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Waste Management

Determinants of consumers' food management behavior: Applying and extending the theory of planned behavior

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ABSTRACT

Approximately one quarter of the food supplied in the world is wasted across the food supply chain. Almost half of this amount is related to household food waste, which results from mis-management of consumption. Therefore, the purpose of this study was to investigate the consumer food management behavior in order to reduce food waste. Survey data were gathered among 405 Iranian respondents who were responsible for food preparation in their households and were aged from 15 to 64 years old, by using an extended theory of planned behavior (TPB). In addition to measuring the constructs of planned behavior theory, the feeling of guilt construct was incorporated to the model. The extended model was derived and examined through structural equation modeling (SEM). Results showed the usefulness of using the extended model of planned behavior in predicting intention to reduce food waste and food consumption management. Moreover, attitude, perceived behavioral control, feeling of guilt, subjective norm and intention of not wasting food were the drivers of managing food consumption and avoiding food waste. Besides, results showed that intention to reduce household food waste is predictable by attitude, subjective norm and feelings of guilt constructs. At the end, implications of the study for changing consumers' food management behavior are discussed.

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1. Introduction

Different studies show that about one quarter of the world food production became useless in the form of waste (Stenmarck et al., 2016). Food waste is a controversial issue at a time when hunger and food insecurity is still cruelly prevalent as a widespread problem in all countries of the world and the poor are increasingly vulnerable to fear of food insecurity due to the repeated increases in food prices (Rutten, 2013). According to the latest report by the Food and Agriculture Organization of the United Nations (FAO) in 2017, the number of chronically undernourished people in the world has been estimated to have increased to 815 million, up from 777 million in 2016. The majority (489 million) of these live in countries struggling with conflict, violence and fragility. Asia also has the highest rates of chronic malnutrition, which is often suffered under the influence of the killings, insecurities, displacements and homelessness as a result of the imposed war. With the increasing hunger and malnutrition in the world, especially in the affected countries, understanding the need for food security becomes clearer (FAO, 2017). Based on this, ending hunger and all forms of malnutrition is possible with in integrated actions to achieve this critical goal. One of the preventive approaches to improve food security and nutrition is the reduction of food waste.

Iran also has faced a decline in food production due to droughts in recent years and the problem of water management in agriculture and this issue has led to rising food prices and lower access to food for the poor. So, according to statistics provided by FAO (2017), the number of undernourished population in Iran from 2014 to 2016 is 4.5 million people. That is while, based on FAO's recent report, from 1.3 billion tons of food wasted annually at the global level; Iran is responsible for 2.7%, which is equal to about 35 million tons of the total sum. Most food waste of Iranians is bread, fruit, vegetables and rice (FAO, 2017).

The social implications of food waste are relevant to food security, and reducing waste has been recognized as a key component of strategies to feed a future global population of ninebillion people. Food waste is also problematical due to the unequal distribution of resources which may lead to increasing social inequality (Parizeau et al., 2015). By wasting edible food, all of the resources spent growing, producing, processing, and transporting that food are also wasted, resulting in potentially needless environmental and economic impacts (Thyberg and Tonjes, 2016) that are intertwined with big social influences (Gao et al., 2018).

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High levels of food waste exacerbate environmental impacts such as greenhouse gas emissions, nutrient loss, and the inefficient use of resources, including farm land, energy, water, and fuel used for food production (Parizeau et al., 2015). Hence, foods waste prevention and reductionis an important lever in developing a sustainable food system and diminishing environmental burdens (Priefer et al., 2016). It has the highest economic, social and environmental benefit relative to other waste management approaches. For this reason, there has been growing interest in establishing food waste prevention programs throughout the world (Thyberg and Tonjes, 2016). Since prevention is seen as one of the most suitable ways to deal with the food waste issue and the consumption level has the highest potential for prevention (Stancuet al., 2016; Zhou and Wan, 2017), insight into the influential factors of food consumption behavior could provide a basis for efforts to promote food waste prevention at the household level (Stancuet al., 2016). Therefore, this study uses Ajzen's theory of planned behavior (TPB) to frame an inquiry about household decisions to minimize waste. This theory is one of the most widely prominent and referent socio-psychological guidelines for understanding, predicting and explaining human behavior (Ajzen, 2015), in the varied domains to induce and conduct behavior change (Steinmetz et al., 2016). It also has frequently been used to predict many food-related behaviors (Stefan et al., 2013).

In general, this study follows two major goals: The first goal of this study is whether the TPB can be implemented and approved by incorporating food consumption behavior through different household management routines from supply to consumption. And the second goal is, whether the feeling of guilt could be added as a predictor of food consumption management behavior to improve the planned behavioral model? In order to achieve these goals, at first, the planned behavior model is implemented using structural equation modeling. In the next step, the feeling of guilt variable is added to the model and its fitness is tested. Finally, all the fitness indicators of the two models are compared and the utility of the proposed model is examined.

