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AN ANALYSIS OF KNOWLEDGE, AWARENESS, AND DISPOSAL PRACTICES RELATED TO SOLID WASTE MANAGEMENT AMONG HIGHER EDUCATION STUDENTS IN VASAI-VIRAR

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Abstract
Solid waste management is an important aspect of sustainable urban development. Improper waste disposal leads to various environmental issues and health problems. Higher education students represent an important population group due to their consumption patterns and waste disposal behaviours. This study aims to assess the knowledge, awareness, and disposal practices related to solid waste management among higher education students. A survey was carried out by collecting data through a structured questionnaire. Descriptive and inferential statistical methods were used to analyze the data. The findings indicate that while higher knowledge levels promote compliance with waste segregation practices, knowledge alone is insufficient to ensure consistent behaviour.
Keywords: Solid Waste Management, Knowledge, Awareness, Disposal Practices, Higher Education Students.

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1. Introduction

Solid waste management (SWM) has become a major environmental challenge in India due to rapid urbanization, population growth, and continuously increasing consumption patterns. According to the Central Pollution Control Board (2022), India generated approximately 170,339 tonnes of municipal solid waste per day in 2021–22, with just over half treated and a substantial share still ending up in landfills or unmanaged sites. Inadequate segregation at source, inefficient collection systems, and inadequate infrastructure continue to act as major barriers to effective waste management across Indian cities (Council on Energy, Environment and Water [CEEW], 2025; CPCB, 2022).

Improper management of municipal solid waste (MSW) has been closely associated with environmental degradation, groundwater contamination, air pollution, and increased public health risks in developing countries, including India (World Bank, 2018). These problems can only be handled with active public participation, particularly in waste segregation and responsible disposal at the source. Waste segregation in India remains largely unorganized. There is inadequate source-level segregation at the household level (Joshi & Ahmed, 2016).

Higher education students constitute an important demographic in the sustainable waste management study due to their educational exposure, adaptability to behavioural change, and potential role as influencers within households and communities. However, several studies suggest

that higher levels of education and awareness do not necessarily result in consistent pro-environmental behaviour.

Vasai-Virar City, the only metropolitan city in Palghar district with a population exceeding one million, currently lacks segregation of municipal solid waste at the source despite being governed by a municipal corporation (IIT Bombay, 2023). This situation highlights the need to examine behavioural dimensions of waste management, particularly knowledge and awareness among key population groups. Hence the present study analyses knowledge, awareness, and disposal practices related to solid waste management among higher education students in this region.

2. Literature Review

Kollmuss and Agyeman (2002) argue that environmental knowledge and positive attitudes do not consistently translate into pro-environmental behaviour. Deshpande et al. (2024) conducted a study on the socio-economic factors influencing household waste generation and recycling behaviors in Chennai, India. The research highlighted that education level, income, and environmental awareness are important determinants of effective waste management practices.

Jerath (2021) reported that while high school students in Punjab demonstrated adequate awareness of waste management, this did not translate into participatory action, with many students discontinuing segregation after witnessing municipal collectors mixing waste. Knowledge-practice gap persists into higher education as Parvez et al. (2019) found that despite the high educational exposure at a premier technical institute, students frequently failed to segregate waste due to apathy and infrastructural deficits.

3. Objectives

1. To assess knowledge regarding solid waste management
2. To examine awareness and attitudes related to waste management
3. To analyse waste disposal practices among respondents
4. To study the association between knowledge level and waste segregation behaviour

4. Research Methodology

A cross-sectional analytical study was conducted among higher education students in Vasai- Virar region, Palghar district, Maharashtra, using the purposive sampling method. Primary data was collected by a structured questionnaire. The sample consisted of 185 undergraduate college students.

Students' waste management knowledge was assessed using six dichotomous questions, with total scores ranging from 0 to 6. Respondents scoring 5–6 were classified as having high knowledge, while those scoring 0–4 were classified as having low to moderate knowledge for inferential analysis.

Hypotheses

H_0 (Null Hypothesis): There is no significant association between waste management knowledge level and waste segregation behaviour among higher education students.

H_1 (Alternative Hypothesis): There is a significant association between waste management knowledge level and waste segregation behaviour among higher education students.

Data were analysed using descriptive and inferential statistical techniques. Frequencies and percentages were used to summarize demographic characteristics, awareness levels, sources of knowledge, and waste management practices. The association between knowledge level and waste

segregation behaviour was examined using Fisher-Freeman-Halton exact test due to small expected cell frequencies. Statistical significance was set at $p < .05$

5. Results and Discussion

5.1 Demographic Characteristics of the Respondents

Table 1: Demographic Characteristics of the Respondents (N = 185)

Variable	Category	n	%
Gender	Female	127	68.6
	Male	58	31.4
Age group (years)	Below 18	27	14.6
	18–20	145	78.4
	21–23	11	5.9
	Above 23	2	1.1
Year of study	First year	158	85.4
	Second year	16	8.6
	Third year	11	5.9

Note. Values are expressed as frequency (n) and percentage (%).

5.2 Awareness Regarding Solid Waste Management

Table 2 Awareness and Attitudinal Perceptions Related to Solid Waste Management (N = 185)

Statements	Agree / Strongly Agree, n (%)
Proper waste management is important for environmental protection.	180 (97.3)
College students have a responsibility to manage waste properly.	177 (95.7)
Concern regarding increasing waste generation in the city.	167 (90.3)
Awareness programs can improve waste disposal practices.	167 (90.3)
Online shopping and quick delivery services contribute to more household waste generation.	103 (55.7)

Note. Percentages represent respondents who agreed or strongly agreed with each statement.

