Original Article *Journal of Sustainability and Environmental Management (JOSEM), Vol. 4, No. 1 (2025), 22 – 32*
p-ISSN 2822-1729, e-ISSN 2822-1737 Available online at https://www.nepjol.info/index.php/josem

Household Solid Waste Management Practices and Socioeconomic Condition in Muksudpur Municipality, Gopalganj, Bangladesh

Md. Rajib Hossain[1*], Kazi Ashikur Rahman[1], Md. Shamsur Rahman[1], Rifat Islam[2], Md. Shihab Biswas[1]

[1]Department of Environmental Science and Disaster Management, Gopalganj Science and Technology University, Gopalganj-8100, Bangladesh
[2]Department of Environmental Science, Gazipur Agricultural University, Gazipur-1706, Bangladesh

**Corresponding author: rajib.esd@gstu.edu.bd*

Abstract: Solid waste management is a significant environmental challenge in emerging Asian countries. This study was conducted in Dhaka Division's Gopalganj district, focusing on household solid waste management in Muksudpur municipality. Urbanization, development, and population growth in Muksudpur municipality have led to increased household solid waste. It has been noted that residential garbage in every ward is not being handled properly, and no one seems concerned. The investigation found biodegradable, nonbiodegradable, recyclable, and reusable household waste. There is no trash can system or door-to-door pickup. The research region solely dumps trash into rivers or open spaces. This garbage harms humans and the environment. Organics, paper, plastics, and other minor components accounted for the majority of HSW in Muksudpur. Generally, population density and the health of the local economy are correlated with solid waste production. These items can be collected and disposed of securely at a lower cost, and the savings can be allocated to waste management. Before being removed from houses, this domestic rubbish must first be sorted by residents. The government should be worried about the storage, collection, transportation, and disposal of household waste in the Muksudpur municipal region, according to the project's conclusions.

Keywords: *Solid Waste, Components, Disposal, Storage, Collection, Household*

Conflicts of interest: None
Supporting agencies: None

Received 16.02.2025; Revised 11.04.2025; Accepted 23.04.2025

Cite This Article: Hossain, M.R., Rahman, K.A., Rahman, M.S., Islam, R. & Biswas, M.S. (2025). Household Solid Waste Management Practices and Socioeconomic Condition in Muksudpur Municipality, Gopalganj, Bangladesh. *Journal of Sustainability and Environmental Management*, 4(1), 22-32.

1. Introduction

Waste is unavoidable, as it is generated by everyday human activities, including domestic chores, agriculture, commerce, industry, natural and artificial disasters, and medical services, among others (Ahmed et al., 2023). Waste, as defined by the Bangladesh Environment Conservation Act of 1995, is any solid, liquid, gaseous, or radioactive material whose discharge, disposal, or disposal may result in adverse environmental effects (Amiri et al., 2022). The collection, transportation, treatment, or disposal of abandoned materials and substances constitutes waste management. Because the improper disposal of solid Waste pollutes the environment and poses health risks to humans, sustainable solid waste management is a key criterion for effective environmental management. (Ashikuzzaman & Howlader, 2020). Substances discarded from the household sector are considered household waste or Domestic Waste. Domestic garbage is a common component of daily living. Different categories of household garbage exist, including hazardous and nonhazardous Waste. It may be both biodegradable and nonbiodegradable. Environmental contamination is caused by domestic trash. Additionally, it increases environmental toxicity. If Waste is placed on the ground, it might pollute groundwater. Inefficient waste practices have a detrimental impact on social justice, public health, economic growth, and environmental sustainability (Mahajan, 2023). Diseases such as vomiting, headache, chemical burns, nervous system abnormalities, and so on,

may be caused by household trash (Eshete et al., 2023). The management of solid waste is a serious issue that needs urgent attention in Bangladesh (Shahen et al., 2024). It is essential to comprehend the qualitative and quantitative properties of solid Waste, since its growth necessitates the development (Awino and Apitz, 2024).

