

Original Research Article

A descriptive study to assess the awareness, knowledge, and practices among government senior secondary school students on household waste management in the Gohar block of District Mandi, Himachal Pradesh

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ABSTRACT

Background: Proper household waste management is crucial for environmental sustainability and public health. This study aimed to assess the awareness, knowledge, and practices of household waste management among 400 students and explore the associations with socio-demographic variables.

Methods: A cross-sectional study was conducted using a structured questionnaire. The questionnaire covered aspects of awareness, knowledge, and practices related to household waste management. Socio-demographic information was also collected. Data were analyzed using descriptive statistics and chi-square tests to determine associations.

Results: Among students, 67.8% were aware of household waste management, 84.3% knew waste separation, but only 26.3% and 35% were aware of waste minimization and e-waste. While 92.8% recognized the local government's role, almost half remained unconvinced. 65.3% knew about household waste, and 71% knew disposal methods. However, only 79.3% knew solid waste reuse, and 94.8% knew 'Swachh Bharat Abhiyan.' Practices varied: 92.5% segregated waste, 57.5% composted kitchen waste, and 70.8% disposed outside. A minority (15.3%) disposed of outdoors. Diverse waste collection methods included 29.8% using bins, 28.2% using tin cans, and 15.3% using plastic bags. Socio-demographics influenced awareness, knowledge, and practices.

Conclusions: Comprehensive waste management education is needed, focusing on waste minimization and e-waste. Addressing teacher knowledge gaps is essential. Tailored education accounting for socio-demographic factors is crucial. Improved waste disposal infrastructure is required to reduce improper waste disposal. Continuing government initiatives can enhance awareness and responsible waste management.

Keywords: Awareness, Environmental education, e-waste, Household waste management, Knowledge, Practices

INTRODUCTION

India's swift evolution into an industrial and service-oriented economy has resulted in significant urbanization, with approximately 31.2% of the population residing in

urban areas (Ahmed, 2016).¹ Amid this transformation, one of the most significant challenges confronting India and the world is household waste management (Molina, 2021).² Household waste, also known as domestic or municipal waste, encompasses materials generated within

households and is a subject of global concern due to its potential environmental and health repercussions (Jutta, 2017).³

Proper household waste management is pivotal for maintaining a clean environment, which, in turn, directly impacts human health and the overall quality of life (Shin, 2021).⁴ Failure to manage household waste effectively can lead to various health and environmental problems, making it imperative to address this issue on multiple fronts (Kiran et al., 2015).⁵ Household waste encompasses many materials, including hazardous, recyclable, organic, liquid, and solid waste (Chang, 2021) [6]. Municipal garbage, including food waste, paper, plastic, glass, and metal from residential areas, constitutes significant waste generation. Family size and housing infrastructure influence the daily waste generated (Singh, 2015).^{7,8} Inadequate knowledge and haphazard garbage disposal practices often contribute to the challenges in municipal waste management (Kiran et al., 2015).⁵ Disposal methods range from tipping and incineration to landfill, composting, and salvage, with awareness playing a pivotal role in guiding these practices (Mishra, 2016).^{9,10}

Globally, the production of household garbage has been on the rise, with alarming proportions of waste being handled in environmentally detrimental ways (Kapil Dev, 2020).¹¹ India, too, faces a growing waste crisis, with waste generation predicted to increase substantially (Sunil Kumar, 2017).¹² The importance of effective waste management methods, including recycling, incineration, landfill, biological processing, and animal feed, cannot be overstated (Jerry, 2020). In Himachal Pradesh, the current practices of solid waste management vary, with many areas struggling with disorganized waste collection (MSWMHP, 2017).^{13,14} Education and information dissemination are crucial in raising public awareness and encouraging environmentally friendly practices (Molina, 2021).² As channels for distributing knowledge, schools are responsible for educating students about household waste management (Tartu, 2011).¹⁵ This study assesses the awareness, knowledge, and practices of government senior secondary school students in the Gohar Block of District Mandi, Himachal Pradesh, regarding household waste management. It aims to contribute to the body of knowledge in this field, focusing on empowering young individuals to take responsibility for proper waste management practices and fostering positive environmental attitudes and values. Amidst global and Indian waste management challenges, this study's findings can inform strategies for promoting responsible waste management practices among the youth.

