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How Communications that Portray Unhealthy Food Consumption Reduce Food Intake Among Dieters

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Abstract

Both regulatory agencies and nonprofit organizations seek to understand how different tactics and appeals contained in food and public health advertisements might influence the food intake of an increasingly dieting-concerned population. This article addresses this important issue by examining how consumers who are concerned with their diets react to rich images of unhealthy food consumption. Results of two experiments show that exposure to food advertisements containing unhealthy food consumption imagery reduces food intake among consumers chronically concerned with dieting, whereas a third experiment shows a similar decrease in intended consumption when a public health advertisement portrays the consumption of unhealthy food. These findings in turn offer guidelines for maximizing the effectiveness of messages that attempt to promote healthy eating habits. Additionally, this research provides theoretical contributions to the self-control and mental imagery research domains which have public policy implications for regulatory agencies and nonprofit organizations.

Keywords: dieting concern, consumption imagery, health goal, counteractive control theory

Advertisers trying to market unhealthy food often employ a tactic whereby they provide vivid consumption imagery of the portrayed food item (Poor, Duhachek, and Krishnan 2013). We provide preliminary evidence of the prevalence of such consumption imagery in the advertising of unhealthy foods using a systematic review of the commercials aired during the Super Bowl, the most-watched television broadcast in the United States, over the past 16 years (2006-2021; see Web Appendix A). Descriptive analysis revealed that viewers of each of the approximately four-hour-long broadcasts were exposed to an average of 6.88 food commercials, with 65.5% of those commercials portraying consumption imagery, such as a character eating the advertised food. Interestingly, public health advertisements have at times used similar visual depictions of unhealthy food consumption in attempts to curb (as opposed to encourage) the consumption of unhealthy food (e.g., New York City's Health Department campaign advocating against excessive consumption of sugary drinks; Vitality Institute 2013; see Web Appendix B). This apparent inconsistency in how practitioners use consumption imagery of unhealthy food is mirrored in the literature, with prior research indicating that consumption imagery (portrayed or imagined) has the potential to either increase (Poor, Duhachek, and Krishnan 2013) or decrease (Morewedge, Huh, and Vosgerau 2010) the enjoyment of food and subsequent food intake.

Notably, however, food choices and consumption are guided not only by consumers' attraction to pleasant, palatable food but also (and increasingly) by their growing considerations of health, weight, and diet factors (Bublitz, Peracchio, and Block 2010; Papies, Stroebe, and Aarts 2008a). These drivers often come into conflict, even as they coexist, and their germane role in influencing consumers' food choices offers a partial explanation for why thoughts about food taste tend to be connected to thoughts about health or body weight (Raghunathan, Naylor, and Hoyer 2006; Stroebe et al. 2013). As Fishbach, Friedman, and Kruglanski (2003) demonstrate,

images of tasty food can elicit thoughts about health, thereby reducing rather than increasing the consumption of unhealthy food. In line with this reasoning, consumption imagery might bring to mind more than just the sensory, palatable aspects of food but also conjure conflicting thoughts about its impact on health or diet. We examine this possible link, answering the calls from health practitioners (Pollack 2013), policymakers (Gottlieb 2018), and consumer protection groups (Obesity Health Alliance 2017) for research examining the impact of food communications on food consumption. Specifically, we attempt to give more clear guidance to policymakers by studying how consumption imagery—a key feature of food and public health advertising that can be easily manipulated—affects thoughts relating to dieting and consumption of unhealthy food among health-concerned consumers.

Building on research on mental imagery (Kosslyn, Ganis, and Thompson 2001; Morewedge, Huh, and Vosgerau 2010) and self-control (Fishbach, Friedman, and Kruglanski 2003; Stroebe et al. 2013), we contend and demonstrate, across two studies involving actual food consumption, that individuals chronically concerned with their diet consume less unhealthy food when they are exposed to unhealthy food advertisements that include consumption imagery, relative to unhealthy food advertisements that do not portray food consumption. In a third study, we demonstrate a similar reduction in intended unhealthy food intake when consumption imagery of unhealthy food is inserted in a public health advertisement promoting healthy eating.

It is recognized that dieting has become a central feature of many consumers' lives, with nearly 80% of the U.S. adult population reporting concerns about the healthiness of the food they consume (Pew Research Center 2016). Whilst previous research has analyzed the effects of consumption imagery on food intake among those not necessarily concerned with their diets (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010; Poor, Duhachek, and

Krishnan 2013), this paper contributes to the literature by being the first, to the best of our knowledge, to examine how consumers who are chronically or momentarily concerned with their diet react to consumption imagery featuring unhealthy food, a tactic widely employed in food and public health advertisements alike. We also contribute to the counteractive control theory, which shows that unhealthy food imagery triggers thoughts about a healthy diet (Fishbach et al. 2003; Stroebe et al. 2013), by examining how consumption imagery magnifies this effect. Specifically, consumption imagery increases the likelihood that dieters resist the temptations of unhealthy food.

More importantly, our findings have notable implications for policymakers attempting to curtail the negative impacts of an obesogenic media environment on consumers' health. A widely accepted caution suggests that policymakers should be mindful of their use of health messages because overexposure can cause diminishing or even boomerang effects (Main and Darke 2020; Ringold 2002; Stewart and Martin 1994). The present research suggests that policymakers can improve the efficacy of messages promoting healthful eating by accompanying the portrayal of the consumption of unhealthy food with messaging indicating that the consumption of such unhealthy food represents a failure in achieving important health goals—foregoing the oft-used practice of depicting the consumption of healthy food (see Web Appendix G for a marketplace example).

In the following section, we review the literature that has explored how dieting concern influences people's responses to food cues and how consumption imagery impacts food intake. We build on these two lines of research to predict how dieters will respond to communication campaigns that portray the consumption of unhealthy food. We then present the results of three

studies to support our basic predictions and discuss their theoretical and substantive contributions to the development of effective healthy eating campaigns.

Theoretical Development

How Dieters React to Unhealthy Food

When faced with food stimuli, people oftentimes simply ask themselves “Do I want that?” and decide whether to eat it according to their desire for the food (Bublitz, Peracchio, and Block 2010, p. 241). But other times, people engage in much more complex, conflicting decision-making processes characterized by considerations regarding the potential impact of the consumption of the food on one’s health and/or weight gain (Bublitz, Peracchio, and Block 2010; Papies and Veling 2013). While such concerns might become chronically integrated into some consumers decision processes, they are often made momentarily salient to a larger share of the population by a multitude of contextual and social elements (e.g., health messages, dieting concern of surrounding consumers; Bublitz, Peracchio, and Block 2010; Papies and Veling 2013). Notably, consumers who are concerned about their diet, whether chronically or momentarily, associate food consumption with two desired but seemingly opposing forces: promoting a healthy lifestyle versus enjoying a tasty, pleasurable meal (Bublitz, Peracchio, and Block 2010; Herman and Polivy 2008). The conflict created by these opposing forces tends to prompt chronically or momentarily diet-concerned consumers, to whom we will refer hereafter as ‘dieters’ for the sake of simplicity, to think more about food and their food options than non-dieters (Polivy 1998) as they constantly try to regulate their food intake to achieve their dieting goals (Papies and Veling 2013).

Notably, the dieters' greater focus on food may serve as a double-edged sword as they attempt to attain their dieting goals. On the one hand, exposure to appetizing food can, in some cases, disturb this fragile balance between dieting goals and the desire to enjoy a tasty meal, thereby increasing unhealthy food consumption among dieters (Herman and Polivy 2008; Stroebe et al. 2013; Veling, Aarts, and Papies 2011). On the other hand, much evidence suggests that dieters usually reduce rather than increase their unhealthy food intake after exposure to unhealthy food. For example, Fishbach, Friedman, and Kruglanski (2003) show that simple exposure to tempting foods decreases intake among successful dieters, because they spontaneously think about health, so their dieting goals get activated.

