

Analytical Review of Solid Waste Management in Jind City of Haryana

Dr. D. S. Yadav

Assistant Professor, Department of Geography, CRS University Jind, Haryana (India)

Abstract:

Solid waste management poses critical challenges in Jind City due to rapid urbanization and population growth, leading to uncontrolled waste accumulation and environmental deterioration. This study investigates the nature and implications of solid waste issues in Jind and proposes targeted interventions for sustainable waste management. This study is based on primary and secondary data. A comprehensive study in Jind City revealed widespread awareness of solid waste management issues through various channels such as public meetings, and media platforms. The study identifies important health-related problems attributed to solid waste accumulation, including respiratory issues and the spread of diseases like dengue and malaria. Environmental impacts such as temperature rise, pollution, and soil degradation are also of concern among respondents. Key recommendations for improving solid waste management in Jind include enhancing waste segregation, promoting recycling and composting, and implementing appropriate disposal methods. This study emphasizes the urgent need for coordinated efforts among municipal authorities, stakeholders, and residents to address solid waste challenges effectively. Jind City can alleviate environmental pollution, enhance public health, and achieve sustainable urban development by implementing targeted interventions and leveraging modern waste management technologies.

Keywords: solid waste management, waste segregation, recycling, composting, environmental pollution, public health.

Introduction:

Solid waste management is a critical challenge in urban areas across India, driven by rapid urbanization, population growth, and evolving consumption patterns. The management of solid waste poses significant challenges due to its impact on public health, environmental sustainability, and overall urban liability. According to the Ministry of Housing and Urban Affairs, India generates approximately 62 million tonnes of municipal solid waste annually, and this figure is expected to reach 165 million tonnes by 2030, reflecting the escalating scale of the issue (MoHUA, 2020). Jind City, located in the northern state of Haryana, exemplifies these challenges as it grapples with increasing volumes of solid waste amid its urban expansion and industrial development. Solid waste management is a critical issue facing Jind City, where approximately 32 metric tons of Municipal Solid Waste (MSW) is generated daily. The city, with a population of 166,225 spread across 42 square kilometres, grapples with the challenge of effectively handling its waste. With a population density of 494 people per square kilometre, the demand for efficient waste management strategies is evident. Underscoring the strain on existing waste management infrastructure (Jind Municipal Council, 2023).

The average waste generation per person per day in Jind is approximately 190 grams, amounting to 11680 tonnes of MSW annually. Despite efforts, waste segregation at source stands at only 63%, highlighting the need for improvement. The adoption of color-coded dustbins at households and workplaces could significantly enhance waste segregation, thereby facilitating more efficient waste management practices. Jind, a city located in Haryana spanning an area of 42 square kilometres, faces significant challenges in solid waste management, posing risks to both the environment and public health. Improper disposal of solid waste in Jind leads to the generation of dangerous gases and leachates, highlighting the urgent need to adhere to proper waste management practices outlined in the 'Solid Waste Management Rules 2016'. Waste segregation at the source is a key component of effective waste management. In Jind, about 63% of waste is segregated at the point of generation, facilitating recovery, reuse, and recycling of collected waste materials. However, there remains a need for increased participation from residents, as approximately 37% of households in Jind do not effectively segregate dry and wet waste. Wet waste, including food leftovers and vegetable skins, should be separated from dry waste like plastic and glass to optimize waste management processes. In healthcare facilities across Jind, proper segregation of biomedical waste remains a challenge despite the presence of color-coded dustbins. Mixing general municipal garbage with biomedical waste imposes additional burdens on incinerators designated for bio hazardous materials. Utilizing specialized containers such as biomedical waste bins and sharp containers for proper disposal of biomedical waste is essential to minimize health risks associated with infectious medical waste. Addressing these waste management challenges in Jind requires enhanced public awareness and active community participation to ensure sustainable waste management practices that safeguard both public health and the environment. Keeping in mind the ill effects of solid waste, its proper and permanent management must be done. This study describes solid waste management using various modern technologies.

Research Problem:

Solid garbage is a serious problem in Jind City. There is an unprecedented increase in solid waste due to the increasing population and industrial activities in Jind City. It is having negative effects on the environment and public health and pollution of groundwater and surface water is increasing.

Hypothesis:

Increased community awareness and engagement, coupled with the development of appropriate infrastructure and policy interventions, will lead to improved solid waste management practices in Jind City.

