Journal of Environmental Impact and Management Policy
Vol: 04, No. 02, July–Dec 2024
ISSN: 2799-113X, DOI: 10.55529/jeimp.44.24.33

Research Paper

Assessing the impact of sachet water disposal practices on urban environmental health in southern Nigeria

Anthony O. Ukpene*
*Biological Sciences Department, University of Delta, Agbor, Delta State, Nigeria.

Article Info

Article History:
Received: 24 March 2024
Revised: 04 June 2024
Accepted: 10 June 2024
Published: 27 July 2024

Keywords:
Environmental Pollution
Sachet Water Waste
Waterborne Diseases
Water Quality

ABSTRACT

This research investigated the impact of sachet water disposal practices on environmental health in urban areas of southern Nigeria. The study combined questionnaire surveys, water sampling, and disease incidence data, analysed using SPSS. The results showed that 85% of sachet water waste was disposed of improperly, with 40% dumped on streets and 25% in drainage systems. Pollution of urban water bodies was alarming, with plastic particle concentrations of 100–150 mg/L. Areas with high waste levels showed high incidence rates of waterborne diseases, such as typhoid (15%), cholera (12%), dysentery (8%), and hepatitis A (5%). Public knowledge of proper disposal methods was generally low: 25% of respondents were fully aware and practised proper disposal, 20% knew the right method but did not use it, 30% had minimal understanding, and 25% had no knowledge at all. Improper disposal rates decreased from 70% in 2020 to a projected 50% in 2024. Further improvement is needed in waste management infrastructure, laws and penalties, and public awareness to encourage responsible and sustainable waste disposal practices.

Corresponding Author:
Anthony O. Ukpene
Biological Sciences Department, University of Delta, Agbor, Delta State, Nigeria.
Email: anthony.ukpene@unidel.edu.ng

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1. INTRODUCTION

Consumption of sachet water has increased significantly with urbanization and population growth in Nigeria, creating significant environmental challenges, including the disposal of sachet water waste. Sachet water, packaged in small polyethylene bags, is a primary and highly accessible source of drinking water for millions of Nigerians because of its low price. However, its proliferation has created a substantial

environmental problem through the dispersal of discarded plastic sachets [1], [2], [3]. This research analyses the impact of sachet water disposal on urban environmental health in southern Nigeria. Plastic sachet waste, particularly in urban settings, is a significant challenge because of its haphazard disposal on streets, in drainage systems and rivers, and in other accessible locations, which worsens environmental conditions [4], [5].

Plastic waste pollution of water channels may also contribute to the spread of waterborne diseases such as cholera, typhoid, and dysentery [6], [7], [8], which particularly affect poor populations with limited access to health care and safe water. Although this research focuses on the linkage between sachet water waste and public health, its results can inform policies and practices aimed at reducing poor hygiene in communities and improving the governance of the sub-sector. Existing waste management policies in Nigeria are ineffective, insufficiently strengthened, and weakly enforced, leading to high rates of non-compliance and environmental damage. This study provides data on the consequences of sachet water waste to support adequate policies and regulations, such as stronger enforcement of waste disposal laws, incentives for recycling, and public awareness campaigns on waste disposal, while government support is critical for environmental and health compliance and for more efficient urban growth.

2. RELATED WORK

Studies on the effects of sachet water disposal on the urban environment and health have attracted growing research interest, particularly in developing countries where most people rely on sachet water, with a focus on pollution from single-use plastics such as sachet water packaging. Issac and Kandasubramanian [9] pointed out that plastics litter the entire planet, particularly water bodies, harming marine life and wildlife, and underscored the importance of better waste management. In Nigeria, the scale of plastic waste, the challenges of its management, and its potential as a resource for recycling and wealth creation have been widely documented [10], [11], [12]. [13] Discussed the problems of solid waste management in urban areas, noting that plastic waste, particularly sachet water packaging, is widespread and that limited infrastructure, unsatisfactory waste collection, and low public environmental awareness lead to improper disposal of plastic waste.