In sum, the extant literature suggests that dieters' ability to maintain focus on their higher priority dieting goals ultimately determines whether they resist or succumb to the urges aroused by tempting food cues (Stroebe et al. 2013). Accordingly, much research concurs that dieters often struggle to control their impulses and will eventually succumb to the temptation of unhealthy food (Stroebe et al. 2013). Therefore, it would be beneficial to identify factors that might help dieters direct their attention to dieting goals upon exposure to unhealthy food. We propose that unhealthy consumption imagery, a ubiquitous component of food and public health advertising, might help dieters direct their attention to their higher priority dieting goals.

Food Consumption Imagery and Dieting Concern

Research on mental imagery (Decety and Grèzes 2006; Kosslyn, Ganis and Thompson 2001; Morewedge, Huh, and Vosgerau 2010) suggests that imagery depicting an experience (e.g., food consumption) elicits affective responses, similar to those prompted by the actual experience. For example, images of a person being hit by a hammer activate neural networks associated with pain processing among observers, eliciting affective and behavioral responses

consistent with feelings of pain (Jackson, Meltzoff, and Decety 2005). Exposure to an imagery-evoking advertisement, therefore, increases the likelihood that consumers mistakenly believe they have had the consumption experiences portrayed in that advertisement (Rajagopal and Montgomery 2011). Building on these arguments, we suggest that consumption imagery of unhealthy food elicits dieters' cognitive, affective, and motivational responses, similar to those elicited by the actual consumption of unhealthy food. What might these responses be?

Dieters may find unhealthy food appetizing, but they associate its consumption with weight gain, which would signal a failure in their dieting goals, considering their substantial chronic or temporary concern with weight control and dieting (King, Herman, and Polivy 1987; Papies and Veling 2013; Stroebe et al. 2013). After consuming unhealthy food, dieters tend to shift their attention toward their dieting goals, bringing those goals forward when making subsequent consumption decisions (Inzlicht, Bartholow, and Hirsh 2015; Louro, Pieters, and Zeelenberg 2007). For example, Louro, Pieters, and Zeelenberg (2007) find that participants who are chronically concerned with dieting (study 1) or situationally primed to focus on dieting (study 3) become more likely to engage in goal-consistent behaviors (e.g., drinking an aversive, albeit healthy, drink) after indulging in unhealthy food consumption. Following this reasoning, we contend that if consumption imagery elicits cognitive, affective, and motivational responses that are similar to the outcomes of actual consumption, then exposure to unhealthy food consumption imagery should elicit thoughts associated with dieting and health among dieters (cf. diet-unconcerned consumers), which in turn should reduce their unhealthy food intake.

This proposed mechanism reflects research into counteractive control theory (Fishbach, Friedman, and Kruglanski 2003), which establishes how images of unhealthy food can activate health goals spontaneously among successful dieters. We complement these insights and

integrate the literature on multiple goal pursuit (Louro, Pieters, and Zeelenberg 2007) to propose that eliciting mental images of the consumption of unhealthy food might prompt cognitions and feelings consistent with those that dieters feel after failing in their dieting goals. This effect should strengthen the spontaneous activation of dieting goals that Fishbach and colleagues (2003) observed in their studies.

An interesting implication of our proposed counteractive control mechanism is that exposure to consumption imagery of unhealthy food should result in reduced consumption of any type of unhealthy food, even if unrelated to the food portrayed. This hypothesis is in line with the findings of Fishbach et al. (2003, study 5), where participants who were exposed to several images of unhealthy food (i.e., chocolate bars, cookies, chips, and cakes) were more inclined to reject otherwise unrelated unhealthy food items (e.g., hamburger, pizza, and soda). We, therefore, expect that, in contrast to alternative explanations based on the sensory-specific habituation to the food taste (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010), that the effects of exposure to unhealthy food consumption will not to be stimulus-specific.

Moreover, to provide a more nuanced understanding of the effect of consumption imagery on unhealthy food intake, in the present research we also examine the role of a substantively relevant boundary condition—the healthiness of the portrayed food. Consistent with our theorizing and prior research (Fishbach, Friedman, and Kruglanski 2003; Wilcox et al. 2009), we predict that the effect of food consumption imagery on intention to consume unhealthy food will occur only when consumers view images of consumption of unhealthy food, but not when they see consumption of healthy food. This is because the reduction in unhealthy food consumption is provoked by the feelings and cognitions people sense when they fail to achieve

the active dieting goal (Fishbach, Friedman, and Kruglanski 2003; Louro, Pieters, and Zeelenberg 2007). In contrast, thinking about the consumption of healthy food should elicit a sense (even if unconscious) that the goal has been attained (Wilcox et al. 2009), which in turn should increase rather than reduce intention to consume unhealthy food (Louro, Pieters, and Zeelenberg 2007; Wilcox et al. 2009). Accordingly, reduced intentions to consume food should emerge only if chronic or temporary dieters have been exposed to consumption imagery involving unhealthy food, not imagery depicting healthy food.

Overview of Studies

We test these theoretical propositions in three studies. In Study 1, we manipulate unhealthy food consumption imagery using two real advertisements for candies (M&Ms) that vary in their consumption imagery (high vs. low), assess participants' chronic dietary concerns, and examine their combined effect on actual food intake. With Study 2, we replicate findings from Study 1 while addressing some potential confounds associated with the use of different advertisements by using a single advertisement (i.e., an advertisement for unhealthy food that does not portray consumption) and asking participants to imagine either eating the advertised food or filming it themselves. Moreover, Study 2 rules out alternative explanations based on sensory habituation, by showing that exposure to consumption imagery of unhealthy, savory food (i.e., the hamburger) diminishes the actual intake of unhealthy, sweet food (i.e., chocolate biscuits) among consumers chronically concerned with their diets. In Study 3, we address the public policy implications of our findings more explicitly by examining the effect of consumption imagery on intended unhealthy food intake when the imagery is included in a public health advertisement that directs all consumers (chronically concerned with dieting or not) to think about dieting. Finally, Study 3 provides evidence that such reduction in intended

unhealthy food intake is driven by consumers' thoughts about dieting and is contingent upon the fact that the portrayed consumed food is unhealthy.

Study 1: Consumption Imagery and Unhealthy Food Intake

In Study 1, we expose participants to advertisements for unhealthy food that feature varying levels of consumption imagery, then assess participants' unhealthy food intake. Previous research on mental imagery (Decety and Grèzes 2006; Kosslyn, Ganis and Thompson 2001; Morewedge, Huh, and Vosgerau 2010) shows that images depicting an experience result in mental responses similar to the actual experience. Therefore, in this study, we manipulate consumption imagery with an existing advertisement illustrating a character consuming candy. By using real advertisements for unhealthy food, this study offers good ecological validity.

Methods

Participants and Procedure. One hundred thirty-two undergraduate students participated in this study in exchange for course credit (53.8% women; $M_{\text{age}} = 22.02$ years, $SD = 1.33$). All participants who presented themselves in the lab for this study were kept in the final data set. One participant did not answer all the questions (i.e. the sociodemographic questions), resulting in several missing observations. We chose to keep this case though; the results remain the same whether we exclude it or not. The study design featured a between-subjects manipulated factor with two levels (consumption imagery: high vs low). After entering the laboratory and taking seats in front of computers in separate cubicles, participants were randomly assigned to one of the two consumption imagery conditions (high vs. low). The instructions asked them to evaluate an advertisement for M&M's (see Web Appendix C). The advertisement with high consumption imagery featured M&M's in different colors and a young man eating them; the version with low

consumption imagery depicted an M&M's cartoon character trying to run away from a supermarket cashier, without any consumption taking place. Both advertisements played background music and were 31 seconds long.

Next, participants had to evaluate a product that ostensibly represented a new recipe (in reality, they were traditional peanut M&M's). They received a small glass of water and a container with 70 grams of M&M's, then they were informed that they had 3 minutes to taste as much of the candy as they needed to complete their evaluations. After 3 minutes, the experimenter removed the product, and unobtrusively weighed it, to determine participants' consumption. Participants then completed another questionnaire with items about the product tested (peanut M&M's), their general dietary behaviors, and sociodemographic information. Participants were thanked for their participation and debriefed.

