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Knowledge of household waste management among rural and urban households in Gwalior district, Madhya Pradesh: Correlates and constraints

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Abstract

Household waste management is an important component of environmental sanitation and public health, requiring adequate knowledge and appropriate practices at the household level. The present study was conducted to assess the knowledge of household waste management among rural and urban households and to examine its correlates and major constraints in Gwalior district of Madhya Pradesh. A total of 160 households, comprising 80 rural and 80 urban households, were selected for the study. Data were collected using a structured interview schedule and analysed using frequency, percentage, mean, standard deviation, Pearson's correlation coefficient and Garrett's ranking technique. The findings revealed that the majority of respondents (83.12%) had a medium level of knowledge regarding household waste management, while 16.88 per cent had a high level of knowledge. The proportion of respondents with medium knowledge was higher in rural households (95.00%) than in urban households (71.25%), whereas the proportion with high knowledge was higher among urban households (28.75%) than rural households (5.00%). The overall mean knowledge score was 28.38 ± 2.24 , compared with 27.75 ± 2.17 among rural and 29.51 ± 1.67 among urban households. Education showed the strongest positive association with knowledge ($r = 0.841$). Among the major constraints, irregular timing of the waste-collection vehicle ranked first overall, followed by lack of cooperation from neighbours and non-availability of waste-collection services. The findings highlight the need for strengthening household-level awareness, improving waste-collection services and promoting appropriate waste-management practices, particularly among rural households.

Keywords: Household waste management, knowledge, rural–urban comparison, correlates, constraints, Gwalior, Madhya Pradesh.

1. Introduction

Household waste management is an important environmental and public-health concern because improper handling and disposal of domestic waste can adversely affect environmental quality, sanitation and community well-being. Effective household waste management involves appropriate practices such as source segregation, recycling, reuse, composting and proper disposal. Adequate household knowledge is important for understanding and applying recommended waste-management practices.

In India, the Swachh Bharat Mission (SBM) has placed considerable emphasis on sanitation and waste management at household and community levels. Information, Education and Communication (IEC) activities and awareness programmes have been promoted to encourage improved waste-management behaviour. However, gaps remain in household-level understanding and implementation of scientific waste-management practices, particularly with respect to technically specific aspects of waste segregation and waste handling.

Household knowledge may vary according to social and residential characteristics. Rural and Urban households can

differ in terms of educational background, income, access to information and exposure to waste-management services. Therefore, assessing knowledge separately among Rural and Urban households can help identify groups and areas requiring further extension and awareness efforts.

The thesis-derived findings indicate that respondents generally possessed a medium level of household waste-management knowledge, while Urban respondents had a greater proportion of high knowledge than Rural respondents. Item-wise assessment further indicated that respondents had relatively strong knowledge of some practical aspects, whereas gaps were observed in specific technical areas, including the first step of waste management at source, handling of organic/biodegradable waste and the concept of decluttering.

Knowledge may also be associated with respondents' socio-economic and informational characteristics. The correlation analysis showed that education had the strongest positive relationship with knowledge, followed by annual income and family size. In contrast, information-source exposure, social participation and communication-method exposure showed significant negative relationships with knowledge, whereas

age and gender were not significantly related to knowledge. These findings suggest that mere frequency of information or communication exposure may not necessarily ensure technically accurate knowledge.

Apart from knowledge-related issues, households may face practical constraints in adopting appropriate waste-management practices. The study identified irregular timing of waste-collection vehicles, lack of cooperation from neighbours and non-availability of waste-collection services among the major constraints. Rural respondents were particularly affected by service- and infrastructure-related constraints, whereas Urban respondents reported greater social and behavioural constraints.

Against this background, the present study was undertaken to assess knowledge of household waste management among Rural and Urban households in Gwalior district of Madhya Pradesh, examine its correlates, and identify the major constraints faced by households. The findings are intended to provide a basis for strengthening locality-specific extension, awareness and institutional interventions for improved household waste management.

2. Objectives

The study was undertaken with the following objectives:

1. To assess the knowledge level of Rural and Urban households regarding household waste-management practices.
2. To compare Rural and Urban households with respect to their knowledge level of household waste management.
3. To determine the relationship between selected profile variables and household waste-management knowledge.
4. To identify the major constraints faced by households in adopting proper waste-management practices.
5. To suggest appropriate extension and institutional measures for improving household waste management.

3. Materials and Methods

A descriptive research design was adopted for the study. The study was conducted in Gwalior district of Madhya Pradesh, which was purposively selected. The Urban area was

represented by Morar (Ward No. 61) and Lashkar (Ward No. 16), while Ekhar village of Morar block and Dhuwan village of Ghatigaon block represented the Rural area.

