Determining the food waste behaviour of consumers in Northwest Turkey: A cross-sectional analysis

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Abstract

The aim of this study was to determine attitudes of consumers in the northwestern part of Turkey towards food waste behaviour. A structural equation model was used to analyze the attitudes and behaviour of consumers to food waste within the framework of the Theory of Planned Behaviour. It was found that food-related planning routines had no effect on food waste behaviour, but that food-related shopping routines encouraged food waste behaviour. On the other hand, the intention not to waste acted to discourage food waste behaviour in consumers. Accordingly, the tendency for consumers to buy more food than they need when shopping leads to an increase in food waste in the household, while the intention not to waste food acts to reduce the amount of waste. Moral attitudes increased the effect of shopping routines while perceived behaviour control had the effect of decreasing it. Intention not to waste was reduced by moral norms and enhanced by subjective norms. Food waste is an ever-increasing problem, but it is preventable. It is recommended that these factors be taken into consideration when developing campaigns, public information notices and workshops about food waste reduction.

Keywords: Food waste, Food-related routines, attitudes, behaviour, Theory of Planned Behaviour.

1. Introduction

1.1. *Food waste concerns and background scenario*

One-third of all the food produced (approximately 1.3 billion tonnes) for human consumption gets lost or wasted every year at different stages in the food supply chain (Gustavsson *et al.*, 2011; FAO, 2013a; Priefer *et al.*, 2013; Stancu *et al.*, 2016). Ironically, 795 million people suffer from malnutrition worldwide (UNDP, 2014; FAO/IFAD/WFP, 2015). Food losses and waste occur mainly in industrialized ($ 680 billion) and developing countries ($ 310 billion), which results in a total economic loss of $ 990 billion (FAO, 2014). In addition, food losses and waste contribute to other global problems such as wasted agricultural land resources, water, energy and labour, and also environmental pollution with methane gas (Quested and Johnson, 2009; Kosseva, 2013; Hebrok and Boks, 2017; Lopolito *et al.*, 2017; Schanes *et al.*, 2018). Food losses and waste caused environmental damage to 250 km³ of water, 1.1 billion hectares of usable

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land and the Earth's atmosphere with 3.3 tonnes of gases in 2007 (FAO, 2013b). According to the United Nations (UN), the worldwide population will reach 9.3 billion in 2050 and food waste will increase by 40% by 2020 unless preventive actions are taken (Parfitt *et al.*, 2010; Priefer *et al.*, 2013). This means that, if food losses and waste problems cannot be avoided, hunger and malnutrition problems will be significantly increased.

Food losses may occur during agricultural or industrial production, especially in the post-harvest period or in the food-processing stage in developing countries, while food waste is mainly seen at the consumer level in industrialized countries (Gustavsson *et al.*, 2011; Secondi *et al.*, 2015; Stancu *et al.*, 2016). Awareness of consumers is the key factor in reducing food waste (Secondi *et al.*, 2015). However, consumer perception of food waste is not at all clear despite the occurrence of food waste in huge quantities (Richter, 2017). Consumers are the single biggest actors responsible for food waste in public places and at household level (Evans, 2011; Gustavsson *et al.*, 2011; Kosseva, 2013; Farr-Wharton *et al.*, 2014; Setti *et al.*, 2018). The largest share of food waste occurs at household level (Griffin *et al.*, 2009; Parfitt *et al.*, 2010; Schanes *et al.*, 2018) especially in industrialized economies (Setti *et al.*, 2018), and food waste is still a major concern for many countries (Quested and Johnson, 2009; Gustavsson *et al.*, 2011; FAO, 2012; Tatlıdil *et al.*, 2013). The amount of food wasted by consumers is estimated to be between 95 and 115 kg per capita in Europe and North America, while only 6 to 11 kg per capita in sub-Saharan Africa and in South and South-East Asia (Tatlıdil *et al.*, 2013). According to the Waste and Resources Action Programme (WRAP) 2008 Report, United Kingdom householders threw away 88 kg of avoidable food waste per capita in a year (Ventour, 2008). Therefore, food waste is a common problem both for developed and developing countries.

1.2. *Previous research*

Food waste is a common and interdisciplinary concept – involving social, agricultural, nutrition science aspects, etc. – (Parfitt *et al.*, 2010; Langley *et al.*, 2010; Kosseva, 2013; Elmenofi *et al.*, 2015) for researchers in different countries (Graham-Rowe *et al.*, 2015; Abdelradi, 2018). However, there is still a lack of evidence about all determinants contributing towards food waste behaviour (Principato *et al.*, 2015; Secondi *et al.*, 2015; Stancu *et al.*, 2016; Schanes *et al.*, 2018).

