NEW MEDIT

CIHEAM BARI

5

QUARTERLY
VOL. XX - N. 5
DECEMBER
2021

CONTENTS

Dimensions of household food waste in Turkey

Celile Özçiçek Dölekoğlu*, Sema Gün**, Seda Şengül***,
Isil Var****, Handan Giray*****

Abstract

Food waste creates an increasing concern at the global level and searching methods how to solve food waste is also a significantly increasing. Finding adequate solutions and implementing is only possible through defining the problem. To solve a complicated problem like food waste which interests large population and has different kind of features for each product is a time consuming. At this point, revealing food waste at the different stages is important. The biggest share from the waste is taken by households. This study covers the analyses results of the surveys conducted in 3 big cities in different geographic region in order to identify household food waste's level in Turkey. Totally 1155 surveys were conducted in Erzurum, İzmir and Adana in June 2016 and 2017. In addition to food waste, its perception, food purchase and store behaviors of the consumers were investigated. The results show that households wasted about 7.5 tonnes food during the month surveys carried out. Only 180 families out of 1155 had no food waste and this number is higher in Erzurum. The highest food waste was observed in Adana where it was 3.3 tonnes per month while it was 2.6 tonnes in Erzurum and 1.6 tonnes in İzmir.

Keywords: Food Waste, Consumer food waste, Probit, Food Waste Turkey.

1. Introduction

The amount of the world food waste reported by Gustavsson *et al.* in 2011 was 1.3 million tonnes, while it was approximately 931 million tonnes in 2019. Despite the fact that the amount of the total food waste has decreased in the recent years, it remains still important issue locally and gloabally (UNEP, 2021). Waste, with changing production / consumption habits and prosperity, continues to be an important and remarkable issue that humanity still cannot overcome. Many developed and developing countries strive to take immediate measures on the issue. At the same time, successful implementations have been realized with the efforts of non-governmental organizations as well as some the efforts of some individuals. The most concrete example of improvidence experienced in every aspect of life is also revealed with food waste. While this improvidence is dominant, the hunger, poverty and global warming continue to threaten the life. While 750 million people

---

* Adana Alpaslan Türkeş Science and Technology University, Adana, Turkey.
** Ankara University, Faculty of Agriculture, Ziraat Mah., Şehit Ömer Halisdemir Bulvarı, Ankara, Turkey.
*** Cukurova University, Faculty of Economics and Administrative Sciences, Balcalı, Adana, Turkey.
**** Cukurova University, Department of Food Engineering, Balcalı, Adana, Turkey.
***** Eskişehir Osman Gazi University, Faculty of Agriculture, Ali Numan Kıraç Yerleşkesi, Eskişehir, Turkey.
Corresponding author: cdolekoglu@gmail.com

suffer from chronic starvation, an estimated 2 million people suffer from malnourishment, vast of food loss and waste should be questioned and examined (http://www.fao.org/3/ca9692en/online/ca9692en.html). Approximately 1,3 billion tonnes get lost or waster every year. This is sufficient to feed three billion people and the waste amounts roughly 940 billion USD per year (www.fao.org/save-food). Each year, 1.4 billion ha of land which represents 28% of the agricultural areas in the world, cannot be used effectively (FAO, 2013). These data sufficiently explain the significance and extent of the economic, environmental, and social effects of food waste and loss, and present clearly if food losses and waste problems cannot be avoided, hunger and malnutrition problems will continue to increase (Niyaz and Demirbaş, 2020). Moreover, recently the Coronavirus pandemic has brought out the fragility of the food systems to shocks, and fragilities that particularly damage the most vulnerable populations throughout the world (Ridolfi *et al.*, 2020) which makes reducing food waste and loss even more important.

Its contribution is emphasized to reduce food waste and loss, ensure food security and reduce hunger, which are among the UN sustainable development goals. As food insecurity and malnutrition constitute a problem for all countries, there will be an increasing need for food as the population grows. One in ten people around the world suffer from chronic hunger (http://www.fao.org/3/ca9692en/online/ca9692en.html). As well as the developing countries, chronic starvation is experienced in the developed countries and the hunger is among the major problems and 15% of the population suffering from malnourishment are living in developed countries. Despite the presence of malnourished populations in developed countries, Latin American countries and high-income countries are responsible for 80% of meat waste. In the USA, 14,6% of population living in poverty in 2013-2019 (PRB, 2019) while the households waste 19% of total food. In total 29% of available food supply were lost from human consumption in 2008 (Buzby and Hyman, 2012). Uneaten food costs an average American family of four 1500 $/year (https://www.globalcitizen.org/en/content/

trf-food-waste-could-feed-the-poor/). Reducing food loss and waste will have several positive effects on different aspects of nutrition, economy and rural development through reducing poverty, saving time and effort in farm works, particularly for women, decreasing food expenditures, increasing sources for health, education and other household benefits. On the other hand, reducing waste and loss will also help reduce greenhouse gas emissions by reducing the pressure on the ecosystem and also water pollution pressure on the ecosystem decreases and helps reduce greenhouse gas emissions (Lipinski *et al.*, 2013).

Food waste in medium and high-income countries is remarkable at the consumer level, while in low-income countries, consumer waste is low, but losses in the production process are significant. In the middle and high-income countries, while the rate of consumer-related waste is between 31-39%, this rate is lower in low-income countries (4-16%) (FAO, 2013). It has been reported that the per capita food waste in Europe and North America is 280-300 kg/year while it is 120/170 kg/year per capita in sub-Saharan Africa and South/Southeast Asia (Nahman and Lange, 2013). However, if food waste is reduced through the measures to be taken, the food security will be enhanced. In the UK, 7 million tonnes of food are wasted annually in the households while 4.2 million tonnes of this amount is edible food. That indicates that 6 plates of good are thrown away every week. WRAP (Waste & Resources Action Program), which was established with the public support in 2000 in the UK, rendered positive results in all areas of waste prevention. The total amount of household food waste fell by 15% between 2007 and 2012. This signifies a £470 worth of gain per household (WRAP, 2012). In the UK, before World War II, 1-3% of food in homes went to waste, while in 2009 this rate was 25% (Parfitt *et al.*, 2010).

In addition, there are studies about the practices, policies, and measurements related to food waste. These studies have been focused on which measurement methods will give the right results (Lebersorger and Schneider, 2011; Graham-Rowe *et al.*, 2015; Albisu, 2016; Di Terlizzi *et al.*, 2016; Van Herpen *et al.*, 2019; Langley *et al.*, 2010; Corrado *et al.*, 2019; Elimelech *et al.*, 2018). Many studies on the environmental cost and influ-

ence of food waste, the losses of production factors and the resulting carbon footprint and water footprint were investigated (Buzby and Hyman, 2012; Junguo *et al.*, 2013; Nahman *et al.*, 2012; WRAP, 2012; Refsgaard and Mangussen, 2008; Capagain and James, 2013). Furthermore, there are some common studies conducted for various product groups to demonstrate the waste and loss occurred at every stage of the supply chain (Beausang *et al.*, 2017; Young *et al.*, 2017; Mena *et al.*, 2011; De Laurentiis *et al.*, 2018). The evaluation and disposal of the waste, the researches on consumers that are responsible for approximately half of food waste are carried out in the context of explorative researches. These studies generally examine different aspects of food consumption in households or consumers (Stefan *et al.*, 2013; Bell *et al.*, 2011; Abeliotis *et al.*, 2016; Parfitt *et al.*, 2010; Buzby and Hyman, 2012; Nahman and Lange, 2013; Fami *et al.*, 2019; Van Der Werf *et al.*, 2018; Delley and Brunner, 2017; Ponis *et al.*, 2017; Jribi *et al.*, 2020). As emphasized by De Hooge *et al.* (2017), one of the most important reasons for waste is the thoughts and behaviors of consumers about ugly foods (De Hooge *et al.*, 2017). It is important to determine the perceptions of consumers on this issue. Although empirical research is is scarce and contradictory, recent studies provide important information about consumer preferences (Stefan *et al.*, 2013; Stancu *et al.*, 2016; De Hooge *et al.*, 2017; Aschemann-Witzel *et al.*, 2018; De Meo *et al.*, 2018).

