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Short Communication

Might bigger portions of healthier snack food help?

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ABSTRACT

Two experiments in France investigate how larger portions influence consumption of healthy foods. Our studies compare the portion-size effect across snack foods varying in healthiness (potato chips and apple chips) and in a healthy snack (carrots) in a field setting (a movie theatre). Study 1 showed that doubling the portions increased consumption of both healthy and unhealthy snacks. Study 2, conducted in a movie theatre, showed that high-school students ate more of a healthy snack (baby-carrots) when given a larger portion. It also investigated if the portion-size effect was moderated by the type of movie being watched. Portion-size effect was mitigated when participants watched a food-related (vs. food-unrelated) movie, suggesting that food-focus reduces the effect of the portion size cue. Increasing portion sizes of healthy snacks may be a promising way to promote healthier food consumption. Being exposed to a food-related movie, however, mitigates the effect of portion size on consumption.

1. Introduction

That larger portion sizes encourage greater consumption is well known (e.g., [Wansink & Park, 2001](#)). While many express concerns that the portion-size effect is driving increased consumption of unhealthy, high energy density foods ([Young & Nestle, 2002](#)), the potential for using the portion-size effect for encouraging higher consumption of healthier foods such as fruits and vegetables seems to be overlooked.

In a systematic review of studies examining the portion-size effect, [Zlatevska, Dubelaar, and Holden \(2014\)](#) found that doubling portion sizes resulted in a 35% increase in consumption on average. The effect of increasing portion-size appeared to be attenuated for healthy foods relative to less healthy foods. However, this conclusion is somewhat uncertain because it appears that, in the studies included in this review, healthy foods were mostly meals while unhealthy foods were mostly snack foods. So, healthiness was potentially confounded both with type of food and amount of food served.

Recent research suggested that the portion-size effect holds for healthy foods. [Rolls, Roe and Meengs \(2010\)](#) showed that serving larger portions of vegetables during a meal increased intake among adults. Similarly, bigger portions of fruit and vegetables have been shown to increase consumption among children. Specifically, doubling portion-size increases by 51% the consumption of fruit and vegetables ([Miller](#)

[et al., 2015](#)), by 43% the intake of a fruit side dish ([Kral, Kabay, Roe, & Rolls, 2010](#)), and by 47% the consumption of carrots ([Spill, Birch, Roe, & Rolls, 2010](#)) among children. In these three instances, the portion-size effect for healthy foods exceeded the 35% increase for a doubling of portion size reported by [Zlatevska et al. \(2014\)](#).

But the effects of portion-size on healthy food consumption seem to be moderated by other food attributes. A problem confronting research in this area is that healthy foods can differ from healthier foods not only in terms of healthfulness but on other factors such as taste. For instance, [Roe, Kling, and Rolls \(2016\)](#) have shown that the portion-size effect among adults was greater for foods rated as higher in taste, independently of their nutritional quality. Similarly, [Aerts and Smits \(2017\)](#) found that the portion-size effect among children was reduced for less sweet foods. Although past research suggests that increasing portion-size for healthy foods could be a good strategy to increase healthy eating, there is still need to investigate the boundary conditions of this effect.

The present research builds on this past literature to examine the conditions which might limit or facilitate the operation of the portion-size effect for healthy foods. We thus explore the potential for using larger portion sizes to increase the consumption of healthy foods among young adults and adolescents. The studies show that individuals eat more of healthy snacks offered in larger portion sizes. In a controlled

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setting, larger portion sizes increase consumption equally for healthy and unhealthy snacks (Study 1). We also investigate if the effect of portion-size can be moderated by consumption context. In Study 2, we explore how portion-size influences healthy food consumption in an environment that does (or does not) otherwise cue food consumption.

2. Study 1

The aim of Study 1 was testing the portion-size effect for both healthy and unhealthy foods in a controlled setting. Because social influences are known to have a strong impact on food consumption (Herman, Polivy, & Roth, 2003; Vartanian, Herman, & Polivy, 2007), Study 1 was conducted in a laboratory with cubicles where each participant was isolated from other subjects. Our predictions were that the portion-size effect would operate for both healthy and unhealthy foods, but that it would be larger for unhealthy than for healthy foods.

3. Methods

3.1. Participants and procedure

One hundred and fifty-three French undergraduate students (99 females; $M_{age} = 21.70$; $M_{BMI} = 20.98$) participated in this study in exchange for course credit.

Study 1 used a 2 (portion size: large vs. small) \times 2 (food healthiness: healthy vs. unhealthy) between-subjects design. Small and large portion sizes were 20 g (66 Kcal for apple chips and 111.4 Kcal for potato chips) and 40 g (132 Kcal for apple chips and 222.8 Kcal for potato chips) respectively. Perceived portion-size was measured using a sliding scale anchored 0 = small and 100 = large. The large portion was perceived as larger ($M = 67.18$, $SD = 21.83$) than the smaller one ($M = 55.21$, $SD = 20.89$; $F(1,151) = 11.95$; $p < .01$). A manipulation check confirmed that potato chips were perceived to be less healthy than apple chips ($M_{potato} = 2.59$, $SD = 1.25$; $M_{apple} = 5.59$, $SD = 1.18$; $F(1,151) = 230.41$; $p < .01$).

