

SUSTAINABILITY PRACTICES IN FOODSERVICE: WASTE ANALYSIS AS A FIRST STEP

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ABSTRACT

This study aimed to evaluate waste management in a restaurant by quantifying waste in all production processes and proposing strategies to reduce them. Plate waste and leftovers were considered for food waste. In regard to minimizing food waste, the authors describe some recommendations to improve the foodservice process. A total of 14,934 Kg of organic waste and 2,030 kg of inorganic waste were generated during a 30-day production period. The average leftover-ingestion index was high, which can result in wasted meals and increased

costs. The findings highlight the need to optimize meal production in order to improve sustainable practices, particularly waste management and environmental education. Food waste has become an issue of great public concern. The 2030 Agenda for Sustainable Development reflects the increased global awareness of the problem. The concepts of sustainable management have increasingly been on the agenda of many business associations, especially foodservice and collective meal production.

KEYWORDS: food handler; food services; food waste; sustainability.

1. INTRODUCTION

Meal production demands significant use of natural resources and generates a high volume of waste during food processing. The 2030 Agenda for Sustainable Development, compiled by the United Nations in 2015, includes action plans based on people, the planet, prosperity, peace, and partnership. Some of the goals apply to the foodservice industry since they seek to end hunger and promote sustainable agriculture (objective 2) and ensure sustainable production and consumption patterns (objective 12) (United Nations, 2015).

Annual global food wastage is around 1.3 billion tons, consuming a massive amount of resources and incurring a high carbon footprint (i.e., 3.3 billion metric tons of carbon dioxide-CO₂ equivalent). According to the Food and Agriculture Organization of the United Nations (FAO, 2019), approximately one-third (by weight) of global food production is lost or wasted every year (Figure 1). Such a level of inefficiency has serious environmental and social implications.

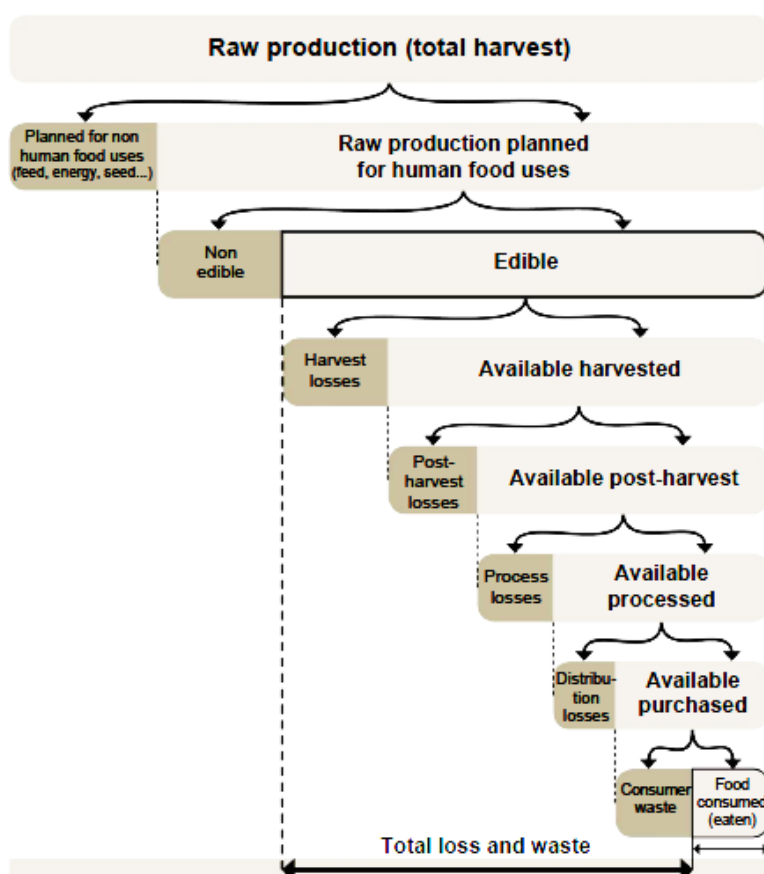


Figure 1: Schematic representation of food losses and waste across the food chain (high-level panel of experts, 2014).