METHODS

The current study employs a quantitative, descriptive, non-experimental research design. The research was conducted in government senior secondary schools in the Gohar Block, District Mandi, Himachal Pradesh, India.

Gohar Block consists of three sub-districts: Thunag, Chachyot, and Nihari. The study specifically focused on the Chachyot-1 sub-district. A purposive sampling technique was employed to select 12 government senior secondary schools in the Chachyot-1 sub-district out of 15. The total student population across these 12 schools was 1384. Using Yamane's formula, a sample size of 399 participants was determined. Data were collected for one and a half months, from January 2023 to mid-March 2023. The questionnaire used in this study underwent reliability analysis, resulting in a Cronbach's Alpha value of 0.703, indicating good reliability. The questionnaire consisted of four sections: Socio-demographic variables, awareness of household waste management, knowledge of household waste management, and practices related to household waste management. Participants were given 20-25 minutes to complete the questionnaire. Ethical clearance for the study was obtained from the Akal Institutional Ethical Committee of Eternal University, Baru Sahib. The principals of the selected government senior secondary schools were also granted permission. Informed consent was obtained from class teachers and participants. Ethical justifications include the absence of reported ethical issues during the study and the potential benefits of raising awareness and knowledge of household waste management among participants.

Inclusion criteria

Senior Secondary School Students, students who were present at the time of data collection and students who were able to write in English and Hindi were included.

Exclusion criteria

Students who were not willing to participate and those schools whose principals did not give permission were excluded from this study.

Statistical analysis

Data were analyzed using SPSS version 29. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to analyze demographic profiles, awareness, knowledge, and practices related to household waste management. The chi-square test examined associations between awareness, knowledge, and practices and selected socio-demographic variables.

RESULTS

In this study, 400 students were selected from government senior secondary schools in the Gohar Block of District Mandi, Himachal Pradesh, India, based on their fulfilment of inclusion and exclusion criteria. The data collection process involved using a questionnaire to gather information on household waste management. The results were analyzed descriptively, and associations with demographic variables were examined.

Table 1: Distribution of frequency and percentage of the socio-demographic profile.

Socio-demographic profile	Frequency (N)	Percentage (%)
Gender		
Male	177	44.3
Female	223	55.8
Age (years)		
15-16	69	17.3
16-17	186	46.5
17-18	141	35.3
18 and above	4	1.0
Religion		
Hindu	400	100.0
Educational level		
10+1	164	41.0
10+2	236	59.01
Type of housing		
Kaccha house	43	10.8
Pukka house	352	88
Rented house	51	1.3
Family monthly income		
Less than 5000	128	32
5000-10,000	122	32
10,000-15,000	76	19
More than 15,000	74	18.5
Mother's education		
Illiterate	20	5
Primary	94	23.5
Secondary	261	65.3
Graduation and above	25	6.3
Father's education		
Illiterate	11	2.8
Primary	71	17.8
Secondary	262	65.5
Graduation and above	561	14
Type of family		
Nuclear family	431	0.8
Joint family	352	88
Separated family	51	1.3
Family occupation		
Agriculture	296	74
Private job	28	7
Government job	541	3.5
Others	22	5.5

The study included male (177, 44.3%) and female (223, 55.8%) participants. Most students were in the age group of 16-17 (186, 46.5%). All participants were Hindu (400, 100%) by religion. Regarding educational levels, 59.01% (236) were in the 10+2 class, while 41.0% (164) were in the 10+1 class. Most participants resided in pukka houses (88%), with 10.8% in kaccha houses and 1.3% in rented houses. Family monthly income was distributed as follows: less than 5000 (128, 32%), 5000-10,000 (122, 32%), 10,000-15,000 (76, 19%), and more than 15,000

(74, 18.5%). For parents' education, 65.3% of mothers completed secondary education, while 65.5% of fathers had completed secondary education. Most participants are joint families (88%), with 10.8% in nuclear families and 1.3% in separated families. Regarding family occupation, 74% were involved in agriculture, 7% in private, 3.5% in government, and 5.5% in other occupations.

