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Waste Disposal Practices, Health Awareness and Challenges in Rapidly Growing Populations: A Case Study of Ede, Southwestern Nigeria

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KEYWORDS

- Waste disposal
- Health awareness
- Socio-demographic
- Populations
- Regression

ABSTRACT

Waste disposal and management have emerged as pressing challenges in urban areas, particularly in developing countries where rapid population growth exacerbates the situation. This study examines waste management practices, health awareness, and the associated challenges in Ede, Osun State, Nigeria. A structured questionnaire was distributed to 310 respondents using a simple random sampling method. The analysis revealed that waste disposal practices predominantly involve open burning (34.2%) and disposal in rivers/streams (26.8%), both of which pose significant environmental and health risks. Despite a high percentage of organic waste (74.2%), sustainable practices such as recycling (7.1%) and composting (3.2%) are minimally utilized. Using ordinal logistic regression, important predictors of waste disposal methods were found. These included lack of money, inadequate facilities, and low awareness. Additionally, dissatisfaction with waste management services correlated with poor waste disposal practices. The findings underscore the urgent need for enhanced public education, infrastructure improvements, and the promotion of sustainable waste management practices to mitigate environmental and health impacts in the study area.

Introduction

Waste disposal and management have emerged as critical issues in rapidly growing populations, particularly in urban areas where the surge in population density aggravates the challenges associated with waste generation and disposal (Gutberlet, 2018). As communities expand, the volume of waste produced increases, often exceeding the capacity of local waste management systems. This disparity can lead to significant environmental and public health concerns (Omang et al., 2021; Ichipi & Senekane, 2023). Improper waste disposal methods, such as open dumping, burning, and unregulated landfill use, contribute to pollution, spreading diseases, and degrading ecosystems. However, the health implications of improper waste disposal are profound, affecting both the immediate and long-term well-being of populations. In many developing countries, informal and unregulated waste disposal methods are prevalent due to inadequate infrastructure and limited resources. According to a study by Kaza et al. (2018) open dump-

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ing is common in lower-income countries, where landfills are not yet available. While just 2% of waste is disposed of in high-income countries, over 93% of garbage in low-income countries is burned or dumped in roads, open spaces, or rivers. Future waste increase will be greatly impacted by the fact that over two-thirds of waste is disposed of in South Asia and Sub-Saharan Africa. These practices pose severe risks to public health and the environment, contributing to air and water pollution and facilitating the spread of infectious diseases. Moreover, the lack of public awareness and inadequate infrastructure further complicate waste management efforts. Understanding the interplay between waste disposal practices and health awareness is crucial for developing sustainable solutions.

Recent studies on improper waste management globally, with a particular focus on Africa, reveal significant health and environmental implications. The mismanagement of waste, particularly in developing countries, has been linked to severe public health risks and environmental degradation. For instance, Sarkingobir et al. (2022) highlight that improper biomedical waste management can lead to soil and water pollution, which in turn affects agricultural productivity and public health through the contamination of food sources. This is echoed by Odonkor and Mahami (2020), who emphasize that improper disposal of healthcare waste in Ghanaian hospitals poses risks of infectious disease transmission, underscoring the urgent need for effective waste management policies. The COVID-19 pandemic has aggravated waste management challenges worldwide, particularly in developing countries. Fadhullah et al. (2022) note that the pandemic has complicated household waste management due to increased waste generation and the potential transmission of SARS-CoV-2 through municipal solid waste handling. This situation is further complicated in Africa, where inadequate infrastructure and governance hinder effective waste management practices. Godfrey et al. (2020) argued that good governance is essential for sustainable waste management, advocating for enhanced capacity in financial, institutional, and technological aspects to address the challenges faced by African nations. In Ethiopia, high levels of improper solid waste management practices, with significant portions of waste being disposed of in unauthorized locations, were reported by Lema et al. (2019). This finding is consistent with studies in other African countries, such as Ghana and Tanzania, where improper disposal rates are alarmingly high (Teferi, 2022). The implications of such practices are profound, as they contribute to environmental pollution and health hazards, including gastrointestinal diseases among waste workers and nearby residents (Adeyi & Adeyemi, 2019).