Globally, the rate of trash production is increasing. In 2020, it was anticipated that the world would generate 2.24 billion tons of solid waste, or 0.79 kg per person per day (Valavanidis, 2023). Rapid population growth and urbanization are projected to increase yearly waste generation by 73% from 2020 levels to 3.88 billion tons by 2050 (World Bank Group, 2022). Developing nations are expected to experience the most significant growth, including increases in packaging waste (Habib et al., 2021). While wealthier nations, such as Germany, have achieved success with various UHSWM programs, waste management (WM) regulations in poorer nations remain ineffective (Fadhullah et al., 2022). The unplanned expansion of many cities due to rapid urbanisation has created infrastructure issues that have hampered the ability of national and local governments to improve household WM service levels at the required pace (Jerin et al., 2022). In developing nations, waste management specialists must contend with the persistent expansion of slums, inadequate infrastructure, limited budgets, corruption, inadequate education, and community mistrust of the government (Azevedo et al., 2021). China, the world's largest developing nation, has already entered a phase of rapid urbanisation. China's urbanisation has grown by more than 1% per year between 2000 and 2022 (Khan et al., 2022). China's urban population is expected to comprise 70.46% of the country's total population by 2025. (China: Urbanisation 2022, Statista, 2023). India has experienced significant improvements in its social, economic, and environmental sectors, but the condition of municipal solid waste treatment has remained the same (Meena et al., 2023). Bangladesh's expanding industrialisation, urbanisation, and growing migrant population are contributing factors to the country's substantial waste output (Khanal et al., 2023). The accumulation of chemically polluted solid and liquid wastes, food waste, agricultural waste, and other waste from various sources in open landfills has damaged metropolitan areas. The city's inadequate rubbish management is evident in this outside garbage pile. In Bangladeshi cities, pollution of the soil, air, and water is pervasive (Lema et al., 2019). The shortage of available land is the key issue. The city of Dhaka alone generates approximately 7,000 metric tons of waste daily due to its densely populated population (Fattah et al., 2022). The government of Bangladesh is particularly concerned about safeguarding the environment, public health, and safety, as cities and municipalities often struggle to manage waste (Ahmed et al., 2023).

The management of solid Waste is an important phenomenon since trash is a problem that affects every civilisation constantly. Since Bangladesh gained independence in 1971, it has used a conventional waste management system (Mahéo et al., 2022). Early waste management practices in Bangladesh permitted indiscriminate open dumping and burning, the disposal of trash into water bodies, landfilling, and the direct placement of Waste onto agricultural land in rural regions. In metropolitan areas, the WASA handled both the midnight collection of solid trash and the house-to-house collection of nocturnal Waste using Bullock Carts (Meng et al., 2019). The nation transitioned from a traditional to a contemporary approach to waste management. Bangladesh has shifted from waste management to resource management, as wastes are now viewed as a valuable resource (Ashikuzzaman & Howlader, 2020). For sustainable expansion, densely populated urban and peri-urban areas need excellent waste management. Municipal SWM degrades public health and living conditions. People often overlook the utilisation of solid waste management. Misused solid materials are a significant contributor to solid Waste. Individual awareness is the most crucial aspect of solid waste management systems in Dhaka (Ornob & Aktar, 2020), and this holds true for Muksudpur municipality in Gopalganj.

Although solid waste management has received more attention, few studies have examined semi-urban settings like Muksudpur. Despite Muksudpur's rapid urbanisation and waste management challenges, the socioeconomic and behavioural aspects of localised studies are not adequately addressed by existing research. By analysing waste sources and disposal practices, this study seeks to close this gap. The findings of this study are likely to be helpful to policymakers in choosing sensible waste management options that benefit the local population. Muksudpur municipality faces serious waste management issues, including river dumping, poor waste segregation, and health risks. This study utilised ward-specific data to develop local policies, raise public awareness, promote recycling, and provide sustainable solutions. This study will promote SDGs 6 and 11 in Bangladesh's peri-urban areas. The study will raise awareness, thereby increasing efforts to minimise the problem by highlighting the engagement of several stakeholders and the variety of methods they may use to fix it. The three main types of garbage are domestic Waste, industrial Waste, and medical Waste; however, only household solid waste will be studied for this study. This study provides a brief examination of the environmental effects associated with the existing trash generation, characteristics, and management scenario in the Muksudpur municipality.

2. Materials and methods

2.1 Study Area

Gopalganj district is situated on the Madhumati River, at coordinates 23°00'47.67" N, 89°04'21.14" E. Research area Muksudpur Municipality is a local government body under Muksudpur Upazila of Gopalganj District, Dhaka Division, Bangladesh. Established in 2000, this municipality is classified as a "B" category municipality in Bangladesh. The coordinates for Muksudpur are

23.3167°N and 89.8667°E. 24,858 people reside in the 16.4 sq km area, comprising 12,707 men and 12,151 women. The population density is 1523 people per square kilometre. There is a total of 4865 households (Muksudpur Upazila, 2023).

