# Determination of the factors affecting the amount of food waste generated from households in Turkey

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This study aims to put forward and discuss the analysis results of various factors on the creation of food waste from households. An online survey application was used, and 1,488 individuals participated in the study. Of the participants, 32.9% stated that they produce 0-1 kg of food waste. The main reasons for food waste were found to be mouldy food, food left in the refrigerator for too long and the date expiration of food. There was a significant negative association between the amount of food waste in households and age, living place, control of refrigerator/storage cabinet, preparation of a shopping list, and the determination of time for food to be cooked and the frequency of preparing meals with fresh foods. On the other hand, there was a significant positive association between the amount of food waste in households and household average food consumption per week, the number of women living at home, frequency of food shopping, buying food that is not needed when shopping, frequency of noticing that you forgot to use food once you used it and stored in the refrigerator/storage cabinet, frequency of ordering food at home, frequency of food preparation with prepared food products, and frequency of thinking that portion size of the dish was large when cooking or serving a meal. Also, it has been found that there is a significant relationship between the amount of food waste and one's profession, shopping place, and the feeling of guilt when throwing food away (p<0.05). Based on the study results, to prevent waste generation behaviours of individuals, effective initiatives should be carried out through awareness campaigns in various areas.

## 1. Introduction

Food loss and waste are critical sustainability issues that should be handled due to the economic, environmental and social impacts. Food losses are associated with the decrease in the amount of edible food during production, post-harvest and processing stages. In contrast, food wastes refer to the foods which are lost at the retailer and consumer level (Parfitt *et al.,* 2010). According to a report by the United Nations Environment Programme (UNEP) and the World Resources Institute (WRI), one-third of the foods produced around the world is wasted or discarded on an annual

basis, half of which is generated at the household level (especially in developed countries) (Jorissen *et al.,* 2015).

The amount of food waste generated by households is estimated to be more than 50.0% of the total food waste in Europe (Kummu *et al.,* 2012), and up to 60.0% of the total food waste occurs in the USA (Griffin *et al.,* 2009). Researches in England have revealed that the amount of food and drink wasted at the household level is approximately 22.0% of all foods and drinks

purchased (330 kg per household annually). More so, 65.0% of such wastes (215 kg per household annually) are edible before they discarded (WRAP, 2009).

Households represent the last point of the profit-driven food supply chain and a complex structure of food management behaviours (Stancu *et al.,* 2016). A better understanding of such behaviours can be used to maximise food-management efficiency in households and to minimise food wastes. Previous studies on the factors affecting food waste in households emphasise that the generation of food waste is a complex issue affected by many factors such as sociodemographic features (age, gender, income, household size, etc.), shopping behaviours, poor cooking skills, packaging failures, medical misunderstandings to waste foods, and cultural differences (Aschemann-Witzel *et al.,* 2015; Evans, 2012; Koivupuro *et al.,* 2012; Monier *et al.,* 2010; Sharp *et al.,* 2010; Stancu et al, 2016; Stefan *et al.,* 2013).

Sociodemographic factors are among the key factors affecting the generation of food waste from households. While research shows that women generate more food waste than men, there are also some studies showing that men generate more food waste (Barr, 2007; Koivupuro *et al.,* 2012; Secondi *et al.,* 2015; Visschers *et al.,* 2016). Age is considered an important factor in the generation of food waste, and it is suggested that young people tend to generate more waste (Quested *et al.,* 2013; Visschers *et al.,* 2016). Household size and type are pointed out as another critical factor in the generation of food waste (Koivupuro *et al.,* 2012; Parizeau *et al.,* 2015; Tucker & Farrelly, 2016; Visschers *et al.,* 2016). It has been observed that bigger households with children generate more food waste while the amount of food waste per person is higher in smaller households. There are some inconsistencies between results showing the impact of household income and residential area on the generation of food waste (Ganglbauer *et al.,* 2013; Jorissen *et al.,* 2015; Koivupuro *et al.,* 2012; Mattar *et al.,* 2018; Neff *et al.,* 2015; Secondi *et al.,* 2015). While an enhanced level of education is correlated with a reduced generation of food waste (Abdelradi, 2018; Qi & Roe, 2016), research has also suggested that people with a lower level of education might generate less food waste (Monier *et al.,* 2010; Secondi *et al.,* 2015). It has been suggested that occupation is also among the factors affecting food waste generation (Mattar *et al.,* 2018;

Qi & Roe, 2016).

The planning and creation of a shopping list are useful in the minimisation of food waste at the household level (Sharp *et al.,* 2010; Stefan *et al.,* 2013). Moreover, it is known that people who fall under the influence of special offers while shopping, generate more food waste (Mattar *et al.,* 2018), and that the foods which are purchased, placed in the refrigerator and forgotten also lead to food waste (Graham- Rowe *et al.,* 2014, Koivupuro *et al.,* 2012; Ponis *et al.,* 2017). The frequency of shopping also affects the amount of food waste. Jorissen et al. (2015) have found that food waste decreases as the frequency of shopping increases in Germany, but not in Italy. It has been established that there is a direct proportion between the weekly cost of food shopping and the amount of food waste (Gaiani *et al.,* 2018). Furthermore; it is considered that foods with bigger package sizes are associated with higher amounts of food waste (Williams *et al.,* 2012).

Williams et al. (2012) observed that approximately 40.0% of food waste from households in England is generated because more meals are cooked, prepared and served than are consumable. Lyndhurst et al. (2007) determined that behaviours such as poor cooking plans, changes in cooking plans, lack of desire to eat leftovers and not knowing what to do with them also lead to the generation of food waste by households.

The growing number of individuals who are concerned or feel guilty about food waste shows an intention to minimise such wastes, which is relevant for the minimisation of food waste (Mondejar- Jimenez *et al.,* 2016; Neff *et al.,* 2015; Principato *et al.,* 2015; Stancu *et al.,* 2016; Stefan *et al.,* 2013; Qi & Roe, 2016; Quested *et al.,* 2013).

It is observed that various sociodemographic, behaviour, and attitude factors are effective in the generation of food wastes, which have unfavourable economic, environmental, and social impacts at the household level. This study aims to establish the factors affecting the generation of food waste at the household level in Turkey and to provide preventive solutions.

## 2. Material and methods

### 2.1. Participants and data collection

The research was conducted between November-December 2018. In consequence of the study, 1,564 individuals living in the country were reached. Individuals who failed to indicate the average monthly amount of food waste, an explanation, the types of raw and cooked foods discarded most frequently, and those who provided imperfect sociodemographic information, were excluded from the study during analysis. The analyses were conducted with 1,488 individuals. The survey form of the research was sent to people through the researcher's social media accounts. The study was conducted voluntarily, and the participants were not provided with an incentive to participate in the study.

