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Original Research Article

Assessment of Household Waste Management Practices in South Indian Villages

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ABSTRACT

Background: Household waste management is an important public health and environmental concern in rural areas of South India. Rapid population growth, changing lifestyles, and increased consumption have led to a rise in the generation of household waste. In many villages, inadequate waste segregation, improper disposal practices, open dumping, and burning of waste contribute to environmental pollution and health hazards. Effective household waste management is essential for achieving sustainable rural development and improving the quality of life in South Indian villages. The aim of the present study is to assess the awareness regarding waste management and to determine waste generation, segregation, storage and disposal practices at the household level.

Methods: A community-based cross-sectional study was conducted in the field practice area of Adichunchanagiri Institute of Medical Sciences, comprising five villages to assess household waste management practices. Data were collected from households using a pre-tested structured questionnaire through face to face interviews. Information regarding waste generation, segregation, storage, collection, and disposal practices was gathered. The collected data were compiled and analyzed using descriptive statistics, and the findings were presented as frequencies and percentages.

Results: Among 153 participants, awareness of waste management was moderate; however, proper practices were inadequate. Open dumping (60.1%) and the use of uncovered bins (88%) were highly prevalent, while lack of waste collection services (51%) emerged as the major barrier to effective household waste management.

Conclusion: Despite reasonable awareness, scientific household waste management practices remain poor in rural communities. Strengthening waste collection infrastructure, promoting source segregation, and implementing sustained community-based awareness programs are essential to achieve sustainable environmental health.

Keywords: Household Waste, Waste Segregation, Rural Villages, Environmental Pollution, Waste Disposal.

INTRODUCTION

Household waste management refers to the proper collection, segregation, treatment, recycling, and disposal of waste generated in homes. Every household produces different types of waste, such as food scraps, paper, plastic, glass, metal, and other materials. If this waste is not managed properly, it can cause pollution, spread diseases, attract pests, and harm the environment. Effective household waste management begins with reducing unnecessary waste and separating it at the source. Organic waste can be composted, while recyclable materials can be sent for recycling. Hazardous waste, such as batteries and certain chemicals, should be disposed of safely. Proper waste management not only keeps our surroundings clean but also conserves natural resources and promotes a healthier and more sustainable community.

Effective urban waste management requires an organized approach involving local

authorities, communities, and waste management services. It begins with reducing waste generation and promoting segregation of waste at the source into biodegradable, recyclable, and hazardous categories. Organic waste can be processed through composting or bioenergy production, while recyclable materials such as paper, plastic, glass, and metal should be directed to recycling facilities. Hazardous and electronic waste must be handled with special care to prevent environmental contamination.In addition, modern urban waste management systems emphasize the use of sustainable technologies, public awareness campaigns, and strict regulations to ensure compliance. Proper waste management in cities not only improves cleanliness and public health but also supports resource conservation and contributes to the development of sustainable and livable urban environments.

Rural waste includes agricultural waste: crop residues, pesticide containers, and livestock waste along with other household waste. Rural waste management has major problems like lack of regular waste collection and transportation, Poor awareness about waste segregation, Limited waste-processing facilities. People prefer open dumping and burning of waste which leads to plastic pollution, contamination of soil and groundwater. Effective management methods includes Segregation at source, Composting – Convert kitchen and agricultural waste into useful manure, Biogas production – Use cattle dung and other organic waste to produce biogas, Recycling – Collect and send recyclable materials to authorized recyclers, Safe disposal – Dispose of non-recyclable and hazardous waste through appropriate facilities, Community participation – Involve households, schools, self-help groups, and local government, Awareness programmes – Educate villagers about reducing, reusing, and recycling waste.

Proper rural waste management improves public health, cleanliness, soil and water quality, and environmental sustainability. It can also create employment through composting, recycling, and decentralized waste-processing activities.

Aims and Objectives

This study was conducted among the rural households to assess the awareness and practices regarding waste management and environmental health. Household waste generation and disposal practices were determined, waste segregation and storage methods at the household level were evaluated.

MATERIALS AND METHODS

A community-based cross-sectional study was conducted in the field practice area of Adichunchanagiri Institute of Medical Sciences, comprising five villages Kanchanahalli, Chunchanahalli, Kuchahalli, Haralahalli and Kodihalli, to assess household waste management practices. Among total 623 houses in five villages, 160 houses were selected by randomisation. Houses were numbered and selected according to random numbers generated using a software tool. All houses selected were included in the study and those houses who were locked during 3 visits were excluded. Individuals who refused to participate in the study were excluded from the study. Available individual at the time of house visit was interviewed using a pre-tested structured questionnaire after informed consent through face to face interviews by trained interns over a period of one month in May 2026. The questionnaire was in local language kannada and comprised of multiple choice questions related to information regarding waste generation, segregation, storage, collection, and disposal practices. Total 153 individuals were interviewed, 2 houses were locked and 5 individuals did not give consent. The collected data was compiled and analyzed using descriptive statistics, and the findings were presented as frequencies and percentages.