Studies conducted in Turkey about food waste are generally conducted for a product group. *Household Food Wastage in Turkey* is the study conducted by Pekcan *et al.* (2006) about the waste per household and it certainly provided a significant perspective. Yıldırım *et al.* (2016) conducted a survey on food waste in their study they have conducted with 150 people. Aydoğdu and Koçoğlu (2017), Dölekoğlu and Var (2019) are the ones to investigate the wastage in mass consumptions. The other study was conducted by Tatlıdil *et al.* (2013) which was "food losses and waste in Turkey". The aim of the study was to estimate food losses and waste in the food supply chain of different stages for commodity groups (cereals, roots, and tubers, oilseeds and pulses, fruit and vegetables, meat, fish and sea-food, milk and eggs). They found that the biggest losses of all commodities turn out to be in the first step of the food supply chain. On the other hand fruit and vegatables was presented as the most wasted. The waste in bread is significant since it attracts considerable attention of the people as the most consumed and most wasted product. Hence, there were many studies conducted on this subject in Turkey. In the research conducted within the context of "Do Not Waste Your Bread" campaign of Soil Products Office (TMO)'s, it has been revealed that 6 million loaves of bread are wasted in Turkey every year. Due to the high size of bread consumption and bread waste in Turkey various studies about bread waste were conducted different cities and regions (Gül *et al.*, 2003; Bal *et al.*, 2013; Dölekoğlu *et al.*, 2014; Mete, 2017; Taşcı *et al.*, 2017; Tepecik and Gümüş, 2017). In the study of the Ministry of Customs and Trade published in August 2017, only waste of bread was taken into consideration. Hence, the studies about food loss and waste in Turkey are limited and it is highly required to conduct studies based on the primary data. Decision makers certainly need regular information on food loss and waste. It is significant for all parties to reveal the level and cause of waste since it influences many dimensions and it is related to the mass consumption.

The biggest responsibility for food waste lies with consumers, the reasons are complex and different in every society. 61 per cent of food waste came from households (UNEP, 2021). The need for consumer studies is high in every community for policy makers and other actors to develop successful campaigns. This research intends to find out the level of food waste in households from different socio-economic groups and geography in Turkey. Furthermore, 1155 surveys conducted in Izmir, Erzurum and Adana provinces were examined in this study in order to contribute to the measures that can be taken by decision makers to reduce waste by determining the factors creating waste and taking into account the variations at the household level. Consequently, the study reveals the factors that cause food waste, the differences in food waste, the types of food that are wasted, and perceptions and attitudes related to food waste.

2. Material and method

2.1. *Study area and sampling procedure*

When creating the sample framework, the annual average usable income of the equivalent households at the level of Turkish Statistical Institute-NUTS (Nomenclature of Territorial Units for Statistics)-1 was taken into consideration. This classification divides Turkey into 12 regions based on the average income and they are classified as low-income, medium-income, and high-income regions. After calculating the average income for each group, the closest sub-region was selected and 3 provinces from these regions were selected as research sites. The cities located in the East, West, and South of Turkey are observed. In the high-income group, Izmir is selected while Adana is selected for the middle-income group. Finally, Erzurum is chosen for the low-income group and the surveys were conducted in May-June 2016 and 2017.

Since each province will be evaluated separately, the number of samples for each province is calculated as 384. 1152 surveys were anticipated in total and in the end, 1160 surveys were conducted. Five of the questionnaires were excluded since there were some missing data on them.

2.2. *Statistical analysis*

In this study, the level of waste was taken as the dependent variable. Food waste per person (kg/month/person) determined physically in households based on the data stated by participants' statements in the surveys is classified as presented in Table 1 and used as the dependent variable. Since there is no classification determined in the literature for the grouping, the criteria used the upper and low category about the waste per capita in the high-level income and low-level income countries, as specified in FAO 2011 were used (Gustavsson *et al.*, 2011).

Low-medium and medium-high categories were calculated considering these two limit values. In the study, the household's waste values of the last week were used. However, since the classification criterion is annual, data and dependent variable criteria are transformed to monthly values and coded as presented in Table 1.

Table 1 - Classification coefficients of household's waste per capita.

Groups	Yearly Waste Limits kg/year	Monthly Waste Limits kg/month
Very low level	0.01-5,9	0.01-0.49
Low level	6-11	0.5-0.99
Low-Medium	12-52	1-4.3
Medium-high	53-94	4.4-7.8
High	95-115	7.9-9.6
Very High	>116	>9.7

Since the individuals in the family have different needs in terms of energy based on age, gender, and physical activities, they consume different amounts of food. Therefore, if we divide the total waste to the number of persons in the household, this would create a misinterpretation. Accordingly, coefficients have been developed to eliminate this difference in nutrition studies and to be able to express family members using the same unit. In this study, "Consumer Unit" coefficient was used in 1974 that takes into account the age and gender of the Turkish Nutrition Survey. Since the coefficient takes into account the gender and age groups, it provides more sensitive results about individuals (Table 2). All family members are calculated in the consumer unit and expressed in the same unit.

For predicting the factors that lead to food waste in households in Turkey and the relative significance of these factors, the sequential Probit model is used. The sequential Probit model is used when the dependent variable is in sequential form (Maddala, 1987; Long, 1997; Greene, 2002). In this study, household food wastage level was investigated in four groups. This classification is as follows; the households having no waste, the households having a low level of waste (0.01-0.99), the households having a medium level of waste (1.0.-4.3), the households having a high level of waste (4.4+). The values of the dependent variable are as follows; 0, 1, 2 and 3 (0=the households having no waste, 1=the households having a low level of waste, 2=the households having a medium level of waste, 3=the households having a high level of waste). Since the dependent variable is sequential, the

Table 2 - Consumer Unit Weight.

Age Groups	Male	Child	Female
0-1		0.4	
1-3		0.5	
4-6		06	
7-9		0.7	
10-12	0.9		0.8
13-15	1.1		0.9
16-19	1.2		0.8
20-19	1.0		0.8
30-39	1.0		0.7
40-49	0.9		0.7
50-59	0.9		0.6
60-69	0.8		0.6
70	0.8		0.6
Because of pregnancy		+0.1	
For nursing mothers		+0.3	

Source: Köksal, 1977.

