

SUSTAINABLE CULINARY PRACTICES FOR REDUCING RESTAURANT FOOD WASTE

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ABSTRACT

Restaurant food waste is an important environmental, economic, and social sustainability issue because large quantities of edible food are discarded during purchasing, storage, preparation, cooking, serving, and post-consumption. Sustainable culinary practices can help restaurants reduce unnecessary waste while improving operational efficiency, controlling costs, and supporting responsible food consumption. This study examines sustainable culinary practices for reducing restaurant food waste, with particular attention to portion control, accurate demand forecasting, menu planning, proper food storage, efficient preparation techniques, reuse of safe food ingredients, staff training, customer awareness, food donation, composting, and waste monitoring. Previous research indicates that food waste in restaurants occurs at multiple stages, with plate leftovers, overproduction, spoilage, and inaccurate forecasting among important sources. Research conducted in Lahore also found customer plate leftovers to be a major source of restaurant food waste. The study adopts a qualitative research approach and uses a systematic review and thematic analysis of relevant literature. The findings suggest that reducing food waste requires a combination of operational practices, employee knowledge, managerial commitment, and customer participation rather than reliance on a single intervention. Recent research also emphasizes circular practices and stakeholder engagement as pathways toward sustainable food-waste management.

KEYWORDS: *Sustainable culinary practices, restaurant food waste, food waste reduction, sustainability, portion control, food management, circular economy*

INTRODUCTION

Food waste has become a major challenge for the restaurant and hospitality industry because food is frequently discarded at different stages of the food-service process. Restaurants purchase large quantities of raw materials, prepare meals according to expected demand, serve customers, and manage leftovers after meals. Țâbuleac, R. M., Coșbuc, E. D., Simion, T. V., Ungureanu-Comăniță, E. D., & Gavrilesu, M. (2026).found that At every stage, food may be lost because of over-purchasing, inappropriate storage, spoilage, preparation waste, overproduction, excessive portion sizes, customer plate leftovers, and poor waste-management systems. A systematic review of hospitality and food-service research identifies food-waste generation, leftover handling, waste reduction, and consumer behavior as major themes in the field. Therefore, reducing restaurant food waste requires an integrated approach that connects culinary operations with sustainability principles. Sustainable culinary practices refer to cooking and food-management activities designed to minimize environmental impacts while maintaining food quality, safety, customer satisfaction, and economic efficiency. These practices include purchasing appropriate quantities, using seasonal and local ingredients where feasible, applying proper storage methods, using ingredients efficiently, controlling portions, forecasting customer demand, and monitoring food waste. Sustainable culinary management also encourages chefs and kitchen employees to rethink how food is prepared and used. For example, some edible parts of vegetables and other

ingredients can be incorporated into stocks, sauces, soups, or other appropriate preparations when food-safety requirements are satisfied.

Food waste also has an economic dimension for restaurants. When food purchased by a restaurant is not consumed or cannot be safely reused, the restaurant loses the money spent on ingredients as well as the labor, energy, water, transportation, and storage resources used to produce the food. A systematic review of food-service waste-reduction strategies identified numerous interventions across different stages of restaurant and food-service operations, while also noting gaps in evidence concerning leftovers and serving waste. Consequently, food-waste reduction can be considered both an environmental responsibility and an operational-management issue. The problem is particularly relevant in Pakistan. A study of restaurants, hotels, and caterers in Lahore measured food waste using surveys and live tracking. In restaurants, the study reported approximately 73.4–79.9 grams of waste per customer and identified customer plate leftovers as a major source of waste, followed by inaccurate customer forecasting. This demonstrates the importance of studying restaurant food-waste reduction within local contexts rather than depending entirely on evidence from other countries. Recent research has increasingly emphasized circular approaches to food-waste management. Circular practices focus on preventing waste, minimizing waste, recovering resources, and recycling unavoidable waste. A 2024 systematic review identified prevention, minimization, and recycling as important areas of circular food-waste research in hospitality. TM, A., Kaur, P., Ferraris, A., & Dhir, A. (2021) explains Similarly, research published in 2025 emphasizes that restaurant managers and employees' knowledge, attitudes, competencies, and everyday practices can influence food-waste management. Thus, sustainable culinary practices should involve not only technologies and waste bins but also changes in daily kitchen behavior and management.

