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# Domestic food practices: A study of food management behaviors and the role of food preparation planning in reducing waste

## ABSTRACT

Recent research has started to show the key role of daily food provision practices in affecting household food waste. Building on and extending these previous contributions, the objective of this paper is to investigate how individuals' everyday practices regarding food (e.g., shopping, cooking, eating, etc.) lead to food waste, and how policy makers and the food industry can implement effective strategies to influence such practices and ultimately help consumers reduce food waste. The research performs three Studies; a critical incident qualitative study (Study 1; N = 514) and a quantitative, survey-based study (Study 2; N = 456) to identify and examine relevant food management behaviors associated with domestic waste. Lastly, findings from a field experiment (Study 3; N = 210) suggest that a specific educational intervention, directed at increasing consumers' perceived skills related to food preparation planning behaviors, reduces domestic food waste. Implications of the research for policy makers and the food industry are discussed.

**Keywords**: food, waste, food management behaviors, food preparation planning, consumer behaviors

## 1. Introduction

Consumers are becoming aware of issues related to food waste and also recognize their active role in preventing it. According to Flash Eurobarometer 425 (2015), the majority of Europeans point to individual responsibility when it comes to ways of reducing food waste, with 63% saying that better food-related practices in terms of planning and shopping would help to reduce waste. However, in spite of the concern consumers express, the level of food waste continues to be very high. Specifically, estimates report waste by consumers as between 95-115 Kg annually per capita in Europe and North America (FAO, 2011; WRAP, 2009; 2012). The consumer's role in preventing food waste is therefore crucial in developed countries (European Commission, 2016; HLPE, 2014; Jörissen, Priefer, & Bräutigam, 2015; Parfitt, Barthel, & Macnaughton, 2010). With the increase in disposable incomes, and the consequent change in lifestyles, the amount of waste in the household has grown relentlessly over time (Parfitt et al., 2010).

Given the magnitude of this phenomenon, it is likely that there are many barriers to reducing domestic food waste to a minimum. Knowing what these barriers are has become increasingly important not only to government and policy makers, but also to food producers, retailers, and other stakeholders at each stage of the supply chain. All of them have a part to play in helping to reduce domestic food waste. Many individual retailers (e.g.,Tesco, Asda, Morrisons, among others) have launched programs aimed at addressing domestic food waste (British Retail Consortium, 2016). In addition, the food industry as a whole (e.g., Food Waste Reduction Alliance in the US, the Waste and Resource Action Programme in the UK, and the Retailers' Environmental Action Programme in Europe) has established waste reduction as a primary goal. Yet the ongoing incidence of consumer waste behavior demands that we find out more about its nature, what causes it, and what can be done about it.

Although increasing in the last few years, empirical research available on factors affecting domestic food waste continues to be relatively limited (Porpino, 2016). Apart from a few exceptions

of studies based on a general conceptual framework (e.g., Quested, Marsh, Stunnell, & Parry, 2013), most of the research available focuses on a subset of micro factors affecting domestic food waste in a variety of social-environmental contexts, thus favoring a more specialized approach to a comprehensive perspective. More specifically, among these factors it is possible to distinguish, according to Roodhuyzen, Luning, Fogliano, and Steenbekkers (2017), between food-related behavioral factors directly affecting food waste and a wide range of other factors (personal or product-specific) underlying such food-related behaviors or more often food waste intentions in general. Instances of personal factors increasing food waste are living alone (Jörissen et al., 2015; Koivupuro et al., 2012; Parizeau, von Massow, & Martin, 2015), being a woman (Koivupuro et al., 2012), being young (Melbye, Onozaka, & Hansen, 2017; Quested et al., 2013; Tucker & Farrelly, 2015), and not knowing much about food labels (Abeliotis, Lasaridi, & Chroni, 2014). Examples of product-specific factors influencing food waste are packages that are difficult to empty (Williams et al., 2012), large packages (Koivupuro et al., 2012), and data labels on products that are most suggestive of food safety concerns (Wilson, Rickard, Saputo, & Ho, 2017). Finally, poor shopping planning and buying more than is needed (Stefan, van Herper, Tudoran, & Lähteenmäki, 2013) are typical examples of food-related behavioral factors directly increasing food waste.

Recently, two systematic reviews (Block et al., 2016; Porpino, 2016) have highlighted the importance of having a better understanding of how food-related behavioral factors contribute to household food waste. Increasing our knowledge of such behavioral factors would be not only of theoretical interest, given the paucity of systematic research on this specific issue (see for exceptions, Stefan et al., 2013, and Stancu, Haugaard, & Lähteenmäki, 2016), but also of practical importance. Such findings as may emerge can assist organizations, both private and public, in developing and implementing more effective actions for reducing food waste at the domestic level.

The objective of our research, therefore, is to find out how behaviors of consumers in their daily food provision affect domestic food waste, and how policy makers and the food industry can implement effective strategies to influence such behaviors and ultimately help consumers reduce

food waste. To accomplish the objective of our research, we first conducted a qualitative study (Study 1) to identify the specific behaviors responsible for food waste in the household. Then we conducted a quantitative study (Study 2) to reveal individual consumer segments based on a different food waste behavior and relevant food management behaviors that impede its reduction. Finally, a longitudinal experimental study (Study 3) was conducted to examine the impact of a specific intervention on domestic food waste. All three studies focus on one specific country, Italy; however, the fundamental constructs within our conceptual framework are likely to be valid for many developed societies, as argued in previous research (e.g., Stancu et al., 2016; Stefan et al., 2013).

## 2. Theoretical framework

Building on the main constructs of the Theory of Planned Behavior (TPB) (Ajzen, 1991), some extended frameworks have been recently proposed to explain consumer food waste (Graham-Rowe, Jessop & Sparks, 2015; Russell, Young, Unsworth, & Robinson, 2017; Stancu et al., 2016; Stefan et al., 2013; Visschers, Wickli, & Siegrist, 2016). These studies integrate the typical TPB constructs with available research on consumer perceptions and behaviors regarding food waste (see Aschemann-Witzel, de Hooge, Amani, Bech-Larsen, & Oostindjer, 2015 and Porpino, 2016 for a review). Although findings of this research (Visschers et al., 2016) show that the TPB can be used in this specific context, Stefan et al. (2013) and Stancu et al. (2016) agree that it is important to add food-related routines to the traditional psycho-social factors typical of the TPB, to better explain food waste behavior and provide more effective ways of influencing it. Consumers, in fact, perceive food waste as a food-related behavior more than as an environmental or a social behavior (Graham-Rowe, Jessop, & Sparks, 2014; Quested et al., 2013; Quested, Parry, Easteal, & Swannell, 2011; Thyberg & Tonjes, 2016; Tucker & Farrelly, 2015; Watson & Meah, 2012). Given this perception, food waste can be seen as the last stage of decision-making in the domestic food provisioning process (Porpino, Parente, & Wansink, 2015) and as intimately connected with other routine food-

related behaviors that are part of this process, such as shopping, stocking up, or cooking. These food-related behaviors may therefore be important in explaining domestic food waste.

Based on Stefan et al. (2013), we conclude that planning and shopping routines explain most of the variance in food waste, with the latter having the larger influence. At the purchase stage consumers often rely on food shopping routines (Maubach, Hoek, & McCreanor, 2009) and admit to regularly buying more food than needed (Evans, 2012) or food products they never use (Wansink, Brasel, & Amjad, 2000), thereby increasing food waste. By contrast, planning routines such as checking the inventory level (Chandon & Wansink, 2006), making shopping lists or planning meals in advance (Bell, Corsten, & Knox, 2011), help consumers to limit food waste. Stancu et al. (2016) confirm Stefan et al.'s evidence of drivers of food waste behavior, emphasizing the additional role of habit in food waste. Their model also shows that in addition to planning and shopping routines, leftovers-reuse routines are important determinants of reported food waste. Even in the absence of food purchase planning and preparation, reusing products and meals could contribute to lower levels of food waste.

Similarly, the central role of consumer routine food provisioning behaviors in food waste has also been shown by Farr-Wharton, Foth, and Choi (2014), using the value-belief-norm (VBN) theory (Stern, 2000) to examine consumer decision-making behavior. In addition to the results discussed above relating to shopping and planning practices, food storage routines emerged as one of the most significant drivers influencing food waste. Random and nonsystematic placing of food items resulted in food becoming easily lost and often expiring before being used; in addition, the low visibility of food items in the refrigerator, particularly of those located towards the back, also resulted in food waste. Other mainly descriptive food waste studies (e.g., Graham-Rowe et al., 2014; Hoek et al., 2017; Koivupuro et al., 2012; Ponis et al., 2017; Principato, Secondi, & Pratesi, 2015; Quested et al., 2013) also support the importance of the household food-related routines noted above, citing as the most common reasons leading to wastage of food such practices as buying too much, managing food storage carelessly, and cooking too much without re-using leftovers.

