Perishable foodstuffs as waste in student households

6.2.2026

Common perishable foodstuffs in student households were leafy vegetables, vegetables, fruit, berries, juice, milk, meat and fish. A literature study and a study based on food waste dairies of participating households are the basis for this article (Närvä et al., 2023). These dairies contained both quantitative data and qualitative reflections. The analysis of household food waste data revealed that fruit and vegetables accounted for 36% of the total waste, followed by milk and dairy products (20%) and meat and fish (11%). The food waste was predominant caused by spoilage (29%), exceeding the “best before” or “use by” dates (21%), too much food cooked (14%), and uncertainty regarding edibility (13%).

1 Leafy vegetables and vegetables

Leafy greens are impacting on a healthy, balanced lifestyle. Green leafy vegetables have high nutritional benefits of vitamins, minerals, fibers, and antioxidants (Knez et al., 2024). The quality of leafy vegetable is dependent on both harvesting technologies, transportation, storage and post harvesting techniques. These products must be harvested with clean tools and handled carefully during harvesting, transportation and storage to improve their microbial safety. Microbial food safety is especially important for products which are consumed raw without sanitizing.

The spoilage of fresh vegetables impacts both the economy and the environment (Kirci et al., 2022). Economic analyses show that proper delivery and collaboration in the food chain can improve the cost structures. Furthermore, First In First Out (FIFO) tracking during storage and inventory in the supply chain can also reduce spoilage and economic loss.

2 Fruits, berries and products thereof

Non-destructive technologies for assessment of how fruits ripen must be developed. The goal of improved assessment is to meet consumer preferences and global demands, because quality fruits are important sources of nutrients, which contribute to health and well-being. Nowadays, the quality of berries and fruits is commonly assessed using organoleptic and nutritional properties (Li et al., 2024; Sady et al., 2024). Fruit and fruit juices processed and packed under hygienic conditions are tasty. When these products are consumed the health of the consumers will be enhanced (Sady et al., 2024). External factors influencing fruit quality are peel colour, possible defects, maturity, shape, size and firmness (Ribeiro & de Freitas, 2020). Internal factors influencing fruit quality are content of sugar, moisture, soluble solids, as well as acidity, taste, and nutrition values. Both external and internal factors affect the consumption of fresh fruits.

3 Milk, meat and fish products

The quality of perishable milk products can be deteriorated by spoilage microbes (Rodrigues et al., 2025) Crucial factors affecting both food safety and energy costs of dairy products are proper processing, packaging, distribution, and storage, which have to be monitored. The quality control is reducing both food waste and food loss in the complex dairy chain.

Meat spoilage due to microbial growth, enzymatic activity, and oxidation is causing both economic losses and environmental problems (Ghanayem et al., 2025). Meat products provides essential proteins, which are necessary for health. Luong et al. (2020) have based on 258 literature studied biological and physico-chemical effects on meat spoilage. Their study showed that the removal of dioxygen, the most common allotrope of oxygen, in packages delayed the spoilage. It also revealed that lactic acid bacteria prevented meat spoilage to some extent.

The Icelandic team (Lauzon et al., 2010) provided an overview of the findings on fish quality. The age of raw fish material is important in processing. Furthermore, post-packaging temperature of products is important for both fish freshness and deterioration. A non-destructive method developed by Heising (2014) can be used in intelligent packaging to communicate important quality attributes of fish. This work resulted in recommendations on how to monitor quality of packaged fish.

4 Conclusions

It is to be noted that microbial contamination of perishable food is common, and it can quickly occur at any time and place. To minimize food waste comprehensive measures are needed. Harvested root crops, vegetables, leafy vegetables, fruits, berries and herbs must be stored at proper temperature and humidity to maintain the quality. Digital solutions with or without artificial intelligence can be used to ensure that control-related operations e.g. temperature and humidity are correctly performed. You find some means how to reduce food waste in the food chain in this article are given in the online article “Means in reducing food waste of perishable foods in the food chain”.

5 Acknowledgement

The writing of this article has been supported by the research fund of Töysä Savings Bank.

