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## **Too Much to Eat It All: How Package Size Impacts Food Waste**

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# Too Much to Eat It All: How Package Size Impacts Food Waste

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## **Too Much to Eat It All: How Package Size Impacts Food Waste**

### **Abstract**

An important contributing factor to food waste by consumers is through unused food from the purchase of large packs that are often associated with promotions, namely bonus packs. Through three studies, we show that by drawing more attention to food waste by consumers their preference for large packs (and additional promotional offers) decreases. Study 1 highlights the mediating role of anticipated food waste on consumers' purchasing intentions as a function of package size. Study 2 shows that priming individuals with information about the consequences of food waste makes them more likely to focus on their anticipated food waste, and thereby reduce their preference for bonus packs. In Study 3, we examine the implications of packaging format, and find that anticipated food waste decreases when large packs are sold as individual units. We also provide a discussion of the practical implications of our results for consumers, food retailers, and policy makers.

*Keywords:* Consumer behavior, food waste, package size, sales promotion, food well-being, food literacy

## **Too Much to Eat It All: How Package Size Impacts Food Waste**

Food waste has become one of the leading food policy concerns in the United States and other OECD countries. The U.N. Conference on Sustainable Development acknowledges food waste and food loss as important components of food insecurity in their Zero Hunger Challenge (Halloran et al. 2014). Reducing food waste is driven by a combination of three inter-related societal objectives. First, food waste is the quintessential environmental problem; it encompasses environmental costs related to excess resources that are used to produce food that is not consumed as well as additional costs that are required to manage the waste from food that is thrown away (Halloran et al. 2014). Second, reducing food waste has the capacity to address the issue of food insecurity (Coleman-Jensen et al. 2015). The abundance of food waste presents a missed opportunity to help food insecure individuals that do not consume enough calories. Third, addressing food waste also has implications for improving human health and well-being. Because a significant share of fruit and vegetable purchases are wasted (Buzby, Wells, and Hyman 2014), any reduction in food waste will increase our intake of nutrient dense foods and lead to healthier diets. Considering what precedes, it appears that any research that would lead to a better understanding of the conditions that prevent food waste would lead to an increase in sustainable food consumption and to greater food well-being (Block et al. 2011, p. 6).

Food waste is largely due to the fact that consumers buy too much food compared to what they consume (see Block et al. 2016, for a review). Among other concerns, advocacy groups have suggested that larger package sizes, bonus packages, and pack promotions (all cases where the per-unit price of the product is reduced when a larger quantity is purchased) are leading culprits in the creation of food waste by consumers (WRAP 2014; Aschemann-Witzel et al. 2015). Price discounts on large packages and promotion packs give the opportunity for consumers to purchase more food for a smaller per-unit price (Chandon, Wansink, and Laurent 2000; Chen et al. 2012),

making them more likely to waste food. To this regard, the literature provides evidence for the notion that larger pack sizes are correlated with greater levels of food waste (e.g., Wilson et al. 2017). Further, in the case of large packs, consumers may relieve themselves of their responsibility for wasting uneaten food by considering that the size of the portions is mainly determined by the food retailers and out of their control (see, Bartling and Fischbacher 2012; Block et al. 2016). Hence, there is a need to study the range of marketing tools and policy solutions that could be used to mitigate food waste associated with larger packages. Our research aims to fill this gap in the literature.

According to Block et al (2011), the adoption of healthy eating behaviors involves knowledge about food and nutrition, and motivation to apply nutrition information to food choices (i.e., food literacy). Thus, in order to reduce food waste from a food well-being perspective, it is important to find ways to encourage consumers to consider their food waste and to modify their behavior. Moreover, since the food choices consumers make are heavily influenced by food manufacturers and marketers (Chandon and Wansink 2010), and that these latter groups may also have an interest in reducing food waste (Van Herpen and de Hooze 2016), policy proposals to address food waste should involve a collaborative involvement of all stakeholders in the food sector (Bublitz et al. 2013).

The goal of this research is to examine whether anticipated food waste can help reduce the preferences of consumers for larger package sizes (and associated promotions). Specifically, our research analyzes the effects of package size (and any associated promotion) on the anticipation to waste, and consequently on purchase intentions (study 1, study 2, and study 3). We also investigate the role that information on the problems linked to food waste (study 2), and the format of the food package (study 3) play. Doing so, we highlight how it is possible to help consumers to better take into account food waste at the time they are deciding to purchase a large

pack. We begin with a review of the relevant literature on package size, sales promotion, and food waste, followed by our core hypotheses. Following that we present three studies that were conducted in order to examine consumer food waste behavior as it relates to package size, information, and package format. Finally, we provide some policy suggestions to reduce food waste, in a food well-being perspective, with implications for consumers, food manufacturers, and food retailers.

## **Literature Review**

### **Package Size as a Method of Promotion**

Consumers tend to prefer sale promotions to regular offerings, and monetary savings are generally considered as the main benefit motivating people to respond to these promotions (Blattberg and Neslin 1993). Added to this benefit, promotions also allow consumers to buy higher quality products, reduce search costs (Inman, McAlister and Hoyer 1990; Raghubir 1998; Wansink, Kent, and Hoch 1998), while providing entertainment, exploration, and value expression (Holbrook 1994; Kahn and Louie 1990; Lichtenstein, Netemeyer, and Burton 1990; Mittal 1994; Chandon et al. 2000).