These findings seem to imply that avoiding food waste is not simply a willed, goal-oriented or planned behavior: it also requires important changes in the consumers' daily food provisioning routines. The adoption of waste-promoting versus waste-reducing routines, related to planning, shopping, storing and cooking, significantly affects the levels of food waste. Over-purchasing of food items that are on sale or in bulk packaging, buying without a shopping list or without taking an inventory of the kitchen, throwing away leftovers, forgetting to use food before it spoils – these are all simple examples of waste-promoting routines, and can therefore become serious barriers to reducing domestic food waste to a minimum. However, the results illustrated by previous research also suggest that specific interventions directed at consumers could improve their food provisioning routines and strongly decrease food waste. These interventions should concern the purchasing of food as well as its preparation and storage at home. In order to further explore the food behaviors discussed above, a qualitative study is first conducted – as a precondition for useful intervention measures – to identify the specific behaviors that lead to food waste.

## 3. Study 1

The purpose of Study 1 is twofold; one is to verify what recent research suggests with regard to the main behaviors related to domestic food waste, and the second is to uncover additional possible reasons responsible for food waste by consumers. By so doing, we are able to identify the most important behavioral causes of domestic food waste and also provide preliminary evidence for directing the selection of possible interventions aimed at decreasing domestic food waste. It is worth noting here also that this preliminary study can be useful in the development of the measures for constructs for the following studies by suggesting, when necessary, items consistent with the words and idioms used by consumers.

### *3.1.* Method

#### *3.1.1.* Sample and data collection

This first study used a critical incident technique (CIT) survey (e.g., Bitner, Booms, & Tetreault, 1990) to uncover and understand the particular situations and related behaviors that cause domestic food waste. A total of 103 undergraduate students collected interviews, over a period of three weeks, from a convenience sample of adults responsible for shopping and cooking in their household. Each student was asked to recruit and interview five people. One of the authors of the present study gave the interviewers detailed training and written instructions for the interviews, and they practiced the procedure by role playing. Specifically, after receiving their explicit consent to participate in the study, we asked all the respondents the following questions and their answers were recorded and transcribed: "Please, think of a recent time when you wasted food in a domestic context. When did the incident happen? What specific circumstances led up to this incident? Exactly what did you do? What resulted that makes you think that this is a typical incident of domestic food waste?"

The data collection resulted in a purposive sample of 514 individual consumers – (182 male and 332 female; average age = 39.9; 44.6% were undergraduate or higher educated respondents, 42.4% with a high school education, and 13% with a lower level of education) – which provided valuable insights into the problems that individuals face in reducing food waste. Two independent coders categorized the responses. In some instances, more than one reason was provided as to why food was wasted. Individuals reporting more than one reason were classified into multiple categories yielding 682 responses. Discrepancies in coding were discussed by the coders in order to reach a resolution. This classification of responses resulted in eight main barrier categories. All responses were then sorted by a third person who was given the eight categories but had not participated in the initial categorization tasks. Inter-judge agreement on assigning the events to the eight categories, based on the third person's sorting of the responses, was 88%. The rest were solved after discussion. These eight main categories, with frequencies and representative quotes from the participants, are reported in Table 1.

--- Table 1 about here ---

*3.2.*Results and discussion

The results of the qualitative study revealed that numerous food management practices in the household are possible causes of domestic food waste. Domestic food storage behaviors in particular, especially disorganization, emerged as the most frequently reported factor (32%) associated with food waste. Domestic food preparation behaviors were another frequently emerged cause (16%). Cooking large amounts of food for special events, and preparing portions too big for the family's needs, were typical experiences reported by the respondents. A lack of purchase planning was the next most frequent response category: 12 percent admitted to doing little or nothing to prepare a shopping list. The absence of appropriate checking on products while shopping was another factor (11%). In particular, respondents confessed to ignoring expiry dates and the state of products' conservation in general. The lack of meal planning was identified as a cause of food waste by 10% of the respondents, who reported their difficulties in developing and following a weekly menu. The rejection of leftovers was also evident among respondents (8%) as a cause of domestic food waste. Excessive purchasing because of in-store influences was a cause of food waste for 8 percent of respondents. In addition, a miscellaneous category contains respondents (3%) who claim that food is wasted because of bad communication within the household and limited food literacy.

*Summary*. As evidenced by the frequency presented for each category, food storage appears to have the greatest adverse effect on the minimization of food waste. Given the overt nature of this initial study it is not surprising that food storage dominated the other categories when participants were asked to use memory recall. As also reported by Farr-Wharton et al. (2014) and Masson, Delarue, and Blumenthal (2017), although the major part of waste in domestic environments occurs because of the ways food is bought, stored and eaten, all pivot around food storage. However, it is also important to note that other relevant reasons were mentioned when discussing reasons for food waste with respondents. These findings validate the results obtained in previous research but also, compared to previous studies (Stancu et al., 2016; Stefan et al. 2013), add two more behaviors

associated with domestic food preparation and in-store food control during purchasing. These relate to the quantities prepared during meal preparation and to the absence of appropriate checking on products while shopping.

## 4. Study 2

A quantitative study was conducted with new participants in an effort to better assess behaviors associated with domestic food waste and the differences in such behaviors between consumers in terms of the different amounts of food waste involved. A number of specific quantitative scales useful to identify consumer household food management behaviors associated with food waste were considered. These additional insights will be extremely valuable to further validate the results obtained in Study 1 and to specifically select and justify targeted interventions directed to help consumers in the minimization of domestic food waste.

### *4.1.*Method

#### *4.1.1.* Measurement: Preliminary assessment

To measure household food management behaviors associated with food waste this study used measures already existing and tested (i.e., Stancu et al., 2016; Stefan et al., 2013), and generated additional items based on the results of Study 1. The scales in English were translated into Italian using a double-back-translation method with independent translators (Brislin, 1980). Concerning the newly generated items, three independent judges, all marketing scholars highly experienced in consumer behavior, both reviewed and helped in reducing the pool of items after reviewing our results from Study 1. In particular, we asked the judges to evaluate each item as regards its relevance to each specific behavior and also to suggest any additional useful items. This process resulted in the elimination of 5 items, where two or all three judges evaluated them as not fully representing the behaviors, and in the addition of 2 new items. The revised pool of items was then pilot tested on a group of adult consumers, after receiving their consent to participate in the study,

to pretest it for clarity and comprehensiveness. The results were positive and the 21 items were included in a survey aimed at a preliminary assessment of the new scales (see Table 2).

Structural equation modeling (LISREL 8.8) was used to assess the convergent and discriminant validity of the measures for the behaviors. Potential respondents were approached randomly by three interviewers as they shopped in city-center shopping areas in three different cities in Italy. Only a small number of people refused to participate (about 7%). The final sample size was 287 consumers responsible for shopping and cooking in their households. The questionnaire took approximately 10 minutes to complete. After finishing the questionnaire, respondents were debriefed by explaining the purpose of the study and thanked. The sample can be characterized as follows: 62% were women; 21% aged 18-29, 40% aged 30-49, 31% aged 50-70, and 8% over 70; 23.3% were undergraduate or higher educated respondents, 39.1% with an high school education, and 37.6% with a lower level of education.

A CFA was performed with all the relevant variables, measured on a 7-point scale (1= never, 7 = always): behaviors in domestic food storage (BDFS; M = 5.31, SD = 0.90); behaviors in domestic food preparation (BDFP; M = 4.63, SD = 1.06); behaviors in planning food purchasing (BPFP; M= 5.31, SD = 1.04); behaviors in in-store food control (BIFC; M = 5.48, SD = 1.04); behaviors in food preparation planning (BFPP; M = 3.94, SD = 1.11); behaviors in leftover consumption (BLC; M = 4.64, SD = 0.97); behaviors in in-store food purchase influence (BIFPI; M = 3.80, SD = 1.14). The fit of the model was excellent ($\chi^2(188) = 287.71$; CFI = .96; NNFI = .95; SRMR = .05; RMSEA = .04), all factor loadings were significant, ranging from a minimum of 0.61 to a maximum of 0.93, which, along with the overall fit, suggests achievement of convergent validity. All construct reliability values were satisfactory, ranging from a minimum of 0.71 to a maximum of 0.83, demonstrating acceptable reliability. All the average variances extracted (AVE) were above the recommended threshold of .50 (ranging from a minimum of 0.50 to a maximum of 0.69), and the likelihood ratio tests further confirmed that the measures of all variables exhibited discriminant validity. Given the positive results of this measurement assessment, we moved on to the main study.

--- Table 2 about here ---

*4.1.2.* Main study: Sample and data collection

Data were collected using face-to-face interviews with a new sample of consumers, responsible for both shopping and cooking for their households, who were approached in three different shopping malls in Italy by three different, trained interviewers. About 6% of the people approached refused to participate. A total of 534 adults explicitly consented to participate in the study and answered the questionnaire. About 17% were disqualified for not being responsible for shopping and cooking for the family. The final sample is composed of 456 Italian consumers[1] (69.5% of the 456 were women; 23% aged 18-29, 37% aged 30-49, 34% aged 50-70, and 6% over 70; 24.1% were undergraduate or higher educated respondents, 40.6% with an high school education, and 35.3% with a lower level of education). In addition to the scales described above (§ 4.1.1), the questionnaire for study 2 included two different measures for the food waste phenomenon: food waste and intention not to commit waste in the future. Moreover, the questionnaire also included measures for the following constructs: personal norms, social norms, subjective norms, lack of concern, and moral attitudes (see Table 3). The introduction of these additional constructs, mainly derived from recent research on food waste (Stefan et al., 2013; Stancu et al., 2016; Visschers et al., 2016), is justified by the need to better understand the psycho-social characteristics of individuals related to food waste. The questionnaire took approximately 15 minutes to complete. After finishing the questionnaire, respondents were debriefed by explaining the purpose of the study and thanked.

