

Review

Food Waste in Public Food Service Sector—Surplus and Leftovers

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Abstract: Food waste occurs at various stages of the food supply chain, starting from the production stage on farms to processing, distribution, and consumption. It is an important global problem that has social, environmental, ethical, and economic costs. The present work aims to discuss the differences in waste generated from surpluses or leftovers, the monitoring systems of food waste in public food services, and the good practices to reduce food waste. Besides the accessible knowledge about reducing waste, tonnes of food were daily discarded and wasted. To achieve a sustainable food system, food waste must be reduced significantly. Collaborative efforts are necessary to achieve significant reductions in food waste for achieving SDG 12.3 in public food services. Thus, policies that support or enforce larger implementation of best practices are needed. Knowledge about food waste is important to change attitudes and behaviors toward surplus food and leftovers. Some best practices can include promoting awareness campaigns to educate staff about the impact of food waste and the best practices to reduce it, including information on proper storage, portion control, and meal planning; implementing inventory management systems; donating surplus food via collaboration with food banks and charities; optimizing portion sizes, ensuring they are adequate and manageable for customers, reducing the likelihood of leftover food on the plate; allowing customers to order smaller quantities or share a meal; providing packaging to allow customers take their leftovers home for later consumption. The procedures to be adopted by public food services should provide guidance for the selection of products that can be donated. However, specific temperature requirements depending on the food category should be complied with. This paper enlarges the understanding of surpluses and leftovers and the best practices that could be implemented in public food services to minimize food waste.

Keywords: best practices; food waste; leftovers; public food services; surpluses



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1. Introduction

Food waste is present throughout the food supply chain, from agricultural production, processing, and distribution to the final consumer. The tonnes of food destined for

consumption that is discarded daily reveal the unsustainability of the food system with environmental, social, ethical, and economic consequences [1]. The causes of food waste vary around the world and are directly linked to the conditions in each country [2]. It is demonstrated that the 1/3 ratio between waste and production remains the same between developed and underdeveloped countries, being differentiated by the stages where losses are more significant; in developed countries, waste is greater in the final stages of consumption, while in underdeveloped countries, it is prevalent in the production and transport stages [3].

The Food and Agriculture Organization of the United Nations (FAO) estimates that almost one-third of the food produced for human consumption—approximately 1.3 billion tonnes per year—is wasted globally [1]. In 2020, the first year of the COVID-19 pandemic, around 131 kilograms (kg) of food waste per inhabitant were generated in the EU, with 53% of food waste generated by households, accounting for 70 kg per inhabitant [4]. The data collected by the European Commission show that around 7% of food waste comes from wholesale and retail, and 9% from restaurants and food services (e.g., school and corporate canteens, hospitals, etc.). Other sectors contributing to food waste in the EU are primary production (11%) and food processing and manufacturing (20%) [4]. The amount of food wasted is estimated to increase by 33% by the year 2030 and reach 2.1 billion tonnes [2].

Food waste has a huge environmental impact, representing millions of tonnes of CO₂ equivalents or greenhouse gas emissions from the food system. Besides environmental impact and waste of limited natural resources such as land and water, food waste has a nutritional, social, and economic impact on societies [5]. Waste food is paradoxical in times when, at the same time in Europe, 8.3% of the population was unable to afford a complete meal containing meat, fish, or a vegetarian equivalent every second day [6]. In 2022, 95.3 million people in the European Union were at risk of poverty or social exclusion, an equivalent to 21.6% of the population [7].

The resolution of this global problem has become increasingly political and social, and in 2015, the member states of the United Nations decided to include food waste in one sustainable development goal of “ensuring sustainable consumption and production patterns” (SDG 12). Target 12.3 is to halve per capita food waste at the retail and consumer level by 2030 and reduce food losses along the food production and supply chains, including post-harvest losses [8]. Thus, reducing food loss and waste is widely seen as an important way to lower production costs and increase the efficiency of the food system, improve food and nutrition security, and contribute to environmental sustainability [1].

Catering services are at the end of the food supply chain and focus on the public food service sector (meals being served for schools, hospitals, prisons, universities, etc.); the impact of lowering food waste can result in great economic and environmental benefits [9]. Public catering services are transversal to different age groups and are the places of choice and consumption for meals for many persons [10]. The relevance and challenges of the study of wasted food in the public food service were recently recognized by the United Nations [11].