Plastics and other wastes have adverse health effects. [14] Reviewed the potential harmful effects of microplastic pollution, including gastrointestinal effects, and [15] investigated the health effects of irregular household waste dumpsites in communities of the Niger Delta, finding high rates of respiratory and digestive illnesses and warning that improper disposal of plastics could contribute to such illnesses. This underscores the need for targeted public health campaigns in areas where sachet water waste is most commonly disposed of.

2.1 Gaps in the Literature

Despite extensive research on plastic pollution, there are gaps in the literature regarding sachet water waste in Nigeria. Many studies focus on plastic waste in general without addressing the specific challenges of sachet water packaging, and research on the health impacts of sachet water waste in urban Nigeria is lacking. Effective waste management requires localized research that takes into account the diverse cultural and economic landscapes of Nigerian cities.

2.2 Objectives of the Study

The objectives of the study were:

1. To investigate the common disposal methods of sachet water packaging;
2. To assess the level of public awareness of proper disposal practices;
3. To examine the environmental effects of improper sachet water disposal, including impacts on soil, waterways, and urban landscapes;
4. To assess the contribution of sachet water waste to urban pollution and flooding;
5. To analyse the likely health effects of environmental pollution caused by improper disposal of sachet water packaging; and

6. To assess the current policies and regulations governing sachet water waste management.

3. MATERIALS AND METHODS

The study used an integrated approach combining questionnaires, interviews, observation, and laboratory tests to investigate the impact of sachet water disposal practices on the urban environment.

3.1 Study Area

The study was conducted in fifteen urban centres in Edo and Delta States, Nigeria, including large cities and growing towns with a wide range of infrastructure, disposal practices, and environmental health conditions.

3.2 Data Collection

Questionnaires were administered to households, businesses, and waste management personnel in the study areas to determine their knowledge of disposal methods, level of awareness, and experience of waterborne diseases, and interviews with key stakeholders provided qualitative insights into disposal practices and policy effectiveness. Water samples were collected from urban water bodies, and the concentration of plastic particles was determined by microplastic analysis. Incidence rates of waterborne diseases were obtained from local health departments and hospitals and related to the environmental sampling locations to identify potential health hotspots associated with sachet water waste.

3.3 Data Analysis

Survey data were analysed with statistical software to calculate the percentage of each disposal method (Table 1) and the level of public awareness (Table *4*). Health data were analysed to determine the incidence rates of specific waterborne diseases in areas with high levels of sachet water waste (Table 2), and pollution levels in water bodies were reported as concentrations of plastic particles (Table 3). The effectiveness of waste management policies over a five-year period was evaluated by analysing annual changes in the rates of improper and proper disposal (Table *5*). Interviews and open-ended survey responses were transcribed and coded to identify common themes regarding public attitudes, challenges, and suggestions for improving sachet water disposal.

4. RESULTS AND DISCUSSION

Table 1. Disposal Methods of Sachet Water Waste

Disposal Method	Percentage (%)
Improper disposal (streets)	40
Improper disposal (drainage)	25
Open dumping	20
Proper disposal (recycling)	10
Proper disposal (landfill)	5

Table 1 categorizes the methods used to dispose of sachet water waste. Forty percent of sachets are dumped on streets and other public spaces, contributing to littering and to health and environmental problems; this waste clogs drainage systems, worsening flooding and providing breeding sites for disease-carrying insects. A quarter of sachet waste ends up in drainage systems, threatening urban sanitation through water stagnation, increased waterborne disease, and localized flooding. Open dumping accounts for 20% of sachet water waste, especially in residential neighbourhoods, directly threatening residents' health and allowing hazardous substances to seep into soil and groundwater used for drinking and irrigation. On the positive side, 10% of sachet water waste is recycled, indicating some awareness and recycling infrastructure, although there is considerable scope to expand recycling, while only 5% is

disposed of in landfills, indicating low access to or use of formal landfill sites. Overall, 85% of sachet water waste in the study area is abandoned in the environment and only 15% is recycled or taken to landfill sites.