All promotions are not appreciated in the same way by consumers (d'Astous and Jacob 2002; Diamond and Sanyal 1990; Ndubisi and Moi 2005). Although both price discount (e.g., 33% off on a base of \$10) and bonus pack (e.g., 50% more on a base of 8 oz.) offer monetary savings, people tend to prefer a bonus pack to a price discount (see Chen et al. 2012; Diamond and Sanyal 1990; Mishra and Mishra 2011; Ong, Ho, and Tripp 1997). This preference can be explained by the fact that the bonus pack is associated with a gain (positive framing), while the price discount suggests a reduced loss (negative framing) following Diamond and Sanyal (1990). Moreover, consumers often neglect the base value, and tend to compare directly a price discount to the economically equivalent bonus pack quantity (Chen et al. 2012). It should however be

noted that for some products (e.g., vice products and high-priced products), consumers may prefer a price discount (Diamond 1992; Hardesty and Bearden 2003; Mishra and Mishra 2011). However, consumers have shown a general trend for bonus packs over price discounts.

Independently of sale promotions, people also perceive larger packs as a better deal than smaller packs, and expect quantity discounts for the larger versions (Carlson, Weathers, and Swain 2016; Haws and Winterich 2013). For instance, Carlson et al. (2016) found that when a product enlargement (i.e., more product, but without mention of price) is associated with a small price increase, it is evaluated positively as a bonus pack. Haws and Winterich (2013) also highlighted that consumers consider purchasing a larger size as an opportunity to achieve a financial value goal, leading to larger size choices. Thus, the trend of consumers to prefer bonus packs seems to be broadening to a more general preference for large packs, leading people to buy products in large quantities.

### **Links between Package Size and Food Waste**

Sale promotions and more specifically bonus packs are an important cause of food waste. They generate an immediate increase of sales volume (Blattberg and Neslin 1993) and encourage stockpiling and consumption (Ailawadi and Neslin 1998; Bezawada and Pauwels 2013; Chandon and Wansink 2002). Although consumers are able to anticipate food waste according to the package size (Wilson et al. 2017), consumers have poor planning abilities (Kahneman and Tversky 1977). They tend to underestimate how much food items they have at home and the amount of time it would take to consume them (Chandon and Wansink 2006). This underestimation leads them to over-purchase food that will thus be wasted (Block et al. 2016; Stefan et al. 2013). Moreover, consumers are four times more sensitive to price changes than size changes (Çakir and Balagtas 2014). They underestimate the increase in the amount of food, which is associated with the increase in package size (Chandon and Ordabayeva 2009).

Therefore, consumers may choose a large package because it presents a gain of money and do not take into account the fact that buying this package will cause them to waste the food. Given what precedes, consumers may be more likely to waste food from such large (versus small) packages.

Therefore, we propose:

H1: Anticipated food waste is higher for larger packages than smaller packages.

Although large packages may be of economic interest, the purchase is not without cost (Block et al. 2011; Bublitz et al. 2013). For instance, even if the per-unit price of a yoghurt in a package of 8 is lower than a yogurt in a package of 4, depending on the quantity wasted (e.g., 2 or 3 yoghurts), the cost of yogurt consumed from the large packet may become higher. Moreover, even if a promotion would remain a good deal (despite the wasted food), some consumers can develop an aversion to waste if they consider their prior monetary investments as wasted (Arkes 1996), or by distaste for unused utility (Bolton and Alba 2012). Those consumers that developed a waste aversion prefer buying less at a more expensive per-unit price than having more at a less expensive per-unit price (Bolton and Alba 2012). Thus, promoting the un wasteful aspect of smaller sized products may increase the purchase intention of these products. Considering the predicted effect of package size on anticipation to waste and the consumers' aversion for such waste, it may be likely that consumers exhibit greater purchase intentions for package sizes that are not associated with food waste. If so, anticipated waste may explain why large food packages may be associated with lower purchase intentions. Therefore, in our second hypothesis we propose the following:

H2: Anticipated food waste mediates the effect of package size on purchase intentions.

### **Overview of the experiments**

Three studies were conducted to examine the links between package size and food waste, and to better understand how additional information and packaging formats influence this relationship.

Our first study is a direct test of these two core hypotheses where we analyzed the mediating role of anticipated food waste on the effect of package size on purchase intentions. Then, we examine how the anticipation to waste, when choosing between different product sizes, influences the purchase intention for smaller sized options. In our second study, we show that priming individuals with information about the societal consequences of food waste (wasting money and utility, see Arkes 1996; Bolton and Alba 2012), reduces their preference for the bonus pack (compared to a smaller pack without promotion). In our third study, we highlight that splitting the pack into portions increases the feeling of control of the participants for small food packages, which acts as a mechanism explaining the effect of the package partitioning on the anticipation of waste.

### **Study 1A: Package Size & Anticipation to Waste: Apple sauce**

The primary objective of this study was to assess whether package size (small versus large) could affect anticipated food waste and consequently purchase intentions, as posited in H1 and H2.

Here we designed a survey to collect data on consumers' likeliness to waste apple sauce in Study 1A, and replicated the exercise with chocolate cream in Study 1B (see Mishra and Mishra 2011).

Of note, because we use surveys to explore food waste patterns among individuals, we use the term “anticipated food waste” as a measure of the likely levels of food waste by the respondents.

#### **Participants, Design and Procedure**

Ninety-six participants (50.5% female,  $M_{Age} = 31.42$ ,  $SD = 10.65$ , range: 18–64) were recruited online by a panelist and asked to evaluate a pack of apple sauce, in one of two package size conditions: a small package (package size: 4 cups) or a large package (package size: 16 cups) in a between-participants experimental design. The expiration date of the package was described in the survey as being 6 days away. The two packs were professionally designed to look like packs

commonly found in a retail location. In order to avoid any bias regarding attitudes toward the brand of the pack, the brand for the packs was fictitious (*Red Tree*).

