BloEx - Journal
Britain International of
EXACT Sciences Journal
Publish: | January - May - September |
E-ISSN: 2686-1208
P-ISSN: 2686-1216
http://biarjournal.com/index.php/bioex

Survey on Household Solid Waste Management in Gbado-Lite city (Nord-Ubangi) in the Democratic Republic of the Congo

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Abstract:

Household solid waste management is a crucial issue for environmental and human health. The purpose of this study was to conduct a survey on household solid waste management in Gbado-Lite (Nord-Ubangi) in the Democratic Republic of Congo (DRC). A household solid waste survey was conducted in 5 neighborhoods of the city of Gbado-Lite in northern DRC from July to August. Data collection was made possible by stratified probability sampling and direct observations. The results of this study revealed that the main informants (75%) were women and 68% of the respondents were in the 18-35 age group. The main socio-cultural groups in the study area are the Ngbadi (55%) and Ngbaka (16%). In addition, 74% of respondents have secondary education and their main sources of income are commerce (25%), the civil service (20%) and the household (13%). Also, the main solid household wastes identified were organic materials (44%) and packaging (25%); the majority (56%) of respondents did not have garbage cans and used plastic buckets without lids as their main garbage can (75%). Almost all (98%) of the waste does not undergo primary separation. The main waste disposal methods used by households are: landfill (43.87%), abandonment on public land (30.62%) and incineration (18.36%). Finally, the main harms of waste reported are: typhoid fever (29%), malaria (25%) and mosquito proliferation (24%). It is therefore desirable that a public sanitation service be set up in Gbado-Lite to enable households to manage their solid waste properly and thus protect the urban environment and human health.

Keywords:

environment; sustainable development; waste, resilience; Democratic Republic of the Congo

I. Introduction

Households all over the world produce waste as they seek to satisfy their basic needs such as food, heating, and consumption. With population growth and rapid urbanization, uncontrolled waste generation has become so significant that it poses a real problem for the governance of urban agglomerations in developed and developing countries (Kaza, 2018). Long neglected, waste has now become a primary issue for elected officials, citizens and the industrialists who produce or treat it (Bertolini, 2005). In this regard, one of the environmental issues associated with urban waste remains the very low collection rate in many African cities. Indeed, in most African cities, less than 30% of waste is disposed of Adepoju (2002), Bontianti et al. (2008). Undisposed waste is dumped in gutters, rivers and streets. The

insufficient rate of waste collection leads to consequences for people's health and the urban economy (Kaza, 2018). Other problems common to African cities such as uncontrolled urbanization weaken the situation. Thus, in Gbado-Lite, waste management in general and that of solid household waste in particular, represents a major problem. As a result of the growing insalubrity, Gbado-Lite has the image of a "garbage town" taken hostage by mountains of garbage. The inoperative character of the structures of collection and evacuation of household waste favors the establishment of uncontrolled wild dumps in the streets. The uncollected rubbish, the unchanneled waste water, the degraded roadways have become the nightmare of the inhabitants of this city. The latter clog the drainage gutters and pollute the shores for lack of drainage. Even if this raises questions, it is observed today that few researchers have favored studies on the reasons for the inefficiency of the management chain put in place in the communes of Gbado-Lite. As a result, there is almost no systematic work on the subject. However, a better understanding of the inefficiency of waste management would make it possible to put in place adequate structures for more efficient and sustainable management. This management, which involves the recovery of waste, remains poorly known by the population and neglected by the public authorities.

The general objective of this study is to conduct a survey on household solid waste management in Gbado-Lite (Nord-Ubangi) in the Democratic Republic of Congo (DRC). More specifically, it is to describe the socio-demographic profile of the respondents; to identify the situation of household solid waste in the Commune of Gbado-Lite; to identify the causes of this situation; to describe the management of this household solid waste; to evaluate the level of knowledge of households on the harm caused by waste on human health and the environment and to propose solutions to improve the system.

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II. Research Methods

2.1. Description of the Study Environment

The present study was conducted in the town of Gbado-Lite (Latitude: 4° 16' 41" North; Longitude: 21° 00' 18" East; Altitude: 300-500 m above the Sea). The town of Gbado-Lite (Figure 1) is located in the Ubangian ecoregion, a subset belonging to the Northeastern Congolian lowland forests. This ecoregion is one of the 200 global priority terrestrial ecoregions known as the "G200"(Ngbolua, 2020a; Ngbolua, 2020b; Ngbolua, 2019a; Ngbolua, 2019b; Ngbolua, 2019c; Ngbolua, 2018).