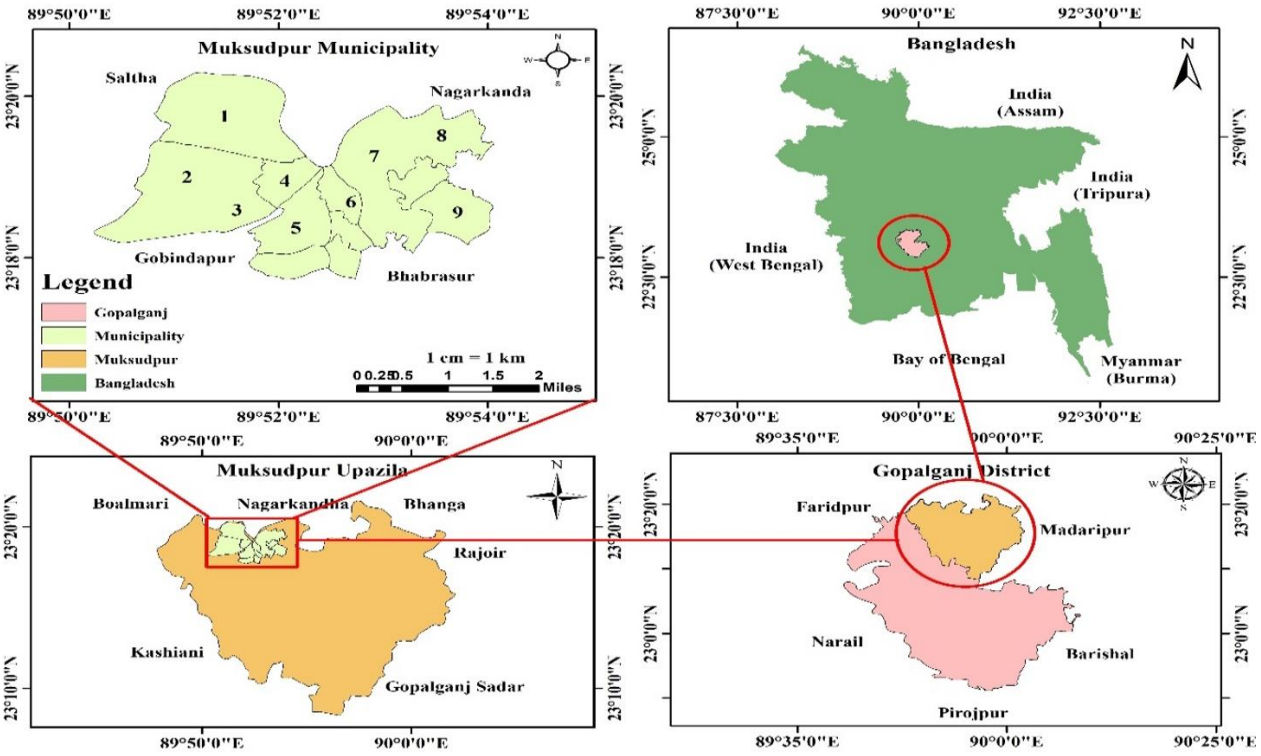

Figure 1: Location of the study area

2.2 Conceptualization and topic selection

Initially, I searched for conceptualisations on the educational search engines Google Scholar, Microsoft Academic, and ResearchGate, among others. Moreover, search online journals such as CORE, Sci-Hub, Directory of Open Access Journals, and Open-door. By studying and gathering knowledge from different articles, journals, and reports. It helps me understand and select a research topic.

2.3 Data Collection

Data were collected from residents of Muksudpur municipality through observation, interviews, questionnaires, and transect walks.

Sources of data

All databases used in this investigation were collected from study area respondents. To calculate this project accurately, two types of data have been used: primary data from a household survey and secondary data to enhance the project's effectiveness.

Primary data collection

Using a field survey, the original data were collected directly from individuals in the research area. The survey was done in the municipality of Muksudpur to get first-hand information for the report. There are two types of survey questions: open-ended and closed-ended, and both have been posed to homeowners. A semi-structured home management questionnaire, which includes their economic profile, family composition, and trash storage, has been administered. The residents were selected from among the 100 homes in the municipality. I immediately visited the wards of our study region to gain knowledge and experience about the residents.

Figure 2: Primary data collection through a field survey

Secondary data collection

Most of the secondary data originated from various sources, including local government documents, newspaper articles, and numerous online platforms.

Village's data collection

The residents were selected from among the 100 homes in the municipality. There are 9 wards in the municipality of Muksudpur, and I allocated 100 residences as follows:

12 in Ward No. 6 and 11 in each of the other 8 wards, as shown in Table 1.

Table 1: Village's selection criteria

Ward No.	Villages	Upazila	District
1	Lakhar char	Muksudpur	Gopalganj
2	Prabhakardi (Partial)		
3	Prabhakardi / Nagar Sundardi		
4	Chandivardi		
5	Gopinathpur		
6	Tengrakhola / Mubarakkandi (Partial)		
7	Kamalapur (Partial)		
8	Kamalapur (Partial)		
9	Golabaria, Hogladanga, Mubarakandi (Partial), Choto Bahara, Bhandaria.		

