Education in Management and Accounting to Reduce Food Waste in the Home

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Abstract

Food waste in the home represents an environmental and economic issue, directly linked to inefficient resource use and the emission of polluting gases. This study aimed to analyze how domestic consumption practices impact food waste and to evaluate the effectiveness of management and accounting tools as educational mechanisms for its reduction. A domestic management guide was applied in a selected household, focused on improving food planning, control, and utilization. The results showed a significant reduction in both the volume and value of waste. Economic incentives proved to be more effective than environmental or social ones in modifying behavior. A widespread lack of knowledge regarding expiration dates was also evident, and distortions were identified that stemmed from external factors such as home production and personal preferences. A negative feedback cycle was found, in which poor planning leads to excessive purchases and disorganization, ultimately resulting in involuntary discarding—an outcome that becomes entrenched in the absence of educational intervention. It is concluded that consumer education, combined with accounting and management tools, constitutes a promising pathway to reduce food waste, although it is necessary to expand the sample and strengthen the methodological design to validate the findings.

Keywords: consumption; responsibility; education

1. INTRODUCTION

Food waste is a global issue that affects both environmental sustainability and economic efficiency. As noted by Szymkowiak et al. (2022, p. 01), "About a third of all food produced in the world is not consumed and becomes waste." This phenomenon is a central concern within Sustainable Development Goal number 12 of the 2030 Agenda, specifically under "Responsible Production and Consumption." The problem of food waste is directly related to the ways in which we produce, distribute, and consume resources. A variety of studies have addressed this topic from different perspectives. Some have focused on identifying the causes of food waste and on proposing strategies to counteract it within the productive sector, including large companies and/or food service establishments. For instance, Filimonau et al. (2020, p. 07) state that "Reduced plate size was more effective than social cues given through posters, and there were no adverse implications for customer satisfaction." Other studies have examined the role of government regulations, highlighting how certain policies, while attempting to solve one problem, may inadvertently create or worsen another. A clear example is provided by Alaybek et al. (2025, p. 10): "Overly restrictive policies could inadvertently increase food waste due to consumer confusion and misinterpretation, or inability to sell or donate food past its label date." Additional research has explored the causes of food waste based on specific lifestyle patterns, as noted by Szymkowiak et

al. (2022, p. 08): "Consumers' food disposal inclination partially depends on their food-related lifestyle." However, despite the multiple studies and perspectives, a significant gap remains. Most research focuses on understanding the causes of food waste and suggesting general strategies to mitigate it, but very few adopt a pragmatic approach aimed at developing concrete tools that are useful for reducing food waste. There is a noticeable tendency among various investigations to underestimate the central role of the consumer as an agent of change. Whether as a restaurant customer, as someone who follows a particular lifestyle, or as a person who misinterprets certain regulations, the consumer directly influences the generation of waste. Moreover, some restaurant policies fail to be effective due to a lack of social acceptance. As Filimonau et al. (2020, p. 08) point out, "For instance, shame and trying to save face act as barriers, negatively affecting the intentions to take away leftovers."

Therefore, this study aims to address that gap by designing a practical guide to help consumers— primarily in the domestic sphere—reduce food waste. The hypothesis guiding this research is that consumer education is key to preventing waste. Furthermore, economic savings prove to be a more effective incentive than traditional environmental discourses that emphasize the broader benefits of tackling this issue. As Alaybek et al. (2025, p. 01) note, "Reducing food waste is considered one of the top three strategies to reverse climate change." To this end, the study first sought to investigate and measure the main causes of food waste, then to create a practical guide for consumers using tools derived from management and accounting, with the aim of educating them. Finally, it evaluated whether there was a significant change in the amount of waste generated by households and in their associated costs after applying this guide, with the goal of improving it in future iterations.

2. METODOLOGÍA

1: Diagnosis (5 Days): During the first stage of this research, a general diagnosis was conducted through the administration of surveys. These surveys explored aspects related to household size, consumption habits, knowledge about the issue, age, occupation, level of predisposition to change habits, reasons for such change, among others. The choice of an in-person survey/questionnaire format was based on criteria of efficiency and effectiveness in data collection, allowing for a relatively broad and meaningful volume of responses. While other formats, such as in-depth interviews, could have yielded more specific, higher-quality, and deeper data, this option was deemed unfeasible due to the limited time available for conducting the research. A mixed-method approach was adopted for the diagnosis, incorporating both qualitative and quantitative questions. The aim of the questions was to identify the main causes of food waste in the home and to determine which food items are most frequently discarded. It is worth noting that the surveys were kept anonymous to encourage participants to respond as honestly as possible and to avoid the alteration of data or opinions in an effort to align with socially accepted norms. Additionally, the response options were deliberately limited to a few targeted choices that would help confirm or refute the research hypothesis.

In pursuit of efficiency, the questionnaire was designed to be as brief as possible, with a total duration not exceeding five minutes, including both the administration of the questions and the participants' responses. Below are some of the most important questions included in the questionnaire, along with the rationale for their selection—specifically, what each question allows us to understand. The full questionnaire is provided in the annex at the end of the article.

A. Household Composition
   a. Who usually purchases the food to be consumed in the household? This question identifies whether most individuals have decision-making power over purchases and, consequently, over the waste generated.
   b. Who is usually responsible for preparing meals? This question helps determine whether most individuals prepare meals and therefore have control over the waste generated during food preparation.

B. Purchasing and Planning Habits

   a. Do you plan your purchases with a list or decide in the moment? This question helps determine whether planning should be a central focus of the guide and assesses the level of pre-purchase organization.
   b. Do you buy food on impulse or because of promotions, even if you don't need it? This question serves to identify whether poor management or planning is a factor influencing waste and detects over-purchasing as a potential cause of food waste.
   c. Do you pay attention to expiration dates when buying products? This question assesses whether knowledge about expiration dates should be included in the guide and helps measure awareness and prevention when purchasing items close to their expiration.
   d. Do you buy more than necessary for convenience or because of price? This question links the economic factor to over-purchasing and helps determine whether financial considerations could serve as an effective motivator to reduce household food waste.

