

Cluster Analysis of Food Consumption and Food Waste Behaviors Among Romanian Consumers

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Abstract

The topic of food waste has garnered increased attention from researchers, non-governmental and policy makers and it has been named one of the main issues which has to be addressed in order to reach the sustainable development goals developed by the UN. The purpose of the present paper was to identify the existence of different consumer groups based on attitudes and behaviors relate to food waste among Romanian consumers. The study relied on quantitative data which was gathered through an online survey done among a sample of 257 Romanian consumers. The cluster analysis revealed the existence of four different consumer groups in relation to food waste: a) “food enthusiasts” who are fussy eaters, lack any planning of food shopping and have a tendency to see the consumption food as a hedonic experience; b) “food hoarders” who tend to buy food in excess and adopt pragmatic food storage strategies and see food as an indicator of wellbeing; c) “food pragmatists” who tend to buy only what they planned and are likeliest to consumer food that is still edible but is altered in aspect; and d) “home cooks/eaters” who have high cooking skills and tend to eat at home, being the category most likely to identify ways to reuse leftovers. The article ends with a discussion of the saliency of relying on behaviors rather than socio-demographic characteristics or attitudes towards food when defining consumer groups for the purpose of identifying the most effective means of reducing food waste.

Keywords: food waste, consumer clusters, food habits, food attitudes, consumer behavior.

JEL Classification: Q56

1. Introduction

Food waste is a highly complex issue which has dire effects on social, economic and environmental wellbeing to the point that it has been included among the sustainable development goals set by the UN which prioritized the reduction by half of all global food waste at both the retail and consumer levels. Before moving forward, it is important to clarify what we mean by food waste and distinguish it from food loss. Food loss refers to the food products which are discarded and not used for other purposes besides human consumption (i.e., animal feed, recycling, seeds etc.) along the supply chain but before reaching retailers and actual consumers (e.g., harvesting, slaughtering, packaging, etc.). In contrast, food waste refers to the food products which end up in landfills at the level of retailers, restaurants and other food service providers and end consumers. This could be the result of decisions to exclude certain food products because they appear unfit for sale (e.g., due to size, shape, color etc.) or to discard food products which have been left on the shelves for too long at the level of retailers or of decisions to dispose of food

leftovers or expired food products at the level of food service producers and consumers. According to recent estimates from the FDA (2021), roughly 30 to 40% of all food products in the US end up in landfills and 31% of the discarded food is generated at the level of retailers and consumers. In the European Union, it is estimated that around 50% of the food wasted is generated at the level of the consumers who contribute annually with more than 50 million tones of food waste which ends up in landfills (Food Europe, 2019). The European Commission has plans to introduce legally binding targets for food waste reduction for all of its country members by 2023 and it is currently working on developing a methodology for accurately measuring the amount of food waste produced at the level of each country. Although many recommendations have been published on what should be done in order to reduce the level of food waste at the consumer stage, there is clearly a need for further investigation into the consumer behaviors and attitudes regarding food purchasing, storage and consumption that lead to the generation of food waste for these recommendations to be effective. For example, currently in Romania, the legislation is only targeting the economic operators in agriculture and food industries and tasks them with the responsibility of diminishing food waste by educating and informing consumers about effective means of reducing the amount of food waste they produce, but includes no stipulations on the clear steps that consumers should take in order to reduce food waste in their households. According to a recent UN report, in Romania each citizen generates around 70kg of food waste each year, which places the country around the middle of the list which is topped by countries such as Greece with 142 kg per capita, Malta with 129 kg per capita and Hungary with 94 kg per capita (United Nations Environment Programme, 2021). According to the National Institute of Statistics, the existing legislation is ineffective because it targets the large retailers which account for only 7% of the food waste generated in Romania and completely overlooks the fact that 49% of the food waste is generated by consumers (Benea, 2021). In this context, the present study aims to investigate the consumer behavior and attitudes towards food that lead to the generation of food waste at the household level through the means of cluster analysis that reveals patterns in how consumers act and think. The purpose is to identify the various existent categories of consumers in relation to food waste in order to better understand what type of policy actions should be developed in order to reduce food waste in Romania.

