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Research report

Preventing the pack size effect: Exploring the effectiveness of pictorial and non-pictorial serving size recommendations

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ABSTRACT

People eat more from large than from small packs, which is known as the pack size effect. We hypothesized that providing a serving size recommendation would reduce the influence of the pack size on consumption and would thus diminish the pack size effect. Moreover, we hypothesized that a pictorial serving size recommendation, displaying food amounts visually, would be more effective than a non-pictorial recommendation that communicates the recommended amount in grams only. We tested these hypotheses in two online experiments (N = 317 and N = 324) and in one lab experiment (N = 89). In the online experiments, participants were shown a small or a large pack of unhealthy snacks, with or without a serving size recommendation. The main outcome measure was expected consumption. Replicating the pack size effect in an online setting, we found that participants expected to consume more food from large than from small packs. Furthermore, the pack size effect was considerably stronger for men than for women. Importantly, when including portion size preferences as a covariate, the pictorial serving size recommendation significantly reduced expected consumption, especially when placed on a large pack, as hypothesized. The non-pictorial serving size recommendation had no effect. In the lab experiment, students received a large bag of M&M's which did or did not contain the pictorial serving size recommendation. We again included general portion size preferences as a covariate. The serving size recommendation significantly lowered the amount of M&M's that participants served themselves, but only when participants reported to have noticed the serving size recommendation. We conclude that providing a pictorial serving size recommendation can be an effective intervention strategy to reduce the pack size effect, if it attracts sufficient attention.

Introduction

An increase in the portion or pack size typically leads to an increase in food consumption (see for example Chandon & Wansink, 2011; Steenhuis & Vermeer, 2009; Wansink, 2004; Zlatevska, Dubelaar, & Holden, 2014 for reviews). This effect is often referred to as the portion size effect or pack size effect. Whether it concerns pasta (Burger, Fisher, & Johnson, 2011; Diliberti, Bordi, Conklin, Roe, & Rolls, 2004), sandwiches (Rolls, Roe, Meengs, & Wall, 2004), snacks (Rolls, Morris, & Roe, 2002; Rolls, Roe, Kral, Meeng, & Wall, 2004; Stroebele, Ogden, & Hill, 2009), stale popcorn (Wansink & Kim, 2005), or vegetables (Mathias et al., 2012; Rolls, Roe, & Meengs, 2010), the bigger the portion or pack from which people eat, the higher their consumption. Similar effects have been found for non-food products (Wansink, 1996). Portion sizes and pack sizes have increased in the past years (Nielsen & Popkin, 2003), making supersized portions and packs an important contributor to the rise in overweight and obesity (Chandon, 2013; Hill & Peters, 1998; Rozin, Kabnick, Pete, Fischler, & Shields, 2003; Young & Nestlé, 2012). It is thus important to find ways to prevent the occurrence of the portion and pack size effect.

Previous research on intervention strategies has mainly focused on finding general ways to reduce the consumption of unhealthy foods, for example by partitioning foods (Cheema & Soman, 2008; Geier, Wansink, & Rozin, 2012) or by activating a health goal (Papies & Hamstra, 2010; Van Koningsbruggen, Stroebe, Papies, & Aarts, 2011). However, no research so far has identified effective ways to prevent people from eating more from large than from small packs. In the present paper, we propose a strategy to prevent the pack size effect that is based on the perspective that consumers are uncertain about how much they should eat and as a result rely on the portion or pack size to determine their consumption quantity (Marchiori, Papies, & Klein, 2014; Wansink & Chandon, 2014). We hypothesized that a clear serving size recommendation will provide consumers with a more suitable quantity to base their

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consumption on, so that they will rely less on the pack size, and the pack size effect will be reduced.

The portion and pack size effect

People rely strongly on external cues in their environment when they determine how much they should eat (Cohen & Farley, 2008; Herman & Polivy, 2005; Robinson, Thomas, Aveyard, & Higgs, 2014; Wansink, 2010). One of the most easy and accessible cues to rely on is the size of the portion or pack from which one is eating. As a result, consumers eat more when provided with a large portion or pack of food than when provided with a more modest serving (Fisher & Kral, 2008; Raynor & Wing, 2007; Rolls et al., 2002; Rolls, Roe, & Meengs, 2007; Wansink, 1996). Recent studies, which have tried to prevent this effect by drawing attention to internal signals to stop consumption, have mainly confirmed the strength of this portion size effect (Cavanagh, Vartanian, Herman, & Polivy, 2014; Marchiori & Papies, 2014).

A possible explanation for this effect is that the size of the portion or pack signals to the consumer how much is appropriate to eat (Rolls et al., 2002; Wansink & Chandon, 2014). In other words, portion and pack sizes act as consumption norms. Marchiori et al. (2014) suggested that portion and pack sizes are used as anchor quantities, such that consumers take the size of the portion or pack as a reference amount. Although they may then adjust their consumption somewhat from this reference amount, this adjustment is typically insufficient (Epley & Gilovich, 2001; Tversky & Kahneman, 1974), so that the larger the pack becomes, the larger the consumption amount will be. To prevent this reliance on the pack size, we propose to provide consumers with a more suitable quantity on which they can base their consumption. More specifically, we suggest providing consumers with a serving size recommendation that clearly visualizes how much they are advised to eat. We reason that if this serving size recommendation is available, consumers may use this as a reference amount to base their consumption on, and rely less on the size of the pack. As a result the pack size effect will be smaller, or even absent. We thus predict that a serving size recommendation that is smaller than the pack will reduce consumption, and that it will be particularly effective on large packs, as these typically lead to high consumption.

We furthermore suggest that a serving size recommendation will most likely be used in the consumption decision if it is presented with a picture. Earlier research has suggested that people typically represent the portions they eat visually (Wilkinson et al., 2012) or in easily countable units (Geier, Rozin, & Doros, 2006; Marchiori, Waroquier, & Klein, 2011). Similarly, people often have difficulty understanding serving size recommendations in grams (Faulkner et al., 2012). In other words, a serving size recommendation might be most effective if it is presented in the way in which food portions are typically and easily processed, which is why a pictorial serving size recommendation might be more effective than numerical information.

The current research

We investigated to what extent a serving size recommendation on a snack package can diminish the pack size effect. We conducted two experiments in an online setting and one experiment in a lab setting.

In the online experiments participants indicated how much of a snack food they would consume. Snack foods were presented either in large or small packs, and the packs did or did not include a serving size recommendation. In Experiment 1, we varied the pack size of a chocolate bar (either small or large) and the presence or absence of a pictorial serving size recommendation. In Experiment 2, we extended this design to include other snack foods (i.e., M&M's, savory crackers, cocktail nuts). We furthermore compared the effectiveness of the pictorial serving size recommendation to a non-pictorial serving size recommendation that only presented the recommended amount in grams.

Finally, in Experiment 3, students served themselves from a large bag of M&M's that either did or did not contain the serving size recommendation, and we measured both the amount served and the amount consumed.

Experiment 1

Methods

Design

The experiment had a 2 (pack size: large vs. small) × 2 (pictorial serving size recommendation: present vs. absent) between-participants design, and participants were randomly assigned to conditions.

