# Healthy Satiation: The Role of Decreasing Desire in Effective Self-Control

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Self-control is typically viewed as a battle between willpower and desire. The authors focus on the desire side of the equation and extol the positive effect of faster satiation that makes unhealthy behaviors less tempting. They demonstrate that consumers higher in trait self-control demonstrate such "healthy" satiation as they satiate faster on unhealthy foods than on healthy foods. In contrast, those with lower self-control fail to consistently show this differential pattern in their satiation rates. This difference for high self-control people can result from faster satiation for unhealthy foods, slower satiation for healthy foods, or both in combination. Moderating and mediating evidence establish that changes in attention to the amount consumed helped account for these effects on the rate of satiation. The resulting differences in satiation influence the ultimate intake of unhealthy foods, underscoring the importance of the contribution made by differential satiation rates to overconsumption and obesity.

Controlling one's food consumption is a challenge that millions of people struggle with on an ongoing basis. For example, consider the abundance of cookies, candies, and cakes at every holiday season and celebration. While some people navigate such temptations without any lasting consequences, others unfortunately fall prey to overconsumption of these tasty treats. This difference is often captured by saying the former have willpower while the latter lack it. However, might it also be that some people simply get their fill of such indulgences more quickly and therefore have fewer holiday pounds to shed in the aftermath? They presumably find these indulgences initially enjoyable, likely as much as others, but they seem to become satisfied with the experience more quickly. Such differences in satisfaction may indeed make their restrained behavior rather effortless.

Unfortunately, overeating is too often the case, as evidenced by adult obesity rates over 33% in the United States (Ogden et al. 2006). We explore this issue by merging perspectives from self-control and satiation. Past research on self-control has primarily focused on the lack of willpower to resist temptations (Baumeister 2002; Carver and Scheier 1998; Tangney, Baumeister, and Boone 2004). We propose that ongoing changes in liking also play a critical role in food consumption patterns. In particular, we study how satiation makes foods less desirable and how this differs across people. Such satiation, defined here as the drop in liking during repeated consumption, has typically espoused a negative connotation in that enjoyment of a favored experience is fleeting. We show how satiation can instead be a positive and "healthy" mechanism when it lowers the desire for unhealthy foods relative to healthy foods. In particular, people with naturally higher trait self-control are able to best take advantage of this positive aspect of satiation.

We treat self-control as an inherent individual trait variable that reflects the general ability to control one's behavior and then examine ongoing satiation reflected in the drop in enjoyment as our key outcome measure. Our research provides a theory to capture the interplay of these constructs, in particular, the interaction of trait self-control and food healthiness in determining the rate of satiation. We first discuss the role of self-regulation of behavior in food consumption, with a specific focus on the importance of desire

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and moderation. We then hypothesize that people's inherent differences in self-control will lead to systematic differences in how quickly they satiate. Most important, we propose that individuals high in general self-control become satiated with unhealthy foods faster than with healthy foods, whereas those lower in self-control show less discriminating patterns. Thus, in addition to the level of willpower, a key component to controlling one's behavior is the extent to which satiation reduces desire.

Across four studies, we support our predictions using both naturally occurring and framing manipulations of the healthiness of a food. We also demonstrate that increased monitoring of one's consumption helps explain why these differing patterns emerge and that differences in satiation rates can translate into changes in the quantity consumed. From a practical standpoint, we also identify small yet effective shifts in the way consumers think about food that may prove useful in encouraging a healthier diet.

## THEORETICAL BACKGROUND

### Self-Control and Willpower versus Desire

Successful self-control requires one to resist the temptation to engage in an immediately pleasurable yet ultimately detrimental behavior (Hoch and Loewenstein 1991). Drawing on past work in this area (Baumeister 2002; Carver and Scheier 1998), the process of enacting self-control can be broken into three primary activities: setting clear standards, monitoring behavior, and regulating behavior. For instance, when people try to resist the cascading fried onion appetizer, they need to realize there is a nearby temptation, identify this as a violation of their diet, and summon the regulatory power to say no. When faced with such a dilemma, one is likely to resist temptation if the resulting willpower exceeds desire or, conversely, succumb to temptation if desire overwhelms willpower (Hoch and Loewenstein 1991). In keeping with this perspective, much previous research has focused on willpower-enhancing strategies that include reducing one's mental load so that cognitions can overcome desires (Shiv and Fedorikhin 1999), utilizing mental budgets to control consumption (Krishnamurthy and Prokopec 2010), using partitions to create more decision points when consuming (Cheema and Soman 2008), and more heavily weighting the potential negative consequences of temptations (Zhang, Huang, and Broniarczyk 2010). These findings all demonstrate a variety of strategies with which people can either increase or avoid depleting their willpower, thereby increasing their self-control.