RESULTS

Characteristics	Sub Groups	Numbers	Percentage
Age	15-25	18	11.7%
	26-40	46	30%
	41-60	56	36.8%
	>60	33	21.5%
Gender	Male	63	41.1%
	Female	90	58.9%
Education	No formal education	61	40.1%

	Primary	35	23%
	Secondary	31	20.4%
	Higher secondary	20	13.2%
	Graduate and above	5	3.3%
Occupation	Farmer	54	33.5%
	Homemaker	63	41.4%
	Laborer	17	11.2%
	Business	8	5.3%
	govt/pvt employee	10	6.6%

Table 1: Characteristics of the participants

Most respondents were females (90-59%), 41-60 yrs old (56-37%), were homemakers (63-41%) & were illiterates (61-40%).

Variable	Frequency n(%)	
	Yes	No
Aware of waste segregation	104 (68%)	49(32%)
Know improper waste disposal causes diseases	105(69%)	48(31%)
Received information/training	64 (42%)	89 (58%)
Know colour coding of waste bins	37(24%)	116(76%)
Believe proper waste management protects the environment	108(71%)	45(17%)

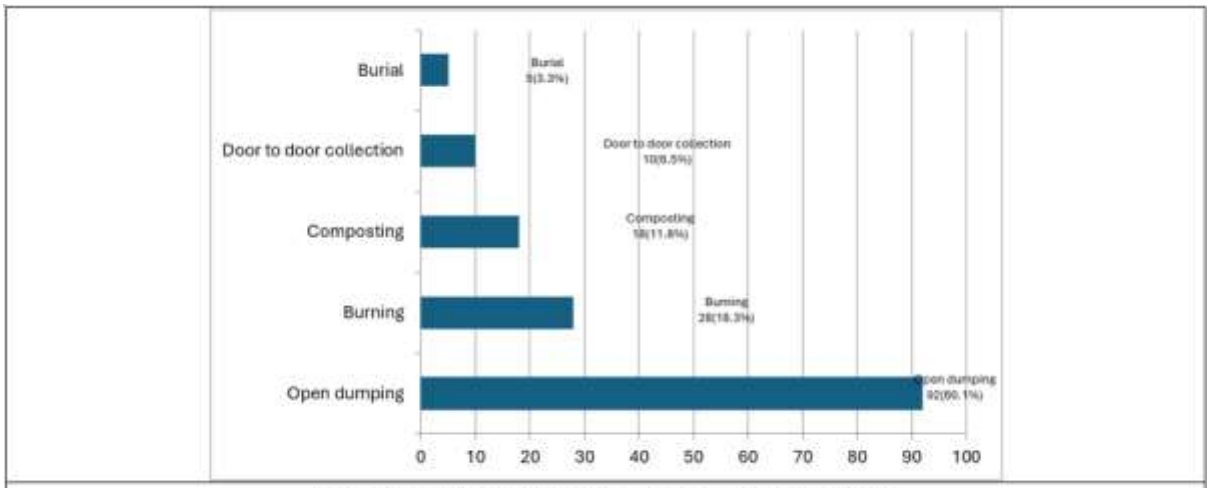
Table 2: Awareness regarding household waste management (N =153)

71% believed proper waste management protects the environment, while 69% knew improper waste disposal causes diseases.

Variable	Sub Category	Frequency n (%)
Number of bins used	One	100(65.8%)
	Two	49(32.2%)
	More than two	4(2%)
Bin coverage	Covered	19(12%)
	Open	134(88%)