Brazilian National Solid Waste Policy aims to minimize the environmental impacts of establishments that generate waste and includes guidelines for the integrated handling of solid waste, responsibilities, government sectors, and applicable economic instruments (Brazil, 2010).

De Laurentiis et al. (2017) listed food waste as one of the main items that influences greenhouse gas emissions. According to Pirani & Arafat (2014), waste improperly disposed of in

landfills decomposes and generates methane emissions with negative effects, which contributes) significantly to climate change.

Waste management reduces environmental and financial impacts, increases recycling, and promotes reuse and appropriate disposal, in line with several public policies. In addition, strategies to minimize waste in restaurants encourage customers to consume more responsibly, generating less waste at the end of the meal production cycle (Brazil, 2018).

Given the significant generation of solid waste in the foodservice sector, efficient menu planning is indispensable to minimize food waste. Managers and employees are very responsive to performing proper waste management, applying tools for waste quantification as a quality index to evaluate the food production process. The use of food waste indicators in restaurants, such as total waste produced and leftovers, creates the possibility for optimizing the natural and financial resources involved in the production process. Thus, the present study aimed to evaluate food waste generation and propose educational strategies for sustainable foodservice.

2. METHODS

2.1 Study characterization

This is an exploratory descriptive, cross-sectional study conducted at a university restaurant in Northeastern Brazil. The study was approved by the University Hospital Research Ethics Committee of the Federal University of Rio Grande do Norte (UFRN) (protocol number nº 81179). To assess waste generation by the restaurant, we analyzed the segregation between organic and inorganic waste; total solid waste in all the production steps; leftover-ingestion index; and food waste cost, and proposed strategies to reduce the amount of solid waste generated by the restaurant. Food handlers' awareness of waste management was also evaluated.

2.2 Food handlers' awareness of waste management

A review and short course on food waste management were performed with workers directly involved in food handling and meal production (Figure 2).

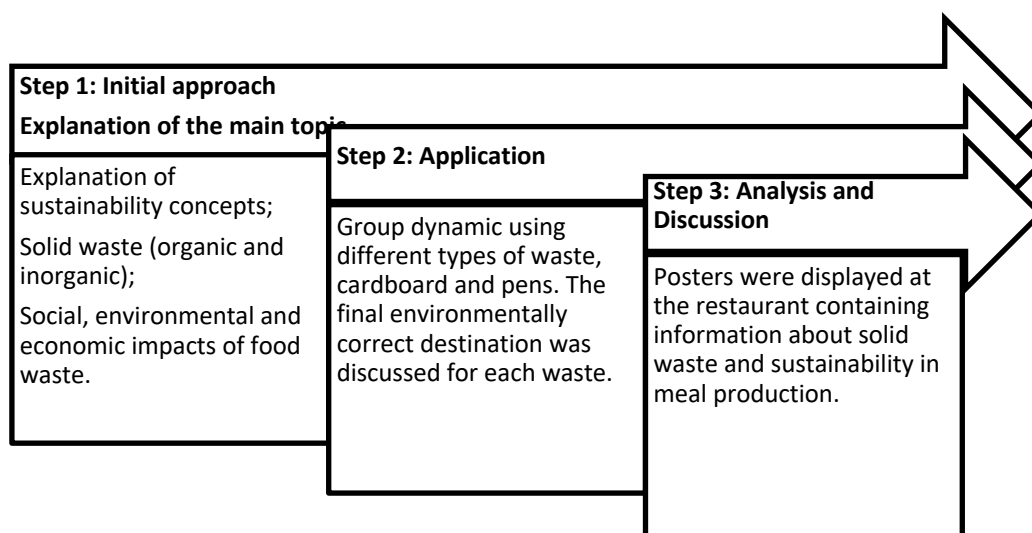


Figure 2: Steps for a short course on food waste management for food handlers in an institutional restaurant.