Sequential Probit model, based on the assumption that the error term is normally distributed, is designed as follows, considering that there is an unobserved (latent) variable as in the binominal probit model.

$$Y^* = X'\beta + \varepsilon \qquad (1)$$

Here, Y^* is the unobservable variable. The relationship between the observable Y and the unobservable Y^* is provided in the following equation (Long, 1997; Greene, 2002).

$$
\begin{aligned}
Y &= 1 &\Rightarrow& \quad Y^* \leq 0 (= \mu_1) \\
Y &= 2 &\Rightarrow& \quad 0 < Y^* \leq \mu_2 \\
Y &= 3 &\Rightarrow& \quad \mu_2 \leq Y^* \leq \mu_3 \\
Y &= 4 &\Rightarrow& \quad \mu_3 \leq Y^*
\end{aligned}
\qquad (2)
$$

μ shows the threshold coefficient that connect Y variable to Y^* variable. In the sequential Probit model; based on the assumption that the error term is normally distributed, the following probability gives the possibility of the observation to be classified in j category.

$$\text{Prob}(Y = j|X) = \Phi(\mu_j - X'\beta) - \Phi(\mu_{j-1} - X'\beta) \qquad (3)$$

$\Phi(.)$, gives the cumulative normal distribution. 3. It provides the derivatives of the equation based on the independent variables as well as the marginal effects of independent variables on this probability. The estimation of the model is obtained by the maximum likelihood method. The variance of the dependent variable, which is not observed under the normal distribution assumption, is assumed to be 1. However, there may be a problem of heteroscedasticity. The heteroscedasticity is used in the model as the exponential form of the variables that would cause the heteroscedasticity (5th Equation) (Williams, 2010). By dividing the 4th Equation by σ_i, it is assumed that the heteroscedasticity is corrected.

$$\sigma_i = \exp(z\gamma_i) \qquad (4)$$

Here; z: shows the vector of explanatory variables that would cause the heteroscedasticity, while γ_i: shows the parameter vector.

The marginal effects are calculated as follows.

$$\frac{\partial \rho(y_1 = 1|\chi_1)}{\partial \chi_1} = -\Phi(\chi_i'\beta)\beta \qquad (5)$$

$$\frac{\partial \rho(y_1 = 2|\chi_1)}{\partial \chi_1} = -\Phi(\mu - \chi_i'\beta)\beta + \Phi(\chi_i'\beta)\beta \qquad (6)$$

$$\frac{\partial \rho(y_1 = 3|\chi_1)}{\partial \chi_1} = -\Phi(\mu - \chi_i'\beta)\beta. \qquad (7)$$

3. Results and discussion

3.1. *Descriptive analyses of the sustainable indicators*

Food loss and waste are present in various stages of the supply chain everywhere in the world. Foods are wasted in different times, in different sizes because of different reasons. There are fundamental principles for solving this global problem. However, the method and effect of these principles are different based on the dynamics of each country. Hence, it is essential to determine the current situation first. With this study carried out for specifically this purpose, the routines of a large number of participants with different socio-demographic characteristics in 3 cities of Turkey in terms of waste, waste management, waste perception, food purchasing and conversation were analyzed.

Table 3 - Descriptive data.

	Cities			Total
	Erzurum	Izmir	Adana	/Average
Size of the house	4.0	3.4	3.4	3.6
Size of Adult Household	3.3	2.7	2.8	2.9
The number of children under the age of 15	0.8	0.5	0.6	0.7
Household income month/TL and distribution (%)				**3,830.57**
>750	0.3	-	2.1	0.8
751-1500	9.6	11.5	24.5	15.3
1501-2500	20.3	30.7	19.4	23.4
2501-4000	34.5	31.5	28.7	31.6
4001-5500	14.8	15.5	11.1	13.8
5501-7500	12.2	6.3	7.5	8.7
7501-10000	6.0	3.1	5.7	4.9
>10001	2.3	1.3	1.0	1.6
Family type distribution (%)				
One family household	69.9	61.4	57.4	62.9
Extended family	8.1	3.4	3.6	5.0
Family without children	10.1	14.1	19.4	14.5
Lone parents with have at least one resident child	7.5	13.1	9.8	10.1
One person	1.8	6.8	9.0	5.9
Household in which there are more than one bachelor	2.6	1.3	0.8	1.6

The average household size is 3.6 people per household and Erzurum is the province with the biggest household size. The average household size is 3.4 people in Turkey (https://data. tuik.gov.tr/Bulten/Index?p=Statistics-on-Family-2018-30726). The average monthly income is TL 3,830.57 ($1,089.9)[1]. When the sample group was analyzed based on the income levels, the majority is placed in the salary between 2501-4000 TL per month. Erzurum is different from other cities since the families living in Erzurum maintain the traditional family life style. Out of the 1155 families, 58 were living with parents and children and second-degree family relatives. This family type is defined as the extended family. More than half of the extended families live in Erzurum. In Adana and İzmir, the number of individuals living individually is exceptional (Table 3). Family type in our study represent in Turkey's general statistics. According to TURK-STAT proportion of one-family households in Turkey was observed 65.3%; lone parents with have at least one resident child 8.9%; one-person households 16.1% in 2018 (https://data. tuik.gov.tr/Bulten/Index?p=Statistics-on-Family-2018-30726).

It was determined that 1155 families wasted approximately 7.5 tonnes of food in the month when the survey was conducted (Table 4). It was calculated by face-to-face survey and the waste of all fresh, cooked food per meal was recorded. It was remarked that there were no wastes in 180 families. The number of households that did not waste in Erzurum was higher than in other provinces. The highest waste rate was obtained in Adana. In Adana, 823 kg of products per week was wasted, while 652 kg were wasted in Erzurum and 393 kg were wasted in İzmir. It is assumed that the high temperature and humidity rate of Adana compared to the other provinces

---

[1] It has been calculated according to the effective selling rate of exchange as for 15 June 2017 (3,5145).

Table 4 - Waste according to the cities.

	Total weekly waste (kg)	Total monthly waste (kg)	Waste per capita* per month (kg)
Erzurum	652.56	2,610.26	2.21
Izmir	393.07	1,572.28	1.60
Adana	823.22	3,292.88	3.63
Grand Total	*1,868.86*	*7,475.42*	*2.46*

* Adult equivalent.

may cause the food to deteriorate more quickly and thus the waste was increased. In terms of the level of waste, there are variations both within the provinces themselves and between the other provinces (Table 5). Nevertheless, in each province, an accumulation was observed in the low-medium waste group.

The highest percentage of total waste was detected in root crops, fruits, and vegetables globally that is roughly 40-50% (https://www.unep.org/thinkeatsave/get-informed/worldwide-food-waste). Also represents the largest group in household food wastes in developing countries is fruits and vegetable, that can vary between 60% and 70% depending on the countries (Esparza *et al.*, 2020). In this study the highest proportion of commodity groups is fruit and vegetables (38.75%). Although there are differences in the other product groups based on the cities, the lowest share belongs to the legumes. This low rate can be explained by the fact that the shelf life of this product is long and this type of product is not frequently purchased (Table 6). A significant part of the waste is due to spoilage

Table 5 - Distribution according to waste levels in cities.