C. Consumption and Preservation Habits
   a. If a product expires, what do you do? This question helps understand how consumers respond to expiration dates and how significant this factor is in generating food waste.
   b. Do you have a routine for checking what's in the refrigerator or pantry? This question detects the level of domestic inventory management and is a key factor to consider for improving household administration.
   c. Which foods spoil most frequently in your home? This question identifies which foods should be prioritized in the guide—for example, strategies for preserving fruit—as it highlights critical food groups for targeted intervention.

D. Knowledge and Perception of Waste
   a. Do you know the meaning of the term "responsible consumption"? This question assesses how familiar participants are with the issue of food waste.
   b. Do you understand the difference between "expiration date" and "best before"? This question measures knowledge of a key variable that influences discard decisions and helps determine whether this factor significantly affects behavior, as discussed in the theoretical framework regarding expiration dates and consumer confusión.
   c. Which reason do you consider most important for avoiding food waste? This question helps identify whether the economic factor serves as a strong incentive, as proposed in the research hypothesis.

E. Willingness to Change and Motivation
   a. What type of support would be most helpful for achieving this? This question informs the most appropriate format for the proposed tool.
   b. What habits would you like to adopt to improve your relationship with food? This question identifies personal interests to help tailor the guide.

Stage 2: Initial State Measurement (7 Days): This stage aimed to conduct a quantitative measurement of food waste. To achieve this, the households that agreed to participate in the study collected the food waste they generated. However, the waste was divided into two categories, of which only one was measured.

   a) Voluntary Waste: This category includes food waste that is perfectly edible but is not consumed due to specific reasons or personal preferences. Examples include peels from certain fruits, chicken skin, stems from particular vegetables, etc.
   b) Involuntary Waste: This category includes food waste that would normally be consumed by the individual but ends up being discarded for some reason. Examples of items in this category include expired yogurt, spoiled cheese due to poor storage, deteriorated fruit in the refrigerator, leftover cooked rice that was forgotten, unconsumed infusions, hardened bread due to lack of consumption, wilted lettuce from improper storage, and honey discarded due to expiration, among others.

The distinction between these two types of food waste is vital to the research, as the guide aims to change habits, not preferences. The intention is not to persuade someone who prefers to eat apples without the peel to change that preference, as such a shift is considered unfeasible. The guide focuses on habits—for example, learning how to store certain foods properly, understanding what consumption dates on products actually mean, and so forth. For these reasons, the research will concentrate on measuring involuntary food waste.

- Measurement:
   a) The total amount of food waste generated over the course of one week will be measured by summing the daily waste to avoid accumulation over multiple days.
   b) Each household will record the weight of the waste generated so that the data can later be transferred to an Excel spreadsheet for better organization.
   c) The total amount of waste generated during the measurement period will be divided by the number of household members to estimate the waste per person.
   d) An estimate will be made of how much each person would waste over the course of a year and the economic loss this represents. It is worth noting that the cost data for each wasted food item will be approximated based on the prices from a local supermarket (Carrefour).
- Participants:
   a) Households with the most heterogeneous profiles possible were selected in order to ensure diversity and broaden the representativeness of the results. These included nuclear families, students living alone, childless couples, and large families, as well as individuals of various ages. The goal was to identify general causes rather than those specific to a single household. The practical guide would

later be applied in a household with particular characteristics in an effort to generate a significant impact.

Stage 3 Guide Development Based on Results and Theoretical Framework (5 Days): In the following stage, the results were analyzed and the guide was adapted accordingly, aiming for the greatest possible impact. It is worth noting that the guide was built upon a solid foundation, based on the knowledge provided by the authors used as the theoretical framework. Some of the topics that proved useful for this research include: proper storage of certain foods, learning to correctly interpret expiration dates and their relation to product properties and food safety, how to avoid excessive portions, and household inventory management. For this reason, the insights from the reference authors served as the basis for the guide, while the results obtained from this particular study played a role in improving and adapting it to the habits of Argentine households.

Stage 4: Intervention / Guide Implementation (10 Days): A series of tips were applied as a guide for the household participating in the study. This intervention was carried out over a period of 10 days, during which food waste was measured again.

Stage 5: Final Survey (1 Day): A new survey was conducted exclusively with the participating household, in which they explained what was easiest and most difficult to apply, which tools they found most useful, which of the newly acquired habits they intend to maintain over time, and what lessons they took away from participating in this project.

Stage 6: Results Analysis and Guide Improvement (3 Days): In the final stage, it was verified whether there was a significant impact on both costs and the amount of waste generated. Additionally, efforts were made to improve these outcomes and refine the guide intended to educate consumers, with the ultimate goal of making it publicly available in the future.

3. RESULTS

DIAGNOSTIC SURVEY RESULTS: The following presents the results obtained from the in-person questionnaire administered to more than 30 individuals from diverse households. The survey aimed to explore people's relationship with food, as well as their perception of food waste within the home. This section details only the most relevant findings for the subsequent analysis based on the proposed hypothesis; however, additional results are included in graphical form in the annex at the end of the article.

1. Household Composition: Most respondents reported having direct involvement in decisions regarding food purchases in their households—whether shopping alone, with another person, or sharing the task among several members. A similar pattern was observed in meal preparation: a large portion of respondents stated they are directly involved in cooking. A significant number cook regularly at home, confirming that the domestic environment is a frequent space for food preparation and waste generation.

2. Purchasing and Planning Habits: A small percentage (19.4%) reported shopping without a list, while the remaining respondents were split between those who use a shopping list occasionally and those who always use one, with a slight majority favoring occasional use. Additionally, two-thirds of respondents admitted to buying food on impulse or due to promotions, even when not needed—either frequently or on specific occasions.