2. Literature review

2.1. Theory of planned behavior

Framework of the theory of planned behavior has been designed to predict and explain human behavior in specific contexts (Ajzen, 1991). This theory is today one of the most popular social-psychological models for understanding and predicting human behavior (Ajzen, 2015). The theory of planned behavior is based on the assumption that humans usually behave in a sensible manner. They pay attention to the available information and implicitly or explicitly regard the implications of their actions. As shown in Fig. 1 a central factor in this theory is a person's intention to perform (or not to perform) a given behavior (Ajzen, 1991).

In the framework of the planned behavior theory, it is assumed that intentions capture the motivational factors that influence a behavior (Ajzen, 1991); they show how hard people are willing to try and and how much effort is put into planning to apply the behavior. As a rule, the stronger the intention to do a behavior, the more likely its implementation should be. However, a behavioral intention can find manifestation in behavior only if the behavior in question is under the control of volition. Therefore, if the required opportunities and resources were provided for an individual, and he or she intends to perform the behavior, that person should succeed in doing so (Ajzen, 1991). In a study by Stefan et al. (2013) on Romanian consumers' food waste based on a planned behavioral model, contrary to the TPB model, the intention of not wasting food had no significant effect on the behavior
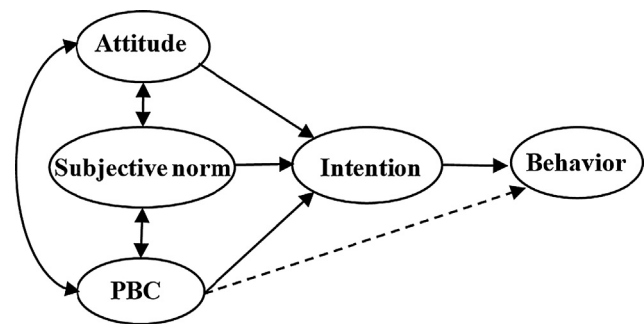

Fig. 1. Model of the theory of planned behavior (Source: Ajzen, 1991). Note: PBC = perceived behavioral control.

of food waste. In a study by Stancu et al (2016) intention also had a rather small contribution in explaining behavior of consumer food waste in the TPB model.

The theory of planned behavior posits three determinants of intention, which indirectly apply their effect on behavior with an effect on intention. The first is the attitude toward the behavior that refers to the degree of evaluation or appraisal of a person from being favorable or even unfavorable in terms of the behavior in question. The second predictor is a social factor known as the subjective norm; it refers to the perceived social pressure to perform or not perform the behavior (Ajzen, 1991). In other words, subjective norms include a person's beliefs about thinking about whether significant others (i.e., individuals whose preferences about a person's behavior in this domain are momentous to her or him) should engage in the behavior (Conner and Armitage, 1998). The third determinant of intention is the measure of perceived behavioral control which refers to the perceived ease or hardness of performing the behavior and it is supposed to reflect the past experience and also anticipated impediments and obstacles (Ajzen, 1991). Perceived behavioral control can indirectly influence behavior, through intentions, and it can also be directly used to predict behavior (Ajzen, 2005). As a general rule, the more favorable the attitude, subjective norm and perceived behavioral control towards a behavior, the stronger individual's intention to perform the behavior under consideration should be (Ajzen, 1991).

Perceived behavioral control in the research by Stancu et al. (2016) did not have a significant contribution to anticipating the intention of not wasting food while the attitudes towards food waste were contributing more to the prevention of food waste. In the research of Stefan et al. (2013), perceived behavioral control had a direct positive and significant effect on the planning routine while it had a negative effect on the purchasing routine and attitude had a significant effect on the intention of not wasting food. Secondi et al. (2015) in a research entitled behavior of household food waste in EU-27 countries also showed that there is a strong and significant relationship between the attitude and food waste behavior.

Graham-Rowe et al. (2015) using the developed theory of planned behavior predicted a reduction in household food waste. The results showed that the extended model estimated a significant amount (64%) of the variance of intention with the attitude, subjective norm, perceived behavior control, self-identity and anticipated regret emerging as significant linear predictors.

The TPB is generally considered to propound a rational view of behavior (McDermott et al., 2015) that focuses on cognitive variables and does not educe affective beliefs or consequences associated with performing or not performing a behavior. Therefore, it has been criticized by researchers or theorists due to not incorporating emotions in its theoretical framework and for not explaining the infrastructure of attitudes (Wang, 2006; Conner and Armitage, 1998).

According to the dual process theory (Sherman et al., 2014; Sloman, 1996), people employ both a cognitive (rational) and an affective (emotional) system to construct their attitudes and behavior. Therefore, relying only on cognitive determinants for predicting behavior might not be adequate. As it has been proved that the affective system acts faster and delivers output earlier (Shiv and Fedorikhin, 1999), the non-cognitive determinants cannot be ignored for predicting behavior (Norman, 2013). In this regard, many scholars agree that emotions affect intention and behavior (Quested et al., 2013; Graham-Rowe et al., 2014).

In 1991, Ajzen also stated that the TPB is open to the inclusion of additional predictors if the additional predictors can help increase the variance in the model and they are selected based upon the behaviors or contexts.

