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Differentiation of food preservation methods to avoid waste

Abstract

Food waste is a problem that affects the food security of Mexican households, increases the erosion of ecological, social, and economic resources, and puts greater pressure on production systems, supply chains and consumers. Among members of society, the waste or discard of perishable products of agricultural origin, linked to intentional or unintentional human behavior and negligence, is in the last links of the food chain. The waste or discard of perishable products of agricultural origin, linked to human behavior and negligence, with or without intentionality, is located at the bottom of the food chain. It is the members of the household who waste the water-soil-energy resources used in food production. The Food and Agriculture Organization of the United Nations (FAO) estimates that 17% of total food production worldwide is wasted; of this, 61% corresponds to households, with fruits and vegetables being the most important, representing 45% of the waste.

The development of new practices associated with the reduction of food waste in households are key to the development of strategies that allow the gradual reduction of losses and contribute to the fulfillment of goal 12 of the Sustainable Development Goals (SDGs) for 2030. The proposal to group different preservation methods, based on the differentiation of fruits and vegetables by organ of consumption in the home, will promote affordable options that contribute to the reduction of waste in households, improve food security, strengthen the household economy, and reduce the ecological impact caused by irresponsible consumption.

Keywords: food, security, waste

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Michelle Angeles-Segoviano,[1] Berenice Hernández-Vázquez[2]

[1]Facultad de Estudios Superiores Cuautitlán UNAM, Mexico
[2]Universidad Juárez Autónoma de Tabasco, Mexico

Correspondence: Berenice Hernández-Vázquez, Universidad Juárez Autónoma de Tabasco, Mexico, Email berenice.hernande@cuautitlan.unam.mx

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Introduction

"When food is lost or wasted, all the resources used to produce it are also wasted, such as water, land, energy, labor and money invested".[1]

Currently, 690 million people suffer from hunger, which represents 8.9% of the world's population; if this continues, by 2030 there could be 840 million people in a situation of food insufficiency.[2] According to FAO data, 17% of the food produced in the world during 2019, ended up in the trash of families, retailers, restaurants, and other actors.[3] Of the total food wasted, the United Nations Environment Programme (UNEP) estimates that 61% of it came from households, 26% from food service and 13% from retail.[4] Fruits and vegetables are the food group with the highest losses, up to 45 % of what is produced, and they also represent the highest levels of waste with a spending of 30 % of the purchases made by consumers.[5]

With respect to this international problem, the United Nations (UN) has promulgated Goal 12 of a total of 17 SDGs for 2030, pointing out the need to "ensure sustainable consumption and production patterns".[6] It is a priority for member countries to achieve target 12.3 by 2030, which seeks to halve global food waste per capita at the retail and consumer levels and along the production and supply chain. To achieve this, there are three monitoring indicators: indicator 12.3.1, which corresponds to global food losses and waste; sub-indicator 12.3.1.a, Food Loss Index (basic products); and sub-indicator 12.3.1.b for Food Waste Index (retail and consumer).[7]

In Mexico, the National Council for the Evaluation of Social Development Policy (CONEVAL) estimates that during 2019 food waste was 20.4 million tons, equivalent to 34 % of the 2018 national production; being households where most of the food waste takes place.[8] The scarce information on the subject makes evident the lack of application of the already existing international instruments to glimpse with certainty the quantity, quality and origin of food that is lost or wasted in the different stages of the supply chain as well as in households.

Objective

This paper aims, from a review of documentary sources, to make a critique of the government strategies adopted by the Mexican government on food waste, from 2017 to the third quarter of 2022 and make visible the methods of food preservation (fruits and vegetables), as a strategy to reduce waste in households and contribute to the fulfillment of the Sustainable Development Goals for 2030.

Food waste

Each person can define food waste according to the role he or she plays in the various stages of the supply chain; there are a wide variety of actors that produce, sell, use, transform, raise awareness, and promote supplies. Starting from the definition that the Royal Spanish Academy (RAE) makes of the term "waste";[9] it refers to the residue of what cannot or is not easy to take advantage of or is left unused due to carelessness. This extensive definition raises two distinct ideas: unusable waste and careless loss; intentional or not, household food can be wasted without the negligence being disqualified or reproached by members of society.

According to the Spanish Ministry of Agriculture, Fisheries and Food's (MAPA) Panel for the quantification of food waste in households (PCDAH). The waste is broken down into two groups:

- "Unused food waste: food discarded as purchased, without having undergone any processing at home.
- Recipe waste: food discarded after having been cooked or used in some type of processing".[10]

In Mexico, the federal definition or position is provided by the Federal Consumer Protection Agency (PROFECO), which defines "food waste" based on FoodPrint; as "the decrease in the quantity or quality of food, as a result of the decisions and actions of retailers, food service providers and consumers; including half-eaten food and food left on a restaurant plate and leftover food prepared at home".[11] Also, it identifies five groups of importance with respect to food waste in Mexican households.