Although researchers have focused a great deal on the willpower aspect of self-control, past work has suggested that desires, impulses, and urges also play a role (see Schmeichel, Harmon-Jones, and Harmon-Jones [2010] for a recent example). However, little emphasis has been placed on the role of desire as it changes over time, even though this may be a critical variable in controlling consumption. Simply put, if one's desire for something has greatly decreased, then resisting further consumption should be much easier. It is such repeated consumption patterns, rather than isolated decisions to resist a temptation, that most dramatically contribute to the long-term consequences of self-control failures. As such, we focus on ongoing enjoyment beyond the initial decision about what to eat.

### Satiation as a Natural Control Mechanism

We define satiation as the decline in enjoyment with greater consumption (Coombs and Avrunin 1977; Redden 2008). Satiation is a ubiquitous process that is observed in nearly every type of pleasurable experience (Frederick and Loewenstein 1999; McSweeney and Swindell 1999). In the case of a favored food, the notion is that people enjoy the food less as they eat more of it. Such satiation is generally thought to be an evolutionary adaptation to encourage consumption of the variety of nutrients necessary for good health (Rozin 1999). That is, satiation helps people restrict how much of any single food they eat because at some point they no longer enjoy it. In the present research, we focus specifically on the rate of such satiation with repeated consumption (i.e., how fast liking declines).

Although people generally attribute ongoing satiation to their feelings of fullness (Mook and Votaw 1992), there is growing evidence that satiation is psychological as well as physiological. Satiation happens too quickly to be purely digestive in nature, does not depend on just caloric content, and easily spreads to other items sharing similar characteristics (McSweeney and Murphy 2000). It appears that satiation is not solely driven by an internal meter indicating whether a need has been met. Rather, satiation also has a psychological component that is likely linked to well-known mechanisms such as sensory adaptation and habituation (Galak, Redden, and Kruger 2009; McSweeney and Swindell 1999). In the next section, we discuss how this psychological component of satiation might be influenced by one's inherent trait self-control.

### Self-Control, Attention, and Satiation

At a foundational level, some people just naturally have higher levels of trait self-control than others. People with more inherent self-control can better control their thoughts, impulses, and behaviors. This control then leads to successful outcomes across varied domains such as social relationships, psychological adjustment, and academic success (Tangney et al. 2004). Even so, the consistent ability to exhibit self-controlled behavior is still difficult because of ego depletion, whereby self-control failures become more likely after exerting regulatory resources (Baumeister and Heatherton 1996). However, people with high trait self-control seem to overcome this challenge through greater selectivity about when to use their resources (Muraven, Shmueli, and Burkley 2006) and by avoiding tempting situations (Hofmann et al. 2011).

Consistent with this notion of self-regulation, previous research would suggest that paying more attention to one's consumption can improve dietary behaviors versus more "mindless" eating (Wansink 2006). In particular, the need for monitoring and restraint is certainly greater for some foods (e.g., ice cream) than for others (e.g., broccoli). We propose that individuals with greater trait self-control are more likely to adjust their monitoring accordingly because they identify the potential health conflict a temptation poses, which has been recognized as a critical component of the self-control process (Myrseth and Fishbach 2009). Conversely, the high trait self-control consumer also realizes that virtuous products require less monitoring such that they can conserve resources when consuming healthy foods. People with higher trait self-control seemingly know when they should attend more carefully to their behavior and when they can relax their attention (Block and Kremen 1996; Tangney et al. 2004). Thus, we expect that higher self-control people will pay more attention to their consumption when consuming an unhealthy food versus a healthy food. In contrast, we expect that individuals with lower self-control will show less adjustment in the level of monitoring across foods.