Literature Review:

The studies conducted by various researchers shed light on the critical issues and challenges associated with solid waste management across different regions, particularly focusing on India and its states like Tamil Nadu, Haryana, and the city of Jind. **Gajalakshmi and Van Mathi (2020)** highlighted the diverse composition of solid waste in Tamil Nadu and underscored the urgency of effective waste management practices to mitigate health and environmental risks posed by increasing urbanization. **Katiyar Manoj (2016)** emphasized the adverse impacts of unchecked waste disposal on health and climate change, advocating for proper waste management to mitigate these effects. **Bharatiya Vandana and Singh Jaspal (2017)** emphasized recycling and reusing waste materials to produce organic fertilizers and

energy, promoting sustainable waste management practices. **Studies by Wokekoro Ebiwari (2007), Raju Dhanna Reddy (2021), and Ophia N (2017)** highlighted the pressing need for improved waste management infrastructure and practices to address solid waste challenges effectively, particularly in regions like Nigeria and Tamil Nadu facing rapid urbanization and population growth. **Singh and Kumar (2019), Gupta et al. (2018), Choudhary and Saini (2017), and Kumar and Verma (2016)** focused on waste management practices specific to Haryana, discussing disparities between urban and rural settings and advocating for tailored strategies to address unique challenges faced by growing urban centers like Jind. **The Jind Municipal Council (2023)** report further outlined specific challenges in Jind City, such as inadequate infrastructure and low waste segregation rates, proposing community awareness campaigns, infrastructure development, and policy reforms as strategies to enhance waste management efforts.

Objectives:

- To analyse the major reason and effects of solid waste in Jind city.
- To assess the people's perception regarding solid waste.
- To provide the applicable suggestions to improve solid waste management.

Study Area:

Jind City is the largest and oldest city in northern Haryana, India, with roots tracing back to the time of the Mahabharata. Legend has it that the Pandavas built a temple in honor of Jayanti Devi, giving rise to the name "Jeedan" city, derived from Jayanti Puri. Geographically, Jind City is situated between 29°03' to 29°51' north latitude and 75°53' to 76°47' east longitude. It shares borders with Karnal and Kurukshetra districts to the east and northeast respectively, forming an interstate boundary with Patiala and Sangrur districts of Punjab to the north. To the west and southwest, Jind City adjoins Hisar district, while its southern and south eastern borders touch Rohtak and Sonapat districts.

Key tourist attractions and religious sites in Jind City include Rani Talab, Gurudwara, Bhuteshwar Temple, and Jayanti Devi Temple. The city experiences heavy rainfall from June to September due to the southwest monsoon, with an average annual precipitation of 515 mm. The climate of Jind district is characterized by a tropical continental monsoon climate. In January, the average minimum temperature hovers around 6 °C, while the average maximum temperature peaks at 40 °C. According to the 2011 census, the total population of Jind City is 166,225, and its area is 42 km² approximately making it a significant urban center in Haryana.

Research Methodology and Results Analysis:

The research methodology employed for investigating solid waste management in Jind City utilized a mixed-method approach integrating descriptive and analytical methods. The study aimed to assess the current state of urban solid waste management and propose effective improvement strategies. Primary data collection involved administering structured questionnaires to 300 randomly selected respondents from various localities within Jind City, providing quantitative insights into waste awareness, types, disposal practices, and perceptions of environmental and health impacts. Additionally, qualitative data was gathered through interviews with key stakeholders including local authorities, community leaders, and waste management experts to capture nuanced perspectives. Secondary data sources such as literature reviews and government reports were extensively analysed to enhance understanding of urban

solid waste management issues in Jind City, providing contextual background. Data analysis utilized descriptive statistics to summarize demographic characteristics and survey responses, with statistical tests exploring relationships between variables. Thematic analysis of qualitative interview data identified recurring themes and stakeholder perspectives. Ethical considerations prioritized informed consent and data confidentiality, adhering to ethical guidelines for research involving human subjects.