Measures. We calculated the amount of candy consumed (in grams) by subtracting the amount remaining after consumption from the initial amount (70 grams). We assessed participants' chronic concern with diet by asking them to complete three items from the Dietary Restraint Scale by Herman and Polivy (1975). This bidimensional scale assesses people's tendency to experience weight fluctuations and their concerns with dieting (see Bublitz et al. 2010 for a detailed discussion of these two dimensions). However, given our focus on dietary concern (as opposed to the larger construct of dietary restraint) and noting criticisms of its low reliability (Allison, Kalinsky, and Gorman 1992), we selectively use only the three items that consistently present the highest loading on the factor regarding concerns with dieting factor (see Ruderman 1983 for a detailed study of the psychographic properties of the scale). Specifically, participants used 5-point scales (1 = "Never" to 5 = "Always") to answer the following questions: "How often are you dieting?" "Do you give too much time and thought to food?" and

“How often do you have feelings of guilt after overeating?” We averaged the scores to form the dietary concern scale (Cronbach’s $\alpha = .72$). Finally, participants provided demographic information (including self-reported weight and height to establish their BMI) and their opinions about the study’s objectives. No participant guessed the research objective correctly.

Pretest

In a pretest with two hundred participants recruited from Prolific Academic (51.3% women; $M_{\text{age}} = 33.91$, $SD = 12.65$) we tested the stimuli used in the study. Participants were randomly exposed to one of the videos presented above (low consumption imagery advertisement versus high consumption imagery advertisement). To assess the consumption imagery that the videos elicited, participants answered 7-point scales (1 = "Do not agree at all" to 7 = "Totally agree"), with two statements: "When I watched the advertisement, a lot of images of product consumption came to my mind" and "When I watched the advertisement, I imagined myself consuming the product portrayed" ($r = .59$, $p < .001$). We also assessed the number of images that participants imagined while watching the advertisement, using 7-point scales (1 = "Do not agree at all" to 7 = "Totally agree"), with the following statements (Cronbach's $\alpha = .822$): “A great number of images came into my mind,” “Many images came into my mind,” and “I had few images in my mind” (reverse-coded) (Bone and Ellen 1992).

T-tests indicated that respondents experienced a higher number of images while watching the high imagery advertisement ($M = 4.60$, $SD = 1.41$) than while watching the low imagery advertisement ($M = 3.61$, $SD = 1.36$; $t(198) = 5.03$, $p < .001$). More specifically, participants reported having marginally more consumption images when watching the high imagery advertisement ($M = 4.41$, $SD = 1.65$) compared to the low imagery advertisement ($M = 4.01$, $SD = 1.65$; $t(198) = 1.70$, $p = .09$). Finding a significant effect on the number of unspecified images

but only a marginally significant effect on consumption imagery underscores the typical issues associated with manipulating constructs using real advertisements. We address this issue in studies 2 and 3.

Results

Before running the analyses on the current study, we checked the effects of our manipulations on dietary concern. A t-test indicated no significant differences in reported dietary concern between the two conditions ($p > .10$, see Table 1).

Food Consumption. We tested for a moderating effect of dietary concern on candy consumption using model 1 from Hayes's (2013) Process macro, with the amount of candy consumed (in grams) as the dependent variable and, as predictors, we used a dummy variable representing the consumption imagery manipulation (1 = high; 0 = low), mean-centered dietary concern, and their interaction. Consistent with our predictions, the two-way interaction is significant ($\beta = -4.75$, $t(125) = -2.05$, $p = .042$), whereas all other effects are non-significant ($ps > .40$). Furthermore, the moderation analysis reveals that the effect of the imagery condition on the amount of candy consumed is significant only among dieters, who self-reported their high chronic dietary concerns (+1SD, $\beta = -6.67$, $p = .043$), and not among those who reported average or low dietary concerns ($p > .38$). We then ran a follow-up analysis in which we added BMI as a covariate on the regression model to reduce error due to individual differences in BMI, as is typical in research on food consumption (e.g., Wilcox et al. 2009). When inserting BMI as a covariate in this analysis, BMI appears to have a significant, positive effect on chocolate candy intake ($\beta = 1.42$, $t(124) = 2.59$, $p = .011$). All the other effects remain similar to the ones reported above: two-way interaction remains significant ($\beta = -5.23$, $t(124) = -2.15$, $p = .034$), while the other main effects (of imagery manipulation and dietary concern) are not significant ($ps > .40$).

In detail, and as illustrated in Figure 1, participants with high dietary concerns (+1 SD) consume less candy when exposed to the advertisement with high (vs. low) consumption imagery ($M_{\text{high}} = 19.11$, $M_{\text{low}} = 25.79$, $t(125) = -2.05$, $p = .042$; with BMI included as a covariate: $t(124) = -1.97$, $p = .05$). Participants who reported average ($M_{\text{high}} = 22.84$, $M_{\text{low}} = 24.77$) or low (-1SD) ($M_{\text{high}} = 26.56$, $M_{\text{low}} = 23.74$) dietary concerns do not differ in their consumption across conditions, regardless of whether we include BMI as a covariate or not ($ps > .20$). Finally, in a Johnson–Neyman analysis (Spiller, Gavan, and McClelland 2013), we find that when the mean-centered dietary concern is higher than .86, the effect of consumption imagery on chocolate candy intake becomes significant. That is, participants who self-report values of 2.89 or higher in defining their dietary concern (not mean-centered) consume significantly less candy after watching the advertisement rich in consumption imagery compared with watching the advertisement low in such imagery.

Figure 1 about here

Discussion

Study 1 supports our prediction that dieters consume less unhealthy food when exposed to an appetizing, unhealthy food advertisement with high (vs. low) consumption imagery. This finding contributes to research on the effect of food cues on intake (Fishbach, Friedman, and Kruglanski 2003; Stroebe et al. 2013) by showing that unhealthy food consumption imagery produces effects above and beyond those of simple exposure to food imagery without consumption. We theorize that exposure to consumption imagery reduces food consumption because it elicits mental images associated with food consumption, which have been shown to

activate responses similar to the actual consumption (Kosslyn et al. 2001; Morewedge, Huh, and Vosgerau 2010). We examine this assumption in study 2 by explicitly asking participants to imagine themselves eating the portrayed food. Moreover, notwithstanding its ecological validity, the use of real advertisements in Study 1 has limitations because the differences across real advertisements raise the specter of potential confounds and possibly dilute the effect of consumption imagery, the target of the manipulation. The latter concern is partially corroborated by the results of our pretest, as the difference in self-reported consumption imagery between conditions is only marginally significant. We address these internal validity concerns in Study 2 by using a more controlled manipulation of eating imagery.

Study 2: Consumption Imagery and Intake Across Food Categories

With Study 2, we seek further support for our theory, while holding the stimulus constant across conditions. In Study 1, we showed that our predicted effects hold when people see someone else consuming unhealthy food. In this study, we wanted to show the robustness of our findings and examine whether our effects also hold when they imagine themselves consuming unhealthy food. Prior research (Jackson et al. 2001) indicates that imagining oneself experiencing the outcome of a behavior produces similar affective and behavioral responses to seeing someone else experiencing the same behavior. Therefore, we manipulate consumption imagery more directly by exposing participants to an advertisement for a hamburger and then asking them to imagine either consuming the product or filming it. In line with MacInnis and Price (1987), we use imagination instructions in both conditions to control for potential confounds and maintain the same level of elaboration. With Study 2, we also examine the effect of consumption imagery across different unhealthy food product categories. In contrast with prior research (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010), we

expect that the effects are not stimulus-specific, such that consumption imagery of one type of unhealthy food (e.g., a savory hamburger) should lead to decreases in the intake of another unhealthy food (e.g., sweet candy), even when the foods do not share flavor characteristics.