We propose that differences in how much a person regulates his or her attention translate into differences in satiation rates. That is, increased monitoring leads to a faster drop in enjoyment. This is theoretically consistent with prior research showing that a distraction that hinders attention reduces the rate of satiation. For example, children eating pizza habituated less quickly when a memory task was more difficult (Epstein et al. 2005), and people eating cake reported smaller changes in the desire to eat when distracted by a computer game (Brunstrom and Mitchell 2006). Likewise, people ate more when tracking consumption was difficult because of amnesia (Rozin et al. 1998), the distraction of television (Higgs and Woodward 2009), or a self-refilling soup bowl (Wansink, Painter, and North 2005). Although ongoing enjoyment was not measured, this past work all suggests that people satiate more quickly as they pay more attention to how much they are consuming.

We posit that higher trait self-control consumers consistently adjust the level of attention up or down on the basis of what is being eaten, while lower self-control consumers do so much less. Therefore, we predict that consumers high in self-control will show systematic differences in rates of satiation across food types: satiation rates will speed up when the food is unhealthy and slow down when the food is healthy. As such, beneficial satiation may manifest in two ways: (1) slower rates of satiation on healthy options (keep eating that broccoli for dinner) and (2) faster rates of satiation on unhealthy options (not finishing that bowl of ice cream). On the contrary, we expect that consumers low in self-control will show less difference in rates of satiation across food types. Of course, we are not suggesting that low self-control people will have exactly the same rate of satiation across all foods. Rather, given two foods that differ in healthiness, we expect low self-control people to show less difference in satiation rates than their high self-control counterparts.

Foods obviously differ along many dimensions that may affect the rate of satiation (e.g., flavor, texture, and nutritional content). We propose that "unhealthy" is an aspect that accelerates the rate of satiation, but primarily only for people with high trait self-control. Although our theoretical question focuses on whether a person with higher trait self-control more actively adjusts monitoring across food types, the outcomes might also emerge within a given food type. For unhealthy foods, higher trait self-control may be associated with faster satiation and vice versa for healthy foods. Whether these associations appear for a given food type may largely depend on the rate at which low self-control people satiate in the given context. When low self-control people satiate quickly (e.g., right after a meal), then the effects of trait self-control on satiation may be more evident as slower satiation on healthy foods by high self-control people. Conversely, when low self-control people satiate slowly, the effects may appear more as faster satiation on unhealthy foods for high self-control people. Regardless, our theory centers on how trait self-control causes differences in satiation rates for a person across food types, so we focus on that empirical question in this research and realize that these differences may emerge more for healthy foods, unhealthy foods, or a combination of the two.

The remainder of this article focuses on testing our predictions in four empirical studies involving real food consumption and satiation. Study 1 confirms our predictions that a natural relationship exists between trait self-control and rates of satiation. People with high self-control satiated faster for unhealthy foods (M&M's and Skittles) than for healthy foods (peanuts and raisins), while those with low self-control did not show this distinction. Study 2 rules out a solely physiological explanation and further demonstrates the role of the healthiness construct as a moderator by replicating the results with different healthiness framings of the same food. Study 3 provides evidence of the proposed attention mechanism as low self-control people satiated the same as high self-control people when their attention was drawn to consumption by having them count the number of times they swallowed. Study 4 produces further evidence that attention processes mediate the relationship between self-control and satiation rate while also extending the effects to the important behavioral outcome of quantity consumed. Across the studies, we find support for our predictions and the proposed process.

## STUDY 1

This study tests our core prediction that individuals with higher trait self-control will satiate faster when eating an unhealthy snack versus a healthy snack, while those with lower self-control will have more similar rates of satiation across the snack types. Specifically, we expect to find an interaction between self-control and food type when analyzing the rate of satiation.

## Method

One hundred and ninety-nine undergraduates completed this study in exchange for course credit. The study was conducted in a behavioral lab with privacy partitions (as were all subsequent studies). Participants were told they would pick a snack to eat and answer some questions about it. We provided a choice of snacks so participants could eat something they liked (as resisting a food one dislikes is not problematic). The available snacks were manipulated between subjects to be either peanuts and raisins (healthy condition) or M&M's and Skittles candies (unhealthy condition). Pretests using scales from 0 to 10 indicated that these snacks differed in perceived unhealthiness ($M_{healthy} = 2.0$ vs. $M_{unhealthy} = 8.1$, $t(66) = 20.68$, $p < .0001$) and were generally liked ($M_{healthy} = 6.7$ vs. $M_{unhealthy} = 6.7$, $t < 1$, NS).

