individuals handle water meant for public consumption.

3. Ongoing Health Education and Training: Water production companies should implement continuous health education and safety training programs for their staff. These sessions should focus on up-to-date hygiene practices, sanitation standards, and preventive health measures to maintain safe production environments.
4. Strict Enforcement and Reporting of Violations: Any facility found engaging in unethical or unsafe practices such as selling of expired products or distributing unregistered sachet water not approved by NAFDAC should be promptly reported to the appropriate regulatory bodies. Swift legal and administrative actions must be taken to serve as deterrents to other producers.
5. Regular Sensitization on Modern Production Methods: Periodic sensitization workshops should be organized for sachet water producers to introduce them to emerging technologies, best practices, and innovations in water purification and packaging. This will improve product quality and promote adherence to global safety standards.

### References

- Addo, H. O., Amegah, K. E., Xonam, T. A., Kabenlah, E., Ameyaw, C., Graham, L. O., Tobigah, T., Hammond, B., Maxwell, D., & Bimi, L. (2020). Consumer preference and quality of sachet water sold and consumed in the Sunyani Municipality of Ghana. *BioMed Research International*, 2020, Article 3865895. <https://doi.org/10.1155/2020/3865895>
- Afolabi, M. O., & Dada, S. O. (2010). Gender and decision making in rural households in Nigeria. *Journal of Gender Studies*, 17(2), 135–147. <https://doi.org/10.1080/09589231003695852>
- Ajayi, M. P., & Olanrewaju, R. M. (2014). Gender dimensions of participation in environmental protection and management in Nigeria. *Journal of Human Ecology*, 45(2), 135–143. <https://doi.org/10.1080/09709274.2014.11906783>
- Begum, A., & Harikrishnarai. (2007). Study on the quality of water in some streams of Cauvery River. *Journal of Chemistry*, 5,



- 377–384.  
<https://doi.org/10.1155/2008/234563>
- Begum, M. N., Johnson, C. S., & Harrower, T. (2010). Dehydration and symptoms of depression in older adults in long-term care. *Canadian Journal on Aging*, 29(4), 411–418.  
<https://doi.org/10.1017/S0714980810000416>
- Dada, A. C. (2009). Sachet water phenomenon in Nigeria: Assessment of the potential health impacts. *African Journal of Microbiology Research*, 3(1), 15–21.  
<https://academicjournals.org/journal/AJMR/article-abstract/1DD83E512208>
- Cabral, J. P. (2010). Water microbiology. Bacterial pathogens and water. *International Journal of Environmental Research and Public Health*, 7(10), 3657–3703.  
<https://doi.org/10.3390/ijerph7103657>
- Chan, N. W., Ku-Mahamud, K., Karim, M. Z. A., Lee, L. K., & Bong, C. (2016). Hydrological cycle and cities. <https://fwrinformationcentre.co.uk/html/hydrological-cycle.html>
- Dargaville, B. L., & Hutmacher, D. W. (2022). Water as the often neglected medium at the interface between materials and biology. *Nature Communications*, 13, Article 4222.  
<https://doi.org/10.1038/s41467-022-31889-x>
- Guzmán, D., & Stoler, J. (2018). An evolving choice in a diverse water market: A quality comparison of sachet water with community and household water sources in Ghana. *The American Journal of Tropical Medicine and Hygiene*, 99(2), 526–533.  
<https://doi.org/10.4269/ajtmh.18-0084>
- Kenney, W. L., & Chiu, P. (2001). Influence of age on thirst and fluid intake. *Medicine & Science in Sports & Exercise*, 33(9), 1524–1532.  
<https://doi.org/10.1097/00005768-200109000-00013>
- Kwakye-Nuako, G., Borketey, P., Mensah-Attipoe, I., Asmah, R., & Ayeh-Kumi, P. (2007). Sachet drinking water in Accra: The potential threats of transmission of enteric pathogenic protozoan organisms. *Ghana Medical Journal*, 41(2), 62–67.  
<https://doi.org/10.4314/gmj.v41i2.55303>
- Manz, F., & Wentz, A. (2005). The importance of good hydration for the prevention of chronic diseases. *Nutrition Reviews*, 63(6 Pt 2), S2–S5.  
<https://doi.org/10.1301/nr.2005.jun.S2-S5>
- Miner, C. A., Tagurum, Y. O., Hassan, Z., Afolaranmi, T. O., Bello, D. A., Dakhin, A., & Zoakah, A. I. (2014). Sachet water: Prevalence of use, perception and quality in a community of Jos South Local Government Area of Plateau State. *Jos Journal of Medicine*, 8(3), 33–40.  
<https://www.ajol.info/index.php/jjm/article/view/138974>
- NAFDAC (National Agency for Food and Drug Administration and Control). (2021). *Regulatory guidelines for packaged water production in Nigeria*.  
<https://www.nafdac.gov.ng>
- Obadare, E. O. (1995). Potability of sachet water in Nigeria: A public health concern. *African Journal of Clinical and Experimental Microbiology*, 6(2), 104–112.  
<https://www.ajol.info/index.php/ajcem/article/view/7387>
- Obiaks Project. (2019). *The implementation of the poverty alleviation programme: Case study of Ikpoba-Okha's local government*.  
<https://project.obiaks.com/14251/>
- Okorafor, K. A., Agbo, B. E., Johnson, A. M., & Chiorlu, M. (2012). Physico-chemical and bacteriological characteristics of selected streams and boreholes in Akamkpa and Calabar Municipality, Nigeria. Department of Microbiology, University of Calabar, Cross River State, Nigeria.  
<http://scholarsresearchlibrary.com/archive.html>
- Okpara, O. G., Chukwueke, J. I., Nwenewo, E. C., Agbom, J. N., Menechukwu, K. C., Egbu, V. N., & Diala, E. C. (2024). Quality assessment of sachet water sold and consumed in Ishiagu, Ivo Local Government Area of Ebonyi State, Nigeria. *Open Access Library Journal*, 11, 1–24.  
<https://doi.org/10.4236/oalib.1112686>
- Olumide, I. A., & Olayemi, A. B. (2020). Quality assessment and regulatory compliance of sachet water in Nigeria: A case study of Lagos State. *Journal of Water, Sanitation and Hygiene for Development*, 10(1), 67–