Solid waste management remains a critical issue in Ede and its surrounding areas in Osun State, Southwestern Nigeria, aggravated by rapid urbanization, population growth, and industrial activities. Omoge et al. (2021) in his study among residents of Buari Ishola Isibo in Ede North Local Government Area, reported that, currently, waste disposal in Ede involves a mix of informal practices such as open dumping and burning, alongside formal systems like municipal collection services. These practices pose severe risks to public health and the environment, contributing to the spread of various infectious diseases in the area. Hence this study therefore aims to investigate the current waste disposal practices, level of health awareness, and associated challenges in the entire Ede and its environ, with a view to identifying sustainable solutions.

Effective waste management strategies are crucial in addressing the challenges posed by improper waste disposal, which include environmental pollution, public health risks, and the depletion of natural resources (Omoge et al., 2021; Gupta et al., 2024). Implementing these strategies helps mitigate these issues and promotes sustainable development. Public awareness and education are critical components in addressing improper waste management. Ouma (2021) emphasizes the importance of training and awareness campaigns to foster responsible waste disposal practices among communities. Similarly, study in South Africa indicates that increased awareness of improper waste disposal correlates with better management practices among households (Raphela et al., 2024). This study entails grassroots and in-depth knowledge of the study area through the administration of questionnaires for valuable insights into waste disposal practices, socio-demographic influences, and public health awareness, randomly across the study area. The use of questionnaires serve as a vital tool for policymakers, environmental agencies, and researchers in developing effective waste management strategies tailored to the needs of rapidly growing populations.

Study Area

Ede is an ancient town in Osun State, Nigeria, located in the southwestern part of the country. It consists of Ede North and South Local Government Areas (comprising 21 wards). Ede is situated approximately 20 kilometers east of Oshogbo, the state capital. It is located between latitude 7° 35'00"N and 7° 47'00"N of the Equator and longitude 4° 18'00"E and 4° 36'00"E of the Greenwich meridian (Figure 1). Ede has an altitude of approximately 287 m above mean sea level and experiences a tropical savanna climate with two distinct seasons: wet (April-October) and dry (November-March). The average temperature ranges from 22°C to 32°C. The town is accessible via Iwo, Oshogbo, Ife, and Ara. The town covers an area of 330 km² with a projected population of approximately 314,738 as of 2022 by the National Bureau of Statistics. The town's economy is diverse, with residents engaged in trading, farming, and artisanal crafts. The presence of three (3) higher educational insti-

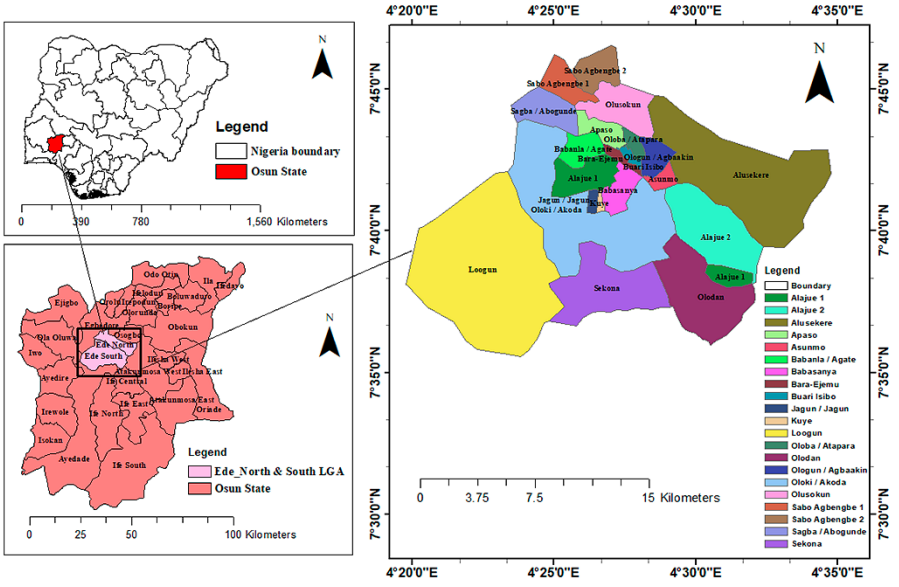

Figure 1. Location Map of the Study Area
(Source: Author)

tutions, i.e., Federal Polytechnic Ede, Redeemer's University, and Adeleke University, adds to the town's demographic dynamics, attracting students, staff, and visitors. Despite its historical and cultural wealth, Ede faces modern challenges, particularly in waste generation and management, necessitating sustainable solutions to maintain the town's environmental health and quality of life (Odeyemi et al., 2024).