Table 2: Awareness of household waste management.

Questions	Awareness of household waste management	Frequency (n)	Percentage (%)
Q1	Do you aware of household waste material?		
	Yes	271	67.8
	No	129	32.3
Q2	Do you know how to segregate household waste?		
	Yes	337	84.3
	No	63	15.8
Q3	Do you think that local authorities have a role to play in the management of household waste?		
	Yes	211	92.8
	No	189	47.3
Q4	Do you know the principle of waste minimization?		
	Yes	105	26.3
	No	295	73.8
Q5	Are you aware of E-waste?		
	Yes	140	35.0
	No	260	65.0
Q6	Do you have environmental topics in your curriculum?		
	Yes	272	68.0
	No	128	32.0
Q7	Are you eager to know about environmental problems?		
	Yes	384	96.0
	No	16	4.0
Q8	Do you know which diseases occur from household waste material?		
	Yes	336	84.0
	No	64	16.0
Q9	Do you know separation of waste in a separate container is necessary?		
	Yes	366	91.5
	No	34	8.5
Q10	Do you know that some solid wastes are reused and recycled?		
	Yes	317	79.3
	No	83	20.8
Q11	Do you know our Prime minister launched a "Swachh Bharat Abhiyan" campaign for solid waste management?		
	Yes	379	94.8
	No	21	5.3

The findings revealed that 67.8% of the participants knew household waste materials, while 32.3% lacked this awareness. Regarding the knowledge of segregating household waste, a substantial majority, 84.3%, were familiar with the practice, but 15.8% were not. Furthermore, 92.8% of the students recognized the role of local authorities in household waste management, contrasting with the 47.3% who believed otherwise. However, only 26.3% knew the principle of waste minimization, while 73.8% did not. Awareness of E-waste stood at 35.0%, leaving 65.0% uninformed about it. A significant 68.0% of participants reported having environmental topics in their curriculum, and an

impressive 96.0% expressed eagerness to learn more about environmental problems. Awareness of the diseases that can result from household waste was exhibited by 84.0% of respondents, whereas 16.0% had no such knowledge. Additionally, 91.5% understood the necessity of separating waste into separate containers, while 8.5% did not. Most notably, 79.3% of the students knew that some solid waste could be reused and recycled, with 20.8% lacking this awareness. Lastly, 94.8% were cognizant of the "Swachh Bharat Abhiyan" campaign launched by the Prime Minister for solid waste management, while 5.3% were unaware of it.

Table 3: Knowledge regarding household waste management.

Questions	Right (%)	Wrong (%)
What do you understand by household waste?	126 (65.3)	274 (34.8)
What do you mean by household waste management?	216 (54.0)	184 (46.0)
According to you what are the methods of household waste management?	116 (29.0)	284 (71.0)
What disease can you get from household waste?	318 (79.5)	82 (20.5)
What problems are caused by household waste?	333 (83.3)	67 (16.8)
What are the causes of poor household waste management?	169 (42.3)	231 (57.8)
What is E-waste?	278 (69.5)	122 (30.5)
What is the E-waste management rule?	126 (31.5)	274 (68.5)
What is the goal of household waste management?	193 (48.3)	207 (51.7)

Table 4: Practices regarding household waste management.

Questions	Practices regarding household waste management	Frequency(n)	Percentage (%)
Q1	Do you segregate household waste?		
	Yes	370	92.5
	No	30	7.5
Q2	Do you use kitchen waste as compost?		
	Yes	170	42.5
	No	230	57.5
Q3	Do you throw your household waste outside your home?		
	Yes	117	29.3
	No	283	70.8
Q4	Do you usually put household waste in an open space?		
	Yes	61	15.3
	No	339	84.8
Q5	In what type of container do you collect waste?		
	Waste basket	119	29.8
	Plastic bag	61	15.3
	Tin/can	113	28.2
	Other	107	26.8
Q6	How often is the waste container emptied?		
	Once a day	160	40.0
	Once in two days	94	23.5
	Once in three days	58	14.5
	Once a week	88	22.0
Q7	Do you have a "Brown bin" for food waste?		
	Yes	75	18.8
	No	325	81.3
Q8	Is the waste disposal practice correct in your house?		
	Yes	337	84.3
	No	63	15.8

Table 5: Association of awareness with demographic variables.