## 2.2. Questionnaire development

The questionnaire was developed upon assessment of similar studies found in literature (Aschemann-Witzel *et al.,* 2017a; Aschemann-Witzel *et al.,* 2017b; Gaiani *et al.,* 2018; Janssen *et al.,* 2017; Mallinson *et al.,* 2016; Ponis *et al.,* 2017; Szabó-Bódi *et al.,* 2018) and sent to participants. Each questionnaire was comprised of four sections:

### 2.2.1. Section #1: Sociodemographic features

This section included multiple-choice questions inquiring on the participants' age, gender, level of education, occupation, marital status, average monthly household income and average weekly household food expenditure. Open-ended questions asked about the residential area and those living in the household, including, number of individuals, children aged 6-11, and women.

### 2.2.2. Section #2: Features and behaviours for food shopping

Participants were given multiple-choice questions about the person who plans and performs the food shopping in their homes, the frequency of food shopping (once a month, once a week, twice a week, every day etc.), where food shopping is generally performed, the means of food shopping, pre-food shopping processes (checking the refrigerator/store cupboard, creating a shopping list), points paid attention to while purchasing food, and tendencies to purchase any unnecessary products or fall under the influence of special offers.

### 2.2.3. Section #3: Features and behaviours for preparing and consuming food at home

Multiple-choice questions were asked to the participants regarding whether they like spending time in the kitchen preparing/cooking meals, evaluation of their cooking skills, the time of determination of the food to be cooked at home, the frequency of take-home foods (never, 1-2 times a week, 3-4 times a week etc.), the frequency of preparing meals with fresh foods and trying new recipes in the kitchen (always, very often, sometimes etc.), consideration of the serving size as large while cooking and serving any meal, the frequency of cooking, ordering a meal, eating any previously-cooked meal and enjoying meals with friends/guests at home in a week (never, 1-2 times a week, 3-4 times a week etc.).

### 2.2.4. Section #4: Information, attitudes and behaviours for food waste

Questions were asked about the raw and cooked foods discarded most frequently, reasons thereof, estimated monthly average of food waste amount, feeling of guilt for wasted foods, suggestions to minimise food waste, and level of awareness and willingness on the initiatives intending to minimise the food waste. While the questions regarding the raw and cooked foods discarded most frequently were open-ended, all others were multiple choice.

## 2.3. Data analyses

The factors that potentially affect the amount of food waste were used variably in the study. These factors included sociodemographic features such as age, income and residential area, shopping features (frequency and points of shopping), features for cooking and consuming meals (frequency of cooking at home, cooking skills) and feeling of guilt for discarding foods.

SPSS 20 software was employed for statistical analysis of the data obtained in the study. Categoric data were presented in figure-percentage. A Multiple Response Set was created while assessing the questions with multiple responses. Chi-square test and Fisher's exact test were used to compare the classified data. Pearson correlation analysis was conducted to assess the relations between the variables. The results were assessed

in a confidence interval of 95%, and a significance level of p<0.05.

## 3. Result

Information on the sociodemographic characteristics of the participants shown in Table 1.

More than half of the participants reported "Myself" as the person who food shops (62.1%) and plans food shopping (53.4%). The frequency of food shopping was reported as "two times a week" on a maximum

**Table 1.** Socio-demographic features of the participants

|  | n | % |
|---|---|---|
| **Age** |  |  |
| Aged 19-30 | **796** | **53.5** |
| Aged 31-40 | 537 | 36.1 |
| Aged 41-50 | 123 | 8.3 |
| Aged 51 and above | 32 | 2.1 |
| **Gender** |  |  |
| Women | **1408** | **94.6** |
| Men | 80 | 5.4 |
| **Level of education** |  |  |
| Literate | 4 | 0.3 |
| Secondary school-primary school graduate | 19 | 1.3 |
| High school graduate | 151 | 10.1 |
| Collage-university graduate | **990** | **66.5** |
| Post-graduate | **324** | **21.8** |
| **Occupation** |  |  |
| Housewife | 265 | 17.8 |
| Government officer | **485** | **32.6** |
| Worker | 21 | 1.4 |
| Self-employed | 82 | 5.5 |
| Unemployed | 91 | 6.1 |
| Retired | 18 | 1.2 |
| Private Sector | 288 | 19.4 |
| Student | 146 | 9.8 |
| Academician | 92 | 6.2 |
| **Marital Status** |  |  |
| Married | **1047** | **70.4** |
| Single | 441 | 29.6 |
| **Average monthly household income** |  |  |
| TRY 500.00 and below ($ 90.0) and below | 101 | 6.8 |
| TRY 500.00-TRY 1,000.00 ($ 91.00 - $ 180.00) | 40 | 2.7 |
| TRY 1,000.00 – TRY 1,500.00 ($ 181.00 - $ 270.00) | 40 | 2.7 |
| TRY 1,500.00 – TRY 2,000.00 ($ 271.00 - $ 360.00) | 97 | 6.5 |
| TRY 2,000.00 – TRY 3,000.00 ($ 361.00 – $ 540.00) | 182 | 12.2 |
| TRY 3,000.00 – TRY 4,000.00 ($ 541.00 - $ 720.00) | 245 | 16.5 |
| TRY 4,000.00 – TRY 5,000.00 ($ 721.00 - $ 900.00) | 219 | 14.7 |
| TRY 5,000.00 and above ($ 901.00 and above) | **564** | **37.9** |
| **Average weekly household food expenditure** |  |  |

**Continue Table 1.** Socio-demographic features of the participants

| Average weekly household food expenditure | | |
|---|---|---|
| Below TRY 50.00 (below $ 9.00) | 48 | 3.2 |
| TRY 50.00 – TRY 100.00 ($ 9.00 - $ 18.00) | 315 | 21.2 |
| TRY 100.00 – TRY 200.00 ($ 19.00 - $ 36.00) | **502** | **33.7** |
| TRY 200.00 – TRY 300.00 ($ 37.00 - $54.00) | 353 | 23.7 |
| TRY 300.00 and above ($ 55.00 and above) | 227 | 15.3 |
| Unknown | 43 | 2.9 |
| **Number of individuals living in the household** | | |
| 1 | 94 | 6.3 |
| 2 | 372 | 25.0 |
| 3 | **519** | **34.9** |
| 4 | 359 | 24.1 |
| 5 and above | 144 | 9.7 |
| **Number of children aged 6-11 living in the household** | | |
| 0 | **1237** | **83.1** |
| 1 | 202 | 9.9 |
| 2 and above | 49 | 3.0 |
| **Number of women living in the household** | | |
| 0 | 6 | 0.4 |
| 1 | **1049** | **70.5** |
| 2 | 305 | 20.5 |
| 3 and above | 128 | 8.6 |
| **Residential area** | | |
| Metropolitan | **1130** | **75.9** |
| City | 285 | 19.2 |
| Town | 57 | 3.8 |
| Village | 16 | 1.1 |

basis (33.9%). The frequent points of shopping were shown to be "supermarkets" (41.7%) and "markets" (37.0%), and 53.6% of them do so by "motor vehicles (car, motorcycle, taxi)". Before going for food shopping 49.5% of them "always" check the refrigerator/store cupboard, 34.2% of them "always" create a shopping list, while 33.1% of them "sometimes" forget the foods they have purchased in the refrigerator/storage cupboard (Table 2).