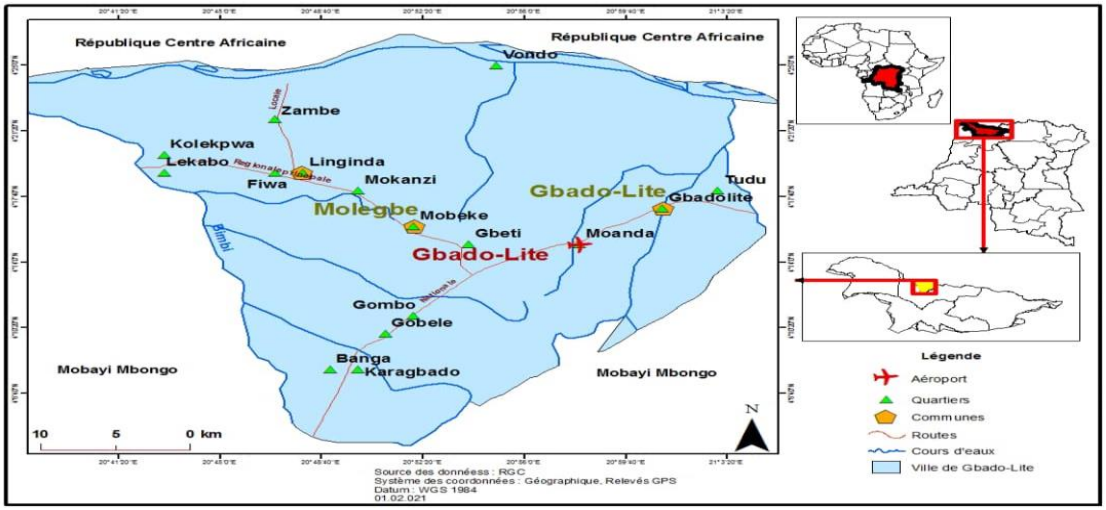

Figure 1. *Geographic Location of the City of Gbado-Lite*

2.2. Methodology

The stratified probability sampling method was used as previously described by Ngbolua et al. (2020) and Masengo et *al.* [2021a; 2021b]. It consists of dividing the study area (Commune of Gbado-Lite) into different strata, represented here by the five neighbourhoods (Kaya, Lite, Mbanza, Moanda and Pangoma) and associating the same number of respondents (20). The survey questionnaire administered to the respondents included two parts: (1) sociodemographic data: gender, age, socio-cultural group, level of education, occupation and marital status; (2) management of household solid waste by the population: modes of waste disposal, people who take care of waste disposal and people who are responsible for waste management in urban areas, etc. The interview was conducted in the local language (Lingala).

The study was conducted according to the principles of the Declaration of Helsinki: free consent of respondents, etc. [(Masengo, 2021a; Masengo, 2021b; Mongeke, 2018; Ngbolua, 2019; Ngbolua, 2016; Ngbolua, 2017)]. Microsoft Excel version 2010, SPSS version 20, and Origin version 8.5 Pro were used for data processing and analysis.

III. Discussion

3.1 Results and Discussion

Figure 2 shows the distribution of respondents by gender.

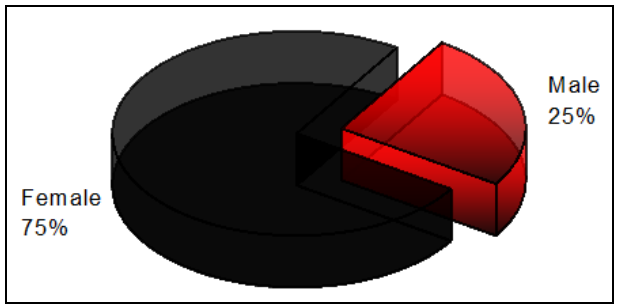

Figure 2. *Distribution of Respondents by Gender (%)*

Figure 2 shows that the majority (75%) of respondents are female and barely ¼ or 25% of respondents are male. Figure 3 shows the distribution of respondents by age.

