

# Influence of Packaging Related Characteristics on Product loss - a Case Study in the Dairy Industry

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## Abstract

Food loss is a significant global challenge that has far-reaching environmental, economic, and social implications. In recent years, the role of packaging design in mitigating food loss has gained increasing attention. Packaging design plays a crucial role in protecting food during transportation, extending its shelf life, and reducing spoilage. However, packaging can also be a source of food loss if not designed and implemented effectively. One way to determine food loss by packaging design is the factor of emptiability. Emptiability refers to the ease and efficiency with which a product or packaging can be emptied or completely depleted of its contents. It is a concept that considers the practical aspects of using and accessing the full quantity of a product without leaving a significant amount of residual material behind. The emptiability of a product or packaging is crucial for several reasons. First, it ensures that consumers can fully utilize the product they have purchased, maximizing their investment, and avoiding unnecessary waste. Secondly, efficient emptying contributes to reducing food waste and minimizing the environmental impact associated with the disposal of unused or leftover products. Lastly, from a user experience standpoint, products or packaging with high emptyability provide convenience and satisfaction to consumers, as they can easily access and utilize the entirety of the contents. Several factors influence the emptyability of product packaging. The design of the container plays a significant role, including factors such as shape, size, and materials. A well-designed container will facilitate the complete removal of its contents, allowing consumers to easily pour, squeeze, or otherwise extract the product without leaving significant residue. Additionally, features like opening size, appropriate closures, and ergonomic designs can enhance emptiability by enabling efficient pouring or dispensing. The characteristics of the product itself also impact emptiability. For example, the viscosity or flow properties of liquids, creams, or pastes influence how easily they can be emptied from their containers. Thick or sticky substances may require specialized packaging or dispensing mechanisms to ensure complete emptying. In the framework on a comprehensive sustainability assessment of dairy product packaging in the DACH region (Germany, Austria, Switzerland) food loss was used as an indicator for indirect environmental effects of food packaging. A methodology for emptiability was developed and applied to various product categories in the segments drinking milk (n=66) and yoghurt products (n=57). The methodology

thereby imitates an eco-conscious consumer and is based on the intended handling of the packaging. The packaging systems include different sizes and shapes of beverage cartons, cans, pouches, jars, cups and bottles of various materials. For each type of packaging a specific method was developed, partially based on existing research by Meurer et al. (2017) and Wohner et al. (2019). The results show significant differences based on the packaging type and design, consumer handling, as well as fat content. Food residues in cups in the category fruit yoghurt vary between 0,99 % and 1,91 %, with one exception, where one cup retained 32,00 % of total product content due to design aspects of the cup pared with a small packaging size. Residues of fruit yoghurt in a pouch were determined with 5,24 %. For buttermilk the amount of residues is up to four times higher, if no instructions to shake the product before opening are given to the consumer. These examples show high differences in food waste based on packaging design and handling and can be seen as a call for action towards product and packaging producers.

**Keywords:** food waste, food loss, packaging, packaging design, emptiability

### References

- Meurer, I. R., Lange, C. C., Hungaro, H. M., Valenzuela Bell, M. J., de Carvalho dos Anjos, V., Antonio de Sá Silva, C., & Aparecida de Oliveira Pinto, M. (2017). Quantification of whole ultra high temperature UHT milk waste as a function of packages type and design. *Journal of Cleaner Production*, 153, 483-490. <https://doi.org/10.1016/j.jclepro.2016.10.172>
- Wohner, B., Schwarzingler, N., Gürlich, U., Heinrich, V., & Tacker, M. (2019). Technical emptiability of dairy product packaging and its environmental implications in Austria. *PeerJ*, 7(e7578), e7578. <https://doi.org/10.7717/peerj.7578>