

Research Paper

Environmental Consequences of Food Packaging Disposal in Urban Pakistan: A Case Study of Multan

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Abstract:

Packaging is one of the major sources of solid waste produced in the world which is leading to multiple environmental issues, especially in developing countries that do not have the resources or the means to control its disposal and recycle them back into the system. This study aims to highlight the impacts and problems that food packaging is creating in the city of Multan in Pakistan, with the help of qualitative observations in public, commercial, and educational areas. Results have shown that Pakistanis are very dependent on non-biodegradable Styrofoam and low-density polyethylene food packaging and when these types of waste are being thrown away, the main effects on the environment are being realized through open-air burning, which causes air pollution from toxic smoke, waste disposal in canals and rivers that pollutes the water and has long-term impact on aquatic life, and on the ground, it has effects such as decreasing soil fertility and killing crops. The causes for this pollution are the lack of awareness of biodegradable products and lack of government initiatives to minimize the use of non-biodegradable products. This study will provide a better understanding of the environmental problems that are rising in Pakistan and other developing countries due to the lack of control of food packaging waste. It is suggested to take a combined approach in order to improve the situation: banning single-use plastic bags and other similar products, promoting biodegradable options, creating awareness among the population, and investing in recycling initiatives and waste management.

Keywords: Food packaging, environmental pollution, plastic waste, solid waste management, Pakistan, biodegradable materials, policy intervention

Citation: Fayaz N., Aslam S., Amin R., Maryam U., (2026). Environmental Consequences of Food Packaging Disposal in Urban Pakistan: A Case Study of Multan. *J Life Sci Inform*, 2(1), 1–8.

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Conflict of Interest: Author(s) declared no conflict of interest.

Introduction:

Food packaging has a function in protection, preservation and information delivery, thus it is indispensable in the modern global supply of food (Coles et al., 2003). But its environmental inheritance, particularly of single-use non-biodegradable products, has turned into a serious global problem. With the larger part of municipal solid waste originating from the packaging industry, a leading economy sector (Sydow et al., 2018), food packaging is its largest segment. Packaging in developed countries typically makes up about two thirds of the material used to wrap consumer goods and much of it is single use (Robertson, 2016).

In Pakistan, there is increased challenge of this global phenomenon because of urbanization processes and high population growth rates plus inadequate waste management system. These plastic, Styrofoam and laminated packages are consumed widely and when disposed off in an unsustainable way (like dumping or open burning), they cause very serious environmental problems. This degradation extends to land and water ecosystems, fauna contamination, and severe threats to human life. There exist loopholes and inconsistent application of plastic usage regulations in Pakistan. Lack of a clear-cut regulatory framework to tackle the menace has dealt a blow to enforcement and the response at all levels.

This study focuses on the city of Multan to conduct a granular analysis of the environmental impact of food packaging. It aims to: (1) document the predominant types of food packaging materials in use, (2) analyze the common disposal practices and their immediate environmental consequences, and (3) evaluate the interplay between public awareness and regulatory gaps. The findings are intended to provide evidence-based insights to inform effective policy formulation and promote sustainable packaging practices in Pakistan's urban centers.

The environmental ramifications of food packaging are a well-established concern in international scholarship, spanning issues of waste management, ecological health, and public policy. Research consistently highlights the persistence of plastic waste in ecosystems. Savita G Pawar et al. (2014) emphasize the direct human health risks, detailing how chemical migrants from plastic packaging can leach into food, constituting a long-term public health hazard. This is particularly critical in contexts like Pakistan, where regulatory oversight of food-contact materials is limited.

Policy interventions have demonstrated varied efficacy. A study on South Africa's plastic bag levy found it initially successful in reducing consumption, but its long-term impact diminished without complementary measures such as public education and the promotion of alternatives (Diikgang et al., 2012). This underscores that fiscal disincentives alone are insufficient and must be part of a broader, integrated strategy a crucial lesson for Pakistani policymakers.

Local research confirms the scale of the domestic challenge. Mahmood et al. (2020) quantified substantial plastic waste generation in Abbottabad, Pakistan, stressing the urgent need to divert waste from landfills towards formalized recycling and recovery streams. Their work points to a national infrastructure deficit that requires immediate investment and systematic planning.

The development of sustainable packaging alternatives is a key research frontier. Investigations into biodegradable polymers, such as Polyhydroxyalkanoates with thermosetting starch (PHA-TPS), show significant promise. However, L.S. Dilkes-Hoffman et al. (2018) caution that the environmental benefits of such materials are fully realized only when they contribute to reducing food waste. This highlights the complex interplay between different waste streams and the need for a systems-thinking approach.