The participants' main consideration points while purchasing foods are as follows; whether the product meets the "price-quality balance", "high-quality" and "label info". A great majority of the participants (82.9%) check the "expiration date" of the product while food shopping. The ones who "sometimes" purchase any unnecessary products during shopping correspond to 48.7% of the participants, and 86.2% of the

participants fall under the influence of special offers (discounts, multiple packages) during shopping (Table 2).

More than half of the participants (59.2%) have indicated that they like spending time in the kitchen preparing/cooking meals, and 57.9% of them have indicated that their meal preparation/cooking skills are "good". In comparison, 56.7% of them have indicated that they determine what food will be cooked "on the day of cooking". Of the participants, 59.9% indicated that they "quite often" prepare meals with fresh foods while 40.7% of them indicated that they "rarely" prepare meals with take-home foods (canned, frozen foods). 55.9% of the participants have indicated that they "sometimes" try new recipes in the kitchen, while 46.2% of them have indicated that they "sometimes" consider the serving size as large while cooking or

serving any meal. 46.6% of the participants cook meals "5-7 times" a week, 56.1% of them "never" order any meal to their homes. Overall, 62.8% of them report-ed eating any previously-cooked meal "1-2 times" a week, and 54.7% of them enjoy their meals with their friends/guests "1-2 times" a week (Table 3).

**Table 2.** Information to food shopping

|  | n | % |
| --- | --- | --- |
| **The person planning the food shopping** * | | |
| Myself | 1328 | 62.1 |
| My wife/husband | 491 | 23.0 |
| Family Elders | 294 | 13.8 |
| Brother/Sister | 15 | 0.7 |
| Other (Assistant, etc.) | 7 | 0.3 |
| Children | 2 | 0.1 |
| **The person going to food shopping** * | | |
| Myself | 1277 | 53.4 |
| My wife/husband | 783 | 32.8 |
| Family Elders | 297 | 12.4 |
| Brother/Sister | 21 | 0.9 |
| Other (Assistant, etc.) | 10 | 0.4 |
| Children | 2 | 0.1 |
| **Frequency of food shopping** | | |
| Everyday | 99 | 6.7 |
| Every other day | 286 | 19.2 |
| Twice a week | 505 | 33.9 |
| Once a week | 433 | 29.1 |
| Biweekly | 112 | 7.5 |
| Once in a month | 53 | 3.6 |
| **Place of food shopping** | | |
| Supermarkets | 621 | 41.7 |
| Markets | 550 | 37.0 |
| Small shops (bakery, butcher, etc.) | 124 | 8.3 |
| Bazaar | 114 | 7.7 |
| Direct from the manufacturer | 56 | 3.8 |
| Online | 19 | 1.2 |
| Wholesale markets | 4 | 0.3 |

## Continue Table 2. Information to food shopping

|  | n | % |
|---|---|---|
| **The way to go food shopping** | | |
| Motor vehicles (car, motorcycle, taxi) | 797 | 53.6 |
| On foot | 639 | 42.9 |
| Public transport | 33 | 2.2 |
| Home delivery (Online) | 10 | 0.7 |
| Bicycle | 9 | 0.6 |
| **Checking the refrigerator / store cupboard before food shopping** | | |
| Always | 737 | 49.5 |
| Very often | 481 | 32.3 |
| Sometimes | 222 | 14.9 |
| Rarely | 39 | 2.6 |
| Never | 9 | 0.7 |
| **Creating a shopping / needs list before food shopping** | | |
| Always | 509 | 34.2 |
| Very often | 421 | 28.3 |
| Sometimes | 370 | 24.9 |
| Rarely | 122 | 8.2 |
| Never | 66 | 4.4 |
| **Forgetting purchased food in the refrigerator / store cupboard** | | |
| Always | 31 | 2.1 |
| Very often | 133 | 8.9 |
| Sometimes | 493 | 33.1 |
| Rarely | 731 | 49.1 |
| Never | 100 | 6.7 |
| **Main points considered when buying food \*** | | |
| Meeting the price-quality balance | 1212 | 25.5 |
| Being high-quality | 864 | 18.1 |
| Label info | 746 | 15.7 |
| Being organic | 705 | 14.8 |
| Being cheap | 591 | 12.4 |
| Being an ordinary product | 395 | 8.3 |
| Packaging feature | 178 | 3.7 |
| Having new features | 43 | 0.9 |

**Continue Table 2.** Information to food shopping

|  | n | % |
|---|---|---|
| Being domestic production | 13 | 0.3 |
| Not close to the expiration date | 8 | 0.2 |
| Being expensive | 4 | 0.1 |
| Having halal certificate | 2 | 0.05 |
| **Checking the expiration date when food shopping** | | |
| Yes | 1233 | 82.9 |
| Sometimes | 244 | 16.4 |
| No | 11 | 0.7 |
| **Buying the unnecessary product while food shopping** | | |
| Always | 20 | 1,3 |
| Very often | 133 | 8,9 |
| Sometimes | 724 | 48,7 |
| Rarely | 547 | 36,8 |
| Never | 64 | 4,3 |
| **Special offers positive affect purchasing status when food shopping** | | |
| Yes | 557 | 37.4 |
| Sometimes | 725 | 48.8 |
| No | 206 | 13.8 |

*Multiple responses were provided.