Participants entered the lab to participate in a product test and received a bowl containing either 20 or 40 g of apple or potato chips. They had three minutes to test the product after which, a research assistant removed the remaining food. Leftovers were unobtrusively weighed to compute consumption in grams and calorie content.

Finally, participants completed a computer-based questionnaire with product evaluation measures, manipulation checks, covariates (e.g., “In general, I like this type of snack”), and demographics. Both the potato and apple chips were rated on a 7-point scale (anchored 1 = untasty and 7 = tasty) as being equally tasty ($F(1,146) = 0.10$; $p = .75$).

4. Results

4.1. Calories in the amount consumed

We conducted a three-way ANCOVA with portion-size, food healthiness, gender, and their interactions entered as independent variables predicting calories consumed (in Kcal). BMI, liking of the food, and time elapsed since the last meal were included as potential covariates. Results revealed no effect of BMI ($F(1,134) = 0.26$; $p = .61$). However, the other covariates were all significant predictors of calorie consumption: gender ($M_{males} = 78.19$ Kcal, $SD = 57.86$; $M_{females} = 58.01$ Kcal, $F(1,134) = 7.46$; $p < .01$), snack liking ($F(1,134) = 7.46$, $p < .01$), and time elapsed since the last meal ($F(1,134) = 12.46$; $p < .01$). The interactions of gender with portion size and healthiness were non-significant (all p 's $> .10$). There were main effects for portion-size and for food healthiness. Participants who received the larger portion ate more calories than those who received the smaller portion ($M_L = 75.48$ Kcal; $M_S = 53.04$ Kcal; ($F(1,134) = 7.00$; $p < .01$). Participants who received the potato chips ate more calories

than those who received the apple chips ($M_P = 75.38$ Kcal; $M_A = 54.11$ Kcal, $F(1,134) = 12.48$; $p < .01$). Of all the participants, only three who were served the small size ate everything and only 2 who were served the large size ate everything. All those who ate everything were served the potato chips. Eliminating these five respondents from the analysis did not alter the significance of any of the results.

4.2. Amount consumed

We also conducted a three-way ANCOVA with portion-size, healthiness of the chips, gender, and their interactions entered as independent variables predicting amount of chips consumed (in g). BMI, liking of the food, and time elapsed since the last meal were included as potential covariates. Results revealed no effect of BMI ($F(1,131) = 0.24$; $p = .62$) so it was dropped from further analysis. However gender, liking and time elapsed since the last meal were all significant predictors of consumption: gender – $M_{males} = 14.32$ g vs. $M_{females} = 10.55$ g, $F(1,131) = 8.84$; $p < .01$, snack liking – $F(1,131) = 19.61$, $p < .01$, time elapsed since the last meal – $F(1,131) = 12.739$; $p < .01$. The interactions of gender with portion size and healthiness were all nonsignificant ($p > .25$). After accounting for the covariates, there were main effects for portion size and for food healthiness. Participants who received the larger portion ate more than those who received the smaller portion ($M_L = 14.09$ vs $M_S = 9.38$; $F(1,131) = 9.31$; $p < .01$). Participants who received the potato chips ate more than those who received the apple chips ($M_P = 13.72$ g vs. $M_A = 9.87$ g, $F(1,131) = 16.77$; $p < .01$).

5. Discussion

Study 1 shows main effects for portion-size and healthiness, but there was no interaction between portion-size and healthiness. These results confirm that the healthier snack (apple chips) responds to portion-size as well as the unhealthier snack (potato chips), but from a lower consumption baseline. Apple chips are simply consumed less. It is noteworthy that there were no ceiling effects in this study since only five participants ate all the snacks offered.

However, the healthy and the unhealthy snack were perceived as equally tasty in Study 1. Although unhealthy foods can be implicitly associated with good taste (Raghunathan, Naylor, & Hoyer, 2006), there is evidence showing that in France healthy foods are associated with tastiness (Werle, Ardito, & Trendel, 2012). This association could explain this absence of difference in taste perceptions among type of snack.

While results suggest that the portion-size effect can be used to increase calorie intake from healthy snacks, this first study only used apple chips as the healthy snack. Study 2 was designed to test our prediction using another, healthier snack—baby carrots—in a more naturalistic setting. We decided to use baby carrots because they are not as sweet as apple chips and they might be perceived as untasty (e.g., Raghunathan et al., 2006), which might limit the portion size effect. In Study 2 we also investigated how consumption context influences the portion-size effect.

6. Study 2

The second experiment used a different form of healthy snacks, namely baby carrots, and the setting was a movie theatre. The first objective was to see if portion-size effects hold for a different healthy snack in the field. The second objective was to explore potential boundary conditions of portion-size effects, specifically, whether this effect is stronger when participants are exposed to an environment containing other food-related cues. This was motivated by previous work (Zlatevska et al., 2014) suggesting that portion-size effects diminish in situations where food was more focal.

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