Questions related to awareness	Demographic variables (p-value)								
	Gender	Age group	Educational level	Type of housing	Family monthly income	Mother's education	Father's education	Type of family	Occupation
Do you aware of house hold waste material?	<.001	0.080	0.530	0.188	0.025	0.016	0.184	0.273	0.016
Do you know how to segregate household waste?	0.002	0.035	0.029	0.397	0.150	0.007	0.090	0.222	0.041
Do you think that local authorities have a role to play in management of household waste?	0.002	0.013	0.084	0.488	0.026	0.197	0.426	0.040	0.299
Do you know the principle of waste minimization?	0.211	0.201	0.169	0.208	<.001	0.001	0.070	0.177	0.078
Do you aware of E-waste?	0.681	0.283	0.898	0.576	0.006	0.136	0.050	0.028	.830
Do you have environmental topics in your curriculum?	0.112	0.422	0.325	0.309	0.066	0.661	0.579	0.136	0.059
Are you eager to know about environmental problems?	0.002	0.127	0.819	0.880	0.549	0.970	0.524	0.034	0.055
Do you know which diseases occur from household waste material?	0.008	0.456	0.534	0.183	0.133	0.302	0.289	0.124	0.159
Do you know separation of waste in a separate container is necessary?	0.004	0.389	0.065	0.779	0.209	0.185	0.823	0.382	0.014
Do you know that some solid wastes are reused and recycled?	0.289	0.129	0.808	0.268	0.002	0.215	0.038	0.138	0.261
Do you know us Prime minister Launched a “Swachh Bharat Abhiyan” campaign for solid waste management?	0.222	0.131	0.781	0.002	0.161	0.678	0.664	0.096	0.427

The participants' knowledge regarding household waste management varied widely. While 65.3% understood what household waste entailed, 34.8% did not possess this knowledge. Similarly, 54.0% were aware of the meaning of household waste management, leaving 46.0% with inadequate comprehension. Moreover, only 29.0% of the students were informed about the methods of household waste management, while a considerable

71.0% were unaware of them. Regarding diseases that could be contracted from household waste, 79.5% knew, but 20.5% were uninformed. Furthermore, 83.3% of participants knew about the problems caused by household waste, while 16.8% did not. The causes of poor household waste management were understood by 42.3%, but 57.8% lacked this knowledge. In electronic waste (E-Waste), 69.5% were informed about it, while

30.5% were not. Interestingly, only 31.5% knew E-Waste management rules, whereas 68.5% did not possess this knowledge. Finally, 48.3% understood the goals of household waste management, while 51.7% were unaware of them.

The study unveiled the participants' practices in household waste management. A significant majority, 92.5%, engaged in segregating household waste, demonstrating a positive behavioural aspect. In contrast, 7.5% did not follow this practice. Notably, 42.5% of the students used kitchen waste as compost, indicating environmentally friendly behaviour. However, 57.5% did not adopt this practice. The study also revealed that 29.3% of the participants admitted to throwing their household waste outside their homes, while 70.8% refrained from this unsanitary practice. Furthermore, 15.3% usually put household waste in open spaces, whereas 84.8% did not indulge in this behavior. Various types of containers were used for waste collection, with 29.8% opting for waste baskets, 15.3% using plastic bags, 28.2% employing tin/cans, and 26.8% utilizing other containers. When it came to emptying waste containers, 40.0% did so daily, 23.5% emptied them once every two days, 14.5% did so every three days, and 22.0% followed a weekly schedule. A smaller fraction of the participants, 18.8%, had a "Brown Bin" for food waste, while 81.3%

did not. Finally, a substantial majority, 84.3%, confirmed that their waste disposal practices at home were correct, while 15.8% believed otherwise.