Data and method

Sample Size

A structured questionnaire was employed as the primary research instrument to obtain comprehensive data on waste generation and management practices in Ede. To accurately assess solid waste generation and disposal methods in the study area, the study utilizes a simple random sampling method to capture the diverse waste production patterns across residential, commercial, industrial, and institutional sectors. The provided data represents a sample of 310 respondents gotten from simple random sampling distributed across the political wards in Ede and the surrounding area, Southwest, Nigeria, with various demographic and socio-economic variables. An adequate sample size was determined by employing the appropriate sample calculation procedure below. Sample size was determined based on the estimation method outlined by Israel (2012), with results provided below:

$$n = \frac{N \cdot Z^2 \cdot p(1-p)}{E^2 \cdot (N-1) + Z^2 \left(p(1-p)\right)}$$

Where

- n is the sample size
- N is the population size (314,738)
- Z is the Z-score (95% confidence level equivalent to 1.96 critical value)
- p is the estimated proportion of an attribute that present in the population (commonly 0.5 for maximum variability)
- E is the margin of error (0.05 or 5%)

$$n = \frac{314738 \cdot 1.96^2 \cdot 0.5(1-0.5)}{0.05^2 \cdot (314738-1) + 1.96^2 \cdot \left(0.5(1-0.5)\right)}$$

Estimation of respondent rate was $310/384 \cdot 100 = 81\%$
Non respondent rate was estimated as $74/384 \cdot 100 = 19\%$

Methods of Data Analysis

In this study, quantitative methods were used for the questionnaire analysis to present the collected data. Descriptive statistics was used to determine the socio-demographic variables, waste type and disposal methods, waste disposal practices, health awareness, and challenges in the studied area. The ordinal logistic regression was used to model the impact of waste type and health awareness and challenges on the method of waste disposal. The ArcGIS 10.8 software was used to generate various maps in the study.

Results and discussion

Socio-Demographic Variables

This section focuses on the socio-demographic status of respondents from Ede, Osun State, Nigeria, aiming to capture a comprehensive picture of the community. The data was collected from a sample of 310 individuals, encompassing various aspects such as age, gender, ethnicity, education, and occupation. Each of these variables plays a significant role in shaping the socio-economic landscape of the region. By examining these variables, a deeper understanding of the population's structure and the factors that influence their daily lives and opportunities was gained.

Table 1 presents the socio-demographic variables of the respondents in this study. The socio-demographic profile of respondents in this study reflects a diverse and representative sample of Ede, Osun State's population. A majority (45%) of respondents fall within the 18–30 age group, followed by 39.4% in the 31–45 age bracket, indicating a predominantly working-age sample. This aligns with recent findings by Chukwuone et al. (2022), who observed that younger populations in Nigerian urban centers exhibit higher waste generation rates due to increased consumption linked to economic activity. The gender distribution is balanced (slight female majority), mirroring trends in Nigerian waste management studies such as Adeoye et al. (2025), which emphasized gender inclusivity in environmental surveys to avoid behavioral bias. Ethnically, Yoruba respondents dominate (reflecting Ede's demographics), ensuring findings mirror local practices. This resonates with Nigeria's National Bureau of Statistics (2022) report, which highlights ethnicity as a key factor in shaping community-specific waste practices in southwestern Nigeria. Educationally, over half of respondents completed secondary education, a factor strongly correlated with waste management awareness, as noted in Adekola et al. (2021) for similar semi-urban Nigerian populations. Economically, most respondents are self-employed, students, or formally employed, suggesting varied waste generation

Table 1. Socio-Demographic Variables

Variables		Frequency	Percent %
Age	under 18	1	.3
	18-30	139	44.8
	31-45	122	39.4
	46-60	42	13.5
	above 60	6	1.9
	Total	310	100.0
Gender	Male	148	47.7
	Female	162	52.3
	Total	310	100.0
Ethnicity	Yoruba	285	91.9
	Igbo	14	4.5
	Hausa/Fulani	11	3.5
	Total	310	100.0
Education	No Formal	43	13.9
	Primary Education	55	17.7
	Secondary	113	36.5
	Tertiary Education	99	31.9
	Total	310	100.0
Occupation	Employed	54	17.4
	Self-employed	157	50.6
	Student	69	22.3
	Unemployed	17	5.5
	Retired	13	4.2
	Total	310	100.0

Source: Result from questionnaire, 2024

patterns. For instance, self-employed individuals (e.g., traders) may produce more organic or commercial waste, while students generate recyclables like plastics, as observed in Sahathu (2021) and Opusunju et al. (2024). These socio-demographic nuances underscore the need for tailored waste strategies, consistent with Wolff et al. (2021), who argued that localized interventions must account for economic diversity and cultural norms in sub-Saharan African communities.

