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Strategies to Reduce Food Waste and Losses in Food Service

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Abstract

The aim of this review is to discuss the causes of food waste in food service and potential solutions to reduce waste and losses. The authors used different search engines such as Web of Science, PubMed, Science Direct, Google Scholar and Scopus to find relevant publications and prepared this mini review. Food waste from food service has become a major environmental, economic and social problem. Proper purchasing, a well-planned menu, trained and adequate number of staff, standardization of meals and production according to a workflow chart, appropriate portion sizes, experience of service staff and good communication skills with customers are important points in reducing food waste in food service. This mini review will encourage researchers to find solutions to reduce food waste in food service and contribute to raising the awareness of staff working in food service.

Keywords: Awareness; Food service; Food waste; Food losses

Introduction

Food waste is defined as the use of food that can be consumed by humans to feed animals for non- consumptive purposes or the disposal of consumable food [1]. While the reduction in food mass in the first three stages of the food production chain (agricultural production, post-harvest handling and storage, processing and packaging) is referred to as food losses [2], the reduction in food mass at the end of the food supply chain is referred to as food waste. The terms food waste and food loss are often used synonymously in the literature [3].

In recent years, food waste has become a global and significant problem. More than one billion tons of food is thrown away each

year, wasting one third of the food produced [4]. This corresponds to an economic loss of 400 million dollars per year [5]. In developing countries, the majority of food waste occurs in primary production and the supply chain, whereas in developed countries, it has been reported that the majority of food waste occurs at the consumption stage [6]. While 46% of food waste in Europe occurs at the consumption stage, this rate is 5% in Africa. On the other hand, 1/9 of the world population struggles with hunger [7]. Such a high rate of hunger and food waste at the same time indicates that the world population will soon face major problems in meeting food demand [8]. The urgency of this problem has prompted governments, regions, cities, businesses, organizations and individuals to



take action. Several food waste reduction targets have been set, including Sustainable Development Goal 12.3, which aims to halve global food waste per capita at the retail and consumer levels and reduce food losses in production and supply chains by 2030 [9]. Food waste creates problems in food safety and ethics [10], has a negative impact on natural resources such as water and land [11], and leads to increased greenhouse gas emissions [12]. Food loss and waste is responsible for approximately 8-10% of annual greenhouse gas emissions [13]. Total food waste covers an area equivalent to about 30 percent of the world's agricultural land [14]. Food service have an important share in food waste. According to the FAO Food Waste Index 2024 report, the amount of food waste per capita worldwide for 2022 is 36 kg and 290 million tons in total [14]. Furthermore, with the increasing tendency to eat out of home, waste from the food service sector has become a major problem for both developed and developing countries [15]. Therefore, it is of great importance to reduce food waste both at the production stage and at the consumption stage in places of mass consumption. Although the amount of food waste generated in this sector is frequently discussed in the media, there are not enough scientific studies on this issue yet [16]. There is a lack of information on solutions to reduce food waste in the food service. Understanding and identifying the root causes of food waste is the first step in finding solutions to minimize food waste. The aim of this review is

to discuss the causes of food waste in food service establishments and potential solutions to minimize food waste and losses.

Stages of Food Waste Occurrence

In the food supply chain, food waste occurred at different stages from production to consumption. Food waste occurred at different stages differs in composition and is recycled accordingly [17]. Food waste from the consumption stage has a greater negative impact on the environment and natural resources as a result of further processing and transportation of food compared to previous stages [18]. Therefore, the identification of waste occurred at different stages is important for effective food waste management. Scientists consider it appropriate to measure food waste in grams per meal at storage, preparation, serving and consumption stages [19]. Food waste is classified into kitchen waste (related to food preparation stages), serving waste and plate waste according to their level of generation [20]. Engström and Carlsson-Kanyama [21] divided waste occurrence from production to consumption into four categories: storage losses, preparation losses, serving waste and plate waste (Figure 1). Waste occurring during the production stage, such as kitchen waste, is classified into two types: avoidable waste (food with expired shelf life) and non-preventable waste (food parts that are not consumed) [22].



Figure 1: Waste occurrence from food production to consumption in food service. Source(s): Author's work.