2.2. Inclusion of feeling of guilt in the TPB

This research investigates the effect of guilty feelings on the intention and food consumption management behavior of individuals to participate in the reduction of food waste in the framework of the TPB and it seeks to prove that the inclusion of emotions such as guilty feelings can further expand the TPB in relation to food waste and make it a more comprehensive theory. The reason for choosing the variable feeling of guilt as one of the determinant emotional factors for the behavior of food consumption management in the TPB model is that first, from the positive or negative feelings that humans experience daily, feeling of guilt is one of the common negative emotions, which has a great deal of universality throughout people and cultures and, through the immediate punishment of guilty person with creating an unpleasant inner feeling, he/she is forced to leave his/her wrong behavior (Wang, 2006; Baumeister et al., 1994). Secondly, feeling of guilt can help to implement common norms that prescribe mutual concern, respect, and positive behavior without self-interested return (Baumeister et al., 1994). Therefore, it helps stabilize the reduction of food waste through creating desire within people towards pro-environmental behavior and supporting their peers. Feeling of guilt also does not depend on formal power and influence, and may even work better in the absence of such power (Baumeister et al., 1994). Therefore, given that the amount of consumer waste at household level is not highly controllable and imposed by governments and requires internal motivation, feeling of guilt can reduce the misbehavior of food waste by punishing the individual as an inner inhibitor (Baumeister et al., 1994). Findings by Baumeister et al. (1994) in this regard showed when people feel guilty, the probability of their learning increases and subsequently leads to change in their behavior. They deduce that feeling of guilt is a valuable mechanism through which individuals change their behavior as others expect or conform to abstract norms and standards. Hence, it is a suitable variable for adding to the planned behavior theory model in relation to reducing food waste.

Feeling of guilt is the most essential emotion to the development of the affective-cognitive structures of conscience and the affective-cognitive-action patterns of moral behavior (Izard, 1978) that can be described as an important pro-social emotion because it results in a felt obligation (moral norm) to retaliate for the caused damage (Bamberg and Moser, 2007), which promotes a variety of pro-social effects and motivates individuals to make amends or change behaviors (Wang, 2006).

Although intense and chronic guilt can paralyze the person psychologically, feelings of guilt may be the basis for personal-social responsibility and the motive to avoid guilt may heighten one's sense of personal-social responsibility (Izard, 1978).

Feeling of consumer guilt results from realization of having failed to achieve, or violated internalized personal or social moral standards in the context of consumption (Dedeoglu and Kazançoglu, 2012). It affects consumer attitudes and behaviors (Aydin and Ünal, 2017) and stimulates the consumer with the motivation to perform a certain behavior (Quested et al., 2011), and thus the likelihood that the consumers will engage in making a more sustainable consumption as well (Antonetti and Maklan, 2014).

Most consumers experience a feeling of guilt in them when they engage in wasteful behavior (Evans, 2012) which motivates them to alleviate the negative feeling to reduce their food waste (Quested et al., 2013).

Langen et al. (2015) found that people who do not feel guilty for wasting food do not need to reduce their food waste; hence they are more likely to waste food (Langen et al., 2015). Blichfeldt et al. (2015), by investigating consumer attitudes towards food waste, acknowledged that the anti wasting behavior of some interviewees could be due to reducing their feeling of guilt. In a study by Quested et al. (2011), feeling of guilt was identified as a key motivation in reducing food and drink waste of UK households. The majority of respondents in Yaqub's (2016) research described their most important motivating factor in reducing food waste was due to their guilty feelings. More than half of respondents in the study of Qi and Roe (2016) acknowledged that a feeling of guilt is one of the most important drivers of reducing food waste. Wang (2006) in his study, by adding feeling of guilt to the framework of the theory of planned behavior (TPB), showed that while anticipated guilt addressed individuals' intentions to participate in physical activity, past guilt could not be a useful construct in explaining the intentions and behavior of individuals, however, the inclusion of guilt construct supported the sufficiency of this theory. On the basis of this discussion and standard TPB assumptions, the following hypotheses can be proposed:

> H1: Independent variables of the TPB model, according to the relationships defined in the model, significantly influence the intention to reduce food waste and therefore food consumption management behavior.
> H2: Feeling of guilt construct positively affects intention to reduce food waste and also food consumption management behavior of household consumers.

3. Research methodology

3.1. Designing of the questionnaire

The questionnaire consisted of seven sections: food consumption management behavior, behavioral intention, perceived behavioral control, attitude, subjective norm, feeling of guilt and demographic questions. Most of the questions for the measurement of research constructs were adapted from the scales available in the literature review. Other variables included in the conceptual model of research except food consumption management behavior, were measured with a 5-point Likert scale, with strongly disagree (1) to strongly agree (5). In many items of the questionnaire, the respondent responsible for at least half of the home management functions, such as cooking and buying family food, is likely to answer the questionnaire items only by self-evaluation. Some items were designed so that the respondent should answer in the way she/he believes best represents the whole household's thoughts and feelings. Before finalizing the questionnaire, it was reviewed and commented on by senior academics and experts. According to their comments, minor adjustments to the wording, phrasing, formatting and overall visual construct were adjusted. Furthermore, a pilot study was performed to assess the internal consistency of the scale items. It shows adequate reliability, as the value ranges from 0.556 to 0.901 (Table 1). After conducting the pilot study some items were omitted to

Table 1
Reliability and validity of measurement model.