After having been exposed to one of the two packs, to inhibit response bias (Podsakoff et al. 2003), participants were first asked to rate their purchase intentions, using a 4-item scale (I would: “be likely to purchase this product,” “be willing to buy this product,” “likely make this product one of my first choices in this product category,” “exert a great deal of effort to purchase this product”) following White, MacDonnell, and Ellard (2012) where  $\alpha = 0.83$ . Then, they rated their anticipation to waste some part of the apple sauce (“To what extent do you anticipate you will waste some apple sauce from this pack?”: 1 = “To a poor extent,” and 7 = “To a great extent”). Also, to ensure that respondents did not perceive the brand familiar, their familiarity with the brand was assessed (“How familiar are you with the brand *Red Tree*?”: 1 = “Not at all,” and 7 = “Very much”). Finally, because the respondents disgust for the product might increase with package size (Larson, Redden, and Elder 2014; Petit et al. 2017), a 2-item measure of disgust (“Disgusted,” “Revulsed”;  $\alpha = 0.91$ ) has been included to test this variable as an alternative mechanism – i.e., in addition of anticipated food waste – explaining of the effects of package size on intentions. All the statements were rated on 7-point Likert scales.

## **Results and Discussion**

Manipulation checks confirmed that brand attitude ( $t = .46, p > .10$ ) and familiarity with the brand ( $t = -.55, p > .10$ ) did not differ across conditions. Turning to our hypotheses tests, and supporting H1, results from an independent samples t-test revealed a positive effect of package size on anticipated food waste ( $M_{\text{Small}} = 2.77, M_{\text{Large}} = 3.98, t = -2.91, p < .01$ ). Interestingly, a mediation analysis performed using the Process macro (model 4, 5000 bootstraps) following Hayes (2012) supported H2 and revealed a significant indirect effect of package size on purchase intentions through the mediating effect role of anticipated food waste (95%  $CI = -.24; -.03$ ).

Precisely, larger packages lead to an increase in anticipated food waste ( $\beta = .60, p < .01$ ), resulting in lowered purchase intentions ( $\beta = -.16, p < .01$ ). To rule out disgust as a potential alternative mechanism explaining the effect of package size on intentions, a similar analysis conducted with disgust as the mediator was performed, and a revealed non-significant result (95%  $CI = -.07; .01$ ). Table 1 presents a summary of the results from study 1A.

[Insert Table 1 here]

Study 1A indicates that anticipated food waste increases with package size and acts as a mediator explaining purchase intentions. Study 1B replicates the experiment with a different food product to understand if the results from study 1A can be generalized.

### **Study 1B: Package Size & Anticipation to Waste, Replication with Dessert Cream**

#### **Participants, Design and Procedure**

In order to replicate the results beyond the specific product used in study 1A, study 1B followed a similar procedure, but here we used a dessert cream product. One hundred participants (53% female,  $M_{Age} = 34.04, SD = 1.16, Range: 18-63$ ) were exposed online by a panelist to a fictitious pack of either 4 (small package condition) or 16 (large package condition) cups of chocolate cream with an expiration date, as in study 1A, in 6 days. Again, to avoid any bias due to the potential familiarity of participants with the brand, the decision was made to use a fictitious brand, *Crema*.

#### **Results and Discussion**

As in study 1A, participants did not exhibit any differences in brand attitude ( $t = -.96, p > .10$ ) and familiarity with the brand ( $t = -.65, p > .10$ ) across conditions of package size. The pattern of results in study 1B was similar to those in study 1A, with anticipated food waste being higher for larger ( $M = 3.42$ ) versus smaller ( $M = 2.42, p < .05, t = -2.21, p < .05$ ) packages, and mediating the effect of package size on purchase intentions (95%  $CI = -.23; -.001$ ). Again, disgust was ruled

out as an alternative mediator (95%  $CI = -.06; .17$ ). Together, these results bring further support to H1 and H2.

By replicating the results of study 1A in another context, results of study 1B provide further evidence for the notion that larger packages lead to more anticipated food waste. As in study 1A, the results also bring support to the mediating role of anticipated food waste, which thus explains why larger packages lead to higher anticipated food waste. While study 1 provides insight about the effect of package size on anticipated food waste, the results leave unexamined the potential role played by promotions. The literature shows that bonus packs are particularly attractive for consumers (Chen et al. 2012; Diamond and Sanyal 1990; Ong, Ho, and Tripp 1997), increase food consumption (Ailawadi and Neslin 1998; Bezawada and Koen Pauwels 2013; Chandon and Wansink 2002), and potentially lead to more food waste (Block et al. 2016). In order to reduce this potential food waste associated with the purchase of bonus packs, study 2 explores whether priming people with information about the negative social implications of food waste (wasting money and utility, Arkes 1996; Bolton and Alba 2012) can lead them to better anticipate food waste (if there is waste), and accordingly reduce their preference for bonus packs.

### **Study 2: Can Food Waste Priming Reduce Consumers' Preferences for Bonus Packs?**

Study 2 has two objectives. We first look to replicate the effect of package size on anticipated food waste. Second, we explore whether priming people with information about the consequences of food waste can reduce their preference for bonus packs. Bonus packs are very attractive economically for consumers (Chen et al. 2012; Diamond and Sanyal 1990; Mishra and Mishra 2011; Ong, Ho, and Tripp 1997). However, consumers can develop a disgust for unused utility and prefer to buy smaller packages at a more expensive price to avoid food waste (Arkes 1996, Bolton and Alba 2012). Because priming people can increase awareness (Block et al. 2011; Bublitz et al. 2014), we hypothesize that priming consumers with information about the negative

consequences of food waste for society will lead to consumption choices that result in less food waste. Hence, we propose that consumers who are primed with information about the negative externalities of food waste will exhibit lower preferences for a large pack. Therefore our third hypothesis is as follows:

H3: Priming consumers with information about food waste will lead them to exhibit less preference for large packages.