Key words: perishable foodstuffs, food hygiene, microbial spoilage, student households

Gun Wirtanen
DSc (Tech), Senior Advisor in Food Safety
ORCID 0000-0002-5134-647X
SEAMK

Margit Närvä
DSc (Tech), Principal Lecturer
ORCID 0000-0002-4937-3938
SEAMK

Jarmo Alarinta
MSc (Tech), Head of Training in Food and Biotechnology
ORCID 0000-0002-0901-8472
SEAMK

Bibliography

Astuti, P. K., Ayoob, A., Strausz, P., Vakayil, B., Kumar, S. H. & Kusza, S. (2024). Climate change and dairy farming sustainability; a causal loop paradox and its mitigation scenario. *Heliyon, 10*(3), e25200. https://doi.org/10.1016/j.heliyon.2024.e25200

Ghanayem, H.R., Amal, F. E., Radwa, A. L. & Eman, K. F. (2025). Meat spoilage: A comprehensive review of causes, mechanisms and control strategies. *Animal Health Research Journal, 10*(1), 144-154. https://www.researchgate.net/publication/392519364

Heising, J. K. (2014). *Intelligent packaging for monitoring food quality: A case study on fresh fish.* [Dissertation thesis, Wageningen University]. doi: 10.18174/298571. https://research.wur.nl/en/publications/intelligent-packaging-for-monitoring-food-quality-a-case-study-on

Kirci, M., Isaksson, O. & Seifert, R. (2022). Managing perishability in the fruit and vegetable supply chains. *Sustainability ,14,* 5378. https://doi.org/10.3390/su14095378

Knez, M., Mattas, K., Gurinovic, M., Gkotzamani, A, & Koukounaras, A. (2024). Revealing the power of green leafy vegetables: Cultivating diversity for health, environmental benefits, and sustainability. *Global Food Security, 43,* 100816. https://doi.org/10.1016/j.gfs.2024.100816

Lauzon, H. L., Margeirsson, B., Sveinsdóttir, K., Gudjonsdottir, M., Karlsdottir, M. G. & Martinsdottir, E. (2010). *Overview on fish quality research. Impact of fish handling, processing, storage and logistics on fish*

quality deterioration. Report 39-10 (70 p). Matís. ISSN 1670-7192.

Li, Y., Li, Q., Yan, Y., Liu, W., Xu, C., Wang, Y., Nan, L., & Liu, X. (2024) Evaluation of soil nutrients and berry quality characteristics of Cabernet Gernischet (Vitis vinifera L.) vineyards in the eastern foothills of the Helan Mountains, China. Frontiers in Plant Science, 15, 1418197. https://doi.org/10.3389/fpls.2024.1418197

Luong, N.-D. M., Coroller, L., Zagorec, M., Membré, J.-M. & Guillou, S. (2020). Spoilage of chilled fresh meat products during storage: A quantitative analysis of literature data. *Microorganisms, 8,* 1198. https://doi.org/10.3390/microorganisms8081198

Närvä, M., Alarinta, J. & Wirtanen, G. (2023). Needs to change behaviour in households producing lots of food waste. *International Journal of Food Studies, 12*(1), 29-41. https://doi.org/10.7455/ijfs/12.1.2023.a2

Ribeiro, B. S., & de Freitas, S. T. (2020). Maturity stage at harvest and storage temperature to maintain postharvest quality of acerola fruit. *Scientia Horticulturae*, *260*, 108901. https://doi.org/10.1016/j.scienta.2019.108901

Rodrigues, R. D. S., Machado, S. G. & Nero, L. A. (2025). Spoilage microbial groups in dairy industry. *Advances in Food and Nutrition Research, 113,* 519-561. https://doi.org/10.1016/bs.afnr.2024.09.014

Sady, S., Ligaj, M., Pachołek, B., Błaszczyk, A., Płaczek, Z., Dłużniewska, N., Kawałek, P., Pakuła, K., Konopelski, A. & Gołaszewski, E. (2024). Designing the quality characteristics of berry processing byproducts using fermentation. *Applied Sciences, 14,* 3110. https://doi.org/ 10.3390/app14073110