Methods

Participants and Procedure. One hundred and thirty business students completed this study in exchange for course credit (56.2% women; $M_{\text{age}} = 20.15$ years, $SD = 5.34$). All participants who presented themselves for this study were kept in the final data-set. As in Study 1, this study design featured a between-subjects manipulated factor with two levels (consumption imagery: high vs low). After entering the laboratory and taking seats in front of computers in separate cubicles, participants started with an advertising study, followed by an ostensibly unrelated product tasting. We also assessed their dietary concerns and sociodemographic characteristics (including BMI).

In the alleged advertising study, participants were randomly assigned to one of the two conditions (high vs low consumption imagery). In the high consumption imagery viewing condition, participants had to observe the advertisement while imagining eating the portrayed product; in the low consumption imagery condition, they were asked to observe the advertisement while imagining filming the portrayed product. All participants watched a 23-second television commercial for a hamburger (see Web Appendix D), McDonald's® Big Tasty® Bacon, that presented a rich visual demonstration of all the ingredients (i.e., bread, hamburger patty, bacon, cheese, tomato, and sauce) with musical background ("O Fortuna," from *Carmina Burana*). No actor appeared, and there was no consumption imagery. Consistent with the cover story, participants evaluated this advertisement on a series of dimensions.

After this advertising study, participants received instructions for an ostensibly unrelated task, in which they had to evaluate a new recipe of an existing product (chocolate-coated biscuit sticks). Each participant received a silver, unbranded package with 90 grams of chocolate biscuits. They were told that they had 3 minutes to test the product, after which the research assistant gathered the remaining product and instructed participants to continue by answering a questionnaire on the computer. In the end, participants were thanked and debriefed.

Measures. The amount consumed was calculated by subtracting the amount remaining from the initial weight of the pack (90 grams). We used the scale from Study 1 to measure dietary concern (Cronbach's $\alpha = .65$). No participant guessed the objective of the study accurately.

Pretest

To test the effectiveness of our manipulations, we ran a pretest with two hundred participants recruited from Prolific Academic (58.3% women; $M_{\text{age}} = 33.67$, $SD = 12.14$) who were randomly exposed to the study's video, which was preceded by instructions to either imagine eating the food portrayed or to imagine filming it. We asked participants to indicate the number of images that came to mind while watching the advertisement (Cronbach's $\alpha = .617$) and the consumption imagery the advertisement elicited ($r = .55$, $p < .001$) using the same scales as in the pretest of Study 1.

Participants reported significantly more consumption images when watching the advertisement in the high consumption imagery condition (while imagining eating the food portrayed: $M = 5.35$, $SD = 1.29$) compared to watching the advertisement in the low consumption imagery condition (while imagining filming the food portrayed: $M = 4.12$, $SD = 1.89$; $t(198) = 5.37$, $p < .001$). T-tests indicated that respondents experienced the same number of

general, unspecified images ($M_{\text{eat}} = 3.91$, $SD = 1.40$; $M_{\text{film}} = 3.64$, $SD = 1.38$; $t(198) = 1.41$, $p > .15$). The pretest therefore confirmed the effectiveness of our manipulations.

Results

We first checked for the effects of our manipulations on dietary concern. T-tests indicated no significant differences in reported dietary concern between the two conditions ($p > .10$, see Table1).

Food Consumption. The results regarding the amount that participants consumed matched those from Study 1, even though the product differed from what was presented in the advertising stimuli. Specifically, we ran a regression using model 1 from Hayes's (2013) Process macro with chocolate biscuits consumption (in grams) as the dependent variable and consumption imagery (1 = high, 0 = low), the mean-centered dietary concern, and their interaction as predictors. The results yield a marginally significant interaction between dietary concern and consumption imagery ($\beta = -3.97$, $t(123) = -1.90$, $p = .059$). When inserting BMI as covariate in the above analysis, BMI has a marginally significant effect on chocolate biscuits intake ($\beta = .74$, $t(122) = 1.91$, $p = .058$), whereas the effect of dietary concern becomes marginally significant ($\beta = 2.47$, $t(122) = 1.70$, $p = .093$) and the interaction effect of consumption imagery and dietary concern becomes significant ($\beta = 4.74$, $t(122) = -2.25$, $p = .026$).

As illustrated in Figure 2, participants with high dieting concerns (+1SD) consumed less of the biscuit (albeit marginally so) when they had been instructed to engage in active consumption imagery processing (high consumption imagery condition) than when they were instructed to engage in low consumption imagery processing ($M_{\text{high}} = 13.50$, $M_{\text{low}} = 18.61$, $\beta = -5.11$, $t(123) = -1.73$, $p = .085$). No such differences arise among participants with average ($M_{\text{high}} = 15.18$, $M_{\text{low}} = 16.32$, $\beta = -1.14$, $t(123) = -.55$, $p > .58$) or low (-1SD, $M_{\text{high}} = 16.85$, $M_{\text{low}} =$

14.03, $\beta = 2.82$, $t(123) = .96$, $p > .34$) dieting concern scores. A Johnson–Neyman analysis (Spiller et al. 2013) indicates that although the effect of consumption imagery on biscuit intake is only marginally significant among participants reporting +1SD above the mean in dieting concern ($\sim .69$) when the mean-centered dietary concern is equal or greater than .84 the effect becomes statistically significant. That is, dieters who reported dietary concerns of 2.80 (not mean-centered) and higher consumed less of the chocolate-covered biscuits after they had been instructed to imagine consuming the hamburger rather than imagine filming it. Finally, follow-up analyses including BMI as a covariate indicate a significant effect of consumption imagery in chocolate biscuits consumption among participants with high dietary concern ($\beta = -6.60$, $t(122) = -2.06$, $p = .042$). All the other effects remain similar after controlling for BMI.

Figure 2 about here

Discussion

With this study, we establish that it is possible to prompt decreased food intake among dieters, simply by asking them to imagine the consumption of unhealthy food. This study also controls for the potential confounds that might have arisen in our ecologically valid manipulation using real advertisements in Study 1. As a further extension of our prior findings, Study 2 shows that among dieters, evoked consumption imagery diminishes their intake of *sweet* food, even if they imagine the consumption of unhealthy *savory* food.

Study 3: Consumption Imagery in Dieting Campaigns

Having established support for our basic predictions, in Study 3 we examine their more specific implications for public policy efforts aimed at curbing unhealthy food intake. In this study, we change the context in which the consumption imagery is presented, introducing it embedded in a public health advertisement rather than in a commercial food advertisement. Public health advertisements (or public service announcements) are a form of communication similar to regular advertisements (Nan 2008) but aim to increase the well-being of consumers and society as a whole rather than to sell products and services. Policymakers often design such communication campaigns to motivate consumers to eat healthier, but too many messages calling for people to modify or limit their consumption of potentially harmful products can have limited effects or even boomerang reactions (Main and Darke 2020; Stewart and Martin 1994). In trying to optimize the use of health communication, which strategy should policymakers implement—using images portraying healthy or unhealthy food? With or without consumption?

Consistent with our theorizing, imagining the consumption of unhealthy food conveys failure on a central goal, which is followed by increased motivation to pursue health goals. In the case of imagining healthy food consumption, it should create a sense that the goal has been attained (Wilcox et al. 2009), thus inhibiting healthy choices (Louro, Pieters, and Zeelenberg 2007; Wilcox et al. 2009). Accordingly, we expect that the reduction in the consumption of unhealthy food should be observed if the consumption imagery portrays unhealthy food, but not if it portrays healthy food. We test this prediction in Study 3 by manipulating the healthiness of the products portrayed in the public health advertisement.

