

Means in reducing food waste of perishable food in the food chain

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Environmental conditions, distribution costs, transportation time and transportation distances must be optimised in the complex distribution system. Comprehensive measures including proper storage conditions with digital monitoring are essential in reducing food waste throughout the food chain (Fatorachian, 2025). The aim of the article is to present some means to reduce waste of perishable foodstuffs reported in earlier food waste articles (Närvä et al., 2023, 2024).

1 Appropriate methods and tools in food handling

Internal food safety indicators in the food companies are e.g. proper handwashing, healthy employees in the processing, and training in good manufacturing practices (Griffith, 2013). Both process environment and equipment must be hygienically designed. Microbes on surfaces especially in design errors form biofilms, which accelerate food spoilage (Wirtanen, 1995). Fellows (2017) states that the main reasons for preservation of food are: 1) reduce losses generated as a result of the highly perishable foodstuffs, 2) provide meat products, vegetables and fruits with added value, and 3) provide variations in the diet by making products available outside the growing season.

2 From raw materials to final products

2.1 Harvesting

The quality of perishable berries, fruits and vegetables is dependent on actions from harvesting through transportation to storage. The products must be harvested with clean tools and handled carefully (Kaur et al., 2023).

2.2 Transportation

The food supply chain consists of a series of processes in which food raw materials, e.g., vegetables, fruits, berries, milk and meat, are processed to semi-finished or ready-to-eat products (Haji et al., 2020). The food industry follows stringent hygiene standards within the production facilities. The internal standards must also be followed in the transportation chain, where there are numerous critical phases which can cause spoilage. Both humidity and temperature in received baches should be checked at arrival to ensure that the microbial quality is correct (Liivat, 2022; Food Standards Agency, 2024). The focus should be on both maintenance and cleaning.

2.3 Storage

Cross-contamination refers to unwanted transfer of harmful substances from one food to another. Cross-contaminants can lead to foodborne illnesses due to either allergens or microbes. Microbial contamination occur, when the temperature and humidity during storage are incorrect for storage (Liivat, 2022). Note that microbial contamination will also happen at fridge temperatures, when the storage time is too long or the temperature exceeds the level set for storage (Food Standards Agency, 2024).

2.4 Processing

Most preservation concepts maintain desired properties as long as possible (Fellows, 2017). Heat treatment is an essential and widely used control method in food safety. Cooking must be performed accurately to ensure that the recommended internal temperature is achieved. Furthermore, the raw materials should be cooled quickly after processing to avoid food waste. Sugar, salt, ice, and cold air are used in food preservation. Furthermore, smoking is used to preserve protein-rich foods e.g. meat, fish and cheese.

Cooling practices can improve the food quality, because hot food must be cooled quickly to prevent foodborne illness outbreaks (Fellows, 2017). The effects of cooling depth in foods, cooling time and cooling temperature should be monitored. Chilled semi-ready foods should be kept in the fridge as long as possible during the preparation of the final food products. By dividing food into smaller portions, the cooling occurs more quickly.

2.5 Packaging

Packaging is used to protect food from being contaminated after the final heat treatment (Fellows, 2017). The shelf-life of fish and meat products can be extended using modified atmosphere packaging (MAP). MAP has also improved the quality of packaged food containing pasta and vegetables (Mullan & McDowell, 2011). The flexible plastic films used in MAP applications must comply with EC/EU legislation on food contact materials (Regulation EC 1935/2004). Chip and label systems in intelligent packages can be used to detect both quality and safety directly (Du et al., 2025).

2.6 Cleaning, disinfection and drying

The cleaning in processing is built on three main steps (Wirtanen, 1995; Liivat, 2022): 1) removal of soil and microbes through cleaning, 2) disinfection and rinsing and 3) drying. In the cleaning step it must be ensured that the cleaning agent is in contact with the soil on the surface, removes soil from the surface and keeps soil from reattaching to the surface. In addition, disinfection is used to kill microbes remaining on the surface after cleaning. Furthermore, post-rinsing is essential, it should remove soil, cleaning agents and sanitizers.

3 Conclusions

Microbial contamination of perishable food can quickly occur at any time and place. To maintain the quality of harvested root crops, vegetables, fruits, berries and herbs they must be stored properly. Digital solutions can be used to ensure that temperature and humidity values are kept correctly. Despite that artificial intelligence can be used to monitor decided values automatically there must be personnel, which check that monitoring is performed correctly.

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