Participants

The sample consisted of members of the general Dutch population between 18 and 65 years old. Participants who indicated that they never eat milk chocolate or indicated that they would eat zero pieces of the presented chocolate bar, were told that they did not belong to the target group of the study and hence could not continue. This led to an initial sample of 362 participants. We removed 27 participants because they did not finish the survey and another 17 because of poor data quality. Data quality was defined to be poor when participants answered the survey in less than 4 minutes (the average time needed to fill in the questionnaire was 12 minutes ($SD = 8$)), or when they gave the same answer to at least 21 of the 22 *agree*/*disagree* and *true*/*false* statements. Finally, 1 participant was removed because she indicated to strongly dislike both milk chocolate and the brand of chocolate used in this study. This led to a final sample of 317 participants, of which 159 were female. Their mean age was 44 ($SD = 12$) years.

Procedure

Participants were recruited by panel agency GMI, who also provided them with a small monetary compensation for participation. During recruitment, the study was announced as a consumer market research study. The questionnaire was administered in Dutch. After some introductory questions about age, gender and consumption frequency of milk chocolate, participants were presented with the chocolate eating scenario that we used for our experimental manipulation and to assess expected consumption. Participants were presented with the picture of the chocolate bar and the following scenario: "Imagine that it is afternoon and you feel like eating something tasty. You decide to unwrap the chocolate bar shown below. The total weight of the bar is 75 gr (180 gr). How many pieces of chocolate do you think you will eat?" Participants then typed the number of chocolate pieces in an input box to indicate their expected consumption. To clarify what we meant by a piece of chocolate, we displayed a picture of one chocolate piece next to the input box (see Web appendix A for a screenshot). Participants then completed a number of additional questionnaires. Finally, participants were debriefed by means of a short text, and had the opportunity to write down any comments they might have.

Materials

In the critical scenario, we presented participants with a picture of the chocolate bar. The screen showed either a small (75 gr, 14 pieces) or a large (180 gr, 30 pieces) plain milk chocolate bar of the Dutch brand Verkade. The bars were shown in their actual size, and a standard pen was shown below the package as a size reference. In the serving size recommendation condition, the serving size

recommendation sticker was shown on the front of the pack. It included a picture of four pieces of chocolate and the text: "recommended serving: 4 pieces". The sticker had a white background and a pink border that matched the package. We chose the serving size to be somewhat lower than the average amount of chocolate consumed per consumption occasion in The Netherlands (Dutch National Food Consumption Survey, 2007–2010). The recommended serving size of four pieces equals about 23 grams. See Web appendix A for an overview of the pictures used.

Other measures

The measures that are included in the subsequent analyses are listed here. For all other measures please refer to Web appendix 1. We asked participants in the serving size recommendation condition if they remembered the amount stated on the recommended serving and if yes, if they could specify how much it was (in number of pieces). We asked participants in the control condition what size they would suggest as an appropriate recommended serving size. Next, all participants were asked to evaluate the size of the recommended serving of 4 pieces (1 = *way too little* to 7 = *way too much*). Then, they completed the dietary restraint subscale of the Three Factor Eating questionnaire (Stunkard & Messick, 1985; $\alpha = 0.86$). We also asked if participants were currently trying to lose weight (*yes* or *no*). We then included three items to assess perceived self-regulatory success (Fishbach, Friedman, & Kruglanski, 2003; $\alpha = 0.81$). We measured the tendency to eat the whole package on a 7-point scale (1 = *strongly agree* to 7 = *strongly disagree*) using the following statements: "When I open a package with candy or salty snacks, I usually empty the whole package, regardless of its size"; "It is easy for me to close a package from which I have been eating, so I can save some food for a later time (recoded)"; "I almost never eat the whole contents of a package (recoded)" ($\alpha = 0.73$). Next, we assessed frequency of snacking in the afternoon (*0–7* days a week). Then, the frequency of consuming milk chocolate was measured (*multiple times a day; once a day; multiple times a week; once a week; 1–3 times per month; once a month; less than once a month; never)*. We then assessed liking of Verkade chocolate (the brand used here) and of milk chocolate in general (1 = *do not like it at all* to 7 = *like it very much*). We assessed current hunger by two statements ("How hungry are you at this moment"; "How much could you eat right now"; $\alpha = 0.81$) using a 7-point scale (1 = *not hungry at all* to 7 = *very hungry*; 1 = *nothing at all* to 7 = *a lot*). Finally, participants provided their weight and height. The other demographic questions included education, household income and living situation.

There were no significant differences across the four experimental conditions with regard to gender, age, BMI, living situation, education and household income (all *p*s > 0.4). Participants in the four conditions also did not differ with respect to hunger, dietary restraint, consumption frequency of milk chocolate, liking of milk chocolate or Verkade chocolate, current dieting behavior, perceived self-regulatory success, tendency to eat the whole pack and frequency of snacking in the afternoon (all *p*s > 0.05). The evaluation of the size of the recommended serving differed between conditions, as indicated by a main effect of the presence of the serving size recommendation, $F(1, 313) = 4.04$, $p = 0.05$, $\eta_p^2 = 0.01$, and an interaction between the pack size and serving size recommendation, $F(1, 313) = 4.22$, $p = 0.04$, $\eta_p^2 = 0.01$. Simple main effects showed that in the condition without the serving size recommendation, the size of the recommended serving was evaluated as significantly more appropriate in the small pack condition ($M = 3.92$, $SD = 1.09$) than in the large pack condition ($M = 3.46$, $SD = 1.31$), $F(1, 313) = 5.43$, $p = 0.02$, $\eta_p^2 = 0.02$. In the condition with the serving size recommendation, the evaluation of the size of the recommended serving was similar in both pack size conditions. In other words, participants in the no serving size recommendation condition were more positive about the appropriateness of the size when they had just seen a small pack than when they had just seen a large pack. The evaluation of the recommended serving size was included as a covariate in two of the analyses reported below.

Results

Expected chocolate consumption

The number of chocolate pieces that participants expected to consume varied between 1 and 30 for the small bar ($M = 7.24$, $SD = 4.39$) and between 1 and 36 for the large bar ($M = 9.30$, $SD = 7.23$). We transformed expected consumption from pieces to grams.

A 2 × 2 ANOVA with pack size and the presence of the serving size recommendation as factors revealed a main effect of pack size, $F(1, 313) = 9.27$, $p < 0.01$, $\eta_p^2 = 0.03$, such that mean expected consumption in grams from the small bar ($M = 39.86$, $SD = 24.17$) was significantly lower than mean expected consumption from the large bar ($M = 51.16$, $SD = 39.78$). This indicates that the predicted pack size effect occurred.

The main effect of the serving size recommendation approached significance, $F(1, 313) = 2.60$, $p = 0.11$, $\eta_p^2 = 0.01$, with mean consumption somewhat lower when a serving size recommendation was shown ($M = 42.49$, $SD = 31.48$) compared to when no serving size recommendation was shown ($M = 48.62$, $SD = 35.00$). Contrary to our hypothesis, the interaction between pack size and serving size recommendation was not significant, $F(1, 313) = 0.73$, $p = 0.39$.