The transboundary nature of plastic pollution is evident in regional studies. Thushari et al. (2020) documented how land-based plastic contamination devastates freshwater and marine ecosystems in Sri Lanka, causing entanglement, ingestion, and ecological disruption, with knock-on effects on local economies and human well-being. This pattern is alarmingly relevant to the pollution observed in Pakistan's riverine systems.

Finally, a global review by Ncube et al. (2021) advocates for a holistic, circular economy framework. They argue for a fundamental shift from end-of-pipe waste management to upstream pollution prevention through redesign, reduction, and reuse, involving all stakeholders from producers to consumers. This paradigm is essential for crafting a sustainable path forward for Pakistan.

Material and Methods

This study employed a qualitative, observational research design to investigate the patterns of food packaging consumption and disposal in Multan, Pakistan, and to assess their visible environmental impacts. The primary method of data collection was systematic field observation, which was triangulated with a comprehensive review of existing scholarly literature to contextualize the local findings within the broader academic discourse.

Data Collection

Site observations were conducted over a two-month period across a purposively selected range of locations in Multan to ensure a representative sample of packaging use and disposal behaviors. The sites were categorized as follows:

- Educational Institutions: Five schools, two colleges, and one university campus.
- Commercial Zones: Three major shopping malls, ten popular local restaurants and cafes, and two large department stores.
- Public and Residential Areas: Various public parks, two main residential neighborhoods, and the banks of two primary canals.

The observational protocol focused on: (1) identifying the types of packaging materials most prevalent at point-of-sale and in waste streams; (2) documenting the dominant methods of disposal (e.g., municipal bins, open dumping, burning, littering in water); and (3) noting any visible environmental labeling on packaging. Photographic evidence was systematically compiled to corroborate the observational field notes.

Data Analysis

The collected qualitative data was analyzed using a thematic analysis approach. Field notes and photographs were meticulously reviewed and coded to identify recurring themes and patterns directly related to the research objectives. The emerging themes were then synthesized to construct a coherent narrative describing the lifecycle of food packaging in the study area, from consumption to disposal and environmental impact.

Results

Dominance of Non-Biodegradable Materials

The analysis of collected packaging samples revealed a heavy reliance on single-use, non-biodegradable materials, as summarized in Table 1. Styrofoam (expanded polystyrene) containers and low-density polyethylene (LDPE) plastic bags were the ubiquitous materials for takeaway services and street food. A critical and consistent finding was the complete absence of any identifiable biodegradable or recyclable labeling on all sampled packaging.

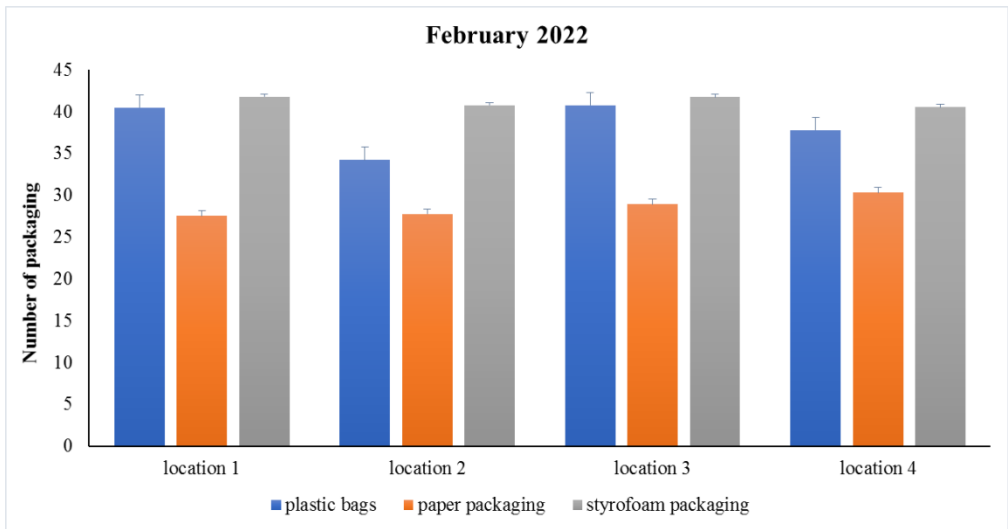


Figure 1: Baseline Packaging Distribution (February 2022): This chart illustrates the initial qualitative survey of predominant packaging types established across the four observation locations in Multan, identifying Plastic Bags, Paper Packaging, and Styrofoam Containers as the primary materials in use before the seasonal surge.