Several studies have aimed to investigate consumer perception and behaviours related to food waste over the last decade (Evans, 2011; Evans *et al.*, 2013; Stefan *et al.*, 2013; Schneider, 2013; Quested *et al.*, 2013; Farr-Wharton *et al.*, 2014; Graham-Rowe *et al.*, 2014; Abeliotis *et al.*, 2014; Graham-Rowe *et al.*, 2015; Parizeau *et al.*, 2015; Porpino *et al.*, 2015; Thyberg and Tonjes, 2016; Visschers *et al.*, 2016; Stancu *et al.*, 2016; Hebrok and Boks, 2017; Setti *et al.*, 2018; Abdelradi, 2018; Diaz-Ruiz *et al.*, 2018; Schanes *et al.*, 2018; Welch *et al.*, 2018). Some of these studies involved literature reviews (Evans *et al.*, 2013; Schneider, 2013; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017) and other research has been structured using experimental data divided into focus groups (Evans, 2011; Farr-Wharton *et al.*, 2014; Visschers *et al.*, 2016) or survey data (Stefan *et al.*, 2013; Graham-Rowe *et al.*, 2015; Stancu *et al.*, 2016; Aktaş *et al.*, 2018; Abdelradi, 2018; Setti *et al.*, 2018). Research involving empirical survey data can be divided into two categories: studies using the Theory of Planned Behaviour (TPB), (Stefan *et al.*, 2013; Graham-Rowe *et al.*, 2015; Stancu *et al.*, 2016; Aktaş *et al.*, 2018; Setti *et al.*, 2018) and those that do not (Abeliotis *et al.*, 2014; Abdelradi, 2018). TPB is the most common model for research into empirical survey data for household food waste.

Recent studies agree that food waste behaviour cannot be explained by only the socio-economic environment of the consumers (Farr-Wharton *et al.*, 2014; Setti *et al.*, 2018; Aktaş et al., 2018). Also, the drivers for food waste are well known and have been investigated (Stefan *et al.*, 2013; Stancu *et al.*, 2016). Thus, there are many studies about food waste (Evans, 2011; Evans *et al.*, 2013; Quested *et al.*, 2013; Farr-Wharton *et al.*, 2014; Graham-Rowe *et al.*, 2014; Abeliotis *et al.*, 2014; Graham-Rowe *et al.*, 2015; Porpino *et*

al., 2015; Thyberg and Tonjes, 2016; Visschers et al., 2016; Stancu et al., 2016; Hebrok and Boks, 2017; Setti et al., 2018; Abdelradi, 2018; Diaz-Ruiz et al., 2018; Schanes et al., 2018), but research that analyzes the drivers of food waste using empirical data at a household level is still limited (Stefan et al., 2013; Graham-Rowe et al., 2014; Diaz-Ruiz et al., 2018; Stancu et al., 2016; Schanes et al., 2018).

Stefan et al. (2013) outlined the role of food-related practices (planning and shopping behaviours), as well as the core conceptual structures specified by TPB, with investigations of food waste behaviour of consumers in Romania.

There are few country reports (Pekcan et al., 2006; Tatlıdil et al., 2013; EU FUSIONS, 2016; COMCEC, 2017) that contain data on ratios and quantity of food losses and waste about Turkey. International literature features only one study on food wastage in Turkey (Yıldırım et al., 2016). The authors evaluated food waste using only a few basic food waste patterns from Turkish consumers using basic statistical analyses. Prior to this study there had been no research into consumer food waste drivers using TPB, either in one area or in the whole of Turkey. Therefore, our study is important for both the Turkish and international literature as it uses a similar model to compare different cultures.

1.3. *Theory of the Planned Behaviour Model*

Food waste is the result of preferential behaviour related to the feeding behaviour and attitude of individuals (Kosseva, 2013). That is why consumer attitudes and behaviours are becoming important in reducing or avoiding food waste at household level. TPB (Ajzen, 1991; 2015) is widely used to explain the behaviour of consumers in terms of beliefs, attitudes and intentions (Stefan et al., 2013; Farr-Wharton et al., 2014; Graham-Rowe et al., 2015; Stancu et al., 2016; Setti et al., 2018). There have been many food-related behaviour studies based on TPB (Ajzen, 1991), but only a few recent food waste studies structured by TPB were used to guide this study (Stefan et al., 2013; Graham-Rowe et al., 2015; Stancu et al., 2016; Aktaş et al., 2018; Setti et al., 2018).

