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# Impact Study of Solid Waste Disposal Sites in Abuja, Nigeria

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**Abstract**
The issue of illegal solid waste disposal is widespread in Nigeria, particularly affecting Abuja Municipal and other states of the Federation. This problem stems from factors such as the rapid growth in population, public behaviours toward handling of waste disposal, inadequate education in disposing of waste, and common use of illegal dumping sites. This study aimed to evaluate the impact of solid waste dumping in Abuja, Nigeria. Its objectives included mapping existing waste dumpsites in Abuja, assessing their proximity to residential areas, and examining their potential health effects on individuals. The research utilized structured questionnaires distributed to residents of Kbwa, Dutse, Gosa, Durumi, and Karshi districts in Abuja. Analysis revealed that food and inorganic waste are the predominant components in municipal solid waste at most dumpsites, both during wet and dry seasons. Additionally, variations in waste composition were observed across dumpsite locations in Abuja, influenced by factors such as income levels and household size. The study recommends increased participation of the private sector in waste recycling efforts. It also suggests the need for improved methods of waste collection fee collection and emphasizes the importance of conducting dumpsite location suitability analyses in Abuja districts to prevent disease outbreaks. Furthermore, it recommends the closure of dumpsites located near residential areas by relevant authorities.

**Keywords:** Assessment, Impact, Solid Waste, Dumping, Municipal

## Introduction

Municipal solid waste management poses a significant challenge for environmental agencies in numerous developing nations, including Nigeria (Olawale et al., 2017). The combined effects of urbanization, industrial expansion, and eating habits exacerbated solid waste handling. Particularly in all cities in Nigeria, the surge in population, industrial growth, and evolving consumer behaviours have further complicated waste management efforts. This inadequate management not only jeopardizes the health and well-being of local residents, especially those residing near disposal sites but also poses environmental risks (Olukan et al., 2020). Throughout history, communities have grappled with waste generation, stemming from the production of goods and services and the exploitation of natural resources. In Nigeria, this challenge persists, with the continuous rise in population, industrial activities, and consumption patterns. The repercussions of inefficient waste management on human health are profound, with individuals residing near dumpsites facing heightened risks of water, food, land, vegetation, and air pollution (Ogunmodede et al., 2014). Solid waste originates from diverse sources, including households, businesses, institutions, agriculture, construction sites, and healthcare facilities. However, in many Nigerian cities, the bulk of this waste ends up in poorly managed dump sites. Often, collected solid waste is incinerated outdoors, leading to incomplete combustion and the improper disposal of ashes on-site. This practice not only destroys organic matter but also accelerates metal oxidation, resulting in the enrichment of surrounding environments with pollutants (Adeyi & Majolagbe, 2017). Contaminants from waste disposal sites can move into surrounding ecosystems through biological and physio-chemical processes. This movement can result in pollution of soils, and hand-dug wells, and ultimately pose serious health risks (Mizah & Obiri, 2005). The solid waste components cause some inorganic substances to be absorbed into the soil, aggravate health problems, soil, and water pollution, and generate offensive odors. Higher ambient temperatures can worsen these effects (Abdus et al., 2011). Abuja, like many urban areas in developing countries, is experiencing rapid population growth and infrastructure development, leading to increased solid waste generation. Unauthorized dumping of solid waste is a widespread problem in all cities of Nigeria, driven by poor attitudes to waste disposal, inadequate education, and negative public perceptions toward waste management (MEPH, 2021).

Developing countries like Nigeria face various challenges in managing solid waste (Ogbuene, 2017). The escalating urban populations contribute to a surge in the generation of solid waste, leading to indiscriminate


