



Causes, barriers, and prevention strategies for household food waste in Switzerland

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ABSTRACT

Despite increasing attention to household food waste, limited national-level research has examined consumer perceptions of its causes, barriers, and prevention strategies, which are essential for informing effective interventions. Therefore, this study aimed (1) to identify the main causes of food waste for different types of food and beverages, (2) to investigate barriers to waste reduction, and (3) to explore potential prevention strategies and who should take responsibility for taking action. We collected data on the amount of food waste using a diary-based web application, while barriers and prevention strategies were gathered through an online survey. We used a random stratified sample of 515 households in three linguistic regions of Switzerland.

The main causes of food waste were edible peel waste (34%) and spoilage (24%), with causes varying across food categories. The main barriers identified were the belief that composting food items does not classify them as food waste (19%), and the belief that food waste is not costly (13%). Of the 72 strategies for reducing food waste identified, most focused on mindful cooking, eating, and food shopping behaviour, and better food storage management.

The findings suggest that household food waste is largely driven by avoidable behaviours, particularly edible peel disposal, low perceived financial impact, and the misconception that composting sufficiently offsets waste. This highlights the need for consumer awareness and behaviour-change strategies promoting better food utilization. The recognition of shared responsibility among consumers, supermarkets, and the federal government further emphasizes the importance of coordinated interventions, retail reforms, and supportive public policies.

1. Introduction

Globally, 1,052 million tonnes of food are wasted annually [1]. Households contribute almost 60% (631 million tonnes) to the total food waste, followed by food services with 27.5% (290 million tonnes) and retail with 12.5% (131 million tonnes) [1]. Food waste is a global issue that adversely affects the economy, environment, and society [1]. In response, reducing food waste has become a key priority within international sustainability agendas, including the United Nations Sustainable Development Goal (SDG) 12.3, which aims to halve per capita global food waste by 2030.

In Switzerland, approximately one third of all food is lost throughout the entire value chain, with households contributing with 38% the most

[2]. Besides households, food is also wasted during food processing (27%), in the gastronomy sector (14%), agricultural production (13%), wholesale (4%), and supermarkets (4%). Hence, Switzerland launched the 'Swiss Action Plan against Food Waste, which aims to halve food waste across the entire value chain by 2030 compared to the year 2017. Effective reduction and prevention of food waste requires systematic measurement and monitoring of the amount of food waste and an understanding of the underlying causes, barriers, and potential strategies [3].

1.1. Household food waste measurement

Quantifying and tracking food waste requires consistent data

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collection of both the quantity and composition of food waste [4]. However, food waste data from households often suffers from challenges related to harmonisation and robustness, as comparable national-level data from different countries remain scarce [1]. More direct (weighing by scale) food measurement might help enhance the confidence of current food waste estimates [1]. A variety of methods have been used to quantify household food waste, including waste composition analysis (WCA), bin cameras, kitchen caddies, surveys, and diaries [5], [6], [7]. Among these, food diaries represent a direct method that enables participants to record both solid and liquid waste, along with the causes of disposal and the various disposal routes—features not simultaneously captured by other measurement approaches [7]. This method reduces recall bias compared to retrospective surveys and provides detailed contextual insights into household food management practices. Consequently, the food diary is considered an effective tool for capturing the diversity and dynamics of household food waste generation. Further, using a web-based application to record food waste could enhance data management efficiency for researchers, reduce errors associated with handwritten data by participants, and offer a more sustainable alternative to paper. However, food waste diary studies often lack nationwide samples [8], [9], [10], [11], which limits the generalisability of the findings.

In Switzerland, three diary studies have been conducted in recent years [7], [12], [13]. These studies used non-probability sampling, with sample sizes ranging from 84 to 223 households. However, none of these covered all three main linguistic regions of Switzerland (German, French, and Italian). Thus, to improve the robustness of food waste data on solid and liquid waste and to better capture the diversity and dynamics of household food waste generation, more nationwide and large-scale web-based diary studies are required. Using a national sample would further enhance the generalisability of the data.

1.2. Causes, barriers, and prevention strategies

Recent research has found that the causes of household food waste and the barriers to reducing it are complex and multifaceted. The behaviour of consumers in wasting food can be attributed to many influencing factors [14], [15]. Key influencing factors are social-demographic characteristics (e.g. age, geographic areas and cultures, and educational level), the individual perception towards food waste issues (e.g. values and beliefs, concerns, and awareness), and household food-related practices and lifestyle [3]. For example, panic buying, stockpiling, and large and non-resealable food packaging could act as underlying causes but also as barriers to reducing food waste [3].

To date, a few strategies have been identified that can help reduce food waste in households [16]. For example, a clear understanding of the difference between ‘best before’ and ‘use by’ dates can influence behaviours that help reduce food waste [17]. Other effective practices include planning meals before grocery shopping [18], using proper storage to extend food shelf life [19], [20], and consuming foods with minor cosmetic defects [21]. The most common household strategies for reducing food waste involve managing leftovers, controlling portion sizes, improving storage, and participating in educational campaigns [22].

Although households have been identified as key contributors to food waste generation, there is still limited understanding of the causes of household food waste, the barriers to reducing it, and potential strategies for reduction. A better understanding of households’ perceptions of the causes, barriers, and strategies for reducing food waste could inform the development and testing of new effective interventions.

1.3. Aim of the study

Our study had three main goals: to (1) identify the main causes of avoidable food waste for different types of food and beverages, to (2) investigate barriers to reducing food waste, and to (3) explore potential

prevention strategies and who should take responsibility for action. The study was therefore designed as an exploratory and predominantly descriptive investigation which enables among others the documentation of the wide range of prevention measures suggested by participants. The novelty of this study lies in the integrated assessment of quantified household food waste, its underlying causes, perceived barriers, prevention strategies, and stakeholder responsibilities within a single study framework. By combining diary-based food waste measurements with psychological and behavioural survey data from a nationwide stratified sample across the three linguistic regions of Switzerland, the study provides comprehensive insights linking behavioural factors to measured food waste quantities. In addition, a broad range of 72 prevention strategies was systematically identified and analysed. The findings are intended to inform policymakers, public institutions, and civil society organisations in developing targeted interventions that foster sustainable consumption and advance Switzerland’s progress towards SDG 12.3 and the goals of the ‘Swiss Action Plan against Food Waste’.

2. Methods

We quantified the average avoidable food and beverage waste in households through a nationwide, tri-lingual (German, French, Italian) Swiss diary study, which used a randomly stratified sample of 515 households (total drawn sample $n = 4,670$ from the Swiss Federal Statistical Office). Of the 4,670 randomly selected households, 137 were unreachable, leaving 4,533 eligible households. Among these, 794 individuals registered to participate (17%), while 3,670 did not respond. An additional 69 individuals actively declined participation, citing lack of interest ($n = 45$), feeling too old ($n = 8$), lack of time ($n = 8$), or not generating food waste at home ($n = 8$). Of the registered participants, 634 (80%) completed food waste quantification for their household, 546 (69%) completed the full 7-day assessment, and 515 (94%) also completed the final sociodemographic survey.

The sample is broadly reflective across various age groups, genders, linguistic regions, marital statuses, and household sizes (see [Appendix A](#)). An overview of the sampling procedure can be found in [Appendix B](#). Further detailed information on the sampling process, and the participant characteristics can be found elsewhere [23]. Survey data and study documents are freely available on Zenodo [24,25].

2.1. Study design

Registered participants were informed that the study was approved by the ETH Zurich Ethics Commission (EK-2024-N-249-A) and provided written informed consent online. The study was conducted in two phases, as illustrated in [Fig. 1](#). In the first phase, we quantified household food waste using a web-based diary and asked participants to report the causes of disposal. In the second phase, the participants were asked about the barriers to reducing food waste and potential strategies through an online survey. In each household, one randomly selected member was responsible for recording food waste and completing the final survey on behalf of the entire household. The study lasted 12 weeks, from October to December 2024. To motivate participation, we provided several incentives. If needed, participants received a digital kitchen scale free of charge, a CHF 20 shopping voucher upon full completion of the study, and a summary of the study results. Responses in French and Italian were first translated into German and then into English. Causes and barriers were collected from the full sample of 515 households, while strategies for reducing food waste were available for 244 households.