3. Consumption and Preservation Habits: A large portion of respondents stated that they consume expired products depending on the type of item (53.6%), while a significant share discard products once expired regardless of the type (42.9%). A very small percentage consume products regardless of whether they are expired or not. Respondents stated that leftover food after meals is most often repurposed into other preparations. However, a relatively large portion is also either discarded or stored for later consumption. A significant percentage of respondents reported not having an established routine for checking the contents of their refrigerator or pantry. Among those who do perform such checks, the predominant frequency is every few days. This pattern of domestic organization is closely linked to the results regarding the types of food most frequently wasted, which largely consist of items with a short shelf life—traditionally classified as perishable foods. Among these, fruits, vegetables, baked goods, and prepared meals stand out as the most commonly discarded.

4. Knowledge and Perception of Waste: A high percentage of respondents stated that they are familiar with the term "Responsible Consumption" or can infer its meaning, although they lack in-depth understanding of the concept. Additionally, more than one-third of respondents believe that the terms "expiration date" and "best before" are equivalent. Most participants reported feeling guilty when wasting food; however, the majority also indicated that the most important reason to avoid food waste is economic.

5. Willingness to Change and Motivation: Respondents indicated that the most viable educational formats for them would be a practical guide and explanatory videos. There was no clear preference regarding which topic they would most like to learn about—all options were considered appealing, including planning purchases, making use of leftovers, improving food preservation, and understanding expiration dates.

INITIAL MEASUREMENT RESULTS: In this stage, a quantitative measurement was conducted to assess the food waste generated over the course of one week in four different households. The food waste produced was collected and weighed. Since the study aims to implement a guide focused on changing habits rather than preferences, only involuntary food waste was taken into account.

- <u>Household 1: Waste Generated by 2 Adults Over One Week</u>

Category	Grams	Description	Cause	Approximate Cost
Fruits	771 gr	5 pieces of fruit (oranges)	Overripe	$771
Vegetables	357 gr	Lettuce head	Spoiled in the refrigerator	$2.500
PANIFICADOS	343 gr	Dry/hard bread	Forgotten	$1.544
Meats and Cold Cuts	85 gr	Slices of cold cuts	Forgotten	$1.983

*Prepared Meals	378 gr	Various ingredients	Not consumed the next day	$5.000
Others	226 gr	Opened can of preserved food	Opened, not consumed, and forgotten	$690

*Due to the difficulty of accurately calculating the cost of a homemade prepared meal, the price of an economical meal box, estimated at 5000 pesos, was used as an approximate representation of the cost of a home-cooked dish.

- Household 2: Waste from 2 Adults Over One Week (Adult and Older Adult)

Category	Grams	Description	Cause	Approximate Cost
Fruits	1567 gr	9 pieces of fruit (oranges)	Overripe	$1567
Vegetables	439 gr	2 small carrots and 1 small tomato	Soft texture due to poor storage	$2085
Baked Goods	343 gr 150 gr	Dry/hard bread Dry pastries (3 units	Forgotten Forgotten	$4543
Grains and Cereals	500 gr	Pack of pasta	Expired	$1700
Dairy and Desserts	190 gr	Yogurt	Expired	$1400

- Household 3: Waste from 1 Adult Over One Week

Category	Grams	Description	Cause	Approximate Cost
Fruits	155 gr 178 gr	1 orange 1 banana	Overripe	$1084
Vegetables	258 gr 400 gr 120 gr	Bell pepper Spinach Portion of avocado	Spoiled in the refrigerator	$5967

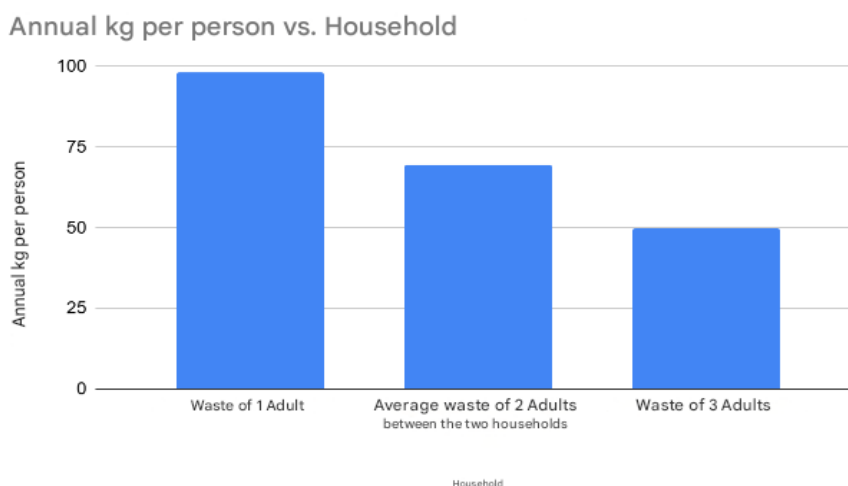| Baked Goods | 455 gr | Dry/hard bread | Leftovers not reused | $2047 |
| Prepared Meals | 327 gr | Various ingredients | Leftovers not reused | $5000 |

- Household 4: Waste from 3 Adults Over One Week

Category	Grams	Description	Cause	Approximate Cost
Fruits	550 gr	Banana, apple, strawberry	Overripe	$14.146
Vegetables	889 gr	Spinach, lettuce, tomato, avocado	Wilted, oxidized, or lost texture	$15.075
Baked Goods	435 gr	Bread and pastries	Hardened or moldy due to non-consumption	$10.657
Grains and Cereals	267	Cooked rice	Poor portion estimation	$340
Meats and Cold Cuts	325 gr	Chicken leftovers	Leftovers not reused	$910
Dairy and Desserts	180 gr	Spoiled creamy cheese portion	Leftovers not reused	$1.566
Prepared Meals	250 gr	Pizza portions	Leftovers not reused	$4.687

- Comparative Table Between Households

Household Type / Number of People	Annual Waste per Person (kg)	Annual Cost per Person (ARS)
Waste from 1 Adult	98	$733.096
Waste from 2 Adults (average)	69,5	$309.179
Waste from 3 Adults	50	$807.707

- Comparative chart between individuals

Annual kg per person vs. Household

Stage 3 Guide Development: After analyzing the results and identifying that the most frequently wasted foods were fruits, vegetables, baked goods, grains, and prepared meals, the decision was made to focus the guide primarily on tips related to these specific food categories. The complete guide is included in the annex.