We then explored the potential role of pre-existing portion size preferences by including the evaluation of the recommended serving size as a covariate. The ANCOVA showed that this variable indeed had a strong effect on expected consumption, $F(1, 312) = 79.86$, $p < 0.01$, $\eta_p^2 = 0.20$. Participants who felt that the recommended serving size was too small indicated that they would eat much more chocolate than those who felt that the recommended serving size was too large. Including this covariate thus controlled for participants' general notions of what an appropriate portion size of chocolate is. When controlling for the evaluation of the size of the recommended serving, both the main effect of pack size, $F(1, 312) = 7.64$, $p = 0.01$, $\eta_p^2 = 0.02$ and the main effect of the serving size recommendation were highly significant, $F(1, 312) = 7.84$, $p = 0.01$, $\eta_p^2 = 0.02$. Expected consumption was significantly lower in the serving size recommendation condition than in the control condition. Again, the interaction between pack size and serving size recommendation was not significant, $F(1,312) = 0.01$, $p = 0.94$. Fig. 1 illustrates the effectiveness of the serving size recommendation across the different conditions.

The effect of the serving size recommendation was not moderated by hunger, liking of the chocolate, dietary restraint, perceived self-regulatory success, tendency to eat the whole pack, BMI, and gender (all *p*s > 0.14), which we tested in a series of regression analyses in the General Linear Model in SPSS (Version 22).

Moderating role of gender on the pack size effect

We additionally explored if in this study, as in previous studies, women showed a smaller pack size effect than men (Rolls et al., 2004; Rolls, Roe, & Meengs, 2006; Rolls et al., 2004). An ANCOVA with pack size, serving size recommendation and gender as factors, and evaluation of the size of the recommended serving as covariate, showed that gender had a significant main effect on consumption, $F(1, 310) = 14.35$, $p < 0.01$, $\eta_p^2 = 0.04$, such that men ($M = 53.19$, $SD = 39.28$) consumed more than women ($M = 37.91$, $SD = 23.99$). In line with earlier findings, gender also interacted significantly with pack size, $F(1, 310) = 7.22$, $p = 0.01$, $\eta_p^2 = 0.02$, such that the pack size effect was only significant for men, $F(1, 310) = 15.54$, $p < 0.01$, $\eta_p^2 = 0.05$, and not for women, $F(1, 310) = 0.03$, $p = 0.87$.

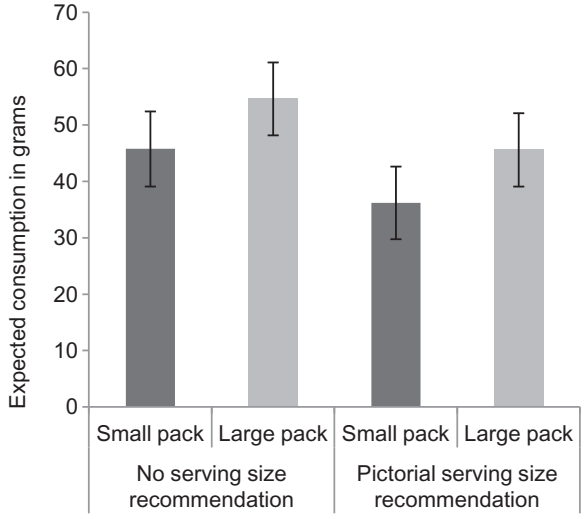

Fig. 1. Mean expected chocolate consumption in grams, when controlling for the evaluation of the size of the recommended serving.

Remembering the magnitude of the recommended serving

We assessed whether participants recalled the exact amount stated on the serving size recommendation. Of the participants in the serving size recommendation condition, the majority (81%) remembered the correct amount. We furthermore examined if participants felt that the size of the recommended serving of 4 chocolate pieces was appropriate. On a 7-point scale ranging from *way too little* to *way too much*, the recommended serving size scored $M = 3.55$ ($SD = 1.25$), suggesting that participants found it appropriate.

Discussion

This experiment provided a first test of the effect of a pictorial serving size recommendation on expected chocolate consumption, in an online setting. Our results showed a clear pack size effect, with participants expecting to consume about 10 grams (56 kcal) more from the large chocolate bar than from the small chocolate bar. In line with previous findings, we also found that the pack size effect only occurred for men, and was actually negligible for women (Rolls et al., 2004, 2006). These findings suggest that an online setting, using expected consumption scenarios rather than measuring actual consumption, can be used to study the psychological mechanisms leading to the pack size effect.

We further found that when controlling for the evaluation of the size of the recommended serving, the pictorial serving size recommendation significantly lowered expected consumption, by approximately 9 grams of chocolate (50 kcal). Contrary to our hypothesis, however, the serving size recommendation decreased expected consumption equally for the small and for the large pack. Thus, although the serving size recommendation had beneficial effects, it did not prevent the pack size effect.

In Experiment 2, we attempted to replicate and extend our findings to other snacks, including non-countable snack foods. Including several snacks might increase the power of our experiment and thus provide a stronger test of the effectiveness of the serving size recommendation. In addition, Experiment 2 was designed to also test the effectiveness of a non-pictorial serving size recommendation, which merely communicates the recommended amount in grams and without a picture. Consumers need to be able to incorporate the serving size information in their consumption quantity decision, and they might find this more difficult when the serving size recommendation is conveyed in grams only (Faulkner et al., 2012). Therefore, we hypothesized that only the pictorial serving size recommendation would reduce expected consumption and possibly reduce the pack size effect.

Experiment 2

This experiment included four snack foods: chocolate, peanut M&M's, TUC savory crackers, and cocktail nuts (peanuts in a crispy coating; Dutch: *borrelnootjes*). The foods thus varied in whether they are sweet or savory, and in the extent to which they are easily countable. The experiment was again conducted online.

Methods

Design

The experiment had a 2 (pack size: large vs. small) × 3 (serving size recommendation: pictorial vs. non-pictorial vs. absent) between-participants design, and participants were randomly assigned to conditions.

Participants

The sample consisted of members of the general Dutch population between 18 and 55 years old. Participants who had never eaten one or more of the snacks in the survey were told that they did not belong to the target group of the study and hence could not continue. This led to an initial sample of 372 participants. We removed 31 participants because they did not finish the survey and another 15 because of poor data quality. The criteria for poor data quality were the same as in Experiment 1, except that we now set the minimum completion time at 5 minutes (the average time needed to fill in the questionnaire was 14 minutes (SD = 9)). Finally, two extreme responses (an expected consumption of 50 hands of M&M's and 60 TUC crackers, both 5 SD from the mean consumption in the large pack condition), were excluded as outliers. This led to a final sample of 324 participants, of which 154 were female. Their mean age was 38 ($SD = 11$) years.