Food waste is a complicated behaviour which is related to many variables (Quested et al., 2013; Secondi et al., 2015; Setti et al., 2018). That is why all the variables involved with food waste cannot yet be very well described. Individual behaviours are determined by intentions (Ajzen, 1991; Schanes et al., 2018). TPB assumes that intentions are major drivers of behaviour (Ajzen, 1991; 2015), as intentions can drive the food waste processes of consumers (Stefan et al., 2013). The role of norms on the intention to decrease food waste is also interesting (Schanes et al., 2018). In contrast, according to TPB, behavioural intentions may be affected by behavioural attitudes, subjective norms (commonly confirmed or unconfirmed behaviours in a culture (Schanes et al., 2018)) and Perceived Behavioural Control (PBC) (Ajzen, 1991). Generally, in the TPB model, attitudes are considered as one concept. However, in this study, as in other related food-waste studies (Stefan et al., 2013; Stancu et al., 2016), attitudes are divided into two concepts. The first one is a lack of concern about wasting food, which contains more general attitudes such as whether consumers think that food waste is good or bad. The second one is concerned with moral attitudes as in previous studies. Moral attitudes seem pertinent to this subject, as consumers are expected to feel guilty about food waste behaviour. Two other components expected to affect behavioural intentions are subjective norms and PBC variables (Ajzen, 1991; Stefan et al., 2013; Stancu et al., 2016). The term 'subjective norms' basically refers to support given or not given by important others, like family, friends or neighbours (Ajzen, 1991; Schanes et al., 2018). In the present and previous studies (Stefan et al., 2013), subjective norms are used to explain the effect other important people (family members, neighbours, etc.) have on the behaviour of households in influencing them not to waste food. In the published literature, subjective norms are divided into injunctive norms and descriptive norms. While injunctive norms refer to behaviour that is approved or disapproved by others, descriptive norms refer to the way others typically behave. This study, which is also based on the model of Stefan et al. (2013), used injunctive norms as

subjective norms. PBC may be effective on intentions or directly on behaviours (Ajzen, 1991; Stefan *et al.*, 2013; Stancu *et al.*, 2016). PBC demonstrates the barriers and challenges to the consumer of a subject. PBC is relevant in this study to the extent that consumers think food waste is under their control.

Planning and shopping routines may be related to food-waste behaviour in addition to the intention not to waste food. Consumers' shopping routines may be the cause of food waste if consumers buy more food than they need (Evans, 2012; Stancu *et al.*, 2016; Hebrok and Boks, 2017). Also, planning routines about cooking quantities and checking stock in the refrigerator may give important clues about consumers' food waste behaviour (Hebrok and Boks, 2017).

Initially, the guide study expected planning routines to have the effect of reducing the amount of food waste, while shopping routines were expected to increase it. We expected similar results before the field survey. The guide study and the expectations of our study were similar at the beginning, and the results are compared in the results section. The objective of this study was to determine the routines and attitudes of consumers in north-west Turkey about food waste behaviour according to TPB.

1.4. *Research area*

Turkey is one of the countries that struggles with food losses and the problem of waste (Pekcan *et al.*, 2006; Tatlıdil *et al.*, 2013). Turkey is a developing economy in the European Zone and an important producer of agricultural products in the world. As a Mediterranean country, Turkey has a high potential to produce many kinds of fresh agricultural products. Data on agricultural production shows that food losses occur mainly at farm level. It is estimated that 20% of fruit and vegetables, 15% of oilseeds and pulses, 10% of meat and fish products and 5% of cereals are lost at production level (Tatlıdil *et al.*, 2013; Karaca and Öztürk, 2018). While food losses generally stem from technical and economic issues which take time and money to solve, food waste can easily be prevented through changes in consumer behaviour. However, given the size of

the population (82 million people TSI, 2018a), food waste at household level – cereals at 5%, fruit and vegetables at 5%, oilseeds and pulses at 4% – is still a big concern. According to the Food and Agriculture Organization 2006 (FAO) report, Turkish households waste 480 kcal/day of their daily energy intake through food wastage (Pekcan *et al.*, 2006). Wastage by Turkish consumers is estimated at 9.8% of their food needs on average. Average daily discards per household (816 g) and per person (318 g) are very high. As a consumption pattern, Turkish people's bread consumption is above the world average; however, bread is the most wasted product at a level of 5% of consumption (Tatlıdil *et al.*, 2013; Albisu, 2016).

Northwest Turkey is an important part of the country with a well educated population and a high level and variety of agricultural production (TSI, 2018b, 2018c, 2018d). Çanakkale province is located in this region. It links the land masses of Asia and Europe together via the Çanakkale Bosphorus. Many kinds of Mediterranean products (olives, fresh fruits and vegetables) are produced in the province and consumers in the city have access to fresh agricultural products all the time. (TRCG, 2019; TRMFA, 2019). More than half a million people (540,662) live in Çanakkale province (TSI, 2018a), which is one-third of the population of Northwest Turkey.

2. Material and methods

In this section, the sample and analysis methods are given in detail.

2.1. *The sample*

Data were collected through face-to-face surveys. They were conducted between August and October 2015 in the centre of Çanakkale province. A probability sampling method was used to determine the sample size. In the target group with 95% confidence bounds, where $\alpha=0.05$ and $t=1.96$, the sample size was calculated to be at least 383. Four hundred and twenty-two questionnaires were conducted with volunteer consumers, of which twenty-two were found not to be of acceptable quality for evaluation. Therefore a total of 400 questionnaires

were included in the study. The sample size was required to be at least 200 for the Structural Equation Model (SEM) according to the published literature (Kline, 2011; Abdelradi, 2018). The survey was targeted at people of 18 years of age or older who have responsibility for what happens with food; either for cooking or shopping for food. For the purposes of the study, the population of Çanakkale city center was effectively divided into five income groups and the surveys were distributed according to the number of citizens in the districts. Table 1 details the socio-economic status of the consumers.