A total of 160 household respondents were selected, comprising 80 Rural and 80 Urban respondents. Simple random sampling was used for the selection of Rural respondents, whereas snowball sampling was used for Urban respondents. In addition, 10 officials/public representatives were interviewed to obtain an institutional perspective on household waste management.

Knowledge regarding household waste-management practices was assessed using structured knowledge items incorporated in a pre-tested semi-structured interview schedule. The knowledge score was used to classify respondents according to their level of knowledge. The knowledge scale had a maximum possible score of 45. The observed overall mean knowledge score was 28.38, with a standard deviation of 2.24.

The major constraints faced by respondents in household waste management were assessed using Garrett's Ranking Technique. Respondents ranked the identified constraints, which were converted into percentage positions and corresponding Garrett scores. Mean scores were calculated for each constraint to obtain the final ranking.

The collected data were analysed using frequency, percentage, mean, standard deviation and Pearson's correlation coefficient. Pearson's correlation coefficient was used to determine the relationship between selected profile variables and knowledge level. Garrett's Ranking Technique was used to rank the constraints faced by the respondents. Results were presented separately for Rural, Urban and overall respondents.

4. Results and Discussion

4.1 Profile of the Respondents

A total of 160 household respondents, comprising 80 Rural and 80 Urban respondents, were included in the study. Their socio-personal and socio-economic characteristics were examined to understand the background of the respondents.

Table 1: Socio-personal and socio-economic characteristics were examined to understand the background of the respondents

S. No.	Variable	Rural (n=80) f (%)	Urban (n=80) f (%)	Overall (N=160) f (%)
1	Age			
	Young (<35 years)	23 (28.75)	20 (25.00)	43 (26.88)
	Middle (36–55 years)	42 (52.50)	41 (51.25)	83 (51.88)
	Old (>55 years)	15 (18.75)	19 (23.75)	34 (21.25)
2	Education			
	Illiterate	11 (13.75)	0 (0.00)	11 (6.875)
	Read only	6 (7.50)	0 (0.00)	6 (3.75)
	Read & Write	10 (12.50)	2 (2.50)	12 (7.50)
	Primary	17 (21.25)	8 (10.00)	25 (15.625)
	Middle	11 (13.75)	10 (12.50)	21 (13.125)
	High School	9 (11.25)	15 (18.75)	24 (15.00)
	Higher Secondary	7 (8.75)	20 (25.00)	27 (16.875)
	Graduate	6 (7.50)	15 (18.75)	21 (13.125)
	Post Graduate & above	3 (3.75)	10 (12.50)	13 (8.125)
3	Gender			
	Male	80 (100.00)	78 (97.50)	158 (98.75)
	Female	0 (0.00)	2 (2.50)	2 (1.25)
4	Occupation			
	Agriculture	40 (50.00)	6 (7.50)	46 (28.75)
	Trade/Business	7 (8.75)	17 (21.25)	24 (15.00)
	Government Service	6 (7.50)	10 (12.50)	16 (10.00)
	Private Service/Job	7 (8.75)	20 (25.00)	27 (16.87)
	Daily Wage Labour	15 (18.75)	1 (1.25)	16 (10.00)
	Professional/Self-employed	5 (6.25)	26 (32.50)	31 (19.37)

The findings revealed that the majority of respondents belonged to the middle-age category (36–55 years), accounting for 52.50 per cent of Rural respondents, 51.25 per cent of Urban respondents and 51.88 per cent overall. Young respondents constituted 28.75 per cent in Rural areas and 25.00 per cent in Urban areas, while 18.75 and 23.75 per cent belonged to the old-age category, respectively.

A clear Rural–Urban difference was observed in educational status. Among Rural respondents, the largest proportion had primary education (21.25%), followed by middle education (13.75%) and illiteracy (13.75%). In contrast, Urban respondents had comparatively higher educational attainment, with 25.00 per cent having higher secondary education, followed by 18.75 per cent each having high-school and graduate-level education. Notably, none of the Urban respondents were illiterate or belonged to the read-only category.

Regarding gender, the sample was overwhelmingly male, with males constituting 100.00 per cent of Rural respondents

and 97.50 per cent of Urban respondents. Overall, males accounted for 98.75 per cent of the respondents, while females constituted only 1.25 per cent.

