

Life cycle assessment of selected edible parts of discarded food in Greek households

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Keywords: food waste, environmental evaluation, quantification, raw data

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Abstract

Keywords: Food waste, environmental impacts, measurement, consumption, national data

A significant proportion of municipal solid waste consists of organic matter, with food waste being a major contributor to this stream (FUSIONS, 2014). According to the most recent available statistics published by Eurostat (2023), the largest share of food waste in the European Union is generated by households. Furthermore, it is widely acknowledged that food waste generation at this stage results in substantial implications, as it entails/encompasses the cumulative/ aggregated loss of embodied resources and energy inputs that were used to produce, store and distribute the food (Caldeira et al., 2019). Although, in Greece, household food waste accounts for approximately 45% of food waste produced along the food supply chain, the impacts of this phenomenon have not been thoroughly investigated at the national level. Without diminishing the significance of socio-economic implications, the aim of the present study is to investigate the environmental impacts of food waste generated in Greek households. Hence, the aim of this study is to investigate the environmental impacts that occur from the daily discarding of edible food parts by Greek households.

For this purpose, a nationally representative sample of 1,147 households was surveyed in spring 2020. Information about food waste generation was gathered through online diaries. Household members responsible for food preparation and/ or purchasing were instructed to record the food waste levels produced in their households on a daily basis for a week and to provide the reasons for discarding food for each instance of food waste generation. Microsoft® Excel® (Version 2019 MSO) was utilized to convert the raw data into an editable format. For the purposes of the data analysis, food waste was classified based on its edibility status at the time of disposal, and only edible parts of wasted food were taken into consideration for this analysis. The environmental assessment was conducted with the life cycle analysis (LCA) methodology according to ISO 14040/44 standards, which in general involves the following steps: goal and scope definition, inventory analysis, impact assessment, and interpretation (Figure 1).

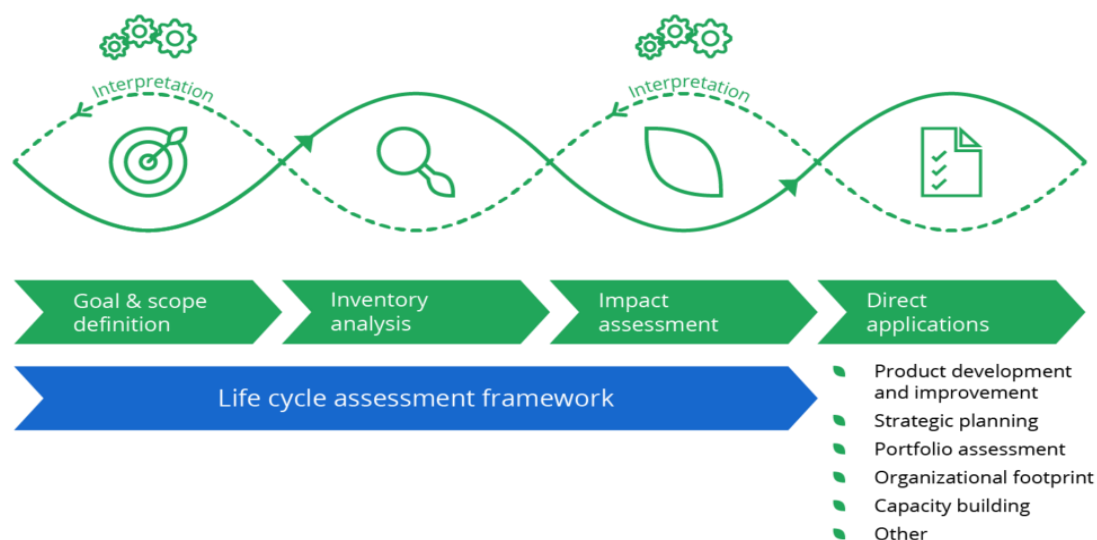


Figure 1: LCA methodology steps. (Life Cycle Assessment (LCA) explained (PRé Sustainability, 2023)).