**Table 3.** Respondents' answers on meal preparation and cooking at home

|  | n | % |
|---|---|---|
| **Liking spending time in the kitchen preparing/cooking meals** | | |
| Yes, I like | 881 | 59.2 |
| Sometimes I like | 440 | 29.6 |
| No, I do not like | 167 | 11.2 |
| **The skill to meal preparation/cooking** | | |
| Very bad | 7 | 0.6 |
| Bad | 17 | 1.1 |
| Middle | 411 | 27.6 |

**Continue Table 3.** Respondents' answers on meal preparation and cooking at home

|  | n | % |
|---|---|---|
| Bad | 17 | 1.1 |
| Middle | 411 | 27.6 |
| Good | 862 | 57.9 |
| Excellent | 191 | 12.8 |
| **The time to determine the food to be cooked at home** | | |
| Just before cooking | 7 | 0.6 |
| On the day I cook | 843 | 56.7 |
| One or a few days before cooking | 543 | 36.5 |
| At the beginning of the week | 92 | 6.2 |
| At the beginning of the month | 3 | 0.2 |
| **Frequency of preparing meals with fresh foods** | | |
| Always | 437 | 29.4 |
| Very often | 892 | 59.9 |
| Sometimes | 148 | 9.9 |
| Rarely | 10 | 0.7 |
| Never | 1 | 0.1 |
| **Frequency of food preparation with take-home food products (canned, frozen foods, etc.)** | | |
| Always | 8 | 0.5 |
| Very often | 124 | 8.3 |
| Sometimes | 539 | 36.2 |
| Rarely | 605 | 40.7 |
| Never | 212 | 14.3 |
| **Frequency of trying new recipes** | | |
| Always | 54 | 3.6 |
| Very often | 320 | 21.5 |
| Sometimes | 832 | 55.9 |
| Rarely | 260 | 17.5 |
| Never | 22 | 1.5 |
| **Frequency to think about the big portion size of a meal when cooking or serving** | | |
| Always | 83 | 5.6 |
| Very often | 253 | 17.0 |
| Sometimes | 687 | 46.2 |
| Rarely | 356 | 23.9 |
| Never | 109 | 7.3 |
| **The frequency of cooking at home in a week** | | |
| 5-7 times | 693 | 46.6 |
| 3-4 times | 620 | 41.7 |
| 1-2 times | 165 | 11.1 |
| Never | 10 | 0.6 |

**Continue Table 3.** Respondents' answers on meal preparation and cooking at home

|  | n | % |
|---|---|---|
| **The frequency of cooking at home in a week** | | |
| 5-7 times | 693 | 46.6 |
| 3-4 times | 620 | 41.7 |
| 1-2 times | 165 | 11.1 |
| Never | 10 | 0.6 |
| **The frequency of ordering food to home within a week** | | |
| 5-7 times | 5 | 0.3 |
| 3-4 times | 55 | 3.7 |
| 1-2 times | 593 | 39.9 |
| Never | 835 | 56.1 |
| **Frequency of eating previously cooked food at home within a week** | | |
| 5-7 times | 37 | 2.4 |
| 3-4 times | 458 | 30.8 |
| 1-2 times | 934 | 62.8 |
| Never | 59 | 4.0 |
| **Frequency of eating with friends/guests at home within a week** | | |
| 5-7 times | 9 | 0.6 |
| 3-4 times | 46 | 3.1 |
| 1-2 times | 814 | 54.7 |
| Never | 619 | 41.6 |

The estimated amounts of monthly foods discarded in the households by participants are provided in Figure 1.

The raw foods discarded from households most frequently were vegetables (35.7%), salad ingredients (greens) (33.0%), and fruits (17.8%) (Figure 2).

The cooked foods discarded by households most frequently were pasta, rice, bulgur (24.1%), leftovers (15.0%) and soups (11.4%) (Figure 3).

Results reveal that the main reasons for discarding foods from households were as follows: "expired products", "formation of mould, etc. on the food" and "storage of food for an excessive period in the refrigerator" (Table 4).

The question of "Do you feel guilty for discarded foods?" was responded with "Yes" by 91.5% of the participants, "no" by 0.7% of them, and "sometimes" by 7.8% of them. Where the participants were requested to provide suggestions to minimise food waste, the most common suggestions were as follows: "Provision of more information to people about the environmental impacts of food waste", "creation of recipes for re-use of any leftover meals/foods", "raising the level of awareness of people on the monetary value of food waste", "raising the level of awareness of people on the social value of food waste", "making serving sizes smaller" and "purchase of smaller packages while purchasing packaged foods".

After analysis of the levels of food waste awareness and willingness of the participants, 63.0% of them have indicated that they have read, seen or heard something about this matter in the last six months. Still, only 11.6% of them know about either a practice, initiative or campaign to minimise the food waste generated across the country or in cities in which they live. In

total, 93.2% of the participants have indicated that they want to be provided with more information on how to prevent food waste, and 76.0% of them have indicated that they want to spend extra time and effort to eliminate any food waste. Besides, 64.8% of them have indicated that they would like to take part in any practice, initiative, campaign or other programs to minimise the food waste generated by households.

Table 5 shows the correlations between some factors considered to affect the generation of food waste and amounts of food waste generated by households. As the factors of age and urbanisation rate increased, the amount of food waste decreased ($p<0.05$). Similarly, when participants engaged in pre-shopping processes such as checking the refrigerator/supply cabinet or preparing a shopping list, prepared meals with fresh foods, and conducted menu planning in advance, the amount of food waste also decreased ($p <0.05$). On the contrary, when factors such as weekly food expenditure, the number of women living in the household, and the frequency of food shopping increased, food waste increased ($p<0.05$). Results also revealed that food waste increased as the following behaviours increased ($p<0.05$): purchases of unnecessary products during food shopping; purchase of foods stored and forgotten (in refrigerator/store cupboard,) after

single-use; meals bought for home delivery; meals prepared with take-home foods (canned, frozen products); frequency of considering the serving size of any meal as big while cooking or serving such a meal.