With respect to occupation, agriculture was the predominant occupation among Rural respondents (50.00%), whereas professional/self-employment was the major occupational category among Urban respondents (32.50%), followed by private service/job (25.00%) and trade/business (21.25%). Overall, agriculture constituted the largest occupational category (28.75%), followed by professional/self-employment (19.37%) and private service/job (16.87%).

4.2 Knowledge Level of Respondents Regarding Household Waste Management

The knowledge level of respondents regarding household waste-management practices was assessed using a 45-point knowledge scale. Respondents were classified into low, medium and high knowledge categories based on their scores.

Table 2: Distribution of Respondents According to Knowledge Level Regarding Household Waste Management

Knowledge category	Rural (n=80)	Urban (n=80)	Overall (n=160)
Low (0–15)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Medium (16–30)	76 (95.00%)	57 (71.25%)	133 (83.12%)
High (31–45)	4 (5.00%)	23 (28.75%)	27 (16.88%)
Total	80 (100%)	80 (100%)	160 (100%)
Mean $\pm$ SD	27.75 $\pm$ 2.17	29.51 $\pm$ 1.67	28.38 $\pm$ 2.24

The findings revealed that the majority of respondents (83.12%) possessed a medium level of knowledge, followed by 16.88 per cent with a high level of knowledge. None of the respondents belonged to the low-knowledge category.

A clear Rural–Urban difference was observed. Among Rural respondents, 95.00 per cent had medium knowledge and only 5.00 per cent had high knowledge. In comparison, 71.25 per cent of Urban respondents had medium knowledge and 28.75 per cent had high knowledge. The mean knowledge score was also higher among Urban respondents (29.51) than Rural respondents (27.75).

These findings indicate that although most respondents had a moderate level of knowledge, specific and technical aspects of household waste management require further attention, particularly among Rural households. The subsequent item-

wise analysis provides a clearer picture of the specific knowledge gaps. The thesis reports, for example, that the lowest Rural correct-response rate was for the first step of waste management at source (21.25%), while the lowest Urban correct-response rate was for the use of organic/biodegradable waste (32.50%).

4.3 Item-wise Knowledge of Household Waste-Management Practices:

The overall knowledge score provides the general level of knowledge, but the item-wise analysis helps identify specific areas of strength and knowledge gaps among Rural and Urban respondents. The thesis assessed knowledge through individual questions covering reuse, recycling, organic waste, 3R concepts, composting and source-level waste management.

Table 3: Item-wise Knowledge of Household Waste-Management Practices

S. No.	Knowledge item	Rural (n=80)	Urban (n=80)	Overall (n=160)
1	Reuse of household items	52 (65.00%)	56 (70.00%)	108 (67.50%)
2	Proper recycling methods	38 (47.50%)	48 (60.00%)	86 (53.75%)
3	Reuse of recyclable materials	25 (31.25%)	49 (61.25%)	74 (46.25%)
4	Use of organic/biodegradable waste	53 (66.25%)	26 (32.50%)	79 (49.37%)
5	Full form of “3R” strategy	18 (22.50%)	67 (83.75%)	85 (53.125%)
6	Concept of reuse	22 (27.50%)	62 (77.50%)	84 (52.50%)
7	Concept of decluttering	27 (33.75%)	46 (57.50%)	73 (45.625%)
8	Recycling process	32 (40.00%)	31 (38.75%)	63 (39.37%)
9	Composting process	59 (73.75%)	72 (90.00%)	131 (81.875%)
10	First step of waste management at source	17 (21.25%)	67 (83.75%)	84 (52.50%)
11	Waste suitable for composting	68 (85.00%)	75 (93.75%)	143 (89.375%)
12	Waste collected in green bin	24 (30.00%)	72 (90.00%)	96 (60.00%)
13	Item not suitable for composting	80 (100.00%)	76 (95.00%)	156 (97.50%)
14	Waste collected in blue bin	24 (30.00%)	72 (90.00%)	96 (60.00%)

The item-wise findings revealed considerable variation in knowledge across different aspects of household waste management. Among Rural respondents, the highest correct-response rate was recorded for “item not suitable for composting” (100.00%), followed by “waste suitable for composting” (85.00%). The lowest correct-response rate was observed for “first step of waste management at source” (21.25%), followed by the “full form of 3R strategy” (22.50%).

Among Urban respondents, the highest correct-response rate was observed for “waste suitable for composting” (93.75%), followed by “item not suitable for composting” (95.00%) and composting process (90.00%). The lowest correct-response rate was for “use of organic/biodegradable waste” (32.50%), followed by recycling process (38.75%).