2.3 Solid waste quantification

The solid wastes (organic and inorganic) were weighed separately on 30 non-consecutive days. Quantification was carried out by direct weight using a platform scale (Welmy), with 300 kg maximum capacity and 0.05Kg precision. Organic waste from food processing, that is, meals from the distribution line that would not be used, and discarded stock (from refrigerating chambers) were determined, as well as inorganic waste from the consumption area (disposable glasses, napkins), storeroom (cardboard boxes, paper) and kitchen (cans, plastic packaging, and glass).

2.4 Plate waste evaluation

The leftover-ingestion index was calculated using the percentile and classified as good (0-5%); fair (5-10%), poor (10-15%) and inadequate (> 15%) (Vaz, 2006; Castro & Queiroz, 1998).

2.5 Waste reduction strategies

Based on the amount of solid waste generated in foodservice and the costs resulting from distribution losses, strategies were proposed to minimize solid waste generation in the university restaurant. These measures aimed not only at reducing costs, but also decreasing the negative impacts on the environment and consequently society, in addition to adhering to current sustainability policies recommended by public universities.

3. RESULTS

3.1 Solid waste quantification

The amount of solid waste was quantified on 30 non-consecutive days for waste generated in the processing and consumption areas, from food handling, and utensil cleaning. The results displayed in Table 1 show the amount of waste and plate waste generated in the university restaurant during the study period.

Table 1: Waste management quantification in an institutional restaurant in Brazil on 30 nonconsecutive days.

Waste management parameters	Value
Number of meals	46,700
Organics waste (metric tons)	14.9
Inorganic waste (metric tons)	2.0
Plate waste (%)	13.4

The amount of organic waste generated on weekdays accounted for about 86% (12,925 Kg) of the total, with Saturdays representing 9% (1286.19 Kg) and Sundays and holidays approximately 5% (722.6 Kg). With respect to inorganic waste, the amounts were 90% (1815.75Kg), 6% (128kg), and 4% (86.6kg) on weekdays, Saturdays, and Sundays and Holidays, respectively.

In the present study, the largest amount of organic waste derived from the utensil cleaning area, which receives all the gastronomics and pans containing the leftovers of the entire production. It is important to underscore that these leftovers are discarded when they do not meet the reuse criteria of the restaurant, such as temperature, and being prepared on the same day, except leftover raw salad and soups. In the vegetable processing area, organic waste originated from food parts considered inappropriate for consumption (peels, roots, deteriorated parts), accounting for a significant amount of waste (1,732 Kg; 12%). The other areas, such as juice/dessert processing, cooking, and cold food processing, generated less organic waste in the foodservice (Figure 3).