Besides the preceding, the average monthly amount of food waste generated by households also varies depending on an individual's occupation, common points of shopping, and whether they feel guilty for discarding foods ($p<0.05$). While most housewives, workers, self-employed persons, unemployed persons, retired persons, students and academics indicate their average monthly food waste amount as 0-1 kg, government officers and private sector employees indicate amounts between 1-3 kg. Nearly half of those shopping in supermarkets indicated that they generate 1-3 kg of food waste, while most of those shopping in small shops (butcher's shop, bakery, etc.), markets, direct producers, online shops, bazaars or retail markets indicated generating 0-1 kg of food waste. When respondents were asked about whether they feel guilty for discarding foods, 37.8% of those who responded "Yes" have indicated that they generate food wastes of 0-1 kg. Whereas 50.0% of those who responded "No" and 33.0% of those who responded "Sometimes" indicated that they generate 1-3 kg of food waste.
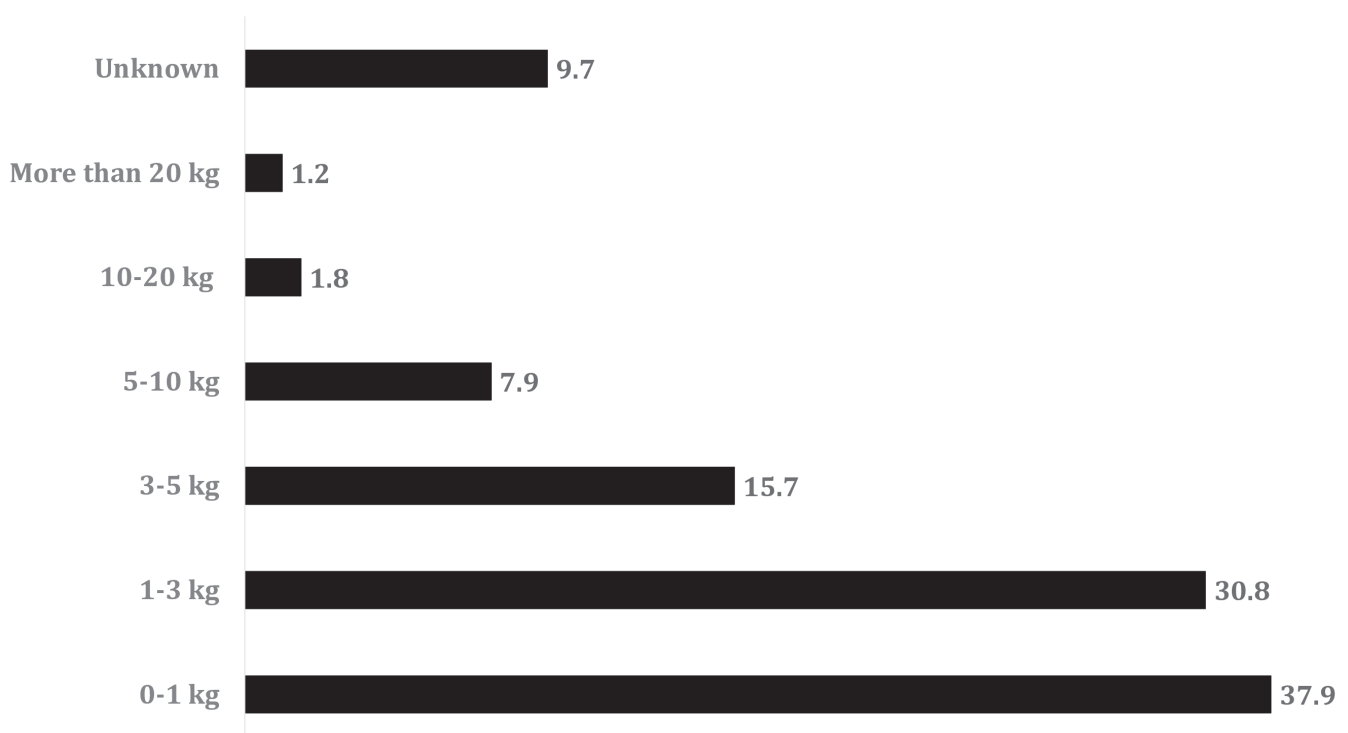


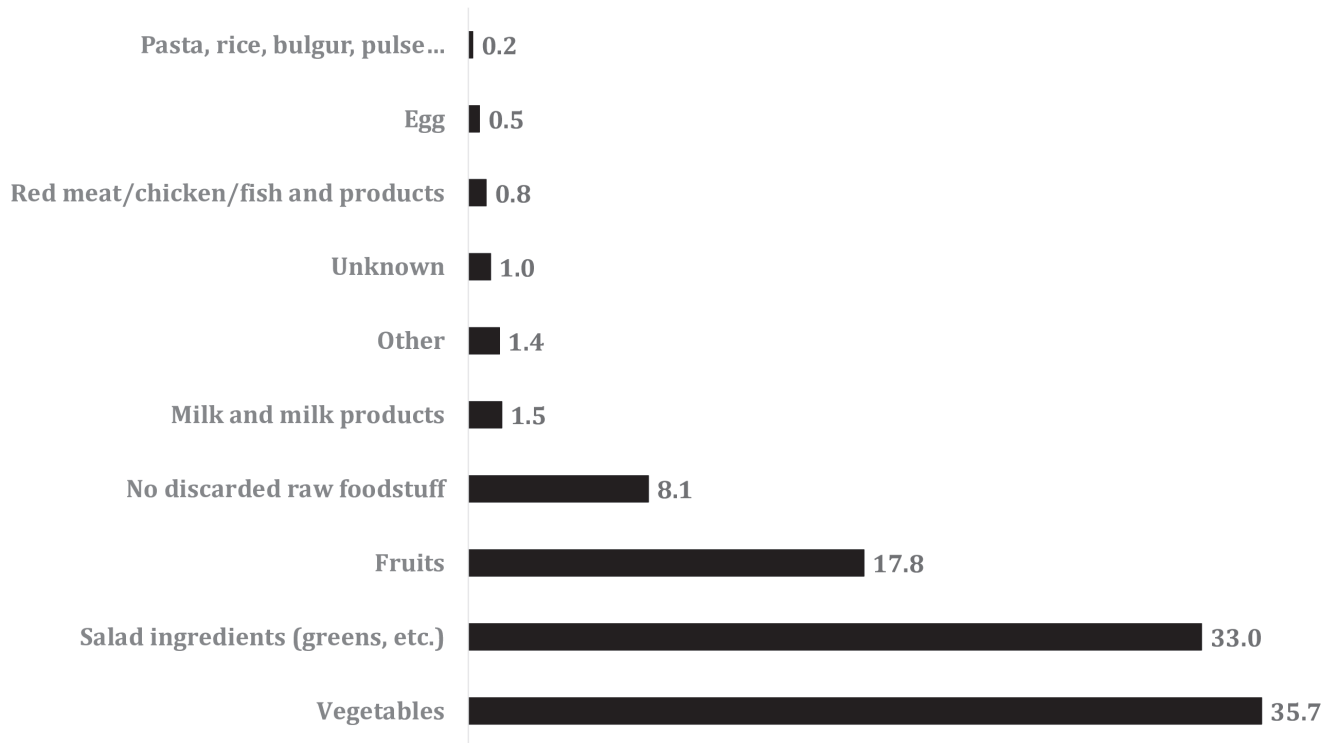**Figure 1.** Amount of food discarded by households in a month (%)

| | |
|---|---|
| Pasta, rice, bulgur, pulse... | 0.2 |
| Egg | 0.5 |
| Red meat/chicken/fish and products | 0.8 |
| Unknown | 1.0 |
| Other | 1.4 |
| Milk and milk products | 1.5 |
| No discarded raw foodstuff | 8.1 |
| Fruits | 17.8 |
| Salad ingredients (greens, etc.) | 33.0 |
| Vegetables | 35.7 |