The present work aims to discuss the differences in waste generated from surpluses or leftovers, the monitoring systems of food waste in public food services, and the good practices to reduce food waste.

2. Food Waste Definition

Food waste is defined as the use of food meant for consumption by humans for non-consumption purposes, the redirection of food to feed animals, or the disposal of edible food [12]. In catering services, three components of food waste can be observed, resulting from different stages of meal production. Initially, waste can occur in the storage and preparation stages and includes excessive amounts of purchased ingredients, spoiled food, inedible portions of food, and parts not usually consumed, such as peels and stalks of fruit and vegetables. In the second phase, food that is prepared but not served, resulting from inadequate planning of the quantities needed and commonly referred to as surpluses,

contributes to total food waste. Finally, quantities of food that are served but not consumed contribute significantly to waste [13]. There is no exact definition of the concept of food waste, and definitions can vary among the authors. The definition of food waste differs from the definition of what is considered wasted, how it is wasted, its origin, and the cultural impositions involved, as what is considered waste in some countries may be considered edible in others [14].

Three different notions have been identified for food waste: “avoidable”, “not avoidable”, and “partially avoidable”. Avoidable food waste is all food that is wasted while still fit for human consumption, such as a slice of bread, an apple, or surpluses from a meal. Partially avoidable food waste includes food that some people eat and others do not, i.e., waste produced by different consumption habits (e.g., bread crusts). Non-avoidable food waste corresponds to the portions of food that are not suitable for human consumption under normal circumstances (inedible parts), such as bones and eggshells [15]. Scholars also argue that these three broad classifications of food waste may differ in different cultural contexts [16].

The European Parliament defines food waste as all food products that are eliminated from the agri-food chain for economic or aesthetic reasons or due to the proximity of the consumption deadline but which are still in a perfectly edible state and fit for human consumption and which, in the absence of possible alternative use, are intended to be disposed of and thrown away. “Food loss” is usually considered as occurring along the food supply chain from harvest/slaughter/catch up to, but not including, the retail level, and “Food waste”, occurs at the retail and consumption levels [2].

Food waste results are usually presented as the percentage of food that was served but not consumed. However, there are other ways of presenting the results, for example, in terms of the energy value per meal or the protein content that was not eaten, and also by the monetary value of that waste [17,18].

Fish by-products have certainly been proven to be a rich source of nutrition, especially the inorganic portion, but the availability of nutrients, as well as the presence of other ingredients (e.g., starch, other proteins, phenolic compounds, lipid profile), is still a question mark. The addition of fish waste can increase or decrease the bioavailability of nutrients in the final product. Calcium from fish bones has received considerable attention as a way of making up for calcium deficiencies [19].

In public food services, food waste can occur during food storage or preparation, for example, losses related to the expiry date of the products and the lack of knowledge of the information contained in the labels, the aesthetic aspects of the product that are part of the criteria of choice, in which defective products and damaged by handling are rejected, and inadequate food storage conditions. However, an important percentage of waste comes from food produced and prepared to be served but was wasted by surpluses or from consumers (leftovers) (Figure 1).

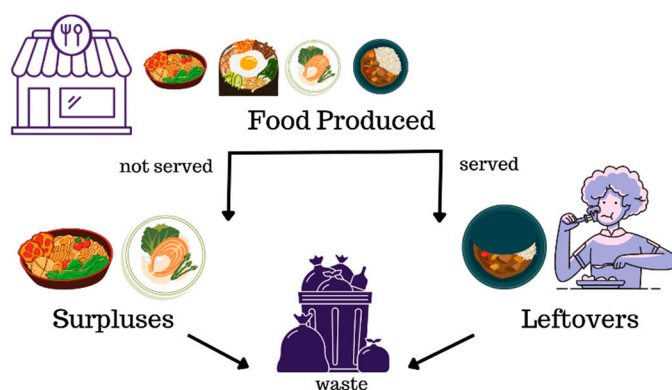


Figure 1. Food waste from food produced in food services, surpluses, and leftovers.

2.1. Surpluses

Surpluses are foods cooked in excess for certain quantities or portions. In general, these foods are eligible for hygienic conditions or free from bacteriological development. Surpluses, when not contaminated by pollutants or if kept in good, safe conditions, may be subsequently consumed up to a maximum of 48 h after their preparation, provided they are properly packaged at refrigeration temperatures. Surpluses can be classified as unused food waste, as they are characterized by ready-made food that has been left over and not distributed and/or consumed [20].