Overall, the highest proportion of respondents correctly identified the item not suitable for composting (97.50%), followed by waste suitable for composting (89.375%) and the composting process (81.875%). In contrast, the lowest overall correct-response rate was recorded for the concept of decluttering (45.625%), followed by reuse of recyclable

materials (46.25%).

These findings indicate that respondents were relatively well informed about composting and identification of certain waste materials, whereas knowledge was comparatively weaker for some conceptual and technical aspects, particularly source-level waste-management sequencing, decluttering, recycling and reuse-related concepts. The Rural–Urban differences were particularly pronounced for the 3R strategy, concept of reuse, green/blue-bin identification and the first step of waste management at source.

4.4 Relationship of Profile Variables with Knowledge

Level about Household Waste Management The relationship between selected profile variables and the knowledge level of respondents regarding household waste management was examined using Karl Pearson’s correlation coefficient (r). The analysis was carried out separately for Rural respondents ($n=80$), Urban respondents ($n=80$) and the overall sample ($N=160$).

Table 4: Correlation between Selected Profile Variables and Knowledge Level

S. No.	Variable	Rural (r)	Urban (r)	Overall (r)
1	Age	−0.089 NS	−0.005 NS	−0.026 NS
2	Education	0.827**	0.724**	0.841
3	Gender	NA	−0.098	0.006 NS
4	Occupation	0.228*	−0.234*	0.245
5	Family size	0.393**	0.243*	0.185*
6	Annual income	0.350**	0.249*	0.441
7	Information-source exposure	−0.383**	−0.268*	−0.282
8	Social participation	−0.325**	−0.326**	−0.308
9	Communication-method exposure	−0.390**	−0.267*	−0.413

Note: ** Significant at 0.01 level; * Significant at 0.05 level; NS = Non-significant; NA = Not applicable.

The findings revealed that education had the strongest positive and highly significant relationship with knowledge level among Rural respondents ($r = 0.827^{**}$), Urban respondents ($r = 0.724^{**}$) and the overall sample ($r = 0.841^{**}$). This indicates that respondents with higher educational attainment tended to have higher knowledge regarding household waste management.

Annual income also showed a positive and significant relationship with knowledge among Rural respondents ($r = 0.350^{**}$), Urban respondents ($r = 0.249^{*}$) and overall respondents ($r = 0.441^{**}$). Family size was also positively and significantly associated with knowledge in Rural ($r = 0.393^{**}$), Urban ($r = 0.243^{*}$) and overall ($r = 0.185^{*}$) respondents.

Occupation showed a *positive and significant relationship among Rural respondents ($r = 0.228$) and overall respondents ($r = 0.245^{*}$), whereas it showed a negative and significant relationship among Urban respondents ($r = -0.234$).*

In contrast, information-source exposure showed a negative and significant relationship with knowledge among Rural ($r = -0.383^{**}$), Urban ($r = -0.268^{*}$) and overall respondents ($r = -0.282^{**}$). Similarly, social participation was negatively and significantly associated with knowledge among Rural ($r = -0.325^{**}$), Urban ($r = -0.326^{**}$) and overall respondents ($r = -0.308^{**}$). Communication-method exposure also showed a negative and significant relationship with

knowledge among Rural ($r = -0.390^{**}$), Urban ($r = -0.267^{*}$) and overall respondents ($r = -0.413^{**}$).

Age did not show a significant relationship with knowledge in Rural ($r = -0.089$), Urban ($r = -0.005$) or overall respondents ($r = -0.026$). Gender was not significant in the overall sample ($r = 0.006$); its Rural correlation was recorded as NA, reflecting the absence of variation in gender among the Rural respondents.

These findings indicate that education was the strongest positive correlate of household waste-management knowledge, while income and family size also showed positive associations. The negative correlations observed for information-source exposure, social participation and communication-method exposure should be interpreted as statistical associations rather than causal effects. The results suggest that greater exposure or participation alone does not necessarily correspond to higher knowledge and that the content and quality of information may also be important.

4.5 Constraints Faced by Households in Waste Management

The major constraints faced by respondents in household waste management were assessed using Garrett’s Ranking Technique. The constraints were ranked separately for Rural, Urban and overall respondents according to their mean Garrett scores.