76.  
<https://doi.org/10.2166/washdev.2020.107>
- Olusegun, O., Awotayo, G., & Bolarinwa, O. (2015). Consumers' perception and buying behaviour of sachet water in Ogbomoso, Nigeria. *Journal of Economics and Sustainable Development*, 6(23), 111–117. <https://www.iiste.org/Journals/index.php/JEDS/article/view/27370>
- Oloruntoba, E. O., Folarin, T. B., & Ayede, A. I. (2014). Hygiene and sanitary practices of vendors of packaged drinking water in Ibadan, Nigeria. *BMC Public Health*, 14(841), 1–9. <https://doi.org/10.1186/1471-2458-14-841>
- Opafola, O. T., Oladepo, K. T., Ajibade, F. O., & David, A. O. (2020). Potability assessment of packaged sachet water sold within a tertiary institution in southwestern Nigeria. *Journal of King Saud University - Science*, 32, 1999–2004. <https://doi.org/10.1016/j.jksus.2020.02.004>
- Oyebode, O., Oti, S., Chen, Y.-F., & Lilford, R. J. (2012). Sachet water in Nigeria: A sustainable interim solution or a polluter? *Public Health*, 126(11), 1031–1036. <https://doi.org/10.1016/j.puhe.2012.07.001>
- Popkin, B. M., D'Anci, K. E., & Rosenberg, I. H. (2010). Water, hydration, and health. *Nutrition Reviews*, 68(8), 439–458. <https://doi.org/10.1111/j.1753-4887.2010.00304.x>
- Singh, S., & Mosley, L. (2003). Trace metal levels in drinking water on Viti Levu, Fiji Islands. *The South Pacific Journal of Natural and Applied Sciences*, 21. <https://doi.org/10.1071/SP03006>
- Sissons, C. (2020). What is the average percentage of water in the human body? *Medical News Today*. Accessed February 11, 2025. <https://www.medicalnewstoday.com>
- Solomon, K. B., Alhaji, B. G., Bashiru, M., & Bashiru, M. K. (2010). Quality assessment of five (5) brands of sachet water. *Chemistry Department, School of Environmental Sciences, Njala University, Freetown, Sierra Leone*
- Solomon, M. M., Okareh, O. T., & Olowoporoku, A. O. (2018). Quality assessment of packaged water consumed in Ibadan, Nigeria. *African Journal of Environmental Science and Technology*, 12(7), 280–288. <https://doi.org/10.5897/AJEST2018.2547>
- UNICEF. (2024). *Lagos cholera outbreak*. Accessed February 11, 2024. <https://www.unicef.org>
- UNWWAP (United Nations World Water Assessment Programme). (2023). *The United Nations World Water Development Report 2023: Partnerships and cooperation for water*. UNESCO. <https://www.unesco.org/reports/wwdr/2023>
- World Health Organization. (2003). *Factsheet on drinking water*. <https://www.who.int/news-room/factsheets/detail/drinking-water>
- World Health Organization. (2019). *The hydrologic cycle and interactions of ground water and surface water*. [https://pubs.usgs.gov/circ/circ1139/htdoc/s/natural\\_processes\\_of\\_ground.htm](https://pubs.usgs.gov/circ/circ1139/htdoc/s/natural_processes_of_ground.htm)
- World Health Organization. (2024). *Multi-country outbreak of cholera: Report no. 16, 18 July 2024*. Accessed February 11, 2025.