Sr. No.	#	%
1	Yes	94.00
2	No	6.00
3	Over Radio	0.67
4	Over TV	24.67
5	In School	26.67
6	On Poster	9.33
7	In Public Meeting	39.33

Source: Personal Survey (2023-24)

Based on the personal survey conducted in 2023-24, the responses from respondents in Jind City reflect a strong interest and engagement in seeking information about solid waste management. An overwhelming majority (94.00%) of respondents indicated that they actively seek information on this topic, highlighting a positive inclination towards understanding and addressing waste management issues within their community. Among the various channels through which respondents acquire information, public meetings emerged as the most prominent source, with 39.33% of respondents citing these gatherings as a key source of knowledge. This underscores the importance of community engagement and outreach efforts in disseminating information about solid waste management practices. Additionally, educational initiatives in schools play a significant role, as noted by 26.67% of respondents, suggesting that integrating waste management education into school curricula could effectively promote awareness and behavioural change among younger generations. Television broadcasts (24.67%) and informational posters (9.33%) also contribute to disseminating information about solid waste management, reaching a substantial portion of the population through visual and audio-visual means. Interestingly, the survey reveals relatively lower engagement with radio broadcasts (0.67%) as a source of information on solid waste management, indicating potential opportunities for optimizing this channel or exploring alternative communication strategies.

Sr. No.	Type	Present Time	5 Years	10 Years	20 Years
1	Organic Waste	100.00	81.00	58.00	36.00
2	Toxic Waste	14.67	11.00	5.67	1.67
3	Recyclables Waste	56.33	39.67	19.7	9.00
4	Ashes Or Dust	59.00	44.67	28.33	22.67

5	Dead Animal	49.67	42.67	34.33	30.67
6	Bulky Waste	14.00	12.00	2.67	0.00
7	E-Waste	32.33	12.00	1.33	0.00
8	Solid Waste	32.67	22.00	12.00	2.33
9	Hazardous Waste	33.33	25.67	8.03	0.00
10	Domestic Waste	56.67	48.00	25.33	31.67
Source: Personal Survey (2023-24)					

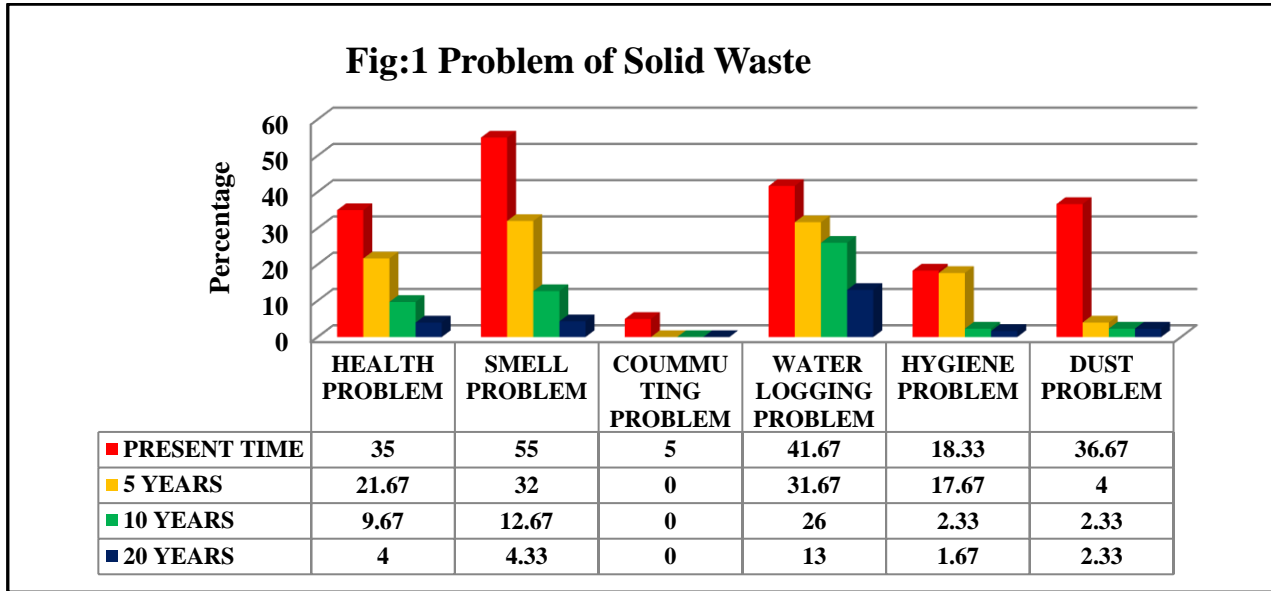
Data collected from a personal survey conducted in Jind City provides insights into the prevalence and awareness of these different types of solid waste among the local population.