Respondents' selection criteria

Households were selected through stratified random sampling to ensure representation across socioeconomic status, gender, and housing types within each ward. There are a total of 9 wards in the municipality of Muksudpur, and 100 residences were allocated as follows: as shown in Table 1. The responders above the age of twenty have been chosen. Respondents were asked to complete a pre-designed questionnaire. The purpose of the survey was to collect information on the age, level of education, total monthly income, household pattern, Waste, occupation, Waste reuse or recycling, respondents' difficulties, and environmental changes in the research area.

Questionnaire design content and validation process

A semi-structured questionnaire was developed based on previously approved instruments (Fattah et al., 2022). The questionnaire examined: (1) waste generation patterns; (2) household waste storage techniques; (3) relevant socioeconomic variables; (4) segregation and disposal procedures; and (5) awareness and attitudes regarding home solid-waste management. To capture both measurable outcomes and contextual detail, the tool included a mix of closed-ended items for quantitative analysis and open-ended items to elicit deeper qualitative responses.

A pre-test was conducted using the questionnaire on 10 households not included in the final sample. The feedback allowed us to reword, eliminate redundancy, and simplify the definition so that it makes sense. Reliability for field deployment was confirmed through an internal consistency analysis using Cronbach's alpha, yielding an α of 0.78. Questionnaires were administered face-to-face, and data were collected directly during field interviews. It was designed to collect data on age, education level, monthly income source, waste reuse or recycling practices, respondents' complaints, and any changes in the environment.

2.4 Data analysis and essential materials

The obtained data and the literature have been thoroughly evaluated and condensed in sequence. Unnecessary elements of the gathered materials and data were omitted to prevent the project report from getting too lengthy. After sorting the data, it was analysed and compiled progressively and with care. Using Microsoft Office Excel 2023, the gathered data were examined and processed. The data was evaluated using a table, a bar chart, a pie chart, and a column chart. In this study, ArcGIS 10.8 software is used to identify the study area.

2.5 Flow chart of the step-by-step procedures and methods

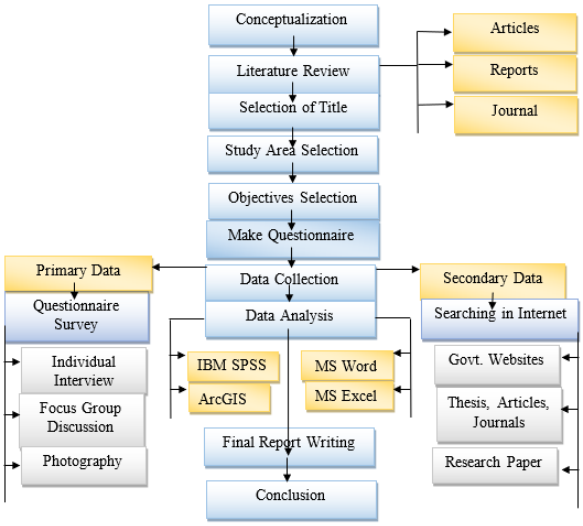

Figure 3: Flow chart of the step-by-step procedures and methods (author illustration).