Cities	Very low level 0,01-0,49		Low level 0,5-0,99		Low-medium level 1- 4,3		Medium-high level 4,4 -7,8		High level 7,9-9,6		Very high level > 9,7		No waste	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Erzurum	69	17.9	38	9.9	107	27.8	50	13.0	7	1.8	20	5.2	94	24.4
Izmir	63	16.4	97	25.3	166	43.3	20	5.2	6	1.6	10	2.6	21	5.5
Adana	37	9.6	30	7.8	134	34.6	70	18.1	13	3.4	38	9.8	65	16.8
Total	**169**	**14.6**	**165**	**14.3**	**407**	**35.2**	**140**	**12.1**	**26**	**2.3**	**68**	**5.9**	**180**	**15.6**

X^2 value is 165,291. Sig. value is 0,00<0,05 H_o= rejected.

Table 6 - Quantity (kg) and distribution (%) of household food waste based on the product groups.

Product Groups	Erzurum		Izmir		Adana		Total	
	kg	%	kg	%	kg	%	kg	%
Grains and products	67.42	10.33	89.73	22.79	111.03	13.49	268.18	14.35
Milk and dairy products	56.76	8.70	40.23	10.22	38.44	4.67	135.43	7.25
Meat and meat products	45.15	6.92	30.79	7.82	61.82	7.51	137.76	7.37
Vegetable and fruit	200.48	30.72	145.57	36.97	378.19	45.94	724.24	38.75
Tuber Plants	79.01	12.11	28.70	7.29	49.56	6.02	157.27	8.42
Legumes	39.63	6.07	2.70	0.69	9.58	1.16	51.91	2.78
Other	164.11	25.15	55.35	14.06	174.60	21.21	394.07	21.09
Total	**652.6**	**100.0**	**393.1**	**99.8**	**823.2**	**100.0**	**1,868.9**	**100.0**

because of the storage conditions. As research sites have various climate and different ecological characteristics, both the consumption habits and the effects of the climate considerably differentiate the amount and rate of waste among the product groups. For example, in Erzurum meat and dairy products are consumed at a high rate due to the fact that animal husbandry is popular in that region and therefore the amount of waste of this group increases. A similar situation is valid for the province of Adana as well. The prevalence of the nutrition based on meat products in Adana province increases waste due to increased consumption in this province. While vegetable production and consumption have similar characteristics in İzmir and Adana, the waste of fruit and vegetable vegetables in these two cities is higher compared to Erzurum. In addition, the difficulty of ensuring storage conditions for cereal group products in hot and humid regions also increases the risk of deterioration in these products and thus, shortens the shelf life of the products. Consequently, the waste rate of the cereals increases in Adana and Izmir. Nevertheless, a common characteristic for all provinces in cereals and products is that bread has the highest share of waste in all provinces within this product group. While the waste of bread consists 60,2% of the total cereals waste in Erzurum, the rate is 88.8% in Izmir and 80% in Adana.

3.2. *Estimation of variables influencing food waste - Sequential probit analysis*

One of the most significant explanatory variables in the model is certainly the logarithm of household total expenditure. This variable was added as an explanatory variable to the model as a sign of purchasing potential since it involves relatively less measurement error. Although it is expected that there will be a reverse relationship between food waste and income, the direction of the effect is surely not clear. Since if we consider the existence of a positive relationship between income and education, we can assume that the income increases when education level will be improved. Smith and Landry (2021) found significantly correlated with education levels and observed food waste, Di

Talia *et al.* (2019), Secondi *et al.* (2015), and Lusk and Ellison (2017) emphasized the possible effect of education. Furthermore, it can be stated that the high diversity of the consumption pattern of the high-income consumers will certainly cause food waste. Abeliotis *et al.* (2016) suggested that in terms of leftover, high income households cared less about the waste than households with less income. On the other hand, some studies reported that higher income were more likely to decide to sort food waste (Florkowski *et al.*, 2018). Stefan *et al.* (2013) point out household income correlated positively with food waste. For determining how education level affects the level of food waste, the level of education of the head of the household and the level of education of the household's spouse were divided into 4 groups and used as the dummy variables. The educational level with dummy variables composed of 4 groups; the head of the household is not literate or is literate without having a diploma (reference variable), the head of the household is graduated from the primary school, the head of the household is graduated from secondary-high school and the head of the household is graduated from the university. Since it is expected that the level of food waste changes based on the size of the household, the number of children, the age of the spouse and the family type (elementary family, extended family, a family with a single member, single family living together – this category is taken as the reference value), the size of the household (as the adult equivalent value) and the age of the household's spouse are added to the model as explanatory variables. Many studies showed that results on the relation between family size and household food waste studies (Setti *et al.*, 2016; Jörissen *et al.*, 2015, Di Talia *et al.*, 2019; Williams *et al.*, 2012). Parizeau *et al.* (2015), Florkowski *et al.* (2018), and Abdelradi (2018) found positive correlation between food waste and household size. In order to determine whether food waste varies according to cities where the survey was applied, city dummy variables were created and İzmir was taken as a comparison choice since the waste of Izmir was lower compared to the other cities. Finally, since the waste will vary

Table 7 - Descriptive statistics of the variables used in the model.

Variables	Average	Standard Deviation
Logarithm of total spending	8.04	0.60
Household size according to the adult equivalent	2.79	1.13
Level of education of household head		
Primary school	0.27	0.44
Middle school/High school	0.57	0.49
University	0.10	0.29
Other	0.06	0.21
The level of education of the household's spouse		
Primary school	0.43	0.49
Middle school/High school	0.40	0.49
University	0.13	0.32
Other	0.04	0.23
The age of the household's spouse	46.22	14.39
If the woman makes the purchase decision	0.33	0.47
The number of children under the age of 15 in the household	1.88	0.77
Family type		
Elementary family	0.58	0.48
Extended family	0.25	0.44
Family type consisting of a single individual	0.11	0.23
Family type consisting of single individuals (more than one)	0.06	0.02
City dummies		
Erzurum	0.333	0.47
Adana	0332	0.47
Izmir	0.335	0.47

according to the individual that makes the purchase of food, the dummy values are added to the model; if the woman takes the decisions to purchase food, 1 value is added to the model, while the other option signifies 0 as the value.

Table 7 presents descriptive statistics of the variables that are used in the sequential probit model. The logarithm of total household expenditure is 8.04 households and the household size are 2.7 according to the adult variable. 57% of the heads of the households and 40% of the spouse of the household head are graduated from middle-high school. Furthermore, the number of children under the age of 15 in the household is 1.88 while in 33% of the households the purchasing decision of food is given by the women and 58% of the families consist of elementary families.

In this study, the determinants of household food waste in Turkey are determined by sequential probit model. Parameter estimations are presented in Table 8. Most of the explanatory variable parameters in the model were statistically meaningful at 5% significance level. At the same time, changing variations were corrected.

When analyzing the marginal effects presented in Table 9, the parameter of total expenditure was determined to be statistically meaningful and positive at 5% significance level for all waste levels. The increase in total expenditure was 7.1% in households having a low rate of waste; 8.2% increase was observed in households having a medi-

Table 8 - Estimates of sequential probit model.