Stage 4 Guide Implementation (10 Days): Following the implementation of the guide, several unexpected results emerged due to uncontrolled external factors. These will be addressed in the discussion section. However, the overall outcome was a significant reduction in both the quantity of food wasted and household food-related expenses, as shown in the graphs below.

Hogar 3: Desperdicio de 1 Adulto a lo largo de 10 días aplicando los tips de la guía.

Category	Grams	Description	Cause	Approximate Cost
Fruits	90 gr	1 apple	Overripe	$270
Vegetables	153 gr 300 gr	Carrot / Spinach	Softened	$3483
Baked Goods	60 gr	Moist cookies	Not consumed and became soggy	$467
Prepared Meals	140 gr	Various ingredients	Not consumed	$5000

- Comparative Table: Pre- and Post-Intervention Waste (Weekly Equivalent)

Category	Pre-Intervention Waste		Post-Intervention Waste (Weekly)	
Fruits	333 gr	$1084	64 gr	$189
Vegetables	778 gr	$5967	317 gr	$2438
Baked Goods	455 gr	$2047	42 gr	$327
Prepared Meals	327 gr	$5000	98 gr	$3500
Total per Week	1893	$14098	520	$6454
Annual Estimate per Person (52 weeks)	98 kg	$733.096	38 kg	$335.608

Stage 5: Final Survey (1 Day): The participant stated that the research allowed him to recognize patterns of excessive consumption within the household, particularly in the purchase of products such as bread, fruits, and vegetables. Following this awareness, he expressed his intention to incorporate prior planning practices, such as creating shopping lists or at least anticipating which products to buy and why. He noted, for example, that he wishes to avoid impulsive purchases driven by promotions—such as discounted bananas or spinach—when he knows he will not be able to consume the entire quantity. Instead, he indicated that he will begin adopting a weekly shopping approach more aligned with his actual needs, such as buying three or four apples instead of two kilograms. He also expressed interest in applying food recovery strategies, such as using overripe fruits in smoothies or repurposing stale bread as a coating ingredient. However, he clarified that he does not plan to implement these practices frequently, as he does not consider himself fond of cooking and prefers simpler preparation options. Regarding expiration dates, the participant mentioned prior knowledge about certain products that do not spoil easily, such as honey, although he still prefers not to consume them if alternatives are available. He found particularly appealing the possibility of purchasing foods close to their expiration date at a lower price, especially those he plans to consume immediately, such as pasta or sauce. In relation to the proposed guide, he noted that one of the challenges was labeling containers and systematically checking the pantry and refrigerator—practices he considers unsustainable in his daily routine. While he appreciated the idea of continuously monitoring food waste and available products, he

acknowledged that such tasks are unlikely to be implemented due to his limited familiarity with basic technological tools.

4. DISCUSSION

1. Hypothesis Validation: This research was developed based on the central hypothesis that consumer behavior plays a crucial role in the generation of food waste. To address this issue, it was proposed that consumer education—supported by tools from accounting and management—could contribute to reducing household food waste. It was also suggested that the economic savings resulting from such reductions would serve as a more effective incentive than factors such as social empathy or environmental impact. The intervention was applied in Household 3, composed of one adult over a 10-day period. The results indicate an approximate 55% reduction in the total annual cost of food waste and a reduction of over 60% in terms of weight. These findings suggest a trend that partially supports the proposed hypothesis, although they do not provide robust validation due to methodological limitations (small sample size and short duration). Regarding the economic factor as a motivator, the diagnostic survey results show a tendency among respondents to prioritize economic concerns over social or environmental empathy. However, this evidence is also conditioned by the limited sample used, although participation in the diagnostic phase was higher than in the intervention phase. As for the use of tools from management and accounting to reduce waste, their application proved relevant and functional in educating and assisting consumers in addressing issues such as planning, organizing, and managing food at home. While the results are encouraging, it is not possible to precisely determine the extent of the impact achieved. It is likely that a more extensive and comprehensive study would modify the observed effects and yield more robust and generalizable data.

2. Key Findings: The results of the diagnostic survey show that most respondents are directly involved in the generation of food waste within their households. The majority carry out food purchasing and/or meal preparation tasks either alone or in collaboration with another person. This reinforces the central hypothesis that the domestic consumer plays a pivotal role in the dynamics of food waste—more so than restaurants or food service establishments. This finding aligns with the theoretical framework used in the study. One referenced study demonstrated that certain anti-waste policies in the food service sector fail to produce the desired effect because the consumer themselves acts as a limiting factor: "For instance, shame and trying to save face act as barriers, negatively affecting the intentions to take away leftovers" (Filimonau et al., 2020, p. 08). Additionally, key concepts from management—such as planning, organization, and control—were found to be directly related to waste generation. Respondents reported difficulties in these areas, including: excessive purchasing, lack of clarity about what to buy, cooking errors, poor portion estimation, and confusion regarding expiration dates. These responses suggest a significant lack of knowledge about domestic management, which contributes to inefficiencies in the use of household resources—both food-related and economic. Regarding lack of knowledge as a factor in waste generation, the data supports this hypothesis. When asked what they do when a product expires, respondents were divided into two main groups: those who consume expired products depending on the type, and those who discard them outright. This suggests that most perishable foods are the ones most frequently discarded, consistent with the results identifying the most wasted food categories: fruits, vegetables, baked goods, prepared meals, and dairy products. This finding directly aligns with the theoretical framework: "The high probability of wasting organic food may stem from the fact that this type of food (i.e., being

chemical-free) does not often fit into the so-called prototypical appearance of fresh products pushed by food manufacturers" (Szymkowiak et al., 2022, p. 7). The foods topping the list of most wasted items in the survey are precisely those that lose their "fresh" appearance most quickly—such as fruits, vegetables, and prepared meals. This leads to perfectly edible products being discarded due to the consumer's perception that they are no longer healthy to eat, as in the case of an apple that no longer has a vibrant color. This is compounded by confusion around expiration dates, where products are discarded simply because consumers do not understand when they cease to be safe to consume—for example, a yogurt that is two days past its expiration date.