### **Participants, Design and Procedure**

Participants ( $N = 310$ ,  $M_{\text{Age}} = 32.90$ ,  $SD = 10.76$ , Range: 18–62) were recruited online by a panelist in order to participate in a 2 (priming on food waste vs. control) x 3 (small 8 cup pack vs. a large promotion pack of 8 cup + 8 for free vs. a large 16 cup pack) between subjects experiment. We first asked subjects to read a paragraph that manipulated the priming of food waste. In both the food waste priming condition and in the control condition, the paragraph emphasized the notion of food availability (“According to the Food and Agriculture Organization of the United Nations (FAO), the growth of global agriculture’s productive potential has so far been more than sufficient to exceed population growth, resulting in an increase in average per capita food availability”). Then, in the food waste priming condition, the paragraph provided statistics describing the quantity of food waste in the United States and globally (“However, Americans throw away an estimated 25% of the food they bring home, which represents more than 20 pounds of food per person every month. More broadly, 1/3 of the overall food in the world is wasted. This 1.3 billion tons of food would be enough to feed 4 times all the hungry in the world.”). On the contrary, in the control condition, no such mention of food waste was made and the focus was made on how beneficial such food availability can be for undernourished people in developing countries (“This growth in food availability in conjunction with improved

access to food helped reduce the percentage of chronically undernourished people in developing countries.”).

After reading the paragraph, participants were randomly presented with a small (8 cups) or large (16 cups) pack of yogurt from a fictitious brand (*Berlinea*) with an expiration date 6 days away. To manipulate the presence of a promotion associated with a large package, the large pack was presented either without a promotion and a price of \$4.99, or with a promotion and in that case with a price of \$3.99. Importantly, this price of \$3.99 was also the price of the small pack, making the price of the promotional large pack equal to that of the small pack. To make the equality in the prices of the small package and the promotional large package clear, the latter package was designed with a banner “8 cups + 8 FREE”. Having a constant price for the small package and the promotional large package thus enabled us to examine whether people prefer a small pack over a promotional large one due to their recognition that they anticipate to waste less food, even though there was a significant cost savings with the promotional large package.

Next, because being primed with information about food waste (as opposed to the priming control condition) could lead to a decrease in their general mood, participants were asked to describe their overall mood using a two-item measure adapted from Cutright et al. (2011) ranging from miserable to delighted. The result ( $\alpha = .86$ ) eliminated mood as viable explanation for the effects of the manipulations. Participants then rated their purchase intentions ( $\alpha = .88$ ), and their anticipated food waste (using the same measure as in study 1). They then were presented with two pictures that were side by side, one being that of the small pack of yogurt (presented as Product A) and the other being that of the promotional large package (presented as Product B). Importantly, both products A and B were priced \$3.99. Participants were asked to indicate which one they would prefer to purchase (on a 7-point scale from 1: “Definitely Product A” and 7: “Definitely Product B”).

## Results and discussion

A manipulation check indicated that the priming of information about food waste did not alter respondents' moods as compared to participants that were not primed with information about food waste ( $t = .640, p > .10$ ). Turning to the focus of the study and the replication of the effect of package size on anticipated food waste, a one-way ANOVA test brought support for the replication of this effect, with anticipated food waste being higher in the non-promotional ( $M = 3.46$ ) and promotional ( $M = 3.57$ ) large package conditions than in the small package condition ( $M = 2.37, F(2, 308) = 9.20, p < .001$ ). A similar ANOVA was conducted after having aggregated the non-promotional and promotional large package conditions. Results revealed the same pattern, with the small package leading to less anticipated food waste ( $M = 2.37$ ) than the large package condition ( $M = 3.50, F = 18.40, p < .001$ ). Overall, these results bring further support to H1. Using the large aggregated package size conditions and opposing them to the small package condition, a mediation analysis was conducted to replicate the indirect effect of package size on purchase intentions through the mediating effect of anticipated food waste (H2). Results revealed the same pattern as in Study 1 (95%  $CI = -.34; -.10$ ), with package size increasing anticipated food waste ( $\beta = 1.12, t = 4.28, p < .001$ ) and such food waste leading to lower purchase intentions ( $\beta = -.19, t = -6.17, p < .001$ ). These results bring further support for H2 and the mediating role of anticipated food waste in the effects of package size on purchase intentions.

Next we focus exclusively on the data for the choices made between the small package and the promotional large package. An ANOVA revealed that respondents being primed with information about the negative consequences of food waste exhibited lower preferences for the large promotional package than for the small package ( $M = 5.62$ ) as compared to respondents in the control priming condition ( $M = 6.25, F(1, 309) = 8.03, p < .01$ ), supporting H3. To investigate if the anticipation of food waste can explain this effect, a mediation analysis was conducted.

Precisely, the small package condition and the promotional large package condition served as the independent variable, the measure of anticipated food waste as the mediator, and the scale measuring the choice between the small package and the promotional large package was the dependent variable. Results revealed a significant indirect effect of the type of package on choice (95%  $CI = -.29; -.03$ ), indicating that being primed with information about food waste leads to more anticipation of food waste ( $\beta = .71, t = 2.84, p < .01$ ) and consequently a decrease in the preference for the promotional large package ( $\beta = -.53, t = -2.36, p < .05$ ). Table 2 presents a summary of the results from Study 2.