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disposal practices that exacerbate environmental issues such as water, soil, and air pollution. These practices heighten blocked water drains and flooding. Proper disposal of solid waste is crucial to mitigate the risk of waterborne diseases (Oyebode, 2023). Nigeria faces challenges in solid waste disposal management, ranked the lowest solid waste disposal management rate globally. The lack of accurate, comprehensive figures hinders adequate provision of solid waste services, complicating planning, evaluation, and monitoring at local, national, and regional levels. This inadequacy contributes to improper management of solid waste, reflecting a broader trend across African countries (Naji, 2015). Globally, the surge in solid waste generation has strained existing waste management facilities, overwhelming authorities' capacity to handle the volume of waste generated. Nigeria, in particular, grapples with a substantial increase in municipal solid waste in its major cities, placing immense burdens on collection, transportation, and disposal services, often with insufficient attention from authorities (Bichi, 2013). Geographical location, and standard of living, energy sources among others influence the composition of solid waste, as noted by the World Health Organization. Additionally, factors like residential and commercial distinctions, economic disparities between high and low-income areas, seasonal variations, and cultural practices further shape the characteristics of municipal solid waste in different regions (Ejati et al., 2018). The established guidelines for selecting and sitting dumpsites, according to the National Environmental Standards and Regulations Enforcement Agency (NESREA) stipulate that dumpsites in urban areas should be situated no less than 1000 meters away from any residential settlement. Similarly, dumpsites near watercourses must maintain a minimum distance of 1000 meters to mitigate the risk of hazardous emissions. Moreover, dumpsites adjacent to roads should be positioned at least 2000 meters away from existing roadways to minimize transportation costs. Additionally, dumpsites should be situated on slopes with inclinations of less than 9% (Ezeah et al., 2009). The monitoring and citation of waste dumpsites are crucial environmental considerations for any community due to the numerous health issues associated with open dumpsites, including malaria, typhoid, cholera, and dysentery, which have significantly impacted public health in many areas (Cheeseman et al., 2007). The indiscriminate disposal of solid waste has become prevalent in numerous Nigerian cities, posing serious health hazards to nearby communities. Studies have confirmed that waste accumulation along roadsides, rivers, drainage, and open spaces in both rural villages and urban centres poses significant threats to public health and the entire environment. This study focuses on assessing the impact study of solid waste dumping in Abuja, the Federal Capital Territory. The specific objectives of this research include mapping existing solid waste dumpsites in Abuja, determining their proximity to residential areas, and evaluating their potential effects on individual health.

**Methods and Materials**

Abuja, as in Nigeria, is located northern part of the Niger River and the Benue River. It lies between latitudes 8.25° and 9.20° North and longitudes 6.45° and 7.39° East. Abuja is bordered by Niger State to the west and north, Kaduna State to the northeast, Nasarawa State to the east and south, and Kogi State to the southwest. It covers a landmass of 7,550 km² and is situated within the savannah region, which experiences reasonable climatic conditions. Abuja is administratively divided into six local government councils, which comprise Abuja city and five local government administration areas such as Abaji, Abuja Municipal, Kuje, Kwali, Gwagwalada, and Bwari. The city has a population of 2,638,000 people. The primary sources of solid waste in Abuja involve construction activities, households and industries. This study was conducted using five different district dumpsites. The structured questionnaires were administered to residents of Kubwa (7.34°N, 6.05°E), Dutse (8.25°N, 7.03°E), Gosa, Durumi, and Karshi, all located within Abuja, as detailed in Table 2 The only data collection tool for this study is a web-based survey questionnaire, as shown in Table 1. The questionnaire features a mix of closed-ended and open-ended questions that address a range of topics, including demographic information, educational backgrounds, waste management practices, and perceptions and experiences related to the environmental and health impacts of illegal dumping. The data collected for this research was analyzed to detail the demographics of the study population, the prevalence of waste disposal practices, and the impact of illegal solid waste dumping on public health in Abuja. The results of this analysis are presented using tables, bar charts, and graphs. The study involved visits to five key dumpsites: Kubwa, Dutse, Gosa, Durumi, and Karshi, where questionnaires were distributed to residents. A structured questionnaire was administered using a stratified and random sampling approach. Over two weeks during both dry and wet seasons, households were randomly selected to ensure a comprehensive and representative sample size for the entire study area. The sampling formula for continuous variable measurements, as referenced by (Cochran, 1977), was employed, a method commonly used by many researchers (MEPH, 2021). The minimum sample size required for a representative household analysis was determined using the following formula:

n= z2x p(1-p)/d2 where n represents the sample size, z denotes the confidence interval, p signifies the percentage mass of households selected, and d stands for the confidence interval.