Procedure

The same procedure was followed as in Experiment 1. Participants were again recruited by panel agency GMI, who also provided them with a small monetary compensation for participation. Instead of answering the expected consumption question for only chocolate, participants now answered this question for all four snack foods. The order in which the four snacks were presented was randomized. As in Experiment 1, expected consumption of chocolate was measured in pieces. Expected consumption of the TUC crackers was measured in number of crackers. For the M&M's and cocktail peanuts, expected consumption was measured in "hands". For these foods, the screen showed a hand holding respectively 7 M&M's (about 15 gr) and 15 cocktail peanuts (about 12 gr). Participants indicated how many of these "hands" they expected to eat (see Web appendix B for a screenshot). An important difference with Experiment 1 was that we also included an "I would eat the whole pack" option. Before conducting Experiment 2, we conducted a small pilot study among university staff (N = 34) to determine how we could best assess expected consumption for the non-countable foods, such as M&M's and nuts. Both in Experiment 1 and in this pilot study for Experiment 2, we noticed that many participants indicated an amount that was close to eating the whole pack. Furthermore, pilot participants often commented that they wanted to eat the whole pack but were not sure how to indicate this. To make it possible for participants to indicate this choice, we therefore included an "I would eat the whole pack" answer option. This answer option was shown as a box that participants could check, and was located below the answer field where participants could fill in their expected consumption amount in pieces or hands. Some participants filled in their

expected consumption in pieces or hands and also ticked the "I would eat the whole pack" option. In this case we assumed that participants wanted to eat the whole pack, since these participants' numerical responses were also very close to eating the whole pack/or they expected to eat whole pack for the other snacks.

Participants then completed a number of additional questionnaires. Finally, they were debriefed by means of a short text, and had the opportunity to write down any comments they might have.

Materials

The pictures used for the chocolate bar were the same as in Experiment 1. For the M&M's, we used the Dutch "Maxi" bag to represent a large pack (400 gr), and an American portion bag to represent a smaller pack (165 gr). The TUC crackers were only available in one pack size. We therefore manipulated the image of a 100 gr pack to resemble a small 60 gr pack and a large 120 gr pack using Jasc Paint Shop Pro (Version 7, Jasc Software, Inc.). We used a similar procedure for the bag of cocktail nuts and thus visually created a 300 gr and a 125 gr bag (see Web appendix 2 for example pictures). In case a nutrition panel was visible on front of the pack, this was removed. In all pictures, the pack was held by a hand which served as a size reference to judge the actual size of the pack.

The design of the pictorial serving size recommendation sticker was similar to Experiment 1. For chocolate, we again included a picture of four pieces of chocolate. For the TUC crackers, four crackers were shown. For M&M's and cocktail nuts, the recommended serving of 30 grams was displayed with the corresponding food amount lying on a hand. The non-pictorial serving size recommendation sticker only said: "recommended serving: XX grams" (see Table 1) and did not include a picture of the foods. As in Experiment 1, we set the recommended serving for each snack somewhat lower than the average consumption amount per consumption occasion in The Netherlands (Dutch National Food Consumption Survey, 2007–2010). Table 1 gives an overview of the snacks, the pack sizes, the size of the recommended servings, and how we measured expected consumption for each snack. See Web appendix B for example pictures.

Other measures

The measures that are included in the subsequent analyses are listed here. For all other measures, please refer to Web appendix 3. In case the same question was asked for all four snack foods, the order in which the foods were presented per question was always randomized.

We first asked all participants to indicate what they thought the optimal recommended serving size would be for each of the four snacks. Next, we asked participants in both serving size recommendation conditions if they remembered the size of the recommended serving for each of the four foods, and if yes, we asked them to indicate what the size was. As a manipulation check, we assessed how participants perceived the size of the packs (1 = *very small* to 7 = *very large*). We also asked how realistic participants thought the packs looked (1 = *not realistic at all* to 7 = *very realistic*). We next included a number of the same measures as in Experiment 1: the evaluation of the size of the recommended serving, dietary restraint ($\alpha = 0.87$), currently trying to lose weight, perceived self-regulatory success ($\alpha = 0.78$), tendency to eat the whole pack ($\alpha = 0.81$), frequency of snacking in the afternoon, consumption frequency of the snacks, liking of the snacks, hunger ($\alpha = 0.87$), weight, height, living situation and education.

There were no significant differences across the six experimental conditions with regard to gender, age, BMI, living situation and education (all $ps > 0.18$). Participants in the six conditions also did not differ with respect to hunger, dietary restraint, consumption frequency of the snacks, liking of the snacks, current dieting behavior, perceived self-regulatory success, tendency to eat the whole pack, frequency of snacking in the afternoon, and evaluation of the size of the recommended serving (all $ps > 0.07$).

Manipulation check

For all snacks, the size of the pack was perceived to be significantly bigger in the large pack condition than in the small pack condition, $t(322) > 3.09$ and $p < 0.01$ for all snacks. Participants also found the packs to look realistic, $M = 5.41$ ($SD = 1.03$).

Results

Expected consumption

In a 2×3 ANOVA, we tested whether the pack size and serving size recommendation affected the average expected consumption of the four snack foods. In case a participant had indicated to eat the whole pack, we used the contents of the whole pack in grams as their expected consumption.

This ANOVA revealed a significant main effect of pack size, $F(1, 318) = 13.81$, $p < 0.01$, $\eta_p^2 = 0.04$, such that expected consumption from the small packs ($M = 59.10$, $SD = 31.86$) was smaller than from the large packs ($M = 80.74$, $SD = 65.87$). This is again strongly consistent with earlier findings and Experiment 1. The serving size recommendation did not have a significant main effect, $F(2, 318) = 1.72$, $p = 0.18$, with expected consumption in the no recommendation, non-pictorial recommendation, and pictorial recommendation conditions being $M = 75.48$ ($SD = 61.16$), $M = 72.52$ ($SD = 52.85$), and $M = 62.35$ ($SD = 43.12$), respectively. Thus, although these means were in the expected direction, the main effect of the serving size manipulation did not reach significance. The interaction between pack size and serving size recommendation was not significant, $F(2, 318) = 1.32$, $p = 0.27$.

As in Experiment 1, we then added the evaluation of the recommended serving size as a covariate. This variable again had a strong main effect on expected consumption, $F(1, 317) = 20.59$, $p < 0.01$, $\eta_p^2 = 0.06$. As in Experiment 1, participants who felt the recommended serving was too little consumed significantly more than those who felt it was too much. However, including this covariate did not change the other findings: the main effect of pack size was again significant, $F(1, 317) = 17.96$, $p < 0.01$, $\eta_p^2 = 0.05$, while the main effect of the serving size recommendation, $F(2, 317) = 1.26$, $p = 0.29$, and the interaction, $F(2, 317) = 1.40$, $p = 0.25$, were not significant.

A variable that could also have a significant influence on expected consumption is the tendency to eat the whole pack. It is likely that participants who scored high on the statements regarding the

Table 1
Pack size, recommended serving size, and measurement of expected consumption of the four snack foods in Experiment 2.