[1] A CFA data analysis was performed considering the complete set of behaviors related to food waste. Also in this case, the fit of the model was excellent ($\chi^2(188) = 474.44$; CFI = .95; NNFI = .95; SRMR = .06; RMSEA = .05), factor loadings significant (ranging from a minimum of 0.66 to a maximum of 0.94), construct reliability values satisfactory (ranging from a minimum of 0.69 to a maximum of 0.80), and AVE satisfactory (ranging from a minimum of 0.50 to a maximum of 0.71), confirming the reliability and validity of the measures.

--- Table 3 about here ---

*4.2.*Results and discussion

To better understand behaviors associated with domestic food waste and the differences in such behaviors between consumers, we applied a cluster analysis approach to the data. Respondents were grouped considering the complete set of behaviors related to food waste (as detailed in Table 2). Personal norms, social norms, subjective norms, lack of concern, and moral attitudes are considered in this analysis; these psycho-social characteristics are used only for descriptive purposes and they play no part in the clustering procedure. The groups of respondents identified with the cluster analysis were then assigned a label based on levels of food waste and waste intention.

A two-step cluster analysis procedure was conducted to categorize sample respondents based on their responses to the clustering variables (Punj & Steward, 1983). Average scores for the seven food-related behaviors for each of the 456 respondents were used for the cluster analysis. In the first stage, Ward's hierarchical clustering method with squared Euclidean distances was used to identify clusters. The elbow criterion suggested a 3-cluster solution. In the second stage, a non-hierarchical, k-means clustering procedure (MacQueen, 1967) was used to develop a 3-cluster solution. The internal validity of the cluster solution was tested by applying multivariate analysis of variance (Maute & Dubé, 1999), in which the clusters were compared in terms of all the original items on the behaviors scales. Significant differences between the clusters were found by using Hotelling's trace statistic ($T = 3.08$, $F(44, 862) = 30.17$, $p < 0.001$), providing strong evidence for the internal validity of the 3-cluster solution. Table 4 summarizes the resulting segments. Follow-up analyses were conducted to assess differences between the clusters. In particular, chi-square tests were run to compare the 3 clusters on the demographic information. ANOVA analyses and Tukey pairwise comparison tests were conducted to compare the 3 clusters on the clustering variables, the outcome variables, and the psycho-social characteristics (see Table 4).

--- Table 4 about here ---

The three groups were labeled based on their levels of food waste. Those high in food waste and waste intentions were labeled “waster”, while the low in both were labeled “virtuous”. The intermediate group was labeled “moderate”.

Cluster 1, labeled as “Virtuous”, is comprised of 158 individuals (34.6 percent of the sample) who are the least engaged in food waste and exhibit the strongest intentions not to waste. This segment is significantly higher than the other two segments on variables identified as food-related behaviors that drive the minimization of food waste (i.e., organization in food storage, adequate amount of food preparation, planning in advance for food purchasing and preparation, in-store food control, reuse of leftovers, and prudent purchasing independently of in-store influences). Furthermore, this segment is higher on the socio-psychological constructs associated with the minimization of food waste (i.e., personal norms, subjective norms).

Cluster 3, labeled as “Waster”, is comprised of 74 individuals (16.3 percent of the sample) who score the highest on food waste and lowest on intentions not to waste. This segment is significantly lower than the other two segments on all the drivers of food waste minimization. Moreover, this segment is also lower on the psycho-social variables related to waste reduction.

Finally, an intermediate position is presented by Cluster 2 labeled “Moderate”. This cluster is comprised of 224 individuals (49.1 percent of the sample) who present an intermediate level on food waste and intentions not to waste. This segment also presents intermediate levels on both the drivers for food waste minimization and the psycho-social related constructs, with the exception of a similarity with Cluster 3 on planning for food preparation, excessive buying because of in-store influence and subjective norms, and with Cluster 1 on social norms and moral attitudes.

*Summary*. The three segments are very different from each other since individuals belonging to each of them tend to differ greatly on the main behavioral drivers of food waste. However, considering the mean values for each of the clustering variables it is evident that the lack of planning for domestic food preparation appears to be the most significant barrier to reducing domestic food waste to a minimum. In general, for all the segments the low scores on planning are

an indication of the general inability felt by consumers to plan their meals in advance and to organize a weekly menu. Given the relevance of these food-related behaviors and the important role they probably have in forming and/or eliminating other hurdles for food waste minimization, the following study seeks to examine this key food behavior.

## 5. Study 3

The results of studies 1 and 2 provide valuable insights into the household food management behaviors associated with food waste. In an effort to evaluate the efficacy of interventions which should help individuals to reduce food waste in their households, we undertook an experimental consideration of the planning for food preparation.

Each of the foregoing studies suggests that consumers' inability to plan meals in advance is an important driver for domestic food waste. Previous research also tends to confirm this conclusion. Based on Parizeau et al. (2015), when people were asked what activities would help them to reduce food waste, the most popular response was meal planning (30%). Again, Mallinson, Russell, and Barker (2016) attributed the large proportion of food waste, generated by heavy users of convenience food, to their lack of advance planning. Moreover, Stefan et al. (2013) and Stancu et al. (2016) concur that an important role in reducing food waste was the improvement of meal planning skills. Thus, based on our previous studies and also on available research, we hypothesize that an educational intervention directed at increasing consumers' perceived skills related to food preparation planning behaviors will reduce the levels of domestic food waste. Such an intervention will impact food waste through the mediating role of improvements in consumers' perceived skills for such specific behaviors.

This hypothesis was examined in a study whose design was guided by three considerations: First, while previous research supports a relationship between household food management behaviors and food waste, most of the evidence is correlational. Therefore, experimental approaches are needed to establish causality for this relationship. Second, to demonstrate the effect of an

educational intervention, one must analyze domestic food waste over a period of time. And third, laboratory settings are suboptimal in food research because they usually have low external validity, thereby limiting the possibility of generalizing from the findings. To meet all of these considerations, we conducted a longitudinal field experiment. Participants were exposed to an educational intervention directed at increasing skills in planning for meals. Both before and after the program, their levels of domestic food waste were assessed in their actual home environment.

## *5.1.* Method

### *5.1.1.* Sample

A new sample of respondents was used. Participants were recruited by 58 Master's students participating in a consumer behavior class in Italy. Each student recruited 4 respondents; s/he was instructed to recruit only people who are the main ones responsible for shopping and cooking in their household, and who belong to a household that includes at least one child. All the respondents who explicitly consented to participate in the research received a letter explaining the aim of the study and consequent visits to the home. Twenty-two respondents (corresponding to about 9% of the sample) abandoned the research in progress. Therefore, the final sample included 210 participants responsible for food shopping and cooking in their household (56.9% of the total were women; 17.1% aged 18-29, 32.3% aged 30-49, 42.5% aged 50-70, and 8.1% over 70; 21.4% were undergraduate or higher educated respondents, 40.5% with a high school education, and 38.1% with a lower level of education; average household member = 3.6, SD = .81; average number of children per household = 1.7; SD = .70). We provided a small monetary reward to respondents who completed the study.

### *5.1.2.* Materials

The intervention was reading an educational article, explaining how to organize a weekly menu quickly and simply. The article was developed together with an Italian social organization working on food waste (Senza Spreco) (Appendix A; educational article translated into English). To involve respondents successfully, the article had a positive focus and provided something easy to put into

practice – qualities that are considered essential if interventions directed at consumers are to be effective (Aschemann-Witzel et al., 2016). Specifically, the article firstly illustrated the advantages associated with the organization of a weekly menu (e.g., time-saving on shopping, since with a plan for the whole week it is easier to draw up a weekly shopping list and so avoid several visits to stores; a more balanced menu and greater variety of dishes on the table; reduced stress in serving food). Secondly, the article illustrated the use of an Excel file based on different sheets: sheet 1 is a plan for the weekly menu, printable in A4 horizontal; sheet 2 is a list of possible recipes useful in organizing the menu. The file was printed together with the article, but a web link was also provided. Finally, the article closed with a list of useful suggestions (e.g., to insert quick and simple recipes, to involve the whole family in planning and preparation, to organize meals based on components prepared in advance, such as sauces for pasta or cakes for breakfast).

To pretest this material for its effectiveness in improving perceived skills for planning meals, 30 additional participants responsible for food shopping and cooking in their households were recruited (100% were women; age, M = 45.5, SD = 10.82). Each participant received the article via mail and on a 7-point scale (from 1, corresponding to "completely disagree", to 7, corresponding to "completely agree") rated the following items: "I1: The article provides useful advice on how better to plan meals in advance" (M = 6.30; SD = .79); "I2: the article provides a practical tool to deal with meal planning" (M = 5.97; SD = .81); "I3: the article can really help me to improve my ability to manage my family's weekly menu" (M = 4.93; SD = .98); "I4: the article can help me improve my skills in planning the meal program for the week" (M = 4.73; SD = .87); "I5: the article can help me improve my skills in planning the meal program in general" (M = 4.77; SD = .90). All the item evaluations are statistically higher than the average value of the scale (4) ($I1\_t(29) = 15.86$, $p < .001$; $I2\_t(29) = 13.32$, $p < .001$; $I3\_t(29) = 5.22$, $p < .001$; $I4\_t(29) = 4.63$, $p < .001$; $I5\_t(29) = 4.68$, $p < .001$) showing the effectiveness of the educational articles prepared for the study in improving perceived skills for planning meals.