[Insert Table 2 here]

Study 2 replicates the effects of package size and anticipated food waste from study 1, and it examines the mediating role of such food waste on purchase intentions. Study 2 also demonstrates that when people are primed with information about food waste, the preferences for smaller packages remain even if a large package is associated with promotion. While one may have expected that such a large package represents a better deal than the small package and may be preferred, the results of study 2 indicate that it is the anticipation of food waste that explains why people still prefer the small package over the large promotional package.

### **Study 3: Partitioned versus plain packaging formats and food waste**

In our preceding studies, the food package was presented as partitioned, for instance being composed in study 2 of 8 or 16 cups depending on the size condition. To this regard, previous research has shown that partitioning an aggregate quantity of food into smaller units reduces the consumed quantity of that food (Cheema and Soman 2008). The reason for that effect seems to lie in the perception of control that partitions prompt. A potential explanation for this mechanism may be found in research from Cutright (2012) which shows that boundaries can act as cues that people rely on to feel control over their consumption.

Hence, what we suggest is that food partitions, or portions, can serve as boundaries and as cues for consumers to estimate food quantities. Because people are not good at estimating package size and volume content (Chandon and Ordabayeva 2013), especially when it comes to estimating large quantities of food (Chandon 2013; Chandon and Wansink 2007), these boundaries may help consumers estimate more accurately the food content of large packages and thus the potential waste such packages could prompt. Nevertheless, because non-partitioned products do not provide boundaries that can help to accurately estimate food quantities, the effect of package size on anticipated food waste may be observed only in the condition of non-partitioned packages. Therefore, our fourth hypothesis is:

H4: The size and the format (partitioned versus non-partitioned) interact to affect the anticipation of food waste.

Specifically, when partitioned, large food packages may lead to more anticipation of food waste. On the contrary, when non-partitioned, no differences in anticipated food waste may be observed across conditions of small and large packages. This hypothesis is in line with our prior results showing that large packages lead to more anticipation of food waste when the package is partitioned.

Given the role played by partitions on estimation accuracy (Cheema and Soman 2008), the question remains regarding the mechanism explaining the effects of partitioned (versus non-partitioned) packages on anticipation of food waste. Due to the boundaries represented by the partitions, one may wonder if partitions increase the control that people feel over their consumption, thus reducing the anticipation to waste. This reasoning is in line with research showing that rationing consumption – as do partitions – helps people feel in control (Wertebroch 1998). While this explanation may appear appealing at first glance, this reasoning does not consider the role played by the small or large size of the package. Since partitions can

serve as cues to estimate quantities, what we suggest is that partitions may help consumers feel in control of their consumption but more strongly when the package is small. In the case of large packages, partitions may make salient the real quantity of food, making consumers feel less able to eat the whole quantity of food, thus decreasing the feeling of being in control. For partitioned products, partitions may make salient how small the quantity of food is, resulting in a feeling of control over its consumption. In that case, when partitioned, small food packages may lead to more perceptions of control, and being more in control of their consumption may prompt consumers to anticipate less food waste. Therefore, in our fifth hypothesis we posit the following:

H5: Package size moderates the indirect effect of package format on anticipation to waste through the mediating role of perceived control.

Study 3 provides a test of H4 and H5 through a close examination of consumer response to the format of packaging on anticipated food waste. It also tests our prediction regarding the role played by the format (partitioned food versus not) of the food on consumers' perception of control and anticipation of waste.

### **Participants, Design and Procedure**

Participants (N = 263, 52.90% Female,  $M_{Age} = 32.36$ , S.D. = 11.47, Range: 18–68, 100%) were recruited online by a panelist and asked to participate in a study which had a 2 (small vs. large package)  $\times$  2 (partitioned vs. non-partitioned package) between subjects design. Participants were hence randomly assigned to a small or large package of yogurt with either a partitioned or plain package. To manipulate the package format, the yogurt was presented either as containing smaller-sized cups or as a larger single pot. Turning to the manipulation of package size in the partitioned format condition, the pack was presented with 4 cups of 100 grams of yogurt in the small package condition, and with 12 cups (still of 100 grams) in the large package condition. In order to avoid any confounding effects, the same quantities were retained in the non-partitioned

format condition, with the small package containing 400 grams (hence, the equivalent of the 4 cups of 100 grams each) and the large package contained 1.2 kilograms (the equivalent of 12 cups of 100 grams each). As in previous studies, a fictitious brand was used – here, *NaturfruiX* – to avoid any bias associated with a familiar brand.

Participants then answered the same measures of purchase intentions ( $\alpha = .85$ ) and anticipated food waste ( $M = 2.79$ ,  $S.D. = 1.90$ ) as in studies 1 and 2. They also completed a 3-item measure of perceived control ( $\alpha = .92$ ) adapted from previous research (Cutright, Bettman, and Fitzsimons 2013; Durante and Laran 2016) which asked participants to indicate, on a seven-point scale (1 = “definitely disagree,” and 7 = “definitely agree”), how much they agreed with the following statements: “This package of yogurt enables me to easily control my consumption,” 2/ “Seeing this package, I feel I could easily control how much I consume,” and 3/ “This package makes me feel in control of the quantity of yogurt that I consume.” We collapsed the items into a composite measure of perceived control. After completing these measures, participants indicated their demographics and were thanked online for their participation.

