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Knowledge of rural women regarding household and agricultural waste management: A study from rural Rajasthan

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Abstract

Waste management is essential for environmental sustainability, public health, and resource conservation, particularly in rural areas where women play a pivotal role in household waste handling and sanitation. The present study was conducted to assess the knowledge of rural women regarding waste management in Udaipur district of Rajasthan. A multistage random sampling technique was employed to select 120 rural women from eight villages across four panchayat samities. Data were collected through a structured interview schedule and analysed using frequency, percentage, and Mean Percent Score (MPS). The findings revealed that respondents possessed moderate knowledge regarding waste management. Among the major knowledge domains, the highest MPS was recorded for environmental and health impacts of waste (MPS = 45.92), followed by agricultural waste utilization and composting (MPS = 42.15), sanitation, government programmes and community health (MPS = 38.26), household waste management practices (MPS = 46.38), and general knowledge of waste management (MPS = 31.36). High levels of awareness were observed regarding the role of earthworms in vermicomposting (95.83%), improvement of soil fertility through compost (90.00%), recycling as reuse of waste materials (91.67%), the non-biodegradable nature of plastic (91.67%), decomposition of kitchen waste (89.17%), foul odour caused by open dumping (91.67%), disease prevention through sanitation (91.67%), and awareness of the Swachh Bharat Abhiyan (89.17%). Conversely, knowledge was considerably lower regarding hazardous waste (3.33%), government waste management schemes (5.83%), village sanitation programmes (8.33%), the contribution of waste management to community health (4.17%), and the environmental benefits of recycling and composting. The study concludes that although rural women possess satisfactory knowledge of basic household waste management and sanitation practices, substantial gaps remain in scientific waste management concepts, environmental sustainability, resource recovery, and awareness of government initiatives. Strengthening extension services, community-based awareness programmes, and capacity-building interventions is therefore essential to enhance sustainable waste management practices in rural communities.

Keywords: Waste management, rural women, knowledge assessment, environmental sustainability

1. Introduction

Waste is an inevitable by-product of human activities, generated from households, agriculture, industries, and various socio-economic processes. Traditionally, waste has been considered a nuisance—something to be discarded as quickly as possible. However, in recent decades, the concept of waste has evolved significantly, both in academic discourse and in policy frameworks. Waste is no longer merely viewed as refuse, but as a resource that can be managed, reused, and valorised through scientific and sustainable practices (Amasuomo and Baird, 2016) ^[1]. Rural areas, historically characterised by low industrial activity and predominantly organic domestic refuse, are now experiencing a rapid transformation in waste generation due to changes in consumption patterns, lifestyle shifts, and increased access to packaged goods. This has led to a dual

composition of rural waste: biodegradable materials such as food scraps, vegetable peelings, garden residues, and agricultural by-products; and non-biodegradable materials, including plastics, metals, glass, and synthetic packaging (Gautam *et al.*, 2025) ^[4].

Waste management has become a major environmental and public health concern due to rapid population growth, changing consumption patterns, urbanisation, and increasing generation of biodegradable and non-biodegradable waste. Modern waste management extends beyond collection and disposal to include waste reduction, segregation, recycling, composting, and resource recovery for sustainable development (Vinti and Vaccari, 2022) ^[16]. The United Nations Environment Programme (UNEP, 2024) ^[14] reported that global municipal solid waste generation exceeds 2.1 billion tonnes annually and is projected to reach

3.8 billion tonnes by 2050 if current trends continue. In developing countries, inadequate waste management infrastructure and poor disposal practices contribute to environmental pollution, climate change, and public health risks. Therefore, promoting sustainable waste management is essential for achieving environmental sustainability and the Sustainable Development Goals (Kaza *et al.*, 2018) ^[7].