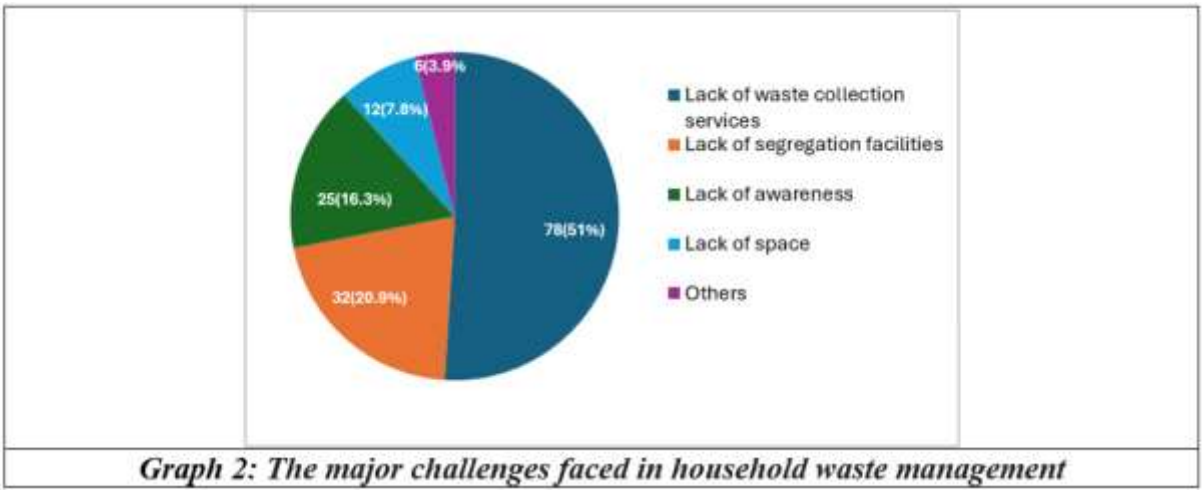
Table 3: Waste storage practices (N=153)

65.8% of households used only one waste bin, and 88% stored waste in uncovered bins, these findings indicate poor house level waste segregation and storage practices.



Graph 1: Household waste disposal methods

Most respondents (92-60%) were resorting to open dumping, while only 28 (18%) & 18 (12%) respondents were either burning or composting, respectively.



Graph 2: The major challenges faced in household waste management

The lack of waste collection services 51% was identified as the most common challenge.

Among 153 participants, awareness of waste management was moderate; however, proper practices were inadequate. Open dumping (60.1%) and the use of uncovered bins (88%) were highly prevalent, while lack of waste collection services (51%) emerged as the major barrier to effective household waste management.

DISCUSSION

Solid waste management is an increasingly important environmental and public health issue in India due to rapid population growth, urbanization, changing lifestyles, and increasing consumption of packaged and disposable products. India generates approximately 62 million tonnes of waste annually, of which only about 43 million tonnes is collected. Of the collected waste, nearly 12 million tonnes is treated, while approximately 31 million tonnes is disposed of in landfills. Thus, only around 70% of municipal waste is collected and merely 22–28% is processed or treated. The composition of waste further complicates management, as it includes approximately 5.6 million tonnes of plastic waste, 0.17 million tonnes of biomedical waste, 7.9 million tonnes of hazardous waste, and about 1.5 million tonnes of e-waste annually. With per capita waste generation in Indian cities ranging from 200 to 600 g/day, the projected increase in waste generation from 62 million tonnes to approximately 165 million tonnes by 2030 represents a substantial challenge for existing waste-management systems.[1]

Bengaluru provides an important example of the difficulties associated with managing rapidly increasing municipal solid waste in an urban setting. The city generates approximately 3,000–5,500 tonnes of solid waste every day, largely as a consequence of rapid urbanization. The Bruhat Bengaluru Mahanagara Palike (BBMP) has established a system involving door-to-door collection, source segregation, decentralized processing, biomethanation, dry waste collection centres, and landfill disposal. Despite serving approximately 80% of buildings with a large workforce and fleet of collection vehicles, only about 40–45% of the city's waste is reportedly treated. The remaining waste is transported to landfill sites, including saturated sites such as Mavallipura, creating concerns regarding groundwater pollution and public health. Although Bengaluru has 16 biomethanation plants and 164 Dry Waste Collection Centers, less than half of the city's daily waste is processed. The introduction of usage-based fees in 2025 and plans for four major treatment plants are positive measures that could reduce landfill dependency. However, these measures need to be supported by effective source segregation, reliable collection, adequate treatment capacity, and continuous monitoring.[2]

The household-level findings demonstrate that urban populations generally have better waste-segregation practices and awareness than rural populations. In the cross-sectional study conducted in an urban field practice area of Bangalore, 76.3% of participants practiced proper household segregation, compared with 32.2% of the rural population reported in the comparable study. Similarly, 79.38% of the urban participants had good awareness regarding the consequences of improper waste disposal, compared with 68% among the rural population. These findings

suggest that urban residents may have greater exposure to municipal services and information regarding waste management. However, the difference between awareness and actual practice observed across several studies indicates that knowledge alone is insufficient to ensure appropriate waste disposal.[3]