Constructs and measuring items	Standardized loading	C.R.	AVE
Feeling of guilt (α = 0.901)		0.869	0.65
I feel guilty due to food wasting while many people do not have assured access to edible food	0.832		
I will properly manage and take care of my future behaviors to reduce feeling of guilt	0.783		
PBC (α = 0.643)		0.637	0.51
I can buy food to meet the household needs	0.719		
I can cook and prepare food to meet the household needs	0.756		
I can increase the shelf life of food by proper storage	0.625		
Subjective norm (α = 0.605)		0.559	0.44
My family members are sensitive to food waste and always try to avoid it	0.540		
Most family members disagree with food waste and try to minimize it	0.718		
Most of my friends are advocates of reducing food waste and try to avoid it	0.723		
Society managers and politicians prevent food waste	0.669		
To reduce food waste, it is better for the government to legitimize food wastes	0.505		
I prepare more food in order not to be ashamed in front of my guests	0.708		
I usually provide several different types of meals so that everyone can eat what he/she likes	0.678		
Everyone should collaborate to prevent and minimize food waste	0.748		
Attitude (α = 0.792)		0.712	0.50
I sometimes think about reducing food waste	0.701		
Preventing food waste is everyone's responsibility	0.689		
I'm saddened by seeing the discarded food	0.740		
Intention (α = 0.556)		0.593	0.41
I intend to seriously reduce my food waste in the near future	0.673		
I intend to use all the leftovers	0.635		
I intend to notify my friends, family and neighbors to reduce their food waste	0.630		
Food consumption management behavior (α = 0.763)		0.612	0.45
(a) Shopping routine (α = 0.607)			
We make a shopping list before the shopping trips and do shopping according to it	0.706		
We usually buy higher amounts of food when the food price drops (R)	0.719		
Due to the variety and attractiveness of food on store shelves, I'm tempted to buy even what we do not need (R)	0.722		
To minimize waste, we try to buy smaller amounts of food	0.490		
(b) Reusing leftover routine (α = 0.561)		0.548	0.47
In our family, the leftovers are eaten in the same form or re-heated for reuse	0.772		
The leftovers, before they are eaten, will be transformed into a different food by adding some of the ingredients	0.812		
I adjust our meal plan to use leftovers	0.793		
I do not like to eat the same target food in sequence (R)	0.685		
I forget the leftovers I kept in the fridge until their nutritional value is lost (R)	0.457		
In the case the bread becomes old, I dip and transform it in other foods like pasta, soup, etc.	0.499		
(c) Food storage routine (α = 0.662)		0.631	0.50
I know which food is approaching its expiration date	0.880		
I monitor food to consume it before it deteriorates	0.875		
Foods that are kept in the refrigerator are subject to being forgotten due to my overstuffed, disorganized refrigerator (R)	0.575		

Note: two items from the PBC, one item from feeling of guilt and one item of food consumption management behavior were removed from the analysis due to low factor loadings. R-item was reversed for analyses. * – C.R – Composite Reliability, AVE-Average Variance Extracted, AVE calculated as Σ SMC/ (ΣSMC + Σstandard measurement error). ** – The criteria of Cronbach's alpha for establishing the internal consistency reliability: Excellent ($\alpha > 0.9$), Good ($0.7 < \alpha < 0.9$), Acceptable ($0.6 < \alpha < 0.7$), Poor ($0.5 < \alpha < 0.6$), Unacceptable ($\alpha < 0.5$) (Source: George and Mallery, 2016).

increase the Cronbach's alpha coefficient. So, three items from the attitude scale, one item of behavioral intention, two items of subjective norm, three items of feeling of guilt, one item of PBC, and four items of food management behavior were removed according to modifications provided by SPSS software. Food waste was further dropped and the items were simplified to further be understood by the respondents.

3.2. Sample and data collection

The survey took place via the use of a face-to-face questionnaire. Therfore, face-to-face questionnaire as the most accurate method for surveying illiterate or low-literate people (Salant and Dillman, 1994), was conducted to collect data from respondents. They were randomly selected from the specified statistical population including a person from a household aged 15–64, who is responsible for at least half of the cooking, shopping (effective in buying households) and managing their own homes in Najaf Abad County, Iran. The required sample was selected by stratified proportional random sampling method. Since women were responsible in all of the sample cases, women formed all respondents except one. The selected samples were asked to participate in the

interview to complete the anonymous questionnaire. Therefore, the respondents were free to discontinue their participation at any time.

According to the definition provided from the statistical population, the base of the population was all households in Najaf Abad County, Iran. To determine the sample size, Bartlett et al. (2001) table was used with a margin of error of 0.33 and t = 2.58, and α = 0.01. The sample consisted of 405 respondents with an average age of 39.42 years (standard deviation = 10.25), the majority of whom (80.7%) earned primary education to high school.