Food waste has become a significant environmental, economic, and social challenge within the restaurant industry. Restaurants purchase, store, prepare, cook, serve, and dispose of large quantities of food every day, and waste can occur at almost every stage of this process. Ingredients may be wasted because of over-purchasing, poor storage, spoilage, excessive trimming, preparation errors, overproduction, inappropriate portion sizes, buffet leftovers, and food left on customers' plates. In addition to the food itself, the resources used to produce and deliver that food—including water, energy, labor, packaging, transportation, and agricultural resources—are also effectively wasted when food is discarded. Research on hospitality food waste therefore increasingly considers food waste not simply as a disposal problem but as an important sustainability and operational-management issue. Sustainable culinary practices provide an important approach for addressing this problem. These practices involve using food ingredients, equipment, energy, and human resources efficiently while maintaining food quality, hygiene, safety, and customer satisfaction. In a restaurant environment, sustainability can begin before food enters the kitchen through responsible purchasing and accurate demand forecasting. It continues through appropriate storage, inventory control, menu planning, efficient food preparation, portion management, and careful cooking. After food is served, restaurants can also reduce waste through customer awareness, appropriate takeaway options, redistribution of suitable surplus food, and responsible management of unavoidable organic waste. The overall objective is to prevent

food from becoming waste in the first place and then manage unavoidable waste through appropriate recovery practices.

One of the most important sources of restaurant food waste is overproduction. Restaurants often prepare food according to expected customer demand, but actual demand can be difficult to predict. Unexpected changes in customer numbers, weather, special events, holidays, cancellations, and fluctuations in menu popularity can result in more food being prepared than customers actually consume. Research conducted in Lahore, Pakistan, identified inaccurate customer forecasting as one of the important contributors to food waste in the hospitality sector. The study also found customer plate leftovers to be a major source of restaurant food waste. Therefore, restaurants can potentially reduce waste by improving demand forecasting through historical sales information, reservation data, seasonal patterns, and daily customer trends. Purchasing and inventory management are also central to sustainable culinary operations. When restaurants purchase more ingredients than they can use within an appropriate period, perishable products may spoil before they can be incorporated into meals. Vegetables, fruits, dairy products, meat, seafood, and other fresh ingredients are particularly vulnerable to deterioration when storage conditions or inventory rotation are inadequate. Sustainable purchasing involves determining realistic quantities, monitoring inventory regularly, applying appropriate stock rotation systems, and coordinating purchasing decisions with menu requirements. These practices can help restaurants reduce unnecessary spoilage while also controlling food costs. Another important practice is proper food storage. Even when restaurants purchase appropriate quantities, food can become waste if it is not stored correctly.

Incorrect temperatures, poor packaging, excessive storage time, cross-contamination, and failure to monitor expiration or use-by dates can result in food being discarded. Kitchen employees therefore need appropriate knowledge about storage temperatures, labeling, stock rotation, refrigeration, freezing, and food-safety procedures. Rustam, F., Ishaq, A., Munir, K., Almutairi, M., Aslam, N., & Ashraf, I. (2022) explains Effective storage can extend the usable life of ingredients and reduce the amount of food that must be discarded because of deterioration or safety concerns.. Food-waste monitoring is another useful practice. Restaurants cannot effectively manage a problem if they do not know how much food they are wasting or where the waste is occurring. A restaurant can record waste according to categories such as preparation waste, spoiled food, overproduction, buffet waste, and customer plate waste. Regular monitoring can help managers identify recurring problems. For example, if a restaurant discovers that a particular menu item consistently produces large quantities of leftovers, management can investigate whether the issue relates to portion size, demand forecasting, preparation quantity, or customer preferences. Systematic reviews of food-service interventions have identified waste measurement and monitoring as important components of broader food-waste management strategies.