*5.1.3.* Procedure

To assess the potential impact of the intervention on food waste we developed a quasi-experiment using a Solomon four-group design (Solomon, 1949). As Campbell and Stanley (1963) discussed, three experimental designs (the pre- and post-test control group design, and the post-test-only control group design, and the Solomon four-group design) are adequate to assess the effect of the treatment and to maximize internal validity. Of these three, the Solomon four-group design has the advantage of being the only one able to assess the presence of pre-test sensitization, that is, the respondents' sensitivity to the experimental treatment after exposure to the pre-test. The Solomon four-group design removes such sensitization that prevents generalization of results from the pretested sample to an un-pretested population (Huck & Sandier, 1973), and therefore adds a higher degree of external validity in addition to its internal validity.

Consistent with the Solomon four-group design, one group of respondents (G1; n= 57) completed a pre-test diary (see Measures section), received the article to read and completed a post-test diary. The diaries and the article were delivered to respondents personally by students who spent some time with them commenting on, and explaining, the materials available. A second group of respondents (G2; n=56) completed a pre-test and a post-test diary, but did not receive the article to read. The third group of respondents (G3; n=49) received the article and completed the post-test diary, but did not complete the pre-test diary. The final group of respondents (G4; n=48) only completed the post-test diary. In details, the inclusion of G3 and G4 in the experimental design allows us to assess the presence of the pretest sensitization.

For those respondents who received the article (G1 and G3), the post-test diary was started one week after they received the intervention. As noted above, respondents in the second group (G2) completed the post-test diary two weeks after the pre-test diary, but did not receive the intervention. Respondents in the fourth group (G4) completed the post-test diary during the same time period that respondents in the other groups completed theirs (see Table 5). No differences were found among the experimental groups in terms of frequency distributions for age (chi-square (df) = 448.57 (462);

p = .66), gender (chi-square (df) = 21.98 (11); p = .05), number of household members (chi-square (df) = 54.14 (55); p = .51), and number of children (chi-square (df) = 39.53 (44); p = .66).

--- Table 5 about here ---

*5.1.4.* Measures

The pre-test and post-test diaries were identical for all groups. The diary was a one-week, daily-based paper diary in which participants were asked to enter all the food and drinks they throw out as waste for each meal in the day (i.e., breakfast, lunch, dinner, snacks). In addition, for each day a "clearing out" section was available to include the disposing of any other food if participants, deciding to throw away some food, had examined their fridge or cupboard. Only avoidable food waste was included in the study. Unavoidable food waste, such as vegetable and fruit peelings, bones and coffee grounds, was excluded. No drinks other than milk and other potable dairy products were included (WRAP, 2012).

The diary incorporated full instructions on use, a section that addressed potential issues that might arise, and examples of how the daily entries were to be recorded, including suggested measurements most commonly used in practice, which could be by weight, volume or specific descriptions, such as a level handful, half a teaspoonful, etc. For each item of food or drink waste, the following information was requested: a) description of the food or drink waste; b) why it was thrown out (providing a qualitative description); c) specific reasons behind the food or drink waste (to select one of the following options: reasons related, respectively, to food shopping, food storage, food preparation, food consumption, or other residual reasons); and d) how much was wasted. Each diary was then composed of 54 pages (Appendix B; Diary-in Italian).

The amount of food waste thrown out could be recorded using a number of metrics: weight, volume or number of items. However, we asked respondents to weigh items as much as possible using their available scales. All participants kept the diary/diaries over the full period of seven days. Information from the diaries was then inserted manually into an excel database by the authors. All the quantities were converted to weight (grams) during the post analysis of the diaries (see Table 6).

The post-test diary also included two additional questions asking participants to rate on a 7-point scale (from 1, corresponding to very low, to 7, corresponding to very high) their skills in terms of a) planning for meals in advance and b) following a weekly menu (M = 4.64; SD = 1.15). Finally, for the groups receiving the intervention article we checked the correct reading of it with an open-ended question about its content. All respondents answered correctly.

--- Table 6 about here ---

*5.2.*Results and discussion

In the first step, we controlled for pretest effects according to the recommendations of Braver and Braver (1988) regarding the analysis of Solomon four-group experimental designs. We calculated 2x2 ANCOVA with intervention (yes/no) and pretest (yes/no) as experimental factors; gender, age, household size, and number of children in the household as covariates; and post-test food waste per household as the dependent variable (see Table 7). An interaction between both factors would indicate pretest effects.

The results of the ANCOVA were not significant for the covariates. In terms of the experimental factors, there was no significant main effect for the presence of a pre-test ($F = .44$, $p = .51$; partial eta square (effect size) = .002), and no significant interaction effect ($F = .05$, $p = .82$; partial eta square (effect size) = .00). There was, however, a significant main effect for the intervention ($F = 11.00$, $p < .001$; partial eta square (effect size) =.05). Hence, we found no evidence for pretest sensitization, but rather an effect of the intervention on food waste. The results of a follow-up test on the main effect of the intervention confirmed the presence of a treatment effect ($t (208) = 3.36$, $p < .001$). Therefore, a significant effect of the intervention was identified.

--- Table 7 about here ---

Given this effect, we moved to the mediation analysis. The procedure for computing conditional indirect effects (Hayes, 2013) was applied. A model for estimating the influence of the independent variable (intervention), on the outcome variable (food waste), through the mediator (perceived skills in planning for meals) was used. Table 8 presents the results. Under the mediator variable model,

we find that the intervention influences their meal planning skills (.48, $p < .05$). We find a marginally significant effect of the planning for meals skills (-97.69, $p < .10$) on food waste, supporting this mediating role. The bottom panel of Table 8 displays the indirect effect, along with bootstrapping results and these are significantly different from zero at $\alpha = .05$.

*Summary*. Study 3 finds that the educational intervention reduces the amount of domestic food waste. Moreover, this effect of the intervention on food waste is mediated by the improvement in consumers perceived skills in planning meals. These findings confirm our hypothesis about the positive role of the educational intervention in reducing domestic food waste, as predicted.

--- Table 8 about here ---

## 6. General discussion

As consumer household food waste is a significant issue for consumers, retailers, producers, and society at large, it is imperative that supply chains, together with social and public actors, understand the reasons behind consumer food waste behavior so as to create independent and/or collaborative initiatives that will help consumers waste less. To meet this specific need, the aim of our research was to examine the extent to which consumer household food management behaviors result in unnecessary food waste. Therefore, a series of studies were undertaken that employed a variety of research methods (i.e., interviews, a survey, and a field experiment). The results of these studies provided a set of interesting implications, not only for researchers working in the area of domestic food waste but also for the different actors in the food industry that consider waste reduction a primary goal (Aschemann-Witzel, de Hooge, & Normann, 2016).

The qualitative interviews in Study 1 provided an identification and overview of the behaviors that consumers readily admit to being barriers to reducing domestic food waste to a minimum. Behaviors in domestic food storage emerged as a key issue in producing domestic food waste, which was in line with previous research (Farr-Wharton et al., 2014; Ponis et al., 2017); but other food-related behaviors also emerged as relevant barriers. Our findings are in line with the

observations made by Quested et al. (2013) that wasting food does not reflect one singular behavior but rather is an outcome of the way the household deals with food during planning, shopping, preparing, and consuming activities. See also, along the same line, Porpino et al. (2015) on the way in which a variety of everyday practices related to food affect wasting decisions.

Using a clustering technique, Study 2 was conducted in order to better understand the food management behaviors responsible for food waste. The ensuing insights helped to define the possible actions that would enable consumers to reduce their food waste (Brookie et al., 2017). We found that the lack of planning for domestic food preparation is the main factor in producing domestic food waste. As revealed, the inability to plan in advance is a significant barrier regardless of a consumer's orientation toward food waste. Moreover, meal planning potentially affects all the other behavioral factors related to food waste. For example, if ability to plan meals increases, an individual can consequently plan shopping and cooking in a better way, reducing overstocking and leftovers frequently associated with food waste. It is from this logic that a field experiment (Study 3) was undertaken to provide an initial in-depth investigation of the effect of an intervention addressing this specific food behavior on the minimization of domestic food waste.

Study 3 was then conducted in a field experiment with the aim of increasing the consumer's meal-planning skills by means of an educational article. Findings from the field experiment demonstrate that exposing respondents to educational materials positively impacts the minimization of food waste through improvements in consumer perceived planning skills. This evidence is in line with prior literature on the role of perceived skills in directing behaviors in food-related contexts (Hartmann, Dohle, & Siegrist, 2013; Stancu et al., 2016; Watson & Mead, 2012; Winkler & Turrell, 2009).