- Food spoilage: Occurs due to improper storage, which originates from lack of visibility, rarely used ingredients and miscalculated portions.
- Excessive preparation: When portions are cooked or served that are greater than the recommended intake. Sometimes leftover food is thrown away.
- Confusion in date labelling: Waste occurs when there is confusion in the reading of expiry or best-before date labels.
- Overbuying: Buying items for hoarding or unnecessary bargains as they do not fit into regular meal plans and expire before they can be used.
- Poor planning: Inaccurate estimates of what and how many ingredients are purchased for needed portions in the household. Unplanned meals increase the risk of food spoilage before it can be used.[11]

Mexican policy

Social policy in Mexico has different faces and nuances; when it comes to social welfare, the formula of welfarism is constantly repeated; if welfare translates into the availability of food, food supply is sought; but if the objective is to avoid food waste, it becomes an issue that is not very visible among decision-makers.

Working on the issue and unsuccessfully since 2017, the Secretary of Environment and Natural Resources (SEMARNAT) has been a pioneer in raising awareness of food waste among Mexicans. Concerned about the growing situation, its objective was to design a national strategy based on the report "Food losses and waste in Mexico" prepared by the World Bank;[12] an idea that never materialized but laid the groundwork for the secretary to make a statement in 2018 and declare that the design of new government strategies to address food loss and waste should focus on three key areas; the prevention of loss and waste, the recovery of food that can be used and the revaluation of organic waste along the supply chain, emphasizing the need for joint work between the three orders of government.[13] At the end of that same year, already in office, "the fourth transformation" (4T); created the Single Working Group (GTU) to address food loss and waste in our country; who after holding its second meeting in which the World Bank will present the strategic guidelines to address this problem,[14] did not issue any position again; it disappeared without notice and there is no record of the work done.

The National Crusade without Hunger is part of the public policies with good intentions; decreed in the Official Gazette of the Nation in 2013 and disappeared after eight years of implementation in 2022. This social assistance program aimed at reducing food deprivation and had four axes to supply seven out of ten million Mexicans who were in food poverty, the idea contemplated the use of 37% of food that was wasted in Mexico.[15] This strategy was not clear about the problem it sought to solve hunger, malnutrition, waste, access, or availability of food to the most vulnerable people. In the initial design, the Crusade did not have a precise definition of hunger or the strategy to reduce it. Despite the work conducted during five years of the previous government and three years of the 4T, the program "did not meet its objective" and the population identified as suffering from food deprivation increased by more than 12.5% in 2018; for the period 2018 - 2022 there was no reduction.[16]

Currently, the Secretary of Agriculture and Rural Development (SADER) through its agency called SEGALMEX, oversees designing objectives and executing actions to guarantee food security in Mexico. Within the 2020-2024 institutional program of Mexican Food Security (SEGALMEX), its priority objectives are diverse; however, the terms of food loss or waste are not included; nevertheless, it is aligned, and leaves seen that just like the national development plan "It will leave no one behind and will leave no one out".[17]

Clearly the work done by Mexico is not very fruitful in reducing food waste. Achieving the UN goal twelve by 2030 is almost impossible after 8 years of policies without results. The formulation of new policy strategies should develop and strengthen capacities in the short term, based on a local vision that adapts to the needs of the immediate environment. Hence the importance of "not only disseminating information among members of society", but also raising awareness and providing change-generating actors with probable solutions.

Results and discussion

Preservation methods Proposal

The role played by each member of the household is important to achieve waste reduction; not only for the food consumed, but also for the resources used to produce it. As the individual becomes aware of the overexploitation of ecosystems, their ecological footprint.[18] as well as recognizing the impact on their pocketbook, they will be able to identify viable solutions to achieve food security. Preserved and available food can sustain food consistently and over time. Whether they are roots, stems, leaves, flowers, fruits, or seeds, they can be treated for preservation. Preservation methods can be varied and differentiated according to their purpose in food: whether frozen, syrups, jams, jellies, brines and dehydrated, if the procedure is done correctly, maintaining cleanliness and hygiene, sterilizing, closing the packaging well and stored in a dry, cool, and dark place; prepared foods can last for months and even years for consumption.