Rural areas generate considerable quantities of household, agricultural, and livestock waste, predominantly comprising biodegradable organic materials. However, inadequate collection systems, limited recycling and treatment facilities, insufficient financial resources, and weak institutional capacity continue to constrain effective waste management. As a result, open dumping, open burning, and uncontrolled disposal remain widespread, leading to environmental pollution, greenhouse gas emissions, deterioration of soil and water quality, and increased risks to human health (Nguyen *et al.*, 2024) ^[11]. Despite the significant potential of organic waste for composting, biogas production, and nutrient recovery, its utilisation remains limited because of inadequate awareness, poor technical infrastructure, and low community participation. Strengthening decentralised waste management systems through source segregation, resource recovery, and community-based interventions is therefore essential to improve environmental sustainability, rural sanitation, and circular resource utilisation (Kaza *et al.*, 2018) ^[7].

Rural women are key stakeholders in household waste management because of their primary responsibility for domestic activities, livestock care, and agricultural operations. They are actively involved in the handling, segregation, reuse, composting, and disposal of household and organic waste, thereby influencing household sanitation, environmental quality, and public health (Mukhter & Chowdhary, 2024) ^[10]. Despite their critical role, the adoption of scientific waste management practices is often constrained by limited environmental awareness, inadequate technical knowledge, poor institutional support, and socio-cultural barriers (Safira & Tumuyu, 2025) ^[12]. Evidence suggests that enhancing women's knowledge, skills, and participation through targeted awareness and capacity-building programmes can significantly improve household waste management practices and promote sustainable rural development. Consequently, strengthening the role of rural women is essential for developing effective community-based waste management systems and achieving environmental sustainability (Trushna *et al.*, 2024) ^[13].

Knowledge and practices are essential components of sustainable waste management, as they influence both awareness and the adoption of environmentally responsible behaviours. Adequate knowledge helps households understand the health and environmental impacts of improper waste disposal, while practices such as waste segregation, composting, recycling, and safe disposal improve sanitation and resource conservation. However,

knowledge does not always lead to appropriate practices, as socio-economic conditions, education, infrastructure, and institutional support also affect behaviour (Konstantinidou *et al.*, 2024) ^[8]. Rural women, as the primary managers of household waste, play a crucial role in translating knowledge into sustainable waste management practices. Therefore, assessing both knowledge and practices is important for identifying existing gaps and designing effective awareness, educational, and community-based waste management interventions (Moeini *et al.*, 2024) ^[9].

2. Methodology

The present study was conducted in the Udaipur district of Rajasthan to assess waste management practices among rural women. A multistage random sampling technique was adopted, wherein four panchayat samities, namely Gogunda, Badgaon, Mavli, and Girwa, were selected randomly, followed by the random selection of two villages from each panchayat samiti. From each village, 15 rural women were selected randomly, constituting a total sample of 120 respondents. Data were collected through personal interviews using a structured interview schedule developed through an extensive review of literature and expert consultation. The schedule covered respondents' socio-economic characteristics, knowledge of waste management, waste management practices, and constraints faced in adopting these practices.

The independent variables comprised selected socio-economic characteristics, while the dependent variables included knowledge, waste management practices, and constraints. Knowledge was measured using a test with a maximum score of 100, practices were assessed on a three-point continuum (Always = 2, Sometimes = 1, Never = 0) with a maximum score of 50, and constraints were measured on a three-point scale (Most Serious = 3, Serious = 2, Least Serious = 1) with a maximum score of 75. The collected data were classified, tabulated, and analysed using appropriate statistical tools such as frequency, percentage, mean per cent score (MPS).

3. Results and Dissection

Waste management is essential for environmental sustainability, public health protection, and efficient resource utilization. Adequate knowledge of waste management facilitates the adoption of appropriate waste handling and disposal practices at the household and community levels. This section examines the knowledge of rural women regarding waste management concepts, types of household waste, waste segregation, recycling and reuse, composting and vermicomposting, environmental and health implications of improper waste disposal, sanitation and hygiene practices, government initiatives, and the role of waste management in environmental conservation and community well-being.