Food	Size small/large pack	Size of recommended serving	Measurement unit for expected consumption (DV)
Milk chocolate	75 gr/180 gr	4 pieces (20 gr)	Pieces
Peanut M&M's	165 gr/400 gr	30 gr	Hands
TUC crackers	60 gr/120 gr	4 crackers (15 gr)	Crackers
Cocktail nuts	125 gr/300 gr	30 gr	Hands

tendency to keep eating until the pack is empty, checked the "I would eat the whole pack" answer option, thus significantly increasing their consumption over that of others. Indeed, participants who indicated for at least one snack that they would eat the whole pack (N = 148) had an average consumption of $M = 106.44$ grams ($SD = 57.04$), while participants who did not indicate this for any of the snacks (N = 178) had an average consumption of only $M = 40.21$ grams ($SD = 21.64$), $t(179.23) = 13.27$, $p < 0.01$. The provision of the "I would eat the whole pack" option thus significantly increased the variance in the data. Therefore, we explored the effects of including the tendency to eat the whole pack as an additional covariate. Indeed, an ANCOVA showed that the covariates "evaluation of the recommended serving size" and "tendency to eat the whole pack" had a significant main effect on expected consumption, $F(1, 316) = 10.47$, $p < 0.01$, $\eta_p^2 = 0.03$, and $F(1, 316) = 108.45$, $p < 0.01$, $\eta_p^2 = 0.26$, respectively. The main effect of pack size was significant, $F(1, 316) = 28.22$, $p < 0.01$, $\eta_p^2 = 0.08$, and was qualified by the hypothesized interaction between pack size and serving size recommendation, $F(2, 316) = 3.80$, $p = 0.02$, $\eta_p^2 = 0.02$. Fig. 2 displays the effect of the serving size recommendation across conditions.

We then analyzed the simple main effects to test our hypothesis that only the pictorial serving size recommendation would reduce expected consumption and prevent the pack size effect. Indeed, and as can be seen in Fig. 2, the pack size effect was significant in the control condition and in the non-pictorial serving size condition, $F(1, 316) = 23.25$, $p < 0.01$, $\eta_p^2 = 0.07$ and $F(1,316) = 11.29$, $p < 0.01$ $\eta_p^2 = 0.03$, respectively. Importantly, however, there was no pack size effect in the pictorial serving size recommendation condition, $F(1, 316) = 1.02$, $p = 0.31$, which is in line with our hypothesis. This implies that participants expected to eat similar, small amounts when a pictorial serving size recommendation was displayed, irrespective of the size of the pack, and confirms our hypothesis that the pictorial serving size recommendation can diminish the pack size effect.

In addition, we examined the simple main effects to determine if the pictorial serving size recommendation only significantly reduced consumption from the large pack and not from the small pack. Indeed, expected consumption from the large pack was significantly lower in the pictorial serving size recommendation condition than in the control condition, $F(1, 316) = 8.04$, $p = 0.01$, $\eta_p^2 = 0.02$. In contrast, expected consumption from the small pack was not affected by the pictorial serving size recommendation, $F(1, 316) = 1.05$, $p = 0.31$.

Additional regression analyses in the General Linear Model showed that the effect of the serving size recommendation was not moderated by hunger, dietary restraint, tendency to eat the whole pack, BMI and gender (all $ps > 0.26$). The serving size recommendation significantly interacted with perceived self-regulatory success, $F(2, 310) = 3.74$, $p = 0.03$, $\eta_p^2 = 0.02$. The three-way interaction between pack size, serving size recommendation and perceived self-regulatory success reached marginal significance, $F(2, 310) = 2.94$, $p = 0.05$, $\eta_p^2 = 0.02$. Using simple slopes analysis we examined the effect of pack size and the serving size recommendation on expected consumption at 1 SD above and 1 SD below the mean of self-regulatory success (Aiken & West, 1991). Expected consumption from the large pack was significantly lower in the pictorial serving size recommendation condition than in the control condition only for those participants who scored low on perceived self-regulatory success. In other words, the pictorial serving size recommendation lowered consumption from the large pack most for those who find it difficult to control their weight. The interaction between the serving size recommendation and average liking of the four snacks was also significant, $F(2, 310) = 3.11$, $p = 0.05$, $\eta_p^2 = 0.02$. Simple slopes analyses showed that the pictorial serving size recommendation only significantly lowered consumption when participants had a high liking for the snacks and not when they had a low liking for the snacks.

Differences across foods

To explore whether the effects of pack size and serving size recommendation differed across the four food items, we ran a repeated measures ANCOVA with food item as the within-subjects factor and pack size and serving size recommendation as between subject factors. Evaluation of the recommended serving size and tendency to eat the whole pack were again included as covariates. As Mauchly's test indicated that the assumption of sphericity was violated, $\chi^2(5) = 146.00$, $p < 0.01$, we used a Greenhouse–Geisser degrees of freedom correction. As expected, there was a main effect of food item on the excepted consumption in grams, $F(2.47, 781.92) = 91.82$, $p < 0.01$, $\eta_p^2 = 0.23$. Food item also significantly interacted with pack

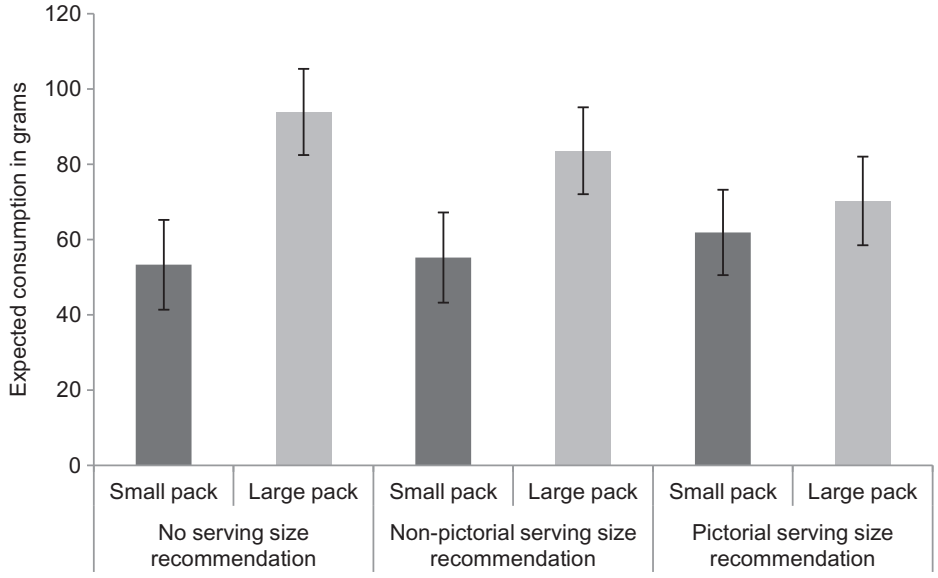

Fig. 2. Mean expected consumption of the four snack foods in grams when controlling for the evaluation of the recommended serving size and the tendency to eat the whole pack.

size, $F(2.47, 781.92) = 4.30$, $p = 0.01$, $\eta_p^2 = 0.01$, but importantly, it did not interact with serving size recommendation, $F(4.95, 781.92) = 1.07$, $p = 0.38$. The effect of pack size thus differed across the foods, but the effect of the serving size recommendation did not.