2.2. *Variables and measures*

The questionnaire was divided into three parts. The first covered the socio-demographic characteristics of consumers such as gender, age, education, number in the household and household income. The second part asked for information on what percentage and what kind of food they wasted at household level. The third part included questions about attitudes and behaviour. The questionnaire included items on self-reported food waste behaviour, the intention not to waste food and on shopping and planning behaviour. In addition, subjective norms included PBC, lack of concern, moral attitudes and socio-demographic factors (see Table 3 for the measures included in SEM).

In this study, we used the Food Waste Model developed with SEM by Stefan *et al.* (2013). Some items were changed or evaluated in the model (Table 3). They implemented TPB for food waste behaviour with the variables mainly collected from WRAP reports. They recommended that this model should also be implemented for different cultures. Some alterations and additions were made in our study to improve certain items and areas of the model identified by Stefan *et al.* (2013) as weaknesses. These items and the scales used are shown in Table 3. In their studies, food waste behaviour was divided into five product groups. For this study, we wanted more specific focus and so eleven different product groups were identified. While Stefan *et al.* (2013) said that they deleted "bread and bakery products" in their study because of low factor loadings – according

to factor analysis – in our study we found that "milk and dairy products", "red meat and products", "poultry and meat products", "fish and marine products", "eggs, oils and pulses" all had low factor loadings. Therefore, these could not be included as variables in our model. Products of this kind have high value in Turkey compared to other products in the model, so they cannot be easily bought and are unlikely to be wasted. The variables, items and scales included in *Intentions Not to Waste*, *Planning Routines* and *Shopping Routines* are also presented in Table 3. In a previous model study, the first item: "how likely is it that you will not discard food during the next week" and its scale: "not at all likely (1) to extremely likely (5)", were both deleted under factor loading from the beginning in their model. That is why we did not use this variable in our study. We used the same scale for the *Intention Not to Waste*: from "strongly disagree (1) to strongly agree (7)", which had already been used in a previous study and known as the 7- Point Likert Scale. The first two items in *Intention Not to Waste* (Table 3) were derived with small differences (instead of 'next week', we tried 'next year', etc.) compared to the previous study model. But the first item was below the required factor load for our study, though the previous study found it sufficiently high to include in their model. The last two items we added to the model were from published literature, which are also related to awareness of production and environmental resources. In *Planning Routines* the first three items were modified from the previous model. However, two of these items had low factor scores in our study. We added a new item for the fourth, and its factor load for our region was acceptable (Table 3). In *Shopping Routines*, two items were taken from the previous model which provided sufficiently high factor load scores for our model. In *Moral Attitudes*, the first two items are taken from the previous study; however, one of them was under the expected factor loading for our study and could not be taken into our model. Additionally, we added a few items derived from the published literature and only one of them provided the necessary factor load. The items which were added later and had low factor loadings could not be taken into our model. The first three items for the *Lack of Concern* variable in Table 3

were adapted from the previous study. The first item did not fit our model but the other two items did. From this, the last item was added by us as it had a high enough factor load to be used in the final model. For *Subjective Norms* and *PBC*, we selected items from the previous model which had sufficiently high factor loads (Table 3).

2.3. *Data analysis*

Empirical data analysis was performed in three stages. Firstly, Chi-square Analysis was carried out to highlight the relationships between consumers' food waste status and demographic characteristics. Chi-square Analysis was used for categorical (ordinal or nominal) variables to test and examine the difference between expected and observed distributions (Weaver *et al.*, 2017). The variables and characteristics of variables which were used in the Chi-square Analysis are shown in Table 1. The hypothesis for the Chi-square Analysis test is given below:

- H_1: There are relationships between consumers' food waste status and their socio-demographic characteristics.

Secondly, Confirmatory Factor Analysis (CFA) was carried out to test the validity and reliability of the scales. Finally, SEM was run in Lisrel 9.1 to test the food waste conceptual model.

Goodness of fit indices according to CFA values are shown in Table 3. The Incremental Fit Index (IFI) and Comparative Fit Index (CFI) were found to be 0.94, and the Goodness of Fit (GFI) was 0.91, all of which were acceptable. The Root Mean Square Error of Approximation (RMSEA) value of the CFA was 0.069. An RMSA value lower than 0.08 is acceptable as a good fit for CFA. The convergent validity of the factors was checked. The loading of items was more than 0.50, except for one, and all factor loadings were significant (p<0.01) providing evidence for convergent validity. The factors below a load of 0.42 and not significant were deleted after CFA. As a result, our measurement of the model is satisfactory.