Measurement of Food Waste Amount

Measuring the amount of food waste enables the creation of a food waste inventory that allows to determine how much food is wasted and at what stage. Such an inventory allows managers to track changes in the amount of food waste over time and identify what to prioritize in reducing it [8]. In reducing food waste, it is important to evaluate the amount and source of the waste [23]. For

this, it should be determined at which stage the waste occurs. Waste occurrence in the production chain is divided into four groups as storage, preparation, serving and consumer. It is important to accurately measure the amount of waste occurring at these stages. The amount of food waste measured at the storage and preparation stages is gross weight as the food has not undergone any cooking process. However, since serving and plate waste contain prepared

and cooked food, there is a weight change and the measured weight is net weight. This difference should be taken into consideration when comparing the amount of waste in the studies. Measurement of the amount of food waste in catering services is generally low. In a study conducted with 228 staff of 19 enterprises, it was determined that the majority of the enterprises did not measure the amount of food waste. However, in studies, it was determined that the most food waste usually occurs during service [24]. In a study on food production systems of different hotels, it was reported that measuring the amount of food waste with digital scales instead of manual measurement can give more reliable results. At the same time, it was reported that the distinction between avoidable waste and unavoidable waste reduced the amount of wasted food from 7% to 3% [8]. In another study in which food waste amounts of two different catering companies were evaluated, it was found that

food losses occurred mostly at the serving stage and the main food group wasted was vegetables. Moreover, the main reasons for plate waste were found to be “too much portion served by the staff” and “not being hungry” [24]. On the other hand, the fact that food waste quantification is not sufficiently developed and standardized makes it difficult to analyze and reach comparable results [25].

Causes Of Food Waste and Reduction Strategies

Identifying the causes of food waste is important in reducing food waste because effective food waste management is achieved by a good assessment of the amount and source of waste [23]. In this section, the causes of food waste generated during storage, preparation and cooking, serving and consumption stages and activities to reduce food waste (Table 1) are examined.

Table 1: Possible strategies to reduce food waste and losses in food service.

Strategies	References
Purchasing / storage	
More clear and standardized raw material acceptance criteria	[24, 26]
Correct determination of the purpose of the purchase	
Optimization of storage management (implementation of the first-in, first-out principle and periodic control of the expiration date)	
Direct use of food with a close expiration date (flexible meal planning)	
Long-term analysis of meals sold to adapt food orders (in terms of weekdays, seasons and external factors such as holidays or major events)	
Preparation / cooking	
Developing strategies against overproduction (e.g. freezing)	[28, 30, 31]
Reuse of residues (taking into account applicable legislation)	
Control of preparation losses and training of employees	
Rapid cooling of food to prevent the growth of microorganisms	
More semi-finished raw materials (clean vegetables and food ingredients prepared by suppliers)	
Counter / Buffet service	
Use of small serving bowls at the buffet (given as needed)	[20, 32, 35, 36]
Not filling the bowls completely towards the end of lunch	
Adapt portion sizes according to customer needs	
Impressive presentation of the foods	
Using less food for plate decoration and providing information that it can be eaten, removing side plates	
For expensive foods, change the plate size, reduce the portion size and at the same time reduce the price.	
Consumers	
Sensitizing customers to the area of food waste and the causes of food waste (e.g. use of posters)	[31, 39]
Informing consumers about different portion sizes	
Contact through customers increasing tolerance to sustainability measures	
Investigate the causes of plate surplus through feedback surveys (and then implement appropriate actions)	
Possible food donation to local institutions	
Innovative Approaches	
Changing lunch/dinner from a fix menu to a buffet for employees	[20, 44]
Innovative menus using whole food ingredients (leather, etc.)	
Use of machine learning algorithms for the prediction of spoilage and abnormalities in food	

Reducing purchasing / storage waste

Clearer and standardized raw material acceptance criteria, not purchasing inferior quality products, good communication with the supplier, seasonality of products, adequate food quality controls during delivery are factors that should be considered at the purchasing stage in preventing food waste. It is important to purchase the right and quality product in sufficient quantity to reduce food waste and plate waste [24]. To reduce storage waste, it is recommended to implement a first-in, first-out (FIFO) system, regularly check expiration dates of products and adapt menus to foods close to their expiration dates. Proper temperature and humidity, pest and rodent control, avoiding overbuying through good purchasing, and using well-functioning cooling systems to prevent spoilage and reduce energy costs are important activities to prevent storage losses [26].

Reducing kitchen waste

The first step to minimize food waste during the preparation and cooking phase is a menu planned in accordance with basic principles by considering consumer demands. Preparing food in stages according to a workflow chart and segmenting the cooking process are important for food waste management [27]. In addition, the raw material used during food preparation can affect food waste management. In one study, it was reported that the use of semi-prepared food may reduce food waste due to ease of storage, planning and cooking [28]. On the other hand, it has been emphasized that semi-prepared foods may increase food waste due to lack of cultural acceptance, encouragement of overconsumption and rapid deterioration, especially of vegetables and fruits [29].