According to the Secretary of Social Development (SEDESOL), the largest amount of food wasted in the home belongs to the fruit and vegetable group. In the case of vegetables, garlic, squash, pumpkin, potato, chili, tomato, nopal, cucumber, green tomato, and carrot; while in the fruit group, avocado, guava, lemon, mango, apple, melon, orange, papaya, pineapple, banana, watermelon, and grapes are among the most wasted (SEDESOL, n.d.). Preventing or delaying the activity of decomposer microorganisms most of the time is possible if preservation methods are used.

Because of the difference between the biological and cultural use of food, fruits and vegetables can be morphologically classified according to the organ of consumption (root, stem, leaf, flower, fruit, seed); their identification allows differentiating the appropriate preservation methods for their functionality in the home (Table 1).

The different preservation methods proposed in the Table above contribute to slow food spoilage by destroying or inactivating the enzymes necessary for the development of microorganisms;[19] for example, through marinade, the rotting reaction in chili, nopal, carrot, garlic, onion, cabbage, cauliflower, broccoli, squash blossom and asparagus (Table 2) is prevented or slowed down. Remaining available for up to two years with proper storage.[20]

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Table 1 Main methods of preservation in fruits and vegetables consumed in Mexico, classified by organ of consumption. Own elaboration (2022)

Morphological classification		Common name of Fruits and Vegetables	Method of preservation
ROOT	Pivoting	Carrot, radish	Dehydrated
	Tuber	Potato, sweet potato, beet, yucca	Dehydrated Marmalade
	Bulb	Onion, garlic	Brine Marinade
	Rhizome	Ginger, turmeric	Frozen Dehydrated Brine
STEAM	Modified	Asparagus, nopal	Frozen Marinade
LEAVES	Simple	Spinach, chard, cilantro, epazote, peppermint, celery	Frozen Dehydrated
	Modified	Lettuce, cabbage, artichoke	Marinade
FLOWER	Solitaire	Squash, jamaica (flower), huauzontles, agave flowers, tree blossoms	Brine Marinade Dehydrated
	Inflorescence	Broccoli, cauliflower	Marinade Frozen
FRUIT	Simple	Tomato, green tomato, chili, eggplant, avocado, melon, watermelon, cucumber, squash, orange, lemon, grapefruit, papaya, banana, mango, grape, apple, peach, strawberry, pear, tejocote, guava, pomegranate	Dehydrated Brine Marmalade Jam Jelly Frozen Liqueur
	Compounds	Pineapple, fig, green bean, blackberry	Dehydrated Marmalade Jam Jelly Frozen
SEED	Consumption in immature state.	Pea, corn, broad beans	Frozen Dehydrated

Table 2 Shelf life using different preservation methods. Own elaboration (2022)

Method of preservation	Product	Utility time	Storage
Preserved in sugar	Syrup	4 months[21] 6 months[22]	Without stacking, in a dry and cool place, in a dark place and not subjected to sudden changes in temperature. Once opened, the product should be refrigerated.[21]
	Marmalade	4 months[21]	
	Jellies	5 months[21]	
Preserved in vinegar	Marinade	2 months[21] 2 years[20] 6 months[22]	Keep refrigerated.[21] Sterilization of the final product extends the shelf life.[20]
Dehydration		1 year[23]	Pack in cellophane bags and store in a dry, cool, and dark place[24]
Preserved in salt	Brines	6 months[22]	Store in a cool, dry place. Once opened, the product should be refrigerated.[22]
Preserved in alcohol	Liqueurs	1 year[22]	Store in a dark, dry, and cool place. Once opened, the product should be refrigerated.[22]
Others	Freezing	8 to 12 months[25]	Store in freezer at les of -5°C.[25]

Conclusion

Generating quality information to correctly identify food waste in Mexico requires the design and implementation of public policies focused on the SDGs for 2030. Solving this global problem requires local work to develop capacities and skills among members of the population. Programs to support and reduce waste should be designed from a multidisciplinary, dynamic, and co-responsible concept that allows the recognition of waste, evidencing its ecological, social, and economic impact; while generating options for post-harvest management, conservation, and storage of food at home.

Avoiding food waste during production and along the supply chain can increase access to resources such as water - soil - energy in different food systems. Once food is brought to the household, preservation methods represent an option for reducing the problem,

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but also increase the availability, access, and stability of food over time, representing a way to end hunger and malnutrition for millions of people in the world.

The multidimensional investigation of social problems such as hunger will depend on how each of the issues related to it is made visible. Food waste in each of the nations and the design of strategies to reduce its growth as much as possible, should provide society with tools to recognize the consumerism and waste of goods and services, since we condemn future generations, who will struggle for increasingly scarce food.

Encouraging new research in food conservation and storage may reduce the inequality gap in some households, however; formulating new practices and replicating them among community members will serve as evidence that it is not in vain.

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Conflicts of interest

All the authors declare that there is no conflicts of interest.

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