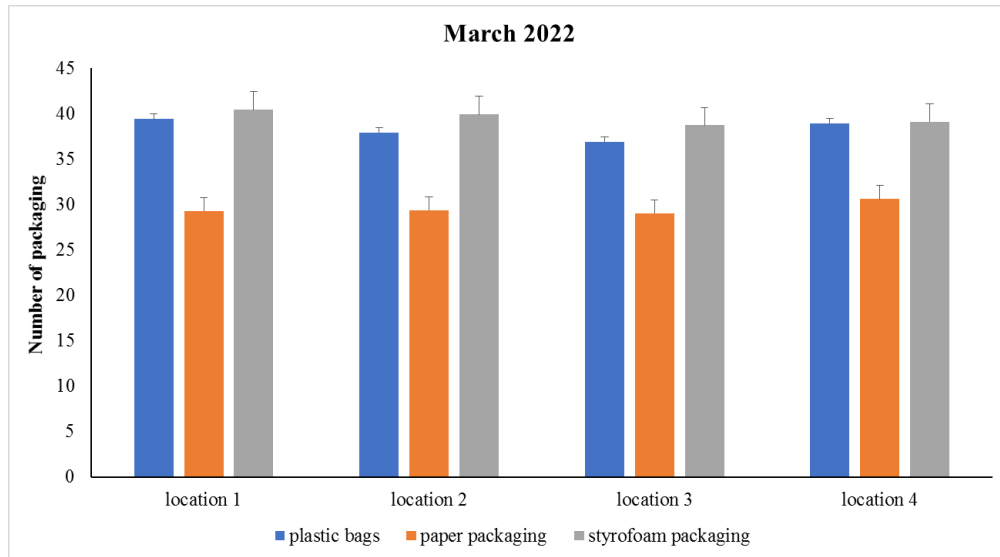


Figure 2: Pre-Ramadan Consumption Surge (March 2022): This bar graph quantifies the sharp increase in packaging waste collected, showing a clear peak in usage for all material types, with Plastic Bags recorded as the most prevalent, coinciding with household and commercial preparations for the holy month of Ramadan.

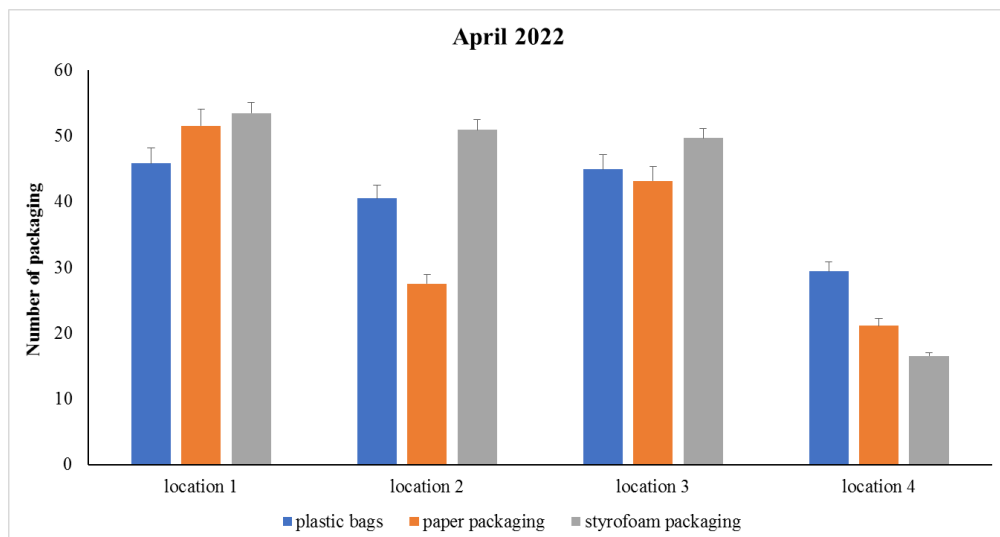


Figure 3: Shifting Disposal Patterns (April 2022): This line graph tracks the transition in waste generation observed during the month of Ramadan, indicating a noticeable change in the volume and composition of packaging waste, attributed to altered consumption habits and meal schedules during the fasting period.