The family size of the majority of respondents (64.4%) was in the range of three to four. Half of the surveyed households (51.1%) had at least one child under the age of 12 years and 57.1% of respondents stated that their monthly household income is less than ten million Rials in Iranian currency (42000 Rials = 1 Euro), 26.6 percent of respondents stated their family monthly income 10–15 million Rials and 16.3% of them had an income of over 15 million Rials.

3.2.1. Variables and measurements

The definition and measurement of the variables used in this study is as follows:

• Food consumption management behavior

Since managing buying routine and the consumption practice, leftover food reuse and food storage prevents food waste (all edible foods and drinks) the food consumption management behavior was measured with three components of shopping (5 items), reusing of leftovers (6 items), and food storage (3 routines) routines (Van Geffen et al., 2016b; Stefan et al., 2013; Stancu et al., 2016; Mallinson et al., 2016; Rispo et al., 2015). The engagement in the three mentioned behaviors was answered by the respondents using a 5-point Likert-type scale. The likelihood responses were 'always' (5), 'very often' (4), 'sometimes' (3), 'rarely' (2), 'never' (1).

• Intention to reduce food waste

Behavioral intention is related to the person's decision and willingness to commitment or non-commitmentto engage in food management behavior in the future (Kharat et al., 2017) and shows the person's readiness to reduce food waste. Intention to prevent food waste based on previous validated literature (Visschers et al., 2016; Stancu et al., 2016; De Groot and Steg, 2009; Stefan et al., 2013) in the field of consumer food waste was measured with three items.

• Attitudes towards food waste

Attitude is a latent disposition or tendency to respond with some degrees of favorableness or unfavorableness to a psychological object (Fishbein and Ajzen, 2010). Accordingly, attitude toward food waste was measured with the items of person's desirability evaluation of food waste reduction. The items of this construct were extracted from previous literature (Qi and Roe, 2016; Visschers et al., 2016; Shin and Hancer, 2016) and modified for the purpose of the present study. The three items were carried out by a 5-point Likert-type scale (strongly disagree = 1 to strongly agree = 5.

• Perceived behavioral control

Perceived behavioral control describes the consumer's perception of the ease or hardness of control over how to reduce food waste. This construct was measured with 5 items including the ease of reducing food waste behavior from the respondent's point of view, the ability of a person to manage the purchase and cooking to meet the household needs, the ability to increase the shelf life of food with proper storage, and the uncontrollabilty of the creation of food waste in households (Visschers et al., 2016; Stefan et al., 2013; Rispo et al., 2015).

• Subjective norm

Subjective norms relate to the support given (or not) by social groups such as family and friends. In other word, they refer to what is considered approved or disapproved behavior in a specific situation (Ajzen, 1991); people should intend to waste less food if wasting food is disapproved by important others. The literature on social influence posits that the injunctive norm is conceptually similar to the subjective norm included in the TPB, since both patterns concern others' expectations about an individual's behavior (i.e., perception of what other people think one should do) (Ohtomo and Hirose, 2007). One of the other subjective norms at the household level is the norms of being a good provider that refers to ensuring a wide range of healthy and delicious food for family members and guests. This norm is important for consumers, even if it leads to food waste (Van Geffen et al., 2016b). Accordingly, the subjective norm was measured, with eight items containing others' engaging and approving the behavior and good provider attributes (Visschers et al., 2016; Stefan et al., 2013; Van Geffen et al., 2016a).

• Feeling of guilt

When food waste is seen as a concern, it can lead to a feeling of guilt, which in turn motivates the consumer to a corrective behavior of reduction of their food waste and to behave in a pro-environmental manner (Qi and Roe, 2016). The feeling of guilt construct was measured with three item scales with one item measuring the amount of respondent's approval of feeling of guilt inside herself/himself as a result of the adverse effect of environmental problems caused by the food waste of her/his family. The next item is a guilty feeling due to food wasting while many people do not have assured access to edible food and the last item asks the respondent's compensatory behavior through careful control on future behaviors of food consumption to reduce feeling of guilt (Qi and Roe, 2016; Dedeoglu and Kazançoglu, 2012).

3.3. Data analysis

The axis of discussion in this study is that feeling of guilt can be a useful construct to explain the intention and food consumption management behavior of household consumers. Moreover, the inclusion of emotions can further expand TPB and make it a more comprehensive theory. Data analysis was performed using the IBM SPSS Statistics 22.0 software in order to test the significance of proposed relationships in structural models of the research, as well as to measure the overall fitness of models to the data. Thus, structural equation modeling in Amos 24.0 was utilized in two stages; first, an initial confirmatory factor analysis (CFA) was conducted to measure the reliability and validity of the measurement scale. Second, a structural equation model was run to test the best fitting model for investigating the casual relationship between the independent and dependent variables of conceptual model.

4. Results

4.1. Data screening and measurement model

A confirmatory factor analysis (CFA) was applied on the conceptual model in order to monitor the fulfillment of the assumption of general linear model. It revealed that after deleting four items (two items from the PBC and one item from feeling of guilt and one item of food consumption management behavior) that had low standardized factor loading (<0.4) and reapplying CFA on the modified conceptual models, the value represents a more appropriate model (χ^2/df = 3.167, GFI = 0.801, AGFI = 0.767, TLI = 0.626, CFI = 0.661, IFI = 0.666, RMSEA = 0.073).