Surpluses are qualified as foods that have been cooked and kept under time and temperature control that guarantee their microbiological safety and nutritional and sensory quality without having been exposed in distribution, and thus allow their correct storage and subsequent use. They are directly related to planning, namely the number of meals to be produced, the number of people served, the determination of portions, the plating, and the acceptance of the menu [21].

The procedures to be adopted by public food services should provide guidance for the selection of products that can be donated. For example, products that remain in the kitchen can be donated since they comply with hygiene rules. Some Member States and trade organizations have established specific guidelines for the sector [22].

Public food services usually serve a defined client, more or less homogeneous, considering the age group and activity level, and also usually restricted, which allows better quantitative planning of meals. Meals are planned and produced by default, starting from an average intake for the population of each unit, and production is made according to the average consumption. Even if there is planning for the number of meals that are served in a given establishment, food waste in the form of surpluses is very common in mass catering units, mainly due to the difficulty in anticipating the demand.

The surpluses index can be expressed as:

$$\text{Surpluses index (\%)} = (\text{kg of food surpluses}) / (\text{kg of food produced}) \times 100$$

The rate of surpluses varies greatly among catering units. However, some authors stated that values higher than 7% or 25 g per person should not be admitted [21].

Since surpluses are food that is safe for human consumption, the facilitation of food donation is a priority area of work in Europe [22], and the preferred destination could be to make it available to people in need and aid institutions, as reported by some authors [23] as measures to increase the social and environmental sustainability of food services.

In 2018, the Commission adopted EU guidelines to help valorize, as animal feed, food no longer marketable for human consumption (e.g., unsold bread, broken biscuits).

The adoption of these EU guidelines aimed to promote sustainable food production systems, reduce food waste, and contribute to the circular economy by using food that is no longer suitable for human consumption as animal feed [22].

The guidelines highlighted that this usage as feed should comply with the applicable EU legislation, such as the feed hygiene and safety regulations, ensuring that no risk was carried to animal health or the environment. The food intended for animal feed should be safe in terms of its composition and possible contaminants and properly labeled [22].

For that, it is important to implement good agricultural practices and develop appropriate infrastructures to collect, transport, and store food waste for animal feed purposes. Cooperation between food business operators, feed manufacturers, and competent authorities should be encouraged to ensure the safety and efficient valorization of food waste. A risk assessment and appropriate control measures should be implemented throughout the food chain to avoid any potential hazards.

2.2. Leftovers

Leftovers are cooked and safely distributed foods that have not been fully consumed by the consumer. They are, therefore, bacteriologically contaminated by those who have

partially consumed them, and for that reason, leftovers should never be reused in human food, at the risk of spreading infectious diseases, namely hepatitis B [24].

The leftover index is represented by the ratio between the amount that was served and the leftover food returned to the consumer plate. It is directly related to the acceptance of menus, the sensory quality of the food prepared, and the satisfaction of the user in relation to the meal served. An investigation carried out in 2015 showed that, even when customers are satisfied with the meal service, the average food waste is considerable [25].

Considering the unacceptability of this value in the literature, there is a need to improve the planning of the quantities produced and plated and the adequacy of the menus in relation to consumer preferences. Considering that the food is well prepared, the rate of leftovers should be minimal. However, it is also the responsibility of the food service to record the values of the leftover index over time and to establish a limit for the unit according to the type of population inherent in its use and consequent adaptation and prior planning. It is assumed that a high rate of leftovers represents dissatisfaction with the meal or service and may mean poor planning [24].

The leftovers index can be calculated as:

$$\text{Leftovers index (\%)} = (\text{kg of leftovers}) / (\text{kg of food served}) \times 100$$

Waste values from leftovers could be from 7.5 to 16.8% in university canteens and can vary according to the type of meal, from vegetarian to meat dishes [23]. In the hospital context, the value of food waste from leftovers can rise to 72.6% [26]. The main reasons for leftovers are not meeting customer preferences, the food service not allowing customers to take leftovers home, and not being flexible in offering different portion sizes according to consumer needs.

3. Food Waste Monitoring Systems

Measurement of food waste is imperative to give evidence on which to build strategies for food waste prevention. In that way, in 2019, the EU Commission adopted a common methodology to measure food waste at each stage of the food supply chain [27]. Food and Agriculture Organization (FAO) in 2018 reported that 20 MT of fisheries by-products (head, skin, fins, bone, red meat, viscera, trimmings, and scale) are being generated. Numerous efforts have been developed to use these by-products in feed, food packaging, fish silage, fertilizer, and biofuels and to recover more for use as human food [18,28].