One of the central pillars of the hypothesis proposed in this research is the idea that the economic factor serves as a primary incentive for encouraging consumers to become concerned about the food waste they generate. To evaluate this premise, the diagnostic survey included a direct question about which dimension—economic, environmental, or social—was considered most significant in preventing household food waste. This finding allows for partial validation of the hypothesis, which suggests that strategies focused on economic savings have a greater potential for impact than those centered on environmental awareness or the ethical dimension of waste. It can be inferred that the prioritization of the economic factor over others, such as the environmental one, is largely due to the ease with which economic impact can be quantified—making it more tangible and immediate for the average consumer. In more practical terms, it is easier for a household to estimate the monetary loss caused by discarding a portion of spoiled cheese due to poor storage than to grasp the contribution of that same decomposing cheese to global warming through methane emissions.

The various findings from the diagnostic survey suggest the emergence of what is known in management and systems analysis as a negative feedback loop, in which a sequence of events reinforces itself, leading to the progressive deterioration of the system. In this specific case, each link in the process feeds into and exacerbates the problems of the next, without any corrective mechanism. Poor planning leads to excessive purchasing, which in turn generates disorganization. This is compounded by a lack of knowledge, ultimately resulting in involuntary food waste. This waste then restarts the loop: once a food item is discarded, it is repurchased—thus perpetuating the cycle.

3. Unexpected Findings: One particularly unexpected result relates to the concepts of "expiration date" and "preferred consumption." The initial hypothesis assumed that, as in the U.S.-based study used as part of the theoretical framework, there would be a certain degree of ambiguity and confusion surrounding food labeling in Argentina. However, a significantly high percentage of respondents (35%)—much higher than anticipated—reported not knowing the difference between the two terms. This suggests that the level of confusion may be even more severe than the survey results indicate and more pronounced than originally hypothesized. Part of this confusion stems from the terminology used in the survey itself, which, although relatively clear, still allows for deductive interpretation even if the respondent is unfamiliar with the terms. While "expiration date" refers to the point at which a food product is no longer safe to consume, "preferred consumption" refers to the point at which the product may begin to lose its properties but remains edible. However, Chapter V of the Argentine Food Code (CAA) introduces a variety of terms that are even more ambiguous than those used in this study's survey. These include: "consume before…", "valid until…", "validity…", "val…", "expires…", "expiration…", "exp.…", "expir…", and "preferably consume before…". It is worth noting that the CAA uses "expiration date" and "preferably consume before" as interchangeable terms, even though they refer to two distinct

situations. On one hand, the preferred consumption date does not imply that the product cannot be consumed after that date; rather, it suggests that the product should be checked for proper storage conditions and consumed with caution, as it may have undergone changes in sensory characteristics. It marks the date until which the product is expected to retain its specific properties under appropriate storage conditions. On the other hand, the expiration date applies to microbiologically highly perishable food products that may pose a risk to human health. Therefore, it represents the last safe opportunity to consume the product in terms of hygiene and safety. These findings reinforce the hypothesis confirmed by Alaybek et al., who state: "The confusion around the meaning of date labels can lead consumers to discard safe, wholesome, and edible food they mistakenly think is no longer good to consume" (Alaybek et al., 2025, p. 2), and "As consumers see a variety of dates on their products, they are not able to distinguish between those dates that relate to safety and those that are merely indicators of freshness" (Alaybek et al., 2025, p. 4). Our study contributes to reaffirming the results obtained by U.S. researchers and suggests that the level of confusion among Argentine consumers—and the ambiguity of the terminology used—may be even greater than that reported in the U.S. study and in our own survey.

One of the most contradictory and unexpected findings of the study was the apparent correlation between household size and the amount of food waste generated. Specifically, it was observed that the smaller the household, the greater the tendency to waste food. This may be explained by the fact that in larger households, more individuals are involved in managing and preventing waste—or that some members may be more conscious than others, which helps reduce overall waste generation. However, a deeper analysis of the data revealed a significant increase in the waste of a specific food item in two households: fruit, particularly oranges. Households 1 and 2 discarded over two kilograms of oranges within a single week. Upon investigating the cause, it was found that Household 2 has an orange tree on the property, and both households are part of the same family. Therefore, this spike in waste data can be attributed to the continuous production of oranges from the tree and the sharing of surplus fruit among family members. This detail is highly relevant to the assessment of data quality, as these figures are not the result of poor purchasing decisions but rather stem from an external factor that was not accounted for in the study's methodology. Nevertheless, the data was retained, since—even if not directly caused by mismanagement or consumer fault—the food was ultimately wasted and carries an economic cost, even if not borne by the household itself. In contrast, the third household, consisting of a single adult, showed that the primary cause of waste was excessive purchasing, particularly of vegetables and baked goods.