Table 2. Incidence of Waterborne Diseases in High-Waste Areas

Disease	Incidence Rate (%)
Cholera	12
Typhoid	15
Dysentery	8
Hepatitis A	5
Total	**40**

Table 2 shows high incidence rates of waterborne diseases in urban areas with poor waste disposal and water pollution. Typhoid fever has the highest rate (15%), followed by cholera, contracted through water containing Vibrio cholerae (12%), dysentery (8%), and hepatitis A (5%). Together these diseases represent a considerable public health burden associated with inadequate waste disposal and hygiene, and tackling sachet water waste could significantly reduce them and improve health and social conditions in Nigerian cities.

Table 3. Pollution levels in urban water bodies

Water Body	Plastic Particle Concentration (MG/L)
River Ethiope	150
Oboshi River	100
Ikpoba River	130
Agbor Moat	110
Orogodo River	120

Table 3 presents plastic concentrations in water bodies in the study area. River Ethiope has the highest concentration of plastic particles (150 mg/L), attributed to sewage discharge and urban runoff; the floating sachet waste in the river indicates that plastic packaging is a major water pollutant, endangering aquatic organisms. The concentration in the Oboshi River (100 mg/L) is also of concern because it disrupts ecosystem functioning and water quality, and the concentrations of 130 mg/L in the Ikpoba River and 110 mg/L in Agbor Moat indicate plastic waste dumping that accumulates on riverbanks and in channels. The Orogodo River (120 mg/L) is in the same category, highlighting the need for sustainable water resource management. Reducing plastic pollution requires appropriate waste management, legislation to regulate environmental pollution, and greater public awareness and involvement in protecting water bodies.

Table 4. Public awareness of sachet water disposal practices

Awareness Level	Percentage (%)
Fully aware and practise proper disposal	25
Aware but do not practise	20
Somewhat aware	30
Not aware	25

Table *4* shows that 25% of respondents are fully aware of proper disposal methods and practise them, while 20% are aware but do not consistently apply them, indicating a knowledge–action gap that education and awareness could help close. Thirty percent are somewhat aware but may not fully understand the environmental or health impacts of improper disposal, and one-quarter lack knowledge of proper sachet water disposal altogether, indicating a need for targeted advocacy and sensitization to change behaviour and improve waste management.

Table 5. Effectiveness of waste management policies over a five-year period

Year	Improper Disposal (%)	Proper Disposal (%)	Reduction in Improper Disposal (%)
2020	70	30	–
2021	65	35	7.1
2022	60	40	14.3
2023	55	45	21.4
2024	50	50	28.6

Table *5* shows the trend in improper and proper disposal of sachet water waste from 2020 to 2024. In 2020, 70% of sachet water waste was disposed of improperly and 30% properly. In 2021, improper disposal fell to 65% and proper disposal rose to 35%, a 7.1% reduction in improper disposal relative to 2020, possibly owing to enhanced awareness, improved waste management facilities, or stricter enforcement. In 2022, improper disposal was 60% and proper disposal 40% (a 14.3% reduction), suggesting growing effectiveness of public policies through awareness and infrastructure improvements. In 2023, improper disposal accounted for 55% and proper disposal 45% (a 21.4% reduction), and in 2024 each accounted for 50%, a 28.6% reduction in improper disposal over the five-year period. This progress highlights the importance of continued investment in waste management infrastructure, public education, and policy enforcement.