Table 5 presents the association between awareness of household waste management and various demographic variables among the participating senior secondary school students. The results indicated that several demographic factors significantly shaped students' waste management awareness. Gender emerged as a crucial variable, with a highly significant difference observed. Male and female students exhibited varying levels of awareness, underlining the importance of considering gender-specific strategies in waste management education. Family monthly income also had a notable impact, highlighting the need for tailored interventions based on socio-economic factors. Additionally, the mother's education and occupation were significant influencers of awareness, suggesting that parents' educational and professional backgrounds can influence their children's awareness of waste management practices. Type of family, age group, educational level, father's education, and type of housing also demonstrated varying degrees of association with awareness. These findings underscore the importance of considering diverse demographic factors when designing waste management awareness campaigns and educational programs.

Table 6: Association of knowledge with demographic variables.

Questions related to knowledge.	Demographic variables (P value)								
	Gender	Age group	Educational level	Type of housing	Family monthly income	Mother's education	Father's education	Type of family	Occupation
What do you understand by household waste?	0.027	0.062	0.005	0.620	0.198	0.607	0.637	0.198	0.661
What do you mean by household waste management?	0.625	0.704	0.267	0.895	<0.001	0.153	0.647	0.492	0.291
According to you what are the methods of household waste management?	0.054	0.352	0.566	0.352	0.003	0.213	0.483	0.631	0.003
What disease can you get from household waste?	0.008	0.517	0.108	0.550	0.192	0.249	0.302	0.552	0.055
What problems are caused by household waste?	0.149	0.625	0.885	0.922	0.079	0.062	0.866	0.081	0.729
What are the causes of poor household waste management?	0.965	0.636	0.167	0.134	<0.001	0.587	0.0852	0.035	0.005
What is e-waste?	0.002	0.392	0.662	0.851	0.083	0.549	.443	0.765	0.443
What is the e-waste management rule?	<0.001	0.765	0.609	0.107	0.196	0.535	0.384	0.077	0.037
What is the goal of household waste management?	0.136	0.567	0.860	0.428	0.117	0.304	0.304	0.106	0.664

Table 7: Association of practices with demographic variables.

Questions related to practice	Demographic variables (P value)								
	Gender	Age group	Educational level	Type of housing	Family monthly income	Mother's education	Father's education	Type of family	Occupation
Do you segregate household waste?	<0.001	0.162	0.097	0.603	0.812	0.622	0.687	0.557	0.049
Do you use kitchen waste as compost?	0.963	0.207	0.951	0.026	0.011	0.233	0.002	0.181	0.015
Do you throw your household waste outside your home?	<0.001	0.042	0.267	0.140	0.391	0.352	0.044	0.773	0.006
Do you usually put household waste in an open space?	<0.001	0.270	0.998	0.007	0.970	0.426	0.208	0.429	0.342
In what type of container do you collect waste?	0.007	0.341	0.188	0.538	0.015	0.691	0.382	0.708	0.067
How often is the waste container emptied?	<0.001	0.047	0.395	0.628	<0.001	0.344	0.965	0.264	<0.001
Do you have a "Brown bin" for food waste?	0.009	0.243	0.397	0.556	0.956	0.978	0.440	0.348	0.457
Is the waste disposal practices correct in your house?	0.091	0.375	0.149	0.144	0.511	0.788	0.513	0.715	0.487

Table 6 reveals into the association between knowledge regarding household waste management and demographic variables among senior secondary school students. The results illuminated how demographic factors were intertwined with students' understanding of waste management concepts. Gender was a significant factor in determining knowledge levels, indicating that males and females had varying degrees of comprehension regarding waste management. Educational level also played a role, emphasizing the importance of tailoring educational programs based on student's grade levels. Furthermore, family monthly income, age group, and occupation were associated with knowledge, suggesting that socio-economic and age-related factors influenced the depth of students' knowledge in this area. Father's education, mother's education, type of housing, and type of family demonstrated varying degrees of association with knowledge. These findings underscore the necessity of considering the diverse demographic characteristics of students when crafting waste management educational strategies.