4. Methodological Limitations: Although the implementation of the intervention guide led to a significant reduction in food waste in the participating household, the reliability of these results is limited by several methodological constraints encountered during the study. First, cost estimates may vary considerably, as prices were taken from a single supermarket (Carrefour) on the day the data table was compiled. Food prices can differ substantially when purchasing from local markets or when buying in bulk. Another major limitation involved the valuation of prepared meals. Due to the difficulty of measuring the exact quantity and cost of each ingredient used in home-cooked dishes, an average meal box price was used as an approximation. As a result, the data lacks specificity in this category. Regarding the robustness of the data, a key limitation was the small number of participating households—particularly the fact that the intervention was applied in only one. Additionally, the participating household had a specific consumption pattern,

notably a tendency to purchase bread in large quantities, which inevitably led to higher levels of waste compared to an average household. Time frame was also a significant constraint. Certain periods of the year may naturally lead to increased food waste—for example, during the end-of-year holidays such as Christmas or New Year's, when households tend to over-purchase and prepare large quantities of food, resulting in leftovers that are not consumed or products that expire unused and are discarded due to spoilage or aesthetic concerns. Seasonal harvest cycles can also influence waste levels. In this particular study, the orange harvest season coincided with the data collection period, which may have led to a sharp increase in orange waste. Seasonal preferences also play a role—for instance, households may purchase more fruit in summer than in winter, affecting the types and quantities of food wasted. Finally, the study did not account for certain variables such as access to free food in some households, which could significantly influence waste behavior. This is an important factor to consider in future research.

One of the main limitations in assessing the economic factor as the primary motivator for consumers was the omission of household socioeconomic status. This variable could significantly influence the results—for example, higher-income households may purchase more expensive fruits, thereby generating greater economic waste when these items are discarded. For future research, it is recommended to include economic status as an additional variable. This suggestion is based on the survey analysis, which indicates that in countries with more stable economies, consumers may be more inclined to prioritize environmental or social concerns over economic ones. In such contexts, social awareness could serve as a more effective motivational strategy than financial savings. In summary, the most significant limitations of this study were the small number of participants, the short duration of the measurements and interventions, and the omission of key variables that may have distorted the findings.

5. Practical Applications: The results obtained in this study, although preliminary, allow for the identification of several relevant practical applications for designing strategies to reduce household food waste.

5.1. Application of Accounting and Administrative Tools in the Household: Evidence suggests that incorporating basic principles of domestic accounting and management—such as purchase tracking, inventory control, and weekly planning—can significantly contribute to reducing unintentional food waste. These tools, when adapted to accessible and visual formats, enable consumers to identify inefficient consumption patterns, anticipate expiration dates, and optimize the use of available resources.

5.2. Food Education Focused on Habits Rather Than Preferences: The study confirms that the most effective strategies are not those aimed at changing food preferences (e.g., consuming peels or stems), but those that target habits related to storage, preservation, and planning. Educational guides should therefore focus on: proper interpretation of expiration dates, conservation techniques, leftover reuse, menu planning, regular inspection of refrigerators and pantries, and learning to estimate realistic portion sizes.

5.3. Design of Targeted Interventions Based on Household Type: Results show that single-person households tend to generate higher levels of waste, possibly due to lack of cross-checking, lower food turnover, and over-purchasing. This suggests the need to design differentiated interventions based on household type, considering variables such as number of members, purchasing habits, and access to storage infrastructure.

5.4. Consideration of Contextual and Seasonal Factors: The case of orange waste in households with homegrown produce highlights how uncontrolled external factors—such as

seasonality or free food availability—can distort waste patterns. For example, fruit obtained from a relative's tree or shared by a neighbor. Therefore, intervention strategies should: incorporate seasonal factors and surplus utilization guides, promote exchange, donation, or transformation of products at risk of being discarded.

5.5. Potential for State-Level Intervention: Although limited in scale, the results reveal the potential to scale these strategies to the state level, integrating them into: municipal programs for responsible consumption, food education campaigns in schools, public policies for loss and waste reduction, and food donation or exchange management. Example: a fruit exchange program among households with fruit trees to avoid waste due to fatigue from consuming the same fruit repeatedly.

5.6. Campaigns Focused on the Most Impactful Factor According to Society Type: Most food waste prevention recommendations emphasize environmental concerns—such as pollution, overuse of natural resources (water, energy, soil), and greenhouse gas emissions. However, it is recommended that future campaigns focus more on the economic loss experienced by households, rather than on social empathy or environmental impact. This approach aims to highlight a factor that directly affects consumers and can be measured—e.g., calculating how many fruits were discarded in a month and their cost. Unlike other factors, such as environmental impact, which are harder to quantify directly. It is also recommended to survey which factors are most relevant to each type of society. For instance, a country with a more stable economy may prioritize social concerns, whereas one with a weaker economy may prioritize financial considerations.

6. Recommendations for Future Research: The results and limitations identified in this study allow for a series of recommendations aimed at strengthening future research in the field of household food waste reduction. These suggestions seek to improve both the internal and external validity of studies, broaden their scope, and deepen the understanding of causal mechanisms behind the phenomenon.

6.1 Expansion of Sample Size and Study Duration: It is recommended to drastically increase the number of participating households, including those involved in surveys, initial direct measurements, and guide implementation. Ideally, future studies should include over 100 households and diversify household types—such as single-person households, childless couples, families with children and pets, and older adults living alone or with others. Additionally, extending the study duration to at least one year is advised to gather a larger volume of data and better account for seasonal factors.

6.2. Incorporation of More Precise Measurement Tools: To enhance data quality, the use of instruments such as digital scales, photographic records, personalized expiration labels, and inventory control matrices is proposed. These tools would enable more rigorous quantification of waste and facilitate comparative analysis across households.

6.3. Experimental Design with Control Group: It is suggested to implement a design that includes both a control group and an experimental group, with differentiated application of the intervention guide. This would allow for a more accurate evaluation of the impact of accounting and administrative education on food consumption and preservation habits.

6.4. Analysis of Seasonality and Contextual Events: Future research should incorporate specific festive dates—such as Christmas or New Year's—that may increase food waste. It should also consider periods when consumption patterns shift due to harvest seasons, which can affect the waste of certain products. In this study, for example, orange waste increased significantly

during peak harvest periods. Seasonal preferences also influence waste patterns, such as increased fruit consumption in summer compared to winter.