The use of public health advertisements as a context has an important implication. In studies 1 and 2, we assessed an individual's chronic accessibility of dieting concern and

demonstrated that consumption imagery reduces unhealthy food consumption only among consumers chronically concerned with their diets. This happens because, in the context of a food advertisement, concern for dieting is likely to be accessible (and thus influence behavior) only among viewers that are chronically prone to focusing on dieting. However, exposure to communication promoting healthy eating should make dieting concerns accessible for most if not all viewers (Papies and Veling 2013). This implies that prompting thoughts about the relationship between unhealthy food consumption and failure with dieting goals should successfully elicit the viewers' counteractive control tendencies that we theorize underlie our effects, regardless of their chronic concern for dieting (see Kroese et al. 2011 for evidence in support of this prediction). Therefore, we do not expect dietary concern to moderate the effects of consumption imagery and food healthiness on unhealthy food consumption.

Finally, in our prior studies, we manipulated consumption imagery either by portraying a character consuming food (study 1), a pervasive strategy in food advertisements and public health advertisements, or by inviting participants to imagine themselves consuming the product (study 2). In this last study, we took inspiration from real public health advertisements and combined both strategies by showing an image of someone consuming the food while simultaneously inviting the viewers to imagine themselves consuming the portrayed product. We believe that instruction to imagine paired with showing consumption imagery should strengthen the elicitation of mental images of consumption that we theorize drive our effects.

Method

Participants and Procedure. Five hundred and ninety-four adult U.S. consumers (48.7% women; $M_{\text{age}} = 38.73$ years, $SD = 11.70$), sampled from the online MTurk crowdsourcing platform, participated in this study in exchange for a small compensation. We avoided ballot

boxing (see Aguinis, Villamor, and Ramani 2020) by limiting one response per Internet Protocol (IP) and geolocation (see Web Appendix E.1). Participants were first exposed to a print health advertising displaying a woman's mouth eating a food item (French fries or apple, depending on randomly assigned condition; see Web Appendix E.2). We created the public health advertisement by adapting a real campaign designed by the New York City Department of Health and Mental Hygiene (Hunter College New York City Food Policy Center 2014, see Web Appendix F). Specifically, in the unhealthy, high consumption imagery condition, the message instructed participants to "Imagine eating these French fries. They are tasty, crunchy, salty...delicious fries! Is this the choice you want to make? You don't need to indulge!" In the healthy, high consumption imagery condition, the message instructed participants to "Imagine eating this apple. It is tasty, crunchy, sweet...a delicious apple! Is this the choice you want to make? You need to go for it!" In the unhealthy, low consumption imagery condition, the message instructed participants to "Look at these French fries. They are thinly cut, salted...deep-fried potatoes! Is this the choice you want to make? You don't need to indulge!" In the healthy low consumption imagery condition, the message instructed participants to "Look at this light-green apple. It is fully ripe, delicate...a Granny Smith apple! Is this the choice you want to make? You need to go for it!" All advertisements ended with the message "Make real, healthy choices!" next to the logo of the FDA (see Web Appendix E.2).

Measures. We measured consumption intentions by asking participants to "Imagine that you are about to have a snack and you open a bag of chips. There are 20 chips in the bag. How many potato chips would you eat RIGHT NOW?" Participants indicated their answer on a slide bar from 0 to 20. Next, using a 7-point scale (1 = Never; 7 = All the time) adapted from Conner, Norman, and Bell (2002) we asked participants to indicate the extent to which they were thinking

about maintaining a healthy diet: “Thinking about the next two weeks, how often would you say that you...” “expect to eat healthier than usual” and “will try to eat healthier than usual.” ($r = .76$). We also gathered information about the dietary concern using the same items as in prior studies (Cronbach’s $\alpha = .70$), demographic information (including BMI) and predictions about the research objective. None of the participants guessed the objective accurately.

Pretest

Similar to the previous studies, we ran a pretest to evaluate the public health advertisements. In this pretest, two hundred and fifty-nine participants recruited from MTurk (48.8% women; $M_{\text{age}} = 39.75$, $SD = 12.57$) were randomly assigned to one of the four print advertisements used in the study. Only complete answers were included in the final sample (see Web Appendix F). We asked participants to indicate the number of images that came to mind while watching the advertisement (Cronbach’s $\alpha = .765$) and the consumption imagery the advertisement elicited ($r = .61$, $p < .001$) using the same scales as in the previous pretests.

Participants reported having significantly more consumption images when watching the high imagery advertisement ($M = 4.97$, $SD = 1.36$) compared to the low imagery advertisement ($M = 4.49$, $SD = 1.70$; $F(1, 255) = 5.42$, $p = .02$); we find no main ($F(1, 255) = .74$, $p = .38$) or interactive effect of food unhealthiness ($F(1, 255) = 2.41$, $p = .12$), thus confirming the effectiveness of the consumption imagery manipulation. Results also indicated that participants experienced the same number of general, unspecified images across consumption imagery conditions ($M_{\text{high}} = 3.68$, $SD = 1.47$; $M_{\text{low}} = 3.63$, $SD = 1.54$; $F(1, 255) = .003$, $p = .96$); notably, we also find that unhealthy food generate significantly more general, unspecified images ($M = 3.82$, $SD = 1.15$) than healthy food ($M_{\text{high}} = 3.43$, $SD = 1.23$; $F(1, 255) = 4.16$, $p = .04$). Although this effect is significant, we do not consider it a threat to the validity of our manipulations

because (1) the overall means are low, (2) there is no obvious explanation for the finding, and (3) it does not present any plausible alternative interpretation for the effects observed in the main study.

Results

Intention to Eat. Since the dependent variable is a count variable (it can take exclusively discrete values from 0 to 20), we ran a Poisson regression (Shah and George 2020), using the number of potato chips intended to eat as the dependent variable, and consumption imagery condition (1 = high, 0 = low), unhealthiness (1 = unhealthy, 0 = healthy) and their interaction as predictors. Although we did not predict an effect of dietary concern, we included (mean-centered) dietary concern and its two- and three-way interactive effects with the manipulations to test and rule out its role in driving consumption intentions. We observe a significant positive effect of consumption imagery ($\beta = .09, Z = 2.56, p = .01$) and a significant positive effect of food unhealthiness ($\beta = .10, Z = 2.87, p = .004$) as well as a marginally significant negative effect of dietary concern ($\beta = -.04, Z = -1.68, p = .09$) on the number of potato chips participants intended to eat. Importantly, we also observe a significant negative consumption imagery x food unhealthiness interaction effect ($\beta = -.16, Z = -3.54, p < .001$) and non-significant interactions between chronic dietary concern and the manipulated factors ($ps > .10$). Since dietary concern has no impact on the main outcome variable, we will not discuss its role further.

The findings remained virtually unchanged upon the inclusion of BMI as a covariate; results revealed a significant consumption imagery x food unhealthiness interactive effect ($\beta = -.16, Z = -3.38, p < .001$), as well as a significant effect of food unhealthiness ($\beta = .10, Z = 2.94, p = .003$), consumption imagery ($\beta = .09, Z = 2.73, p = .006$), dietary concern ($\beta = -.06, Z = -2.20, p = .02$), and BMI ($\beta = .01, Z = 4.72, p < .001$).

As illustrated in Figure 3, and in line with our theory, when the portrayed food was unhealthy, consumption imagery reduced intended consumption of potato chips ($\beta = -.08$, $Z = -2.44$, $p = .01$; with BMI as a control: $\beta = -.06$, $Z = -2.02$, $p = .04$). Interestingly, however, and consistent with the vicarious goal fulfillment hypothesis (Wilcox et al. 2009), when the portrayed food was healthy, imagined consumption of the food resulted in greater rather than lower intended consumption of unhealthy food ($\beta = .09$, $Z = 2.56$, $p = .01$; with BMI as a control: $\beta = .09$, $Z = 2.73$, $p = .006$).