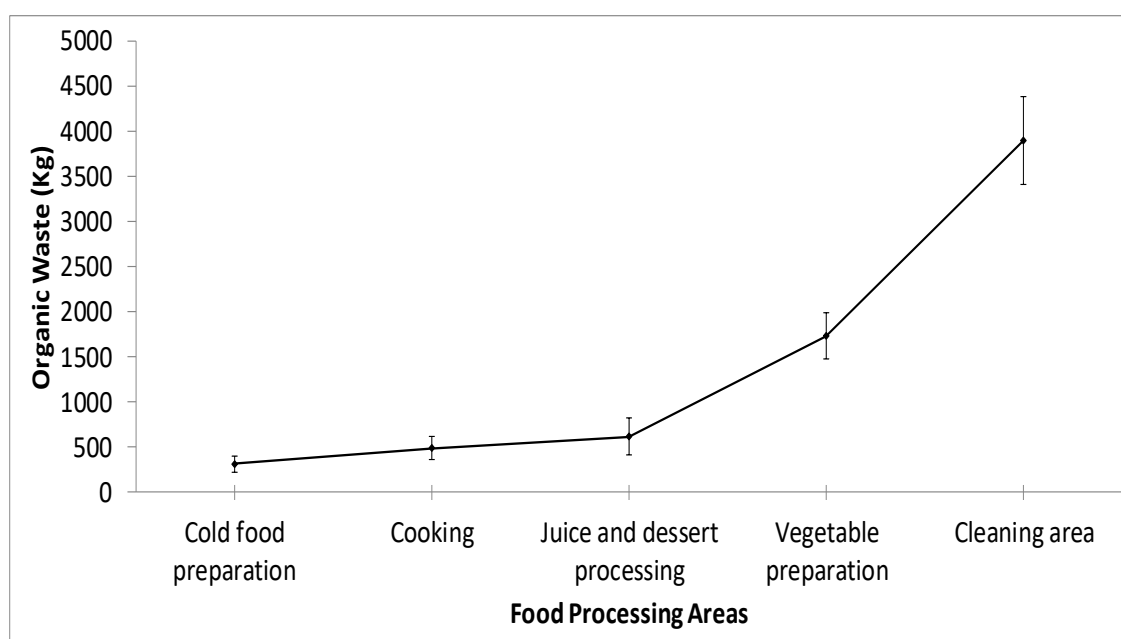


Figure 3: Organic waste generated by different food processing sectors in an institutional restaurant on 30 non-consecutive days.

The inorganic waste generated in foodservice originated in the production process, such as meal distribution, consisting of paper, cardboard, plastic, glass, and cans. Figure 4 shows the amount of inorganic waste generated in the main food processing areas of the restaurant.

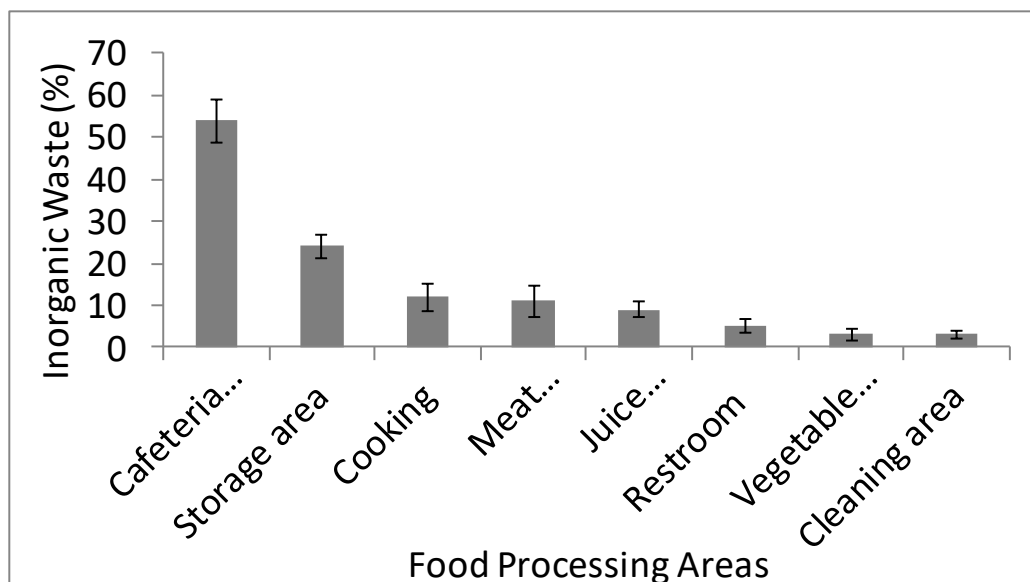


Figure 4: Amount of inorganic waste generated by different processing areas of the restaurant on 30 non-consecutive days

3.2 Plate waste

The food waste index was classified as inadequate for the meals served (Table 1).

3.3 Strategies to minimize waste generation in food services

Some of the strategies to minimize foodservice waste are presented in Figure 5. It is important to invest in employee training programs, because, from a technical standpoint, food lost due to processing and planning errors or inadequate consumption by customers is a major obstacle in controlling raw material costs (Silva; Silva; Pessina, 2010). However, this type of intervention exhibits a number of restrictions because of the changes in the employees' work routine. Restaurant employee training is the most critical part of the entire food production process, in terms of waste management.