Table 1: Knowledge of the respondents regarding general knowledge of waste management n=120

S. No.	Statements	Frequency	Percentage	MPS
1	Meaning of waste management			21.6
i	Proper collection and disposal of waste	91	75.83	
ii	Recycling and reuse of materials	6	5.00	
iii	Reducing waste and maintaining cleanliness	3	2.50	
iv	Protecting the environment from pollution	3	2.50	
2	Different types of household waste			25.62
i	Biodegradable waste	88	73.33	
ii	Non-biodegradable waste	15	12.50	
iii	Hazardous waste	4	3.33	
iv	Other types of waste	16	13.33	
3	Improper waste disposal cause diseases			38.12
i	It spreads germs and bacteria	103	85.83	
ii	It contaminates food and water	16	13.33	
iii	It creates unhygienic surroundings	23	19.17	
iv	It increases infections and illnesses	41	34.17	
4	Advantage of kitchen waste biodegradable			33.96
i	It decomposes naturally	100	83.33	
ii	It can be converted into compost	37	30.83	
iii	Microorganisms break it down	15	12.50	
iv	It becomes organic manure	11	9.17	
5	Disadvantage of plastic non-biodegradable			37.50
i	It does not decompose easily	110	91.67	
ii	It remains in the environment for many years	56	46.67	
iii	It accumulates in soil and water	3	2.50	
iv	It causes environmental pollution	11	9.17	

The data presented in Table 1 indicate that respondents possessed moderate knowledge regarding waste management, with MPS ranging from 21.60 to 38.12 across the five dimensions studied. Knowledge was highest for the role of improper waste disposal in causing diseases (MPS 38.12), followed by the non-biodegradable nature of plastic waste (MPS 37.50), biodegradability of kitchen waste (MPS 33.96), types of household waste (MPS 25.62), and the meaning of waste management (MPS 21.60). A majority of respondents identified waste management as the proper collection and disposal of waste (75.83%), recognized biodegradable household waste (73.33%), knew that improper waste disposal spreads germs and bacteria (85.83%), that kitchen waste decomposes naturally (83.33%), and that plastic is non-biodegradable (91.67%). Overall, the findings suggest that respondents had better knowledge of the immediate health aspects of waste management than its environmental dimensions. Awareness was comparatively low regarding hazardous household

waste (3.33%), recycling and reuse of materials (5.00%), the role of microorganisms in decomposition (12.50%), conversion of kitchen waste into organic manure (9.17%), plastic causing environmental pollution (9.17%), and waste reduction, environmental protection, and plastic accumulation in soil and water (2.50% each). These results indicate limited understanding of environmental sustainability and the long-term ecological implications of improper waste management.

The findings are in agreement with those of Kaithery *et al.* (2024) ^[5] who reported that among 400 households in Cheruthazham Panchayat, Kerala, 79.2 per cent of respondents possessed average knowledge regarding household waste management, followed by 19.2 per cent with good knowledge and only 1.5 per cent with poor knowledge. The predominance of respondents with average knowledge highlights the need for continued awareness and educational interventions to enhance understanding and adoption of sustainable waste management practices.

Table 2: Knowledge of the respondents regarding household waste management practices n=120

S. No.	Statements	Frequency	Percentage	MPS
1	Role of recycling in waste management			39.58
i	Waste materials are used again	110	91.67	
ii	It reduces waste accumulation	29	24.17	
iii	It saves natural resources	20	16.67	
iv	It reduces environmental pollution	31	25.83	
2	Reuse of waste materials for useful purposes			53.33
i	Reusing containers and bottles	106	88.33	
ii	Using old clothes for cleaning	99	82.50	
iii	Repairing materials for reuse	35	29.17	
iv	Converting waste into useful items	16	13.33	
3	Importance of waste segregation			40.21
i	Helps recycling	47	39.17	
ii	Helps composting	47	39.17	
iii	Makes disposal easier	81	67.50	
iv	Reduces pollution	18	15.00	

4	Use of dustbins for proper waste disposal			44.38
i	Waste is collected in one place	103	85.83	
ii	Keeps surroundings clean	14	11.67	
iii	Prevents littering	28	23.33	
iv	Promotes a hygienic environment	68	56.67	
5	Composting kitchen waste to reduce household waste			54.38
i	Kitchen waste decomposes naturally	107	89.17	
ii	Compost pits are used	40	33.33	
iii	Organic manure is produced	42	35.00	
iv	Reduces household waste	24	20.00	

The data in Table 2 show that respondents' knowledge of household waste management was moderate, with mean percent scores (MPS) ranging from 39.58 to 54.38. Knowledge was highest for composting kitchen waste (MPS 54.38), followed by reuse of waste materials (MPS 53.33), while awareness of recycling (MPS 39.58) and waste segregation (MPS 40.21) was comparatively lower.