## **Results and Discussion**

Here we were interested to see if the effects of package size on anticipated food waste observed in studies 1 and 2 would be replicated. Study 3 also provided a test of the effects of the package format on perceptions of control and food waste. Thus, a two-way ANOVA was first conducted, with the package size condition and the format condition as the fixed variables and anticipated food waste as the dependent variable. Results revealed a main effect of package size with anticipated food waste being lower in the small package condition ( $M_{\text{Small}} = 2.56$ ,  $M_{\text{Large}} = 3.05$ ,  $F(1, 261) = 4.09$ ,  $p < .05$ ). This result replicates those observed in studies 1 and 2 and brings further support for H1. Interestingly, and as predicted, a significant interaction was found ( $F(1, 261) = 5.70$ ,  $p < .05$ ; see Figure 1). Precisely, in order to test the notion that, when partitioned,

large packages lead to more anticipated food waste than small packages, a first t-test was conducted in the single condition of partitioned packages. Results revealed that small partitioned packages ( $M = 2.33$ ) lead to significantly less anticipated food waste than large ( $M = 3.35$ ) partitioned packages ( $t = -3.24, p < .001$ ). No difference was found between small and large non-partitioned packages ( $t = .247, p > .10$ ). Overall, these results support H4.

[Insert Figure 1 here]

In order to replicate the effects of package size on anticipated food waste and purchase intentions, a similar mediation analysis as performed in studies 1 and 2 was conducted (Process, Model 4, 5000 bootstraps). The analysis was conducted using the aggregated non-partitioned and partitioned packages conditions. Results revealed the same pattern of results as those observed in studies 1 and 2, with a significant indirect effect of package size on purchase intentions through the mediating effect of anticipated food waste (95% =  $-.147; -.001$ ). This result brings additional support for H2.

Turning now to perceptions of control as the mechanism explaining the anticipation to waste food as a function of package type and size, a moderated mediation analysis was performed (Process, model 8, 5000 bootstraps; Hayes 2015). Specifically, package type served as the independent variable, perceived control as the mediator, anticipated food waste as the dependent variable, and package format as the moderating variable. As expected, results revealed a significant index of moderated mediation (95% CI =  $-.396; -.002$ ; Figure 2), suggesting that package size moderates the indirect effect of package format on anticipated food waste through the mediating effect of perceived control. Precisely, results revealed that in the small package condition, perceived control mediates the effects of partitions on anticipation of food waste (95% CI =  $.018; .388$ ), while such an effect is not observed in the large package size condition (95% CI =  $-.047; .192$ ). In order to investigate more thoroughly the mediating effect of perceived control in

the small package size condition, a mediating analysis has been conducted in this condition. Results show that partitions (coded 0, as opposed to non-partitions coded 1) lead to higher perception of control ( $\beta = -.80, t = -3.88, p < .01$ ), leading to a decrease in the anticipation of food waste ( $\beta = -.31, t = -2.46, p < .05$ ). Overall, these results support H5.

[Insert Figure 2 here]

The results of study 3 – which are summarized in Table 3 – provide additional support for the effect of package size on the anticipation of food waste. Importantly, the results also bring additional insights regarding the role played by the format of a food package. What the results indicate is that the partitions in food packages, as opposed to plain packages, can serve as a cue that help consumers be aware of large quantities of food and lead them to anticipate more food waste. What the results also indicate is that such partitions can help consumers feel more in control of their consumption and lead them to anticipate less food waste.

[Insert Table 3 here]

## **GENERAL DISCUSSION**

### **Theoretical Marketing Implications**

Across three studies, we have demonstrated that package size can influence anticipated food waste and purchase intentions. Importantly, we also have demonstrated that promotions, information on the consequences of food waste, and food package format (partitioned versus not) play a role in the effects of package size on anticipated food waste. Our findings thus represent new insights as to how consumers react to package size as well as how food manufacturers can design food packages to mitigate food waste.

In line with Arkes (1996) and Bolton and Alba (2012), our results suggest that consumers are willing to reduce their purchase intentions for large package sizes and promotional offers (and sacrifice the goal of utility maximization) due to an aversion to food waste. In particular, we put

forward the mediating role of anticipated food waste on consumers' purchasing intentions according to the package size (Study 1). The distaste for unused utility seems to be higher than the economic loss of falling short or not having enough food (Kahneman and Tversky 1979). Our study also highlights that it is possible to increase the anticipation to waste the food by priming individuals with information about the negative social implications of food waste (Study 2), and by splitting the package into several units (Study 3). However, it is not clear that these two strategies produce similar effects on the anticipated food waste. Priming people with information about food waste might increase their food waste aversion, while splitting the package into several units might make potential food waste more salient. Further research needs to be conducted to better understand the relative effects of these strategies on the anticipation to waste food.

We have also shown that presenting the same quantity of food in several portions (vs. a large pot) improves food waste evaluation. Consumers tend to underestimate the caloric content of large packages (Rolls, Morris, and Roe 2002; Chandon and Wansink 2007). Splitting a package into several small units has been shown to help consumers better assess the quantity of the product (Chandon and Wansink 2007; Marchiori, Waroquier, and Klein 2012; Wansink, Payne and Shimizu 2011). The same seems to be true for the anticipation to waste the food. Interestingly, in our study, dividing a package in several portions did not increase the anticipation to waste the food for all of the package sizes. This anticipation increased for the large package and was reduced for the small one. Petit et al. (2017) demonstrated that representing mentally the consumption of a food portion reduces the portion size effect (i.e., a trend to eat more from a larger portion than from a smaller one) and brought individuals to better evaluate the amount of food they wanted to eat. Similarly, by dividing the package into several small portions, the

participants were more able to visualize their potential food waste. Therefore, future studies should be conducted to better understand the role of mental imagery on anticipated food waste.

### **Public Policy Considerations**

Our findings also have several implications from a policy perspective, and offer insights on how policy makers might be able influence the quantity of food wasted by consumers. We explicitly consider policies that will provide a public good; in the case of study 2 the public good is information and in study 3 the public good is correcting a cognitive bias among consumers. The policy suggestions we offer below might be considered as attempts to increase food literacy among food consumers (Block et al 2011). Any effective policy developed and applied in this setting would ultimately need to be a cohesive effort involving stakeholders throughout the supply chain including policy makers, food manufacturers, food retailers, and consumers.