2.2. Food waste measurement and causes of food waste

2.2.1. Food waste measurement

Participants received detailed written instructions on how to weigh

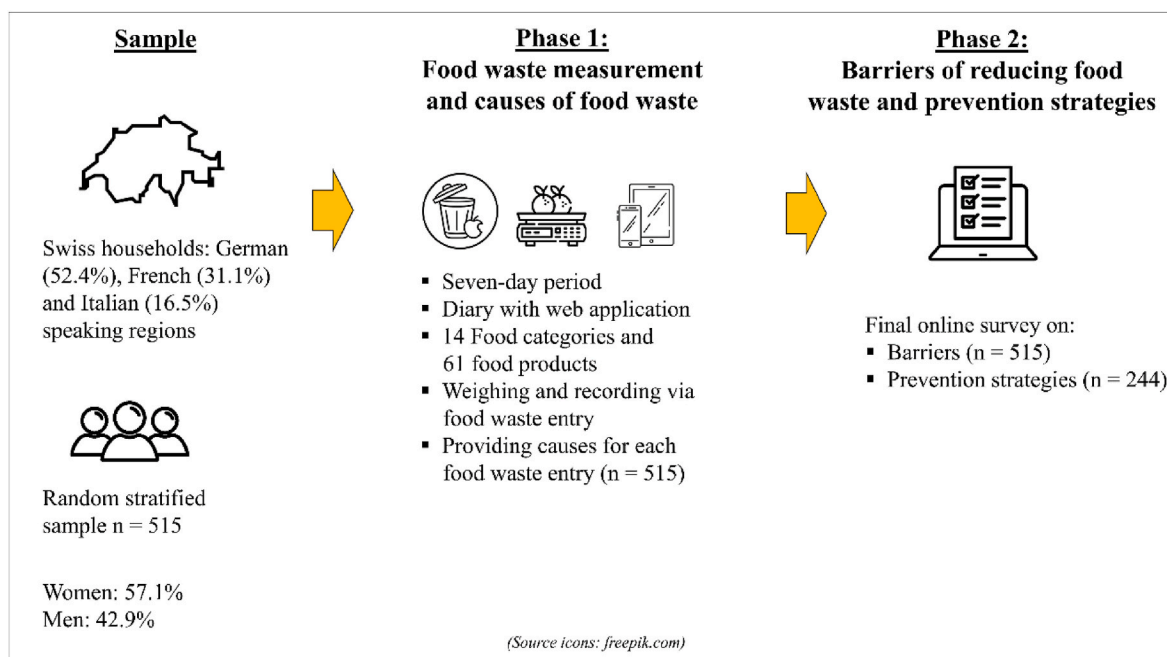


Fig. 1. Overview of the study design: Phases 1 and 2 included a total sample of 515 households for analysis of the overall and category-specific causes of food waste, as well as barriers to reducing it. A subsample of 244 households provided qualitative responses on possible food waste prevention strategies.

and record food waste throughout the study period. The instruction sheet is available on Zenodo [24]. To facilitate accurate measurements, digital kitchen scales were provided when needed. The study team also remained available to answer questions during the data collection period. To quantify the amount of food waste for a nationwide sample of Swiss households, we used a web application based on a food waste diary. This method has been applied and validated in a previous Swiss study that quantified household food waste [7]. The web application for recording food waste and the surveys for collecting data on personal and household characteristics were first pre-tested with 11 adult volunteers. The pre-test focused particularly on the clarity of the web application and the survey, as well as on ensuring reliable online data transmission. Further, to ensure data quality, we excluded food waste measurements collected over periods shorter than seven days and included only fully completed data records.

We asked the participants to quantify the amount of food and beverages discarded by their households, covering all household members. Food and beverages discarded outside the home (e.g. at work or in restaurants) were excluded from the study. As in previous studies, the participants recorded the discarded food items over a period of seven days [26], [27]. As our focus was on avoidable food waste,¹ the participants were instructed that ‘All food and beverages intended for human consumption and discarded must be weighed and recorded’. To support accurate reporting, they were provided with two lists that included illustrative photos—one of items considered edible (e.g. carrot or potato peel waste) and the other of items not suitable for human consumption (e.g. chicken bones, non-edible peels of fruits and vegetables such as avocado peel, banana peel, non-edible peel waste such as tomato stalk or pepper stalk and non-edible seeds, pits, and cores from fruits and vegetables). The detailed instruction letter is available on Zenodo [24].

Participants could freely choose a consecutive seven-day period between November and mid-December 2024 to record their food waste.

Food waste was quantified using a web-based diary method. The web application (available upon request) was tested and validated in a previous study [7]. The participants started by quantifying the amount of household food waste in grams each day using the provided digital kitchen scale. They then entered their records into the web application. For each entry, the participants first selected the corresponding food category (14 in total; see Appendix C) and food products (61 in total; see Appendix C) before entering the quantified weight in grams. If no suitable category or product was available, the participants could record the item under ‘Other’. The list of products and categories was adapted from previous studies [7,13,26]. All questions and reference photos for the 14 food categories included in the web application are available on Zenodo [24]. To calculate the quantity of food waste, we summed the total waste per household over the seven-day recording period. Per capita food waste was then calculated by dividing the total household food waste by the number of household members.

2.2.2. Causes of food waste

After selecting the corresponding food category and entering the weight in grams, the participants were asked to provide additional information about the cause of disposal in the web application. Specifically, we asked the question: ‘What was the main cause for disposing this food?’ and presented a dropdown list of 10 predefined causes (see Appendix D), adapted from Merian et al. [7]. The participants selected the causes that were most applicable to their situation. If none of the options applied, they could select the option ‘Other’ and enter a free-text response. Dropdown selection responses were analysed based on frequency. Free-text responses from the ‘Other’ category were coded and classified. Causes for disposal were then analysed and visualised using a heat map. We coloured the food waste causes based on their frequency (highest frequency [deep purple coloured], second highest frequency [purple coloured], third highest frequency [light purple coloured], mentioned in lower frequency [very light purple coloured], never mentioned [white]) (see Fig. 4).

2.3. Barriers to reducing food waste

After the participants quantified their household food waste and

¹ Definition of avoidable food waste according to the Food Use for Social Innovation by Optimising Waste Prevention Strategies (FUSIONS): ‘all food fit for human consumption not eaten by humans but discarded or composted; in any case, food not used for human consumption’.

indicated their disposal causes (Phase 1), they were asked to identify barriers to reducing food waste from a list in the final online survey (Phase 2). For this purpose, we provided 12 barriers from Quested et al. [28], as shown in Appendix E. The participants were asked, 'Which, if any, of the following prevents you from reducing, or reducing further, the amount of food that your household throws away? Please select all barriers that apply'. If none of the listed options applied, the participants could select 'Other' and provide a free-text response. The free-text responses were analysed and coded. Preselected responses were analysed based on their frequency.

2.4. Strategies for reducing food waste

After asking the participants about the barriers, we invited them to suggest possible strategies for reducing food waste. The open-ended question was: 'In general, what would help you—or, looking back, what would have helped you—to reduce food waste in your household? You can freely write down whatever comes to mind'. This question was optional. Of the 515 participating households, nearly 60% (306 households) responded to this question. Of these, around 20% (62 households) provided answers not related to food waste reduction strategies. Therefore, the final subsample consisted of 244 households that answered this question, distributed across German- (56%), French- (29%), and Italian-speaking (15%) regions. Free-text responses addressing specific food waste strategies from 244 households were analysed and categorised into 10 main groups of food waste causes. A bubble map was created to visualise these categories, with bubble size indicating response frequency. Where possible, the 10 groups were further categorised by the researchers based on the participants' views on who should implement the food waste reduction strategies. For each category, we also compiled an overview of the specific food waste reduction strategies mentioned.

3. Results

3.1. Food waste amounts

On average, the participants reported wasting 401.9 g (SD = 394.3) of food per capita per week. Considering the 14 food categories, more than half of the food waste amounts were made up of five food categories—that is, vegetables, fruits and other fresh foods (53.5%), starchy side dishes (8.5%), leftovers from dishes (8%), bread and bakery goods (8%), and milk, dairy products, and eggs (7%) (see Appendix F). In addition to solid food, beverages also made a notable contribution to the overall amount of food waste (5.5%). The other eight food categories contributed less to the total amount of food waste (meat, sauces, pesto, etc.; chocolate, confectionary, etc.; plant-based proteins; nuts, seeds, kernels; savoury snacks; fish and seafood; others [mixed waste, flour, scraps, yeast, baby food, sugar, and unspecified items]) (see Appendix F). Among the 61 food products, vegetables (31%), fruits (18%), and homemade dishes from leftovers (8%) accounted for the highest amount of waste.

Fig. 2 shows the six food categories that contributed the most to food waste, along with the food products within each category. Among the food categories, the highest amounts of food waste were recorded for the following food products: vegetables 57.5% (vegetables, fruits and other fresh foods), grains 42% (starchy side dishes), homemade meals 94% (leftovers from dishes), bread 82% (bread and baked goods), cheese 29.5% (milk, dairy products, and eggs), and non-alcoholic beverages 86% (beverages).