Waste disposal, health awareness and challenges

Table 2 provides valuable insights into the community's practices and perceptions regarding waste disposal, health awareness, and related challenges in Ede, Osun State, Nigeria. The data reveal several key issues and trends that impact environmental health and waste management effectiveness. The types of waste present in a community and their disposal methods can significantly impact environmental and public health.

Firstly, the predominant type of waste identified is organic/paper waste, constituting 74.2% of the total waste, followed by plastic at 21.0% and glass/metal/electronics at 4.8%. This distribution aligns with findings from Noufal et al. (2020), who reported that organic waste often forms the largest component of household waste in various regions. The high percentage of organic waste suggests a potential for composting initiatives, which could mitigate the environmental impact of waste disposal and enhance soil fertility, as noted by Rani et al. (2022). To utilize the organic fraction of municipal solid waste (OFMSW) for soil ferti-

Table 2. Waste generation types, disposal and health awareness

Variables		Frequency	Percent %
Type of waste	Organic/paper: (Less harmful)	230	74.2
	Plastic: (harmful)	65	21.0
	Glass/Metal/Electronics: (very harmful)	15	4.8
	Total	310	100.0
Which of these do you notice in and around public waste bin or dumping land in your area?	Dark flowing water/odour/fire/smoke	241	77.7
	Mosquitoes/cockroaches	57	18.4
	Animal Presence	10	3.2
	Human scavenger	2	0.6
	Total	310	100.0
Did you ever hear of health problems due to solid waste in your area?	No	178	57.4
	Yes	132	42.6
	Total	310	100.0
How adequately informed are you about the potential environmental impact of improper waste disposal?	Uninformed	12	3.9
	Not well informed	108	34.8
	Well informed	115	37.1
	Very well informed	75	24.2
	Total	310	100.0
Have you ever received education or training on proper waste management practices?	No	205	66.1
	Yes	105	33.9
	Total	310	100.0
Waste Disposal Method	By road side	13	4.2
	open space in the compound	51	16.5
	In rivers/stream	83	26.8
	Open burning	106	34.2
	Public bin	17	5.5
	Recycling	22	7.1
	Composting	10	3.2
	Reuse for other purposes	8	2.6
	Total	310	100.0

Source: Result from questionnaire, 2024

lization through composting, primary waste segregation at the source is essential to ensure the production of uncontaminated, nutrient-rich compost suitable for agricultural use. Source segregation prevents contamination from non-biodegradable materials (e.g., plastics, metals) and hazardous substances, which can compromise compost quality and soil health (Adeoye et al., 2024). This step aligns with the waste management hierarchy (reduce, reuse, recycle), as emphasized by Pires and Martinho (2019), by prioritizing waste prevention and material recovery. Effective segregation at the household or institutional level enables the collection of organic waste (e.g., food scraps, garden waste) for composting, reducing the burden on landfills and minimizing environmental pollution (Policastro & Cesaro, 2023; Adeoye et al., 2024).

The data also highlights concerning observations in and around public waste bins, with 77.7% of respondents noting issues such as dark flowing water, odors, and smoke. These findings resonate with the research by Oruonye et al. (2018), which emphasizes the environmental degradation resulting from improper waste disposal, including contamination of water sources and air pollution. Such conditions not only affect the environment but also pose significant health risks, as improper waste management can lead to the proliferation of disease vectors like mosquitoes and cockroaches. Regarding health problems associated with solid waste, 42.6% of respondents acknowledged having heard of health issues linked to waste in their area. This awareness is crucial, as highlighted by the work of Marange et al. (2023), which discusses the public health threats posed by improper waste management. The lack of education or training on proper waste management practices, with 66.1% of respondents indicating they had not received such education, further exacerbates the issue. This lack of awareness is consistent with findings from Immurana et al. (2022), which suggest that education significantly influences waste disposal practices. The preferred waste disposal methods reveal a troubling trend, with open burning (34.2%) and disposal in rivers/streams (26.8%) being the most common practices. This aligns with the observations made by Ishaq (Ishaq, 2023), who noted that open dumping remains a prevalent waste disposal method in many urban areas. Such practices not only contribute to environmental pollution but also pose health risks, as highlighted by the potential for leachate and landfill gas emissions discussed by Ardiatma (2023). The low rates of recycling (7.1%) and composting (3.2%) indicate a missed opportunity for sustainable waste management, which could be improved through community education and infrastructure development.