The results from study 2 show that consumers may reduce purchases of larger packages and reduce their associated food waste if they are presented with information describing the negative externalities of food waste. This result indicates that there may be missing information among consumers and, since information is considered a public good, there is an argument that public policy will improve the well-being of society. The specific type of information needed in this situation requires further investigation, yet our results suggest that consumers will respond to this type of priming or information. In practical terms, the government could fund and lead an informational campaign (via television, print media, and social media outlets) to better inform the public about the (environmental, social/distributional, and economic) problems associated with food waste.

In study 3 we found that consumers reduced purchases of the promotional pack when we manipulated the package size. This is another case where public policy could be developed to help correct a cognitive bias among consumers; here consumers may not realize the magnitude of

the quantity in a large pack when it is not presented in a typical package size. Our results show that when the larger pack is shown in a normal or standard package size, they are more likely to predict their anticipated waste level and are less likely to purchase the large package size. One real-world policy proposal could be to mandate food manufacturers to use similar package sizes when offering promotional packaging. This policy would not prevent food manufacturers from offering promotional or bonus packs, but it would limit the differences in package designs that they use for promotional and non-promotional packs. Marketers may also find an interest in facilitating the anticipation of food waste by consumers at the time of purchase, suggesting that they should also be involved in the policy program. By adapting their packaging, food marketers might help consumers assess whether a promotional offer is relevant or not and thus not reduce their evaluation for the brand after wasting food (Van Herpen and de Hooze 2016).

### **Potential Limitations and Further Research**

One limitation of our work was that we examined anticipated food waste using survey data rather than actual food waste collected as part of a field experiment. Further research that examines actual food waste would lead to a richer comprehension of the links between package size, promotions, and package format on food waste. Further work that measured the exact amount of food that is wasted for given package sizes would help policy makers better understand how regulations on package size might prevent food waste.

As with a wide body of research using consumers' self-reported intentions as a proxy of actual behavior, another limitation relates to purchase intentions as a measure of actual purchasing behavior. Although strong evidence exists regarding the predictive validity of measures of intention (Chandon, Morwitz and Reinartz 2005) – which lends confidence to the findings of the our studies – being able to measure the exact amount of products that are actually purchased after being exposed to a small or a large package would help estimate more accurately

the mediating role of (anticipated) food waste in the relationship between package size and consumer behavior.

Finally, because we only used two package sizes for a specific product in our research, our results may not generalize to a wider range of package sizes or for package sizes in other food product categories. We purposefully focused our research on this distinction to examine if larger packages lead to more anticipated food waste. However, we understand that such a dichotomy does not represent the whole variety of package sizes that exist in the marketplace. Further research should explore, for specific product categories, the more nuanced effects between product sizing and food waste such that policy makers have more complete information before they consider regulations on the design of food packages.

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**Table 1. Descriptive Statistics, Regressions Coefficients, and Confidence Intervals for Studies 1A and 1B**

<b>Descriptive Statistics (Means, SDs): Overall and Across Condition of Package Size</b>						
	<b>Study 1A</b>			<b>Study 1B</b>		
	<b>Overall</b>	<b>Small</b>	<b>Large</b>	<b>Overall</b>	<b>Small</b>	<b>Large</b>
<b>AFW</b>	3.31 (2.11)	2.77 (1.89)	3.98 (2.17)	3.01 (2.26)	2.42 (2.06)	3.42 (2.40)
<b>PI</b>	3.57 (1.19)	3.63 (1.09)	3.45 (1.24)	3.48 (1.32)	3.54 (1.38)	3.43 (1.27)
<b>Disgust</b>	2.22 (1.36)	2.14 (1.34)	2.38 (1.36)	2.60 (1.59)	2.75 (1.54)	2.46 (1.64)

<b>Regression Coefficients From the Mediation Analysis</b>				
	<b>Study 1A</b>		<b>Study 1B</b>	
	<b><math>\beta</math></b>	<b>95% CI</b>	<b><math>\beta</math></b>	<b>95% CI</b>
<b>Size→ AFW</b>	.60**	[.19; 1.02]	.50*	[.05; .95]
<b>AFW→PI</b>	-.16**	[-.27; -.05]	-.15**	[-.27; -.04]
<b>Size→PI</b>	.04	[-.18; .28]	.05	[-.21; .31]
<b>Size→ AFW→ PI</b>	-.10*	[-.24; -.03]	-.08*	[-.23; -.01]

Note: AFW = Anticipated Food Waste; PI = Purchase Intentions

\*\* :  $p < .01$ ; \* :  $p < .05$

The CIs are the bias-corrected bootstrap 95% confidence intervals.