2.3.1. *Test of Structural Equation Model (SEM) and the conceptual model*

The SEM technique was applied in the study to test the food waste behavioural model. Lisrel 9.1 software was used for SEM. This analysis technique is widely used in consumer and food waste research. SEM allows modeling of many relationships between latent variables, such as dependent or explanatory variables (Abdelradi, 2018), as well as multivariate analysis of consumer behaviour that cannot be explained by direct behaviour.

The following variables were included in the SEM model to test consumers' food waste attitudes and behaviours in the study: Food Waste (dependent variable), F1; intention not to produce waste, F2; planning and shopping routines, F3; moral attitudes, F4; lack of concern, F5; subjective norms, F6; Perceived Behavioural Control.

The hypothesis related to the food waste behaviour model is given below. We expected that if the consumers' intention was not to increase waste, then their food waste pattern would be decreased (H_2). While shopping routines have an increaser effect on consumers' food waste behaviour (H_3), planning routines were expected to have the opposite impact (H_4), as in Stefan *et al.* (2013).

- H_2: The intention not to waste has a negative sign (i. e., decrease) on consumers' food waste behaviour.
- H_3: Shopping routines have a positive sign (i. e., increase) on consumers' food waste behaviour.
- H_4: Planning routines have a negative sign (i. e., decrease) on consumers' food waste behaviour.

According to the TPB concept, PBC, subjective norms and attitudes can be used to predict food waste, shopping and planning behaviours (see Figure 1).

3. Results and Discussion

3.1. *Socio-demographic characteristics and descriptive results*

Firstly, respondents were asked if they were shopping and/or cooking food in their household. Results showed that 79.8% of the consumers were the main food shoppers and cooks. The rest of the consumers (20.2%) also cooked, and they had an opinion about the kitchen. Some of

Table 1 - Socio-demographic and other characteristics of respondents (N=400).

Variables name	Groups of Variable	**Percentage
Gender	1. group: Female	(62.5%)
	2. group: Male	(32.5%)
Education	1. group: Low (5-8 years)	(33.2%)
	2. group: Middle (9-12 years)	(38.8%)
	3. group: High (13 years and up)	(28.0%)
Descriptive statistics of education	Min= 5 years Max=17 years Mean=10.98 years Sd=4.00 years	
Age	1. group: 18-28 years	(16.8%)
	2. group: 29-39 years	(27.0%)
	3. group: 40-49 years	(23.8%)
	4. group: 50 years and more	(32.4%)
Descriptive statistics of age	Min=18 years Max=73 years Mean=42.20 years Sd=13.57 years	
Income per capita in households	1. group: 0-294 $*	(19.8%)
	2. group: 294.1-588 $	(51.0%)
	3. group: 588.1-955 $	(20.5%)
	4. group: 955.1-1323 $	(5.0%)
	5. group: 1323.1$ and more	(3.8%)
Descriptive statistics of income per capita	Min= 110 $ Max=2757 $ Mean=547 $ Sd=343 $	
Food waste status	1. group: Yes	(10.8%)
	2. group: Sometimes	(60.0%)
	3. group: No	(29.2%)
Number of households	1. group: 1-3 person	(70.0%)
	2. group: 4 person and more	(30.0%)
Descriptive statistics of number of households	Min= 1 Max=6 Mean= 2.80 Sd= 1.09	

* 1 Dollar=2.72 Turkish Liras in 2015 (CBRT, 2019).
** All % percentage calculations are equal to 100 % in the groups.

the demographic variables are presented in Table 1. The percentage of women consumers was 62.5%. More than 66.0% of consumers were at, or above, average educational status. The consumers' mean age was 42.20 years and income per capita was $547. 10.8% of consumers stated that they wasted food and 60.0% of them said they sometimes wasted food (Table 1).

Descriptive results of the respondents' perception of food waste are given in this section. Food waste behaviour was investigated in relation to all kinds of foods (edible and semi-edible) for the study. When asked if they wasted food, 10.2% of respondents said "yes", 60.0% of them said "sometimes" and 29.2% said "no". The ratio of food waste and also the kind of food that is wasted is detailed in Table 3. In addition, the relationship between food waste and demographic characteristics was investigated by Chi-square Analysis. The variables and groups used are also shown in Table 1. The Chi-square Analysis showed that age (p=0.000), gender (p=0.01) and education (p=0.000) variables had significant relationships with food waste status, while there was no significant relationship with income per capita (see Table 2).

Table 2 - Results of Chi-Square Analysis.