Variables	Coefficients	Z statistics
Logarithm of total spending	0.257	4.12*
Household size according to the adult equivalent	-0.208	-5.38*
Level of education of household head		
Primary school	-0.575	-2.21*
Middle school/High school	-0.508	-2.06*
University	-0.001	2.21*
The level of education of the household's spouse		
Primary school	-0.263	2.09*
Middle school/High school	-0.299	1.97*
University	0.001	2.01*
The age of the household's spouse	0.043	2.19*
If the woman makes the purchase decision	0.174	5.42*
The number of children under the age of 15 in the household	0.311	4.02*
Family type		
Elementary family	-0.163	-7.49 *
Extended family	-0.363	-6.45*
Family type consisting of one single individual	0.199	2.82*
City dummies		
Erzurum	-0.140	-2.78*
Adana	-0.709	7.39*
Sigma		
Household size	-0.321	2.72*
Loglikelihood	-1041.174	
LR	61.49	
Number of Observations	1155	
Cut1	-0.721	0.121
Cut2	0.585	0.183
Cut3	0.881	0.396

*: 5% significance level.

um rate of waste; while 6.3% increase was determined in households having a high rate of waste. The effect of household size on waste categories was determined to be statistically meaningful and negative. This negative effect was determined to be higher for the households having a low rate of waste compared to the other households (households having a medium and high rate of waste). In other words, as household size increases, the percentage of households having a low level of waste will be increased by 22.1% while the percentage of households having a high level of waste will be re-

duced by 18.9%. When the effect of the education of the household head on the level of food waste is examined, it can be observed that if the household head is graduated from primary, secondary or high school, there will be an increase on the household having a low level of waste. On the other hand, if the household head is graduated from the university, the household having a low level of waste will be decreased by 11%. It has been ascertained that the level of household head is graduated from primary, secondary-high school or university and the level of food waste can be decreased in the house-

holds having a medium and high level of waste. It was determined that the households having a medium level of waste will be decreased by 4,6% when the heads of household were graduated from primary school. On the other hand, the percentage of the household having a medium level of waste and the household head graduated from university will be decreased by 12,3%. Similarly, it was determined that the percentage of the households, where the education level of the household head is at the primary school level and having a high level of waste will be decreased by 15,7% while the percentage of household where the education level of the household head is at the university level and having a high level of waste will be decreased by 9,3%. Accordingly, it can be assumed that there will be a decrease when the level of education of the household head increases in the households having a medium and high level of waste. At the same time, in households with low levels of food waste, the conclusion that the level of food waste will be decreased if the education level of the household head increases to the university level, supports the fact that the consumer awareness, and awareness level will be increased with the education and the food waste will be reduced.

It can be asserted that with the increasing level of education of the household head's spouse, the rate of households having a low, medium and high level of waste will be decreased. These findings confirm the idea that education will improve consumer consciousness and awareness and this will lead to a decrease in food waste. As the age of the household head increases, it can be assumed that food wastage will be increased in the households having a low level of waste while it will be decreased in the households having a high level of waste. Since women takes places at every phase of the food processing starting from farm to fork in both developing and developed countries their role in preventing food loss and waste is significant (Lipinski *et al.*, 2013). If the woman takes the decision to purchase food, it can be assumed that there will be a reduction in the food waste rate compared to households, where family members other than the women take the purchasing decisions. This is a significant finding since it shows that if the woman plans the purchasing, there will be less waste because generally, the woman cooks more in the households. The dummy, which was created for the individual making the purchasing decision on food was determined to be statistically insignificant for the households having a low and high level of food waste.

It was ascertained that there would be an increase in food waste according to the number of children under 15 years old. This is consistent with the expectation that the presence of young children will cause food waste. Older consumers stated not wasting food more frequently than younger consumers (Witzel *et al.*, 2019). In many studies, it has been determined that food waste increases in households with children under the age of 18 (Evans, 2011; Jörissen *et al.*, 2015; Parizeau *et al.*, 2015; Ilakovac *et al.*, 2020).

When the level of food waste is examined according to the family type, it is determined that food waste will be increased in the elementary families compared to the households consisting of more than one individual while the food was will be decreased in large families. If the rate of elementary families increases, there will be an increase of 10,1% in the rate of households having a low level of waste, 12,8% in the rate households having a medium level of waste, 9,7% in households having a high level of waste. However, the increase in the number of large families compared to the households consisting of more than one single individual will lead to a reduction in the rate of the household having a low level of waste by 20,6%, while it will lead to a reduction of 12% in the households having a medium level of waste and of 10,3% in the households having a high level of waste. When the city dummies were examined, it has been ascertained that there will be an increase in the households having a low level of waste in the urban areas of Erzurum and Adana, compared to the urban area of Izmir. This increase was observed to be higher with a value of 0.257 for Adana urban area. Furthermore, it is an essential finding in this study to reveal that there will be a reduction in the rate of households having a medium and high-level of waste in Adana's urban areas, compared to the households having a high and medium level of food waste in the urban area of Izmir (Table 9).

Table 9 - Marginal effects.

Variables	Households having a low level of waste	z statistic	Households having a medium level of waste,	z statistic	Households having a high level of waste	z statistic
Logarithm of total spending	0.071	6.04*	0.082	2.16*	0.063	4.27*
Household size according to adult equivalent	-0.221	-2.23*	-0.209	-2.47*	-0.189	-2.13*
Level of education of the household head						
Primary school	0.203	4.21 *	-0.046	-2.51*	-0.157	-4.27*
Middle school/High school	0.143	4.00*	-0.048	-2.92*	-0.138	5.56 *
University	-0.110	-2.16*	-0.123	-2.63*	-0.093	-2.12*
The level of education of the household's spouse						
Primary school	-0.020	-4.40	-0.022	-3.57*	-0.181	3.82*
Middle school/High school	-0.029	-4.54	-0.032	-3.45*	-0.025	4.28*
University	0.014	2.29	-0.015	-2.79*	-0.011	3.79*
The age of the household's spouse	0.012	1.18	0.017	5.29 *	-0.020	3.09*
If the woman makes the purchase decision	0.012	1.12	-0.017	-2.16*	-0.009	-0.923
The number of children under the age of 15 in the household	0.141	3.04*	0.188	4.15*	0.025	2.17*
Family type						
Elementary family	0.101	5.75 *	0.128	2.91*	0.097	3.12*
Extended family	-0.206	-2.32*	-0.120	-2.51*	-0.103	-3.65*
Family type consisting of one single individual	-0.079	-1.43	0.027	1.15	0.081	3.09*
City dummies						
Erzurum	0.048	2.72	-0.062	-1.32	-0.041	-1.78**
Adana	0.051	8.48*	-0.257	-4.23*	-0.192	-9.53*

* 5% significance level, **10% significance level.

4. Conclusion and recommendations

Food loss and waste constitutes an increasing problem for the whole world. In addition to the loss of quality and quantity in all steps of the food chain, it is also caused by when the edible foods are dumped. This study defines the food waste of households in cities representing the different economic and socio-cultural structures in Turkey. It was determined that 1,9 tonnes of food were wasted in 1155 household per week. Among the cities where the research is carried out, waste is mostly experienced in Adana province and most of the product groups wasted there consist of fresh fruits and vegetables. Children in households are the greatest reason for the waste. It has been ascertained that waste is significantly different in households including the children under 15 years old. Food wastage was determined to be high

in small households that include a married or a single couple without children since they often spend time outside the home. These households consist of single or unmarried young couples that spend more time outside the home.