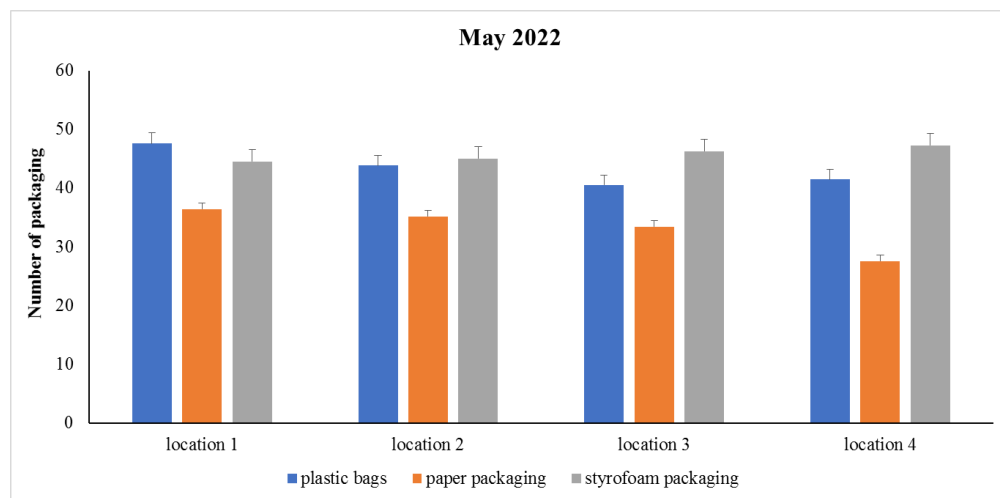


Figure 4: Post-Festive Period Analysis (May 2022): This chart employs calculated totals (T) to analyze the consolidated packaging waste following Eid al-Fitr celebrations, capturing the unique waste stream composed of festive food containers, gift packaging, and residual materials from the concluding phase of the holiday season.

Looking at the packaging data collected from different spots around the city over those few months in 2022, a clear story emerges, one that is deeply tied to the rhythm of life in Multan. The numbers and notes tell us not just about trash, but about people's habits, celebrations, and daily routines.

In February, the research was just getting started. The main goal was to see what was out there. It quickly became clear that each location had its own personality. One spot was dominated by flimsy plastic bags, another by paper wrappers, and a third was a hotspot for styrofoam containers, the kind you get with takeaway meals. This was the baseline, the normal picture of packaging waste before things changed.

Then came March, and the numbers shot up. This wasn't a small increase; it was a massive jump. The counts for plastic bags, paper, and styrofoam all climbed sharply. It's no coincidence that this surge happened right before Ramadan began in April. This is the time when the city feels a different energy. Families are stocking up for the month ahead. There's more shopping, more preparation of food for Iftar gatherings, and inevitably, more packaging waste from all this activity. The high numbers in March perfectly mirror this pre-Ramadan rush.

When Ramadan started in April, the data became less about counting and more about observing. The sheer volume might have changed, or perhaps the types of waste shifted. During the fasting day, there's less consumption, but the evenings are marked by Iftar. This can lead to different

patterns maybe more waste from dates and juice boxes, or specific containers for sharing meals with neighbours and the less fortunate. The data from this month reflects that transition.

Prevalent and Unsustainable Disposal Practices

Land littering and informal dumping were the most frequent, while disposal in proper bins was negligible. Three primary, environmentally damaging disposal methods were documented:

- Open Burning: The incineration of packaging waste in open areas was frequently observed, producing visible plumes of black smoke.
- Aquatic Dumping: Significant accumulations of packaging waste were found clogging canals and informal water sumps.
- Terrestrial Littering: Plastic bags and food containers were extensively littered across open plots and agricultural land.

Discussion:

The findings from Multan paint a stark picture of a linear and destructive packaging economy. The dominance of non-biodegradable materials aligns with global patterns identified by Ncube et al. (2021), but is exacerbated by the local absence of producer responsibility. The total lack of environmental labeling confirms the regulatory gaps highlighted in the national context by Mahmood et al. (2020). Without such labeling, consumer choice is hindered, and effective waste segregation becomes unfeasible.

The relationship between packaging types, disposal behaviors, and their ultimate environmental consequences can be conceptualized as an impact pathway. This model illustrates how the prevalence of non-biodegradable materials, when combined with a lack of public awareness and policy, leads directly to the documented pollution.

The documented disposal practices have direct and severe consequences. The open burning of plastics is a major public health concern, releasing carcinogenic substances that corroborate the health risks identified by Savita G Pawar et al. (2014). The choking of water bodies creates a direct pathway for microplastics, mirroring the ecological devastation described by Thushari et al. (2020). The littering on agricultural land directly impacts food security by degrading soil quality.

The root cause of this crisis is a synergistic failure of governance and public awareness. The ineffectiveness of isolated policy instruments, as seen in the South African case (Diikgang et al., 2012), suggests that Pakistan requires a multi-pronged strategy that integrates stringent regulation, the development of affordable alternatives, and a nationwide educational campaign.

Conclusion

The food packaging in Multan is unsustainable in environment due to the use of non biodegradable materials, lack of awareness and poor disposal. there should be strict governement

rules and actions to address the crisis also there should be urgent ban on use of plastic, styrofoam boxes etc. there should be packaging compliance unit to monitor and encourage biodegradable alternatives.

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