Table 7 examines the association between waste management practices and demographic variables among senior secondary school students. The results shed light on how various demographic factors influenced students'

behaviours related to waste management. Gender emerged as a significant factor, indicating differences in waste management practices between male and female students. Occupation played a notable role, underscoring how students' family occupations were linked to their waste management practices. Family monthly income also had a significant association, highlighting the influence of socio-economic factors on waste disposal behaviours. The age group connected with practices, emphasizing that students of different ages had varying waste management behaviours. Additionally, the type of housing, type of family, educational level, father's education, and mother's education exhibited varying degrees of association with practices. These findings underscore the importance of considering demographic variables when developing interventions to promote responsible waste management practices among students, thereby contributing to a more sustainable environment.

DISCUSSION

The current study assessed awareness, knowledge, and practices of household waste management among 400 senior secondary students from 12 government schools in the rural Gohar Block of Mandi District, Himachal Pradesh.

The study found that most students (67.8%) were aware of different types of household waste materials. This shows a moderately high level of awareness, although 32.3% were still unaware. A previous study conducted in 2013 among high school students in Kerala also found that students in higher classes (Classes 11 and 12) had better awareness about waste segregation and disposal compared to lower classes (Vivek et al, 2013).¹⁶

In the present study, a large majority (84.3%) correctly knew how to segregate household waste into biodegradable and non-biodegradable categories. This indicates that most students have grasped waste segregation principles well. However, awareness about other important aspects of waste management was low. Just 26.3% of students knew the basic principle of waste minimization, and only 35% knew about e-waste, its harmful effects and disposal. This lack of awareness is concerning and needs to be addressed. A similar knowledge gap was highlighted by a study done in 2021 among secondary and tertiary students at Fernando Pessoa University in Portugal (Debrah et al, 2021).^{17,18} Although students had positive environmental attitudes and moderate awareness of some issues, their practical knowledge of waste minimization, recycling, and sustainability was limited. The study concluded that the lack of hands-on training experiences for teachers on waste management translated into insufficient environmental education for students.

In India, the Environmental Education Awareness and Training (EEAT) law enacted in 2008 made environmental education compulsory at all levels of schooling, focusing on waste minimization, segregation, and recycling.¹⁹ However, the current study indicates major gaps in the implementation of EEAT guidelines in rural areas. Strengthening environmental education in school curricula through progressive, interactive teaching methods and field experiences is essential to improve awareness. Involving local waste management authorities to conduct awareness programs can also help.

A high majority (91.5%) correctly agreed that separating household waste into different bins is necessary. Also, 79.3% knew that some components of solid waste like paper, plastic, glass, and metals can be reused or recycled. This shows that the basic concepts regarding waste segregation and recycling are well understood, although still not comprehensive. More intensive awareness of waste minimization, composting, and toxic waste hazards is needed. A study in Malaysia also recommended school campaigns and community programs to enhance public knowledge of household waste management.²⁰

Regarding knowledge, only 31.5% of students could accurately explain household waste's meaning. Just 54% knew solid waste management concepts and processes. Though the majority knew about diseases (79.5%) and problems (83.3%) caused by mismanaged waste, only 42.3% were correctly aware of the reasons and causes

behind poor waste practices. Also, only 31.5% knew about e-waste rules and regulations. This indicates major gaps in conceptual understanding about household waste and its implications, even though basic awareness exists. Studies in developing country cities like Lahore have also found high disease awareness but poor system-based knowledge of waste and a lack of responsibility for proper practices.

Practical knowledge and skills regarding waste sorting, minimization, recycling, composting, and safe disposal were also limited. This was reflected in the insufficient waste management practices seen among students, as discussed further below. Knowledge-behavior disconnects are common when environmental education relies only on theory without practical learning. Equipping teachers with hands-on waste management training can address this gap. Field visits, projects, and experiments can provide contextual knowledge to students while stimulating analytical thinking.