Organic waste, such as food scraps and yard debris, was reported to be present in 100% of households surveyed, indicating its widespread occurrence. Over time, there has been a decrease in the presence of organic waste, with 81% of respondents noting its presence five years ago, 58% ten years ago, and 36% twenty years ago. Recyclable waste, including materials like glass, plastic, paper, and metal that can be reused or repurposed, is recognized by 56.33% of respondents currently, with decreasing awareness over the past years: 39.67% five years ago, 19.7% ten years ago, and 9% twenty years ago. Toxic waste, stemming from industrial and chemical processes, was identified by 14.67% of respondents, with decreasing awareness over time: 11% five years ago, 5.67% ten years ago, and 1% twenty years ago. Ashes or dust, classified as solid waste, were acknowledged by 59% of respondents, with decreasing awareness over the years: 44.67% five years ago, 28.33% ten years ago, and 22.67% twenty years ago. Dead animals, categorized as dead animal waste, were recognized by 49.67% of respondents, showing a decline in awareness over time: 42.67% five years ago, 34.33% ten years ago. Bulky waste, encompassing large items like furniture and tree branches, was known to 14% of respondents currently, with decreasing awareness over the years: 12% five years ago and 2% ten years ago. E-waste, comprising unused electronic equipment, was identified by 32.33% of respondents currently, with 12% five years ago and 1.33% ten years ago. Solid waste, a general category of waste, was acknowledged by 32.67% of respondents currently, with declining awareness over time: 22% five years ago, 12% ten years ago, and 2.33% twenty years ago. Domestic waste, generated from household activities, was recognized by 56.67% of respondents, with varying levels of awareness over the years: 48% five years ago, 25.33% ten years ago, and 31.67% twenty years ago.

Respondent's Views Regarding Problem of Solid Waste:

During the personal survey conducted in Jind City, respondents were asked about the problems they face due to the presence of solid waste in their surroundings, revealing significant challenges and concerns associated with waste accumulation. Health-related issues emerged as a prominent concern, with 35% of respondents currently experiencing health problems attributed to solid waste. This percentage has decreased over time, with 21.67% five years ago, 9.67% ten years ago, and 4% twenty years ago reporting health-related issues due to solid waste exposure. The accumulation of solid waste can lead to unpleasant odors, particularly when waste remains stagnant, posing health risks. Currently, 55% of respondents in Jind City face minor discomfort due to foul odors emanating from solid waste. This percentage has decreased over the years, with 32% five years ago, 12.67% ten years ago, and 4.33% twenty years ago reporting similar issues. Transportation difficulties also arise when solid waste obstructs pathways or roads. Currently, 5% of respondents encounter transportation problems due to

solid waste blocking routes. This percentage has declined over time, reflecting improvements in waste management practices.



Another significant issue highlighted by respondents is water stagnation in drains caused by solid waste accumulation, leading to drainage blockages and waterlogging. Currently, 41.67% of respondents face this problem, with 31.67% five years ago, 26% ten years ago, and 13% twenty years ago reporting similar challenges. Hygiene problems associated with solid waste accumulation are prevalent, affecting 18.33% of respondents currently. This percentage has remained relatively consistent over the years, with 17.67% five years ago, 2.33% ten years ago, and 1.67% twenty years ago reporting hygiene-related issues due to solid waste. Additionally, dust blowing during the summer season due to solid waste dispersion contributes to respiratory and environmental issues. Currently, 36.67% of respondents report facing dust-related problems, with lower percentages observed in previous years.