RESEARCH OBJECTIVES

1. To examine the major causes and sources of food waste in restaurant culinary operations.

RESEARCH QUESTIONS

1. What are the major causes and sources of food waste in restaurant culinary operations?

LITERATURE REVIEW

Food waste in restaurants has received increasing attention because of its environmental, economic, and social consequences. Restaurants operate at the intersection of food production and consumption, making them an important setting for sustainability research. Cantaragiu, R., Hadad, S., & Condrea, E. (2019) revealed Dhir et al. found that hospitality and food-service food-waste research covers causes of waste generation, waste hotspots, leftover handling, interventions, and consumer behavior. Their systematic review demonstrates that food waste is not produced at a single point but emerges throughout the food-service process. Sustainable food-waste management requires attention to purchasing, storage, preparation, cooking, serving, and post-consumption activities. Munir's systematic review explains that sustainable food-waste practices are influenced by materials, meanings, and competencies, highlighting the importance of managerial attitudes, employee behavior, knowledge, and organizational practices. This perspective suggests that providing waste-management equipment alone may not be sufficient. Restaurant employees need knowledge and skills to use ingredients efficiently and identify opportunities for waste prevention. Food purchasing and inventory management are important areas of food-waste prevention. Restaurants can reduce waste by purchasing quantities according to historical sales data, seasonal demand, menu requirements, and expected customer numbers. Overstocking can lead to spoilage, particularly for fresh vegetables, fruits, dairy products, meat, and other perishable ingredients. Effective inventory systems, including first-in-first-out practices, regular stock checking, and appropriate storage temperatures, can therefore reduce unnecessary food losses. Menu planning is another important sustainable culinary practice. Menus can be designed around ingredients that are available in appropriate quantities and can be used across several dishes without compromising quality.

Cross-utilization of ingredients can reduce the probability that unused ingredients will become waste. Menu engineering can also help restaurants identify dishes that have high demand and dishes that generate excessive leftovers. Portion control is particularly important because customer plate waste represents a significant component of restaurant food waste. Research from Lahore identified customer plate leftovers as a major source of food waste in restaurants. Restaurants can address this issue through appropriate portion sizes, flexible serving options, half portions, customer choice, and awareness messages. However, portion reduction should be implemented carefully because excessively small portions may negatively affect customer satisfaction. Food preparation practices can also influence waste levels. Culinary staff can be trained to use ingredients efficiently and minimize unnecessary trimming. Appropriate preparation methods can help restaurants obtain greater usable yield from purchased ingredients. Where food-safety regulations permit, suitable edible ingredients or by-products can be incorporated into other preparations rather than discarded. Demand forecasting is another major component of food-waste reduction. Inaccurate predictions of customer numbers can result in overproduction. The Lahore hospitality study specifically

identified inaccurate customer forecasting as an important contributor to waste. Restaurants can use previous sales data, reservation information, day-of-week patterns, holidays, weather conditions, and special events to improve production planning. Research on food-service waste-reduction strategies has identified a large number of possible interventions. One systematic review analyzed 107 academic and grey-literature sources and identified 180 strategies grouped into 30 categories. It also reported that evidence for many strategies was exploratory, demonstrating the need for stronger empirical evaluation. This indicates that restaurants should monitor the results of interventions rather than assuming that every sustainability practice will produce the same outcome. Employee training and organizational culture are also essential. Chefs, cooks, servers, purchasing staff, and managers all influence the quantity of food discarded. Employees who understand the financial and environmental consequences of waste may be more likely to follow waste-prevention procedures. Recent research applying Social Practice Theory to restaurants found that materials, meanings, and competencies shape the attitudes and behaviors of managers and staff and can contribute to food-waste reduction.

Customer participation is another important factor. Restaurants can encourage customers to avoid unnecessary leftovers through menu information, portion choices, awareness messages, and appropriate takeaway options. A recent systematic review of restaurant food waste highlights behavioral intention and perceived behavioral control as important concepts in understanding consumer food-waste behavior. Therefore, restaurants need to address both kitchen-side and customer-side waste. Finally, circular food-waste management provides a broader sustainability framework. Prevention should generally be prioritized, while unavoidable waste can potentially be directed toward appropriate recovery, donation, animal-feed systems where legally and safely permitted, composting, or other resource-recovery pathways. Research on circular practices in hospitality indicates that prevention, minimization, and recycling are central themes, while further research is needed concerning customer engagement. Cordero, J., Torres-Zambrano, J., & Cordero-Castillo, A. (2024). elaborated on Restaurant food waste has become an important area of sustainability research because food-service establishments generate waste through purchasing, storage, preparation, cooking, serving, and consumption. The literature increasingly views restaurant food waste as a multidimensional problem involving culinary practices, management systems, employee behavior, customer behavior, economic considerations, and environmental sustainability. Dhir et al. (2020), in a systematic review of hospitality and food-service literature, identified major research themes including the causes and stages of food-waste generation, waste hotspots, leftover handling, interventions, consumer behavior, and stakeholder involvement.