From a theoretical perspective our study extends recent research (Stancu et al., 2016; Stefan et al., 2013) that explains food waste behaviors combining classic psychosocial factors related to TPB (Ajzen, 1991) with the role of household food-related practices. Our findings add to this stream of research suggesting new interesting directions for further investigation of the "routine route to food

waste" (Stancu et al., 2016). Specifically, the findings suggest that additional constructs referring to food related practices (e.g., specific meal planning behaviors, food storage behaviors) should be taken into account when exploring food waste behaviors using a behavioral approach (Porpino, 2016). Moreover, as shown in our Study 3, the positive role of household skills in planning meals should be considered in conceptual frameworks aimed at explaining food waste.

*6.1.*Implications

Overall, the results provide important insights for managers and policy makers interested in designing initiatives aimed at reducing food waste at the household level. In line with the recent call for research into the effectiveness of different types of intervention (Quested et al., 2011; 2013; Thyberg & Tonjes, 2016), this study may serve as a critical resource for designing future waste prevention programs and improving existing ones. Although several projects have been developed to reduce domestic food waste (e.g., Aschemann-Witzel et al., 2016; Hebrok & Boks, 2017), there has been little quantitative work assessing their positive impact. Thus, as suggested by Thyberg and Tonjes (2016, p. 121), "rather than struggle with the lack of existing data and concrete conclusions regarding the best policy means to prevent food waste, it's suggested that new, well-planned intervention campaigns be initiated, but with mandates for proper monitoring and evaluation". Our research takes this perspective, providing novel insights for future programs.

Our findings on reducing domestic food waste were very encouraging, and suggested that several similar initiatives could be used on a larger scale by private and public actors to improve consumers' meal-planning skills. Two interesting examples come from two main UK retailers. Marks & Spencer has recently funded cookery classes in Manchester, England, to help residents plan meals better and prevent waste. Similarly, Morrisons' website gives specific information about planning and ideas for recipes. Again, in addition to planned actions seeking to educate consumers, sharing with them evidence on online social networks of the efforts of households that aim to reduce their food waste using the specific informative resources provided could be an additional useful way to raise awareness, skills, and directly support intentions. Successful experiences could

be celebrated and/or rewarded by the promoter of the campaign and, at the same time, could evoke feelings of empowerment and control and positively affect other families' behaviors. However, it is also important to stress here that all these interventions should be grounded in adequate research directed to investigate their actual effects on food waste levels. Although difficult to obtain, this type of knowledge is necessary to validly attribute positive results, at least in part, to these specific interventions.

Moreover, technology may provide additional opportunities to help consumers reduce waste. Menu planning and shopping apps are still at a relatively early stage of development (Ganglbauer, Fitzpatrick, & Comber, 2013; Hebrok & Boks, 2017), but in the near future they will be much more widely available, and they could represent an important self-regulatory resource, especially for consumers keen to reduce food waste (Jones, 2016).

*6.2.* Limitations and future research

Our study presents some limitations. First, the data for the study were gathered from single sources. As self-reported data were used, some error is likely in the behaviors recorded. However, self-reported data may be particularly appropriate for self-regulation by consumers who set personal goals and monitor and control their own behavior. The sensitive nature of the topic also suggests the possibility that respondents might exaggerate their reporting of waste minimization. If possible, future research should monitor actual waste behaviors in order to acquire the most accurate indication of real food waste. Second, while clustering allows the identification of individual segments of consumers, as has been done here, different techniques might yield varying results. Other algorithms were considered, but the method reported is the most robust and provides the most practical relevance. Third, our studies used convenience samples, albeit with actual adults in households. Future studies may try to collect data on samples representative of the general population in order to strengthen the possibility of generalizing the findings.

Our research was intended to provide a foundation for launching additional research into how food is wasted. The evidence presented here provides a basis for future studies to empirically assess

how effective different interventions are in reducing food waste. Future research is also needed when considering how behaviors in in-store environments influence food purchasing, or behaviors in domestic food preparation, related to household food waste. On both issues European retailers especially seem very active, but some theoretical underpinning and more rigorous outcome evaluations for these projects would be useful. For example, Tesco recently decided to reduce multi-buy offers in preference to everyday lower pricing and dedicated promotions (British Retail Consortium, 2016). This trend offers better value and is better designed to discourage the over-purchasing of food which could end up as waste, but whether this works in practice needs to be empirically evaluated. The same type of verification is needed, for example, for the new meal kit bags recently launched by Waitrose (British Retail Consortium, 2016). The bags provide customers with quick and convenient solutions for cooking from scratch with ingredients required to cook a meal for two. Everything is measured out to ensure no wastage or leftovers, although food-related waste (e.g., packaging) might emerge as side-effects that should be monitored. The company plans to extend the trial to further branches if successful.

Finally, from a theoretical point of view, a better understanding of food-related behaviors associated with food waste is needed. How do efforts at food waste management grow and become habitual? What lies behind them? How are they related to each other? Is it possible to define a specific order of influence? Additional research in this area would provide a better understanding of these behaviors and help to find improved ways to reduce domestic food waste for the benefit of all.

## REFERENCES

Abeliotis, K., Lasaridi, K., & Chroni, C. (2014). Attitudes and behaviour of Greek households regarding food waste prevention. *Waste Management & Research, 32 (3),* 237-240. http://dx.doi.org/10.1177/0734242X14521681

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50(2),* 179-211. http://dx.doi.org/10.1016/0749-5978(91)90020-T.

Aschemann-Witzel, J., de Hooge, I., Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: Causes and potential for action. *Sustainability, 7* (6), 6457-6477. http://dx.doi.org/10.3390/su7066457.

Aschemann-Witzel, J., de Hooge, I., & Normann, A. (2016). Consumer-related food waste: Role of food marketing and retailers and potential for action. *Journal of International Food & Agribusiness Marketing, 28(3),* 271-285. http://dx.doi.org/10.1080/08974438.2015.11105489.

Aschemann-Witzel, J., de Hooge, I., Amani, Rohm, H., Normann, A., Borzanini Bossle, M., Grønhøj, A., & Oostindjer, M. (2016). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – A multiple case study. *Journal of Cleaner Production*. http://dx.doi.org/10.1016/j.jclepro.2016.11.173.

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. http://dx.doi.org/10.1509/jmktg.75.1.31.

Bitner, M. J., Booms, B. H., & Tetreault, M. S. (1990). The service encounter: diagnosing favorable and unfavorable incidents. *Journal of Marketing, 54(1),* 71-84. http://dx.doi.org/10.2307/1252174.

Block, L. G., Keller, P. A., Vallen, B., Williamson, S., Birau, M. M., Grinstein A., Haws, K. L., LaBarge, M. C., Lamberton, C., Moore, E. S., Moscato, E. M., Walker Reczek, R., & Tangari, A. H. (2016). The squander sequence: Understanding food waste at each stage of the

consumer decision-making process. *Journal of Public Policy & Marketing, 35(2),* 292-304. http://dx.doi.org/10.1509/jppm.15.132.

Braver, M. C. W., & Braver, S. L. (1988). Statistical treatment of the Solomon four-group design: A meta-analytic approach. *Psychological Bulletin, 104*, 150–154. http://dx.doi.org/10.1111/j.1464-0597.1999.tb00006.x

Brislin, R. W. (1980). Translation and content analysis of oral and written materials. In H. C. Triandis, & J.W. Berry (Eds.), *Handbook of cross-cultural psychology, Vol. 2.* (pp. 389–444). Boston: Allyn & Bacon.

British Retail Consortium (2016). The retail industry's contribution to reducing food waste. Retrieved from http://brc.org.uk/media/105811/10105-brc-food-waste-report-final.pdf

Brookie, K. I., Mainvil, L. A., Carr, A. C., Vissers, M. C. M., & Conner, T. S. (2017). The development and effectiveness of an ecological momentary intervention to increase daily fruit and vegetable consumption in low-consuming young adults. *Appetite, 108*, 32-41. http://dx.doi.org/10.1016/j.appet.2016.09.015.

Campbell, D., & Stanley, J. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally.

Chandon, P., & Wansink, B. (2006). How biased household inventory estimates distort shopping and storage decisions. *Journal of Marketing, 70(4),* 118-135. http://dx.doi.org/10.1509/jmktg.70.4.118.

European Commission (2016). Estimates of European food waste levels. Retrieved from http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf

Evans, D. (2012). Beyond the throwaway society: ordinary domestic practice and a sociological approach to household food waste. *Sociology, 46(1),* 41-56. http://dx.doi.org/10.1177/0038038511416150.

Farr-Wharton, G., Foth, M., & Choi, J. H. (2014). Identifying factors that promote consumer behaviours causing expired domestic food waste. *Journal of Consumer Behaviour, 13(6),* 393-402. http://dx.doi.org/10.1002/cb.1488.

Flash Eurobarometer 425. (2015). *Food waste and date marking*. European Commission.

Food and Agricultural Organization (FAO). (2011). *Global food losses and food waste – Extent, causes and prevention: Study conducted for the International Congress SAVE FOOD! At Interpack2011 Dusseldorf, Germany.* Rome. Italy: Author. http://www.fao.org/docrep/014/mb060e/mb060e00.pdf (accessed August ***, 2017).