3.2. Causes of food waste

Overall, we identified 13 causes of household food waste (see Fig. 3). Causes without an asterisk reflect those proposed by Merian et al. [7], whereas four causes marked with an asterisk were additionally derived

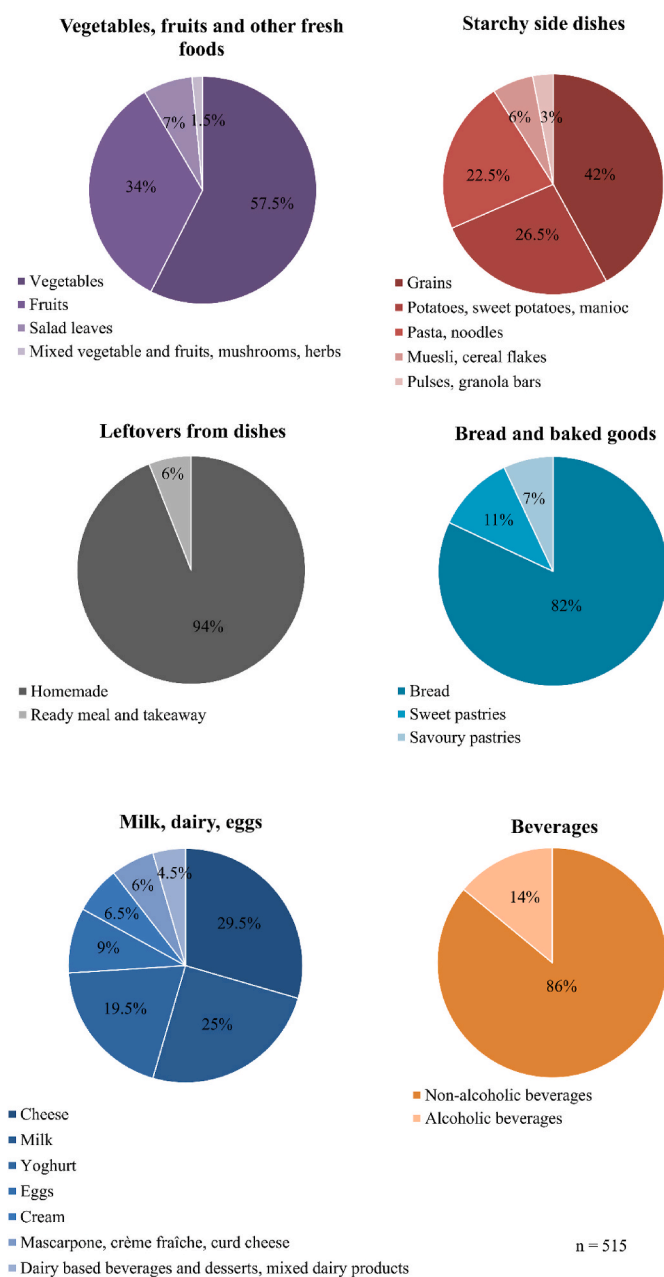


Fig. 2. Percentage of products wasted in the first six food categories from the nationwide Swiss diary study including 515 households. Leftovers from dishes consist of several food categories or food products, for example, lasagne or potato and vegetable gratin.

from the qualitative analysis of free-text responses categorised as 'other'. In total, 'other' causes accounted for 14.5%. These consisted of four subcategories: 'eating habits and quality loss', 'leftovers from children', 'no reuse of leftovers and ingredients', and 'used as pet food'. Examples within the category 'eating habits and quality loss' included hard bread (especially the ends), sparkling water that had lost its carbonation, cold coffee or tea, and overly soft mandarins. Causes included in the category 'leftovers from children' referred to situations in which children did not finish the food on their plates, parts of foods were not suitable for children, or children played with food or food fell on the floor. The category 'no reuse of leftovers and ingredients' included cases where leftovers were not reheated and consumed a second time or only the egg white was used while the yolk was discarded, or ingredients were used solely for flavouring. The participants selected the category 'used as pet

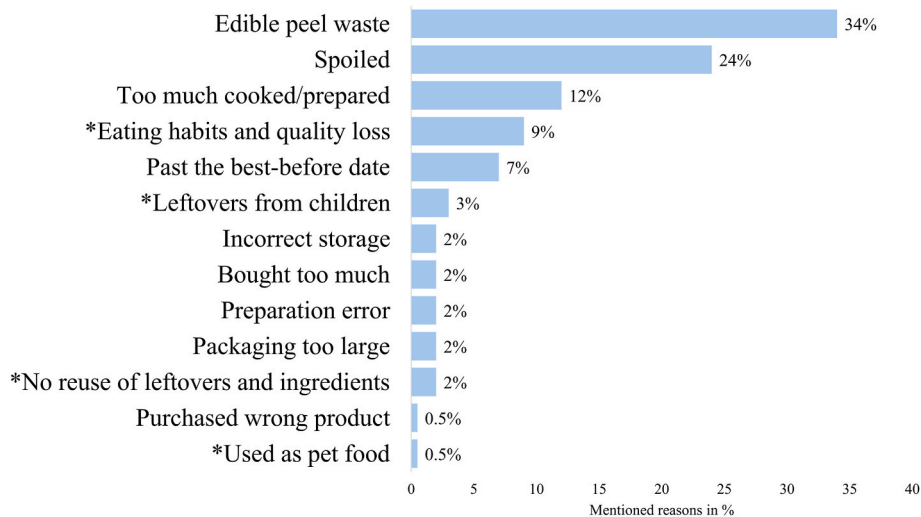


Fig. 3. Causes of food waste in households (n = 515), according to Merian et al. [7]. Causes marked with an asterisk (*) are newly added based on free-text answers from the ‘other’ category.

food’ to indicate feeding the discarded food (e.g. hard bread, fatty parts of meat, or leftovers from dishes) to their pets.

In line with the high amounts of food waste from vegetables and fruits (see Appendix F), the most frequently mentioned cause was edible peel waste (34%) (see Fig. 3). Spoilage (24%) and cooking or preparing too much (12%) were identified as the second and third most frequently mentioned causes of food waste. Further frequently mentioned food waste causes were due to eating habits and quality loss (9%) and the passed ‘best before’ date of the food (7%). All remaining causes (leftovers from children, incorrect storage, bought too much, preparation error, packaging too large, no reuse of leftovers and ingredients, purchased wrong product, and used as petfood) were recorded at lower frequencies (see Fig. 3).

Fig. 4 presents a heat map grouping the causes of food waste by food

category. It highlights that the causes of food waste vary depending on the food categories. For vegetables and fruits, the primary cause was the presence of edible peel waste. The second and third causes for vegetable and fruit waste were spoilage and preparation/cooking of too much food. Spoilage was particularly common for perishable foods such as milk, dairy products, and eggs; sauces, pesto, and similar items; chocolate, confectionery, and sweet bread and nuts, seeds, kernels, and savoury snacks. Foods that were often prepared or cooked in excess included starchy side dishes, leftovers from meals, and beverages. Interestingly, bread, bakery goods, meat, fish, and seafood were mostly wasted due to eating habits and quality loss. Plant-based proteins were predominantly discarded due to their passed ‘best before’ date, while one of the main causes of wasting savoury snacks was excessively large packaging.

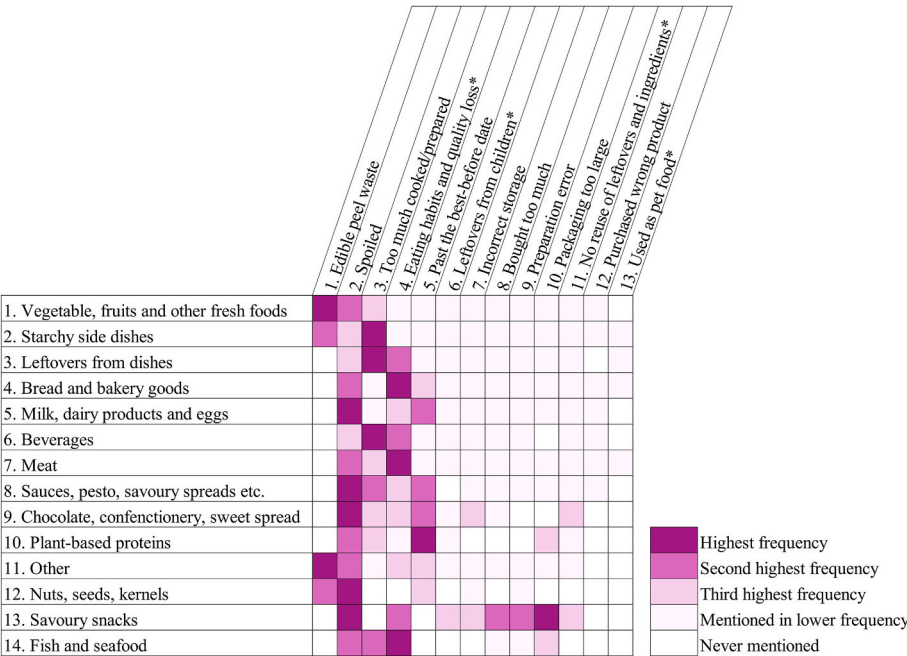


Fig. 4. Heat map with 13 food waste causes (on the top) across 14 food categories (on the left), coloured based on the most frequently cited causes in a sample of 515 households. Food categories are ranked according to the amount of food waste, from highest to lowest, while food waste causes are ranked by how frequently they were reported, from the highest to the lowest frequency. Causes indicated with an asterisk (*) represent additions to the food waste causes identified by Merian et al. [7], derived from qualitative responses in the ‘other’ category.