Moderating role of gender on the pack size effect

An ANCOVA with pack size, the serving size recommendation and gender as factors, and evaluation of the recommended serving size and tendency to eat the whole pack as covariates, showed that gender had a significant main effect on consumption, $F(1, 310) = 5.92$, $p = 0.02$, $\eta_p^2 = 0.02$, such that men ($M = 79.91$, $SD = 57.82$) consumed more than women ($M = 59.17$, $SD = 44.78$). As in Experiment 1, gender also interacted significantly with pack size, $F(1, 310) = 6.35$, $p = 0.01$, $\eta_p^2 = 0.02$. Although the pack size effect was significant for both men and women, $F(1, 310) = 33.24$, $p < 0.01$, $\eta_p^2 = 0.10$ and $F(1, 310) = 4.17$, $p = 0.04$, $\eta_p^2 = 0.01$ respectively, it was considerably larger for men.

Effect of the serving size recommendation on the choice to eat the whole pack

Using binary logistic regression analysis, we determined whether the serving size recommendation lowered the odds of eating the whole pack. The dependent variable measured whether or not the participant opted to eat the whole pack, the independent variables included were size, the non-pictorial and pictorial serving size recommendation, and the interaction between the size and serving size recommendations. The serving size recommendation, the pack size, and their interaction did not have a significant impact on the odds of eating the whole pack for any of the foods.

Remembering the magnitude of recommended serving

We assessed whether participants recalled the exact amount stated on the serving size recommendation. The percentage of participants that correctly recalled the amount was 43% (averaged across the four foods) in the pictorial serving size recommendation condition, while this was only 12% in the non-pictorial serving size recommendation condition. We furthermore examined whether participants felt that the recommended serving size was appropriate. On a 7-point scale ranging from *way too little* to *way too much*, the recommended serving size scored $M = 3.58$ ($SD = 1.29$) for chocolate, $M = 3.29$ ($SD = 1.20$) for M&M's, $M = 3.69$ ($SD = 1.32$) for TUC crackers, and $M = 3.72$ ($SD = 1.21$) for cocktail nuts. These findings suggest that the size of the recommended serving was appropriate.

Discussion

As in Experiment 1, we again found a pack size effect, such that participants expected to consume about 22 grams more from large packs than from small packs. Contrary to Experiment 1, there was no main effect of including a serving size recommendation. When controlling for the evaluation of the size of the recommended serving and the tendency to eat the whole pack, however, results showed the predicted interaction between the pack size and serving size recommendation. As hypothesized, only the pictorial serving size recommendation lowered consumption, and it did so only for the large pack. Consumption from the large pack was about 23 grams lower when the pictorial serving size recommendation was displayed on the pack than when no recommendation was displayed. As a result, the pictorial serving size recommendation prevented the pack size effect. As hypothesized, expected consumption and the pack size effect were not affected by the non-pictorial serving size recommendation.

Experiment 3

In Experiment 3, we investigated the effect of the pictorial serving size recommendation on actual consumption instead of expected consumption. Participants were invited to serve themselves a portion of M&M's, and to eat this while watching movie trailers. As Experiment 2 showed that the pictorial serving size recommendation is most effective on large packs, we only included large packs in this experiment.

Methods

Design

The experiment had a 2-group (pictorial serving size recommendation: present vs. absent) between-participants design, and participants were randomly assigned to conditions.

Participants

Students aged between 17 and 25 years from a Dutch university participated for course credit. Before signing up for the study, students were informed that they could only participate if they liked M&M's with peanuts and were willing to eat them during the experiment. The total sample consisted of 89 participants (51 women). Their mean age was 20 ($SD = 1.5$) years.

Procedure

Upon arrival in the lab, participants were brought to the cubicle section by the experimenter and received an instruction sheet. To hide the true purpose of the experiment, participants were told that we were investigating the effect of eating a tasty snack on the TV viewing experience. They were furthermore asked to imagine that they were at home, studying, and were about to take a break in which they watch TV and eat some M&M's. In the cubicle, an open package of M&M's and a bowl were present in which participants could pour the amount of M&M's they would like to eat while watching movie trailers. Participants then took their bowl with M&M's to a second cubicle where they watched the trailers and filled in the computerized questionnaire. In case the participants emptied their bowl and wanted to eat more M&M's, they were instructed to call the experimenter. The trailers did not contain any references to food, weight or dieting. After participants saw the trailers and answered some questions about them, the experimenter took away the bowl of M&M's and started the second part of the questionnaire, which is described below. Debriefing information was provided to the participants via a website, which was made available the day after the last day of the experiment. Before the start of each session, the M&M packages were weighed. After the experiment, both the package and the amount left in the bowl were weighed to determine how much participants served themselves and how much they had consumed.

Materials

We used 400 gram "Maxi" packages of M&M's with peanuts. To ensure that the opening was the same in all packages (+/– 7 cm), the bag was cut open by the experimenter before the participants arrived. The design of the serving size recommendation sticker was similar to Experiment 2, with the exception of the color of the border, which was changed to brown to make it blend more naturally with the pack. The sticker was placed on the right above the center of the package, so that it was well visible when the pack stood upright. The nutrition and portion size information in the lower, right corner of the front of the bag was covered up by a yellow sticker. Participants poured the M&M's in stoneware bowls that were big enough to contain the content of the whole pack (see Web appendix C).

Other measures

The measures that are included in the subsequent analyses are listed here. For all other measures please refer to Web appendix 4. Before watching the trailers, feelings of hunger and satiation were asked together with a number of other feelings, including happy, sad, relaxed, irritated, enthusiastic and thirsty. This question was framed as "to what extent do you feel. . ." (1 = *not at all* to 7 = *very much*) and was repeated at the end of the experiment, before the demographic questions. After watching each trailer, participants rated the trailer on a number of aspects (see Web appendix 4). Liking of the M&M's was assessed on a 7-point scale (1 = *do not like at all* to 7 = *like very much*). Frequency of consumption of peanut M&M's was assessed using the following categories: *at least once a week; at least once a month; at least once a year; ate them in the past but not in the past year; never.* The tendency to eat the whole pack was assessed with two items ("If I take a snack, I keep eating until the package is empty"; "I often eat more from snacks than I initially intended to", $\alpha = 0.77$). The measures for dietary restraint ($\alpha = 0.88$), current dieting behavior, perceived self-regulatory success ($\alpha = 0.66$), and preferred size of the recommended serving were similar to Experiment 1 and 2. We furthermore measured whether respondents remembered seeing the sticker on the pack using the question: "Some M&M packages had a sticker with the recommended serving size. Did the bag from which you took M&M's contain such a sticker?" (*yes*, *no*, or *don't know*). We asked those who remembered seeing the sticker whether they remembered the recommended amount (*yes, the number of grams was. . .*, or *no*), and what they thought when seeing the sticker (open-ended question). We then assessed the evaluation of the size of the recommended serving, using the same question as in Experiment 1 and 2. Finally, participants indicated their gender, age, height and weight, and what they thought the purpose of the study was.

There were no significant differences between the two experimental conditions with regard to gender, age, and BMI (all *ps* > 0.09). Participants in the two conditions also did not differ with respect to hunger and satiation (pre and post eating), dietary restraint, consumption frequency of M&M's, current dieting behavior, perceived self-regulatory success, evaluation of the size of the recommended serving, and tendency to eat the whole pack (all *ps* > 0.13). Liking of the M&M's was somewhat higher in the condition without the serving size recommendation, $t(80.60) = 1.92$, $p = 0.06$.