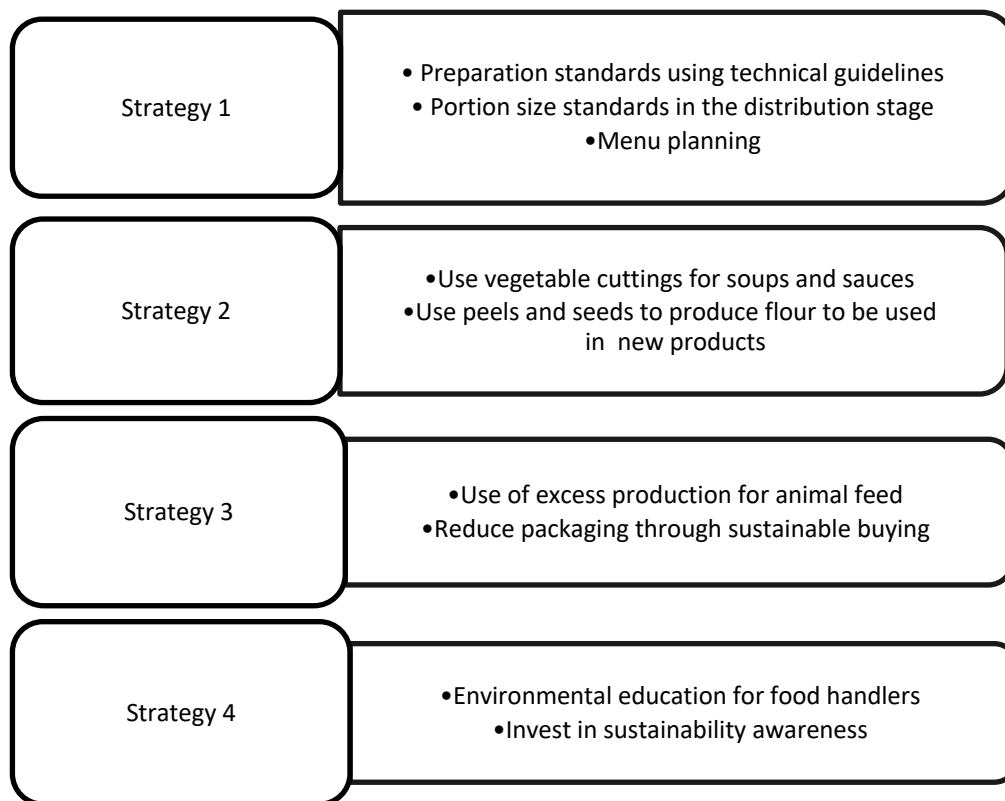


Figure 5: Strategies to minimize food waste in the foodservice sector.

4. DISCUSSION

The results obtained in the present study showed high organic waste generation, due to the nature of the production process. In meal production, organic solid waste generation is directly proportional to production volume. However, nutritionists, employees, and customers are also responsible for optimizing the process and minimizing losses.

Food waste can minimize composting or animal feed production. Peels and seeds can be used as food ingredients in the development of new products, for foodservice applications. One study demonstrated the viability of melon seed flour as an ingredient in cake manufacturing, and that food waste can be used in restaurants and the food industry in order to adhere to sustainable production guidelines (Da Cunha et al., 2020).

Managers and employees should be encouraged to manage waste. Government support is also essential, due to the importance of proper infrastructure for waste collection and final destination. In addition, strategies to minimize or reuse solid waste and natural resources should be encouraged.

Organic waste from containers is relevant because the food is ready to consume. Menu planning flaws, such as the demand for large portions, may have caused low acceptance. The amount of organic waste produced in the processing area was high, possibly due to previous preparation and inadequate storage temperature.

According to Rossi et al. (2010), excessive organic waste is a "collateral" result of most foodservices, requiring urgent action on the part of food and nutritional professionals through

proper planning, aimed at guaranteeing safe, nutritionally balanced food. However, sustainable planning aims at adequate water and electrical energy use in addition to promoting environmentally friendly waste disposal. In other words, it is vital to plan the menu to ensure cleaner production.

This reflects the global concern to preserve the environment and reduce hunger by minimizing food waste. According to Carmo & Lima (2011), Brazil is among the 10 countries that most waste food in the world. Of the 41,000 metric tons of food waste produced annually, 15% is generated by restaurants (around 6000 metric tons).