3.3. Barriers to reducing food waste

We identified 24 barriers to reducing household food waste among a sample of 515 households (see Fig. 5). Barriers without an asterisk reflect those proposed by Quested et al. [28], whereas 14 barriers marked with an asterisk were derived from the qualitative analysis of free-text responses categorised as ‘other’ in the present study. In total, ‘other’ barriers accounted for 13%. The majority of participants (79.5%) indicated that they perceived at least one of the listed answers as a barrier to reducing food waste. By contrast, approximately one fifth (20.5%) reported that they did not view any of the provided options as barriers.

Interestingly, a notable portion of participants (19%) answered that they did not need to reduce food waste because they composted most of the food waste at home. Similarly, for some participants (3%), disposing of food waste through local authority collection reduced their motivation to further reduce food waste. Other commonly reported barriers included the perception that food waste does not lead to significant financial costs (13%) and the need to purchase a wide variety of foods to provide a healthy diet for their families (8%). Further frequently mentioned barriers were challenges related to their children (7%), lack of time (6%), the belief that food waste was already minimal (5%), and reluctance to reduce the amount of fresh food purchased (4.5%). A smaller portion of participants (3%) indicated that they did not know how to reduce food waste. All other barriers were reported at a frequency below 3% (see Fig. 5).

3.4. Strategies for prevention

Based on free-text responses from 244 households regarding food waste prevention strategies, we identified 72 specific strategies to reduce household food waste. Appendix G provides an overview of the 72 specific food waste strategies, listed in descending order of frequency. We then grouped the strategies into 10 distinct categories (see Fig. 6), which are listed in descending order of frequency as follows: *mindful cooking and eating behaviour*, *mindful shopping behaviour*, *better food storage management*, *improving food waste management practices in retail*, *provision of knowledge, educational and informational measures with practical tips*, *better communication within household*, *provision of*

awareness building measures, *raising awareness within households*, *practicing sharing*, and *the provision of sharing opportunities*. Most food waste reduction strategies focused on consumer responsibilities, while a few addressed the roles of retailers or the government.

Within the category *improving food waste management practices in retail*, strategies such as smaller packaging and portions, no special offers with reduced prices and large packaging, and the unnecessary nature of ‘best before’ dates were the most frequently mentioned strategies. Some participants mentioned that ‘best before dates’ were unnecessary, noting that some foods did not have a clear ‘expiration date’, that the dates could be extended, or that there were simply too many dates on product packaging. Further, some participants mentioned the problem of pre-packaged and oversized packaging and the need for smaller packaging sizes: ‘When shopping at the supermarket, however, I sometimes have to buy pre-packaged items in quantities that can be too much for our two-person household’. or ‘More appropriate package sizes for singles are needed, as these are not available for all products’. Further, one participant mentioned a possible trade-off between smaller packaging sizes and food waste: ‘So for milk, we buy smaller cartons, but that just shifts the problem: while we waste less food, it creates much more packaging to dispose of’.

The category *mindful shopping behaviour* captures strategies to help consumers reduce food waste by changing their shopping habits. These strategies include buying less in advance, buying only what is needed with the help of a shopping list, and purchasing fresh foods more frequently. This includes, for example, ‘Make precise shopping lists before going to the store to avoid buying excessive quantities’ or ‘Only buy what’s on the shopping list. Spontaneous purchases tend to be left unused (and spoil) more often than items bought according to a planned menu’.

Freezing food, ingredients, and leftovers and having a better overview in the fridge, storage room, freezer, and cellar were the most frequently mentioned strategies within the category *better food storage management*. Overall, causes were mostly related to better storage conditions, enhancing a product’s shelf life, and using food with a shorter shelf life first and making them better visible to remember. Moreover, reducing overall food storage was mentioned as a relevant strategy to help reduce food waste. One participant shared a solution for keeping track of freezer contents: ‘We created a freezer inventory list to keep on hand, which helps us avoid forgetting what’s inside and ensures food is used within an appropriate time. These lists are shared on our phones between my

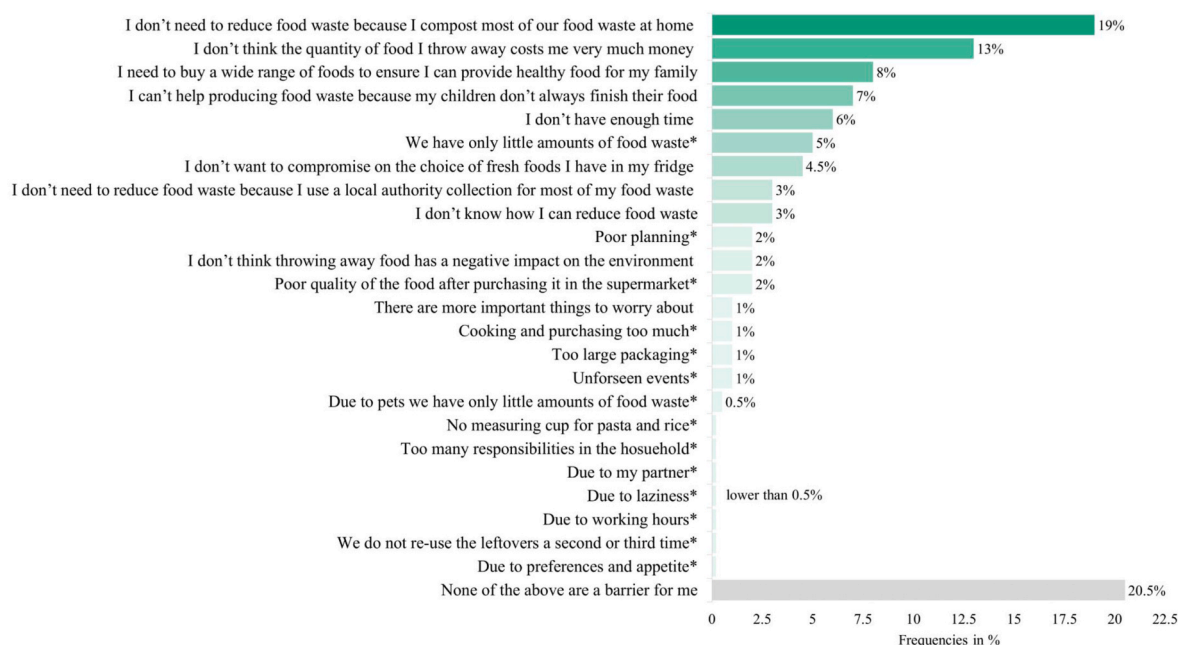


Fig. 5. Barriers to reducing food waste (n = 515). Barriers indicated with an asterisk (*) represent additions to the food waste barriers identified by Quested et al. [28], derived from free-text responses in the ‘other’ category.

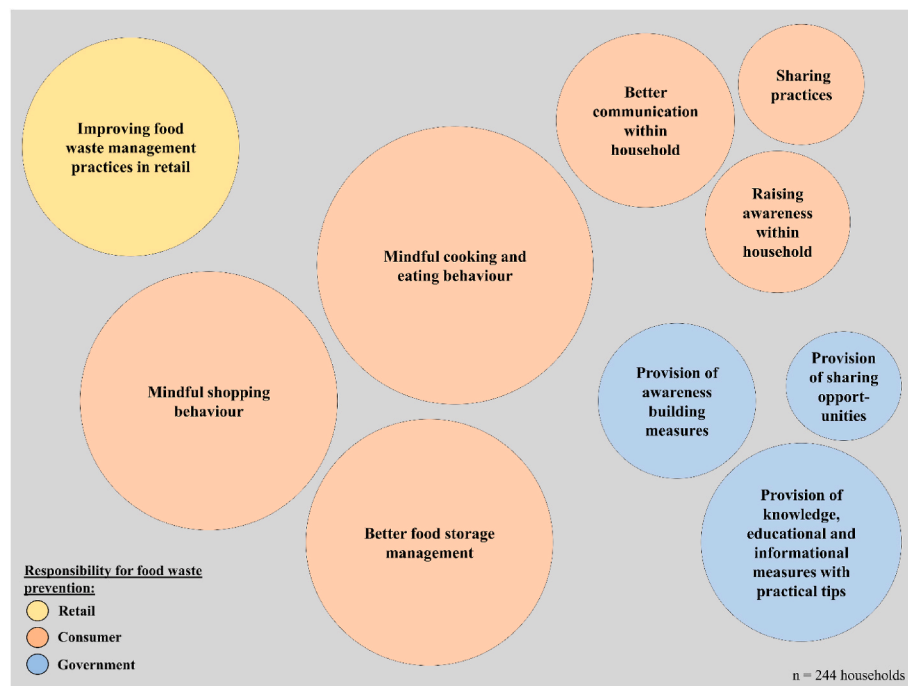


Fig. 6. Bubble map showing 10 identified categories with different food waste prevention strategies among a sample of 244 households. Bubble sizes indicate the cited frequency of prevention strategies, with larger bubbles representing higher frequency and smaller bubbles representing lower frequency. The 10 groups are further categorised based on participants' views of actors responsible for implementing the food waste reduction strategies. The different colours represent the varying levels of responsibility for implementing the food waste reduction strategies.

partner and me, since we both cook. Before adopting this system, we had a lot of waste, especially from the freezer'. Another participant mentioned the reduction of the food stock: 'In general – less is more. One shouldn't be afraid if something runs out. For example, when cooking, it's not very useful to choose from five different types of salt. Yet, we have five types of salt. It's good that salt doesn't spoil, but other things do'.