6.5. Evaluation of Economic and Environmental Impact: Future studies could include economic indicators (e.g., avoided costs, potential savings) and environmental metrics (e.g., carbon or water footprint of waste) to better assess the impact of food waste. This would strengthen the case for public policies and educational programs aimed at waste reduction.

5. CONCLUSION

Despite multiple limitations, this study provides highly relevant insights. In particular, it allowed for the identification of concrete patterns that lead to food waste in domestic contexts, distinguishing between voluntary and involuntary waste, and focusing on the latter due to its greater potential for intervention. This was achieved through the application of a guide based on accounting, administrative, and educational tools. As a result, a significant reduction in both the volume and economic value of waste was observed in the participating household, suggesting that planning, inventory control, and education on food preservation are viable strategies to mitigate the problem. Furthermore, the study concludes that the economic factor is a much more effective motivator for consumers to reduce waste—surpassing social empathy or environmental concern—and that education supported by administrative and accounting principles proves useful in addressing household food waste. Additionally, important findings emerged, such as the fact that Argentine consumers appear to have a much deeper misunderstanding of expiration labeling than previously assumed, and that national labeling policies are considerably more confusing than those in countries like the United States. Nevertheless, the validity of the results is limited by the small sample size, the short duration of the study, and the contextual variability of the participating households. In particular, external factors such as homegrown food production (e.g., fruit trees) and personal preferences may distort the data if not properly controlled. A larger and more diverse sample would help minimize the impact of such specific variables and strengthen the generalizability of the findings.

Furthermore, a negative feedback loop was identified that perpetuates food waste: poor planning leads to over-purchasing, which results in disorganization, lack of knowledge about food preservation and expiration, and ultimately involuntary discarding. This cycle, when not interrupted by educational mechanisms, repeats and becomes entrenched. Based on these findings, it is concluded that consumer education—integrated with domestic management tools—represents a promising pathway for reducing household food waste. However, further research is needed with more representative samples, robust experimental designs, and seasonal analyses to validate and extrapolate the results obtained.

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ANNEX

Diagnostic Survey – Stage 1

A. Household Composition
- How many people live in your household? (Allows segmentation by household type and calculation of waste per person)
  - 1
  - 2
  - 3
  - 4
  - More than 5
- Who usually purchases the food consumed in your household? (Identifies whether most individuals have decision-making power over purchases and, therefore, over the waste generated)
  - I do alone
  - I do together with another household member
  - Another household member (partner, relative, housemate)
  - Shared among several household members
  - External person (caregiver, assistant, regular delivery service)
- Who is usually responsible for preparing meals? (Helps identify whether most individuals prepare meals and therefore control the waste generated during food preparation)
  - I do alone
  - I do together with another household member
  - Another household member
  - Shared among several
- How many times per week do you cook at home? (Relates cooking frequency to leftover generation)
  - 0–2 times
  - 3–4 times
  - 5–6 times
  - Every day
- Do you usually eat outside the home? (Helps estimate the volume of domestic consumption)
  - Never
  - 1–2 times per week
  - 3–4 times per week
  - Almost every day
- What is your occupation? (To determine whether limited time influences waste—for example, to correlate whether workers waste more than students)
  - Student
  - Worker
  - Worker and Student
  - Retired / Pensioner
  - None

B. Purchasing and Planning Habits
- Do you plan your purchases with a list or decide in the moment? (This helps determine whether the guide should focus on planning and evaluates the level of pre-purchase organization)
  - I always use a list
  - I sometimes use a list
  - I shop without a list
- Do you buy food on impulse or because of promotions even if you don't need it? (This helps identify whether poor management/planning is a factor influencing waste and detects over-purchasing as a potential cause)
  - Yes, frequently
  - Sometimes
  - No, almost never
- Do you pay attention to expiration dates when buying products? (This helps determine whether this factor should be included in the guide and measures awareness and prevention when buying products close to expiration)
  - Always
  - Only for some products
  - Never
- Do you buy more than necessary for convenience or price? (Links economic motivations to over-purchasing)
  - Yes, for convenience
  - Yes, for price
  - No, I buy only what I need

C. Consumption and Preservation Habits
- If a product expires, what do you do? (Helps understand how consumers respond to expiration or best-before dates)
  - I consume it
  - I consume it depending on the product
  - I discard it
- Is there usually leftover food after meals? What do you do with those leftovers? (Helps identify future reuse strategies, e.g., ripe fruits for compost or desserts)
  - It is thrown away
  - It is saved for another day
  - It is repurposed into another dish
  - It is given to animals
  - It is frozen
- Do you use the freezer to preserve food? How often? (Evaluates use of preservation techniques)
  - Yes, frequently
  - Sometimes
  - I don't use it
- Do you have a routine for checking what's in the fridge or pantry? (Detects domestic inventory management and is a key factor for better administration)

- o Yes, weekly
- o Yes, every few days
- o I don't have a routine
- Which foods spoil most frequently in your home? (Helps determine what to emphasize in the guide, e.g., how to preserve fruits, by identifying critical food groups for intervention)
  - o Fruits: (banana, apple, orange, avocado, strawberry)
  - o Vegetables: (lettuce, tomato, onion, carrot, spinach, potato)
  - o Baked goods and cookies: (bread, pastries, sweet or salty cookies, biscuits)
  - o Cooked grains and cereals: (rice, pasta, polenta, cooked legumes)
  - o Meats and cold cuts: (cooked chicken, ground beef, sausages, barbecue leftovers)
  - o Dairy and desserts: (yogurt, milk, cheese, flan, refrigerated desserts)
  - o Prepared meals: (lunch boxes, deli food, pizza, empanadas, stews)
  - o Eggs: (expired eggs, shells discarded by mistake)
  - o Infusions and beverages: (tea, coffee, mate cocido, juices, plant-based milk, soda)
  - o Others: (honey, sauces, homemade preserves, forgotten frozen foods)