Futermore, to test the internal consistency among items, Cronbach's α was used (see Table 1). Additionally, convergent validity was measured using factor loading and discriminant validity was also assessed with average variance extracted. The values of factor loadings of all items were higher than or very close to 0.50 on their corresponding factors. The value of average variance extracted (AVE) of the subjective norm, intention, shopping routine, and reusing leftover routine had an AVE value slightly less than the recommended value of 0.50, while all other constructs had AVE higher than the threshold. In order to evaluate the construct reliability, composite reliability (CR) was considered. The composite reliability measures the extent to which items in the construct measure the latent concept. Hair et al. (2010) suggested that the CR estimates that measures the amount of variance explained by the construct should be higher than 0.60. The results of Table 1 show that

Table 2
Correlations between model constructs; descriptive statistics and collinearity statistics tolerance.

	Feeling of guilt	PBC	Subjective norm	Attitude	Intention	Behavior
Feeling of guilt	**0.654**					
PBC	0.334**	**0.501**				
Subjective norm	0.162**	0.247**	**0.605**			
Attitude	0.452**	0.375**	0.199**	**0.508**		
Intention	0.379**	0.280**	0.209**	0.371**	**0.419**	
Behavior	0.359**	0.515**	0.291**	0.400**	0.372**	**0.587**
Mean	4.902	4.742	3.769	4.858	4.587	4.361
Standard deviation	0.474	0.528	0.428	0.349	0.584	0.474
Collinearity statistics tolerance	0.723	0.792	0.912	0.705	0.785	–

PBC = perceived behavioral control. **p < 0.01. The bold diagonal values represent the square root of AVE.

the construct reliability with the estimates of composite reliability is acceptable.

Finally, discriminant validity of the scales was assessed by comparing the square root of the AVE with the correlations among the six constructs. As shown in Table 2, the square roots of the AVE of constructs (bolded) are all higher than the off-diagonal correlation values except for the perceived behavioral control, which supports the discriminant validity. In addition, to justify collinearity concerns of the internal model, tolerance statistics were calculated. The collinearity tolerance statistics is an approximate linear relationship between constructs to show the existing multicollinearity among them which would affect the actual regression weights (Liu et al., 2003). It is the proportion of variability in a construct that is not explained by other constructs (Schroeder, 1990). A general rule is that tolerance statistics should not be less than 0.1 in order to avoid the collinearity problem (Miles, 2014). Some researchers suggest that its value is 0.2 or higher (Wong, 2013). In this way, low-tolerance constructs (less than this value) should be discarded (Liu et al., 2003; Schroeder, 1990). The value of the tolerance statistics for the independent variables in this study are shown in Table 2 indicating there is no collinearity between the constructs. In general, the results of Tables 1 and 2 allow us to conclude that the model and the constructs have acceptable reliability and validity.

4.2. Structural model: Goodness of fit statistic and hypothesis testing

Evaluating the fit of the original TPB model with data showed that this model was relatively powerful as indicated by $\chi^2/df = 1.237$, GFI = 0.977, AGFI = 0.826, TLI = 0.666, CFI = 0.933, IFI = 0.935, RMSEA = 0.168). Therefore, in order to improve the model, fit, the feeling of guilt variable was added to the original model.

Results revealed that the modified model fit the data very well. Goodness of fit indicators indicates the suitability of the final proposed model ($\chi^2/df = 3.923$, GFI = 0.997, AGFI = 0.933, TLI = 0.907, CFI = 0.994, IFI = 0.994, RMSEA = 0.085).

In the end, the TPB model and the proposed conceptual framework were compared for explanatory power (Table 3).

The findings showed that by adding the feeling of guilt variable and applying the necessary modifications on the original model

Table 3
Fit indices and explanatory power of the models.

| Fit indices	Original model (TPB)	Extended model	Norm[*]
χ^2/df	1.237	3.923	>1 and <5
GFI	0.977	0.997	≥0.90
TLI	0.666	0.907	≥0.90
CFI	0.933	0.994	≥0.90
IFI	0.935	0.994	≥0.90
RMSEA	0.168	0.085	≤0.08
R^2	0.322	0.363	

[*] Source: Bagozzi and Yi (1988).

(TPB), the proposed conceptual framework explained the greater variance in behavior. As shown in Fig. 3, the explained variance ($R^2 = 0.32$) for food consumption management behavior in the initial model was increased (to $R^2 = 0.36$) in the final model and the explained variance for the intention of not wasting food has increased from 0.17 to 0.21 in the proposed model.