**Figure 2.** Raw foods discarded most frequently (%)

| | |
|---|---|
| Canned products | 0.1 |
| Desserts | 0.2 |
| Milk and milk products | 0.6 |
| Bakery products (cakes, pastries, etc.) | 0.9 |
| Unknown | 1.5 |
| Egg | 1.5 |
| Pulse meals | 2.0 |
| Rotten meals/foods | 2.7 |
| Red meat/chicken/fish and products | 3.4 |
| Vegetable meals | 9.0 |
| Bread | 10.1 |
| Soups | 11.4 |
| Leftover of all kinds of cooked meals | 15.0 |
| No discarded cooked foodstuff | 17.5 |
| Pasta, rice, bulgur, etc. | 24.1 |
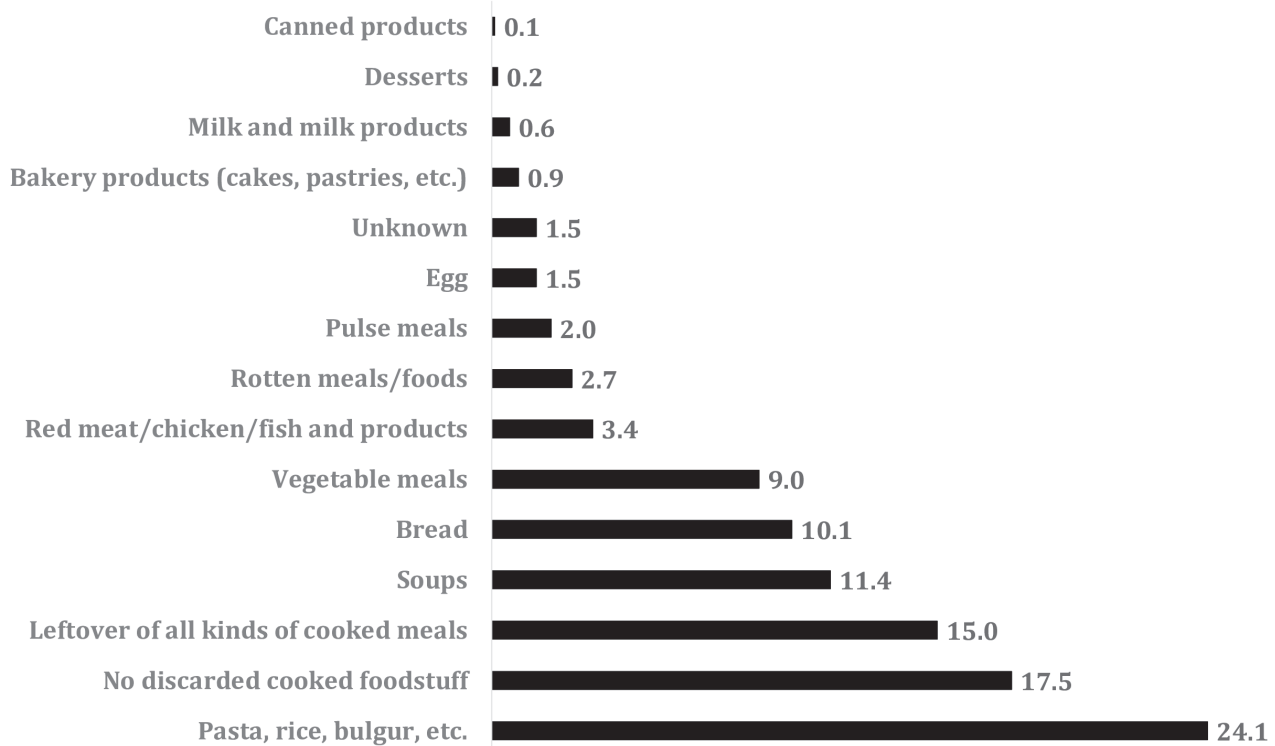
**Figure 3.** Cooked foods discarded most frequently (%)

**Table 4.** Reasons for discarding foods

|  | n | % |
|---|---|---|
| Formation of mold, etc. on the food | **1115** | **18.1** |
| Storage of food for an excessive period of time in the refrigerator | **1006** | **16.3** |
| Expired products | **919** | **14.9** |
| Impaired taste of food | 844 | 13.7 |
| Storage of foods for an excessive period of time inside the store cupboard | 485 | 7.9 |
| Bad appearance of food | 383 | 6.2 |
| Big serving sizes of prepared meals | 295 | 4.8 |
| Dislike of any ingredient of a certain food or meal | 271 | 4.4 |
| Failure to plan shopping well | 254 | 4.1 |
| Erroneous preservation (storage) method at home | 230 | 3.7 |
| Big sizes (excessive amount) of packaged foods | 160 | 2.6 |
| Problems with cooking skills | 138 | 2.2 |
| Simultaneous serving of similar meals | 57 | 0.9 |

*****Multiple responses were provided.**

**Table 5.** Assessment of some factors affecting the generation of food wastes

| **Average Amount of Food Discarded in a Month** | | |
|---|---|---|
|  | **r** | **p** |
| **Socio-demographic factors (n=1343)*** | | |
| Age | **-0.079** | **0.004** |
| Level of education | 0.023 | 0.401 |
| Average monthly income | 0.026 | 0.349 |
| Average weekly household food expenditure (**n=1316**)* | **0.101** | **0.000** |
| Number of individuals living in the household | 0.039 | 0.150 |
| Number of women living in the household | **0.072** | **0.008** |
| Number of children aged 6-11 living in the household | 0.002 | 0.933 |
| Residential area | **-0.060** | **0.028** |
| **Factors for shopping (n=1343)*** | | |
| Frequency of going for food shopping in the household | **0.122** | **0.000** |
| Purchase of any unnecessary products during good shopping | **0.177** | **0.000** |
| Frequency of purchasing foods and forgetting them in the cabinet (refrigerator/store cupboard, etc.) after using them for once, and noticing that they have not been used again | **0.212** | **0.000** |
| Checking the refrigerator/store cupboard | **-0.123** | **0.000** |
| Creation of a shopping list | **-0.077** | **0.005** |
| **Factors for preparing, cooking and consuming meals (n=1343)*** | | |
| Frequency of cooking at home | -0.048 | 0.077 |
| Frequency of ordering meals to home | **0.104** | **0.000** |
| Frequency of eating any previously-cooked meal at home | -0.026 | 0.350 |
| Frequency of enjoying meals with friends/guests at home | 0.026 | 0.350 |
| Cooking skills | -0.035 | 0.195 |
| Time of determination of the meal to be cooked | **-0.067** | **0.014** |
| Frequency of preparing meals with fresh foods | **-0.056** | **0.042** |
| Frequency of preparing meals with take-home foods (canned, frozen products, etc.) | **0.086** | **0.002** |