Results

Amount of M&M's taken

An ANOVA without covariates showed that the presence of the serving size recommendation sticker did not significantly influence the amount of M&M's participants served themselves, $F(1, 87) = 1.10$, $p = 0.30$. As in Experiment 1 and 2, we then added the evaluation of the size of the recommended serving as a covariate. The effect of the evaluation of the size of the recommended serving on the amount of M&M's taken was significant, $F(1, 86) = 10.17$, $p < 0.01$, $\eta_p^2 = 0.11$, and the effect of the recommended serving approached significance, $F(1, 86) = 2.56$, $p = 0.11$, $\eta_p^2 = 0.03$.

We therefore explored the hypothesis that the serving size recommendation is only effective for participants who noticed it consciously (see also Papies, Potjes, Keesman, Schwinghammer, & van Koningsbruggen, 2014). A considerable part of the participants in the serving size recommendation condition indicated that they did not know if there was a serving size recommendation present on the pack, and one participant even indicated that it was not present. We therefore split the complete sample in three groups: (1) those in the no serving size recommendation condition (N = 42), (2) those in the serving size recommendation condition who indicated that they noticed the sticker (N = 14), and (3) those in the serving size recommendation condition who did not notice the sticker (N = 33). We ran an ANCOVA with these 3 groups as a factor, and with evaluation of the size of the recommended serving as a covariate. Evaluation of the size of the recommended serving was again significant, $F(1, 85) = 11.14$, $p < 0.01$, $\eta_p^2 = 0.12$. The effect of group was marginally significant, $F(1, 85) = 2.54$, $p = 0.09$, $\eta_p^2 = 0.06$. As expected, simple main effects analysis confirmed that the amount served was significantly lower among participants who had noticed the serving size recommendation compared to control participants who received a package without serving size recommendation, $F(1, 85) = 5.06$, $p = 0.03$, $\eta_p^2 = 0.06$. Participants who did not notice the serving size recommendation did not take less than control participants, $F(1, 85) = 2.47$, $p = 0.12$. These results are displayed in Fig. 3.

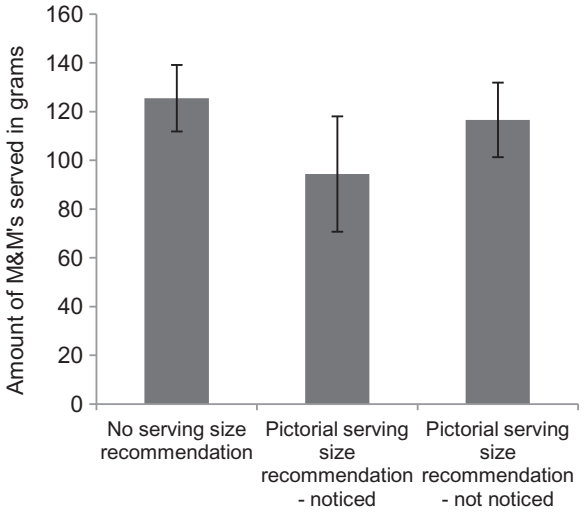

Fig. 3. Mean amount of M&M's that participants served themselves, when they were not provided with a serving size recommendation, when they were provided with a recommendation but did not notice it, and when they did notice the serving size recommendation, while controlling for the evaluation of the recommended serving size.

To examine whether those who noticed the serving size recommendation served themselves less because they are restrained eaters or successful dieters, we conducted additional regression analyses in which we included either restrained eating or perceived self-regulatory success in dieting as potential moderators of the effect of the serving size recommendation. These analyses showed, however, that neither restraint nor dieting success moderated the effect of the serving size recommendation on the amount of M&M's served, all *ps* > 0.55. Furthermore, additional regression analyses revealed that the effect of the serving size recommendation on amount taken was also not moderated by hunger, liking of the M&M's, tendency to eat the whole pack, BMI and gender, all *ps* > 0.28.

Amount of M&M's eaten

The same ANCOVA as described above but with the amount of M&M's eaten again showed an effect of the covariate, $F(1, 85) = 7.08$, $p = 0.01$, $\eta_p^2 = 0.08$, but no effect of the serving size recommendation, $F(1, 85) = 0.54$, $p = 0.59$. Note that only 10 participants finished the M&M's they took, probably due to time constraints, as they only had 13 minutes to eat an average of 117 grams.

Remembering the magnitude of the recommended serving

Of the 14 participants that noticed the serving size recommendation, 9 correctly remembered that the magnitude of the recommended serving was 30 grams. On a 7-point scale ranging from *way too little* to *way too much*, the recommended serving size scored $M = 3.26$ ($SD = 1.01$), suggesting that participants found it appropriate.

Thoughts about the serving size recommendation and the goal of the study

When asked what participants thought when they saw the serving size recommendation on the pack, no participants mentioned that they thought they were not allowed to take more than 30 grams or that they thought it was expected of them to take about 30 grams. Only 4 participants indicated that they thought that the serving size recommendation had something to do with the purpose of the experiment. Of these, only 1 participant indicated that she was influenced by the sticker. When asked about the goal of the study only 6 participants mentioned that investigating the effect of the serving size recommendation sticker on consumption probably was one of the goals of the study. Together, these findings suggest that it is unlikely that our results were driven by demand effects.

Discussion

This study was designed to test whether a serving size recommendation on a large snack package can reduce the amount that participants serve themselves in an actual eating situation. Our results showed that the serving size recommendation significantly lowered the amount of M&M's taken, but only when participants consciously noticed it. This effect was not due to participants' dietary restraint or other participant characteristics. Hence, we conclude that it is indeed important for consumers to become aware of the serving size recommendation, in order for it to be effective in reducing consumption. As in Experiment 1 and 2, we again found that the evaluation of the size of the recommended serving had a significant influence on the amount of M&M's taken and consumed. The amount of snack food that people take thus clearly depends on people's general notions of what a small, reasonable or large portion size is (Brunstrom & Shakeshaft, 2009; Wilkinson et al., 2012) and is not only influenced by environmental factors.

General discussion

We presented three Experiments that investigated whether displaying a pictorial serving size recommendation on food packages affects food quantity decisions and can diminish or even prevent the pack size effect. We argued that consumers are less likely to use the pack size as a reference amount when provided with a serving size recommendation. We conducted two online experiments in which we measured the expected consumption of a number of common, high-calorie snack foods, and one lab experiment in which we assessed how the serving size recommendation affected how much participants served and consumed from a large pack of an unhealthy snack.