Within the category *mindful cooking and eating behaviour*, strategies such as planning meals for one week and cooking less and planning portions better were mentioned most frequently. A participant provided insights into how they were able to reduce their household food waste: 'We generate hardly any food waste because we follow a meal plan based on what needs to be used up, what is on offer, what should be consumed from the freezer, and what leftovers are in the fridge. If we have too much food in the fridge, we use the approach of 'mixing whatever is in the fridge' as a solution to reduce food waste'.

In the category *better communication within the household*, most participants suggested strategies related to confirming attendance for meals. One participant noted the need to request more commitment once a guest confirmed their presence at a meal: 'To stay in regular contact with my children about who will be eating with or without guests, and to require more commitment'. Another relevant strategy focused on anticipating portion sizes by asking about hunger levels before each meal: 'Take the time to ask my children about their appetite and discuss the meal before preparing it in order to avoid leftovers'.

A few strategies focused on *sharing practices*, such as distributing food, offering it for free, or sharing it with flatmates. One participant described the problem of the unused potential of sharing: 'Most of the food that gets thrown away comes from my roommates. Unfortunately, I would gladly eat it if they offered it to me, but everyone is very individualistic and prefers to throw away rotten potatoes rather than share them. It's a shame, because sometimes they throw away mouldy bread that I would have happily eaten before it went bad. But by the time they throw it away, it's already too late. People are too individualistic, as they don't care about wasting food—it doesn't pose any ethical problem for them—whereas it pains me to see food go to waste. When I notice that I have food that will expire

before I can eat it all, I like to distribute it on the streets, since there are always people asking for food'. Moreover, one participant mentioned the need for the provision of sharing opportunities, such as public fridges or shops offering over-purchased food.

More appreciation of food and tracking food waste amounts were the most frequently mentioned strategies to reduce food waste within the category *raising awareness of food waste within households*, such as, for example, 'Keeping track of all food waste to become more aware of it' or 'Growing your own food (fruits and vegetables) and buying meat from a trusted local farmer helps to appreciate and value the food'. As further mentioned, ideally, all household members should be involved in raising awareness about food waste. In addition to tracking food waste, another participant suggested waste visualisation as a solution: 'Having a compost and adding freshly spoiled food to it each evening helps keep the amount of waste in check and serves as a reminder when doing the shopping'. Besides raising awareness within the households, the *provision of awareness building measures* outside households was also mentioned. Most frequently mentioned was awareness building among school-aged children: 'Talking about how to handle food properly at a young age in school, including what to pay attention to when purchasing food'.

Within the category *provision of knowledge, educational, and informational measures with practical tips*, ideas about menus that could be prepared with leftovers and edible peel waste and a better understanding of which foods can still be consumed after the 'best before' or expiration date were most frequently mentioned. Overall, the participants noted that a deeper knowledge of storage practices, which parts of food are edible, and how long food or leftovers remain safe to eat would help reduce food waste. Some participants indicated that 'In some cases, it would be useful to have a reliable way to assess whether leftovers are still safe to eat. It is likely that leftovers are thrown away simply because of doubt and a preference not to take any risks'. Others said, 'Regarding food expiration dates, the general public should be better and more realistically informed about how to interpret these labels. In our circle of friends, products are often thrown away precisely on the stated expiration date'.

4. Discussion

This study aimed to (1) identify overall and category-specific causes of food waste, to (2) investigate barriers to waste reduction, and to (3) explore potential prevention strategies. For this, we quantified the average avoidable food and beverage waste from a randomly stratified sample of 515 households in three linguistic regions of Switzerland. Data on the amount of food waste and its causes were collected using a diary-based web application, and barriers and strategies were gathered through an online survey.

4.1. Causes of food waste

We identified 13 causes of food waste among 515 Swiss households, with the most common being edible peel waste, spoilage, preparing or cooking too much, eating habits and quality loss, and products past the 'best before' date. Our results show that food-waste causes differ by food category. For fruits and vegetables, the main causes were edible peel waste, spoilage, and cooking or preparing too much. Prior studies link frequent grocery trips and takeaway purchases to higher fruit-and-vegetable waste, while using shopping lists reduces it [15]. Recommended waste reduction strategies include better storage guidance, improving consumers' ability to valorise produce (e.g. jams, sauces, dehydrated items), and enhancing packaging to extend freshness [14]. Our findings align with these suggestions: improved storage, creative use of edible peel waste, and more effective shopping and meal planning could all help reduce waste.

Our results showed that spoilage was common in several categories—especially milk, dairy products, and eggs—which generated some of the highest waste amounts. Prior research recommends 'use-it-up' refrigerator areas for older or opened items and improved packaging to extend freshness [14]. Our findings further suggest that better storage, improved in-home practices, and more mindful shopping and cooking could help reduce dairy waste. Foods often prepared or cooked in excess included starchy sides, leftovers, and beverages, with leftovers generating the third-highest waste amount. A study of 230 Norwegian families found that leftovers made up 48% of all food waste—the largest share—and showed that a multicomponent intervention (e.g. leftover kitchen, guidance, tips, and family engagement) reduced leftover waste in both the short and long term [29].

In our study, bread, bakery goods, meat, fish, and seafood were mainly wasted due to eating habits and quality loss. Cross-country research similarly shows that waste patterns reflect eating habits, with greater waste linked to convenience-oriented diets [30]. Iori et al. [30] also found that skills, time, and food management—especially handling leftovers—matter more than attitudes. Nutrition-conscious consumers also waste less, partly due to better planning, while sustainability awareness alone has a limited impact [31]. These findings highlight the value of interventions that combine sustainability with healthy eating habits. To reduce bread waste, recommended strategies include visual cues to prompt freezing and clearer storage instructions [14]. For meat and seafood, helpful measures include clear storage guidance, portion-controlled packs, and recipes for repurposing leftovers [14].

Furthermore, our results demonstrated that food waste was primarily driven by eating habits and a loss of quality. A recent study found that stronger sensory preferences were linked to higher household food waste, with effects varying by demographic and moderated by storage practices [32]. Thus, food waste driven by preference and quality loss represents a major opportunity for reduction. Further, a shift in perception is also needed to accept imperfect food. Evidence suggests that consumers tend to accept colour flaws but are less tolerant of shape or physical defects [33]. To increase the acceptance of imperfect foods, researchers recommend tailored message framing rather than relying solely on environmental arguments [33], [34].

4.2. Barriers for the reduction of food waste

We identified 24 barriers to reducing food waste among a sample of 515 households. As highlighted by our findings, the barriers to reducing food waste are very broad and thus complex. Some participants reported no barriers to reducing food waste—an attitude also seen in a study from the United States, suggesting optimism bias [35]. However, national and global data show rising household food waste, indicating that current efforts are insufficient [1]. This gap may stem from the avoidance of negative feelings about waste, low awareness of one's own discarding, the gradual and invisible nature of waste, and social desirability bias. Many participants also believed that their food waste was already minimal and that no further reduction was unnecessary. To counter optimism bias and low self-awareness, future interventions should make food waste visible, offer personalised feedback, avoid moralising, improve planning and storage, use positive social norms, adjust environments to support low-waste actions, and highlight financial benefits.

Another notable finding was that many participants felt no need to reduce food waste because they composted food waste or used local collection services. However, composting does not reduce food waste; it may simply lessen guilt by making disposal feel less harmful. This reflects moral licensing, where a 'good' action (e.g. composting) justifies less desirable behaviour [36]. Also according to the waste hierarchy [37], [38], prevention and the preparation for reuse represent the most favourable options for reducing food waste. In contrast, recycling (e.g., composting and conversion to animal feed), recovery (e.g., anaerobic digestion), and disposal (e.g., landfill) are considered less favourable. Furthermore, composting is classified as a waste management strategy rather than a waste reduction measure. However, beyond prevention, it appears highly relevant to show consumers how to manage food waste that has already occurred in households, in order to avoid the least favourable option—landfilling—and to promote more environmentally sustainable alternatives such as the reuse, recycling, and recovery of food waste, including proper waste separation practices, as well as biogas or fertilizer production. Additionally, national awareness campaigns could help clarify the definition of food waste and improve public understanding.