D. Knowledge and Perception of Waste
  - Do you know the meaning of the term "responsible consumption"? (Helps assess how well-known the issue of food waste is)
    - o Yes, clearly
    - o Yes, but not very well
    - o No, I've never heard of it
  - Do you think "expiration date" and "best before" mean the same thing? (Measures knowledge of a key variable that influences discard decisions and helps determine whether this factor significantly affects behavior, as explained in one of the theoretical framework articles used in the study)
    - o They are the same
    - o They are different
  - In your opinion, the amount of food wasted in your home is... (Helps understand consumer perception of the problem)
    - o A lot
    - o Moderate
    - o Little
    - o None
  - What do you feel emotionally when you have to throw away food? (Explores sensitivities that may trigger change and helps design more effective messages in the guide)
    - o Frustration
    - o Guilt
    - o Indifference
    - o Other (specify)
  - What do you think is the most important reason to avoid food waste? (Helps determine whether the economic factor is significant, as proposed in the hypothesis)
    - o Environmental impact
    - o Economic savings
    - o Social empathy

E. Willingness to Change and Motivation
- Would you be willing to change your habits to reduce food waste? (Measures willingness to change, key for selecting participants for the intervention)
  - o Yes, completely
  - o Yes, partially
  - o I'm not sure
  - o No
- What type of support would be most helpful to achieve this? (Informs the most appropriate format for the proposed tool)
  - o Practical guide with tips
  - o Explanatory videos
  - o In-person workshop
  - o Other (specify)
- What habits would you like to adopt to improve your relationship with food? (Identifies interests to personalize the guide)
  - o Yes, weekly
  - o Yes, every few days
  - o I don't have a routine

Guide Applied to the Participating Household:

1. Purchase and Consumption Planning

Administrative Tool: Weekly Purchase Planning

Accounting Tool: Consumption Budget by Category

Tip	Objective	Relation to Academic Fields
Plan a weekly menu	Reduce impulsive and unnecessary purchases	Enables better cost estimation and improved expense control
Use a segmented shopping list	Enhances focus on essential items	Reduces budget deviations and improves planning and purchasing management
*Estimate real portion sizes	Prevents overproduction	Optimizes resource (ingredient) usage
Buy fruits and vegetables by unit	Align purchases with actual consumption	Minimizes losses due to over-ripening or spoilage
Prioritize seasonal produce	Improve freshness and pricing	Reduces food costs and associated waste

* To easily estimate the portions one should eat, measurements such as hand size or the plate itself can be used. As a manual guide, a portion of protein should be the size of your palm, a portion of carbohydrates (like pasta or rice) the size of your fist, and for vegetables, both hands

together are used. To use the plate as a guide, it is recommended that half of it be vegetables, and the other half be equally divided between protein and carbohydrates.

2. Household Storage Management (Pantry, Refrigerator, etc.)
Administrative Tool: Domestic Stock Control
Accounting Tool: Loss Record Due to Spoilage

Tip	Objective	Relation to Academic Fields
Separate fruits that continue ripening after harvest	Prevent cross-ripening	Reduces unforeseen losses
Use transparent containers	Improve visibility	Facilitates inventory control
Label and date containers used for food storage	Prevent forgetting and expiration	Enables traceability of ingredients
Check the refrigerator every 2–3 days at minimum	Detect early spoilage	Improves stock rotation
Use absorbent paper for vegetables	Control humidity and reduce mold formation	Reduces losses due to ingredient spoilage
Learn the difference between "expiration date" and "best before"	Avoid discarding food that is still edible	Resource optimization

* The Argentine Food Code (CAA) uses the terms "expiration date" and "best before" as synonyms; however, they refer to two different situations. On one hand, the best before date does not imply that the contents of the package cannot be consumed after that date. Rather, it means the food should be checked to ensure it is in good storage condition and, even then, consumed with caution. This label refers to changes in sensory characteristics and indicates the date until which the food product is expected to retain its specific properties under appropriate storage conditions. On the other hand, the expiration date applies to microbiologically highly perishable food products that may pose a risk to human health. Therefore, it marks the last safe opportunity to consume the product in terms of hygiene and safety. Expired products cannot be sold and, certainly, should not be consumed after that date, as they may represent a serious health risk to consumers. Chapter V of the Argentine Food Code includes a variety of terms that tend to confuse rather than clarify—similar to what was found by the authors cited by Matías. Some of these confusing terms include: "consume before…", "valid until…", "validity…", "val…", "expires…", "expiration…", "exp….", "expir…", and "preferably consume before…".

3. Utilization and Reuse
Administrative Tool: Leftover Utilization
Accounting Tool: Cost Reduction through Reuse

Tip	Objective	Relation to Academic Fields
Transform ripe fruits into desserts or smoothies	Prevent discarding	Increases efficiency and effectiveness by reducing purchases of other items (e.g., desserts) while avoiding waste
Reuse stale bread in puddings, toast, or as breading	Utilize surplus	Minimizes purchases of baked goods
Use leftovers in wraps, stir-fries, or fillings	Create new meals	Reduces spending on ready-made meals
Freeze individual portions	Prevent overconsumption and overproduction	Improves stock control
Record what is discarded	Adjust future purchases	Generates efficiency indicators and improves tracking of discarded items and their causes

4. Monitoring and Evaluation

Tip	Objective	Relation to Academic Fields
Measure weekly waste in grams	Detect patterns	Facilitates comparison and identification of root causes
Estimate the cost of waste	Make economic impact visible	Enables realistic budgeting
Classify by category (fruits, baked goods...)	Identify critical areas	Improves resource allocation
Use an editable waste matrix	Systematize data	Facilitates accounting analysis