Table:3 Respondent's Views Regarding Elements of Solid Waste

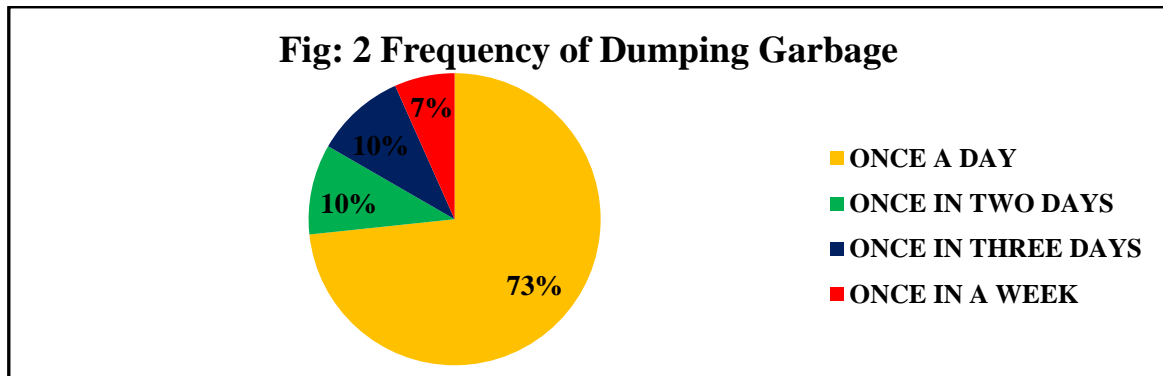
Sr. No	Element	Present Time	5 Years	10 Years	20 Years
1	Paper & Carton	100.00	40.00	32.33	14.00
2	Plastic (Bag /Bottels)	92.33	38.00	27.67	10.67
3	Food Waste	100.00	39.33	10.00	35.33
4	Fiber Bages	46.67	7.33	2.33	0.00
5	Glass	41.67	4.00	1.67	0.33
6	Tins /Cans	32.00	7.33	4.00	0.33
7	E-Waste	57.67	4.33	0.67	0.33
8	Plant Leaves	26.67	16.67	1.67	6.67
9	Dust	55.00	24.33	0.00	0.00

Source: Personal Survey (2023-24)

According to the survey data, households in Jind City produce various types of solid waste, including paper and cartons, plastic bags or bottles, food waste, fiber bags, glass, tins or cans, e-waste, plant leaves, and dust. These waste categories are prevalent among nearly all households surveyed; underscoring the ubiquity and significance of solid waste generation in everyday life. Paper waste is generated by 100% of households in Jind City, with current generation reported by 40% of respondents, decreasing to 32.33% five years ago, and further to 14% twenty years ago. Plastic waste, notably plastic bags or bottles, is prevalent among 92.33% of households currently, with previous generation reported by 38% five years ago, 27.67% ten years ago, and 10.67% twenty years ago. Food waste is universally generated during food preparation, reported by 100% of households surveyed. The prevalence of food waste has been consistent over time, with 39.33% five years ago, 10% ten years ago, and 35.33% twenty years ago. Fiber bags used for stuffing are produced by 46.67% of households currently, with lesser percentages reported in previous years. E-waste, resulting from damaged electronic items, is generated by 57.67% of households currently, with smaller percentages reported in previous years. Dry leaves from trees and plants, common in households, contribute to solid waste generation, reported by 26.67% of households currently. Dust and soil are also significant contributors to solid waste, with 55% of households currently generating such waste.

Respondent's Views Regarding Frequency of Dumping Garbage:

The survey revealed varied practices among households in managing their solid waste disposal. A significant majority of respondents, accounting for 73.33% of households, reported emptying their garbage or disposing of waste at the designated garbage collection centre every day. This daily disposal routine reflects a proactive approach to managing waste and ensuring regular cleanliness.



Additionally, 10% of families indicated that they empty their dustbins every two or three days, suggesting a slightly less frequent disposal schedule compared to daily practices. A smaller percentage of households, approximately 6.67%, reported emptying their dustbins on a weekly basis. This less frequent disposal pattern may be influenced by household size, waste generation rates, and convenience factors.

Table:4 Respondent's Views Regarding Impact of Solid Waste on Environment		
Sr. No	Type of Impact	%
1	Change In Ecosystem	51.00
2	Temperature Increase	85.00

3	Environmental Pollution	83.00
4	Increase In Dust Particles	58.33
5	Extinction Of The Species	29.33
6	Increase The Amount Of Green House Gases	61.00
7	Soil Acidification	35.00
Source: Personal Survey (2023-24)		

A majority of respondents, accounting for 51% of the surveyed population, believe that solid waste contributes to changes in the ecosystem, underscoring the broader ecological implications of waste accumulation and mismanagement. An overwhelming percentage, comprising 85% of respondents, expressed concerns that solid waste contributes to an increase in temperature, which can have adverse effects on the environment, including climate change and heat-related impacts. Furthermore, 83% of respondents identified solid waste as a primary contributor to environmental pollution, particularly through the release of harmful gases when waste is burned. This acknowledgment reflects awareness of the direct link between waste management practices and environmental degradation. A substantial portion, representing 58.33% of respondents, highlighted the release of dust particles into the atmosphere when solid waste is burned, emphasizing the secondary pollutants generated from waste combustion.