Many participants also believed that they were not losing much money through food waste. However, based on estimates, Swiss households lose a considerable amount—approximately CHF 620 per household and year—due to household food waste [39]. Evidence suggests that highlighting these financial losses can motivate reduction: the 'Reduce Food Waste, Save Money' intervention, which provided cost information and practical tips, cut waste by up to 31% [20]. Other interventions using financial framing or incentives show similar benefits [40], [41]. Campaigns emphasising the monetary cost of food waste may therefore be an effective way to boost awareness and motivation.

4.3. Strategies for prevention

Based on free-text responses from 244 households regarding food waste prevention strategies, we identified 72 specific strategies to reduce household food waste. We grouped these strategies into 10 distinct categories, which are listed here in descending order of frequency: mindful cooking and eating behaviour, mindful shopping behaviour, better food storage management, improving food waste management practices in retail, provision of knowledge, educational and informational measures with practical tips, better communication within households, provision of awareness building measures, raising awareness within households, practicing sharing and the provision of sharing opportunities.

4.3.1. Strategies targeting consumer behaviour and household practices

Most strategies mentioned by the participants targeted consumer behaviours, indicating that consumers are aware that they could change their actions to reduce food waste. These strategies aligned with the

identified causes, which were primarily related to household practices and lifestyle, including planning, preparation, and cooking (e.g. edible peel waste, overcooking, preparation errors), and storage management (e.g. spoilage, past the 'best before' date, improper storage). According to Li et al. [42], unpredictable lifestyles and forgotten or spoiled food are high-difficulty actionable household food waste causes and are generally more challenging and costly to address. Nevertheless, several approaches may help mitigate their impact. For example, community food-sharing initiatives and smart refrigeration technologies that remind consumers about food expiry dates can help reduce waste arising from changing schedules and forgotten items [43]. Looking ahead, technological innovations and improved digital solutions may further enhance the ability of households to prevent food waste associated with these high-difficulty causes [42].

Mindful cooking and eating, careful shopping, and improved food storage were the most frequently mentioned strategies. According to Li et al. [42], medium-difficulty actionable household food waste causes, such as excessive shopping, require more substantial interventions to address. At the retail level, retailers can encourage consumers to purchase smaller quantities, particularly when trying unfamiliar products, and promote responsible purchasing during sales campaigns [42]. Providing guidance on food storage can also help reduce waste after purchase. At the household level, interventions should focus on improving consumers' knowledge and skills related to meal planning, food preparation, and storage. For example, mobile applications can support more effective shopping planning and cooking practices [44], as well as facilitate the management and use of leftovers [45]. Similarly, Chia et al. [3], highlighted meal planning, creating grocery lists, and checking food inventories before shopping as effective measures. Furthermore, a recent food waste diary study in Switzerland confirmed that effective solutions for reducing food waste include raising awareness, improving knowledge about proper food storage, and implementing stricter food waste policies for retailers (Ammann et al. submitted).

Further, based on our results, a clear distinction between food categories may be useful to adapt storage practices accordingly. For example, psychrotrophic bacteria can grow in refrigerated milk, raw meat, poultry, and fish, leading to spoilage even at low temperatures [46], [47]. In contrast, moulds commonly affect products such as bread, as well as fresh fruits like berries, apples, and citrus, particularly under humid storage conditions [47], [48]. This distinction helps justify storage temperature recommendations (for example, storing bread at room temperature rather than in the refrigerator, where it may stale more quickly despite somewhat slower mould growth).

Recent reviews further show that nudges and awareness-raising strategies are particularly effective for reducing household food waste, with multicomponent interventions combining nudges, knowledge enhancement, and awareness campaigns yielding the greatest impact [49]. For example, tailored multi-component interventions combining individual coaching with prompts via text, email, or calls have demonstrated reductions in household food waste of up to 79% [50]. Enhancing awareness was emphasised by the participants in our study, with responsibility shared between consumers and the government. One approach highlighted by the participants was self-reporting food waste, which increased their awareness of the issue. This aligns with previous research showing that food-waste diaries and self-reporting practices effectively raise consumer awareness and reduce waste [29], [51], [52]. As multicomponent interventions remain underrepresented, further testing of these approaches is needed. Integrating nudges, knowledge enhancement, and awareness-raising components—such as self-reporting food waste—may be particularly promising for changing consumers' cooking, eating, shopping, and storage behaviours.

4.3.2. Strategies targeting the provision of knowledge and education

Another commonly proposed strategy focused on government support was the provision of knowledge, education, and practical guidance. The participants suggested providing ideas for using leftovers and edible peel waste, clarifying which foods remain safe after 'best before' dates, and offering storage advice. This need for more guidance may also reflect a lack of knowledge regarding proper food waste management at home and the reuse of food, for example through fermentation, pickling, freezes-drying, or other biological household preservation methods. Ammann et al. (submitted) highlighted that consumer's lack an understanding of what food waste actually means, particularly regarding distinguishing between avoidable, unavoidable, and potentially avoidable food waste. A recently published Swiss guide [53] already addresses many of these needs, offering multilingual (German, French, Italian, English) tips on planning, shopping, storage, expiry dates, and using leftovers and edible peel waste. Such resources are valuable tools for reducing household waste. Beyond offering tips, government action across policy, education, regulation, and infrastructure is critical to helping consumers adopt more sustainable food practices.

Further, participants often noted that some foods may not need a 'best before' date and requested clearer guidance on interpreting date labels, highlighting their role in reducing food waste. Additionally, misunderstanding labels can lead to unnecessary disposal, with studies showing that consumers reject still-edible, date-expired food [54], [55], [56]. Revising or rephrasing 'best before' labels—for example, 'best before, often good after'—and encouraging consumers to assess freshness could significantly cut waste, potentially by around 50,000 tonnes per year [57], [58].

4.3.3. Strategies targeting retail and policy interventions

Another strategy focused on the retail sector, particularly improving food waste management practices. The participants suggested strategies such as smaller packaging and portions, avoiding special offers on large packages, and reconsidering the need for 'best before' dates on certain products. Research confirms that shoppers exposed to multiunit promotions purchase larger quantities than those offered single-unit discounts, with many of the additional items remaining uneaten, thereby increasing household food waste [59]. Consequently, researchers have proposed policies to limit multiunit offers for highly perishable items, such as vegetables, bread, and dairy. Voluntary industry initiatives could further encourage regulatory measures to reduce household food waste [60]. Further, previous studies have shown that large packages are a major cause of food waste [61], [62], particularly for bread, dairy, and meat products [63]. Accordingly, a relevant packaging-related strategy include optimising package size and providing detailed information about product safety and storage [63]. Beyond this, edible coatings made from chitosan or alginate may represent promising additional approaches to extend product shelf life without contributing to plastic and packaging waste [64].

According to Li et al. [42], low-difficulty actionable food waste causes are for example oversized package sizes and the misinterpretation of food date labels. These causes offer significant opportunities for waste reduction, as they can be addressed relatively easily and at low cost. Consequently, policymakers may prioritize interventions targeting these waste streams, for example by encouraging manufacturers and retailers to offer smaller package sizes and by improving consumer education on the interpretation of food date labels. Further, Aschemann-Witzel et al. [65] highlighted that collaborative efforts between retailers and consumers are more effective than blaming one or the other. Retail-based interventions have shown spillover effects, leading to reduced household food waste [66]. Thus, in addition to policies, partnerships between consumers, retailers, and the government are a promising approach to decreasing household food waste [67],

[68].

4.4. Implications

The findings of this study offer several important implications for policy, practice, and future research aimed at reducing household food waste in Switzerland.

Targeting key causes and household practices: Our results show that household food waste is largely driven by preventable factors, including edible peel waste, spoilage, over-preparation, poor storage, and eating habits. Interventions should therefore prioritize improving in-home practices such as meal planning (make a plan for the week, plan left-over days etc.), portion control (using your own hand as a guide can be a practical way to estimate portions, using a smaller plate size etc.), proper storage (storing food in the right zone of the fridge, placing foods with a shorter shelf life in visible areas etc.), and leftover management (planning left-over meals such as vegetable tart, using a see-through storage container etc.) and creative use of edible peel waste (soup, confiture etc.) [53], [69]. Tailored interventions [70], [71] for specific food categories, such as dairy, bread, fruits, and vegetables, could enhance the effectiveness of these measures by addressing the particular spoilage patterns and storage needs of each category.

Overcoming psychological and perception barriers: Our results showed that households often underestimate their waste or rely on composting, reflecting optimism bias and moral licensing. Interventions should aim to increase awareness of actual waste quantities, for example through self-reporting, diary-based feedback [51], [72]. Highlighting both the environmental and financial consequences of food waste may further enhance motivation [73], [74], particularly as Swiss households lose an estimated CHF 620 per year due to avoidable waste.