Determining the appropriate portion size

Determining the appropriate portion size is important to reduce waste during production. Personnel should be experienced in adjusting portion sizes according to consumer demands. It has been found that by increasing the awareness of the personnel about food waste, the personnel can better determine the amount that can be consumed [30]. Strategies should also be developed for the reuse of overproduced food. Foods that can be frozen should be frozen for future use or leftovers should be reused by considering the applicable legislation.

Reducing serving waste and plate waste

It is important to determine the appropriate serving portion size, to have experienced staff and to use the appropriate serving equipment and plate size to reduce service waste. Portion sizes should be adjusted according to consumer needs or, if possible, different options should be offered. Especially in restaurants and hotels, serving larger portions of food to customers than they can eat is the most important cause of preventable food waste in restaurants and hotels [31]. It has been shown that by reducing both plate size and portion size and adjusting the price accordingly, food waste can be reduced by 57% without adversely affecting customer satisfaction [32]. In a study, it was reported that changing the plate size for expensive meals and reducing the price at the same time reduced food waste and increased consumer demand

[24]. In buffet catering, reducing plate size has also been found to be effective, resulting in up to a 30% reduction in plate waste [33]. Portion size is frequently discussed in studies to reduce food waste [20, 34-36]. Appropriate sequencing of the meals served at the buffet, appropriate mealtimes, and the use of small serving bowls to make them appear full have been reported as methods to reduce the amount of food waste in buffet service [20].

Other factors affecting food waste and losses in food service

Communication

Communication affects the amount of losses plates and food waste in food service. Communication is important between suppliers and customers and between staff and within the company. Knowing and communicating with customers is an important part of ensuring customer satisfaction. Communication with customers becomes important when information about the content or nutritional value of food portions and meals is needed, or in a school and kindergarten setting, how to behave at mealtimes. It is also important for the company to inform the consumer about issues such as the environmental impact of food waste, which is an important element in reducing food waste. Communication can also be achieved through billboards, written messages or instructions [31, 37].

Awareness on food waste

Food waste awareness is defined as alerts used to remind relevant stakeholders of their role in waste reduction. These alerts and other interventions to raise awareness have been found to be effective in reducing food waste in cafeterias, canteens and restaurants [38, 39]. Various activities are carried out to raise awareness, such as providing social cues using posters [39] packaging plate waste [40] and informing about waste and waste reduction through cards on tables. The way in which waste awareness is raised varies across organizations. For example, in restaurants, reducing plate size was found to be more effective than social cues given through posters and did not have any negative impact on customer satisfaction [39]. Environmental informations have also been found to influence consumers and lead them to develop positive attitudes towards waste reduction in buffet restaurants [30]. In one study, the percentages of food consumption preferences and consumption amounts were assessed before and after the implementation of a school lunch policy. After the lunch policy, there was an 18% increase in vegetable consumption and a 12.7% increase in fruit consumption preference [41]. Providing an appropriate menu with good nutritional value at school lunch fulfills not only the necessary nutritional requirements for children but also educational objectives. These purposes are seen to learn dining etiquette, to implement healthy eating education, and to inform and raise awareness among students about food waste and losses.

Occupational skill of personnel

Occupational skill refers to a person's ability to perform professional tasks and act appropriately in various situations [42].

An untrained worker is more likely to make mistakes in cooking, resulting in food waste. Errors can also result from reading a recipe incorrectly or carelessly. Care, meticulousness and the ability to follow instructions are important components of professional skills [43]. Taste and attractive presentation of meals are seen to reduce food waste [36]. Chefs' experience, easy adaptation to new recipes and proper performance of general duties has a great impact on reducing both kitchen and buffet waste [44] Estimating the appropriate portion size and performing purchasing and preparation accordingly are also part of occupational skills. The importance of occupational skills and competence in preventing food waste is especially evident in the organization and planning of mealtimes [20].

Conclusion

Food waste has become a major environmental, economic and social problem. Food waste from food service constitutes a significant portion of total food waste. Proper purchasing, a well-planned menu, trained and adequate number of staff, standardization of meals and production according to the workflow chart, determination of the appropriate portion size and experience of the service staff and good communication skills with customers are important points in reducing food waste in food service. It is important to raise awareness and consciousness among staff and consumers about food waste. To reduce food waste in food service, the stage of food waste occurrence and the amount of food waste should be monitored and corrective actions should be identified and implemented accordingly. The effectiveness of the corrective actions should then be monitored through feedback such as customer satisfaction surveys.

Conflict of Interest

The authors declare no conflict of interest.

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