Variable	Variable	Chi-square Value	Degree of Freedom	P Value
Food Waste Status	Age	44.10	6	0.000**
Food Waste Status	Gender	4.63	2	0.098*
Food Waste Status	Education	25.47	4	0.000**
Food Waste Status	Income per capita	14.24	10	0.162

** Significant for p<0.01, *Significant for p<0.1.

3.2. Measurements of the model

The items were measured against three kinds of scale (see Table 3). Food waste behaviour employed a 5- Point Scale (any, less than 10%, more than 10%, less than 15%, more than 15%, less than 50% and more than 50%), which is derived from Stefan *et al.* (2013). Two kinds of 7- Point Likert Scales were used to measure the other items. Intention not to waste, moral attitudes, lack of concern, subjective norms and PBC were measured against a scale using *strongly disagree* (1) to *strongly agree* (7), while *never* (1) to *always* (7) were used for planning and shopping routines (Table 3). The correlation between the statements was checked for internal consistency. Cronbach's Alpha coefficient was used to measure the constructs. Factor loadings of the items were all higher than 0.50, and all factor loadings were significant except one (p<0.01). Factors under 0.42 and lower than 2.58 of the *t* value were omitted from the main model in this study.

3.3. Structural model results and discussion

Results of the SEM are presented in Figure 1. The goodness of fit indices for the model are given below the figure. CFI and IFI (0.94), and GFI (0.90) values were acceptable. The RMSEA value (0.07) was lower than 0.08. The chi-square/df ratio was lower than 3. All these indicators confirmed that the model is statistically acceptable. Finally, it can be concluded that the model itself is acceptable and does not require modification.

Figure 1 shows the Food Waste Model and the related variables used in this study. Results from the model showed that *Planning Routines* were not a significant factor for *Food Waste*. However, the *Planning Routines* sign is nega-

tive as we excepted. Stefan *et al.* (2013) found *Planning Routines* were significant with a negative sign. Cultural differences produced different results. *Planning Routines* were found to be important for *Food Waste Behaviour* among Romanian consumers but not for consumers in Northwest Turkey.

On the other hand, the *Intention Not to Waste* and *Shopping Routines* were significant factors in *Food Waste Behaviour* in this study. As we expected, *Shopping Routines* increased the food waste, while the *Intention Not to Waste* decreased. As a result, when the tendency of consumers to purchase more food than they need increases, the food waste pattern rises at the same time. In contrast, if the *Intention Not to Waste* increases, *Food Waste* decreases according to the results of this study. In the Stefan *et al.* (2013) model, however, the *Intention Not to Waste* is not significant as expected, but mirrors the present study, and the *Intention Not to Waste* has a negative value. Stefan *et al.* (2013) found that *Shopping Routines* were significant in a positive way, while *Planning Routines* were significant in a negative way. Contrary to the findings of Stefan *et al.* (2013), the *Intention Not to Waste* variable was also found to be significant in other research as it is in this study (Graham-Rowe *et al.*, 2015; Stancu *et al.*, 2016).

Continuing with the model, *Moral Attitudes* were found to be significant with a negative value and S*ubjective Norms* were found to have a positive effect on the *Intention Not to Waste*. *Subjective Norms* consisted of such items as "when I cook more than I need, people around me condone this situation", or "when I throw away food, people around me condone this situation". Consequently, if people around consumers condone

Table 3 - Results of Confirmatory Factor Analysis (N=400).

Factors, Items and Scales	Factor scores
Food waste	
How much food do you waste per week? [d] Scale: Any, Less than 10%, More than 10%, less than 15%, More than 15%, less than 50%, More than 50%	
Foods [d]	0.84
Fresh fruits	0.74
Bread and bakery products [d]	0.71
Fresh vegetables	0.69
Milk and dairy products[d], Red meat and products, Poultry meat and products, Fish and sea products, Eggs, Oils, Pulses *	-
Intention not to waste Scale: strongly disagree (1)…. strongly agree (7)	
I am aware of all the foods having many processes like plantingand processing from farm to fork.	0.86
I am aware of how much land, water and labor are used for each food I throw away.	0.82
I usually make effort to avoid food waste. [d]	0.51
I intend not to throw food in the garbage for the next year. * [d]	-
Planning Routines Scale: never (1), always (7)	
How often do you make a shopping list before shopping? [d]	0.61
How often do you keep to the shopping list?	0.42
How often do you check food stock at home? * [d]	-
How often do you make a cooking plan for a week? * [d]	-
Shopping Routines Scale: never (1), always (7)	
How often do you buy more food than you need ? [c d]	0.69
How often do you buy food that you are not interested in after buying?	0.66
Moral Attitudes Scale: strongly disagree (1)…. strongly agree (7)	
It would not bother me if somebody throw away food.	0.87
It would not bother me to throw away food. [b d]	0.83
I blame myself when I throw away food. * [b d]	-
I feel bad when somebody throws away food. *	-
I believe food waste can maybe be ended. *	-
I believe the end of food waste will be the start of the end of hunger*	-
Lack of concern Scale: strongly disagree (1)…. strongly agree (7)	
I don't care about the environmental effects of food that I throw away. [d]	0.98
I don't care about the social results of food that I throw away.	0.94
I don't care about the cost of food that I throw away. [a d]	0.86
I don't care about the amount of food that I throw away.* [a d]	-
Subjective norms Scale: strongly disagree (1)…. strongly agree (7)	
When I throw away food, people around me condone this situation. [d]	0.86
When I cook more than I need, people around me condone this situation. [d]	0.81
Perceived behavioural control Scale: strongly disagree (1)…. strongly agree (7)	
I can cook and prepare exactly the amount of food I need. [d]	0.91
I can shop for exactly the amount of food that I need. [d]	0.84
It's hard to know exactly how much food I will consume in a week* [d]	-

* Since the factor loadings and / or "t"values of these variables are not within the expected limits, they are not included in the analysis.