Participants then received a plate with 40 grams of their chosen snack. This quantity was less than the manufacturer's serving suggestion (about 50 grams) to ensure that many people would eat the entire snack. This control allowed us to analyze the degree of satiation while holding the quantity of consumption very similar. Participants were asked to first eat only a single piece of the snack. They then rated "How much did you enjoy this bite?" and "How much would you like to eat more of your snack?" on 9-point scales (1 = not at all, 9 = very much so).

Next, participants watched an 11-minute video on their computer and were told to feel free to keep eating the snack as they watched. Once the video finished, participants received a bag with more of their chosen snack. They then ate only one piece of the snack and rated it using the same two 9-point scales as before. They also answered "How much would you like to eat more of the snack you had today again tomorrow?" (1 = not at all, 9 = very much so). This provided two measures of satiation: change in enjoyment from the start to the end of consumption and the residual desire to eat more in the near future.

After several unrelated tasks, participants completed the 13-item short form of Tangney et al.'s (2004) general trait self-control scale. This scale includes items such as "I am good at resisting temptation" and "I refuse things that are bad for me." We used this general measure of self-control for two reasons. First, this measure has proven reliable and valid in an extensive development process (Tangney et al. 2004), and it has been commonly used in various self-control domains (de Ridder et al. 2012). Second, past research supports using this general measure because all self-control regulation tends to come from the same bank of resources (Vohs and Baumeister 2004). After completing the self-control scale, participants rated "How healthy was the snack you ate today?" (1 = not at all healthy, 7 = very healthy).

## Results

We verified that participants in the healthy condition perceived their snack as healthier than those in the unhealthy condition ($M_{unhealthy} = 1.6$ vs. $M_{healthy} = 4.8$, $t(197) = 20.66$, $p < .0001$). We next created two separate indices as the means of the two enjoyment measures taken after the first bite ($\alpha = .82$) and the last bite ($\alpha = .85$). A self-control index ($\alpha = .74$) was also created as the mean of the 13 items on the self-control scale after appropriate reverse coding. We verified that our experimental manipulation did not affect the self-control measure ($t(197) = 1.27$, $p > .20$).

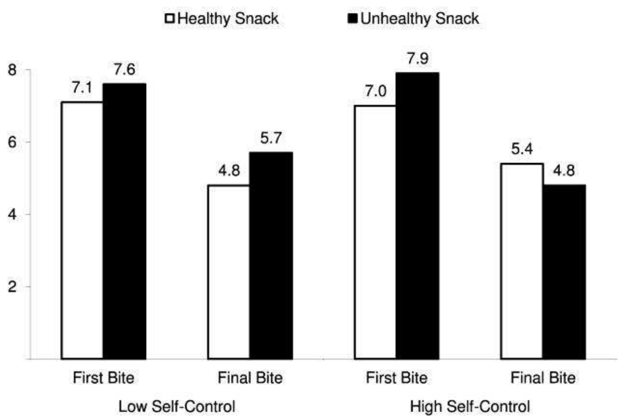
A repeated-measures ANCOVA was then performed on the enjoyment indices with snack type (healthy or unhealthy) as a between-subjects factor, timing within the consumption episode (first bite or last bite) as a within-subjects factor, and the self-control index (mean-centered) as a continuous measured factor. The analysis found main effects for both timing ($F(1, 195) = 230.00$, $p < .0001$) and snack type ($F(1, 195) = 4.02$, $p < .05$). More important, there was the predicted timing × self-control × snack type interaction ($F(1, 195) = 7.00$, $p < .01$). The model did not have any other significant factors (all $p > .05$).

We ran two further analyses to understand the nature of the three-way interaction. First, we ran the model separately for the first enjoyment rating and the last enjoyment rating. The interaction between snack type and self-control appeared for the last rating ($F(1, 195) = 4.87$, $p < .03$) but not for the first rating ($F < 1$, NS). Differences in initial liking did not drive the effects on enjoyment; rather they appeared only over time with satiation. Second, to more directly test our theory, we performed a spotlight analysis across levels of self-control (Aiken and West 1991; Fitzsimons 2008). Our critical dependent measure here was the change in enjoyment calculated as the first rating minus the last rating of enjoyment. When we ran the spotlight analysis at 1 SD above the mean for self-control, participants showed a greater drop in enjoyment for the unhealthy snack than for the healthy snack ($M_{unhealthy} = 3.1$ vs. $M_{healthy} = 1.6$, $t(195) = 3.54$, $p < .001$). These high self-control participants experienced faster satiation based on the type of snack they were having. In contrast, an analysis at 1 SD below the mean for self-control did not find any difference in satiation rates between the two snack types ($M_{unhealthy} = 1.9$ vs. $M_{healthy} = 2.3$, $t < 1$, NS). Figure 1 shows the pattern of results.