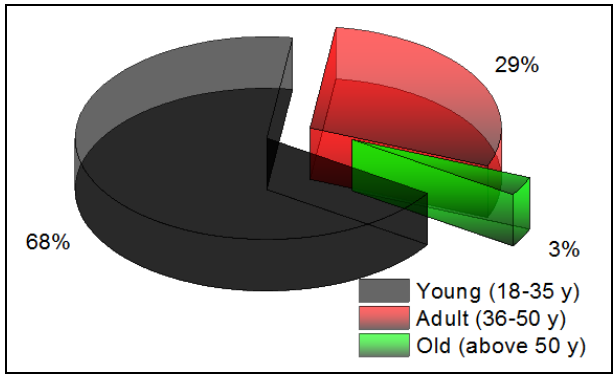

Figure 3. *Distribution of Respondents by Age (%)*

Figure 3 shows that the majority (68%) of respondents is between 18-35 years old. In addition, 29% of respondents are between 36-50 years old. Finally, just under a tenth (3%) of those surveyed is at least 50 years old. Figure 4 shows the distribution of respondents according to their socio-cultural group.

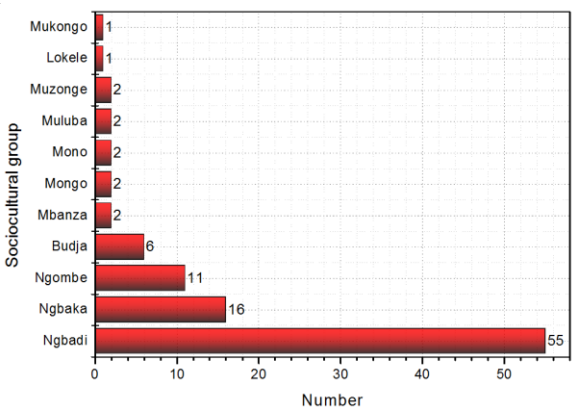

Figure 4. *Distribution of Respondents by Socio-cultural Group (%)*

Figure 4 shows that the majority (55%) of respondents are Ngbadi. The other socio-cultural groups are: Ngbaka, which represents 16%, Ngombe (11%), Budja (6%), Mbanza, Mongo, Mono, Munzonge (2%) and Muluba (2%), Lokele (1%) and Mukongo (1%). Figure 5 shows the distribution of respondents according to their level of education.

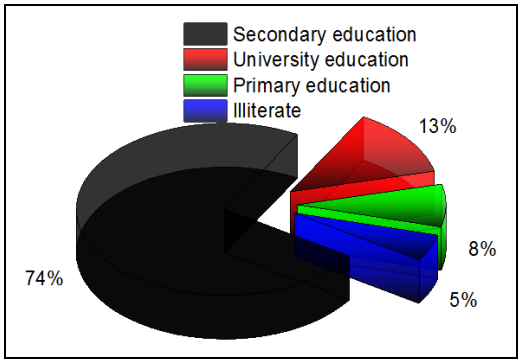

Figure 5. *Distribution of Respondents by Education Level (%)*

Figure 5 shows that the vast majority (95%) of respondents are literate, compared to 5% who are illiterate. Of the 95% of respondents who are literate, 74% have a secondary education, 13% have a university education and 8% have barely completed primary school. Figure 6 shows the distribution of respondents by occupation.

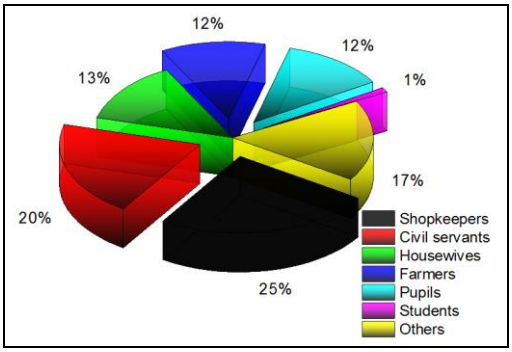

Figure 6. *Distribution of Respondents by Occupation (%)*

The figure 6 shows that the majority (25%) of respondents are shopkeepers following by civil servants (20%), housewives (13%), pupils (12%) and farmers (12% each) and students (1%). Other unspecified categories make up 17% of respondents. Figure 7 shows the distribution of respondents by family status.