Furthermore, the data reflects a critical need for enhanced public education on waste management practices, improved waste disposal infrastructure, and the promotion of sustainable practices such as recycling and composting. Addressing these issues is essential for mitigating the environmental and health impacts associated with solid waste disposal. The practice of separating waste at its source (e.g., households, businesses) into categories like recyclables, organics, and hazardous materials is a cornerstone of effective waste management. By prioritizing segregation at the point of generation, communities can drastically reduce contamination in recycling streams, enhance the efficiency of composting systems, and prevent hazardous materials from entering landfills or informal dumping sites. By emphasizing primary segregation, communities can directly address environmental degradation, reduce greenhouse

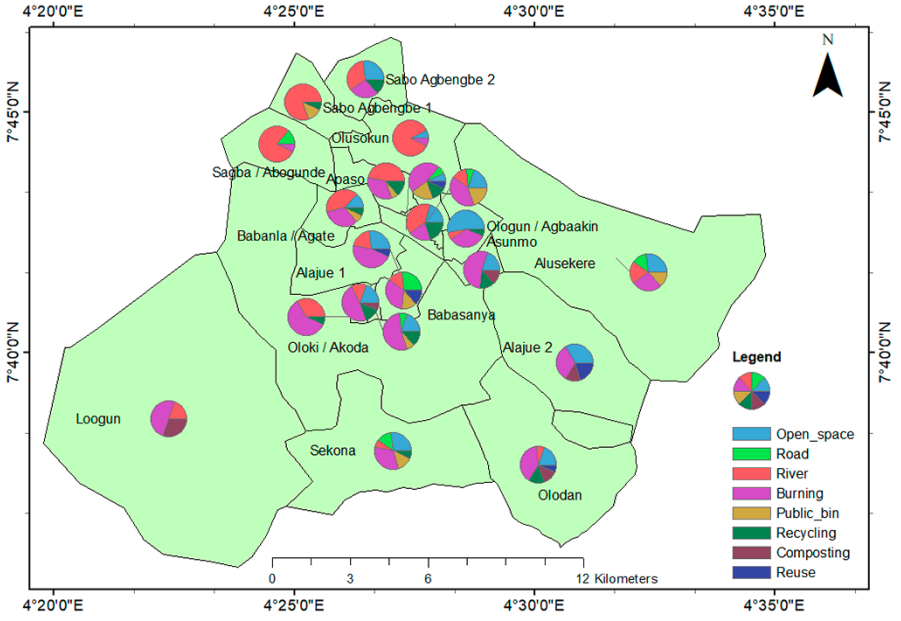

Figure 2. Distribution pattern of waste disposal methods across the political wards