Respondents demonstrated comparatively better knowledge of practical household waste management practices than of their environmental benefits. A large majority knew that recycling involves the reuse of waste materials (91.67%), containers and bottles can be reused (88.33%), dustbins collect waste at a designated place (85.83%), and kitchen waste decomposes naturally (89.17%). Knowledge was moderate regarding waste segregation making disposal easier (67.50%). However, awareness was relatively low about conserving natural resources through recycling (16.67%), converting waste into useful products (13.33%),

maintaining clean surroundings through dustbin use (11.67%), and composting as a means to reduce household waste (20.00%). Overall, knowledge was highest for composting of kitchen waste (MPS 54.38) and reuse of waste materials (MPS 53.33), while recycling (MPS 39.58) and waste segregation (MPS 40.21) received comparatively lower scores.

Similar results were reported by Kaur and Kaur (2024) ^[6] who conducted a study among 708 households in Delhi and found that knowledge of waste segregation significantly influenced household waste management practices. The study further revealed that awareness regarding waste segregation methods and proper waste handling was positively associated with improved waste management behaviour, emphasizing the importance of knowledge dissemination in promoting effective household waste management practices.

Table 3: Knowledge of the respondents regarding agricultural waste utilization and composting n=120

S. No.	Statements	Frequency	Percentage	MPS
1	Conversion of organic waste into compost manure			42.92
i	Natural decomposition of organic waste	105	87.50	
ii	Compost pits or compost bins	27	22.50	
iii	Microorganisms break down waste	42	35.00	
iv	Nutrient-rich manure is produced	32	26.67	
2	Benefits of compost manure in agriculture			40.00
i	Improves soil fertility	108	90.00	
ii	Helps plant growth	52	43.33	
iii	Reduces chemical fertiliser use	14	11.67	
iv	Utilizes organic waste	18	15.00	
3	Vermicomposting as a waste management method			43.54
i	Earthworms convert waste into manure	115	95.83	
ii	Improves soil fertility	45	37.50	
iii	Reduces organic waste	25	20.83	
iv	Produces nutrient-rich compost	24	20.00	

The data presented in Table 3 indicate that respondents possessed moderate knowledge regarding agricultural waste utilization and composting practices, with MPS ranging from 40.00 to 43.54. Knowledge was highest for vermicomposting (MPS 43.54), followed by the conversion of organic waste into compost manure (MPS 42.92) and the benefits of compost manure in agriculture (MPS 40.00). An overwhelming majority correctly identified that earthworms convert organic waste into manure (95.83%), compost manure improves soil fertility (90.00%), and compost is produced through the natural decomposition of organic waste (87.50%). In contrast, awareness was comparatively lower regarding the role of microorganisms in decomposition (35.00%), production of nutrient-rich manure through composting (26.67%), use of compost pits or compost bins (22.50%), reduction of organic waste through

vermicomposting (20.83%), and production of nutrient-rich compost (20.00%).

Overall, the findings suggest that respondents were well informed about the basic principles of composting and vermicomposting but had limited knowledge of their broader agronomic and environmental benefits. Awareness was particularly low regarding the role of compost manure in reducing chemical fertilizer use (11.67%) and utilizing organic waste (15.00%). These findings are consistent with Bhatia *et al.* (2024) ^[2], who reported that sustainable practices such as composting, vermicomposting, biochar production, and anaerobic digestion effectively convert agricultural organic waste into valuable resources, thereby improving soil fertility, nutrient availability, environmental sustainability, and reducing pollution and soil degradation.