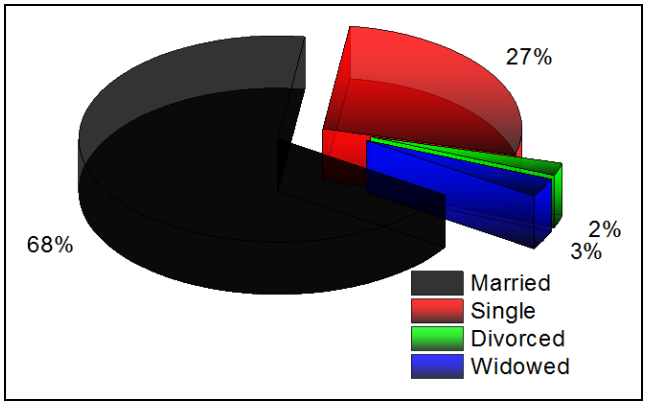

Figure 7. *Distribution of Respondents According to Family Status (%)*

Figure 8 shows that the majority (68.00%) of respondents are married. In addition, 27.00% of the respondents are single, 3.00% are widowed and 2.00% are divorced. Table 1 gives the opinion of the respondents on waste and its collection.

Table 1. Opinion of the Respondents on Waste and its Collection

Variables	**Frequency**	**%**
Types/categories of waste		
Organics Material	95	44.00
Paper	26	12.03
Glass	15	6.94
Packaging	54	25.00
Others	26	12.03
Total	216	100.00
1) Garbage cans		
Yes	44	44.00
No	56	56.00
Total	100	100.00
2) Type/category of waste garbage cans		
Bag (Markets)	05	11.40
Plastic seal with lid	05	11.40
Plastic seal without cover	33	75.00
Metallic container	01	2.20
Total	44	100.00
3) Primary sorting		
Yes	02	2.00
No	98	98.00
Total	100	100.00
4) Collection Service		
Yes	11	11.00
No	89	89.00
Total	100	100.00

According to the opinion of the respondents on waste and its collection (Table 1), almost half, or 44.00% of the solid waste produced by households in Gbado-Lite city is organic material, followed respectively by packaging (25.00%), paper (12.00%) and glass (6.94%). The majority (56.00%) of respondents do not have garbage cans compared to 44.00% of respondents who do. In addition, 75.00% of households use plastic buckets

without lids as their main waste garbage can, followed respectively by bags "locally called markets" (11.40%) and plastic buckets with lids (11.40%). Finally, only 2.20% of the respondents use metal containers as garbage cans. 98.00% of households do not carry out primary waste separation and against 2.00% who do carry out primary separation. 89.00% of households do not have waste collection services in their neighborhoods, compared to 11.00% of respondents who do. With regard to waste disposal, 90.9% of waste is disposed of by private individuals, compared with 9.10% who are disposed of by the municipal hygiene service. 54.54% of respondents dispose of their waste twice a week, while 36.36% of respondents dispose of their waste three times a week and 9.10% of respondents dispose of their waste every day. The study also revealed that waste disposal is done using wheelbarrows. Figure 8 shows the methods of waste disposal.

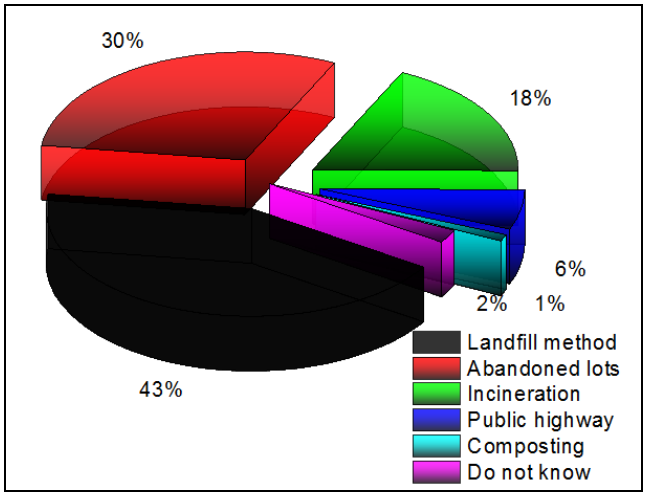

Figure 8. *Different Methods of Waste Disposal in Gbado-Lite (%)*

Figure 8 shows that the majority (43%) of respondents uses the landfill method to dispose of household waste. In addition, 30% of the respondents dispose of their waste on abandoned lots. Finally, the other methods of household waste disposal used by the respondents are: incineration (18%), abandonment on the public highway (6%) and composting (1%).