Chi-square: 409.83, df:142, Chi-square/df=2.88 $p<0.001$, GFI:0.91, IFI:0.94, CFI:0.94, RMSEA: 0.069.

References: [a] Exodus, 2007. [b] Hamilton et al., 2005. [c] Lyndhurst, 2007. [d] Stefan et al., 2013.

Figure 1 - Structurel Model Results of Food Waste Drivers.
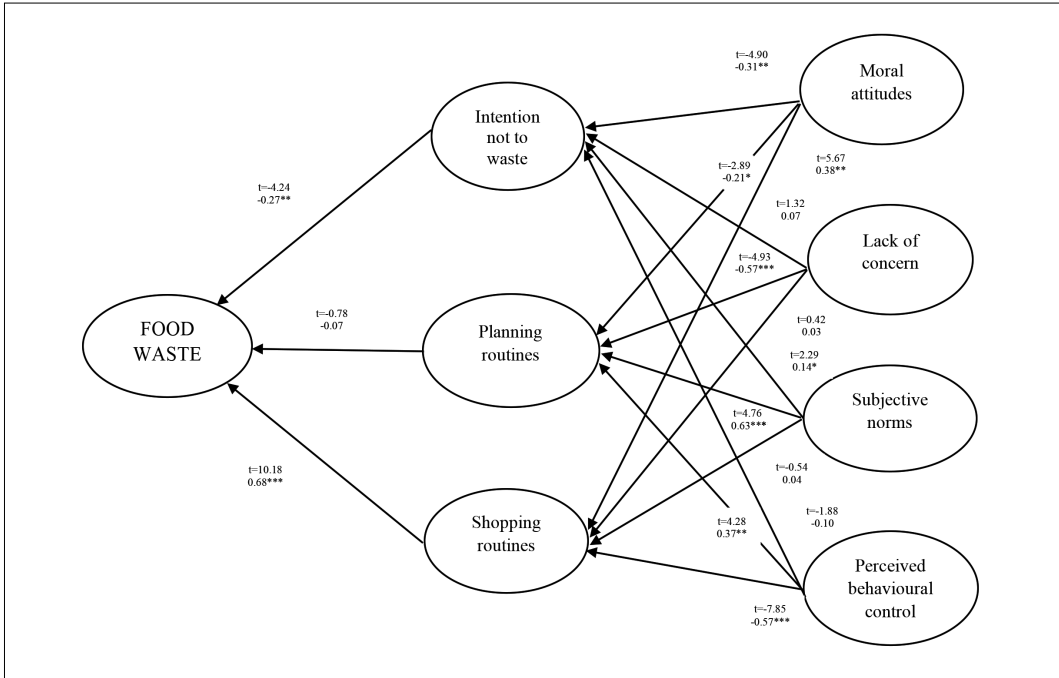
Note: * p<0.005, **p<0.01, ***p<0.001
Chi-square= 459.69, df=155, Chi-square/df=2.96, p<0.001, GFI=0.90, AGFI=0.86, IFI=0.94, CFI=0.94, RMSEA=0.07
Derived from: Stefan et al. (2013).

these two behaviours, the intention not to waste food increases. *Moral Attitudes* was constructed in order to test the accusation of throwing away food. It contained items like "it would not bother me to throw away food", and "it would not bother me if somebody throws away food". However, most consumers worried about those kinds of accusations in this study. When consumers were concerned about being blamed by other people in society, the intention not to waste food increased. Stefan *et al.* (2013) found *Moral Attitudes (−)* and *Lack of Concern* (+) acted significantly on the *Intention Not to Waste*. *Subjective Norms* were not found to be significant in previous studies (Graham-Rowe *et al.*, 2015; Stefan *et al.*, 2013; Visschers *et al.*, 2016), but this finding was contradicted in our study. We believe this result can be explained by the difference in cultures, with the main distinction in Turkish society being the Islamic Religion.

Moral Attitudes (+) and *PBC* (−) were found to be significant in *Shopping Routines*. Shopping for more than consumers actually need and throwing away food are related in a positive direction. As expected, there is an opposite relationship between "shopping for just enough food and cooking just the right quantity for households", and " shopping for more food than the household needs". Stefan *et al.* (2013) concluded that *Moral Attitudes* and *PBC* are effective for *Shopping Routines* with a negative sign.