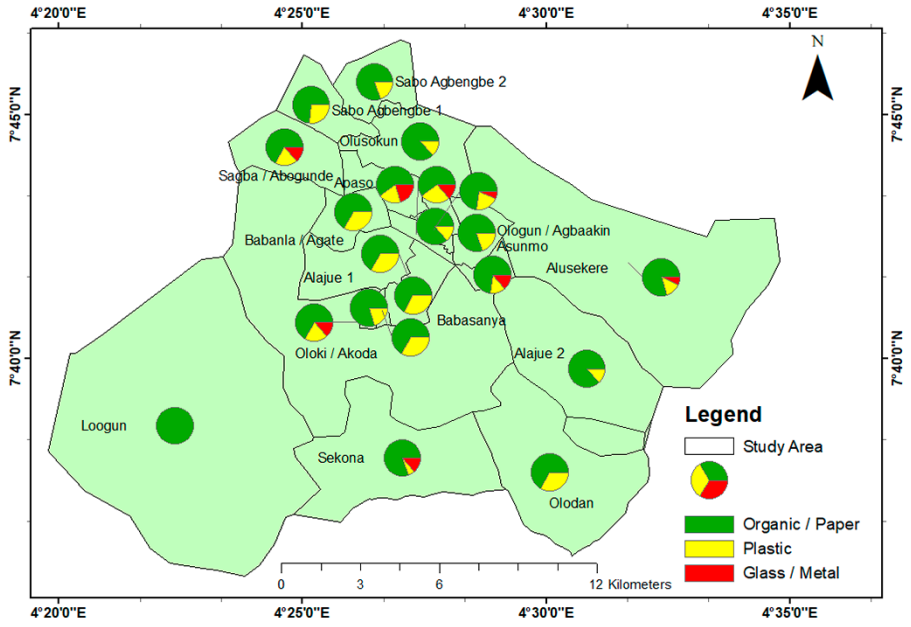

Figure 3. Distribution pattern of waste generation types across the political wards

gas emissions from landfills, and minimize public health risks linked to improper waste handling.

Ordinal Regression of Waste disposal methods on Waste disposal, health awareness and challenges

The analysis of the ordinal regression of waste disposal methods on various factors, including health awareness and challenges, reveals significant insights into the waste management practices in Ede and its environs. The results are discussed below, focusing on the interpretation of estimates and odds ratios and their implications on public health and waste management strategies.

The findings from this study offer critical insights into waste disposal behaviors and their determinants, contextualized within contemporary research on sustainable waste management. The strong preference for composting (OR = 13.343) and recycling (OR = 5.430) aligns with global shifts toward circular economies, where organic waste diversion and material recovery are prioritized to reduce landfill reliance (Kaza et al., 2018). The high odds for composting reflect growing recognition of its role in mitigating greenhouse gas emissions, as highlighted in a study linking organic waste management to a 47% reduction in methane emissions in urban areas (Chen et al., 2022; Manea et al., 2024). However, the lower odds for plastic

Table 3. Analysis of the ordinal regression

Parameter Estimates							
Variables	Categories	Estimate	Std. Error	Wald	df	Sig.	Odds Ratio (OR)
Threshold: Methods of waste disposal	By road side	-7.836	.927	71.450	1	.000	0.0004
	open space in the compound	-4.211	.703	35.916	1	.000	0.0148
	In rivers/stream	-2.047	.667	9.432	1	.002	0.1291
	Open burning	.243	.655	.137	1	.711	1.2751
	Public bin	.705	.659	1.146	1	.284	2.0238
	Recycling	1.692	.680	6.188	1	.013	5.4303
	Composting	2.591	.727	12.701	1	.000	13.3431
Waste Type	Organic/paper(Less harmful)	.036	.520	.005	1	.945	1.0367
	Plastic (harmful)	-.105	.557	.036	1	.850	0.9003
	Glass/Metal	0a			0		
What is your personal waste disposal assessment	Poor	-1.787	.271	43.468	1	.000	0.1675
	Fair	.557	.384	2.098	1	.147	1.7454
	Good	0a			0		

Parameter Estimates							
Variables	Categories	Estimate	Std. Error	Wald	df	Sig.	Odds Ratio (OR)
How often do you dispose of your household waste? How often do you dispose of your household waste	Monthly	-1.193	.761	2.456	1	.117	0.30331
	Bi-weekly	1.106	.555	3.972	1	.046	3.0222
	Weekly	.280	.234	1.430	1	.232	1.3231
	Daily	0a			0		
Are there any waste separation and recycling programs available in your community	No	.561	.262	4.599	1	.032	1.75242
	Yes	0a			0		
How satisfied are you with the waste management services privided in your community	Very dissatisfied	.098	.327	.090	1	.765	1.10296
	Dissatisfied	1.006	.468	4.620	1	.032	2.73464
	Satisfied	-.088	.563	.024	1	.876	0.91576
	Very Satisfied	0a			0		
How knowledgeable do you consider yourself about proper waste disposal practices	Not Knowledgeable	-.108	.475	.052	1	.820	0.897
	Not very knowledgeable	-.865	.389	4.958	1	.026	0.4211
	Somewhat knowledgeable	.178	.432	.169	1	.681	1.1948
	Very knowledgeable	0a			0		
Do you believe that the current waste disposal methods in your community are environmentally friendly	No	-.053	.257	.042	1	.837	0.9484
	Yes	0a			0		
Are there any challenges you face in managing household waste	Financial constraint	-9.025	1.017	78.737	1	.000	0.00012
	Insufficient waste disposal facilities	-2.702	.325	69.093	1	.000	0.0671
	Limited awareness about recycling options	-1.700	.284	35.829	1	.000	0.1827
	Lack of proper waste collection services	0a			0		
	No	-.449	.237	3.593	1	.058	0.63836
	Yes	0a			0		

waste management (OR = 0.900) mirror global challenges, with recent estimates suggesting only 9% of plastics are recycled globally, while 22% are mismanaged (d'Ambrières, 2019; OECD, 2022). This underscores the urgency of policies targeting plastic production and recycling infrastructure.