2. Literature Review

The topic of food waste at the consumer level in Romania has only been studied by a handful of researchers. For example, Gheorghescu and Balan (2019) found that the households that were larger and had children under the age of 16 and those that had a higher disposable income were the ones responsible for the majority of the food waste. In addition, they found that people under the age of 35 who had a university education, were living in large cities and shopped at supermarkets were the ones generating the highest amount of food waste. In a study analyzing the influence of gender on food attitudes and behaviors related to food waste, Cantaragiu (2019a) established that young men are less likely to feel bad about throwing food away and that they also feel less competent at using leftover food items in other meals in order to prevent food waste. In terms of reasons for discarding food, the authors indicated the short shelf-life of food items (26%), the cooking of more food than can be consumed (21%) and excessive shopping (14%). Similarly, Iorga et al. (2017) in their ample study of Romanian consumers found that those who

waste food in excess are preponderantly male, younger than 35, living alone and with a university degree. According to Iorga et al. (2017) food waste is mostly generated because consumers are not interested in managing their food supplies efficiently, usually lack the time to properly shop and cook food and fall under the influence of advertising strategies that compel them to buy more or try out food items they do not like or are unable to consume in due time. In addition, Ghinea and Ghiuta (2018) also cited among reasons for food waste among young Romanian consumers the following: the short shelf-life of food products, the improper storage of food items, the propensity to forget the food items stored in the refrigerator and the disposal of food that is still edible but looks bad. As an overall conclusion, we can look at the findings from the study performed by Stefan et al. (2013) which determined that food waste behaviors among Romanian consumers are determined by habits related to planning and shopping for food, moral attitudes towards food and the degree of control able to be exerted by the individual over these habits.

Other studies have investigated aspects related to food waste across the entire food supply chain. In this respect, Cantaragiu (2019b) established that retailers can effectively implement food waste management strategies by relying on initiatives grounded in social entrepreneurship and detailed the four aspects that retailers should pay attention to: a) clearly defining the problem and the solution that they intend to implement; b) involving multiple stakeholders including local non-governmental organizations; c) preparing for a long-term initiative that requires perseverance and a proper allocation of resources; and d) aligning the strategy to the resources that the retailers can effectively mobilize (i.e., internal and external resources). Similarly, Dumitru and Burghiu (2019) established that retailers can effectively deal with food waste only through collaborations with local stakeholders such as non-profit organizations that collect and distribute food to those in need and recommended more support from a variety of actors (i.e., local authorities, universities, retailers, food manufacturers etc.) for the creation of local food banks. Moreover, there are a couple of studies which emphasized the fact that mobile apps could be designed and used in order to help consumers identify opportunities to reuse the food that they have bought or cooked in excess in order to diminish food waste at the household level (Ionita, 2018; Dumitru & Burghiu, 2019).

In the literature on food waste at the consumer level in Romania, there is only one other attempt at using cluster analysis in order to properly understand how different consumer groups act and think about food waste. This is the study performed by Pocol et al. (2020) in which the authors established three main clusters: a) “careless” which consists of those who throw away food (mostly women), have a low level of education and reside in rural or small urban areas; b) “precautious” which consists of those who generate a low amount of food waste (mostly men), have an average education level and reside in small town and have medium-sized families; and c) “ignorant” which consists of those who throw away food (mostly women), have a high level of education, reside in large cities and have smaller families. However, in the literature there are also studies performed in other countries which have attempted to segment consumers based on their food waste behaviors and attitudes. For example, Gaiani et al. (2018) defined seven consumer clusters (i.e., “the conscious-fussy”, “the frugal consumer”, “the exaggerating cook”, “the conscious-forgetful type”, “the confused type”, and “the exaggerated shopper”) and emphasized the fact that one of the main factors leading to differences between clusters was the attitude towards the financial aspects related to food waste. Similarly, Mallinson et al. (2016) defined five consumer clusters (i.e., “epicures”, “traditional consumers”, “casual consumers”, “food detached consumers” and “kitchen

evaders”) in an attempt to show that attitudes related to food have a clear impact on food waste behaviors. In a more recent study, Amicarelli et al. (2021) showed that awareness of food waste and a professed interest in diminishing food waste are not necessarily conducive to food-related behaviors that lead to throwing away less food. They defined three clusters: a) the “blue wasters” who are aware of the issues generated by food waste and also able to reduce the food waste they generate; b) the “red wasters” who are not interested in food waste as a social and environmental issue but nonetheless generate a low amount of food waste; and c) the “green wasters” who, in spite of being highly aware of the issue of food waste, generate a large amount of thrown away food. These findings were similar to those from the study performed by Di Talia, Simeone and Scarpato (2019) who developed three main clusters: a) “non-aware consumers” who are not interested in the issue of food waste and do not feel responsible or guilty over the food they throw away; b) “consumers unaware but not wasteful” who are not interested in food waste as an issue but due to other factors (i.e. frugality, lack of income etc.) generate a low amount of food waste; and c) “conscious consumers” who are actively trying to avoid food waste because they see this as an important issue for society and the environment. In light of these studies, it is evident that more research is necessary in order to understand the way in which food attitudes and behaviors among Romanian consumers are related to food waste and that a cluster analysis is useful for the development of better policies for addressing this issue in Romania.