Although awareness levels were generally high, only about half of the respondents recognized the contribution of online shopping to waste generation, indicating gaps in awareness regarding consumption-related waste sources. A verification question revealed that **21.3%** of respondents were unable to correctly identify a biodegradable item, suggesting gaps in factual understanding among a subset of respondents.

5.3 Sources of Knowledge on Solid Waste Management

Figure 1 illustrates the primary sources of knowledge regarding solid waste management, with formal education channels emerging as the most frequently reported sources.

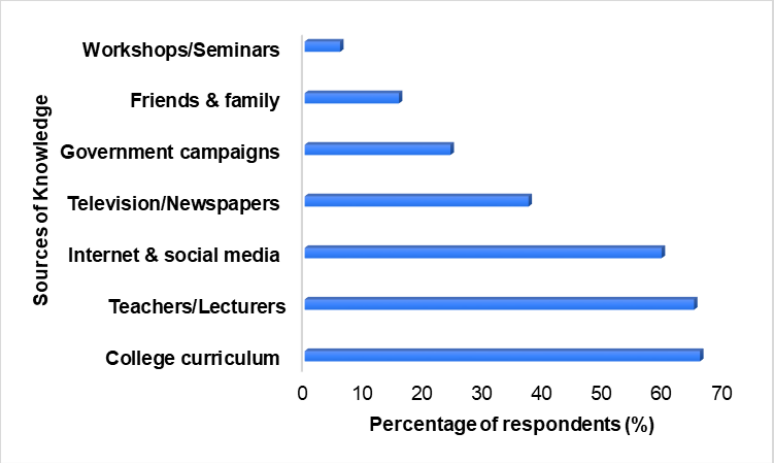

Figure 1: Sources of Knowledge of Solid Waste Management among Respondents (N = 185).

Note. Multiple responses were permitted; percentages represent the proportion of respondents selecting each option and do not sum to 100%.

5.4 Waste Management Behaviour of Respondents

The waste management practices of the respondents showed considerable variation between awareness and actual behaviour. As shown in *Figure 2*, 90.8 % respondents showed either consistent or occasional segregation where they dispose waste into municipal bins. 9.2 % students never segregated waste and 8.6% reported open dumping as disposal method. This variation indicates an awareness-practice gap among students.

Figure 2: Distribution of Respondents by Waste Segregation Behaviour (N = 185).

Regarding the type of waste generated, 57.3% of respondents reported food waste as the major component of household waste but only 47.6 % reported occasional composting while 20.5% never done composting. In terms of sanitary waste disposal, 73.0% of respondents reported wrapping and disposing sanitary waste separately, whereas 18.4% disposed it along with household waste.

Even though only 47% respondents participated in cleanliness drive, 78.4% shown willingness to learn about proper waste management, suggesting a positive inclination toward improving practices if proper support and guidance are provided.

5.5 Association between Knowledge Level and Waste Segregation Behaviour

Table 3 Association between Knowledge Level and Waste Segregation Behaviour (N = 185)

Knowledge Level	Always, n (%)	Sometimes, n (%)	Never, n (%)	Total, n (%)
Low / Moderate	10 (38.5)	8 (30.8)	8 (30.8)	26 (100)
High	64 (40.3)	86 (54.1)	9 (5.7)	159 (100)
Total	74	94	17	185

Note: Percentages are calculated by row.

The association between knowledge level and waste segregation behaviour was assessed using the Fisher–Freeman–Halton exact test. A statistically significant association was observed ($p < .001$). Respondents with low to moderate knowledge were significantly more likely to report never segregating waste (30.8%) compared to those with high knowledge (5.7%). However, high knowledge did not ensure consistent waste segregation, as most high-knowledge respondents (54.1%) reported segregating waste only sometimes. Accordingly, the null hypothesis was rejected.

6. Conclusion

This study examined the relationship between knowledge, awareness, and waste segregation behaviour among higher education students. The findings demonstrated a statistically significant association between knowledge level and waste segregation behaviour, with students possessing higher knowledge being less likely to completely ignore waste segregation. However, higher knowledge did not consistently translate into regular practice, as many knowledgeable students reported segregating waste only occasionally.

Although general awareness of solid waste management was high, inconsistencies in accurate knowledge were observed in specific areas, particularly waste classification. These findings indicate that knowledge alone is insufficient to ensure consistent waste segregation behaviour. The study therefore highlights a clear awareness–practice gap. Integrated educational initiatives, improved waste management infrastructure, and targeted behavioural interventions are required to promote sustainable waste management practices among students.

7. Limitations

The relatively small number of respondents in the low/moderate knowledge category limits subgroup generalization. Additionally, self-reported behaviour may be subject to response bias.

8. Recommendations

1. Universities should adopt formal campus-level solid waste management policies.
2. Properly labelled, colour-coded and strategically placed segregation bins should be provided across campuses to support policy implementation and enable consistent waste segregation behaviour.

3. Curricula should include Solid waste management and sustainable consumption concepts.
4. Targeted awareness programs should address emerging policy-relevant issues such as packaging waste and online shopping–related waste generation.
5. Institutions and policymakers should support periodic monitoring of waste management practices and encourage further research to inform evidence-based policy refinement.

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