Although most students (92.5%) segregated household waste, only 42.5% used the biodegradable fraction for composting. Nearly 29.3% openly dumped waste near their homes instead of proper disposal in dustbins. Such unhygienic practices exacerbate public health risks, mosquito breeding, open burning, and environmental contamination.²² The lack of regular door-to-door waste collection services in rural areas worsens the situation. However, gaps in knowledge and attitudes regarding waste also contribute significantly.

In the study, 15.3% of students admitted to littering, i.e., disposal in open public spaces. For waste collection at home, only 29.8% used dedicated waste baskets/bins, while 15.3% used plastic bags that can tear and spill content. A study in Jaipur city highlighted similar challenges of open dumping and burning of municipal waste due to poor waste collection infrastructure, insufficient resources, manpower, and public participation in cities.²³ The study recommended decentralized waste management with community involvement, engagement of informal waste workers, and awareness campaigns.

Although 40% of students reported daily waste disposal, 23.5% disposed of only on alternate days and 14.5% every third day. Lack of daily waste removal leads to accumulation, smell, and overflowing bins that attract pests. Just 18.8% used separate food waste bins, even though biodegradable waste requires daily disposal, especially in warm climates like India. A study across urban and rural regions in India also found gaps in practices like open waste burning and bin usage, highlighting the need for educational campaigns and policy changes.²⁴

Like previous studies, the current research also found significant associations between awareness, knowledge and waste practices with socio-demographic variables

like gender, age, education, family income, parental education and occupation type.^{25,26}

Awareness about waste materials, segregation, minimization and hazards was higher among females, younger students, higher education levels, middle-income families and households with educated parents engaged in professional jobs. Similarly, students from these socio-demographic groups also had better conceptual knowledge and waste management practices at home.

Earlier studies in Malaysia have also reported socio-demographic differences in waste perceptions and practices. Communities with lower education and income often lacked awareness about health impacts and had poorer waste disposal habits.²⁷ A study across urban and rural households in India found that education level positively influenced waste segregation and recycling.²⁸ The current study reaffirms these findings in the context of adolescent school students in rural India.

Targeted educational efforts are needed to reach subgroups having poor awareness and practices, like boys, older children, illiterate households and agricultural families of lower socio-economic status. Mass media campaigns using folk theatre and radio may improve reach in rural areas and communities with low literacy.²⁹ Leveraging traditional social structures like village councils and women's self-help groups can facilitate participatory learning.

While this study provides valuable insights, several limitations need consideration. First, the sample size, although substantial, may benefit from further expansion to enhance generalizability. Secondly, the reliance on a survey method introduces the potential for common errors. Additionally, the study exclusively focused on one block within the Mandi district of Himachal Pradesh, limiting the representation of the entire region. A narrower focus on a particular stream within the student population could yield more specific findings. Moreover, the study's scope excluded students from private schools, potentially overlooking valuable perspectives.

CONCLUSION

The study's findings underscore the importance of enhancing awareness and knowledge regarding household waste management among secondary school students. While most participants displayed awareness of household waste, significant gaps existed in understanding waste minimization principles and E-Waste. Addressing these knowledge deficiencies is imperative to instil environmentally responsible habits.

To bridge these gaps, educational institutions must integrate comprehensive waste management modules into the curriculum, leveraging students' inherent curiosity about environmental issues. Collaborative efforts involving teachers, guest speakers, and parents can foster

a culture of responsible waste management. Additionally, local governments should enforce waste disposal regulations, while non-governmental organizations can play a pivotal role in advocacy and implementation. These steps can empower the youth to reduce household waste and create a sustainable future.

Recommendations

Several recommendations emerge to build upon this research and foster improved household waste management. Students should actively engage with parents, teachers, and other stakeholders to deepen their knowledge of waste management practices. Consistently considering student interests can facilitate the development of effective waste disposal programs. Local governments should establish and enforce waste disposal regulations to ensure compliance and curb open dumping. Furthermore, involving NGOs in waste management initiatives can enhance the impact and outreach of these programs, creating a more sustainable environment. By collectively embracing these recommendations, we can work toward a future with reduced household waste and increased environmental consciousness.

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