3. Research Methodology

The data for the present study was gathered through an online survey completed by a convenience sample formed of 257 Romanian consumers. The survey was created using Google Forms and was disseminated through several social media platforms (i.e., Facebook, Instagram, WhatsApp), the answers being collected between June and July of 2022. The questionnaire included a section regarding socio-economic characteristics (i.e., age, gender, level of education, level of household income and marital status) which was followed by a set of 29 items related to attitudes and behaviors that impact food waste. The items were measured on a 5-point Likert scale where 1 represented strong disagreement with the statement and 5 represented strong agreement with the statement and were developed based on the review of the literature. The items were related to habits related to planning and shopping (e.g., “I tend to buy food items that are not on the shopping list.”, “I have a fixed schedule for going food shopping.”), the storage of food items (e.g., “I freeze food items to preserve them for longer periods of time.”, “I store food items in proper conditions in order to prolong their life.”), cooking (e.g., “I tend to cook more food than is consumed in the household.”, “I cook and eat at home every day.”), the usage of leftovers (e.g., “I recycle leftovers to make compost.”, “I reuse the food items to feed the animals in the household.”), and attitudes related to food waste (e.g., “Every time I throw away food, I think about the money spent.”, “I feel guilty whenever I want to throw away food.”). The data was analyzed using IBM SPSS.

4. Research Results

The 29 items included in the questionnaire regarding food-related behaviors were combined into 9 factors using principal axis factoring. Overall, the 9 extracted factors explained 62.6% of the total variance of the items and had a KMO value of 0.676 which

was deemed as an acceptable level of sampling adequacy. The details regarding the extracted factors are presented in Table 1.

Table 1. Total variance explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.683	12.700	12.700	3.142	10.835	10.835	2.008	6.926	6.926
2	3.155	10.881	23.581	2.634	9.083	19.918	1.840	6.344	13.269
3	2.476	8.538	32.118	1.923	6.633	26.550	1.739	5.997	19.266
4	2.144	7.393	39.512	1.703	5.873	32.423	1.548	5.337	24.603
5	1.508	5.201	44.713	.989	3.410	35.833	1.531	5.281	29.884
6	1.455	5.018	49.731	.924	3.185	39.018	1.396	4.813	34.697
7	1.325	4.568	54.299	.780	2.690	41.708	1.351	4.658	39.355
8	1.269	4.374	58.673	.731	2.521	44.228	1.082	3.732	43.086
9	1.134	3.912	62.585	.617	2.127	46.355	.948	3.269	46.355

In order to establish which items belonged to each of the extracted factors we used varimax with Kaiser normalization as the rotation method. The significant loading values are showcased in Table 2. Factor 1 was titled '*excessive shopping*' since it contained items such as "I tend to buy food items that are not on the shopping list" and "For holidays and special occasions, I tend to buy more food than necessary" and explained 12.7% of the total variance in the data. Factor 2 was named '*moral norms*' since it contained items such as "Every time I throw away food, I think about poor children who do not have enough to eat" and "I feel guilty whenever I want to throw away food" and explained 10.8% of the total variance. Factor 3 was named '*pragmatic food storage/usage*' since it loaded on items such as "I store food items in proper conditions in order to prolong their life" and "I tend to keep food until it is not edible anymore in the hope that I will eat it". Factor 4 was termed '*fussy eating*' because it loaded most heavily on items such as "I prefer to eat out even though there is cooked food in the fridge" and "I throw away food even if it

is edible, if I know that I am not going to eat it". Factor 5 was titled '*food as necessity*' and it contained items such as "I have a fixed schedule for going food shopping (e.g., once a week)" and "I think that an abundant food offering is a sign of social status". Factor 6 was named '*consumption of altered, but edible food*' since it loaded on items such as "I buy food products even though they have visual defects as long as they are edible" and "I consume food items after the expiration date if they look good". Factor 7 was termed '*cooking skills*' and was related to items such as "I have the ability to use the food items at my disposal to improvise a recipe" and "I cook and eat at home every day". Factor 8 was titled '*repurpose of leftovers*' and contained two items: "I reuse the food items to feed the animals in the household" and "I recycle leftovers to make compost". Finally, Factor 9 was named '*absence of planning*' and contained two items: "I tend to buy food products with longer expiration dates" and "In general, I do not buy food items for a particular recipe".