Consumer-focused prevention strategies: The study identified 72 household-level strategies, with a strong focus on mindful shopping, cooking, eating, and storage practices. These findings underscore that consumers are aware of their potential to reduce waste but require practical tools, knowledge, and behavioural nudges. Multicomponent interventions combining awareness-raising, knowledge enhancement, and behaviourally informed nudges—such as reminders, prompts, and tips—are likely to yield the greatest impact [49].

Role of government and policy: Our results showed that government support is critical in providing education, practical guidance, and public campaigns that clarify food safety, expiry dates, storage, and leftover utilization. National campaigns should emphasize that composting is environmentally beneficial but not a substitute for waste reduction. Policies can also target structural factors, such as clearer labelling ('best before' clarification), optimized packaging, and limiting multi-unit promotions for highly perishable foods, which can directly reduce avoidable household waste.

Retail and multi-stakeholder engagement: Retailers play a key role in preventing household food waste through packaging optimization, information provision, and collaborative campaigns with consumers. Partnerships between consumers, retailers, and government agencies have shown greater effectiveness than isolated efforts [65], [75], and such coordinated approaches could strengthen Switzerland's efforts under the 'Swiss Action Plan against Food Waste'.

5. Limitations and outlook

5.1. Limitations

In terms of indicating prevention strategies for reducing food waste, the response rate among our participants was lower, with 244 households (47% of the total sample) providing answers to the posed question.

Thus, it should be noted that the subsample used for the analysis of food waste reduction strategies may be subject to non-response bias, as participating households could be more motivated or more aware of food waste issues, potentially leading to an overrepresentation of environmentally conscious respondents in this part of the analysis. However, to minimise participant fatigue, the question on prevention strategies was optional. Although this subset is smaller than the full sample of 515 households, the data still offer valuable insights into the strategies employed by the respondents. Given the lower response rate, we recommend that future research explore this area with a more targeted approach to capture a larger, more representative sample.

Additionally, our study relied on self-reported data for food waste measurement, which inherently carries the risk of social desirability bias and underreporting. The participants were aware that their food waste was being quantified, which may have influenced their reporting behaviour. To minimise this bias, we reminded the participants multiple times to behave normally during the measurement to ensure that the results reflected their actual household food waste. In future studies, we recommend exploring less intrusive, unaware methods of food waste measurement to reduce the impact of these biases.

5.2. Outlook

For future interventions, integrating nudges, knowledge enhancement, and awareness-raising components—such as self-reporting food waste—may be particularly promising for changing consumers' food-related practices and lifestyles. Ideally, all family members, including children, should be involved in combining sustainability goals with healthy eating habits to achieve more effective food waste reduction. Further, food waste driven by preference and quality loss represents a substantial untapped opportunity for reducing food waste. Improving consumers' food and nutrition knowledge to enhance their food management skills and improve their acceptance of imperfect food is therefore crucial. Further, more knowledge and awareness about food waste in households are needed. For example, consumers should be aware that composting food does not reduce food waste; rather, it is environmentally beneficial, making food waste visible and showing the monetary loss due to food waste.

While this study focuses on food waste prevention and management in households, future research could further investigate biotechnological valorisation pathways for unavoidable household food waste (e.g., peels or coffee grounds), including mushroom cultivation, insect farming, or enzyme production. Moreover, studies could evaluate long-term adoption of household practices and the cumulative impact of combined consumer, retailer, and policy measures on overall food waste reduction.

6. Conclusion

This nationwide study provides a comprehensive understanding of the causes, barriers, and prevention strategies associated with household food waste in Switzerland ($n = 515$). We identified 13 causes of food waste, with edible peel waste, food spoilage, and overpreparation being the most common, although their importance varied across food categories. We also identified 24 barriers to reducing food waste, including misconceptions about composting as a waste reduction measure, the perception that food waste has limited financial consequences, and the need to maintain sufficient food supplies for healthy family meals. Notably, a substantial proportion of participants reported perceiving no barriers to reducing food waste.

In addition, we identified 72 prevention strategies grouped into 10 categories, highlighting the importance of mindful shopping, cooking,

eating behaviours, and improved food storage practices. Our findings suggest that reducing household food waste requires both behavioural changes by consumers and supportive actions from retailers and policymakers. Retailers can contribute through improved packaging, portion sizes, date labelling, and product information, while governments can support food waste reduction through education, awareness campaigns, infrastructure development, and policies that promote sustainable food practices.

Overall, our findings highlight the need for integrated, multi-component interventions that address both behavioural and structural drivers of household food waste. Further, effective household food waste reduction requires coordinated efforts among consumers, retailers, and policymakers. Such multi-stakeholder collaboration offers a promising pathway toward achieving meaningful and lasting reductions in household food waste.

Generative AI declaration

The authors declare that no generative AI or AI-assisted technologies were used in the preparation of this manuscript.

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CRediT authorship contribution statement

Carole Liechti: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Gabriele Mack:** Conceptualization, Supervision, Validation, Writing – review & editing. **Kevin O'Sullivan:** Data curation, Software, Writing – review & editing. **Sabrina Stöckli:** Writing – review & editing. **Verena Tiefenbeck:** Writing – review & editing. **Jeanine Ammann:** Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft.

Declaration of competing interest

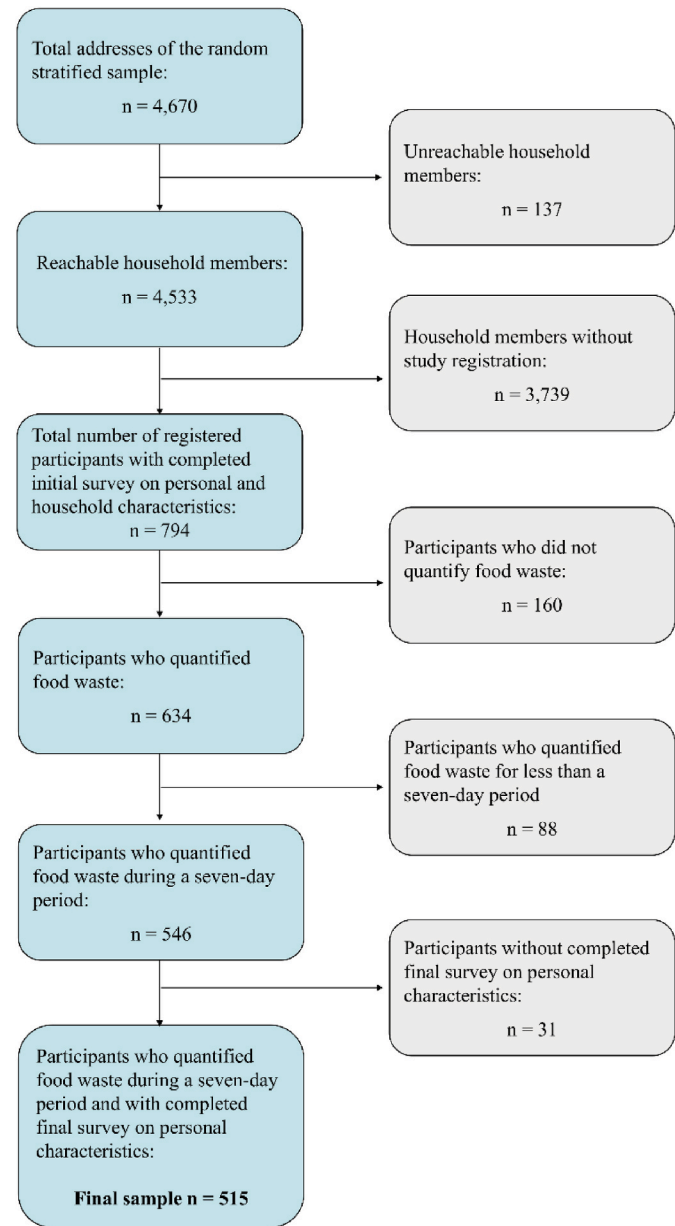
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices.

Appendix A

Comparison of the personal and household characteristics of the sample (n = 515) and the Swiss population (n = 7,094,571).

Sample characteristics	Study participants n = 515		Swiss population n = 7,094,571	
	Number	%	Number	%
Age groups in years				
18–34	98	19.0	1,773,858	25.00
35–49	155	30.1	1,844,753	26.00
50–64	168	32.6	1,830,958	25.81
65 and older	94	18.3	1,645,002	23.19
Gender				
Women	294	57.1	3,585,948	50.54
Men	221	42.9	3,508,623	49.46
Linguistic region				
German	270	52.4	5,082,997	71.65
French	160	31.1	1,706,441	24.05
Italian	85	16.5	305,133	4.30
Marital status				
Single	142	27.6	2,412,261	34
Married/Registered partnership	325	63.1	3,549,711	50
Widowed/Divorced	48	9.3	1,131,855	16
Other	-	-	744	0.01
Number of household members in households				
1	71	13.8	1,472,166	20.8
2	196	38.1	2,529,753	35.7
3	92	17.9	1,198,551	16.9
4	110	21.4	1,240,550	17.5
5	35	6.8	447,921	6.3
6	9	1.7	138,090	2
7	2	0.4	42,831	0.5
More than 7	-	-	24,709	0.3



Appendix B. Overview of the sampling procedure. A total of 4,670 household members were contacted. The final sample consisted of 515 participants who quantified food waste during a seven-day period and completed initial and final surveys on household characteristics.