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**Table 1: Questionnaire questions used to collect data.**

| Different Categories | Social and demographic information. |
|---|---|
| 1.Sex | Male or female |
| 2. Age | 10 -70 years |
| 3. Education | Educated or not educated |
| 4. Marital status | Single/married |
| 5. Residential area | Kubwa/Duse/Gosa/Durumi/Karshi |
| 6. Is unauthorized dumping of solid waste in Abuja good? | Yes or no good |
| 7. Is dumping of solid waste occur in your residential or work Area everyday | Yes or no |
| 8. How often does your community dispose of waste collected? | Daily weekly or monthly |
| 9. Do you normally report people violating the law governing the disposal of wastes | Yes or no |
| 10. Are you personally involved in the illegal dumping of solid waste | Yes or no |
| 11. Are there signs and media advertisements on the dangers of discriminating dumping in your community? | Yes or no |

**Table 2: Households Sample (HS) successful households sampled (SHS).**

| S/N | Cities | HS | SHS |
|---|---|---|---|
| 1 | Kubwa | 156 | 135 |
| 2 | Dutse | 109 | 88 |
| 3 | Gosa | 125 | 102 |
| 4 | Durumi | 130 | 125 |
| 5 | Karshi | 202 | 185 |
| | Total | 722 | 635 |

Number of Households sampled (NHS) = 722, Number Successful Households sampled (NSHS) = 635.

**Table 3: Grouping of surveyed households**

| S/N | Solid wastes | materials | colour |
|---|---|---|---|
| 1 | Metals | metals | Yellow & black |
| 2 | Plastics | plastics | Blue& green |
| 3 | Paper | papers | White |
| 4 | Food waste/inorganic | food wastes | Black |
| 5 | Other wastes | Mixture | Green |


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**Table 4: Characterization of Kubwa dumpsite (dry and wet season)**

| S/N | Waste material | Waste (%) dry | Waste (%) wet |
|---|---|---|---|
| 1 | Metals | 15 | 10 |
| 2 | Plastics | 25 | 15 |
| 3 | Paper | 17 | 09 |
| 4 | Food waste/inorganic | 40 | 55 |
| 5 | Other wastes | 3 | 11 |

**Table 5: Characterization of Duse dumpsite (wet and dry season)**

| S/N | Waste type | Waste (%)mass dry) | Waste (%)mass, wet) |
|---|---|---|---|
| 1 | Metals | 12 | 13 |
| 2 | Plastics | 10 | 11 |
| 3 | Papers | 6 | 9 |
| 4 | Food waste and inorganic | 58 | 60 |
| 5 | Other wastes | 14 | 7 |

**Table 6: Characterization of Gosa dumpsite (wet and dry season)**

| S/N | Waste materials | Waste (%)mass ,dry | Waste (%)mass, wet |
|---|---|---|---|
| 1 | Metals | 4 | 5 |
| 2 | Plastics | 18 | 20 |
| 3 | Papers | 13 | 10 |
| 4 | Food waste/inorganic | 46 | 51 |
| 5 | Other wastes | 19 | 14 |

**Table 7: Characterization of Durumi dumpsite (wet and dry season)**

| S/N | Waste materials | Waste (%mass,) dry | Waste (%)mass, wet |
|---|---|---|---|
| 1 | Metals | 3 | 4 |
| 2 | Plastics | 25 | 21 |
| 3 | Papers | 14 | 12 |
| 4 | Food waste/inorganic | 55 | 50 |
| 5 | Other waste | 3 | 13 |

**Table 8: Characterization of Karshi dumpsite (wet and dry)**

| S/N | Waste materials | Waste (%)mass, dry | Waste (%)mass, wet |
|---|---|---|---|
| 1 | Metals | 5 | 5 |
| 2 | Plastics | 14 | 10 |
| 3 | Papers | 10 | 8 |
| 4 | Food waste/inorganic | 51 | 53 |
| 5 | Other wastes | 20 | 26 |

**Results**

This section presents the results of the solid waste characterization analysis conducted at five major dumpsites in Abuja: Kubwa, Duse, Gosa, Durumi, and Karshi. The characterization of solid waste components at these sites is