In food services, food waste can be measured by direct measurement (weighing or volumetric assessment), waste composition analysis, counting/scanning, and diaries [27]. Direct measurement includes the use of a measuring device (scale) to determine the mass of samples of food waste or fractions of total waste, directly or determined on the basis of volume, and collected food waste can be separated into components. The counting/scanning is the assessment of the number of items that make up food waste and the use of the result to determine the mass. The waste composition analysis is the physical separation of food waste from other fractions in order to determine the mass of the fractions sorted out. Finally, the diaries include the realization of a record or log of food waste information on a regular basis made by an individual or group of individuals [27].

The definition of an acceptable level of food waste in catering services does not meet the consensus between various authors and varies according to the characteristics of the food unit and the population that it serves. The value considered acceptable should be based on values determined in the food unit itself [29]; some authors argue that rates of less than 10% of food waste from leftovers are acceptable [30,31], and less than 5% is optimal [32].

The number of days that are used for food waste quantification can have an impact on the reliability of the results; for example, a short quantification time makes the results highly dependent on the dishes served during the evaluation period since different dishes can be expected to produce different levels and composition of waste generated, making the results inconclusive or difficult to interpret. The time of evaluation varies greatly between the studies, from 1 to 30 days, with the most common duration of evaluation 2 weeks [33].

Several authors recognized the importance of the implementation of accurate methods of continuous measurement of food and food-related waste and have identified the problematic areas and applied the reduction strategies [33,34]. For example, in public food services for schools, the method of the assessment of weighting the waste by aggregated components seems to be the method with the best performance [34], and visual estimation seems to be a less conclusive method.

In order to be more informative, most of the studies weigh leftover food waste according to their components, for example, soup, plate components (garnish, conduct, salads), bread, and desserts [23,26,34]. This measurement is important to evaluate the performance of food service and highlight points of the process that need improvement, for example, the intervention in menu design [23,35].

4. Good Practices

In September 2015, the United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development, and 17 Sustainable Development Goals (SDGs) were assumed as part of the Post-2015 Development Agenda—universal goals to end poverty, protect the planet, and ensure prosperity for all. The issue of food loss and waste reduction was placed on the global agenda. SDG 12 aims to “ensure sustainable patterns of consumption and production”.

Efforts to reduce food waste can be made at all stages of the food supply chain. This includes improving farming techniques to minimize losses during production, implementing better storage and transport methods, and creating effective distribution networks. Businesses can also play a crucial role by implementing stock management systems, donating food unsold to charities, and participating in food waste reduction initiatives [36]. There are several policies that can support and enforce the larger implementation of best practices to reduce food waste in food services, such as promoting awareness campaigns to educate staff about the impact of food waste and the best practices to reduce it, including information on proper storage, portion control, and meal planning; to implement inventory management systems; to donate surplus food using collaboration with food banks and charities; to standardized date labeling, establishing clear and consistent date labeling regulations to prevent unnecessary food waste. This can involve using phrases like “best before” instead of “use by” and implementing national guidelines to determine food safety based on scientific evidence.

The EU Platform on Food Losses and Food Waste (FLW) [37] proposes a set of recommendations that are common at various stages of the food value chain, involving multiple actors and are necessary to achieve global food loss and waste targets. In May 2019 [37], some rules to put food donation into practice were presented for the purpose of “Redistribution of surplus food: examples of practices in the Member States”.

Public Food Services should actively participate in the Prevention and Reduction of Food Waste and subsequently contribute to sustainable patterns of consumption and production with the implementation of some measures [37], namely:

- Train staff on the importance of reducing food waste and practical tips for minimizing waste in their respective roles;
- Ensure that the front-of-house can communicate with customers on certain aspects, namely the availability of dishes, portion sizes, etc.;
- Create customizable or modular menu options that allow customers to choose the desired portion type and size;
- Optimize portion sizes, ensuring they are adequate and manageable for customers, reducing the likelihood of leftover food on the plate;
- Adopt payment policies aligned with operations and business profiles (e.g., payment by weight of food, charging for wasted dishes in all-you-can-eat buffets);
- Allow customers to order smaller quantities or share a meal;
- Donate surplus food to local food banks or charities that are still safe for consumption;

- Analyze menu items and assess their popularity and profitability, removing unpopular or low-selling items that contribute to waste and promoting menu items that are popular and result in less waste.
- Continuously evaluate and improve efforts to reduce food waste; regularly reviewing data, listening to customer feedback, and adjusting practices as needed;
- Carry out awareness campaigns to inform customers that the catering company is committed to combating food waste.