2.6 Municipal solid waste management practice in Bangladesh

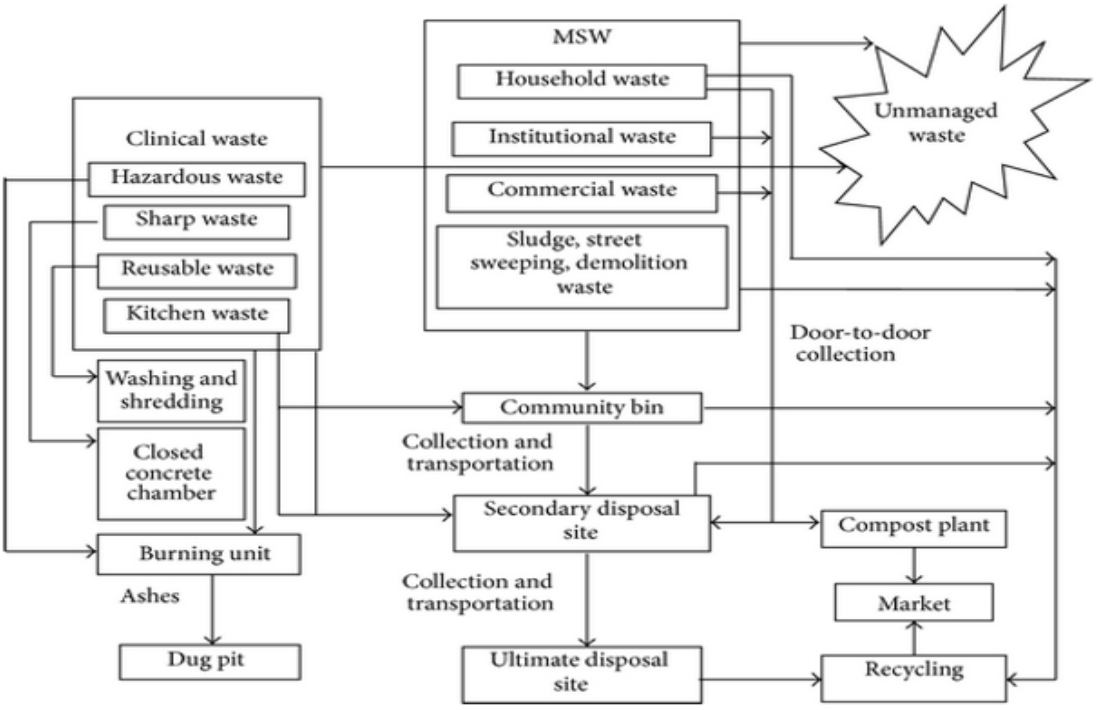

Figure 4: Flow diagram of MSW management in Bangladesh (Ahsan et al., 2014).

3. Results and discussion

3.1 General information about the respondents

The survey was conducted among 100 respondents. The survey was conducted above the 20-year age group. In the study area, the respondents were divided into six categories. Education is the backbone of a nation. No nation can stand or shine in the future without a strong education system. Table 2 shows the socioeconomic demographic information of the respondents.

Table 2: Age group, gender ratio, and educational qualification of the respondents

Characteristics	Ranges	Frequency	Percentage	Total
Age Group	20-29	35	35.0	100
	30-39	23	23.0	
	40-49	16	16.0	
	50-59	16	16.0	
	60-69	10	10.0	
Gender	Male	40	40.0	100
	Female	60	60.0	
Education	Never Studied	17	17.0	100
	Primary	17	17.0	
	JSC	10	10.0	
	SSC	19	19.0	
	HSC	12	12.0	
	University	25	25.0	
Occupation Name	Day labor	6	6.0	100
	Farmer	7	7.0	
	Teacher	5	5.0	
	Service	8	8.0	
	Businessman	12	12.0	
	Housework	55	55.0	
	Banker	2	2.0	
	Transport sector	5	5.0	

Gender identification is the most important part of the survey. According to the table, 40% of the people were male and 60% were female. About 17% of respondents' educational qualifications were never studied in any educational institute; 17% of respondents' educational qualifications were in primary education; 10% of respondents' educational qualifications were in junior

secondary education; 19% of respondents' educational qualifications were in secondary education; 12% of respondents' educational qualifications were in higher education; and 25% of respondents' educational qualifications were at the university level. Work is the most crucial aspect of human existence for maintaining a family. The occupation pattern of a family reveals the respondents' living situation or position. About 6% of the respondents were day labourers, 7% Were Farmers, 5% were teachers, 8% worked in Services, 12% Were Businessmen, 55% Were Housewives, 2% Were Bankers, and 5% worked in the transport sector. Based on Bundhoo's (2018) profession, his research focuses on solid waste management, one of the most immediate and serious environmental problems confronting municipal authorities in developing Asian countries. The study is consistent with other semi-urban studies in Bangladesh, such as Mymensingh city (Fattah et al., 2022). This demographic similarity is important, as socioeconomic status highly affects waste generation and management practices, especially in developing countries.

3.2 Information about the family

Monthly income and expenditure of households (TK)

The household income levels were categorised as follows: ≤ 3000TK, 3001-5000TK, 5001-10000TK, 10001-15000TK, and ≥ 15000TK. The household income levels are shown in Table 3. 64% of the families had an income of more than 15000TK, 19% had an income between 10001-15000TK, 13% had an income between 5001-10000TK, 2% had an income between 3001-5000TK, and 2% of the respondents had an income of less than or equal to 3000TK. According to Chikowore et al. (2020), income level has a relation with municipal waste management, where people with lower incomes are less concerned about waste management than those with higher incomes.

There were five categories of household spending levels: ≤ 3000TK, 3001-5000TK, 5001-10000TK, 10001-15000TK, and ≥ 15001TK. From Table 3, 70% of households had expenditures of more than 15000 TK, 15% had expenditures between 10001 and 15000 TK, 14% had expenditures between 5001 and 10000 TK, 1% had expenditures between 3001 and 5000 TK, and none had expenditures below 3001 TK. The levels of family income and expenditure are shown in Table 3.

Table 3: Monthly income and expenditure of the households (Field survey, 2023).