Figure 9. *(A) Landfill; (B) Garbage bag for metal solid waste; (C) Roadside waste; (D) Incineration of organic solid waste*

Table 2 gives the methods and reasons for waste use by the respondents.

Table 2. Disposal Methods and Choice Reasons

Methods	Reasons
Incineration	Prevent the proliferation of mosquitoes and prevent waste from spreading; Limit the spread of diseases; Prevent bad odors.
Landfill	Preventing the scattering of waste; preventing bad odors for fear of polluting the environment; making compost; no service to evacuate household solid waste; good waste management.
Public road	Only place to dispose of waste (no public garbage cans); Plot too small to dig a hole.

Regarding the responsibility for waste management in Gbado-Lite city, the majority of respondents (49.00%) believe that the community is responsible for waste management; however, 26.00% of respondents believe that the community, with the assistance of local authorities, is responsible for waste management. Finally, 25.00% of the respondents believe that the local authorities ensure waste management. Urban sanitation using the "polluter pays" approach is a strategy that has been proposed elsewhere. The study shows that the majority of respondents (54.00%) claim to be able to pay monthly for the household waste collection service, while 46.00% do not accept this waste collection service. A study conducted by Muzumbi (2008) showed that 97% of households in the Matonge district of Kinshasa agreed to the creation of a sanitation service and to the polluter-pays principle. This means that the major problem of poor management of household waste is linked to the mentality and the absence of urban and municipal sanitation structures in large urban areas.

All the respondents confirmed that they had knowledge of the harmful effects of waste. These are: typhoid fever (29%), malaria (25%), mosquito proliferation (24%) and environmental pollution (2%) (Figure 10).

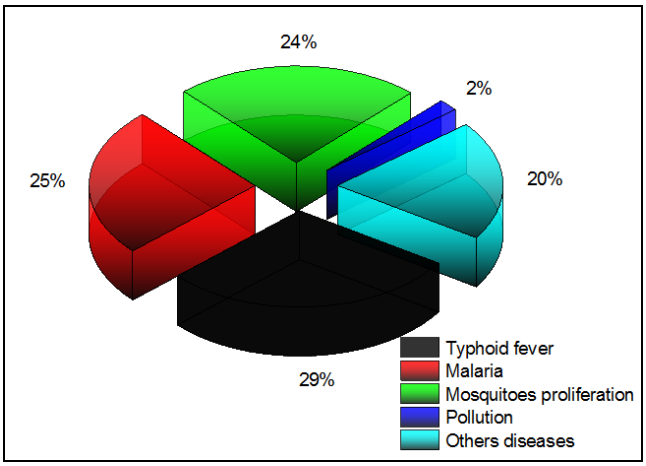

Figure 10. *Environmental and Health Impacts of Waste (%)*

Previous results showed that 92.00% of the households were aware and knowledgeable of the harms related to the presence of household waste on human health, compared to only 8.00% of the respondents who were unaware and did not know the harms. Among the harms mentioned were anopheles' mosquitoes that cause malaria, typhoid fever, diarrhea, etc. (Nkituahanga, 2010).

IV. Conclusions

The aim of this study was to conduct a survey of household solid waste management in Gbado-Lite.

The study found that:

1) The majority of waste produced in households is organic material;
2) The majority of respondents (56.00%) do not have garbage cans;
3) The majority of respondents (98.00%) do not carry out primary waste separation;
4) The majority of respondents (89.00%) do not have a waste collection service;
5) Waste is evacuated twice a week for 54.54% of respondents and all use wheelbarrows as their main means of transport;
6) The majority of respondents use landfill (43.87%) and dumping on public land (30.62%) as their main means of waste disposal;
7) The majority of respondents (54.00%) claim to pay the monthly parcel waste collection fee;
8) All respondents (100.00%) recognize the negative impact of waste on human health;
9) Typhoid fever (29.00%), malaria (25.00%), mosquito proliferation (24.00%) and environmental pollution (2.00%) are the main problems.

It is therefore desirable that a public sanitation service be set up in Gbado-Lite city to enable households to manage their waste properly and thus protect the urban environment and human health.

Acknowledgements

The authors would like to thank the different socio-cultural groups and households surveyed for their free consent to participate in this study and for disclosing the information they provided.

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