Table 2. Rotated factor matrix

	Factor								
	1	2	3	4	5	6	7	8	9
I tend to buy food items that are not on the shopping list.	.404								
I have a fixed schedule for going food shopping.					.653				
I buy food products even though they have visual defects as long as they are edible.						.693			
I tend to buy food products with longer expiration dates.									-.523
In general, I do not buy food items for a particular recipe.									.440
I tend to buy more food than I need to make provisions for unexpected events.	.523								
When I am hungry, I tend to buy more food.	.571								
For holidays and special occasions, I	.775								

tend to buy more food than necessary.									
I think that an abundant food offering is a sign of social status.									
I like to buy new food items to try them out.								.411	
I consume food items after the expiration date if they look good.								.411	
I freeze food items to preserve them for longer periods of time.				.423					
I store food items in proper conditions in order to prolong their life.				.624					
I tend to cook more food than is consumed in the household.									
I have the ability to use the food items at my disposal to improvise a recipe.								.655	
I cook and eat at home every day.								.507	
I reuse the food items left from the previous day.									
I prefer to eat out even though there is cooked food in the fridge.					.635				
I reuse the food items to feed the									.577

animals in the household.									
I recycle leftovers to make compost.								.476	
I throw away food even if it is edible, if I know that I am not going to eat it.					-.541				
I tend to keep food until it is not edible anymore in the hope that I will eat it.				.638					
I throw away food at the first signs of alteration.							.545		
I donate the food that I cannot eat to poor families.									
I think I throw away more food than the rest of people.					.525				
I feel guilty whenever I want to throw away food.		.609							
Every time I throw away food, I think about the money spent.				.533					
Every time I throw away food, I think about poor children who do not have enough to eat.		.854							
I associate a higher amount of food wasted with a food crisis.		.618							

All of the nine factors were included in the cluster analysis, but Factor 2 had to be excluded from the analysis due to low variability. The analysis revealed the existence of four main clusters and were described based on the comparison of their scores for each

of the eight factors done using one-way ANOVA with post-hoc testing using Tukey honestly significant differences of Games-Howell depending on appropriateness. The description of the clusters is shown in Table 3.

Table 3. Categorization of clusters based on comparison of means for the eight extracted factors

Component/Factor	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Excessive food shopping	Medium	High	Low	Medium
Pragmatic food storage/usage	Low	High	Medium	Medium
Fussy eating	High	Low	High	Medium
Food as necessity	High	Medium	Low	Low
Consumption of altered, but edible food	Medium	Medium	High	Low
Cooking skills	Medium	Low	Medium	High
Repurpose of leftovers	Low	High	Low	Medium
Absence of planning	High	High	Medium	Low

The first cluster was named ‘Food enthusiasts’ since it received the highest score for fussy eating habits, absence of planning when shopping for food items, but also for food as necessity. This cluster represented 34.2% of the sample and was the only cluster where the percentage of female respondents (46%) was lower than that of male respondents. These respondents were characterized by a medium level of cooking skills and a low propensity towards finding effective ways to repurpose leftovers.

Cluster 2 was titled ‘Food hoarders’ because it received high scores for factors such as excessive food shopping, pragmatic food storage/usage, repurpose of leftovers and absence of planning. This cluster included 17.1% of the sample and was mostly represented by female respondents (58%). It is also interesting to note that this cluster received the lowest score for fussy eating which indicates that they tend to prioritize eating the food items that have already been purchased/cooked instead of preferring to allow themselves to indulge in momentary whims regarding food preferences.

Cluster 3 was titled ‘Food pragmatists’ because it had the lowest score for excessive food shopping and the highest score for consumption of altered, but edible food. This cluster included 25.5% of the sample and it was almost equally divided between female and male respondents. These respondents were less interested in food as a necessity and had developed only moderate cooking level skills which could explain their low ability to repurpose leftovers.

Cluster 4 was titled ‘Home cooker/eaters’ because it had the lowest score for absence of planning as well as the highest score for cooking skills. The cluster included 23.2% of the sample and was mostly represented by female respondents (58%). These respondents were not excessive shoppers and were also able to effectively repurpose their leftovers in order to reduce food waste.