Other best practices include:

- Make simpler inventory and reduce the number of available items;
- Adjust menus to avoid over-buying an item;
- Practice better food safety and storage protocols to avoid the need for waste;
- Regularly assess stock surpluses and adjust inventory management to reduce surpluses;
- Conduct waste audits to understand overrun outlines;

A recommendation of the European Citizens' Panel on Food Waste Final recommendations (2023) to limit food waste in food establishments has the purpose "to enjoy meals without wasting". All the quality criteria should be met.

The recommendations can also be applied to Public Food Services and include:

- Display a (harmonized across the EU) logo that announces the option to take leftovers home and to put additional text on their menus or wall' information stating "you can take your leftovers home";
- Provide packaging to allow customers to take their leftovers home upon request or offer "doggy bags" or "le Gourmet Bag" for plate leftovers, so consumers can take plate leftovers home for later consumption;
- Leftover prepared food should be offered to employees;
- Raw food left over from the kitchen should be offered to food banks/other charities;
- Food not edible should be used for other proposals, e.g., to produce renewable energy or animal feed if it complies with hygiene and safety rules;
- A composting system or collaboration with local organizations that specialize in food recovery should be improved.
- To organize a week of food waste awareness with the aid of "Stop food waste" or a "thematic week" on food waste to raise awareness on the topic among customers.

When food donation is practiced, it must comply with the General Food Law and EU rules on food hygiene. The Regulation (EC) No 853/2004 on the hygiene of foodstuffs is applied to all food establishments [38]. The organizations, in cooperation with the authorities, should develop procedures concerning the hygiene conditions for the transport and storage of products to be adopted for food services. There are specific temperature requirements for the different stages of the redistribution process (transport, storage, etc.) depending on the food category and food composition.

General hygiene requirements applicable to all food donation activities pretend to prevent contamination of foodstuffs to protect human health and also contribute to the reduction in food waste. EU food hygiene rules offer a large degree of flexibility to meet the specific needs of different types of establishments, and some Member States have also adopted national measures and/or guidelines [22]. A study carried out [39] in the Swedish public catering sector explored the potential gain of applying the Environmental Code as a benchmark to achieve. This study identified some voluntary practices used by the canteens with the best performance, such as reusing leftovers from the buffet, adjusting menus based on past consumption, advising customers to start with small tasting portions, setting waste reduction targets, and serving smaller volumes in buffet containers and refills them more often.

Composting bio-waste also helps reduce the environmental impact of waste disposal, reduces greenhouse gas emissions from decomposing organic materials in landfills, and provides a valuable resource in the form of nutrient-rich compost [40].

5. Conclusions and Future Directions

Knowledge about food waste is important to change attitudes and behaviors toward surplus food and leftovers and provides valuable insights for achieving SDG 12.3 in public food services. This sector can contribute to food waste prevention using the sustainable use of ingredients, sustainable cooking, and environmental protection, and also via consumer collaboration. Several policies that can support and enforce the larger implementation of best practices to reduce food waste should be developed. Best practices and the promotion of awareness campaigns to educate staff and inform customers about the impact of food waste reduction is a good measure that drives the active participation of all. The collaboration with food banks and charities and with other stakeholders plays a crucial role, leading to the ambitious reduction goals. The awareness about food waste and best practices is important and must be properly managed; otherwise, food waste can also occur at another step of the supply chain, for example, when donated food or leftovers taken home in a doggie bag are later wasted or when portions adapted using differently sized plates result in more waste in kitchens. When evaluating the effectiveness of food waste reduction involvements, such indirect effects should be considered.

In conclusion, to address food waste, a multi-faceted approach must be implemented with the involvement of all stakeholders, such as governments, businesses, and individuals. Food waste reduction implies efforts made at all stages of the food supply chain. This includes improving farming techniques to minimize losses during production, implementing better storage and transport methods, and creating effective distribution networks. Businesses can also play a crucial role by implementing stock management systems, donating food unsold to charities, and participating in food waste reduction initiatives.