The most significant finding in the study is certainly the relationship between education and waste. It has been ascertained that the waste will decrease with the increase in the education of the household head and mother. In addition, the mother's decision to purchase food was also comprehended as a factor reducing waste. It is among the most critical factors since the women generally dominate the kitchen and plan the meals accordingly. According to this result, if we start to provide training to the women on waste in terms of activity to fight the waste, the effect will be significant. Participants volunteered to participate in activities related to nutrition, food safety, preservation, and cooking. In this respect, it is anticipated that the fastest and practical measure would be if the public institutions, local governments, and non-governmental organizations prepare an urgent action plan in education and supervision, disclose the significance of the issue to the public with mass communication tools. In fact, starting from the autumn of 2018, the messages on food waste started to be broadcasted in the national channels as public service announcements. However, the announcement is quite long and there are too many public service announcements, it is very hard to remember every one of them. In addition, it is very contradictory when many TV programs, such as reality shows and competitions that encourage waste, are performing the same activity. The other target group in the household should be children. The results of the study reveal that children have a great impact on waste. In this sense, providing waste and nutrition education in schools, including waste management and recycling to the curricula of the schools would be very influential in reducing waste. Particularly, it would be beneficial to explain the consequences of the waste in the school cafeterias, benefit from the resulting organic wastes (the non-edible parts of foods such as crust, kernel, etc.) and present the implementation opportuni-

ties as energy sources. It would be a tool for the children to comprehend food production and to respect the food production process when if the children strive to cultivate products in school gardens and use the compost fertilizers made from food waste. The importance of education in food waste reduction strategies has been emphasized in many studies (Kantor *et al.*, 1997; Jörissen *et al.*, 2015; Priefer *et al.*, 2016).

Although the waste of the households was determined to be at the medium level, it was an important issue for Turkey. Cerciello *et al.* (2019) mentioned that consumption habits were rooted in the local culture and were difficult to change in short run, however Stancu *et al.* (2016) and Stefan *et al.* (2013) highlighted, small changes in the routines of the households in terms of food preparation and eating have a significant effect on food waste. The benefits of organizing direct consumer-oriented activities at the micro level have been proved in many countries. Following would be the first methods to implement as the recommendations to reduce the waste; street demonstrations involving celebrity chefs for the evaluation of the wasted food in Turkey and practices, preparation and distribution of meals by using the foods that are considered not presentable by the stores after they are picked by the volunteers, providing a calendar for purchasing, cooking and throwing to the households defined as the focus group. It has been revealed in studies that label information such as expiration date, production date, consumption time after opening is a factor that increases waste (Wilson *et al.*, 2017). For this reason, informing the consumers about the expiration date, as well as having the best before statement on the labels can also reduce household waste.

Food waste signifies an economic, environmental and social problem. Economically, it causes significant losses for retailers and producers, as well as households. Benefits should also place the food that looks unpresentable by taking into consideration the preferences of the consumers, particularly in fresh fruit and vegetables. This practice will highly contribute to change the consumers' perception on the hand. On the other hand, the costs of the seller will be reduced. In addition, retailers should be en-

couraged to hang warning signs that draw the attention of the consumer and legal regulations should be established to ensure that the practice is mandatory at certain times. Including some warnings on the food packages about the food waste as there are warnings on the cigarette packages would be a serious solution for increasing the awareness of the consumers.

It has been ascertained that the studies prove that the warnings in the hotels, restaurants, cafeterias, and cafes certainly drew attention and the consumers tend to avoid the food waste, even for a short time. In these areas, it is essential to cooperate with the professional institutions for using the warnings. Furthermore, it should be encouraged in restaurants that people can take away the leftovers. If the cost of this waste to the consumers in the restaurants is added to the invoice, it is a method used in some developed countries and it is highly deterrent. This practice may be perceived as unrealistic for Turkey, there may be some volunteer enterprises that may implement this practice. It is not reasonable to implement these micro-practices following the recommendations of the teachers. Various initiatives should be put in place by the relevant public institutions. Enterprises with high environmental sensitivity should be considered as pilot projects. Certainly, there are enterprises in Turkey striving to get the label of green hotels, green restaurants, green cafes. It is possible to launch sample practices with these enterprises.

The implementation of the measures relating to food loss will exclusively be possible if all stakeholders are aware of the magnitude and seriousness of the problem. There is a serious need for encouraging practices to disclose the recording of the foods for all the actors of the food chain in Turkey. It is feasible to encourage the manufacturers to keep the documents regularly regarding the waste processes on sales. For example, a discount on stoppage or additional support can be provided. Similarly, the municipalities can also monitor the records of the enterprises and it is possible to offer some discounts or exemptions to the tradesmen of the market such as middlemen, wholesalers if they manage the process correctly.

Since food waste is not very visible for the society and it is not considered as significant as other social issues such as smoking, infectious diseases, the increase of non-communicable diseases, renewable energy, violence, and abuse, the food waste significantly increases in the society. However, the difficulties encountered in the food supply and the economic and environmental damages of food waste are closely related to all these social issues. However, in some societies, it may be simpler to increase the consciousness against the waste by taking into consideration the effects of norms and beliefs on behaviors.

This work fills a gap in the empirical literature on food waste in Turkey. Since this study is the first study in Turkey in this context, ant it will shed light on many studies to reveal the current situation. The future studies can use the findings of the current study for creating solutions in the studies to be conducted with different groups to reduce the waste This wasting problem, which is yet to be recognized, but still challenging to be accepted, will be resolved if there are studies conducted to find a solution to the problem.

References

Abdelradi F., 2018. Food waste behaviour at the household level: A conceptual framework. *Waste Management*, 71: 485-493.

Abeliotis K., Chroni C., Lasaridi K., 2016. Measuring Food Waste Generation from Households in Greece: Behaviours, Attitudes, and Potential for Prevention. *Current Politics and Economics of Russia, Eastern and Central Europe*, 31(3-4): 467.

Albisu L.M., 2016. Consumer behaviour with respect to food losses and waste. In: International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) and Food and Agriculture Organization of the United Nations (FAO), *Mediterra 2016. Zero Waste in the Mediterranean. Natural Resources, Food and Knowledge*. Paris: Presses de Sciences Po, pp. 303-317. https://www.ciheam.org/uploads/attachments/452/13_Mediterra2016_EN.pdf.

Aschemann-Witzel J., de Hooge I.E., Almli V.L., Oostindjer M., 2018. Fine-tuning the fight against food waste. *Journal of Macromarketing*, 38(2): 168-184.

Aydoğdu A., Koçoğlu C.M., 2017. Helâl Konseptli Otellerde İsraf: Bir Örnek Olay İncelemesi. In: Oktay K., Pamukçu H. (eds.), *1st International Halal Tourism Congress Proceedings Books*. Kastamonu: Kastamonu University, Tourism Faculty, pp. 1105-1115.

Bal E.Z., Sayılı M., Gözener B., 2013. Tokat İli Merkez İlçede Ailelerin Ekmek Tüketimleri Üzerine Bir Araştırma. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi*, 30(1): 61-69.