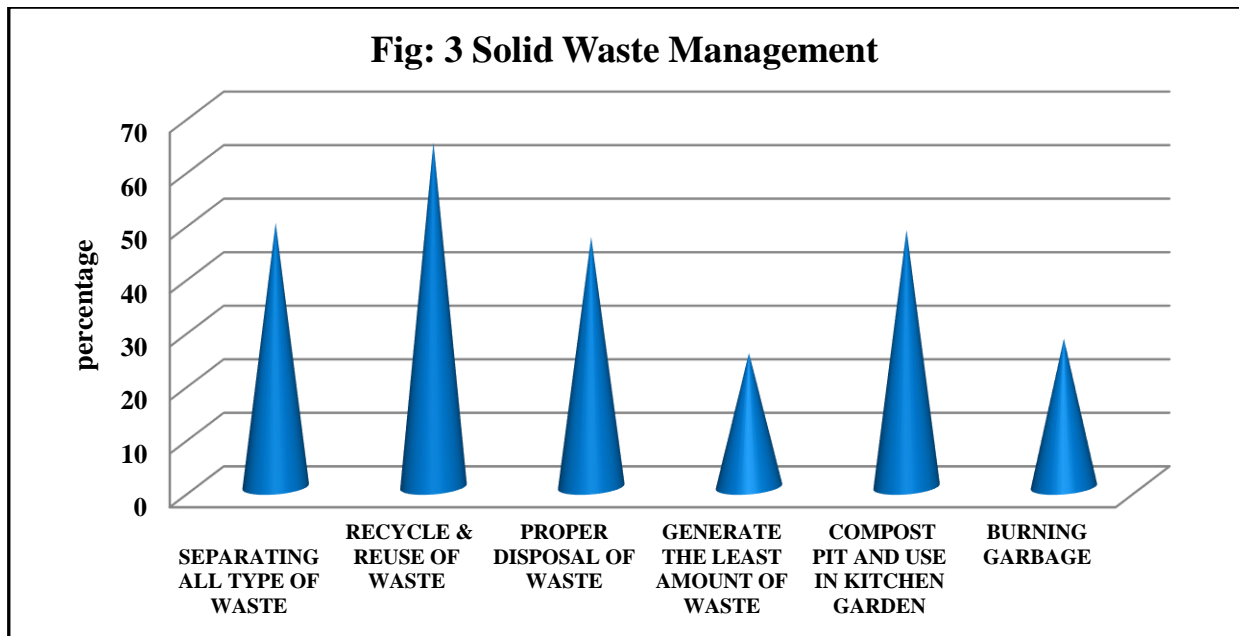
Sr. No	Type of Impact	Human	Animal
1	Spreading Disease	80.67	76.67
2	To Die	5.33	58.67
3	Damage Body Part	58.33	66.00
4	Distribution In Food Chain	11.67	40.00
Source: Personal Survey (2023-24)			

During the personal survey, we tried to know from the people we surveyed what effect solid waste has on humans and animals. Regarding wildlife, 29.33% of respondents expressed belief that solid waste contributes to the extinction of animal and bird species in Jind City, highlighting concerns about habitat degradation and ecological disruptions. A substantial majority, comprising 61% of respondents, identified harmful health effects on animals resulting from burning solid waste. Additionally, 76.67% of respondents believe that solid waste contributes to the spread of various diseases among animals in Jind City, reflecting the indirect consequences of waste accumulation on animal health. Furthermore, 58.67% of respondents expressed concern that animals such as cows, buffaloes, and dogs may suffer or die from consuming solid waste, indicating direct health risks associated with waste ingestion. In terms of physical harm, 66% of respondents noted that animals and birds often sustain injuries or lose body parts when coming into contact with solid waste, highlighting the dangers posed by improperly disposed waste materials. Respondents also raised concerns about broader ecological impacts, with 40% expressing belief that solid waste disrupts the food chain, ultimately affecting the environmental balance. Additionally, 23.33% of respondents observed behavioural changes or signs of distress in animals due to exposure to solid waste, underscoring the psychological and physiological effects of

waste pollution on wildlife. Turning to human health, a striking 80.67% of respondents attributed the spread of various diseases among humans to solid waste, emphasizing the public health risks associated with inadequate waste management practices. Moreover, 5.33% of respondents indicated a belief that solid waste contributes to disease-related deaths among the population near Jind City, highlighting the severity of health impacts resulting from waste pollution.