At the consumer level, individuals can reduce food waste by planning meals, only buying what is needed, properly storing food, and using leftovers creatively. Moreover, raising awareness about food waste and promoting sustainable consumption practices can help change consumer behavior. Bio-waste composted in household composters or in community composters can also contribute to the reduction in food waste.

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References

1. FAO. *Food Wastage Footprint: IMPACTS on Natural Resources: Summary Report*; FAO: Rome, Italy, 2013.
2. FAO. *Global Food Losses and Food Waste—Extent, Causes and Prevention*; Food and Agricultural Organisation of the United Nations: Rome, Italy, 2011.
3. Gustavsson, J.; Cederberg, C.; Sonesson, U.; Van Otterdijk, R.; Meybeck, A. *Global Food Losses and Food Waste*; FAO: Rome, Italy, 2011.
4. Eurostat. *Food Waste and Food Waste Prevention—Estimates*; Eurostat: Luxembourg, 2022.
5. Seberini, A. Economic, social and environmental world impacts of food waste on society and Zero waste as a global approach to their elimination. *SHS Web Conf.* **2020**, *74*, 03010.

6. Eurostat. *How Many People Can Afford a Proper Meal in the EU*; Eurostat: Luxembourg, 2023.
7. Eurostat. *Living Conditions in Europe—Poverty and Social Exclusion*; Eurostat: Luxembourg, 2023.
8. Resolution, G.A. *Transforming Our World: The 2030 Agenda for Sustainable Development*; UN Doc. A/RES/70/1; United Nations: New York, NY, USA, 2015.
9. Eriksson, M.; Osowski, C.P.; Malefors, C.; Björkman, J.; Eriksson, E. Quantification of food waste in public catering services—A case study from a Swedish municipality. *Waste Manag.* **2017**, *61*, 415–422.
10. Puckett, R.P. *Foodservice Manual for Health Care Institutions*; John Wiley & Sons: Hoboken, NJ, USA, 2012; Volume 150.
11. Hamish, F.; Tom, Q.; Clementine, O. *Food Waste Index Report 2021*; United Nations Environment Programme: Nairobi, Kenya, 2021.
12. FAO, Save Food. *Global Initiative on Food Losses and Waste Reduction: Key Findings*; FAO: Rome, Italy, 2013.
13. Dhir, A.; Talwar, S.; Kaur, P.; Malibari, A. Food waste in hospitality and food services: A systematic literature review and framework development approach. *J. Clean. Prod.* **2020**, *270*, 122861.
14. Gjerris, M.; Gaiani, S. Household food waste in Nordic countries: Estimations and ethical implications. *Etikk I Praksis-Nord. J. Appl. Ethics* **2013**, *7*, 6–23. [[CrossRef](#)]
15. Quedsted, T.; Johnson, H. *Household Food and Drink Waste in the UK: A Report Containing Quantification of the Amount and Types of Household Food and Drink Waste in the UK*; WRAP (Waste and Resources Action Programme): Banbury, UK, 2009.
16. Liu, G. *Food Losses and Food Waste in China: A First Estimate*; OECD Publishing: Paris, France, 2014.
17. Li, J.; Li, W.; Wang, L.; Jin, B. Environmental and cost impacts of food waste in university canteen from a life cycle perspective. *Energies* **2021**, *14*, 5907.
18. Brennan, A.; Browne, S. Food Waste and Nutrition Quality in the Context of Public Health: A Scoping Review. *Int. J. Environ. Res. Public Health* **2021**, *18*, 5379. [[CrossRef](#)]
19. Nawaz, A.; Li, E.; Irshad, S.; Xiong, Z.; Xiong, H.; Shahbaz, M.H.; Siddique, F. Valorization of fisheries by-products: Challenges and technical concerns to food industry. *Trends Food Sci. Technol.* **2020**, *99*, 34–43.
20. De Moura, P.N.; Honaiser, A.; Bolognini, M.C.M. Avaliação do índice de Resto-ingesta e sobras em Unidade de Alimentação e Nutrição (UAN) do Colégio Agrícola de Guarapuava/PR. *Rev. Salus* **2009**, *3*, 71–77.
21. Vaz, C.S. *Restaurantes: Controlando Custos e Aumentando Lucros*; LGE: Brasília, Brazil, 2006; Volume 196.