**Continue Table 5.** Assessment of some factors affecting the generation of food wastes

| Average Amount of Food Discarded in a Month | | |
|---|---|---|
| | r | p |
| Frequency of trying new recipes in the kitchen | 0.008 | 0.765 |
| Frequency of considering the serving size of any meal as big while cooking or serving such meal | **0.085** | **0.002** |

***Individuals, who don't know their waste amount and average weekly household food expenditure, are excluded.**

## 4. Discussion

The study results have shown that there is a negative relationship among the sociodemographic factors of age and residential area and the amount of food waste generated by the household. However, there is a positive relationship between the number of women living in a household and the average weekly food expenditure. Occupation was also shown to have a significant difference in the amount of food waste generated by a household (p<0.05). It has been observed that there is a positive yet insignificant relationship between the level of education, average monthly income, the number of individuals living in a household, the number of children aged 6-11 living in a household and the amount of food waste generated. It is known that the young people, women, adults with children aged under 14, self-employed individuals, those with a higher number of individuals living in a household, and people living in metropolitans generate more food wastes (Barr, 2007; Hamilton *et al.,* 2005; Koivupuro *et al.,* 2012; Lyndhurst *et al.,* 2007; Mattar *et al.,* 2018; Secondi *et al.,* 2015; Szabó-Bódi *et al.,* 2018; Visschers *et al.,* 2016).

On the other hand, Neff et al. (2015) found that living in urban or rural areas does not have a significant impact on the generation of food waste. The results obtained from the studies on the relationship between the average monthly income of the households and the amount of waste generated should be discussed. Although studies have determined there is a positive or negative relationship between the income and the amount of food waste (Cox *et al.,* 2010; Farr-Wharton *et al.,* 2014; Hamilton *et al.,* 2005; Lyndhurst *et al.,* 2007; Setti *et al.,* 2016; Stefan *et al.,* 2013), some studies have revealed that there is no relation between such factors (Bolaane & Ali, 2004; Koivupuro *et al.,* 2012; Quested *et al.,* 2013; Williams *et al.,* 2012; WRAP, 2009). Arguably, higher food waste generation

in low-income households is due to a lack of skills, excessive purchasing, purchase of products of low-price and low-quality, and the will to fulfil the obligations of being a parent and to provide as much food as possible at home (Setti *et al.,* 2016; Porpino *et al.,* 2015). Monier et al. (2010) and Secondi et al. (2015) underline the relation between the level of education and the amount of food waste. They have shown that a lower level of education leads to the generation of less food waste. This result can be explained with the fact that individuals with a higher level of education tend to have a higher level of income and therefore spend more. Conversely, it should also be noted that some individuals with a low level of education might not be able to estimate the amount of food waste generated accurately. The relationship between an occupation and the generation of food waste can be explained with the fact that those with higher working hours have time restrictions due to excessive workload. Therefore, the amount of waste generated while preparing meals may go unnoticed, which may increase the generation of waste (Jorissen *et al.,* 2015).

Results further revealed that those shopping from supermarkets generate more (1-3 kg) food waste compared to those shopping from any other points (p<0.05). Also, special offers have a positive impact on the decision to purchase during shopping, which in turn impacts the amount of food waste generated; however, this finding was not statistically significant (p>0.05). It is considered that shopping frequently might increase the amount of food waste as it might trigger unplanned and spontaneous purchases. Furthermore; the households purchasing their foods generally from supermarkets tend to generate more food waste than the ones who prefer mini markets and the other points of shopping (Ponis *et al.,*2017). One assumption is that since supermarkets offer much more variety of products than mini markets and other smaller food retailers, more purchases are made and

thus, the amount of food waste increases. It is known that creating a shopping list and checking the available stocks at home (refrigerator/store cupboard) can help reduce food waste at the household level (Bell *et al.,* 2011; Chandon & Wansink, 2006; Sharp *et al.,* 2010; Stefan *et al.,* 2013; WRAP, 2009). Since planned shopping ensures the purchase of necessary products while preventing the purchase of any unnecessary products, it leads to less food waste. The study conducted by Mattar et al. (2018) in Lebanon shows that falling under the influence of special offers increases the amount of food waste. The reason for this might be excessive purchases due to such special offers (Beretta *et al.,* 2013; Ganglbauer *et al.,* 2013; Koivupuro *et al.,* 2012; Lyndhurst *et al.,* 2007; Stefan *et al.,* 2013).

Food waste may increase with an increase in the frequency of enjoying meals with friends/guests at home that includes various meals of larger serving sizes, and an increase in the frequency of trying new recipes in the kitchen that may lead to non-consumable meals. Increased frequency of considering the serving size of any meal as big while cooking or serving such a meal suggests that meals are often over-sized, and also that more waste might be generated. A low frequency of cooking meals at home, poor cooking skills, and failure to use/consume leftover might lead to the unnecessary discarding of foods. Since the determination of the meal to be cooked beforehand results in preparation/cooking of meals in a more planned manner, it might contribute to the minimisation of waste (Lyndhurst *et al.,* 2007; Porpino *et al.,* 2015). This study demonstrates that a great majority of these factors are associated with the amount of food waste generated.

The raw and cooked foods discarded from households most frequently are vegetables (35.7%), and pasta, rice, bulgur (24.1%), respectively. The types of discarded foods vary by country. The main discarded foods are as follows by country: home-made foods and milk products in Finland (Silvennoinen *et al.,* 2014); bakery products in Norway (Hanssen *et al.,* 2016); fresh vegetables and salads in England (WRAP, 2009); home-made and previously-cooked meals in Hungary (Szabó-Bódi *et al.,* 2018); fruits, vegetables, bread and bakery products in Canada (van der Werf, 2018); cereals and bakery products in Algeria (Arous *et al.,* 2017 ); pasta, fast food, previously-cooked meals, vegetables, fruits and bread in Italy (Gaiani *et al.,* 2018; Lanfranchi *et al.,* 2016). The different food cultures

may explain the reason for the differences in discarded food types.