The study conducted among 318 urban households between April and June 2023 provides further insight into household waste-management behaviour. Food and kitchen waste, plastic, and paper were the most commonly generated waste materials. Although 64.8% of households used closed containers for storing wet waste and 64.4% practiced sanitary disposal, sanitary napkins and pads were often disposed of together with plastic waste without segregation. This indicates an important gap in the management of sanitary waste. The increased use of closed containers among households with children below five years is encouraging because proper storage of wet waste can reduce exposure to flies, insects, odour, and other environmental hazards. The higher likelihood of sanitary waste disposal among households located along main roads may also indicate the importance of accessibility to waste-collection services.[4]

In contrast, the findings of Abraham et al. from rural villages of Visakhapatnam district demonstrate considerably weaker household segregation practices. Although 76.2% of households depended on waste collectors, 19% continued to practice open dumping. Only 13.6% consistently segregated waste, and more than half of the households did not have separate bins. Most households were below the poverty line and had relatively low educational levels. Women constituted 72.7% of respondents, highlighting their central role in household waste-management activities. The predominance of biodegradable material in wet waste and plastics and paper in dry waste suggests considerable potential for composting and recycling if appropriate segregation and collection systems are established. The findings also indicate that socioeconomic conditions and availability of infrastructure may substantially influence waste-management practices.[5]

The findings reported by Usha Rani et al. illustrate that awareness does not necessarily translate into appropriate waste-management behaviour. A high proportion of respondents were aware that burning household waste is harmful to health and the environment (82%), that improper waste disposal can block drainage systems (75%), and that blocked drainage can promote the breeding of insects, mosquitoes, and flies (83%). About 90% had a dustbin at home and 83% had access to municipal garbage bins. However, despite 83% reporting separate bins for wet and dry waste, many respondents found segregation difficult. Approximately 80% reported burning dry waste because of irregular municipal collection. This finding is particularly significant because it demonstrates how deficiencies in municipal services can undermine otherwise positive household practices. At the same time, 83% of respondents reported composting wet waste, demonstrating that household-level decentralized treatment can be a feasible strategy when supported by adequate awareness and facilities.[6]

The rural Kerala study similarly emphasizes the role of women in household waste management. Most participants responsible for household waste management were women, and 82.5% were housewives. Although 82% had high-school education or above, only 19.2% had good knowledge regarding waste management, while 79.2% had average knowledge and 1.5% had poor knowledge. The major sources of information included Kudumbasree classes, Gramasabha meetings, and mass media. These findings suggest that community-based organizations and local governance platforms can play an important role in improving knowledge and encouraging appropriate waste-management practices. The predominance of women in household waste-management activities also indicates that interventions targeting women through community organizations may have considerable potential.[7]

Biomedical waste represents a particularly important and often overlooked component of household waste management. The 2026 study by Ghai and Tripathy in Nagpur demonstrated a striking discrepancy between general domestic waste segregation and biomedical waste segregation. Although 76.7% of households segregated domestic waste, none segregated biomedical waste, and 98.3% disposed of biomedical waste through the regular municipal waste stream. Commonly generated materials included sanitary pads or menstrual materials (84.2%), expired medicines (81.7%), swabs and bandages (57.1%), and used razor blades (56.3%). Although 64.2% of participants expressed willingness to segregate biomedical waste if instructed, only 29.2% were willing to return it

to health centres. These findings emphasize that general waste-segregation awareness does not automatically translate into appropriate handling of specialized waste categories. Dedicated collection mechanisms and clear instructions regarding household biomedical waste are therefore essential.[8]

The findings from the Indian studies are consistent with the broader assessment by Hamdan et al., which identified inadequate resources and technical expertise as major limitations of municipal solid waste-management systems in Indian smart cities. Heterogeneous municipal waste is often managed through a common disposal pathway, resulting in e-waste, hazardous waste, and biomedical waste being landfilled together with municipal solid waste. Such practices can have serious environmental consequences. Poorly managed landfills and open dump yards can allow leachate to contaminate groundwater and surface water, while open burning can release greenhouse gases and other pollutants. Unmanaged waste can also provide breeding sites for insects and rodents, increasing the risk of vector-borne diseases. Furthermore, inadequate segregation results in the loss of potentially valuable resources. Recyclable materials, compostable organic matter, and materials suitable for refuse-derived fuel are lost when mixed waste is sent directly to landfills.[9]

Technological improvement may help address some of these challenges. Hamdan et al. suggested the use of Radio Frequency Identification (RFID) and Internet of Things (IoT)-based systems for tracking waste-collection vehicles and monitoring waste bins. Such technologies can improve route optimization, collection efficiency, accountability, and monitoring of municipal services. However, technology should complement rather than replace basic improvements in segregation, collection infrastructure, workforce capacity, and public participation. The findings from the household studies suggest that irregular collection and inadequate facilities are important reasons why households resort to inappropriate practices such as open dumping and burning.[9]