In the extended model, the impacts of intention of not wasting food and perceived behavioral control (PBC) on behavior have decreased compared to the original model (Figs. 2 and 3). However, PBC was the strongest predictor of food consumption management behavior. Therefore, the most important factor that leads to a better management of household food waste perceives the behavior to be easy and under their own control. Feeling of guilt, subjective norm and attitude towards food waste had a positive and significant effect on the intention of not wasting food. Feeling of guilt has the highest contribution in predicting the intention of not wasting food ($\beta = 0.26$). Therefore, people who feel more guilt will
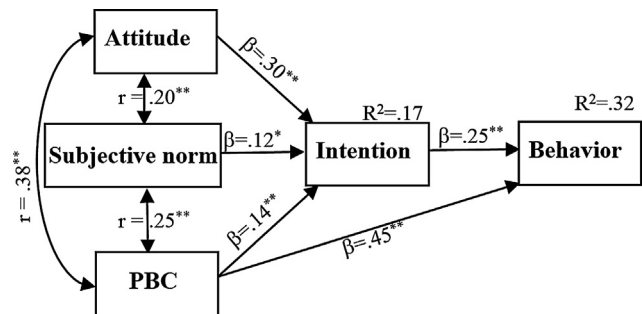
Fig. 2. Theoretical framework of planned behavior used in this study. Note: **p < 0.01.
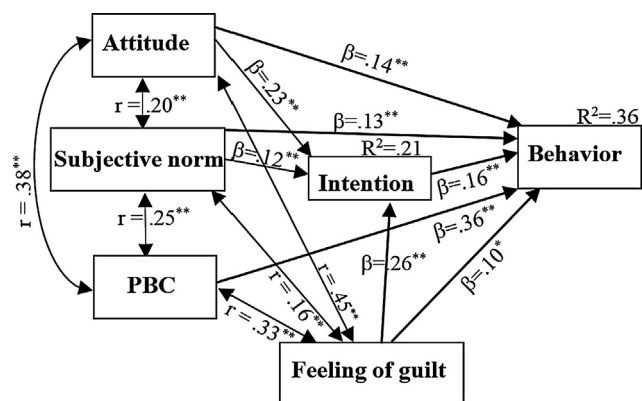
Fig. 3. Conceptual framework of extended planned behavior. Note: **p < 0.01; *p < 0.05.

have a stronger intention of not wasting food. In the proposed model, attitude also has a positive and significant effect on food consumption management behavior. There is also a positive and significant relationship between feeling of guilt and attitude, subjective norm and perceived behavioral control in the model.

4.3. Investigating the effects of variables on food consumption management behavior

In order to better understand the nature of the influence of studied variables on the behavior of food consumption management, the direct, indirect and total effects of variables were examined. Amos software was used to estimate these effects. In this study, the indirect effects of the studied variables were examined only through the mediation of the intention variable.

The results indicated that all independent variables of the model had direct and indirect significant effects on behavior. Intention and PBC just directly affected the behavior, but the attitude, subjective norm and feelings of guilt, had a significant effect, either directly or indirectly, on food consumption management behavior. Therefore, in addition to direct impact on behavior, these variables are likely to indirectly affect the intention on behavior. Meanwhile, among the independent variables, the PBC variable had the most direct and total effect on behavior, while the feelings of guilt exerted a mostly indirect effect on behavior. The total effect of PBC on behavior is considerable, but feelings of guilt had the least total effect on behavior. In fact, the attitude had the highest total effect on behavior after PBC though its value is relatively low. Therefore, among the variables studied in the model, PBC with a total effect of 0.357, was identified as the most effective predictor of food consumption management behavior. That is, one unit change in PBC value is associated with a change of 0.357 in the standard deviation of food management behavior to reduce food waste in the same direction Table 4.

5. Discussion and conclusion

This study shows that perceived behavioral control and attitudes toward reducing food waste respectively have the highest total effect on food consumption management behavior. However, PBC effects may be due to the fact that the items for PBC focus on food routine behaviors whereas most of the items representing attitudes, subjective norms, and guilt focus on the food waste, thus estimates of the effect of PBC on food consumption management may, therefore, be confounded by common measurement variance.

Meanwhile, perceived behavioral control is the most important predictor of behavior and the feeling of guilt is considered the most important driving for the intention of not wasting food. Research by Stefan et al. (2013) regarding the effect of PBC on routines related to food waste and the effect of attitudes on the intention

was in line with the current research but in predicting the intention to behavior disagreed with this research. Results of the study by Stancu et al. (2016) also confirmed the strong and significant effect of PBC and the low impact of intention on food waste behavior. In line with the results of this study are those obtained by Graham-Rowe et al. (2015), in which it was found that attitude and PBC had significant effects on the intention of not wasting food. In support of the results of Sirieix et al. (2017), the present findings indicate that subjective norm is a driver for intention and food waste behavior. Contrary to the results of this study, Graham-Rowe et al. (2015) showed that subjective norms had no effect on intention.

The decomposition of observed correlations into direct and indirect effects showed that "feeling of guilt", "subjective norm" and "attitude towards food waste" had a positive and significant direct and indirect effect on food consumption management behavior. There was also a significant direct effect of the PBC and the intention of not wasting food on behavior. By adding the feeling of guilt the power of explanation of the model was increased, according to the impact of guilty feelings on reducing food waste that was postulated in previous studies (Quested et al., 2011; Langen et al., 2015; Blichfeldt et al., 2015; Yaqub, 2016; Sirieix et al., 2017). In this research also the direct and indirect effect feeling of guilt on the behavior of food consumption management was significant. Contrary to the results of this study, Wang (2006) showed that feelings of guilt had no significant indirect effect on behavior, and he found no demonstrable relation between feelings of guilt and intention for future behavior.