Range (TK)	Income %	Expenditure %
≤ 3000	2.0	0.0
3001–5000	2.0	1.0
5001–10000	13.0	14.0
10001–15000	19.0	15.0
≥ 15001	64.0	70.0
Total	**100**	**100**

The house conditions of the respondents

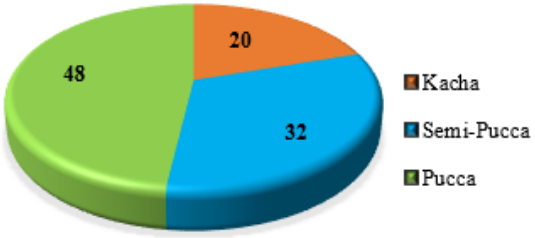

Figure 5: The house conditions of the respondents (Field survey, 2023)

According to Fig. 5, 48% of those questioned had made Pucca their home, indicating that it was constructed of concrete and brick. 32% of respondents constructed their dwelling from semi-pucca. 20% of respondents have constructed a kacha dwelling. Kacha refers to the residence made with CGI sheets, bamboo, and straw. The wealthy respondents built their homes of concrete and brick, whereas the poor used bamboo and straw.

3.3 Information about solid waste management

The way of heritage about solid waste

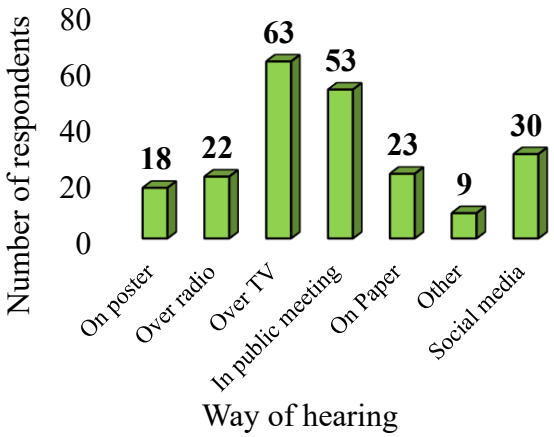

Figure 6: Ways of hearing about waste management

Respondents were given multiple options to choose from, and 100 participants participated. Among the 100 participants, 82% reported hearing about solid waste management. It is stated that they heard about it through the radio, public meetings, TV, posters, and other means. Some of the individuals chose multiple options. In response, participants most often heard about it through TV, with approximately 63 respondents, followed by public meetings, which involved about 53 people. Through social media, 30 respondents became aware of it. Through the mediums of radio, paper, and posters, 22, 23, and 18 participants, respectively, were aware of solid waste management. While only 9 participants heard about it through other means (Fig. 6). According to Roy et al. (2022), the management of municipal solid Waste (MSW) has become a significant issue in urban areas of developing countries, such as Bangladesh. The outcome aligns with Almasi et al. (2019), who found that 48% of respondents in

Kermanshah reported television as their primary source of information. A similar dependency on television has been reported in Bangladesh's cities (Fattah et al., 2022), suggesting that mass media remains a vital tool for advocating changes in waste management practices in less developed countries.

Components of Waste

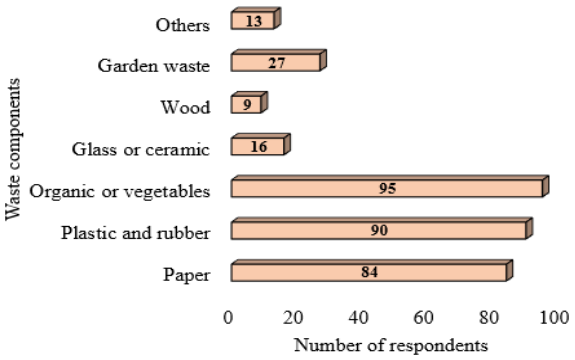

Figure 7: Waste Components (Field survey, 2023)

According to Fig. 7, respondents chose the following waste types for the study area: paper (84 respondents), plastic and rubber (90 respondents), organic or vegetable waste (95 respondents), glass and ceramic (16 respondents), wood (9 respondents), garden waste (27 respondents), and others (13 respondents). At the outset, it is essential to understand that household solid waste management begins at the point of production in homes, where these wastes should be sorted and divided into coloured bins according to type (organic, paper, plastics, metals, and others), which later helps in proper recovery and maintains circularity (Ferronato et al., 2024). The findings are consistent with the research of Fadullah et al. (2022), who found that food waste ranks first among household waste, followed by plastic trash. This crucial stage must be carried out to help reduce waste management costs (Hakami et al., 2015).