Respondent's Views Regarding Solid Waste Management:

Nearly half of the respondents, accounting for 49.33%, reported segregating all types of solid waste by placing dry waste and wet waste in separate dustbins. This practice reflects an organized approach to waste disposal that facilitates efficient recycling and disposal processes. A significant majority, comprising 64.33% of respondents, indicated that they reuse or recycle the waste generated in their homes for various purposes, underscoring a commitment to sustainability and resource conservation. Furthermore, 46.67% of respondents reported managing solid waste generated in their households effectively, suggesting proactive efforts to minimize waste accumulation and promote cleanliness.



A notable portion, representing 25% of respondents, stated that they generate a minimal amount of solid waste, demonstrating a conscious effort to reduce overall waste production through responsible consumption practices. Moreover, 48% of respondents mentioned that they dispose of food waste by feeding it to animals or burying it in compost pits covered with soil, highlighting eco-friendly methods of waste disposal and utilization. However, the survey also revealed less desirable practices, with 27.67% of respondents admitting to burning solid waste. This practice, while common, contributes to air pollution and other environmental hazards.

Sr. No	Responsibility	%
1	Municipal Cooperation	8.00
2	Industries	17.33

3	Common People	90.67
4	Local Street Vendor	7.33
Source: Personal Survey (2023-24)		

During the personal survey, A minority of respondents, comprising 8%, attributed responsibility for solid waste management to the municipal corporation, highlighting expectations for local government entities to oversee waste collection and disposal services.

Approximately 17.33% of respondents identified small and large industries located in the city as responsible for solid waste generation, reflecting concerns about industrial waste and its impact on environmental pollution. However, the overwhelming majority of respondents, accounting for 90.67%, placed responsibility on the general public for solid waste management. This perception underscores the collective role of individuals and households in waste generation and the importance of individual accountability in promoting responsible waste disposal practices. A smaller percentage, representing 7.33% of respondents, attributed responsibility to street vendors responsible for street cleaning, citing concerns about inadequate cleanliness practices.

Table:7 Respondent's Views Regarding Advantage of Solid Waste

Sr. No	Advantage of Solid Waste	%
1	Yes	75.00
2	No	25.00
3	Total	100.00
4	Decoration	50.00
5	Construction of Road	41.67
6	Gardening	51.00
7	Make Money Selling Junk Dealer	50.00
Source: Personal Survey (2023-24)		

The survey found that a significant majority, accounting for 75% of respondents, acknowledged deriving some form of benefit from solid waste, highlighting its potential for reuse and resourcefulness within the community. Among the reported benefits, 50% of respondents mentioned using solid waste as a material for decoration purposes, reflecting creative and innovative uses for waste materials in enhancing aesthetic elements. Additionally, 41.67% of respondents expressed views on utilizing solid waste for road construction, indicating awareness of potential applications in infrastructure development and waste management. Furthermore, gardening emerged as a popular activity associated with solid waste, with 51% of respondents expressing interest in using waste materials for gardening purposes, such as composting and soil enrichment.

Table:8 Respondent's Views Regarding Modern Technology for The Management of Solid Waste

Sr. No	Modern Technology	%
1	Recycling	70.67
2	Composting	51.00
3	Landfilling	37.67

4	Incineration	54.00
5	Bio-Remediation	36.00
6	To Make Energy	36.00
7	Other	70.00
Source: Personal Survey (2023-24)		

A significant majority of respondents, comprising 70.67%, indicated a belief that the municipality employs recycling processes for solid waste management. This reflects widespread recognition of recycling as a key strategy for waste reduction and resource recovery. Additionally, 51% of respondents mentioned the use of composting methods by the municipality, demonstrating awareness of organic waste management techniques that can convert biodegradable waste into nutrient-rich compost. Furthermore, 37.67% of respondents reported landfilling as a method used by the municipality, highlighting awareness of traditional waste disposal practices involving landfills. In terms of advanced technologies, 54% of respondents expressed belief in the potential use of incineration methods for solid waste management, indicating awareness of thermal treatment technologies for waste disposal. Moreover, 36% of respondents mentioned bio-remediation and energy production techniques as viable options for waste management, suggesting awareness of innovative approaches that can convert waste into energy or biodegrade contaminants.