The persistence of open burning (OR = 1.275) despite health risks aligns with studies in low-resource settings where waste collection gaps force reliance on immediate, although harmful, solutions (Ferronato et al., 2021). For instance, a report by Cogut (2016) and Pathak et al. (2023) identified open burning as the source of 40% of airborne dioxins across the globe, exacerbating respiratory diseases. Similarly, river dumping (OR = 0.129) reflects systemic failures in waste infrastructure, a challenge amplified in coastal regions where 8 million tons of plastic enter oceans annually (Borrelle et al., 2020).

The modest use of public bins (OR = 2.024) compared to composting suggests infrastructure gaps, consistent with findings that 60% of urban residents in developing nations lack reliable waste collection (Kaza et al., 2018; Nepal et al., 2023). The preference for biweekly disposal (OR = 3.022) mirrors success in cities like Accra, Ghana, where tailored collection schedules improved compliance by 25% (Sarfo-Mensah et al., 2019). Severe financial constraints (OR = 0.00012) remain a critical barrier, echoing a 2023 global survey where 74% of municipalities cited funding shortages as the primary obstacle to waste management upgrades (Debrah et al., 2022; World Economic Forum, 2023).

The reduced likelihood of proper disposal among less knowledgeable respondents (OR = 0.421) underscores findings from Nigeria, where targeted digital campaigns increased recycling awareness (Osagwu & Nkamnebe, 2025). The marginal benefits of "somewhat knowledgeable" individuals (OR = 1.195) align with a 2021 behavioral study showing that even basic education can reduce contamination in recycling streams (Nurdin et al., 2023).

The preference for managing organic/paper waste (OR = 1.037) signals readiness for primary segregation, a strategy proven to reduce processing costs when paired with community training (Budihardjo et al., 2022). For example, Bandung City, Indonesia, achieved high waste diversion through neighborhood-level segregation programs (Lubis, 2018).

Conclusion

This study highlights the pressing challenges of waste management in Ede, Osun State, driven by rapid urbanization and limited infrastructure. Predominant reliance on environmentally detrimental disposal methods such as open burning and river dumping reflects a critical gap in sustainable practices. Financial constraints, insufficient facilities, and inadequate public awareness emerged as key barriers to effective waste management. The low adoption of recycling and composting practices suggests missed opportunities for mitigating waste impacts and fostering sustainability. Addressing these challenges requires a multifaceted approach, including community education, investment in waste management infrastructure, and policy reforms to promote sustainable practices. Global policy frameworks like the United Nations Sustainable Development Goals (SDGs) provide a critical roadmap for local municipalities to align their Municipal Solid Waste (MSW) management strategies with internationally recognized sustainability targets (Vaidya & Chatterji, 2020). By embedding SDGs into MSW management, municipalities can unlock resources, foster innovation, and contribute to a global sustainability agenda (Wang et al., 2018). This alignment not only addresses local challenges but also amplifies their role in achieving planetary health. Improved governance and active public engagement are essential for achieving environmentally friendly and health-conscious waste management solutions in Ede and similar urban settings. While this study provides valuable insights into waste management practices in Ede, several limitations should be acknowledged:

Limitations in this study reflected that while the study identifies infrastructure gaps and policy enforcement issues, it does not comprehensively assess the effectiveness of existing government regulations and waste management frameworks. Further research is needed to evaluate policy implementation and its impact on local waste management.

Although the study discusses the health risks associated with poor waste disposal, it does not include direct health assessments or epidemiological studies to measure the actual impact on community health. Future research could incorporate medical data to establish stronger links between waste disposal practices and health outcomes.

Addressing these limitations in future research could provide a more comprehensive understanding of waste management challenges and inform the development of more effective and sustainable waste management policies.

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