Figure 3 about here

Thoughts about a healthy diet. A descriptive analysis of self-reported thoughts about a healthy diet confirmed our prediction that public health advertisements would make people momentarily think about their diets, as most participants reported thinking about dieting above the mean of the scale (Min = 1, 25% percentile = 4.00, Median = 4.75, Mean = 4.68). Importantly, however, we hypothesized that public health advertisements would be most effective at eliciting thoughts about dieting when portraying consumption imagery (versus imagery not portraying consumption) of unhealthy food, whereas the vicarious goal fulfillment theory would predict the opposite to be true when participants are exposed to healthy food (Wilcox et al. 2009). We tested these predictions by running a linear regression with thoughts about a healthy diet as the dependent variable, dummy-coded consumption imagery, and food unhealthiness with their interaction as predictors. Results reveal a significant effect of food unhealthiness ($\beta = -.44$, $Z = -2.45$, $p = .01$) and, importantly, a significant consumption imagery x food unhealthiness interaction ($\beta = .48$, $Z = 1.96$, $p = .049$). No other effects are significant.

Simple slope analyses show that when exposed to unhealthy food, participants in the high consumption imagery condition thought more about eating healthily ($M = 4.75$) than those in the low consumption imagery condition ($M = 4.42$; $\beta = .33$, $Z = 2.00$, $p = .04$). We find the opposite pattern among those exposed to healthy food ($M_{\text{high}} = 4.71$, $M_{\text{low}} = 4.85$, $\beta = -.44$, $Z = -2.45$, $p = .01$), again in support of the vicarious goal fulfillment explanation.

To provide stronger support for the underlying role of thoughts about a healthy diet, we ran a test for mediated moderation by estimating a 10,000 bootstraps confidence interval for the indirect effect using R. We used the intentions to eat chips as the dependent variable, the thoughts about a healthy diet as the mediator, and consumption imagery, food unhealthiness, and their interactions as predictors. The effects of the manipulations and their interaction on thoughts about a healthy diet are reported above. The model including thoughts about a healthy diet, the manipulations and their interaction as predictors of intended consumption of chips reveal a significant effect of thoughts about a healthy diet ($\beta = -.04$, $Z = -5.33$, $p < .001$), as well as a significant effect of consumption imagery ($\beta = .08$, $Z = 2.35$, $p = .02$), food unhealthiness ($\beta = .08$, $Z = 2.42$, $p = .02$), and consumption imagery x food unhealthiness interaction ($\beta = -.14$, $Z = -3.03$, $p = .002$; see Figure 4). Importantly, the confidence interval for the interactive effect of consumption imagery and food unhealthiness on intended chips consumption through thoughts about a healthy diet is significant, with the 95% confidence interval excluding zero $[-.03, -.001]$.

 Figure 4 about here

Discussion

In line with the findings from Studies 1 and 2, Study 3 shows that consumers express a lower desire to consume unhealthy food if a public health advertisement elicits consumption imagery for unhealthy food. Interestingly, and consistent with prior findings (Kroese et al. 2011), as shown in Study 3, this was not exclusive among individuals with a high chronic concern with their diet, as the public health advertisement made most (~75%) viewers momentarily focus on maintaining a healthier diet. In contrast, and consistent with the vicarious goal fulfillment hypothesis (Wilcox et al. 2009), public health advertisements including healthy food items increase viewers' intended consumption of unhealthy food when portraying consumption imagery. This study also provided initial support for participants' thoughts about maintaining a healthy diet being the process underlying the interactive effect of food unhealthiness and consumption imagery. We further showed the robustness of our effects which hold when the advertising provides different levels of sensory complexity (the stimuli is static). Since print advertisements display a lower level of sensory complexity than video advertisements, they may also be at disadvantage in boosting the level of viewers' involvement (Greenwald and Leavitt 1984). Interestingly, the results of Study 3 show that our effects hold even when the imagery content is presented in a print advertisement, demonstrating the generalizability of our results.

General Discussion

The overall objective of this research was to understand how food consumption imagery, a common practice adopted in food communications, influences actual food consumption and eating desires among dieters. We found that exposure to advertisements high in consumption imagery diminishes food intake among dieters (Studies 1 and 2) and that these effects persist even when the imagined and consumed food items are of different categories (Study 2).

Interestingly, we also demonstrated that consumption imagery of unhealthy food also increases the effectiveness of public health advertisements in promoting a healthier diet (Study 3).

These deeper, more nuanced insights into how consumption imagery influences food consumption behavior contribute to extant theory and in turn establish some meaningful recommendations for policymakers and consumer protection agencies. Nevertheless, we believe that these findings should be considered alongside some important considerations that we develop below.

Theoretical Contributions

Prior literature has dealt with dieting concerns (Herman and Polivy 2008; King, Herman, and Polivy 1987; Papies, Stroebe, and Aarts 2008a, 2008b; Stroebe et al. 2013), food imagery (Fishbach, Friedman, and Kruglanski 2003; Wilcox et al. 2009), and consumption imagery (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010). We contribute to each of these streams by integrating the different phenomena to explicate the impact of consumption imagery in communications containing tasty, unhealthy food on the behavior of consumers concerned with their diets. In particular, previous studies have shown that unhealthy food primes spontaneously increase consumers' attention to health goals, leading them to avoid unhealthy food (Fishbach, Friedman, and Kruglanski 2003; Papies, Stroebe, and Aarts 2008b). Research on multiple goal pursuit (Louro, Pieters, and Zeelenberg 2007) has also demonstrated that failing to achieve an important life goal typically results in increased motivation to pursue that goal. We combine these findings by showing that goal failure, even when imagined, can produce similar motivational responses, and magnify the effect of unhealthy food imagery on health goal activation and unhealthy food consumption. These findings identify consumption imagery as a visual element that is particularly germane in terms of its influence on food intake among dieters.

Research on consumption imagery also has indicated that imagining consumption can produce satiation associated with salient food aspects (e.g., taste, smell) and thereby diminish the subsequent intake of similar foods (Larson, Redden, and Elder 2014; Missbach et al. 2014; Morewedge, Huh, and Vosgerau 2010). However, those studies do not address the specific effects of imagining a particular type of food (i.e., unhealthy) among a distinct segment of the population (consumers chronically or momentarily concerned with their diet). In this research field, our study makes two key contributions. First, we show, in contrast with the effects registered in prior research (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010), that dieters tend to reduce their food intake after a single exposure to an advertisement that portrays consumption. Second, the effect of food consumption imagery on behavior is not restricted to foods with the same sensory attributes but instead extends to other food items that consumers regard as unhealthy. These findings provide more nuance to our understanding of the effect of consumption imagery on actual food consumption.

Public Policy Implications

Our research offers practical insights for policymakers and practitioners. Public organizations that aim to reduce the negative effects of unhealthy eating can leverage our findings to improve their efforts to facilitate consumers' better health. In particular, we show that consumers differ in their reactions to food communications that feature consumption imagery. This finding supports some existing efforts in that it shows that making dietary objectives salient to at-risk populations can be beneficial for activating dietary concerns, such as through educational campaigns (FDA 2016) and public health advertisements (Study 3).

Even though consumers are expressing increasing concern with their weight and diets, they still often fall prey to the temptations of unhealthy food, so we need more effective

strategies to help dieters succeed in their quest to adopt healthier lifestyles (Stroebe et al. 2013). Many campaigns promoting healthy eating rely on portraying healthy food along with information about its nutritional value (Zhang et al. 2017). For instance, the website of the FNS Center for Nutrition Policy and Promotion depicts different people enjoying eating healthy food (Web Appendix G) and many details about how consumers should think about and choose healthy food on their plate (USDA 2020). While these initiatives are to be applauded for their attempt to educate and motivate American consumers to eat healthier, much research evidence (Wilcox et al. 2009) and our findings (Study 3) suggest that they may be ineffective under certain circumstances. Considering the need for selective executions of health messages to maximize their effectiveness (Stewart and Martin 1994), the present research offers insights into when and where health messages are most effective: it suggests that public policy agencies and health organizations should prioritize efforts to include health messages that also portray the consumption of unhealthy food.