**Table 2. Descriptive Statistics, Regressions Coefficients, and Confidence Intervals for Study 2**

<b>Descriptive Statistics (Means, SDs): Overall and Across Condition of Package Size</b>						
	<b>Small</b>		<b>Large</b>		<b>Promo. Large</b>	
	<b>Priming</b>		<b>Priming</b>		<b>Priming</b>	
	<b>Control</b>	<b>Waste</b>	<b>Control</b>	<b>Waste</b>	<b>Control</b>	<b>Waste</b>
<b>AFW</b>	2.12 (1.60)	2.63 (2.18)	3.13 (2.28)	3.76 (2.20)	3.08 (2.23)	3.98 (2.25)
<b>PI</b>	3.70 (1.22)	3.76 (1.15)	3.93 (1.26)	3.75 (1.38)	3.66 (1.07)	3.66 (1.24)

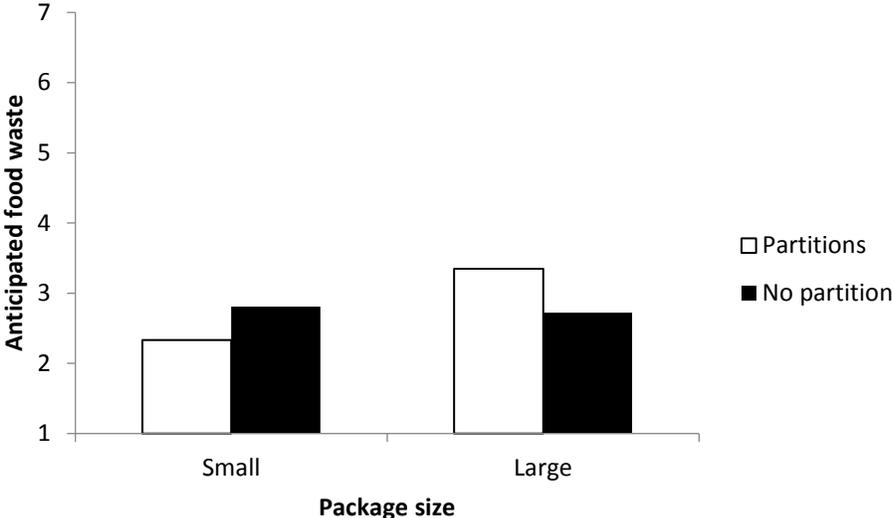
<b>Regression Coefficients From the Mediation Analyses</b>					
<b>Mediation: Size → AFW → PI</b>			<b>Mediation: Waste Prime → AFW → Pref.</b>		
	<b>β</b>	<b>95% CI</b>		<b>β</b>	<b>95% CI</b>
<b>Size → AFW</b>	1.12***	[.61; 1.64]	<b>Prime → AFW</b>	.71**	[.21; 1.20]
<b>AFW → PI</b>	-.19***	[-.25; -.12]	<b>AFW → Pref.</b>	-.17***	[-.27; -.07]
<b>Size → PI</b>	.23	[-.05; .51]	<b>Prime → Pref.</b>	-.53*	[-.97; -.08]
<b>Size → AFW → PI</b>	-.21**	[-.34; -.10]	<b>Prime → AFW → Pref.</b>	-.12*	[-.29; -.03]

Note: AFW = Anticipated Food Waste; PI = Purchase Intentions; Pref. = Preferences for small packages

\*\* :  $p < .01$ ; \* :  $p < .05$

The CIs are the bias-corrected bootstrap 95% confidence intervals.

**Figure 1. Study 3: Anticipated Food Waste as a Function of Package Size and Format**



**Table 3. Descriptive Statistics, Indirect Effects, and Confidence Intervals for Study 3.**

Descriptive statistics (Means and SDs)						
	Small		Large			
	Non-partitioned	Partitioned	Non-partitioned	Partitioned		
<b>AFW</b>	2.81 (1.90)	2.33 (1.75)	2.72 (1.97)	3.35 (1.89)		
<b>PI</b>	3.72 (1.38)	4.24 (1.38)	3.40 (1.29)	3.79 (1.50)		

Indirect Effects (IEs) From the Moderated-Mediation Analysis						
	Index of Moderated Mediation		Conditional Indirect Effects			
			Small		Large	
	IE	95% CI	IE	95% CI	$\beta$	95% CI
<b>Package type <math>\times</math> Size <math>\rightarrow</math> PC <math>\rightarrow</math> AFW</b>	-.13*	[-.396; -.002]	.16*	[.018; .388]	.03	[-.047; .192]

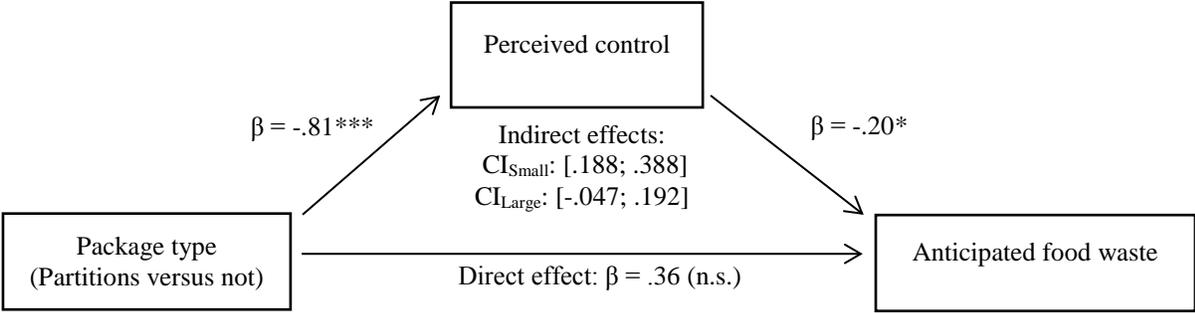
Note: AFW = Anticipated Food Waste; PI = Purchase Intentions; PC: Perceived Control

\*\* $: p < .01$ ; \* $: p < .05$

The CIs are the bias-corrected bootstrap 95% confidence intervals.

The index of moderated mediation is the test of moderated (or conditional) mediation (Hayes 2015). The IEs are the indirect effects for the package type conditions across the different package size conditions.

**Figure 2. An Illustration of the Relationship between Perceived Control, Package Size, and Anticipated Food Waste**



Note: n.s.:  $p > .10$ ; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

## OTHER A.E.M. WORKING PAPERS

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