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illustrated using graphs and histograms. Kubwa Dumpsite (Table 4): The percentage mass composition of fresh mixed solid waste during the dry and wet seasons is as follows: metals (15% and 10%), plastics (25% and 15%), paper (17% and 9%), food waste/inorganic materials (40% and 55%), and other waste (3% and 11%). Duse Dumpsite (Table 5): The percentage composition of fresh mixed solid waste for the dry and wet seasons includes metals (12% and 13%), plastics (10% and 11%), paper (6% and 9%), food waste/inorganic materials (58% and 60%), and other waste (14% and 7%). Gosa Dumpsite (Table 6): The mass percentage composition of mixed fresh waste during the dry and wet seasons is: metals (4% and 5%), plastics (18% and 20%), paper (13% and 10%), food waste/inorganic materials (46% and 51%), and other waste (19% and 14%). Durumi Dumpsite (Table 7): The mass percentages for the dry and wet seasons are as follows: metals (3% and 4%), plastics (25% and 21%), paper (14% and 12%), food waste/inorganic materials (55% and 50%), and other waste (3% and 13%). Karshi Dumpsite (Table 8): The mass percentage composition of mixed fresh solid waste for the dry and wet seasons includes metals (5% and 3%), plastics (4% and 10%), paper (10% and 8%), food waste/inorganic materials (51% and 53%), and other waste (20% and 26%). These tables and charts provide a comprehensive overview of the waste composition across the different dumpsites, highlighting seasonal variations in the types and proportions of waste materials.

**Discussion**

The study reveals that food waste and inorganic materials are the predominant components of municipal solid waste across most dumpsites in the study area, as depicted in Figure 1 (a – h). Tables 5-8 further confirm that these materials, along with plastics, consistently constitute the majority of waste at all dumpsites, regardless of the season. Variations in solid waste composition were observed across different dumpsite locations in Abuja (Figure 1: a – h), influenced by the income levels of the areas and their disposal practices. The increase in the mass percentage of mixed solid waste during the wet season can be attributed to the higher consumption of freshly harvested crops and farm produce. Additionally, the wet season brings about an increase in farmyard waste, garden debris, and the removal of excess weeds from residential and school environments. The study indicates a correlation between the composition of municipal solid waste produced in households and both income levels and household size across all districts of Abuja. Variations in metal waste among households are mainly due to scavenging activities. The study also identifies significant material resources within the waste stream in the area under investigation. To achieve sustainable municipal solid waste management in Abuja, the study suggests implementing practices such as composting food and inorganic waste, recycling plastics and metals, and harnessing waste-to-energy technologies for residential and infrastructural purposes. These findings are expected to enhance understanding of illegal dumping practices in Abuja, including public attitudes, environmental degradation from illegal waste disposal, associated health risks, and the contribution of illegal dumping to disease prevalence. The study recommends increased involvement of the private sector, greater integration of the informal sector, adoption of biodegradable waste composting, and expansion of waste recycling and resource recovery efforts. Additionally, developing more effective waste collection mechanisms and fairer methods of waste fee collection in the study areas is suggested for further improvement. Residents living near dumpsites must be better informed about proper waste disposal methods to protect the local environment and reduce health risks. At the household level, it is crucial to educate individuals on the importance of waste segregation, with a particular emphasis on sorting organic matter for biogas and composting, which represents the optimal approach for sanitary waste disposal.

**Health Impacts of Illegal Solid Waste Dumpsites**

The health hazards associated with illegal solid waste dumpsites include: (i) Vector-borne diseases such as malaria, dengue fever, and Lassa fever. (ii) Exposure to hazardous chemicals from electronic, chemical, and medical waste. (iii) Skin issues like infections and irritations. (iv) Elevated blood pressure leading to hypertension and heart problems. (v) Respiratory tract infections including flu, sinusitis, bronchitis, coughs, pneumonia, and asthma. (vi) Gastrointestinal illnesses such as cholera, and food poisoning (Eloho & Mpinane,2023).

**Recommendations**

1. In the contemporary world, Geographic Information Systems (GIS) have proven to be instrumental in addressing numerous challenges encountered by humanity and the environment. Therefore, the widespread adoption of GIS technology is strongly advocated for in environmental management. This technology possesses the capability to accurately identify known points of contamination, forecast potential areas of concentration yet to be assessed, and predict heightened risks based on these projections.
2. Initiatives such as composting biodegradable waste and expanding waste recycling and resource recovery efforts are essential for further advancement.
3. Improvements in waste fee collection mechanisms are warranted. Collaboration among authorities


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and stakeholders is crucial for the effective implementation of policies aimed at achieving sustainable waste management programs. Encouraging waste segregation within society is imperative to foster recycling and resource recovery initiatives.

**References**


Abdus-Salam, N., Ibrahim, M., & Fatoyinbo, F. (2011). Dumpsites in Lokoja, Nigeria: A silent pollution zone for underground water. *Waste Management Bioresource Technology*, *1*, 21-30.