Ganglbauer, E., Fitzpatrick, G., & Comber, R. (2013). Negotiating food waste: Using a practice lens to inform design. *ACM Transactions on Computer-Human Interaction, 20 (2),* Article 11. http://dx.doi.org/10.1145/2463579.2463582.

Graham-Rowe, E., Jessop, D. C., & Sparks, P. (2014). Identifying motivations and barriers to minimizing household food waste. *Resources, Conservation and Recycling, 84,* 15-23. http://dx.doi.org/10.1016/j.resconrec.2013.12.005

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. http://dx.doi.org/10.1016/j.resconrec.2015.05.020

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis.* Guildford Press.

Hartmann, C., Dohle, S., & Siegrist, M. (2013). Importance of cooking skills for balanced food choices. *Appetite, 65,* 125-131. https://doi.org/10.1016/j.appet.2013.01.016.

Hebrok, M., & Boks, C. (2017). Household food waste: Drivers and potential intervention points for design – An extensive review. *Journal of Cleaner Production, 151,* 380-392. https://doi.org/10.1016/j.jclepro.2017.03.069.

HLPE (2014). Food losses and waste in the context of sustainable food systems: a report by the high level panel of experts on food security and nutrition. Rome: High Level Panel of Experts

on Food Security and Nutrition (HLPE). http://www.fao.org/3/a-i3901e.pdf (accessed August 31, 2017).

Hoek, A. C., Pearson, D., James, S. W., Lawrence, M. A., & Friel, S. (2017). Shrinking the food-print: A qualitative study into consumer perceptions, experiences and attitudes towards healthy and environmentally friendly food behaviours. *Appetite, 108*, 117-131. http://dx.doi.org/10.1016/j.appet.2016.09.030.

Huck, S., & Sandier, H. M. (1973). A note on the Solomon 4-group design: Appropriate statistical analyses. Journal of Experimental Education, 42, 54-55.

Koivupuro, H.-K., Hartikainen, H., Silvennoinen, K., Katajajuuri, J.-M., Heikintalo, N., Reinikainen, A., & Jalkanen, L. (2012). Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *International Journal of Consumer Studies, 36(2),* 183-191. http://dx.doi.org/10.1111/j.1470-6431.2011.01080.x.

Jones, H. (2016). Tech innovations that could reduce food waste. *The Guardian*, https://www.theguardian.com/business/2016/jul/14/tech-innovations-that-could-reduce-food-waste

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. http://dx.doi.org/10.3390/su7032695.

MacQueen, J. (1967). Some methods for classification and analysis of multivariate observations. In L.A. Le Cam & J. Newman (Eds), *Proceedings of the 5th Berkeley Symposium on Mathematical Statistics and Probability*. 281-297. Berkeley, CA: University of California Press.

Mallinson, L. J., Russell, J. M., & Barker, M. E. (2016). Attitudes and behavior towards convenience food and food waste in the United Kingdom. *Appetite, 103*, 17-28. http://dx.doi.org/10.1016/j.appet.2016.03.017

Masson, M., Delarue, J., & Blumenthal, D. (2017). An observational study of refrigerator food storage by consumers in controlled conditions. *Food Quality and Preference, 56,* 294-300. http://dx.doi.org/10.1016/j.foodqual.2016.06.010

Maubach, N., Hoek, J., & McCreanor, T. (2009). An exploration of parents' food purchasing behaviours. *Appetite, 53(3),* 297-302. http://dx.doi.org/10.1016/j.appet.2009.07.005.

Maute, M. F. & Dube, L. (1999). Patterns of emotional responses and behavioural consequences of dissatisfaction. *Applied Psychology: An International Review, 48* (3), 349-366.

Melbye, E. L., Onozaka, Y., & Hansen, H. (2017). Throwing it all away: Exploring affluent consumers' attitudes toward wasting edible food. *Journal of Food Product Marketing, 23 (4),* 416-429. http://dx.doi.org/10.1080/10454446.2015.1048017.

Osterhus, T. L. (1997). Pro-social consumer influence strategies: When and how do they work. *Journal of Marketing*, 61(4), 16-29. http://dx.doi.org/10.2307/1252084.

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. http://dx.doi.org/10.1098/rstb.2010.0126

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(1),* 207-217. http://dx.doi.org/10.1016/j.wasman.2014.09.019

Ponis, S. T., Papanikolaou, P., Katimertzoglou, P., Ntalla, A. C., & Xenos, K. I. (2017). Household food waste in Greece: A questionnaire survey. *Journal of Cleaner Production, 149,* 1268-1277. http://dx.doi.org/10.1016/j.jclepro.2017.02.165.

Porpino, G. (2016). Household food waste behavior: Avenues for future research. *Journal of the Association for Consumer Research, 1(1),* 41-51. http://dx.doi.org/10.1086/684528.

Porpino, G., Parente, J., & Wansink, B. (2015). Food waste paradox: Antecedents of food disposal in low income households. *International Journal of Consumer Studies, 39(6),* 619-629. http://dx.doi.org/10.1111/ijcs.12207.

Principato, L., Secondi, L., & Pratesi, C. A. (2015). Reducing food waste: An investigation on the behaviour of Italian youths. *British Food Journal, 117(2),* 731-748. https://doi.org/10.1108/BFJ-10-2013-0314

Punj, G., & Stewart, D. W. (1983). Cluster analysis in marketing research: Review and suggestions for application. *Journal of Marketing Research, 20(2),* 134-148. http://dx.doi.org/10.2307/3151680.

Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling, 79,* 43-51. http://dx.doi.org/10.1016/j.resconrec.2013.04.011.

Quested, T. E., Parry, A. D., Easteal, S., & Swannell, R. (2011). Food and drink waste from households in the UK. *Nutrition Bullettin, 36,* 460-467. http://dx.doi.org/10.1111/j.1467-3010.2011.01924.x.

Roodhuyzen, D.M.A., Luning, P.A., Fogliano, V., & Steenbekkers, L.P.A. (2017). Putting together the puzzle of consumer food waste: Towards an integral perspective. *Trends in Food Science & Technology, in press.* https://doi.org/10.1016/j.tifs.2017.07.009

Russell, S. V., Young, W. C., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions into food waste behavior. *Resources, Conservation & Recycling, 125*, 107-114. https://doi.org/10.1016/j.resconrec.2017.06.007.

Spangenberg, E. R., Sprott, D. E., Grohmann, B., Smith, R. J. (2003). Mass-communicated prediction requests: practical application and a cognitive dissonance explanation for self-prophecy. *Journal of Marketing, 67(3),* 47-62. http://dxk.doi.org/10.1509/jmkg.67.3.47.18659.

Solomon, R. L. (1949). An extension of control group design. *Psychological Bulletin, 46,* 137-150.

Stancu, V., Haugaard, P., & Lähteenmäki, L. (2016). Determinants of consumer food waste behavior: Two routes to food waste. *Appetite, 96,* 7-17. http://dx.doi.org/10.1016/j.appet.2015.08.025.

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 Preferences, 28(1),* 375-381. http://dx.doi.org/10.1016/j.foodqual.2012.11.001.

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56(3),* 407-424. http://dx.doi.org/10.1111/0022-4537.00175.

Thyberg, K. L., & Tonjes, D. J. (2016). Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling, 106 (1),* 110-123. http://dx.doi.org/10.1016/j.resconrec.2015.11.016

Tucker, C. A., & Farrelly, T. (2015). Household food waste: The implications of consumer choice in food from purchase to disposal. *Local Environment, 21 (6),* 682-706. http://dx.doi.org/10.1080/13549839.2015.101597.

Visschers, V. H. M., Wickli, N., & Siegrist, M. (2016). Sorting out food waste behavior: A survey on the motivators and barriers of self-reported amounts of food waste in households. *Journal of Environmental Psychology, 45 (March),* 66-78. http://dx.doi.org/10.1016/j.jenvp.2015.11.007.

Wansink, B., Brasel, A., & Amjad, S. (2000). Cabinet castaways: Why we buy products we never use. *Journal of Family and Consumer Science, 92 (1),* 104-108. Available at SSRN: https://ssrn.com/abstract=2711801.

Watson, M., & Meah, A. (2012). Food, waste and safety: negotiating conflicting social anxieties into the practices of domestic provisioning. *The Sociological Review, 60 (2),* 102-120. http://dx.doi.org/10.1111/1467-954X.12040.

Williams, H., Wilkström, 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. https://doi.org/10.1016/j.jclepro.2011.11.044.

Wilson, N. L. W., Rickard, B. J., Saputo, R., & Ho, S. (2017). Food waste: The role of date labels, package size, and product category. *Food Quality and Preference, 55,* 35-44. http://dx.doi.org/10.1016/j.foodqual.2016.08.004.

Winkler, E., & Turrell, G. (2009). Confidence to cook vegetables and the buying habits of Australian household. *Journal of the American Dietetic Association, 109 (10),* 1759-1768. http://dx.doi.org/10.1016/j.jada.2009.07.006

WRAP (2009). Household food and drink waste in the UK. Waste & Resources Action Program (WRAP), Banbury, United Kingdom. http://www.wrap.org.uk/sites/files/wrap/Household_food_and_drink_waste_in_the_UK_-_report.pdf (accessed August, 20, 2017).