Specifically, Simapro 9.5 was used as software. Also, coordinated libraries of data were used, such as the Argi-footprint 5, the Ecoinvent 3, the LCA Food DK, and the World Food LCA Database. Although the selected assessment is based on EF method 3.0, published for use during the EF transition phase, it includes the normalization and weighting factors published in November 2019 (Simapro 9.5, PRé Sustainability).

At this point, it should be mentioned that, for bakery products, meat, fish, and seafood, the cooking process was also considered. This method includes sixteen main categories of impacts concerning/ relative to/ related to/ associated with the soil (Land use, Mineral, fossil & ren resource depletion, Terrestrial eutrophication), the atmosphere (Climate change, Ozone depletion, Human toxicity, non-cancer effects, Human toxicity, cancer effects, Particulate matter, Ionizing radiation HH, Ionizing radiation E (interim), Photochemical ozone formation, Acidification) but also the water table (Freshwater eutrophication, Marine eutrophication, Freshwater ecotoxicity, Water resource depletion). Through this process, the discarded food categories that have the most significant environmental impact are identified.

It was found that an average of 280 kg of edible food parts were discarded each day for the total sample. As illustrated in Figure 2, the most wasted food groups were vegetables, fruits, bakery products, followed by meat, fish and seafood. Regardless of price inflations, vegetables, fruits and bakery products are those that have a comparatively lower cost per kilo than meat and fish. In this way, the purchase of surplus quantity does not significantly burden the financial planning of a household on a daily basis and it is easier to leave a quantity of these products without being consumed.

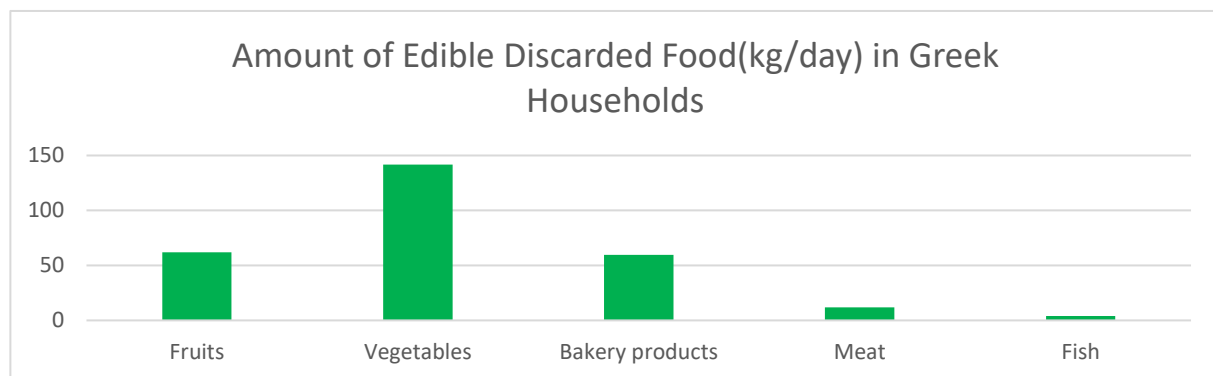


Figure 2: Bar chart representing the amounts of the most wasted foods that were edible during the study.

Furthermore, the most prevalent reason for discarding these food groups was that they were spoiled and, thus, no longer suitable for eating. From the results, bakery products seem to contribute more to this study and the most important impacts concern: marine Eutrophication; Water use; terrestrial Eutrophication; Acidification; Climate change; Particulate matter and freshwater Ecotoxicity. In terms of environmental impacts, bakery products seem to contribute the most, with the most important impacts being: marine eutrophication, water use, terrestrial eutrophication, acidification, climate change, particulate matter, and freshwater ecotoxicity. This is expected since this food group is among the most wasted in terms of quantity and entails additional environmental implications arising from cooking.

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Acknowledgments: This study is co-funded by the European Commission through the LIFE programme “Circular Economy Implementation in Greece” - LIFE-IP CEI-Greece (LIFE18 IPE/GR/000013) and the Green Fund.