From the reasons for discarding foods from the household (Table 4), most selected the formation of mould or spoilage on foods (18.1%), excessive storage period in the refrigerator (16.3%) and expired foods (14.9%). Similarly, the reasons of food waste suggested by other researchers are the storage of foods for an excessive period in the refrigerator/deep freeze, expired foods, deterioration of organoleptic properties of foods (formation of mould, etc.), a dislike of eating any previously-cooked meals, purchase of foods in excessive amounts, and inaccurate calculations of portion sizes while serving (Arous *et al.,* 2017; Gaiani *et al.,* 2018; Ghinea & Ghiuta, 2018; Lanfranchi *et al.,* 2016; van der Werf, 2018). The discarding of foods is generally caused by an insufficient level of attention, information and awareness from the individual.

The average amounts of food waste indicated to be discarded from households in a month was 0-1 kg by 32.9% of the participants, while 30.8% of them have indicated to generate a food waste amount of 1-3 kg. During a study conducted in Algeria with 323 participants, when the participants were asked about the amount of waste generated by them in a week, 21.0% of them indicated to generate less than 250 g, 13.0% of them have indicated to generate waste of 250-500 g, and 2.0% of them indicated to generate more than 2 kg of waste (Arous et al. 2017). Lanfranchi et al. (2016) found in a study of 500 participants that 1.4% generated 1-2 kg of waste, while 0.8% of them generated more than 2 kg of waste. The differences in waste amounts generated from households in the different studies may be attributed to the different features of the participants, such as educational status, economic conditions, social culture. On the other hand, it should be noted that all food waste, whether low or high amounts, will cause unfavourable environmental, social and economic impacts.

The relationship between the sense of feeling guilty for discarding foods and the amount of food waste generated by households has been considered significant in statistical terms ($p<0.05$). It has been observed that participants who responded "Yes" to the question of whether they feel guilty for discarding foods tend to generate less food waste compared to those who responded "Sometimes" and "No" to such question.

Other studies have also found that the sense of "feeling guilty" about waste production has the effect of minimising the amount of food waste by individuals (Lyndhurst *et al.,* 2007; Hamilton *et al.,* 2005; Mattar *et al.,* 2018; Qi & Roe, 2016; Stefan *et al.,* 2013). Conversely, it should be noted that the participants might have wanted to appear "good", and responded that they felt guilty for discarding foods, which might lead to misleading results.

Participants were requested to provide suggestions to minimise food waste, and some of the most common responses were as follows: "provision of more information to people about the environmental impacts of food waste" (19.1%); "creation of recipes for reuse of any leftover meals/foods" (15.7%); "raising the level of awareness of people on the monetary value of food waste" (13.1%); and "raising the level of awareness of people on the social impacts of food wastes" (13.1%). Personal concerns such as money-saving are known to be a stronger motivation than environmental and social concerns to minimise food waste (Graham-Rowe *et al.,* 2014; Neff *et al.,* 2015; Stancu *et al.,* 2016). van der Werf (2018) observed that the most common factor in minimising waste in most participants was the minimisation of money, followed by minimisation of environmental and social impacts. Under the scope of a study conducted by Arous et al. (2017), 45.0% of the participants indicated that if they were provided with more information on the unfavourable effects of food waste on the economy, they would generate less food waste. At the same time, 35.0% of them indicated that they consider that imposing an additional tax on waste could be effective in minimising food waste. Gaiani et al. (2018) have underlined that if people were obliged to pay money for waste generated by them and if they were provided with more information on the financial, environmental, and social impacts of waste, such wastes could be minimised. Lanfranchi et al. (2016) suggested that the principal strategies to reduce waste include smaller food servings, placing additional costs on personal waste, and also that more information should be provided regarding the impacts of food waste on the environment and economy.

It has been found out that more than half of the participants have read, seen or heard something in the last six months about food waste or ways to minimise food waste. However, only 11.6% of them said to be familiar with any of the practices, initiative, or campaigns addressing food waste across the country or by local households. Findings revealed that 93.2% of the participants would like to receive more information about ways to minimise food waste, and 76.0% would spend extra time and effort to eliminate food waste. Besides, 64.8% of respondents would like to be involved in any future practice, study, or campaign aimed at minimising food waste in the household. Interestingly, a great majority of participants would like more information on ways to prevent food waste, and more than half of them would like to be involved in practices, studies, or campaigns for the minimisation of waste. It is questionable to what extent the provision of information alone could be effective towards the minimisation of food waste if it all. Besides the provision of information, the assumption of personal responsibility in minimisation of waste will have the highest effect.

## 5. Conclusions

Discarding foods unnecessarily leads to unfavourable conditions in financial, environmental and social terms. Households represent the major group generating food waste throughout the food supply chain. Therefore, the prevention of waste in households is of great importance. Due to the close relationship between the prevention of food waste in households and individual behaviours of the residents, analysis of individual characteristics (sociodemographic features, behaviour and attitude features) is highly critical to develop appropriate strategies.

The results obtained in this study have revealed that sociodemographic features, food shopping practices, food preparation, cooking and consumption habits, and attitudes for food waste might have a direct impact on the decrease or increase of food waste in Turkey. These findings, thought to be related to the generation of waste, should be taken into account by the government when developing waste prevention strategies. All initiatives should be ensured, as necessary, through awareness-raising campaigns on TV and other media using influential and simplified messages towards individuals' behaviours for the generation of waste. The amount of training for household routines such as shopping and menu planning, storage, and preparation of foods should be increased. Situations leading to the generation of waste can be eliminated by raising the level of awareness and in-

formation available to individuals about the purchase, storage, preparation, cooking and serving of goods. Moreover, waste prevention strategies should aim at motivating individuals to minimise their food waste, and increasing the level of awareness on the unfavourable impacts of food waste. Also, individuals should be more conscious about shopping habits, preparing and cooking food, preserving food and being aware of the adverse effects of waste, and take responsibility for the necessary precautions.

## Study limitations

One significant limitation of the present study is the non-probabilistic sampling design used for data collection as respondents were recruited voluntarily. Therefore, it is likely that a self-selection bias exists and specific characteristics are emphasised but do not ensure either a statistical significance or the extension of the results to the entire Turkish population. At the same time, convenience samples like the one used in this study are often utilised to explore topics that are not yet covered by comprehensive literature. It is worth underlining that, compared to other surveys conducted on food waste in Turkey, the identified sample is relatively larger and still provides relevant insights as it is quite heterogeneous in terms of respondents' profiles. Another limitation is that there were more females and more consumers from metropolitan areas in the population under study. However, having a higher number of women in the sample is rather ordinary in food-related studies, since women generally hold more of the responsibility in cooking and shopping than males, and are more willing to answer questionnaires related to food issues.

## Conflict of Interest

The authors declare that there is no conflict of interest. Also, there was no funder in the decision to collect, analyse or interpret data, write the article and publish the results.

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