Adeyi, A. A., & Majolagbe, A. O. (2017). Assessment of groundwater quality around two major active dumpsites in Lagos, Nigeria. *Global Journal of Science Frontier Research, 14*, 1-14.

Bichi, F. (2013). Improving human health risk assessment, spatial data analysis, and prediction mapping. *Journal of Environmental Sciences, 3,* 29-48.

Cheeseman, C., Imam, A., Mohammed, B., & Wilson, D. (2007). Solid waste management in Abuja, Nigeria. *Waste Management, 28*(2), 468-472.

Cochran, W. G. (1977). Survey sampling (3rd ed.). John Wiley & Sons.

Ejati, D., Tukura, N., Nduka, A., Anita, A., & Amina, A. (2018). Assessing the potential health effect of solid waste dumpsites located close to residential areas in Jalingo, Taraba State, using geospatial techniques. *An International Scientific Journal, 20,* 160-175.

Eloho, B., & Mpinane, F. (2023). An evaluation of the impact of illegal dumping of solid waste on public health in Nigeria: A case study of Lagos State. *International Journal of Environmental Research and Public Health, 22,* 7069.

Ezeah, C., Roberts, C., Watkin, D., & Odunfa, A. (2009). Analysis of barriers affecting the adoption of a sustainable municipal solid waste management system in Nigeria. *Journal of Environmental Sciences, 7*(2), 67-89.

Meizah, K., & Obiri, K. (2005). Municipal solid waste characterization and quantification as a measure toward effective waste management in Ghana. *Waste Management, 46,* 15-27.

MEPH. (2021). LBS Lagos household survey report 2020. MEPH.

Naji, C. C. (2015). Status of municipal solid waste generation and disposal in Nigeria: Management of environmental quality. *An International Journal of Biological Science, 26,* 53-71.

Ogbuene, I. (2017). Environmental and health impact of solid waste disposal in developing cities. Sierra Leone *Journal of Environmental Protection, 5,* 250-261.

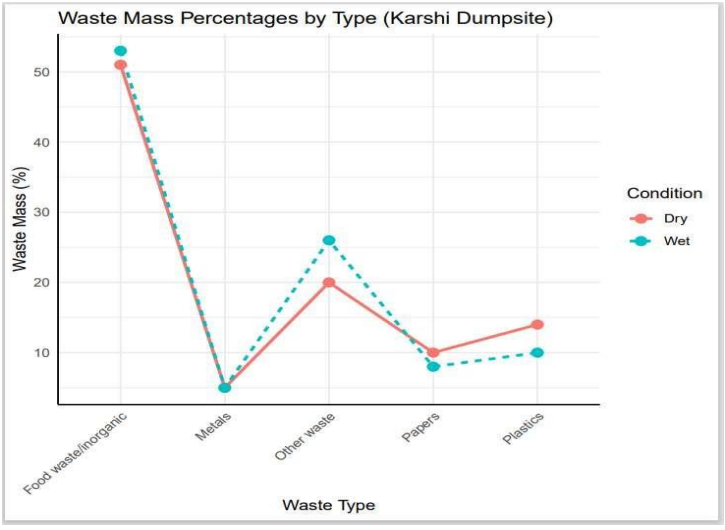
Ogunmodede, O. T., Adewole, E., & Ajayi, O. (2014). Environmental assessment of solid waste management in Nigeria: A case study of Ikere-Ekiti, Ekiti State. *International Journal of Environmental Management, 11,* 1-8.

Olawale, S., Adedotun, T., & Abiodun, A. (2017). Impact of dumpsites on the quality of soil and groundwater in satellite towns of Abuja, Nigeria. *Journal of Health Pollution, 14,* 15-22.

Olukanm, D., Pius, I., & Joseph, S. (2020). Public perception of solid waste management practices in Nigeria: Ogun State experience. *Recycling, 5,* 8-15.

Oyebode, O. (2023). Solid waste management for sustainable development and public health. *Journal of Public Health, 2,* 52-61.