Beausang C., Hall C., Toma L., 2017. Food waste and losses in primary production: Qualitative insights from horticulture. *Resources, Conservation and Recycling*, 126: 177-185.

Bell D.R., Corsten D., Knox G., 2011. From point of purchase to path to purchase: How preshopping factors drive unplanned buying. *Journal of Marketing*, 75(1): 31-45.

Buzby J.C., Hyman J., 2012. Total and per capita value of food loss in the United States. *Food Policy*, 37: 561-570.

Capagain A.K., James K., 2013. Accounting for the Impact of Food Waste on Water Resources and Climate Change. In: Kosseva M.R., Webb C. (eds.), *Food Industry Wastes Assessment and Recuperation of Commodities*. London: Academic Press, Chapter 12, pp. 217-236.

Cerciello M., Agovino M., Garofalo A., 2019. Estimating food waste under the FUSIONS definition: What are the driving factors of food waste in the Italian provinces? *Environment, Development and Sustainability*, 21(3): 1139-1152.

Corrado S., Caldeira C., Eriksson M., Hanssen O.J., Hauser H.E., van Holsteijn F., Stenmarck Å., 2019. Food waste accounting methodologies: Challenges, opportunities, and further advancements. *Global food security*, 20: 93-100.

De Hooge I.E., Oostindjer M., Aschemann-Witzel J., Normann A., Loose S.M., Almli V.L., 2017. This apple is too ugly for me! Consumer preferences for suboptimal food products in the supermarket and at home. *Food Quality and Preference*, 56: 80-92.

De Laurentiis V., Corrado S., Sala S., 2018. Quantifying household waste of fresh fruit and vegetables in the EU. *Waste Management*, 77: 238-251.

De Meo E., Giannoccaro G., Berbel J., Campo R., 2018. Food waste: A survey about consumers and their attitudes. *Rivista di studi sulla sostenibilità*, VIII(1): 181-194.

Delley M., Brunner T.A., 2017. Foodwaste within Swiss households: A segmentation of the population and suggestions for preventive measures. *Resources, Conservation and Recycling*, 122: 172-184.

Di Talia E., Simeone M., Scarpato D., 2019. Consumer behaviour types in household food waste. *Journal of Cleaner Production*, 214: 166-172.

Di Terlizzi B., Van Otterdijk R., Dragotta A., Pink P., El Bilali H., 2016. Innovation for the reduction of food losses and waste. In: International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) and Food and Agriculture Organization of the United Nations (FAO), *Mediterra 2016. Zero Waste in the Mediterranean. Natural Resources, Food and Knowledge*. Paris: Presses de Sciences Po, pp. 281-301. https://www.ciheam.org/uploads/attachments/451/12_Mediterra2016_EN.pdf.

Dölekoğlu C.Ö., Giray F.H., Şahin A., 2014. Mutfaktan Çöpe Ekmek: Tüketim ve Değerlendirme. *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi*, 44. https://dergipark.org.tr/tr/download/article-file/382869.

Dölekoğlu C.Ö., Var I., 2019. Analysis of food waste in university dining halls: A case study from Turkey. *Fresenius Environmental Bulletin*, 28: 156-166.

Elimelech E., Ayalon O., Ert E., 2018. What gets measured gets managed: A new method of measuring household food waste. *Waste Management*, 76: 68-81.

Esparza I., Jiménez-Moreno N., Bimbela F., Ancín-Azpilicueta C., Gandía L.M., 2020. Fruit and vegetable waste management: Conventional and emerging approaches. *Journal of Environmental Management*, 265: 110510.

Evans D., 2011. Blaming the consumer–once again: the social and material contexts of everyday food waste practices in some English households. *Critical Public Health*, 21(4): 429-440.

Fami H.S., Aramyan L.H., Sijtsema S.J., Alambaigi A., 2019. Determinants of household food waste behavior in Tehran city: A structural model. *Resources, Conservation and Recycling*, 143: 154-166.

FAO, 2013. *Toolkit. Reducing the Food Wastage Footprint*. http://www.fao.org/3/i3342e/i3342e.pdf.

Florkowski W.J., Us A., Klepacka A.M., 2018. Food waste in rural households support for local biogas production in Lubelskie Voivodship (Poland). *Resources, Conservation and Recycling*, 136: 46-52.

Graham-Rowe E., Jessop D.C., Sparks P., 2015. Predicting household food waste reduction using an extended theory of planned behaviour. *Resources, Conservation and Recycling*, 101: 194-202.

Greene W., 2002. *Econometric analysis*. Upper Saddle River, NJ: Prentice Hall.

Gustavsson J., Cederberg C., Sonesson U., van Otterdijk R., Meybeck A., 2011. *Global Food Losses and Food Waste: Extent, Causes and Prevention*. Study conducted for the International Congress SAVE FOOD! at Interpack2011, Düsseldorf, Germany. Rome: Fao.

Gül A., Isik H., Bal T., Özer S., 2003. Bread Consumption and Waste of Households in Urban Area of Adana Province. *Electronic Journal of Polish Agricultural Universities* 6(2). Available at: http://www.ejpau.media.pl/volume6/issue2/food/art-10.html.

Ilakovac B., Voca N., Pezo L., Cerjak M., 2020. Quantification and determination of household food waste and its relation to sociodemographic characteristics in Croatia. *Waste Management*, 102: 231-240.

Jribi S., Ben Ismail H., Doggui D., Debbabi H., 2020. COVID-19 virus outbreak lockdown: What impacts on household food wastage? *Environment, Development and Sustainability*, 22: 3939-3955. https://doi.org/10.1007/s10668-020-00740-y.

Jörissen J., Priefer C., Bräutigam K.R., 2015. Food waste generation at household level: results of a survey among employees of two European research centers in Italy and Germany. *Sustainability*, 7(3): 2695-2715.

Junguo L., Lundqvist J., Weinberg J., Gustafsson J., 2013. Food Losses and waste in China and their implication for water and land. *Environmental Science & Technology*, 47: 10137-10144.

Kantor L.S., Lipton K., Manchester A., Oliveira V., 1997. Estimating and addressing America's food losses. *Food Review/National Food Review*, 20(1): 2-12.

Köksal O., 1977. *Türkiye 1974 Beslenme, Sağlık ve Gıda Tüketimi Araştırması* (*National nutrition, health and food consumption survey of Turkey*). Ankara: s.n.

Langley J., Yoxall A., Heppell G., Rodriguez E.M., Bradbury S., Lewis R., Rowson J., 2010. Food for Thought? A UK pilot study testing a methodology for compositional domestic food waste analysis. *Waste Management & Research*, 28(3): 220-227.

Lebersorger S., Schneider F., 2011. Discussion on the methodology for determining food waste in household waste composition studies. *Waste Management*, 31(9-10): 1924-1933.

Lipinski C., Hanson C., Lomax J., Kitinoja L., Waite R., Searchinger T., 2013. *Reducing Food Loss and Waste*. Working Paper, Installment 2 of "Creating a Sustainable Food Future". Washington, DC:

World Resources Institute. https://files.wri.org/d8/s3fs-public/reducing_food_loss_and_waste.pdf.