Our results also showed higher waste generation in the cafeteria (54%). This consisted mainly of plate waste, napkins, and disposable plastic cups. These findings prompted the restaurant to use glassware to avoid plastic waste and reduce costs. The improper disposal of plastic materials harms the environment due to their long-term deterioration (more than 200 years), where excess use can cause soil pollution, manhole clogging and consequent flooding (O'Kane, 2011).

Different factors may have influenced the high plate waste, such as the sensory quality of foods (appearance, taste, temperature), customer appetite, preferences, food habits, inappropriate utensils, and portion size (Pedro & Claro, 2010). Other aspects are also related to waste, including little variety and the lack of worker awareness about waste. Some foods were rejected more, such as roast chicken (38%), fried fish (21%), and chicken pieces (20%). These findings demonstrate the need to reduce foods of animal origin on the menu, since they cause more environmental damage than their plant-based counterparts, especially in terms of greenhouse gas emissions (Harmon & Gerald, 2007; Strasburg & Jahno, 2017).

The cooking area also produced waste. A study carried out in a public hospital restaurant evaluated waste generation from fresh and minimally processed vegetables. The estimated average monthly waste from non-edible fruit parts was 5545.8 kg, corresponding to 34.2% of the total. The authors concluded that minimally-processed vegetables are an alternative for food and nutrition services (Melo & Strasburg, 2020).

These strategies may be applicable to foodservices, since purchasing minimally processed products will reduce energy, water, and human resource costs, especially for those with limited food processing space.

These indicators are useful to managers who need to control their costs and reduce environmental impacts. One study calculated the eco-efficiency of the inputs used in university restaurants (Strasburg & Jahno, 2017), showing the water footprint caused by food waste. Food sustainability, which requires the rational use of water and electricity, improved following diagnosis, training, and interventions in restaurants (Rodrigues et al., 2020).

Good sustainability practices aim at solving part of the ecological impact caused by food services (Silva et al., 2015). Indeed, due to its unpredictable nature, there is significant food waste in foodservices, and vigorous efforts must be made to mitigate it (Falasconi et al., 2015).

It is important to underscore that in order to minimize food waste, greater user awareness is needed through interventions demonstrating the consequences, from the economic, social and environmental standpoint. In addition to quantifying food waste, the present study also describes a number of measures to reduce it in meal production. Users were provided with suggestions on how to reduce waste and costs, in addition to being made aware of the social and environmental impacts.

According to Canepa et al. (2011), food handler and foodservice user awareness is considered one of the essential strategies for implementing and applying further interventions to diminish solid waste production.

Evaluating menus and their acceptance is an optimal way to encourage managers and customers to reduce waste. Changes in food processing can lower food waste and restaurant costs.

In the food handling process, excellent indicators are the correction factor, the association between raw and processed food (Botelho & Camargo, 2005), overproduction, and the leftover-ingestion index. Waste management programs emphasize the eco-efficient use of materials and energy in food production when assessing environmental impacts. (Strasburg & Jahno, 2017).

Sustainable restaurants are relevant and necessary, and Brazilian public policies encourage food purchases from small producers (Brazil, 2015). Given that food products obtained from short supply chains and small producers are fresh, they generally have less packaging than their industrialized counterparts.

Healthy menus support foodservice sustainability. Additionally, controlling production methods is essential for good sustainable management, particularly in terms of waste. Mota et al. (2017) proposed a sustainability survey in foodservice, based on a national and international literature review, in order to address all the principles of sustainable foodservice. The 37-item instrument was deemed able to evaluate adequate menu planning as a potential tool to ensure sustainable development.

5. CONCLUSIONS

The results showed that the restaurant generated more than 16 metric tons of waste per month, an alarming amount that incurred high costs, underscoring environmental, social, and economic problems. Sustainable meal production demands special attention from managers because they are chiefly responsible for employee training and informing users. Finally, food services engaged in controlling food waste and working together with consumers promote environmental education and behavioral changes in food consumption.

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