Appendix



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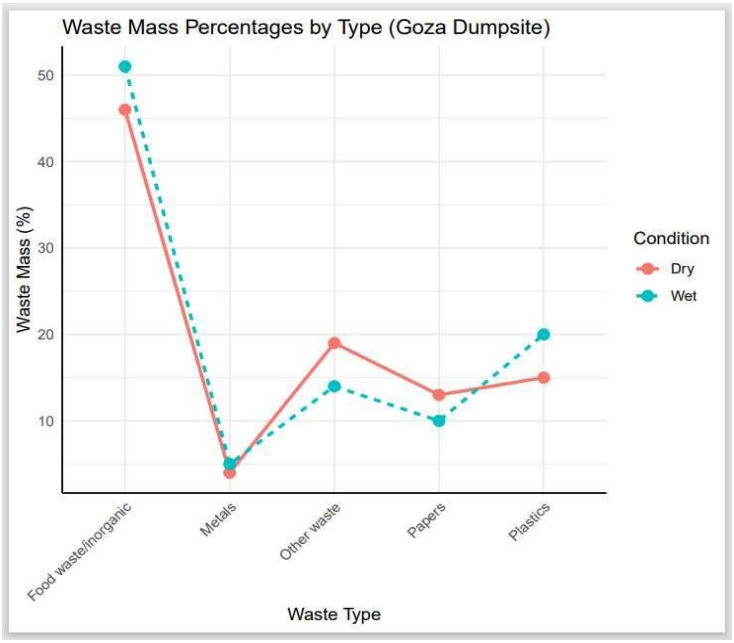
a

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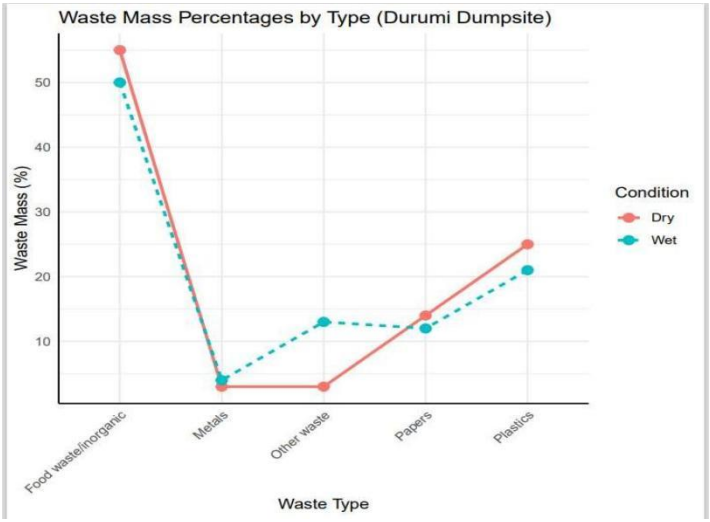


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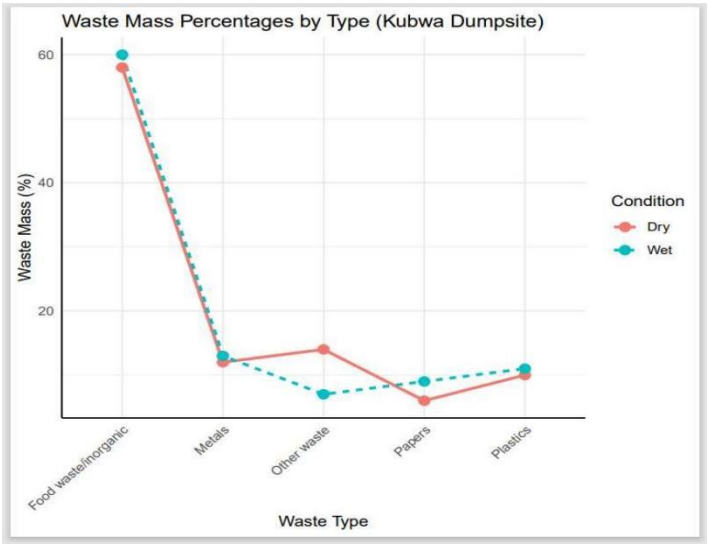


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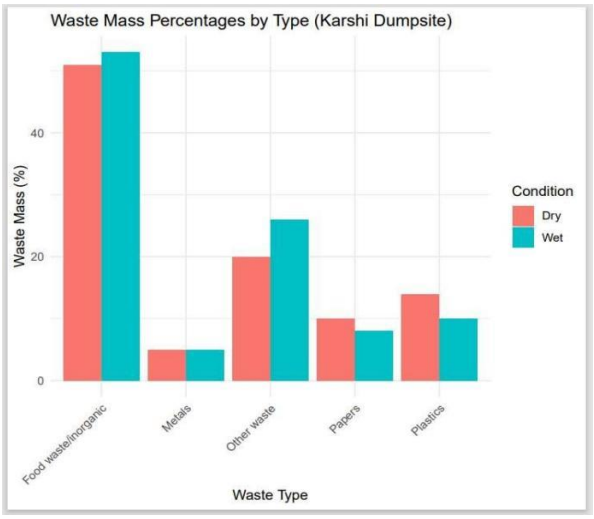