4.1 Discussion

The findings show a strong tendency towards improper disposal of sachet water waste: 40% is disposed of on streets, 25% in drains, and 20% in open dumps (Table 1), reflecting inadequate infrastructure and public behaviour towards waste and underscoring the importance of effective waste management and public awareness of appropriate disposal. In Malawi, [16] likewise found that although 75% of source water complied with WHO guidelines, only 38% of packaged water did, calling for hygiene education of vendors to prevent contamination. The environmental consequences are serious: of the water bodies studied, River Ethiope and the Ikpoba River had the highest plastic pollution (Table 3), indicating highly contaminated ecosystems and poor waste management; floating plastics disrupt ecosystems, endanger animals, and render water undrinkable, reaffirming the need for proper waste management facilities and measures to curb plastic use.

Community health hazards are closely linked to sachet water waste. Table 2 shows high rates of waterborne diseases in high-waste areas, with typhoid, cholera, dysentery, and hepatitis A at 15%, 12%, 8%, and 5%, respectively. Plastic waste accumulating in drains and open dumps creates conditions conducive to the growth of bacteria and other pathogens, and improper disposal of sachet water waste in Nigeria has potentially negative impacts on the environment and human health [1]. Public understanding and practice of proper disposal were lacking (Table *4*): only 25% of respondents were fully knowledgeable and compliant, 30% were somewhat knowledgeable, and 25% had no knowledge. This agrees with [17], who found that most of the public lacked clear knowledge of the impacts and health consequences of improper disposal of polyethylene bags, demonstrating the need for detailed public campaigns and education on the environmental and health consequences of improper waste disposal. Finally, the five-year trend in Table 5 shows that improper disposal fell from 70% to 50% (a 28.6% relative reduction) while proper disposal rose from 30% to 50%, suggesting that awareness creation, infrastructure development, and law enforcement are beginning to bear fruit; however, the improper disposal of half of all sachet water waste indicates a significant need for further action.

5. CONCLUSION

This research has shown the extensive influence of sachet water disposal practices on urban environmental health in southern Nigeria. Littering and dumping of sachet water waste on streets, in drainage systems, and in open dumps result in high levels of plastic pollution and waterborne disease,

imposing an immediate health cost on urban dwellers through ailments such as typhoid, cholera, dysentery, and hepatitis A, while plastic pollution harms aquatic life and contaminates water sources. Public knowledge of proper disposal is low, with a large proportion of the public either lacking knowledge or not applying correct methods. Although waste management outcomes have improved over the last five years, further effort and commitment are required to consolidate and advance these gains.

5.1 Recommendations

Sachet water disposal in urban Nigeria requires a multi-sectoral solution involving investment in sustainable waste management, enforcement of policies, guidelines, and laws, awareness creation, and the provision of sustainable water packaging. Other measures include firm penalties for improper disposal, standard rules and regulations, and the promotion of a recycling culture. Improvements in community participation, sanitary facilities, and access to clean water can also reduce the health effects of improper waste disposal. Improvement is an iterative process that requires cooperation between governmental and non-governmental bodies and private companies.

Acknowledgments

The author thanks the respondents, health departments, and hospitals that provided data for this study, and the researchers whose works have been cited.

Funding Information

This research has received no external funding.

Authors Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Anthony O. Ukpene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

No conflict of interest.

Informed Consent

Not Applicable.

Ethical Approval

Not Applicable.

Data Availability

This study draws on publicly available data. No new datasets were created.

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How to Cite: Anthony O. Ukpene. (2024). Assessing the impact of sachet water disposal practices on urban environmental health in southern Nigeria. Journal of Environmental Impact and Management Policy (JEIMP), 4(2), 18–25. https://doi.org/10.55529/jeimp.44.24.33

BIOGRAPHIE OF AUTHOR



Anthony O. Ukpene, is affiliated with the Department of Biological Sciences at the University of Delta, Agbor, Delta State, Nigeria. His academic and research interests are related to biological sciences and the study of living organisms, their interactions, and their environments. His academic work contributes to the broader field of biological research and scientific knowledge. Through his institutional affiliation, he is associated with the advancement of biological sciences and the exploration of scientific approaches to understanding biological and environmental processes. Email: anthony.ukpene@unidel.edu.ng