Table 4: Knowledge of the respondents regarding environmental and health impacts of waste n = 120

S. No.	Statements	Frequency	Percentage	MPS
1	Harmful effects of burning plastic waste on health			47.08
i	It releases toxic gases	88	73.33	
ii	It causes breathing problems	84	70.00	
iii	It pollutes the air	30	25.00	
iv	It affects human health	24	20.00	
2	Role of waste management in maintaining environmental cleanliness			49.79
i	Reduces waste accumulation	48	40.00	
ii	Keeps surroundings clean	103	85.83	
iii	Prevents pollution	76	63.33	
iv	Improves environmental conditions	12	10.00	
3	Water pollution caused by waste			40.00
i	Waste enters rivers or ponds	90	75.00	
ii	Chemicals mix with water	11	9.17	
iii	Water becomes unsafe for drinking	85	70.83	
iv	It harms aquatic life	6	5.00	
4	Effect of waste pollution on soil fertility			44.58
i	Chemicals contaminate soil	47	39.17	
ii	Soil nutrients decrease	19	15.83	
iii	Crop growth is affected	79	65.83	
iv	Soil quality is damaged	69	57.50	
5	Attraction of insects and rodents due to waste			44.58
i	Food waste attracts flies and mosquitoes	77	64.17	
ii	Waste becomes a breeding place for insects	12	10.00	
iii	Rats and animals are attracted	34	28.33	
iv	It spreads diseases	91	75.83	
6	Effects of open dumping of waste			41.25
i	Bad smell	110	91.67	
ii	Breeding ground for flies	38	31.67	
iii	Causes diseases	13	10.83	
iv	Pollutes environment	37	30.83	
7	Air pollution caused by burning waste			48.33
i	Releases harmful smoke	102	85.00	
ii	Causes breathing problems	26	21.67	
iii	Pollutes air	33	27.50	
iv	Affects human health	71	59.17	
8	Harmful effects of plastic waste on animals			51.04
i	Animals may eat plastic accidentally	101	84.17	
ii	Plastic causes choking	26	21.67	
iii	Blocks the digestive tract	70	58.33	
iv	Leads to the death of animals	48	40.00	
9	Role of recycling in reducing environmental pollution			40.62
i	Reduces waste	106	88.33	
ii	Saves resources	14	11.67	
iii	Conserves energy	55	45.83	
iv	Protects environment	20	16.67	

The data presented in Table 4 reveal that respondents had moderate knowledge regarding the environmental and health consequences of waste, with MPS ranging from 40.00 to 51.04. Knowledge was highest for the harmful effects of plastic waste on animals (MPS 51.04), followed by the role of waste management in maintaining environmental cleanliness (MPS 49.79), air pollution caused by burning waste (MPS 48.33), and the harmful effects of burning plastic waste on health (MPS 47.08). A majority of the respondents knew that burning plastic releases toxic gases (73.33%), proper waste management keeps surroundings clean (85.83%), waste enters rivers and ponds (75.00%), polluted water becomes unsafe for drinking (70.83%), open dumping produces a bad smell (91.67%), burning waste releases harmful smoke (85.00%), and animals may accidentally consume plastic waste (84.17%).

Further, Table 4 shows comparatively lower awareness regarding the broader environmental impacts of waste. Only 20.00% recognized the wider health effects of burning plastic, 5.00% knew that water pollution affects aquatic life, 15.83% were aware that waste decreases soil nutrients, 10.00% identified waste as a breeding ground for insects, 10.83% associated open dumping with disease spread, 16.67% believed recycling protects the environment, and 11.67% knew that recycling helps conserve natural resources.

The findings indicate that respondents possessed satisfactory knowledge regarding the environmental and health consequences of waste, with the highest awareness observed for the fact that open dumping of waste produces a bad smell (91.67%), followed by the recognition that recycling reduces waste generation (88.33%) and proper

waste management keeps the surroundings clean (85.83%). Conversely, awareness was lowest regarding the adverse effects of water pollution on aquatic life (5.00%), chemical contamination of water bodies (9.17%), and the role of waste management in improving overall environmental conditions and waste as a breeding ground for insects (10.00% each). These findings suggest that respondents were more familiar with the immediate health hazards and visible impacts of improper waste management than with its long-term ecological and environmental consequences. A similar pattern was reported by Mathew (2025), who found

moderate to good knowledge of waste-related environmental and health issues, with 70% of respondents expressing high concern about waste-related health risks, 88% adopting preventive health measures, and 56% identifying inadequate awareness as a major barrier. The consistency between the present findings and previous evidence highlights the need for targeted awareness and extension programmes focusing on the ecological impacts of improper waste disposal, particularly water pollution, biodiversity conservation, and sustainable resource management.