Their review demonstrates that food waste cannot be attributed to a single activity because it can emerge throughout the food-service process. Liu, Y., Wells, V. K., & Kapetanaki, A. B. (2026). Found that A major theme in the literature is the distinction between preventing food waste and managing waste after it has already been generated. Sustainable culinary management gives greater importance to prevention because preventing unnecessary food production avoids the resources used to purchase, transport, store, prepare, cook, and serve food that ultimately remains unconsumed. Recent research similarly emphasizes a hierarchy in which prevention and minimization are prioritized before recycling or other recovery

approaches. Cardenas, Schivinski, and Brennan (2024), through a systematic review of 51 studies, found that circular practices in hospitality mainly focus on preventing, minimizing, and recycling food waste. Their review also indicates that customer engagement remains an area requiring further investigation.

METHODOLOGY

This study adopts a qualitative research approach because its primary purpose is to explore and synthesize existing knowledge concerning sustainable culinary practices for reducing restaurant food waste. The research focuses on identifying major sources of food waste, sustainable culinary practices, employee and managerial roles, customer behavior, and waste-management strategies. A qualitative approach is appropriate because the study seeks to understand patterns, themes, practices, and relationships reported in previous research rather than relying exclusively on numerical measurement. The study uses a literature-based approach informed by previous systematic reviews and empirical research on hospitality and restaurant food waste. Existing research has examined food-waste prevention strategies, restaurant operations, consumer plate waste, circular practices, and employee behavior. This study adopts a qualitative research methodology to examine sustainable culinary practices for reducing food waste in restaurants. The methodology is designed to explore how food waste is generated during purchasing, storage, preparation, cooking, serving, and post-consumption stages and how sustainable culinary practices can reduce these losses. The study focuses on restaurant operations because food waste in this sector is influenced by both kitchen activities and human behavior. The research considers practices such as demand forecasting, responsible purchasing, inventory management, appropriate food storage, menu planning, portion control, efficient preparation, employee training, food-waste monitoring, customer awareness, safe reuse of surplus food, and appropriate management of unavoidable organic waste. A qualitative methodology is suitable because the study aims to understand practices, experiences, challenges, and patterns rather than only measuring the quantity of food waste. The study uses an exploratory qualitative research approach. This approach allows the researcher to examine existing knowledge concerning sustainable culinary practices and understand how different practices may contribute to food-waste prevention in restaurant environments.

RESEARCH DESIGN

A systematic literature review design is used for the study. Relevant academic literature concerning restaurant food waste, sustainable culinary practices, food-service sustainability, waste prevention, portion control, food preparation, customer plate waste, and circular food-waste management is reviewed and synthesized. Systematic reviews are appropriate for identifying major themes, research gaps, and established practices within a developing research area. Previous restaurant food-waste research has similarly used systematic literature review designs and thematic analysis. A design is used for this study. The descriptive component identifies the major sources and types of food waste generated in restaurant operations, while the exploratory component examines sustainable practices descriptive and exploratory research that can potentially minimize these waste streams. The design allows the researcher to organize information according to different stages of restaurant operations. The

research framework divides restaurant food-waste management into three major stages: pre-kitchen, kitchen, and post-kitchen activities. Pre-kitchen activities include purchasing, supplier selection, inventory management, forecasting, and storage. Kitchen activities include preparation, cooking, portioning, menu management, and handling of ingredients. Post-kitchen activities include customer plate waste, surplus food, food redistribution, composting, recycling, and final disposal. This structure provides a comprehensive framework for examining food waste throughout the restaurant food-service cycle. The study focuses on individuals who have direct or indirect knowledge of restaurant food purchasing, preparation, serving, and waste-management practices. Managers can provide information about organizational policies and financial considerations, while chefs and kitchen employees can provide practical information about preparation waste, overproduction, storage, and ingredient utilization. Servers can provide information about customer behavior and plate leftovers.

DATA ANALYSIS

The collected literature is analyzed through thematic analysis. Relevant information is organized into major themes, including causes of restaurant food waste, purchasing and inventory management, food preparation, portion control, demand forecasting, employee training, customer behavior, food redistribution, composting, and circular practices. Similar findings from different studies are grouped together, while differences in research contexts and findings are identified. Thematic analysis is consistent with previous systematic research on restaurant food waste. The selected methodology provides a comprehensive way to investigate sustainable culinary practices for reducing restaurant food waste because food waste is influenced by multiple interconnected factors. A purely quantitative measurement of discarded food may show how much waste is produced but may not fully explain why the waste occurs or how restaurant employees and managers attempt to prevent it. The qualitative approach allows the study to investigate these underlying practices and experiences. By examining purchasing, storage, preparation, cooking, portioning, serving, customer behavior, and waste management together, the research can develop a holistic understanding of restaurant food-waste reduction. This approach is consistent with recent literature that treats hospitality food waste as a system involving operational practices, employee competencies, management, consumers, and circular resource-management strategies. The selected methodology provides a comprehensive way to investigate sustainable culinary practices for reducing restaurant food waste because food waste is influenced by multiple interconnected factors. A purely quantitative measurement of discarded food may show how much waste is produced but may not fully explain **why** the waste occurs or how restaurant employees and managers attempt to prevent it.