Long S., 1997. *Regression Models for Categorical and Limited Dependent Variables*. Thousand Oaks: Sage Publishing.

Lusk J.L., Ellison B., 2017. A note on modelling household food waste behaviour. *Applied Economics Letters*, 24(16): 1199-1202.

Maddala G.S., 1987. Limited Dependent Variable Models Using Panel Data. *Journal of Human Resources*, 22(2): 207-338.

Mena C., Diaz B.A., Yurt Ö., 2011. The Causes of Food Waste in the Supplier-Retailer Interface: Evidence from the UK and Spain. *Resources, Conservation and Recycling*, 55(6): 648-658.

Mete H., 2017. Ekmek İsrafı ve Önleme Yöntemleri. *Tekirdağ SMMM Odası Sosyal Bilimler Dergisi*, 7: 1-10.

Nahman A., Lange W., 2013. Costs of food waste along the value chain: Evidence from South Africa. *Waste Management*, 33: 2493-2500.

Nahman A., Lange W., Oelofs S., Godfrey L., 2012. The costs of household food waste in South Africa. *Waste Management*, 32: 2147-2153.

Niyaz Ö.C., Demirbaş N., 2020. Determining the food waste behaviour of consumers in Northwest Turkey: A cross-sectional analysis. *New Medit*, 19(3): 129-142.

Parfitt J., Barthel M., Macnaughton S., 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554): 3065-3081.

Parizeau K., von Massow M., Martin R., 2015. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Management*, 35: 207-217.

Pekcan G., Köksal E., Küçükerdönmez Ö., Özel H., 2006. Household Food Wastage in Turkey. FAO Statistics Division, Working Paper Series. Available at: http://www.fao.org/docrep/013/am063e/am063e00.pdf.

Ponis S.T., Papanikolaou P.A., Katimertzoglou P., Ntalla A.C., Xenos K.I., 2017. Household food waste in Greece: A questionnaire survey. *Journal of Cleaner Production*, 149: 1268-1277.

PRB (Population Reference Bureau), 2019. U.S. Indicators: Percent of the Population Living in Poverty. Available at: https://www.prb.org/us-food-stamps/ (enacted: April 5, 2019).

Priefer C., Jörissen J., Bräutigam K.R., 2016. Food waste prevention in Europe–A cause-driven approach to identify the most relevant leverage points

for action. *Resources, Conservation and Recycling*, 109: 155-165.

Refsgaard K., Magnussen K., 2008. Household behaviour and attitudes with respect to recycling food waste experiences from focus groups. *Journal of Environmental Management*, 90: 760-771.

Ridolfi R., Dernini S., Morrison J., Mathiesen Á.M., Capone R., 2020. Changing Route: Common Action on Food Systems Transformation in the Mediterranean. *New Medit*, 19(3): 119-128. https://doi.org/10.30682/nm2003h2.

Secondi L., Principato L., Laureti T., 2015. Household food waste behaviour in EU-27 countries: A multilevel analysis. *Food Policy*, 56: 25-40.

Setti M., Falasconi L., Segrè A., Cusano I., Vittuari M., 2016. Italian consumers' income and food waste behavior. *British Food Journal*, 118(7): 1731-1746.

Smith T.A., Landry C.E., 2021. Household Food Waste and Inefficiencies in Food Production. *American Journal of Agricultural Economics*, 103(1): 4-21.

Stancu V., Haugaard P., Lähteenmäki L., 2016. Determinants of consumer food waste behaviour: Two routes to food waste. *Appetite*, 96: 7-17.

Stefan V., Van Herpen E., Tudoran A.A., Lähteenmäki L., 2013. Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. *Food Quality and Preference*, 28(1): 375-381.

Taşcı R., Karabak S., Bolat M., Pehlivan A., Şanal T., Acar O, Külen O.A.S., Güneş E., Albayrak M., 2017. Ankara İlinde Ekmek Fırınlarının Üretim Yapısı ve Ekmek İsrafı. *Tarim Ekonomisi Araştirmalari Dergisi*, 3(1): 1-16.

Tatlıdil F.F., Dellal İ., Bayramoğlu Z., 2013. *Food Losses and Waste in Turkey*. Country Report, FAO. https://www.fao.org/publications/card/en/c/274dfc13-7c02-428c-9ae7-e81724dfbfcc/.

Tepecik A., Gümüş Ç., 2017. Ekmek İsrafını Önleme Konulu Sosyal Sorumluluk Kampanyasına İlişkin Akademisyen, Uzman ve Öğrenci Görüşleri. *Sanat ve Tasarım Dergisi*, 19: 161-181.

UNEP (United Nations Environment Programme), 2021. *Food Waste Index Report 2021*. Nairobi: UNEP. https://www.unep.org/resources/report/unep-food-waste-index-report-2021.

Yıldırım H., Capone R., Karanlık A., Bottalica F., Debs P., El Bilal, H., 2016. Food Wastage in Turkey: An Exploratory Survey on Household Food Waste. *Journal of Food and Nutrition Research*, 4(8): 483-489. http://pubs.sciepub.com/jfnr/4/8/1.

Young C.W., Russell S.V., Robinson C.A., Chintakayala P.K., 2018. Sustainable retailing – influencing consumer behaviour on food waste. *Business Strategy and the Environment*, 27(1): 1-15. https://doi.org/10.1002/bse.1966.

Van der Werf P., Seabrook J.A., Gilliland J.A., 2018. The quantity of food waste in the garbage stream of southern Ontario, Canada households. *PloS One*, 13(6): e0198470. https://doi.org/10.1371/journal.pone.0198470.

Van Herpen E., van der Lans I.A., Holthuysen N., Nijenhuis-de Vries M., Quested T.E., 2019. Comparing wasted apples and oranges: An assessment of methods to measure household food waste. *Waste Management*, 88: 71-84.

Williams H., Wikström F., Otterbring T., Löfgren M., Gustafsson A., 2012. Reasons for household food waste with special attention to packaging. *Journal of Cleaner Production*, 24: 141-148.

Williams R., 2010. Fitting heterogeneous choice models with oglm. *The Stata Journal*, 10(4): 540-567.

Wilson N.L., Rickard B.J., Saputo R., Ho S.T., 2017. Food waste: The role of date labels, package size, and product category. *Food Quality and Preference*, 55: 35-44.

Witzel J., Giménez A., Ares G., 2019. Household food waste in an emerging country and the reasons why: Consumer s own accounts and how it differs for target groups. *Resources, Conservation and Recycling*, 145: 332-338.

WRAP (Waste & Resources Action Programme), 2012. *Household Food and Drink Waste in the United Kingdom 2012*. Final Report. Available at: https://wrap.org.uk/resources/report/household-food-and-drink-waste-united-kingdom-2012.

Web Links

http://www.fao.org/save-food (enacted: March 14, 2017)

https://www.globalcitizen.org/en/content/trf-food-waste-could-feed-the-poor/ (enacted: December 21, 2016).

https://www.unep.org/thinkeatsave/get-informed/worldwide-food-waste

http://www.fao.org/3/ca9692en/online/ca9692en.html

https://data.tuik.gov.tr/Bulten/Index?p=Statistics-on-Family-2018-30726