Moral Attitudes, *Lack of Concern*, *Subjective Norms* and *PBC* were found to be significant in *Planning Routines* in a positive way. However, *Planning Routines* were not significant for *Food Waste* in this research. Consumers remarked that they prepared shopping lists mainly before going to the market, but they answered negatively to the question "how often do you keep to the shopping list". Also, the percentage of consum-

ers who did not make a cooking plan was 60%. Therefore, *Planning Routines* were not found to be significant in *Food Waste Behaviour* in this study. Stefan *et al.* (2013) considered *Moral Attitudes* (+) and *PBC* (+) to be significant for *Planning Routines.*

From these results it can be seen that the guide study which used a very similar model found planning and shopping routines to be significant, while the intention not to produce waste was not significant, in terms of the food waste behaviour of Romanian consumers. Some of the consumers' characteristics (moral attitudes and subjective norms) determined their intention not to produce waste, as expected. On the other hand, moral attitudes were also effective for shopping routines with PBC. Unlike previous literature, subjective norms were found to be significant in this study where the model was derived from, and tested in, another culture (i.e.Turkish culture). The results showed that, even if many similarities were found, there are also important distinctions between different cultures. So culture remains an important factor in the food waste pattern.

3.4. *Limitations*

We believe that this research can be used effectively for comparison with similar food waste models in different cultures. However, we are aware that there are some limitations to this study.

We began to configure this research in mid-2015, and our project had concluded by the end of 2017. Some important research studies, which included a wider range of variables relating to food waste were published after that time.

Another limitation lies in the method used in this study. We appreciate that the face-to-face survey method is more reliable than online questionnaires, as researchers conducting the surveys can judge whether respondents are being honest and explain if there is a point that has been misunderstood. It gives a chance for the respondent to ask questions on any points they have about the survey. However, online surveys can be easily completed by respondents, and the face-to-face survey method is not as practical nor

as cheap as the online questionnaire. We were not able to expand the scope of the this research more generally in Turkey because of time, staff and budget limitations with face-to-face surveys.

We recommend that in future studies, variables should be derived from more recent research, and also models should be refined and adapted for implementation in as many different countries as possible.

3.5. *Implications for policy makers and social marketers*

Policymakers have a responsibility to reduce food waste for both environmental and economic reasons. To achieve this, effective public information campaigns are necessary to increase consumer awareness. The findings from this study will contribute to a better understanding of the factors which determine consumers' attitudes towards food waste. These will constitute a basis for constructing social marketing campaigns and public advertisements on this issue.

The most significant finding from this study was that both shopping routines and the intention not to produce waste have an impact on food waste behaviour, indicating that practical measures to improve people's routines can decrease food waste. Therefore, consumers' intentions not to produce waste may be reinforced through events or activities – such as "how to avoid waste" workshops – around food purchase areas. Also, we believe there will be substantial benefits from public advertisements on television and social media about the environmental impact of food waste produced by consumers, particularly with regard to throwing away food. Furthermore, research shows that moral attitudes and subjective norms have an effect on consumers' intentions not to produce waste. Therefore, consumers must feel a moral obligation to make changes to those routines which have a negative impact on food waste behaviour. Because of this, slogans like "tell your neighbour not to be wasteful" can also be aimed at consumers.

On the other hand, established shopping habits and routines (particularly consumers buying more food than they need) serve to increase the amount of food waste. So campaigns like "buy

your food daily", "waste your time, not your food" or "don't shop more to waste more", may be used effectively to capture the attention of consumers with regard to food waste.

4. Conclusion

This study highlights how consumers' shopping routines and their intentions to avoid waste predict their food waste behaviour, while planning routines do not predict food waste behaviour in Northwest Turkey. It can be concluded that, although planning routines of consumers in the research area did not have an impact on food waste behavior, in other studies in the international literature, planning routines were effective on food waste. For this reason, it may be useful to include planning routines in the studies to prevent food waste in other provinces in Turkey and the national level and especially in the development of related policies.

The results indicate that consumers' food waste behaviour can be reduced by consumers' awareness of increased food waste and drivers. So, the study provides valuable knowledge which can be used as a basis for developing campaigns that reducing food waste behaviour at the household level. Food waste behaviour is positively affected by changing the attitudes and routines of consumers. For this, the local administrations (municipalities) and Non-Governmental Organizations (NGOs) in Northwest Turkey should work in cooperation. Some campaigns with mottos like "buy how much you need", ''don't waste your kid's future'' and some workshops in the schools can be organized for both children and parents. Local campaign implementations and their successful results can also be spread across the country.

Declaration of Conflicting Interest

These research results were previously presented at the 2nd International Conference on Agriculture, Food, Forest Sciences and Technologies, on 2-5 April 2018 in Izmir, Turkey, as a conference paper and later published in the official abstract book.

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