FINDINGS

The findings of the literature-based study indicate that restaurant food waste is generated at several stages of culinary operations rather than at a single point. Major sources include over-purchasing, spoilage, inappropriate storage, preparation waste, overproduction, excessive portions, and customer plate leftovers. Evidence from Lahore is particularly relevant because plate leftovers and inaccurate customer forecasting were identified as important sources of

restaurant food waste. The findings further indicate that prevention is more sustainable than simply disposing of food waste after it has been generated. Accurate demand forecasting, inventory management, appropriate purchasing, menu planning, portion control, and efficient preparation can reduce waste before it reaches the waste bin. Systematic research has identified numerous food-service strategies, although stronger empirical evidence is still needed for many interventions. Employee involvement also emerges as an important factor. Managers and kitchen staff need appropriate knowledge, skills, motivation, and organizational support to implement sustainable practices. Recent restaurant research suggests that staff competencies and everyday practices can influence food-waste reduction. Customer behavior is another significant component. Since plate leftovers can represent a substantial portion of restaurant waste, restaurants need strategies that encourage appropriate ordering and consumption. Portion flexibility, customer awareness, and suitable takeaway options can potentially contribute to reducing post-consumption waste. The findings also indicate that sustainable food-waste management should extend beyond prevention to include circular practices for unavoidable waste. Food that cannot be safely prevented or reused may, depending on applicable food-safety and waste regulations, be directed toward appropriate recovery, donation, composting, or recycling pathways. Research on circular hospitality practices supports the importance of prevention, minimization, and resource recovery. The findings of the study indicate that sustainable culinary practices can play a significant role in reducing food waste in restaurant operations. The analysis showed that food waste is generated at different stages of the restaurant food cycle, including purchasing, receiving, storage, preparation, cooking, serving, and post-consumption. Among these stages, preparation waste and customer plate waste were identified as particularly important sources of waste.

CONCLUSION

Sustainable culinary practices provide an important pathway for reducing food waste in restaurants while supporting environmental sustainability, economic efficiency, and responsible food consumption. The literature shows that restaurant food waste occurs through interconnected operational and behavioral processes, including purchasing, storage, preparation, production, serving, and customer consumption. Therefore, effective food-waste reduction requires a comprehensive strategy rather than a single intervention. Restaurants can reduce food waste by improving demand forecasting, purchasing appropriate quantities, strengthening inventory management, applying proper storage practices, designing efficient menus, controlling portions, minimizing preparation losses, training employees, monitoring waste, and involving customers in sustainable consumption. The evidence also suggests that managerial commitment and employee competencies are central to transforming sustainability principles into everyday restaurant practices. The issue is especially relevant to Pakistan, where research in Lahore has already documented measurable restaurant food waste and identified plate leftovers and forecasting problems as important contributors. Future research should therefore investigate restaurant-specific interventions in Pakistani cities and measure their effects over longer periods. Overall, sustainable culinary practices can help restaurants move from a disposal-oriented approach toward a prevention-focused and circular food-management system. Sustainable culinary practices play an important role in reducing restaurant food waste while improving environmental, economic, and operational

sustainability. This study concludes that a significant amount of restaurant food waste can be reduced through practical strategies such as accurate purchasing, proper food storage, portion control, menu planning, efficient kitchen production, reuse of safe surplus food, composting, and staff training. Restaurants can minimize unnecessary waste by monitoring the quantity and type of food discarded at different stages of preparation and service. Better inventory management can also prevent over-purchasing and food spoilage, while appropriate portion sizes can reduce plate waste without negatively affecting customer satisfaction. The findings further indicate that employees are a central part of successful food-waste reduction programs. Chefs, kitchen staff, servers, and managers need awareness, training, and clear procedures to adopt sustainable culinary practices consistently.

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