All variables of model had positive and significant effects on food consumption management behavior, which shows strengthening these variables, could reduce the amount of food waste among domestic consumers. The results indicate that although the feeling of guilt has the greatest effect on the intention of not wasting food, due to its low total effect it does not have much power in stimulating and influencing the behavior of household food consumption management through the mediating role of intention. This may be due to the fact that many respondents felt guilty about environmental problems caused by food waste and the hunger caused by food waste trends. However, except for a few, the majority of people do not have a tangible understanding of the environmental crisis or the famine, which hinders their commitment to the prosocial behavior of reducing food waste.

Feeling of guilt also had the highest correlation with two variables of attitude and PBC, both had a moderate positive and significant correlation (Evans, 1996) with the feeling of guilt. It seems that perhaps people will not feel guilty about the issues whose roots and solutions are typically beyond the scope of their internal control. Therefore, those who consider reducing food waste to be controllable by themselves; likewise will feel guilty for wasting it. Regarding the relationship between feelings of guilt and

Table 4
Standardized path coefficients and significance level of the final model.

Paths	β value	t-value	p value	Test results
Intention → behavior	0.158	3.502	0.001	Supported
ATTbehavior	0.139	2.919	0.004	Supported
PBC → behavior	0.357	7.951	0.000	Supported
Guilt → behavior	0.100	2.090	0.037	Supported
SN → behavior	0.127	3.043	0.002	Supported
ATT → Intention	0.231	4.585	0.000	Supported
Guilt → Intention	0.255	5.099	0.000	Supported
SN → Intention	0.122	2.678	0.008	Supported
ATT → Intention → behavior	0.036	–	0.001	Supported
Guilt → Intention → behavior	0.040	–	0.001	Supported
SN → Intention → behavior	0.019	–	0.004	Supported

Note: ATT = Attitude, PBC = Perceived Behavioral Control, Guilt = feeling of guilt, SN = Subjective norm.

attitudes, Stefan et al. (2013) had measured it as moral attitude construct, some studies, such as those by Stancu et al. (2016) and Poškus (2015) described it as part of a moral norm construct, and other researches, e.g. Bamberg and Möser (2007) have used it as a predictor variable and attitude stimulus.

Given that the greatest contribution of food consumption management behavior variance was explained by PBC in the present study, to reduce household food waste, efforts should focus on increasing consumers' perceived behavioral control on food waste and persuading them that if they so choose, they will be able to reduce their food waste to zero. For this purpose, simple ways to minimize food waste can be considered in a variety of situations, through mass media, training courses, press, related brochures and labels on food packages. In addition, all cooking educators are required to teach food preparation methods with a minimum of food waste.

Since PBC had the greatest total impact on food consumption management behavior followed by attitude, it seems that interventions to change the consumers' attitude towards food waste can be effective in reducing household food waste. In this regard, the desirability of reducing food waste and its associated methods can be inculcated by reviewing the importance of reducing food waste in various communication media, schools, dense population areas and public places, and competitions designed to determine an effective and efficient solution to eliminate food waste by donating exquisite awards.

6. Limitations of the study

Illiterate or low-literate respondents, especially women in rural areas are a clear limitation of the current study. The researchers tried to resolve this limitation with the aid of face to face questionnaire, but this led to a prolonged process of data collection. Furtermore, The use of self-report measures to assess food consumption behavior is another limitation of the study. A further limitation of the study was PBC measurement. Since three items for PBC focus on food routine behaviors whereas most of the items representing attitudes, subjective norms, and guilt focus on the food waste, thus estimates of the relationships amongst the PBC and food consumption behaviors may, therefore, be confounded by common measurement variance. Objective measurement of PBC, using a new sample, is necessary to validate the impact of PBC on food consumption behavior. A final limitation was the confusing measurement of subjective norms. The subjective norm included in the TPB is conceptually considered similar to the injuctive norms, since both patterns concern others' expectations about an individual's behavior. In addition, some items in the content of the descriptive norm and good provider attributes were added to it. This may have created confusion and uncertainty in measurement. Therefore, future studies with accurate measurement of subjective norms are required. These limitations are being addressed in research currently underway.

7. Future research

This research showed that, besides promoting the planned behavioral model, the feeling of guilt also has both a direct and an even more indirect influence on food waste management behavior. Therefore, given the emphasis of theories and experimental support on the effect of emotional variables on behavior, future research can examine the impact of other emotional variables on the TPB model.

This study focused solely on domestic food waste at household level, while the same consumers themselves as community and societal members play an important role in food waste in the position of consumers of food service providers in places such as hospitals, restaurants, halls for organizing ceremonies of celebrations and mourning, hotels and inns, etc. Most of the respondents stated that food waste is higher in these places. Hence, future studies can focus on the same consumers outside home or perhaps other consumers' food waste behavior to compare with this study.

The power to explain the proposed conceptual framework was 0.36. Therefore, integrating other frameworks can help improve the power of explaining the food waste behavior in future studies.

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