Table 5: Knowledge of the respondents regarding sanitation, government programmes and community health n=120

S. No.	Statements	Frequency	Percentage	MPS
1	Government programmes promoting sanitation and waste management			29.58
i	Swachh Bharat Abhiyan	107	89.17	
ii	Village sanitation programme	10	8.33	
iii	Government waste management schemes	7	5.83	
iv	Awareness programmes	18	15.00	
2	Role of sanitation in improving health and hygiene			42.71
i	Prevents diseases	110	91.67	
ii	Maintains hygiene	75	62.50	
iii	Improves quality of life	12	10.00	
iv	Protects environment	8	6.67	
3	Role of waste management in improving community health and hygiene			42.50
i	Reduces disease-causing germs	59	49.17	
ii	Keeps surroundings clean	92	76.67	
iii	Prevents pollution	48	40.00	
iv	Improves community health	5	4.17	

The data presented in Table 5 indicate that respondents had moderate knowledge regarding sanitation, government programmes, and community health, with MPS ranging from 29.58 to 42.71. Knowledge was highest for the role of sanitation in improving health and hygiene (MPS 42.71), followed by the role of waste management in improving community health and hygiene (MPS 42.50), whereas awareness of government programmes promoting sanitation and waste management (MPS 29.58) was comparatively low. An overwhelming majority recognized that proper sanitation helps prevent diseases (91.67%), effective waste management keeps surroundings clean (76.67%), and Swachh Bharat Abhiyan is a major government sanitation initiative (89.17%). However, awareness was limited regarding sanitation awareness programmes (15.00%), village sanitation programmes (8.33%), government waste management schemes (5.83%), and the contribution of waste management to overall community health (4.17%). These findings indicate that respondents were more aware of the immediate health and sanitation benefits of waste management than of government initiatives and their broader role in community health and environmental sustainability, highlighting the need for increased awareness and extension programmes on sanitation and waste management.

These findings are consistent with Anjinappa and Lokesh (2025), who reported that awareness programmes significantly enhanced community participation in sanitation and waste management activities, and Varshney *et al.* (2025), who found that awareness of sanitation and the Swachh Bharat Mission (SBM) improved public understanding of hygiene and community health. Collectively, these studies underscore the importance of

sustained awareness and extension programmes to strengthen knowledge of government initiatives and promote long-term adoption of improved sanitation and waste management practices.

4. Conclusion

The present study demonstrates that rural women possessed a moderate level of knowledge regarding waste management, with considerable variation across different knowledge domains. Respondents exhibited relatively high awareness of household waste management and sanitation practices, as evidenced by their recognition that earthworms convert organic waste into manure (95.83%), plastic is non-biodegradable (91.67%), sanitation prevents diseases (91.67%), recycling involves the reuse of waste materials (91.67%), compost improves soil fertility (90.00%), kitchen waste decomposes naturally (89.17%), and the Swachh Bharat Abhiyan is a major government sanitation initiative (89.17%). These findings indicate that rural women are well informed about routine waste handling practices and their immediate implications for household hygiene and public health.

Despite this encouraging level of awareness, important deficiencies were identified in respondents' understanding of scientific waste management and environmental sustainability. Awareness was particularly limited regarding plastic accumulation in soil and water (2.50%), hazardous waste (3.33%), the contribution of waste management to community health (4.17%), government waste management schemes (5.83%), the impact of water pollution on aquatic ecosystems (5.00%), and the role of composting in reducing chemical fertilizer use (11.67%). These gaps suggest that knowledge remains largely confined to observable

household practices, whereas awareness of the long-term environmental, ecological, and institutional dimensions of waste management is inadequate.

Overall, the findings underscore the need for targeted awareness campaigns, extension programmes, and capacity-building interventions that strengthen rural women's understanding of waste segregation, recycling, scientific composting, resource recovery, and government waste management initiatives. Enhancing environmental literacy and promoting community-based participation in sustainable waste management will improve household sanitation, reduce environmental pollution, and contribute to the achievement of sustainable rural development and circular economy objectives.

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