5. Discussion

The purpose of this study was to investigate the possibility of clustering Romanian consumers based on their attitudes and behaviors related to food waste. The cluster analysis revealed the existence of four clusters namely “food enthusiasts”, “food hoarders”, “food pragmatists” and “home cooker/eaters” which were defined based on the differences in relation to various behaviors related to the purchase, storage, preparation of food and disposal of leftovers. What is immediately apparent from the analysis is the fact that the factor measuring moral norms, i.e., attitudes and perceptions related to food waste was excluded from the definition of the clusters due to the low variability. Thus, based on the findings of the study it was established that attitudes about food waste were not salient for defining the different consumer groups which sets the study apart from previous studies such as those from Amicarelli et al. (2021) or Di Talia et al. (2019). This result, couple with the fact that previous studies have shown that attitudes are decoupled from actual behaviors that generate food waste could indicate the fact that it is more relevant to look at the actual consumer behaviors in relation to food waste rather than on what the consumers believe and say about food waste as a social and environmental issue for the development of proper policies and awareness campaigns aimed at reducing food waste at the consumer level.

The clusters which were obtained are quite similar to the clusters identified by previous studies. The “food enthusiasts” are similar to the “epicures” identified by Mallinson et al. (2016) because they are mostly defined by a high level of curiosity and a desire to experiment with different types of foods but in the absence of proper cooking skills which often generates a high amount of thrown away food. Similarly, the “food hoarders” are similar to the “exaggerated shoppers” identified by Gaiani et al. (2018) because they share a propensity to buying food in excess and consider that having an abundance of food is a sign of wealth which explains why they are not concerned with properly disposing of their leftovers or with properly recycling food that they no longer desire to consume. The category of “food pragmatists” is similar to the category of “red wasters” identified by Amicarelli et al. (2021) since they share a low propensity to generate food waste not as a result of adhering to the belief that food waste is a social and environmental issue that needs to be addressed but as a result of their low interest in food consumption and their interest in adhering to a strict plan in what regards food acquisition and consumption. Finally, the “home cooks/eaters” are similar to the “traditional consumers” identified by Mallinson et al. (2016) because they tend to cook and eat at home, are trying to stick with scheduled purchases of food items and have a high level of cooking skills which results in less leftovers and less food waste. It is also interesting to note that male respondents were more likely to be included among “food enthusiasts”, but that overall gender was not found to be a determinant of cluster inclusion. Similarly, the other socio-demographic variables included in the study did not prove relevant for defining the clusters which indicates that instead of attempting to profile consumers based on age, gender or other personal characteristics, it is more useful to investigate their actual behaviors in relation to food in order to understand food waste. This conclusion is supported by the findings from Pocol et al. (2020) who found that neither the education received during childhood nor the level of education or income had a bearing on the development of proper habits for preventing food waste.

6. Conclusion

The study showed the existence of four different clusters in relation to food waste behaviors among Romanian consumers. The results indicated that raising the level of awareness about food waste as a social and environmental issue might not be sufficient as a measure for dealing with the high amount of food which is thrown each year in Romania. Instead, the results led to the conclusion that initiatives aimed at diminishing food waste have to tackle the issues related with the inability of a large percentage of consumers to plan and shop of food items in an effective manner and to properly store and use the food items purchased before they expire. Thus, more interest from public authorities has to be shown in the area of educating the Romanian public about the ways in which meals can be planned in advance in order to avoid wasting food as well as the proper ways of storing food items in order to prolong their life and ways in which food leftovers can be repurposed in order to prevent them from reaching landfills. In addition, although initiatives at retailer level are seen ineffective by most specialists, it is evident that ensuring that consumers have the ability to buy the food items in the quantities that they desire and spreading awareness about the existing opportunities for dealing with excess food can lead to a decrease in the amount of food waste at the consumer level. Finally, it is evident that campaigns aimed at reducing food waste have to be targeted to specific consumer groups and that different messages and interventions would be required in order to help the different consumer segments to reduce the amount of food they throw away. For example, emphasizing the possibility of tasting before buying for food enthusiasts might be an effective measure for dealing with the situation where these consumers buy food that they find novel only to find out that they do not like the taste and throw it away. In contrast, for food hoarders, emphasizing the utility of a shopping list and proper meal planning might diminish the need to acquire food in excess. Overall, it is evident that food waste has to be translated into an individual responsibility and that the proper setting has to be created for all consumer groups to be able to take effective measures for diminishing the amount of food thrown away without expecting them to change their relation to food.

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