Put the Waste in the house

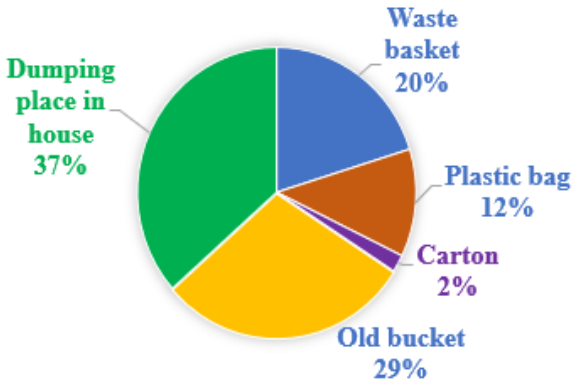

Figure 8: Put the Waste (Field survey, 2023)

Fig. 8 shows that the stored waste is collected in the following proportions: 37% in the Dumping place in the house, 20% in the waste basket, 12% in a plastic bag, 2% in a carton, and 29% in an old bucket.

Problems with waste storage at the house

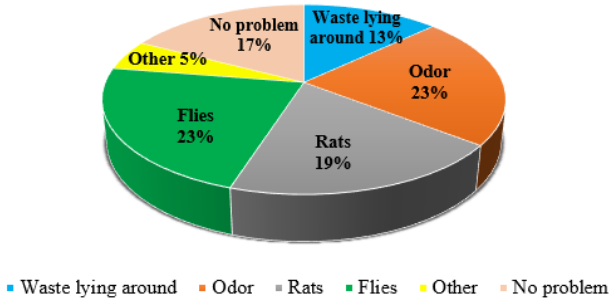

Figure 9: Put the Waste (Field survey, 2023)

In Fig. 9, 23% of respondents attributed their house's difficulties with waste storage to foul odours, and 23% to insects such as flies. 19% of respondents cited rats, 13% mentioned garbage, 5% mentioned other issues, and 17% indicated there were no issues. The findings of this study indicate that existing facilities are failing due to a lack of concern, high waste creation, insufficient collection space, delayed approval of new landfill sites, and a few fire-prone open dump sites. The innuendos of the waste management practices in the city are discussed (Priyadarshi et al., 2019).

Segregate the waste

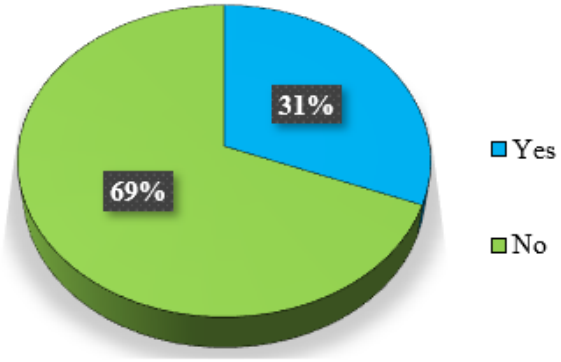

Figure 10: Segregate Waste (Field survey, 2023).

According to Fig. 10, 31% of respondents stated that they separate their garbage, while 69% disagreed. This segregation of percentages is lower than that in the study by Fattah et al. (2022). Amasi et al. (2019) in Kermanshah, Iran, found that 79% of women had high knowledge and 86% had a positive attitude toward segregation, but 77% demonstrated poor actual segregation practices. There are non-monetary expenses associated with sorting garbage into various containers (usually recyclables and general rubbish) by the homeowner (Hakami et al., 2015).

Evaluate the state of the environment depending on solid waste management in the house area

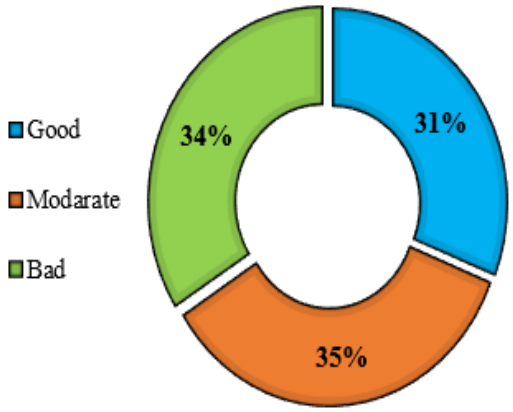

Figure 11: State of the environment depending on solid waste collection (Field survey, 2023)

In this figure, 31% of respondents rated the state of the environment based on solid waste collection in their residential area as good, 34% as bad, and 35% as moderate (Fig. 11). The paper by Shaili Vyas et al., (2022), Municipal solid waste management is a critical aspect of urban development, and it has gained significant attention due to its potential ecological impacts and public health concerns.

Have you ever heard about the importance of recycling and reuse?