Both in Experiments 1 and 2 we found a robust pack size effect, such that participants indicated to eat more from a large than from a smaller pack. The impact of the serving size recommendation, however, differed slightly across the experiments. In Experiment 1, when controlling for the covariate "evaluation of the size of the recommended serving", the serving size recommendation had a main effect such that it lowered consumption to the same extent for both the small and large pack. Although this is a beneficial effect with potentially important health implications, it did not confirm our hypothesis that the pack size effect would be prevented by a clear, pictorial serving size recommendation. In Experiment 2, we therefore included more snack foods to increase statistical power. Because we now also included non-countable food items we added the "I would eat the whole pack" option to the assessment of our dependent variable. We also added the tendency to eat the whole pack as a covariate in order to control for the variance in the data caused by the high consumption of participants who have a tendency to finish a package once they open it. The results of this experiment confirmed our expectation that the pictorial serving size recommendation lowers consumption for large packs but not for small packs, and therefore prevents the pack size effect. Finally, Experiment 3 showed that the serving size recommendation lowered the amount of M&M's participants served themselves, but only when it was noticed by the participants.

Potential implications

Based on the above described findings, we suggest that providing consumers with an alternative reference point for the amount of snack food to consume can be an effective way of reducing the pack size effect. For the serving size recommendation to be effective, consumers do need to be aware of its presence and need to process it so that it can indeed affect food quantity decisions.

To the best of our knowledge, the current experiments are the first to investigate the pack size effect and ways of preventing it using an online method. We replicated the portion size effect that typically occurs in actual eating situations in an online paradigm with food pictures. Our findings correspond with previous research showing that the portion size preferences that people provide while using food pictures (Wilkinson et al., 2012) or food replicas (Bucher, van der Horst, & Siegrist, 2012) align well with actual consumption amounts. Furthermore, our results showed that the pack size effect is also visible when measuring expected consumption. An advantage of online methods is that they provide the researcher with more flexibility, and can be administered quickly and for relatively low costs. Nonetheless, replication in an actual consumption setting remains important. Our lab experiment showed that the percentage of participants who remembered the serving size recommendation was considerably lower in the lab setting than in the online setting. This may be due to the fact that in the lab setting, many other cues compete for a participant's attention than on the computer screen, where a product can be centrally displayed in a very controlled way. This finding indicates that for a serving size recommendation to be effective, consumers' attention needs to be drawn to it, which could be achieved, for example, with highly salient visual cues, and supported with advertising campaigns.

Our finding in Experiment 3 that many participants did not notice the serving size recommendation also has implications for the effectiveness of front-of-pack nutrition labeling. Current front-of-pack nutrition information boxes tend to be rather small and not easily noticeable. If consumers do not even notice a rather big serving size recommendation which includes a picture, it seems highly unlikely that they will consciously notice and use front-of-pack nutrition information.

The findings of Experiment 2 also confirmed our hypothesis that a non-pictorial serving size recommendation in grams is not effective in reducing expected consumption. This finding has important implications for the effectiveness of the serving size information as it is currently displayed on food packages. Serving size recommendations are typically displayed as part of the nutrition label, and particularly for non-countable foods, they are usually presented in grams. Based on our findings, we suggest that such labels are unlikely to reduce consumption.

In all three experiments, the evaluation of the size of the recommended serving had a significant effect on our dependent measures. Despite the influence of external factors on portion size selection, people also have inherent beliefs about what an ideal portion of a given food looks like (Brunstrom & Shakeshaft, 2009; Wilkinson et al., 2012). It is thus important to realize that the amount that people eat is not only determined by environmental factors but also by pre-existing portion size preferences (see also Fay et al., 2011). The importance of other factors in the consumption quantity decision was also visible in the relatively small effect sizes of the pack size and serving size recommendation. This also implies that in studies that investigate the portion or pack size effect and ways to

prevent it using a between-subjects design, it is advisable to include a measure of general portion size preferences for the food under study. When controlling for the variance in portion size preferences across individuals, the effect of the manipulations can be measured more accurately. Furthermore, in a real world setting, the effect of a serving size recommendation will be relative, such that it may mostly change consumption from a large amount to a slightly smaller amount.

Limitations

A potential limitation of our study is the sensitivity of this type of research to demand effects. Showing a serving size recommendation sticker on a pack and then asking people how much they expect they will eat, could lead to demand effects. To prevent such effects as much as possible, we selected an online consumer panel that usually completes marketing studies for companies, rather than for universities. These participants were thus unfamiliar with experimental research in general, and with research focusing on eating behavior. This will have made it less likely that they guessed the purpose of the study and answered accordingly. In addition, and importantly, the non-pictorial serving size recommendation should also have strongly reduced consumption and the pack size effect, if our findings were merely due to demand effects. However, the non-pictorial serving size recommendation did not affect participants' expected consumption. In Experiment 2 we asked how participants determined their expected consumption. Only very few participants directly referred to the serving size recommendation sticker. Finally, also in Experiment 3, very few participants correctly guessed the purpose of the study. Nonetheless, a study in a natural setting in which participants are not aware that their consumption is monitored could be an interesting direction for future research.

In Experiment 3, the lower amount of M&M's taken did not translate into a lower amount of M&M's consumed. This might have been caused by the relatively short time period in which participants could eat. In future research participants could be given more time to finish their desired amount of snack food.

Future research

The exact underlying mechanism by which the serving size recommendation diminishes the pack size effect warrants further investigation. For example, when the serving size recommendation is provided, do consumers only take into account the serving size recommendation when making their consumption quantity decision, or do they then take into account both the pack size and the serving size recommendation? Future research could also study how much attention people need to give to the serving size recommendation for it to be effective.

In line with previous research (Rolls et al., 2004, 2006), we found that the pack size effect was considerably smaller for women than for men. Women are in general more concerned about maintaining a healthy lifestyle than men (Divine & Lepisto, 2005). As a result, women might for example be more likely to have their own consumption rules regarding unhealthy snacks, such as "I should eat no more than 4 pieces of chocolate a day". Investigating why women are less susceptible to the pack size effect than men is an interesting topic for further research.

Another interesting avenue for further study is to determine how providing a serving size recommendation on the pack impacts the consumption experience. In Experiment 1, we measured expected consumption guilt and did not find any differences across conditions and across participants that did or did not follow the serving size recommendation. In Experiment 3, however, liking of the M&M's was somewhat lower in the condition with the serving size recommendation than in the control condition. However as our experiment was not set up to measure the impact of the serving size recommendation on the consumption experience, we cannot easily conclude whether the difference in liking of the M&M's was caused by the presence of the serving size recommendation, and which mechanisms might potentially be responsible. This therefore remains an interesting topic for further investigation, along with developing ways of preventing a potential negative impact of portion size recommendations on product perceptions. Importantly, while adhering to the serving size recommendation could make the consumption experience less indulgent, and not adhering to it could lead to feelings of guilt, the overall effect of limiting the consumption of high-calorie snacks might be an important health benefit.

Conclusion

The portion and pack size effect are likely to be at least partially responsible for the rise in overweight and obesity (Chandon, 2013; Hill & Peters, 1998; Rozin et al., 2003; Young & Nestlé, 2012). The current findings suggest that providing a clear and noticeable reference amount for the consumption decision in the form of a pictorial serving size recommendation can reduce the pack size effect, and we suggest that this approach may constitute a promising topic for further research and a useful strategy for potential interventions.

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Appendix: Supplementary material

Supplementary data to this article can be found online at doi:10.1016/j.appet.2014.12.097.