The experience of Japan provides a useful comparative perspective on how effective governance and systematic waste management can produce substantially different outcomes. Japan generated approximately 40.34 million tonnes of municipal solid waste in fiscal year 2022, equivalent to about 110,600 tonnes per day. Despite its high level of urbanization and consumption, landfill disposal accounts for less than 5% of waste disposal. This difference is associated with systematic source segregation, Extended Producer Responsibility (EPR), extensive collection coverage, Pay-As-You-Throw (PAYT) systems, advanced treatment facilities, and strong public compliance. Japanese households are required to segregate waste into multiple categories, while producers share responsibility for managing products and packaging. The use of IoT-enabled collection vehicles and route optimization further improves collection efficiency.[10]

Japan's experience demonstrates that waste management should be considered a complete value chain rather than simply a process of collecting and disposing of waste. High levels of segregation allow organic waste to be composted, recyclable materials to be recovered, and residual waste to be treated more efficiently. Community-based approaches such as Takakura composting and industrial Eco-Towns demonstrate how waste can be converted into resources. Japan's use of engineered landfill methods, including the Fukuoka semi-aerobic landfill approach, also demonstrates the importance of minimizing the environmental impact of residual waste that cannot otherwise be recovered.[11]

The comparison with Japan does not imply that the same technologies or policies can be directly transferred to India. Differences in population density, socioeconomic conditions, waste composition, institutional capacity, and local governance need to be considered. Nevertheless, several principles are highly relevant to the Indian context. These include strengthening source segregation, implementing effective EPR systems, improving collection and transportation through digital technologies, introducing appropriate user-fee mechanisms, expanding decentralized composting and biomethanation, recovering recyclable materials, and developing scientifically engineered landfills for residual waste. Existing initiatives in Indian cities can be strengthened by adapting these principles to local conditions.

Overall, the evidence indicates that the central problem in Indian solid waste management is not simply insufficient public awareness. Rather, there is a complex interaction between household behaviour, municipal infrastructure, collection reliability, socioeconomic conditions, governance, and

treatment capacity. Urban households generally demonstrate higher awareness and better segregation than rural households, but inappropriate disposal of sanitary and biomedical waste remains a major concern. Rural households face additional challenges related to inadequate infrastructure, irregular collection, limited availability of separate bins, and socioeconomic constraints. Across both urban and rural settings, women play a major role in household waste management and should therefore be considered important stakeholders in behavioural interventions.

The findings suggest that effective solid waste management requires interventions at multiple levels. At the household level, the three Rs-reduce, reuse, and recycle-should be encouraged along with segregation of wet, dry, sanitary, and biomedical waste at source. At the community level, composting, recycling centres, awareness programmes, and community-based waste-management initiatives can reduce the quantity of waste requiring transportation and disposal. At the municipal level, reliable door-to-door collection, adequate vehicles and trained personnel, decentralized treatment facilities, biomethanation, material recovery facilities, and scientifically designed landfills are essential. For specialized waste such as biomedical, hazardous, and e-waste, separate collection and treatment systems are required.

Community participation is particularly important because municipal systems alone cannot manage the rapidly increasing quantity and diversity of waste. Awareness programmes should therefore move beyond providing information about the harmful effects of waste and focus on practical behaviour, including how to segregate different waste categories, where to dispose of sanitary and biomedical waste, how to compost biodegradable waste, and why open burning and dumping should be avoided. Local institutions such as Kudumbasree groups, Gramasabhas, resident associations, schools, and community organizations can serve as important platforms for sustained behaviour-change communication.

CONCLUSION

India's increasing waste generation poses a significant threat to environmental sustainability and public health. Rapid urbanization, inadequate segregation, insufficient treatment capacity, irregular collection, and dependence on landfills have contributed to pollution of air, soil, and water and increased the risk of vector-borne diseases and other health problems. The evidence from Bengaluru and other Indian urban and rural settings demonstrates that awareness is relatively widespread but that significant gaps remain between knowledge and practice. The projected increase in waste generation to approximately 165 million tonnes by 2030 makes strengthening waste-management systems an urgent priority. India can improve its waste-management outcomes by combining household-level segregation and behavioural change with reliable municipal services, decentralized treatment, resource recovery, digital monitoring, EPR, and scientifically managed residual waste disposal. Learning from successful international approaches such as Japan while adapting them to Indian socioeconomic and environmental conditions can help transform solid waste from an environmental burden into a recoverable resource and contribute to a cleaner, healthier, and more sustainable society.

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