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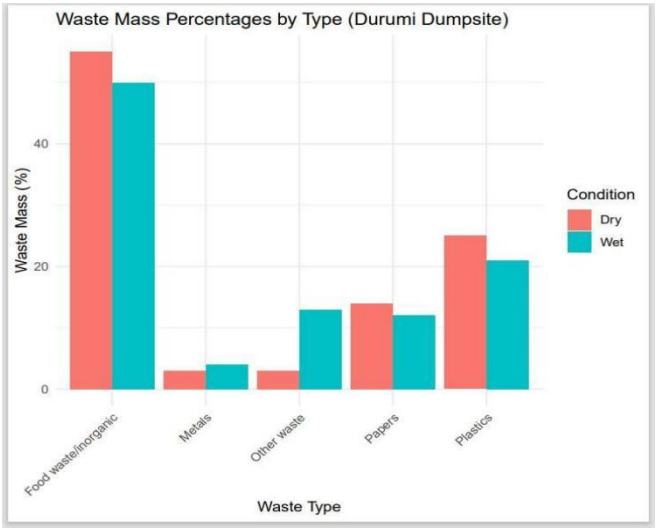


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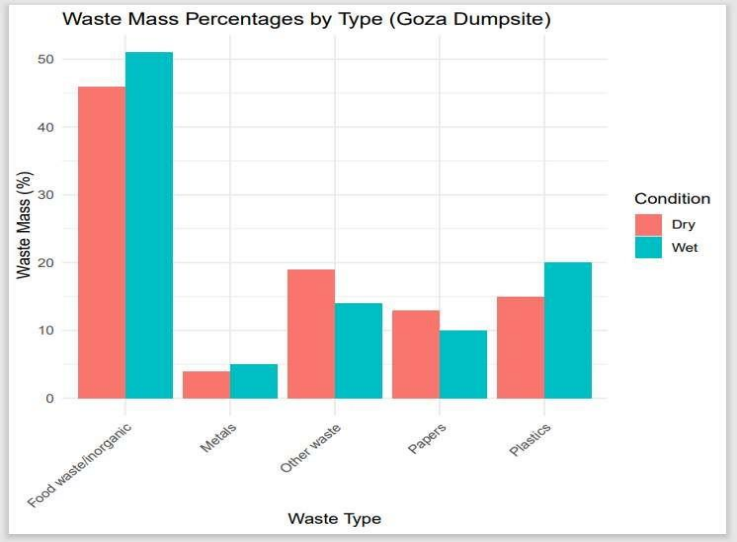


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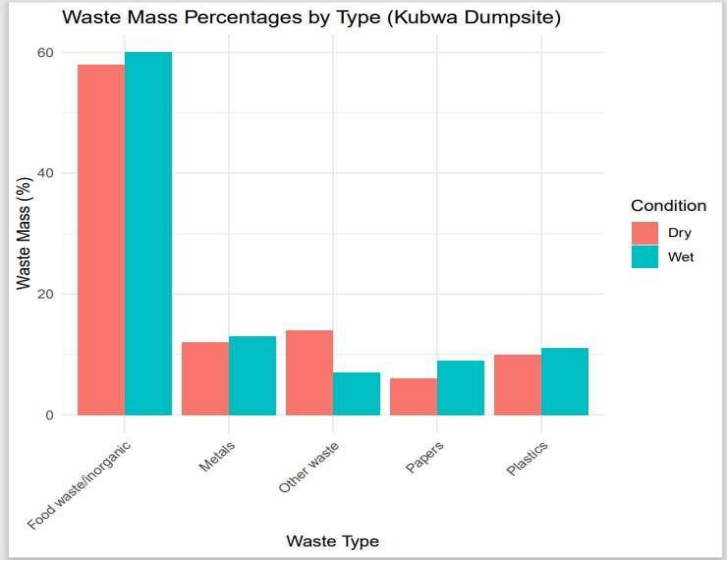


h

Figures a – h: Graphical displays of the results in Tables 5 - 8


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