WRAP (2012). Household food and drink waste in the UK. Waste & Resources Action Program (WRAP), Banbury, United Kingdom. http://www.wrap.org.uk/sites/files/wrap/hhfdw-2012-main.pdf.pdf (accessed August, 20, 2017).

## Table 1. Qualitative excerpts organized by category

| Category | % of respondents | Qualitative comments |
|---|---|---|
| BEHAVIORS IN DOMESTIC FOOD STORAGE | 32% | Interview #4: "Although I do not have a big refrigerator, the pan with the chicken and the vegetables ended up at the bottom of the fridge, so many containers and other things covered it. I didn't notice it for a while and when I did, it was already off." |
| | | Interview #81: "I forgot to keep the gorgonzola in the fridge and when I made potato dumplings I did not remember it. I had to throw it out when I found it a few weeks later. It had already expired. |
| | | Interview #89: "I normally have a lot of products in the fridge and I do not pay attention to expiry dates. This is typical of my wastage at home; normally I have to throw some of them out. And it also happened this weekend when I cleaned the fridge as I normally do every Saturday" |
| BEHAVIORS IN DOMESTIC FOOD PREPARATION | 16% | Interview #41: "I made too much lentil soup; we had it twice, but still some of it remained. In the end I had to throw it out because no one wanted to eat it." |
| | | Interview #216: "Because I was very hungry ... I prepared two burgers, chips, and some potato croquettes ... I ate the first hamburger with all the chips and got halfway through the second. But I was so full that I had to throw out the rest. " |
| | | Interview #7: "When we have friends over for dinner we always tend to buy too much. We are afraid of there not being enough to eat and therefore seeming a bit rude to our guests. So we spend far more than is necessary in the grocery store and in the end there is lot of food that we cannot use and we have to throw it out. This happened also last week and yesterday I had to clean the fridge and throw out several products" |
| BEHAVIORS IN PLANNING FOOD PURCHASING | 12% | Interview #35: "Me and my roommate always buy far more than we need; we eat half and the other half is wasted. Unfortunately, this happens very frequently in our apartment. Probably the reason is that we don't make a proper shopping list before going out shopping" |
| | | Interview #161: "I bought far more vegetables than I needed. I was not able to plan, to calculate adequately according to our family needs. I didn't have a shopping list and I was in a hurry. We didn't eat all the vegetables and I was forced to throw them out." |
| | | Interview #162: "What led to my wasting food is my habit of shopping only once a week instead of several times. I bought several things, keeping them in the fridge and thinking I'd be able to use them. But unfortunately I was wrong and I had to throw several products out because they were no longer good." |
| BEHAVIORS IN IN-STORE FOOD CONTROL | 11% | Interview # 77: "When I purchased these chicken steaks I did not check the expiry date; at home, when I opened them, I immediately got a bad smell and I realized that they had expired." |
| | | Interview #78: "I bought the fruit and I didn't check the boxes before buying. When I arrived home I realized that part of it was damaged and spoiled and I had to throw it out because no one in the family wanted to eat it." |
| | | Interview #99: "I didn't check the expiry dates on the salad bags; I was in a hurry! On arriving home I put them in the fridge and after two days when I decided to use them I realized that the salad was uneatable. The expiry date was the very day I bought the bags." |
| BEHAVIORS IN FOOD PREPARATION PLANNING | 10% | Interview #39: "Because of my inability to plan meals in advance I ended up buying unnecessary food and at the end of the week I had to throw it out. I had no idea at all how to use it! " |
| | | Interview #83: "As is usual with me, also this week I've not been able to prepare my weekly menu. I ended up shopping without any idea of meals in mind and I had to throw out lots of vegetables and other things" |
| | | Interview #270: "This week I wasted several things because of my busy life and my extra work commitments. I was invited out to lunches and dinners so I could not use the food bought for my meals and I was forced to throw it out." |
| BEHAVIORS IN LEFTOVER CONSUMPTION | 8% | Interview #18: "I tried to store the leftovers properly, but unfortunately the next night we went out for dinner and so I was forced to throw them out." |
| | | Interview #29: "We had leftovers from the dinner with friends. The next day the kids were at school and did not return for lunch; also my husband and I were out at work so we could not eat the leftovers for lunch and for dinner we wanted to have something different. The next day I decided to throw them out. " |
| | | Interview #3: "Vegetables need time and creativity to be properly reused as leftovers; something much more complicated than simple pasta, for example. So considering that we had little time available we ended up with pasta and the vegetable leftovers ended up in the bin. " |
| BEHAVIORS IN IN-STORE FOOD PURCHASE INFLUENCE | 8% | Interview #100: "The package contained four portions but I actually just wanted one. I bought the package but I didn't eat the remaining three." |
| | | Interview #14: "Last week I went into a new shop here in town. It's bigger than the one I usually go to, with much larger rooms and bigger assortments. Moreover, the packages are larger than those that I normally buy in my supermarket, especially for fresh food. I bought much more than normal and I ended up wasting much more this week, especially the vegetables and fruit" |
| | | Interview #51: "I often buy products on offer, most of which normally have a shorter shelf life; about a month ago I bought a very big piece of Parmigiano Reggiano, given that it was on offer, but failing to finish it on time I had to throw it out. " |
| MISCELLANEOUS (communication within household; food literacy) | 3% | Interview #142: "This time the waste was caused by my mother who had bought strawberries without asking me if I eat them ... I don't like them, she should have asked!" |
| | | Interview #9: "sometimes I buy special things; this time it was avocados, because my daughter says she likes them; but then not being familiar with them I am not able to tell how long they take to ripen. She put off eating them and I left it too long, so when last night she decided to try one unfortunately it was rotten inside." |

**Table 2. Measures used in Study 2**

| Category | Items | Main sources |
|---|---|---|
| *BEHAVIORS IN DOMESTIC FOOD STORAGE –* ***BDFS*** | How often do you check your fridge and pantry? | Study 1 |
| | How often do you use food with limited expiry dates compared to food with extended expiry dates? | |
| | How often do you check the expiry date of food in the pantry? | |
| *BEHAVIORS IN DOMESTIC FOOD PREPARATION –* ***BDFP*** | How often do you try to cook the right amount of food for special events so that it is sufficient for the number of participants? | Study 1 |
| | How often do you eat all the food you prepare when you invite guests, or cook for special occasions? | |
| | How often do you prepare portions perfectly adequate for the actual needs of each family member? | |
| *BEHAVIORS IN PLANNING FOOD PURCHASING –* ***BPFP*** | **How often do you make a list of the food you want to buy prior to your shopping trip?** | Adapted from Stefan et al. 2013; Stancu et al., 2016 |
| | **How often do you check your food inventories prior to your shopping trip?** | + Study 1 |
| | How often do you avoid buying things that you already have in the pantry? | |
| *BEHAVIORS IN IN-STORE FOOD CONTROL –* ***BIFC*** | How often do you check the expiry date of the products when shopping? | Study 1 |
| | How often do you check the products' state of conservation when shopping? | |
| *BEHAVIORS IN FOOD PREPARATION PLANNING –* ***BFPP*** | **How often do you plan your meals several days in advance?** | Adapted from Stefan et al. 2013; Stancu et al., 2016 |
| | How often do you follow a weekly menu? | + Study 1 |
| *BEHAVIORS IN LEFTOVER CONSUMPTION –* ***BLC*** | **How often do you eat leftovers cold, or just reheated?** | Adapted from Stancu et al., 2016 |
| | **How often do you transform leftovers into different dishes before preparing completely new meals?** | + Study 1 |
| | **How often do you store the leftovers in appropriate conditions so that they will last and be used adequately?** | |
| | How often do you try to eat at home if you have leftovers available? | |
| *BEHAVIORS IN IN-STORE FOOD PURCHASE INFLUENCE –* ***BIFPI*** | **How often do you buy too many food products (more than you need) when you go shopping?*** | Adapted from Stefan et al. 2013; Stancu et al., 2016 |
| | **How often do you buy food items that you did not plan to buy?*** | + Study 1 |
| | **How often do you buy larger amounts of food because shops are offering bargains?*** | |
| | **How often do you buy food in packages that are too big for your household's needs?*** | |
| | How often do you buy larger amounts of food in shops that have a very rich assortment?* | |

*Note*: all variables are measured on a 7-point scale, ranging from 1 (never) to 7 (always). Items in bold are adapted from previous research.

*Reverse coding so that all scales correspond to the same direction of wording.