Table:9 Respondent's Views Regarding Key Steps to Achieve Zero Waste

Sr. No	Major Key Steps	%
1	Refuse	85.67
2	Reduce	83.33
3	Reuse	83.33
4	Rot (Composting)	24.67
5	Recycle	60.33
Source: Personal Survey (2023-24)		

During the personal survey, the majority of respondents, comprising 85.67%, expressed belief in the refuse method as a key strategy to reduce solid waste. The refuse method involves minimizing waste generation by avoiding unnecessary or excessive consumption, emphasizing the importance of conscious consumption patterns to prevent waste creation. Furthermore, 83.33% of respondents identified the "reduce, reuse, recycle" (3Rs) approach as effective in reducing solid waste. This method encourages minimizing waste generation through reducing consumption, reusing items to extend their lifespan, and recycling materials to divert waste from landfills. Moreover, 24% of respondents highlighted composting as a method to reduce organic waste, emphasizing the conversion of biodegradable materials into nutrient-rich compost for soil enrichment. Additionally, 60% of respondents emphasized the importance of waste recycling processes in reducing solid waste. Recycling involves transforming waste materials into new products, reducing the demand for raw materials and minimizing waste sent to landfills.

Conclusion:

In conclusion, the escalating volume of solid waste in Jind City is posing significant challenges, impact-

ing the environment, human health, and animals. The lack of awareness among residents regarding solid waste management contributes to this issue. To address these challenges, national-level policies have been implemented by the administration, and concerted efforts have been made to manage solid waste effectively. One notable initiative is the provision of free garbage collection services throughout Jind City by the municipality. This proactive step aims to discourage indiscriminate waste disposal and mitigate the rising waste levels. The study indicates that a majority of Jind City residents have awareness about solid waste, with television and public meetings being key sources of information. Various types of solid waste are generated daily in households across Jind City, with the most common being paper, plastic, and food waste. The growing solid waste poses multifaceted problems for residents, primarily health issues and drainage blockages due to waterlogging. The diversity of solid waste in Jind City encompasses organic waste, toxic materials, recyclables, ashes, dead animals, and more. Residents are taking diverse measures for waste management, such as reusing and recycling household waste, separating wet and dry waste, and composting food waste for animal feeding or soil enrichment. Ultimately, the study concludes that individual efforts are crucial in reducing solid waste. If each person adopts responsible waste management practices, such as recycling, composting, and reducing waste generation, the collective impact can lead to a significant reduction in solid waste levels in the city. This underscores the importance of community engagement and individual responsibility in tackling the solid waste challenge in Jind City.

Suggestions:

The following suggestions or methods can be used to manage solid waste in Jind City:

- The solid waste collection points should be located within enclosed areas or behind boundary walls, not in open spaces.
- Solid waste should be collected regularly to prevent foul Odors caused by decomposition.
- Waste segregation should be implemented to recover all recyclable materials such as paper, plastic, cardboard, and glass.
- The government should provide free door-to-door garbage collection services.
- There is an urgent need to implement policies for the proper care of stray animals.
- Rickshaws should be used for door-to-door collection in narrow streets.
- Appropriate types of vehicles should be selected for waste collection, transportation, and disposal.
- Awareness programs should be initiated across different areas of the city.
- Encouraging behavioural change among the population can significantly reduce waste generation.
- Increasing literacy levels enhances people's understanding of various issues, including the importance of keeping their surroundings clean.
- Education, enforcement, and penalties are crucial to deter illegal dumping.
- Studying revenue generation potential through composting organic waste and selling compost.
- Increasing the number of sanitation workers in Jind City is essential.
- Regular awareness campaigns should inform people about diseases caused by improper solid waste management.
- Dustbins should be installed along city roads for convenient waste disposal.
- The population should be regularly informed about solid waste policies to raise awareness.

Research Limitations:

During the study on solid waste management in Jind City, several limitations were encountered that could have influenced the research outcomes. The use of convenience sampling to select respondents within Jind City may have introduced sampling bias, potentially leading to participants providing socially desirable responses or inaccurately reporting their waste management practices, which could impact the reliability of the data. Additionally, communication barriers with diverse stakeholders may have affected the quality and depth of qualitative data obtained through interviews, limiting the insights gained. Furthermore, external factors such as seasonal variations in waste generation and unforeseen events might have influenced data collection and study outcomes, adding complexity and challenges to the research process. Acknowledging these limitations is essential for interpreting the study's results accurately and for providing appropriate recommendations for future research and policy development in the field of solid waste management in Jind City.

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