Appendix C

Overview of the 14 food categories and 61 food products used for self-reported food waste recording in the web application.

Food categories		Food products
1	Vegetables, fruits and other fresh foods	Vegetables, fruits, salad leaves, mushrooms, herbs, mixed vegetables, and fruits
2	Starchy side dishes	Grains (e.g. rice, wheat, oat etc.), potatoes, sweet potatoes, manioc, pasta, noodles, muesli, cereals, flakes, pulses, granola bars
3	Leftovers from dishes	Homemade, ready meal, and takeaway
4	Bread and baked goods (sweet and savoury)	Bread, sweet pastries, savoury pastries
5	Milk, dairy products, and eggs	Cheese, milk, yoghurt, eggs, cream, mascarpone, crème fraîche, curd cheese, dairy-based beverages, dairy-based dessert, mixed dairy products
6	Beverages	Non-alcoholic beverages and alcoholic beverages
7	Sauces, pesto, savoury spreads and dips, oil, fats, spice, bouillon	Sauces, pesto, spices, bouillon, savoury spreads, dips, ketchup, mayonnaise, mustard, oils, and fats
8	Meat	Meat, meat products
9	Other	Mixed waste, flour, scarps, yeast, baby food, sugar, unspecified waste
10	Plant-based proteins	Tofu, seitan, quorn, tempeh etc., and plant-based alternatives to meat, fish, eggs, milk, yoghurt, etc.
11	Chocolate, confectionery, sweet spread	Chocolate (bar), chocolates, jam, honey, nutella, nut and chocolate spreads, sweeties, fruit gums, etc.
12	Nuts, seeds, kernels	Nuts, seeds, kernels

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Appendix C (continued)

Food categories	Food products
13 Fish and seafood	Fish, fish products, seafood, seafood products
14 Savoury snacks	Chips, crisps, olives, popcorn, savoury biscuits, savoury nuts

Note: Leftovers from dishes consist of several food categories or food products, for example, lasagna or potato and vegetable gratin.

Appendix D

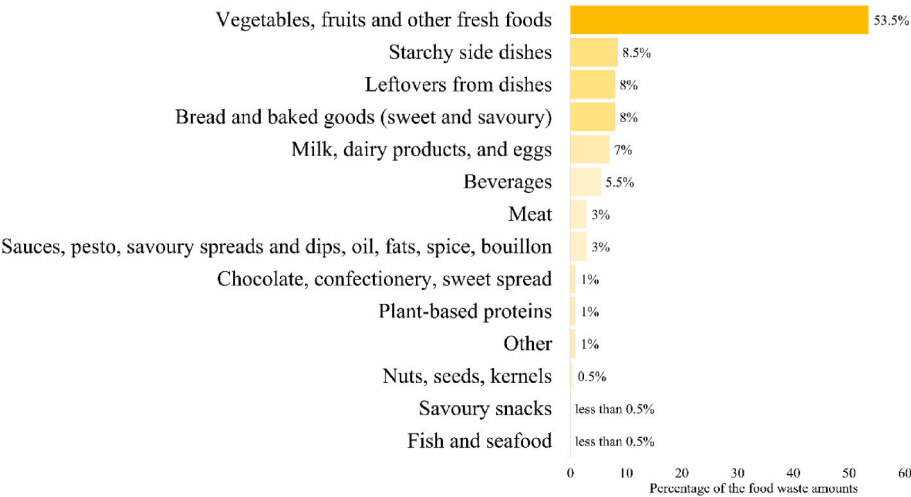
List of 10 food waste causes used in this study adapted from Merian et al. [7].

1.	Edible peel waste
2.	Past the 'best before' date
3.	Spoiled
4.	Too much cooked/prepared
5.	Packaging too large
6.	Bought too much
7.	Purchased wrong product
8.	Incorrect storage
9.	Preparation error
10.	Other

Appendix E

List of 12 barriers to reducing household food waste according to Quested et al. [28].

Barriers to reducing household food waste
1. I don't have enough time
2. There are more important things to worry about
3. I don't think the quantity of food I throw away costs me very much money
4. I don't need to reduce food waste because I compost most of our food waste at home
5. I don't need to reduce food waste because I use a local authority collection for most of my food waste
6. I don't think throwing away food has a negative impact on the environment
7. I don't want to compromise on the choice of fresh foods I have in my fridge
8. I need to buy a wide range of foods to ensure I can provide healthy food for my family
9. I can't help producing food waste because my children don't always finish their food
10. I don't know how I can reduce food waste
11. Other (please specify)
12. None of the above are a barrier for me



Appendix F. Percentage of weekly food waste across 14 food categories in 515 Swiss households.

Appendix G

An overview of the ten food waste prevention strategies listed in descending order of cited frequency.

Retailers	Consumers						Government		
Improving food waste management practices in retail	Mindful shopping behaviour	Better food storage management	Mindful cooking and eating behaviour	Better communication within household	Sharing practices	Raising awareness within household	Provision of awareness building measures	Provision of knowledge, educational, and informational measures with practical tips	Provision of sharing opportunities
• Use smaller packaging and portions • Avoid special offers with reduced prices and large packaging • Indicate which foods do not need 'best before dates' • Print 'best before dates' to be more visible • Extend 'best before dates' as food often has a longer shelf life • Reduce the many dates on food packaging	• Buy less in advance • Buy only what is needed by using a shopping list • Purchase more frequently fresh food • Select food with a longer shelf life and better quality • Select open and not packed fresh food in large packaging • Avoid purchasing food with a large hunger feeling, no mood, and spontaneous shopping • Allocate more time for thoughtful grocery shopping • Use near-by supermarket • Change purchase behaviour • Select smaller fruits, if you need only a little	• Freeze food, ingredients, leftovers • Better overview in the fridge, storage room, freezer, and cellar • Better adapt storage based on food category • Have less in storage • Use products with shorter shelf-life first • Protect food from pests • Use airtight containers and cans • Better visibility of food with shorter shelf life: put new products with longer shelf life behind products with shorter shelf life • Better control of food with short-shelf life • Larger freezer for larger households • Conserve food with short-shelf life • Make a list with all best before and expiring dates on the fridge • Put a sticker on the fridge to remember and check food with	• Plan meal for one week • Cook less and plan portions better • Use and re-use of leftovers • Take an inventory before cooking • Allocate more time for cooking and meal preparation • Serve less (children) • Consume food within the next two days • Pay more attention to the best before date • Use measuring unit for pasta and rice • Follow recommended portion sizes per person on packaging • Portioning food • Reduce of edible peel waste • Use simple recipes with limited number of ingredients • Re-use fresh food several times • Check food quality visual and the odour • Allocate more time for waste reduction	• Communicate out-of-home meals • Ask about the hunger level before cooking • Know who will be present or absent for dinner • Clearly label food in the fridge in a shared flat to show whether it's for everyone or just the owner • Request more commitment when confirming guest for meals	• Distribute cooked food • Offer food for free • Share food with flatmates	• Record the food waste quantities • Visualise food waste (take food waste to the compost every evening) • Include all household members in waste reduction • Acquire more appreciation of the food • Acquire awareness of re-use of leftovers	• Build awareness among school-aged children • Show financial loss and negative ecological impact • A better understanding of whole food production	• Provide ideas for menus with leftovers and peel waste • Better understanding of which foods can still be consumed after the 'best before' or expiration date • Indicate how food should be properly stored • Educate on how food waste can be reduced at home • Improve knowledge of which parts of vegetables are edible • Provide more information on how to test if leftovers are still good • Provide guidelines on how to store food (fridge, kitchen, in the dark, etc.) • Teach how to fully utilise fruits and vegetables	• Offer public fridge or shops for donation of over-purchased food

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Appendix G (continued)

Retailers	Consumers	Government							
Improving food waste management practices in retail	Mindful shopping behaviour	Better food storage management	Mindful cooking and eating behaviour	Better communication within household	Sharing practices	Raising awareness within household	Provision of awareness building measures	Provision of knowledge, educational, and informational measures with practical tips	Provision of sharing opportunities
		short shelf life							
		• Shared online list with household members with food in fridge and freezer							
		• Reduce the storage of the same products in different variations (salt with herbs, salt with spices, normal salt, etc.)							

Data availability

All data obtained in this study are freely accessible on Zenodo:
<https://doi.org/10.5281/zenodo.18163257>.

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