We would like, however, to signal a note of caution to policymakers, as our results indicate that portraying consumption of unhealthy food successfully reduces consumption only if the consumer is momentarily or chronically concerned with dieting. Accordingly, unhealthy food consumption should not be typically presented by itself but together with a message that activates the goal of eating healthy (see Web Appendix B for a marketplace example). The copy of the health advertisement should also indicate that the consumption of unhealthy food represents a failure in achieving this goal. Moreover, given the novelty of these effects, we recommend further research on possible moderators to better guide healthy-eating programs and advertisements. For instance, although our research shows that consumption imagery of unhealthy food reduces immediate intake of unhealthy food among dieters, it is unclear how long

these effects would last. Researchers could, therefore, examine how long these effects persist, providing clearer guidelines to policymakers attempting to promote healthier dieting.

In Study 3 we use a public health advertisement as the context to test our effects, and we suggest that these findings should encourage other organizations trying to induce dieters to stick to their diets. Both public organizations and private institutions (e.g., Weightwatchers) dedicated to helping diet-concerned consumers reach their health goals might develop effective communication campaigns by including, for example, a character who eats unhealthy food and a prompt to encourage viewers to imagine such consumption. Using unhealthy consumption imagery as a healthy eating promotion argument may be a promising way to prevent the well-known boomerang effect of public policy campaigns aimed at reducing obesity that focus only on the health benefits of balanced diets (Werle and Cuny 2012; Werle, Trendel, and Ardito 2013).

Limitations and Future Research

In addition to the aforementioned potential boundaries for our work, we identify other limitations that can inspire future research on the field. For instance, prior work (e.g., Fishbach, Friedman, and Kruglanski, 2003; Stroebe et al. 2013) suggests that dieters might become particularly successful at exerting self-control by developing a strong association between high-calorie food and weight control goals. Such automatic links might be established not only in the course of an individual's regular encounters with unhealthy food but also upon repeated exposure to healthy eating campaigns that reinforce the unhealthy food – health goal link, as we do in Study 3. Future research could examine this interesting hypothesis, potentially offering more specific guidelines to policymakers and health practitioners alike.

Interestingly, some recent research (Biswas and Szocs 2019) has demonstrated that exposure to the scent of unhealthy food decreases consumption of other unhealthy food even among non-dieting concerned consumers because it satiates consumers' need for a pleasant experience. Based on these findings, one could suggest that visual (as opposed to olfactory) imagery could produce similar effects and that the satiation of consumers' need for a pleasant experience could work as a parallel mechanism explaining dieters' reduced consumption of unhealthy food. Future research could examine this complementary mechanism for the effects observed in this study.

Relatedly, in our studies, we alternate images of food consumption (Study 1) with the explicit instruction to imagine food consumption (Study 2) or used both together (Study 3). We base our research on the assumption driven from the mental imagery literature suggesting that watching someone else eating can allow the observer to feel the same effects as if they were themselves eating the product (Jackson, Meltzoff, and Decety 2005). However, it would be interesting to examine potential differences between the mental imagery triggered by images of someone eating the food and imagery elicited when instructed to imagine the consumption of a similar product. A study where these different types of imagery eliciting techniques are manipulated orthogonally could shed more light on the mechanism at play and inform more precise recommendations for future public policy campaigns.

We focused our research on dieters and their food intake, though our findings might apply in other goal-related contexts, in which high priority, long-term goals conflict with short-term desires. For example, people who express chronic concerns for their financial well-being may feel conflicted between saving (e.g., adding money to retirement funds) and spending money immediately on enjoyable purchases (Fishbach and Dhar 2005; Neukam and Hershey

2003). Policymakers seeking to increase savings and long-term investments might evoke these behaviors by prompting consumers who exhibit greater concern about their financial well-being to imagine themselves overspending on immediate, short-term items (e.g., expensive meal, trip), which they would likely associate with negative impacts on their long-term goals.

Along various such paths for further research, we hope our findings inspire researchers to advance theoretical understanding and encourage policymakers and interested organizations to devise policies and educational campaigns that will help dieters resolve the ongoing conflict between their dual goals.

Peer Review Version

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Tables

Variables	Study 1		Study 2		Study 3	
	High imagery (n = 62)	Low imagery (n = 69)	High imagery (n = 65)	Low imagery (n = 62)	High imagery (n = 320)	Low imagery (n = 274)
MEAN (SD)						
Food consumption	22.76	24.94	15.12	16.35	12.78	12.81
/ Consumption	(12.56)	(.13.60)	(10.83)	(10.61)	(6.34)	(6.33)
intentions (Study 3)						
Dietary concern	2.23	2.26	2.18	2.20	2.88	2.76
(DR)	(.73)	(.77)	(.68)	(.70)	(.97)	(.97)
BMI	21.23	21.49	21.11	21.28	24.80	26.10
	(2.08)	(2.31)	(2.79)	(2.70)	(7.59)*	(7.59)*

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 1. Descriptive statistics across the three studies

Figure 1. Exposure to High Imagery Food Advertisement Decreases Intake among Dieters

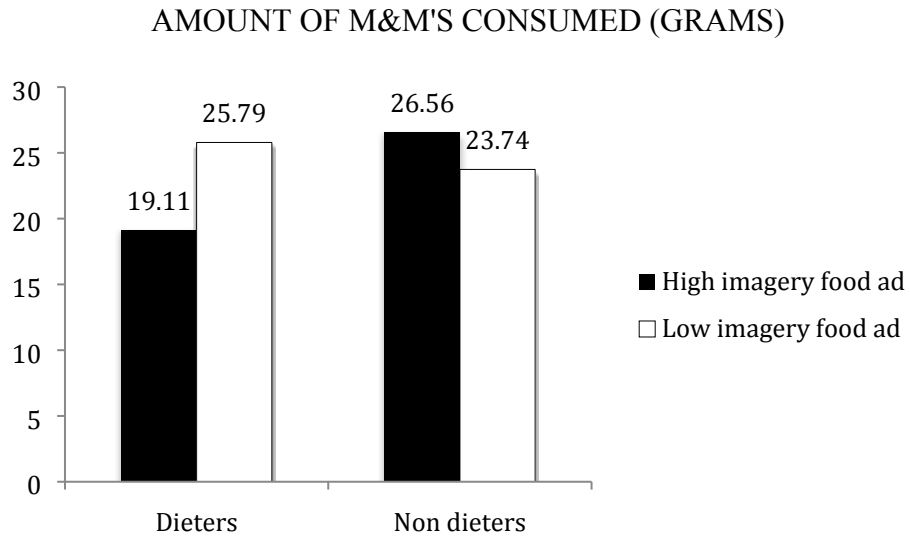


Figure 2. Imagining Consuming Food Depicted in an Advertisement Decreases Intake among Dieters

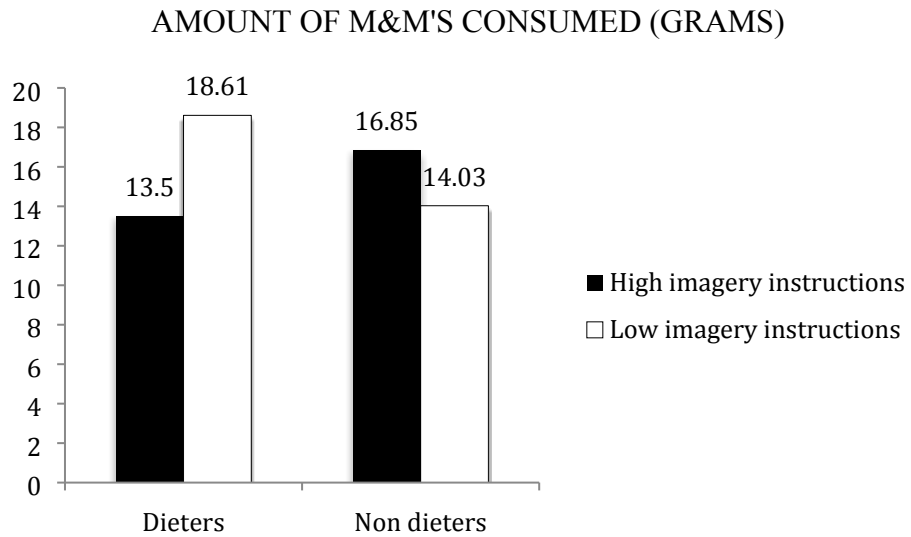


Figure 3. Imagining Consuming Unhealthy Food Depicted in an Advertisement Decreases Intentions to Eat Potato Chips