22. European Commission. *EU Guidelines on Food Donation*; The European Commission: Brussels, Belgium, 2017.
23. Aires, C.; Saraiva, C.; Fontes, M.C.; Moreira, D.; Moura-Alves, M.; Gonçalves, C. Food Waste and Qualitative Evaluation of Menus in Public University Canteens—Challenges and Opportunities. *Foods* **2021**, *10*, 2325. [[CrossRef](#)]
24. Diekmann, L.; Germelmann, C.C. Leftover consumption as a means of food waste reduction in public space? Qualitative insights from online discussions. *Sustainability* **2021**, *13*, 13564.
25. Carvalho, J.G.; Lima, J.P.M.; da Rocha, A.M.C.N. Food waste and consumer satisfaction with the food service of Hotel and Tourism School of Coimbra, Portugal. *Demetra Food Nutr. Health* **2015**, *10*, 405–419.
26. Gomes, A.; Saraiva, C.; Esteves, A.; Gonçalves, C. Evaluation of hospital food waste—A case study in Portugal. *Sustainability* **2020**, *12*, 6157. [[CrossRef](#)]
27. European Union. *Commission Delegated Decision (EU) 2019/1597—Supplementing Directive 2008/98/EC of the European Parliament and of the Council as Regards a Common Methodology and Minimum Quality Requirements for the Uniform Measurement of Levels of Food Waste*; European Union: Brussels, Belgium, 2019.
28. FAO. *The State of World Fisheries and Aquaculture 2018—Meeting the Sustainable Development Goals*; FAO: Rome, Italy, 2018; pp. 1–8.
29. Busato, M.A.; Ferigollo, M.C. Desperdício de alimentos em unidades de alimentação e nutrição: Uma revisão integrativa da literatura. *Holos* **2018**, *1*, 91–102. [[CrossRef](#)]
30. Nutricionistas, C.F. *RESOLUÇÃO CFN Nº 600—Dispõe Sobre a Definição das Áreas de Atuação do Nutricionista e Suas Atribuições*; 25 de fevereiro; Conselho Federal de Nutricionistas: Brasília, Brazil, 2018.
31. NHS. *Managing food Waste in the NHS*; NHS: Edinburgh, Scotland, 2005.
32. Nonino-Borges, C.B.; Rabito, E.I.; Silva, K.D.; Ferraz, C.A.; Chiarello, P.G.; Santos, J.S.D.; Marchini, J.S. Desperdício de alimentos intra-hospitalar. *Rev. Nutr.* **2006**, *19*, 349–356. [[CrossRef](#)]
33. Cook, N.; Collins, J.; Goodwin, D.; Porter, J. A systematic review of food waste audit methods in hospital foodservices: Development of a consensus pathway food waste audit tool. *J. Hum. Nutr. Diet.* **2022**, *35*, 68–80. [[PubMed](#)]
34. Pedrosa, A.S.; Estrada, F.; Silva, M.; Ribeiro, V.; Lima, J.P. Desperdício alimentar em contexto escolar: Análise de metodologias de avaliação para uma avaliação contínua. *Acta Port. Nutr.* **2021**, *25*, 30–37.
35. Liu, H.; Gómez-Miñambres, J.; Qi, D. Menu-dependent food choices and food waste. *Resour. Conserv. Recycl.* **2022**, *176*, 105919.
36. Bajželj, B.; Quedsted, T.E.; Rööös, E.; Swannell, R.P.J. The role of reducing food waste for resilient food systems. *Ecosyst. Serv.* **2020**, *45*, 101140.
37. EU Platform on Food Losses and Food Waste. *EU Actions against Food Waste. Key Recommendations for Action*. 2019. Available online: <https://eplca.jrc.ec.europa.eu/FoodSystem.html> (accessed on 12 August 2023).
38. European Commission. Regulation (EC) No. 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs. *Off. J. Eur. Communities* **2004**, *34*, 319–337.

39. Eriksson, M.; Christensen, J.; Malefors, C. Making food waste illegal in Sweden—Potential gains from enforcing best practice in the public catering sector. *Sustain. Prod. Consum.* **2023**, *35*, 229–237. [[CrossRef](#)]
40. Pucherová, Z.; Jakab, I.; Báreková, A.; Králová, J. Streamlining the Municipal Waste Management System in the City of Nitra (Slovak Republic) Based on a Public Survey. *Sustainability* **2021**, *13*, 13992. [[CrossRef](#)]

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