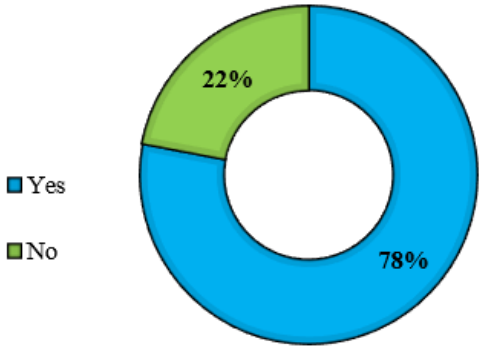

Figure 12: Heard about the importance of recycling and reuse (Field survey, 2023)

Fig. 12 shows that 78% of respondents recognized the importance of recycling and reusing, while 22% opposed it. However, recycling systems that enable residents to deposit a variety of recyclables in a single container, rather than requiring them to sort recyclables into paper, plastic, glass, and metals, tend to yield far greater overall volumes of recyclables (Hakami et al., 2015). According to Hui Wang et al. (2020), a comprehensive review of the key factors that influence public awareness and participation in household solid waste (HSW) recycling in urban areas of China.

Noticed the presence of the following in and around a public waste bin or dumping land?

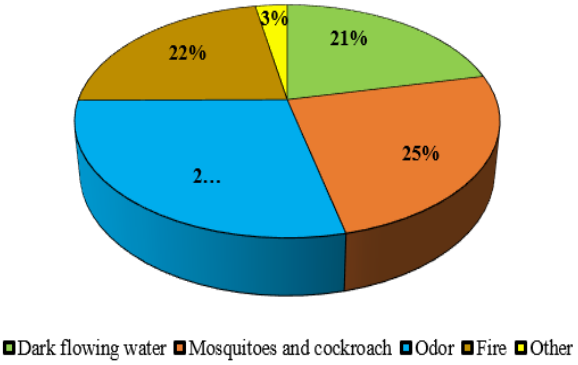

Figure 13: Noticed in public waste bin or dumping land (Field survey, 2023)

In Figure 13, the responders noticed the presence of the following in and around public waste bins or dumping grounds: mosquitoes and cockroaches at 25%, dark, flowing water at 22%, odour at 28%, fire at 22%, and other items at 3%. A holistic approach is needed to address the complex challenges of MSW management, including reducing waste generation, promoting sustainable waste management practices, and increasing public participation in waste management decision-making (Sharma & Jain, 2019).

Overall, how would rate the quality of the environment in Muksudpur municipality compared to the environment had five years ago?

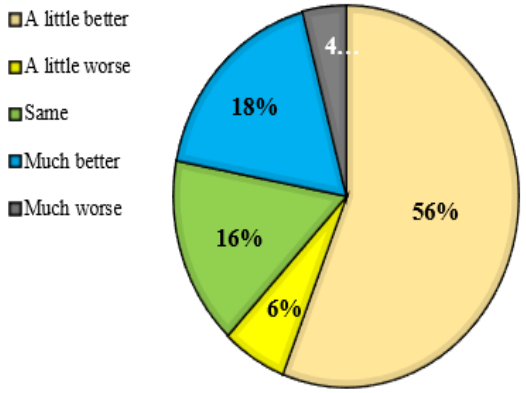

Figure 14: Quality of the environment compared to five years ago (Field survey, 2023)

When asked to rate the quality of the environment, respondents indicated that the environment in the Muksudpur municipality was higher than that encountered five years earlier. This was the respondents' consensus after the question was posed. According to the findings (Fig. 14), the situation has improved for 18% of respondents,

worsened for 4%, improved slightly for 56%, worsened slightly for 6%, and remained the same for 16%. According to a paper by Mohamad Noufal et al. (2020), a study examines the factors influencing the generation and composition of household solid waste in Homs City, Syria. This paper provides an overview of current research on solid waste management, focusing on the determinants of waste generation and composition.

4. Conclusion

Proper solid waste management is crucial for sustainable development, particularly in densely populated countries like Bangladesh. Most towns and cities are in danger due to the unchecked, rising amount of Waste. Most individuals discard their garbage in public areas, but only a small percentage properly dispose of it in designated trash cans. Most respondents to the household poll bemoaned the difficulties they had in disposing of their MSW, blaming it on the lack of action by local authorities and designated dump sites. The survey findings indicate that, although a significant majority of respondents have heard about solid waste management, there is still room for improvement in both awareness and the implementation of waste management practices. The study highlighted the scarcity of public garbage bins, ineffective waste-disposal methods, and issues with household-level waste storage. Despite this, many respondents expressed a willingness to pay for garbage. Muksudpur should take the necessary actions to strengthen the procedures for managing solid Waste in the municipality.

Acknowledgements

Every faith and devotion to the Almighty Creator enabled the author to complete the study project. The author would like to extend special thanks to the respected respondents and the coordinator of Muksudpur Upazila Office, Gopalganj, Bangladesh.

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