**Table 3. Descriptive statistics**

| scales | items | source | M | SD | reliability |
|---|---|---|---|---|---|
| Food waste | How much … would you say that you throw away what you buy and/or grow, in a regular week? | Stefan et al., 2013 | | | |
| | Food | | 1.76 | 0.77 | |
| | Milk and diary products | | 1.70 | 0.74 | |
| | Fresh fruits and vegetables | | 2.13 | 0.84 | |
| | Meat and fish | | 1.34 | 0.53 | |
| | Bread and other bakery products | | 1.86 | 0.90 | |
| | Total | | 1.76 | 0.48 | α= 0.65 |
| | *Scale: from 1 to 5; "not at all"(1), "less than a tenth"(2), "more than a tenth but less than a quarter"(3), "more than a quarter but less than a half"(4) and "more than a half"(5)* | | | | |
| Intention not to waste | How likely is it that you will not throw away food during the next week? | Stefan et al., 2013 | 5.86 | 1.15 | α= 0.61 |
| | *Scale: from (1) not at all likely to (7) extremely likely* | | | | |
| | I intend not to throw away any food over the next week. *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| | In general, I try very hard not to throw away food. | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| Personal norms | I feel that not wasting food means to do something to help future generations. | adapted from Osterhus, 1997 | 6.15 | 1.07 | α= 0.71 |
| | I feel a strong personal obligation not to waste. | | | | |
| | I feel an obligation not to waste where possible. | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| Social norms | People I know don't waste food. | adapted from Spangenberg et al., 2003 | 4.88 | 1.17 | α= 0.87 |
| | People I know are concerned about issues related to food waste. | | | | |
| | People I know think it's important not to waste food. | | | | |
| | People I know recycle leftovers on every possible occasion. | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| Subjective norms | Most people important to me disapprove of me cooking/preparing more than enough food. | Stefan et al., 2013 | 4.95 | 1.47 | r= 0.59 |
| | Most people important to me disapprove of me throwing out some food | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| Lack of concern | I do not really worry about the environmental impact of the food that I throw away | Stefan et al., 2013 | 1.87 | 1.21 | α= 0.89 |
| | I do not really worry about the impact of my food waste on the distribution of resources in the world | | | | |
| | I do not really worry about the amount of food that I throw away. | | | | |
| | I do not really worry about the cost of the food that I throw away. | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |
| Moral attitude | Throwing away food does not bother me. | adapted from Stefan et al., 2013 | 1.42 | 0.96 | r= 0.66 |
| | When I throw away food I don't feel guilty. | | | | |
| | *Scale: from (1) strongly disagree to (7) strongly agree* | | | | |

## Table 4. Consumer characteristics by cluster

| | | Clusters | | | | | | Comparison tests | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Virtuous | | Moderate | | Waster | | | M (SD) |
| | | Cluster 1 | | Cluster 2 | | Cluster 3 | | | |
| | Cluster size (%) | 158 (34.6%) | ẟ | 224 (49.1%) | ẟ | 74 (16.3%) | ẟ | | |
| | | | | | | | | F value (df); p | |
| Clustering variables | BDFS | 5.87 (.88) | (2; 3) | 5.43 (.94) | (1; 3) | 3.73 (1.37) | (1; 2) | 117.44 (453); p<.01 | 5.31 (1.23) |
| | BDFP | 5.63 (.87) | (2; 3) | 4.71 (1.20) | (1; 3) | 3.52 (1.31) | (1; 2) | 93.46 (453); p<.01 | 4.84 (1.32) |
| | BPFP | 6.00 (.88) | (2; 3) | 5.22 (.95) | (1; 3) | 3.88 (1.10) | (1; 2) | 124.98 (453); p<.01 | 5.28 (1.19) |
| | BIFC | 5.99 (.99) | (2; 3) | 5.66 (1.05) | (1; 3) | 4.19 (1.30) | (1; 2) | 73.44 (453); p<.01 | 5.53 (1.23) |
| | BFPP | 4.53 (1.23) | (2, 3) | 2.46 (.89) | (1) | 2.70 (1.35) | (1) | 174.90 (453); p<.01 | 3.22 (1.46) |
| | BLC | 5.84 (.94) | (2; 3) | 5.18 (1.08) | (1; 3) | 4.04 (1.15) | (1; 2) | 74.90 (453); p<.01 | 5.22 (1.20) |
| | BIFPI | 4.96 (1.20) | (2, 3) | 4.20 (1.22) | (1) | 3.98 (1.00) | (1) | 25.39 (453); p<.01 | 4.42 (1.24 |
| Outcome variables | Food waste | 1.59 (.45) | (2; 3) | 1.76 (.42) | (1; 3) | 2.12 (.55) | (1; 2) | 35.85 (453); p<.01 | 1.76 (.48) |
| | Int. not to waste | 6.16 (1.03) | (2; 3) | 5.81 (1.12) | (1; 3) | 5.40 (1.31) | (1; 2) | 12.28 (453); p<.01 | 5.87 (1.15) |
| Psyco-social characteristics | Personal norms | 6.46 (.84) | (2; 3) | 6.22 (.91) | (1; 3) | 5.30 (1.46) | (1; 2) | 34.96 (453); p<.01 | 6.15 (1.07) |
| | Social norms | 4.96 (1.24) | (3) | 4.94 (1.11) | (3) | 4.54 (1.18) | (1; 2) | 3.86 (453); p<.05 | 4.88 (1.17) |
| | Subjective norms | 5.29 (1.43) | (2; 3) | 4.86 (1.40) | (1) | 4.50 (1.63) | (1) | 8.43 (453); p<.05 | 4.95 (1.47) |
| | Lack of concerns | 1.51 (.89) | (2; 3) | 1.80 (1.09) | (1; 3) | 2.82 (1.58) | (1; 2) | 34.92 (453); p<.01 | 1.87 (1.21) |
| | Moral attitudes | 1.24 (.64) | (3) | 1.37 (.86) | (3) | 1.94 (1.48) | (1; 2) | 14.84 (453); p<.01 | 1.42 (.96) |
| Demographic information | | | | | | | | Chi square (df); *p* | |
| | Gender (% of women) | 77.8% | | 69.2% | | 52.7% | | 15.06 (2); p<.01 | 69.5% |
| | Age (% <50 years) | 60.2% | | 59.5% | | 63.4% | | 5.93 (2); p=.74 | 60% |

BDFS "behaviors in domestic food storage"; BDFP "behaviors in domestic food preparation"; BPFP "behaviors in planning food purchasing"; BIFC "behaviors in in-store food control"; BFPP " behaviors in food preparation planning"; BLC "behaviors in leftover consumption"; BIFPI "behaviors in in-store food purchase influence". The number in parentheses under the columns ẟ show the cluster(s) from which this cluster was significantly different at .05 level of significance based on the Tukey pairwise comparison tests.

**Table 5. Experimental design**

| | 1 week pre-test diary | Intervention | 1 week post-test diary | Sample size (n) |
|---|---|---|---|---|
| Group 1 | O1 | X | O2 | 57 |
| Group 2 | O3 | | O4 | 56 |
| Group 3 | | X | O5 | 49 |
| Group 4 | | | O6 | 48 |
| Timeline | T1 → (1 week) | T2 → (1 week) | T3 | |

O: outcome measure; X: intervention (reading educational article).

**Table 6. Descriptive results for food waste (grams)**

| | Pre-test | Intervention | Post-test | Sample size (n) |
|---|---|---|---|---|
| Group 1 | M=1553,9; SD=1184,2 | X | M=816,2; SD=573,6 | 57 |
| Group 2 | M=1584,7; SD=1240,6 | | M=1214,1; SD=1015,9 | 56 |
| Group 3 | | X | M=907,9; SD=508,3 | 49 |
| Group 4 | | | M=1209,3; SD=836,7 | 48 |

X: intervention (reading educational article).

**Table 7: Results for the analysis of the four-group experimental design**

| | Sum of squares | df | Mean square | *F* | *p* |
|---|---|---|---|---|---|
| Model corrected | 11341312.1 | 7 | 1620187.5 | 2.82 | .01 |
| Intercept | 7934781.5 | 1 | 7934781.5 | 13.83 | .00 |
| # children (covariate) | 1708259.2 | 1 | 1708259.2 | 2.98 | .09 |
| Age (covariate) | 1283001 | 1 | 1283001 | 2.24 | .14 |
| Gender (covariate) | 1708685.8 | 1 | 1708685.8 | 2.98 | .09 |
| # household members (covariate) | 1968164.3 | 1 | 1968164.3 | 3.43 | .07 |
| Pretest | 251360.6 | 1 | 251360.6 | .44 | .51 |
| Intervention | 6313801.3 | 1 | 6313801.3 | 11.00 | .00 |
| Pretest x Intervention | 30567.4 | 1 | 30567.4 | .05 | .82 |
| Error | 115935197.2 | 202 | 573936.6 | | |
| Total | 351610087.3 | 210 | | | |
| Total corrected | 127276509.4 | 209 | | | |

## Table 8. The mediation model.

| MEDIATOR VARIABLE MODEL (Perceived skills for planning meals) | | | | |
|---|---|---|---|---|
| | b | t | | |
| X: Intervention | .48 | 2.40* | | |
| OUTCOME VARIABLE MODEL (Food waste) | | | | |
| | | | b | t |
| M: Perceived skills for planning meals | | | -97.69 | -1.80† |
| X: Intervention | | | -209.16 | -1.69† |
| Indirect effect of X on Y | | | | |
| Bootstrap 95% Confidence Intervals for Conditional Indirect Effect - Bias Corrected and Accelerated (BCa) | | | | |
| | | Effect | Lower | Upper |
| M: Perceived skills for planning meals | | -46.71 | -121.37 | -9.44 |
| Direct effect of X on Y | | | | |
| Effect | | SE | t | p |
| -209.16 | | 123.55 | -1.64 | .10 |

† p < .10; * if p < .05; ** if p < .01; *** if p < .001. M = mediator, X = intervention.