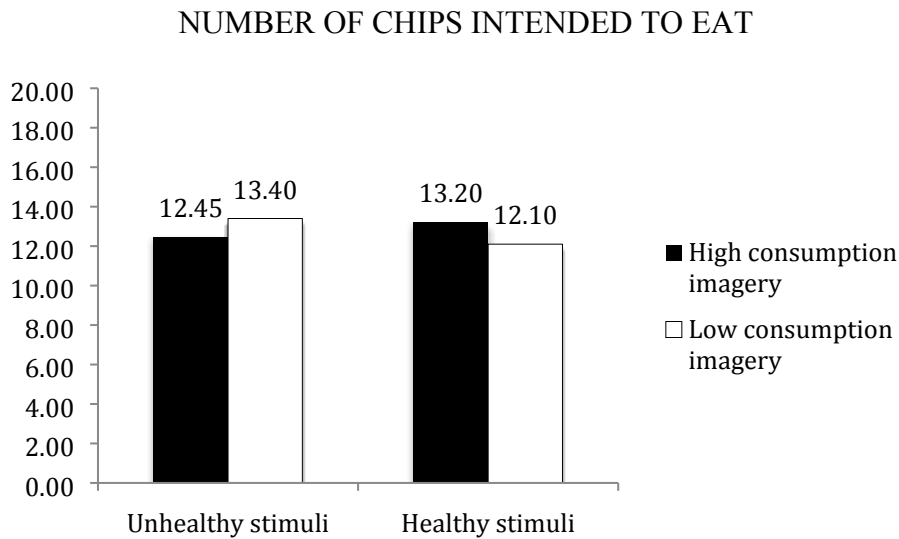
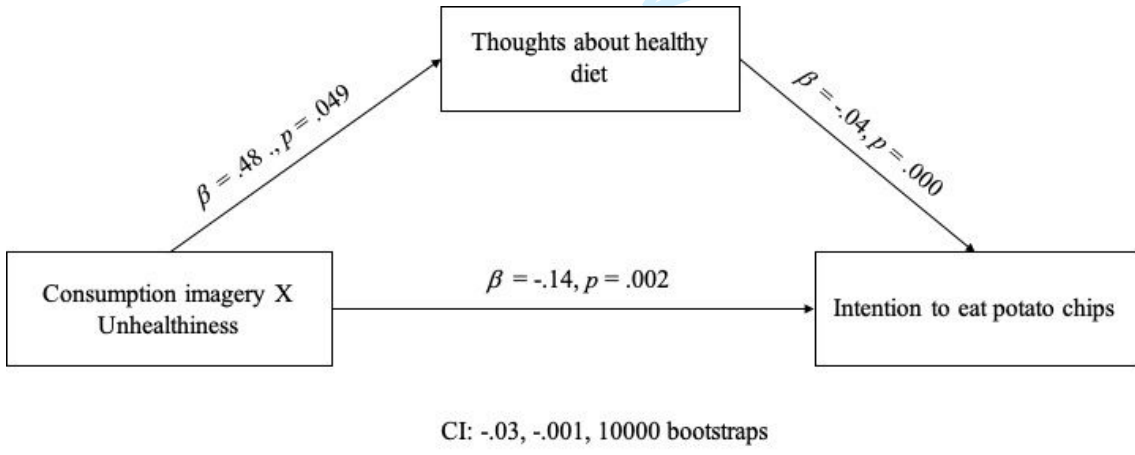


Figure 4. The Mediating Role of Thoughts About a Healthy Diet



Web Appendix A. Super Bowl 2006 - 2021 Food Advertisements

Super – Bowl Year	Total number of advertisements identified	Number of Food advertisements	Food advertisements containing food consumption	Source
2021	54	7	3	CNBC
2020	54	11	9	Business Insider
2019	44	7	4	Business Insider
2018	49	7	4	Business Insider
2017	73	7	2	Fortune
2016	44	8	7	Vox
2015	49	8	5	ABCnews
2014	56	9	4	Business Insider
2013	54	9	6	Business Insider
2012	54	5	3	Business Insider
2011	45	3	3	Nola
2010	37	6	4	Wikipedia
2009	35	6	5	SuperBowl Ads
2008	73	6	3	ADland
2007	33	5	5	SuperBowl Ads
2006	70	6	5	ADland

Web Appendix B. Rich unhealthy eating imagery in public health advertisement clearly underlying the healthy message



Source : <http://newyorktrendnyc.com/2013/12/02/new-ad-campaign-highlights-the-negative-health-impacts-of-excessive-sugary-drink-consumption/>

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Web Appendix C. Video Advertisements in Study 1

High consumption imagery (M&Ms kaleidoscope 30s)

<https://www.youtube.com/watch?v=CruCJnnyfoE>



Low consumption imagery (M&M's checkout 31s)

<https://www.youtube.com/watch?v=mJRDkI5IFao>



Web Appendix D. Video for Study 2

Hamburger video ad



Dependent variable: Consumption of chocolate-coated biscuits (90 g pack)



Web Appendix E. Stimuli and manipulations in Study 3.

Web Appendix E.1. Sample in Study 3 and its pretest.

We collected the data in Study 3 on Amazon MTurk in November 18, 2020. We posted the study online and stopped the data collection after five hours since we obtained a satisfactory final data set of seven hundred and thirty-five complete answers.

There are many benefits and drawbacks when using Amazon MTurk samples. Issues of duplicate geolocation have been already raised ([Necka et al. 2016](#); [Kennedy et al. 2020](#); Denis, [Goodson and Pearson 2019](#); [Moss and Litman 2018](#)) and researchers are even raising the flag to possible vulnerability to web robots ([Aguinis, Villamor and Ramani 2020](#)). Therefore, we decided to use MTurk sample only in Study 3 and solely because the field data collection was impossible in the pandemic times of the end of 2020.

Given the issues raised by using MTurk samples (mentioned here above), we made sure to avoid ballot boxing by limiting one response per Internet Protocol (IP) and geolocation. We identified eight large “clusters” with hits containing the same geolocation; each such “cluster” had between four to twenty-four hits. Overall in the entire data set, we kept one single IP and one single geolocation per hit. Consequently, we ended up with a final sample of five hundred and ninety-four participants in the data set included in Study 3.

We collected the data for the pretest used for testing the stimuli in Study 3 on MTurk in December 21, 2020. We aimed at a sample of three hundred respondents. As opposed to the main study, we did not identify any major “clusters” of hits originating from the identical geolocation or IP. However, we obtained a dataset with several incomplete entries (more than twenty-six empty variables). After removing the incomplete answers, we remained with a final data set of two hundred and fifty-nine complete answers.

Datasets for all studies are available upon request.

Web Appendix E.2. Stimuli and manipulations in Study 3.

Unhealthy food, *high* consumption imagery vs **Healthy** food, *high* consumption imagery:



Unhealthy food, *low* consumption imagery vs **Healthy** food, *low* consumption imagery:



Web Appendix F. Healthy eating campaign launched by New York City Department of Health and Mental Hygiene

No time to eat?



PACKING CONVENIENT FRUITS LIKE APPLES is an easy way to add heart healthy fruits & vegetables to your day.

GET YOUR HEALTHY EATING PACKET!
Search "SoGood" on nyc.gov or call 311.
To find a Farmers' Market near you, text "SoGood" to 877877.



Web Appendix G. Healthy food consumption imagery in USDA healthy eating campaigns



Source : <https://www.fns.usda.gov/cnpp>



There are so many ways to eat **Fruits & Vegetables** every day.

Source : <https://www.choosemyplate.gov>