Table 5: Garrett's Ranking of Constraints Faced by Respondents in Household Waste Management

S. No.	Constraint	Rural Mean Score	Rank	Urban Mean Score	Rank	Overall Mean Score	Rank
1	Lack of knowledge about waste segregation (wet/dry)	44.82	VIII	45.61	VI	44.82	VIII
2	Non-availability of separate dustbins	47.67	VI	43.29	VIII	44.55	IX
3	Non-availability of waste-collection vehicle/service	53.26	II	50.00	IV	51.57	III
4	Lack of cooperation from neighbours	48.35	V	58.15	I	52.94	II
5	Inadequate infrastructure of local body/municipality	52.08	III	49.68	V	50.88	IV
6	Lack of awareness about waste management	48.02	IV	49.19	V	48.26	VI
7	Irregular timing of waste-collection vehicle	53.28	I	56.72	II	55.00	I
8	Lack of knowledge about waste-management practices	53.18	III	53.18	III	50.85	V

Note: Higher mean Garrett score indicates greater severity of the constraint. The Rural/Urban/overall values and ranks should be retained exactly as reported in the thesis table; the displayed thesis text confirms the principal rankings and scores.

The findings revealed that irregular timing of the waste-collection vehicle was the most serious constraint overall, with a mean Garrett score of 55.00, followed by lack of cooperation from neighbours (52.94) and non-availability of waste-collection vehicle/service (51.57). The least serious constraint overall was reported as non-availability of separate dustbins in the thesis discussion, although the thesis's narrative elsewhere refers to lack of knowledge about wet/dry segregation as least serious. This discrepancy requires resolution before submission.

Among Rural respondents, irregular timing of the waste-collection vehicle was ranked first, with a mean score of 56.72, followed by non-availability of waste-collection vehicle/service (53.26) and inadequate infrastructure of the local body/municipality (52.08).

Among Urban respondents, lack of cooperation from neighbours was the most serious constraint, with a mean score of 58.15, followed by irregular timing of the waste-collection vehicle (53.28) and lack of knowledge about waste-management practices (53.18).

These findings indicate a distinct Rural–Urban pattern. Rural households were more affected by collection infrastructure and service-related constraints, whereas Urban households reported greater difficulty related to neighbour cooperation and behavioural factors. This suggests that interventions should address both service-delivery gaps and household/community-level cooperation.

5. Conclusion

The present study assessed household waste-management knowledge among Rural and Urban households in Gwalior district of Madhya Pradesh, examined its relationship with selected profile variables, and identified the major constraints faced in household waste management. The findings showed that the majority of respondents (83.12%) had a medium level of knowledge, while 16.88 per cent had a high level and none had a low level of knowledge. Urban respondents demonstrated a comparatively higher mean knowledge score (29.51 ± 1.67) than Rural respondents (27.75 ± 2.17).

The item-wise assessment indicated that respondents had relatively better knowledge regarding composting and identification of compostable/non-compostable waste, whereas gaps were observed in certain technical and conceptual aspects of waste management, including source-level waste management, decluttering, recycling and reuse-related concepts.

Among the selected profile variables, education showed the strongest positive and significant association with knowledge

in Rural, Urban and overall respondents. Annual income and family size also showed positive associations, whereas information-source exposure, social participation and communication-method exposure showed significant negative associations with knowledge. These relationships represent statistical associations and should not be interpreted as causal effects.

The major constraint identified overall was irregular timing of the waste-collection vehicle, followed by lack of cooperation from neighbours and non-availability of waste-collection vehicle/service. Rural respondents primarily reported collection and infrastructure-related constraints, whereas lack of cooperation from neighbours was the foremost constraint among Urban respondents.

Overall, the findings indicate that improving household waste management in Gwalior requires strengthening technical knowledge, improving regularity and availability of waste-collection services, and promoting greater community cooperation, with particular attention to the specific needs of Rural and Urban households.

6. Recommendations

Based on the findings of the study, the following recommendations are suggested:

- 1. Strengthen knowledge-oriented extension activities:** Greater emphasis should be given to improving household knowledge of source segregation, recycling, reuse, composting and proper disposal, particularly among Rural households.
- 2. Focus on technical knowledge gaps:** Awareness programmes should specifically address areas where knowledge was comparatively low, such as the **3R strategy, decluttering, recycling processes, source-level waste management and colour-coded waste segregation**.
- 3. Improve waste-collection services:** Local bodies should ensure **regular and predictable timing of waste-collection vehicles**, as irregular collection was the highest-ranked overall constraint.
- 4. Strengthen Rural waste-management infrastructure:** Particular attention should be given to the availability and reliability of waste-collection services and local-body infrastructure in Rural areas.
- 5. Promote community cooperation in Urban areas:** Urban interventions should encourage neighbour-level cooperation and collective responsibility, as lack of cooperation from neighbours was the highest-ranked Urban constraint.

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