We also performed an ANCOVA on the desire to have more of the snack tomorrow. The model included snack type as a between-subjects factor, the self-control index as a measured factor, and a covariate for the initial enjoyment rating (mean-centered). There was the predicted two-way interaction between snack type and self-control ($F(1, 194) = 4.10$, $p < .05$) but no other significant factors (all $p > .05$) besides the initial enjoyment covariate ($b = .65$, $t(194) = 6.93$, $p < .0001$). A spotlight analysis at 1 SD above the mean of self-control indicated that participants with higher self-control had less desire to continue eating the unhealthy snack versus the healthy snack ($M_{unhealthy} = 4.8$ vs. $M_{healthy} = 5.7$, $t(194) = 2.17$, $p < .04$). This same contrast in a spotlight analysis at 1 SD below the mean of self-control was nonsignificant ($M_{unhealthy} = 6.1$ vs. $M_{healthy} = 5.6$, $t < 1$, NS).

**FIGURE 1**

MEAN ENJOYMENT RATINGS IN STUDY 1




NOTE.—This figure (and figs. 2–4) was created from analyses using continuous scores on the self-control measure. Self-control scores were graphed at 1 SD above the mean to represent high scores on the self-control measure and 1 SD below the mean to represent low scores on the self-control measure (per procedures recommended in Aiken and West [1991]).

## Discussion

This study establishes a basic link between one's inherent self-control and satiation rate. People with high trait self-control satiated faster on unhealthy versus healthy foods relative to those with low self-control who showed less difference in the rate of satiation across foods. Thus, greater trait self-control is not associated with faster satiation for all foods as an overall generalized effect; rather it depends on the type of food being eaten.

In the present study, although effects for both food types contributed to our key interaction, the correlations between the drop in liking and trait self-control suggest that differences for the unhealthy food ($r = +.23$, $t(101) = 2.39$, $p < .02$) were a slightly larger driver of the interaction than those for the healthy food ($r = -.13$, $t(94) = 1.31$, $p > .19$). A post hoc explanation for this is that the baseline rate of satiation for low self-control people was relatively slow across the foods such that it was closer to the slower rate that high self-control people have for only healthy foods. It could also be that everyone did not perceive the healthy foods as very healthy given that these ratings were less than a point above the midpoint of our scale.

The design of this study suggests that the effects we find are quite general. Of note, this study did not make salient the healthiness of the snacks in any explicit way. This hints that the effects would likely hold in other natural consumption settings (e.g., snacking while watching television). Also, the potential snacks differed along several dimensions such as flavor and texture. Even so, relative to low self-control people, higher self-control people satiated more whenever the foods shared the abstract attribute of being unhealthy versus healthy. Thus, we expect that these findings generalize to a wide range of foods.

# STUDY 2

Study 2 controls for potential differences in specific snack foods by keeping the snack exactly the same for everyone and manipulating the mere perception of healthiness. We also change the foods from study 1 to facilitate the healthiness manipulation and generalize the effect. In addition, we record quantity of consumption in this study as a control to address a limitation of study 1.

## Method

One hundred and fifty-four participants completed this study in exchange for undergraduate course credit. Participants were told that they would be eating Mini Teddy Grahams as part of a taste test. A pretest indicated that this snack was perceived as fairly neutral in rated unhealthiness on a scale from 0 to 10 ($M = 5.7$) such that it could be perceived as relatively healthy or relatively unhealthy. Participants then rated "How much do you want to eat this snack right now?" (1 = not at all, 7 = very much so). We gathered this initial desire measure before any manipulations to serve as a covariate.

Participants next read a description of their snack framed as being healthy or not. We did not use a truly unhealthy description because that seemed unreasonable given that firms do not describe their brands that way. As such, the "unhealthy" manipulation was a neutral or typical description of the product. The two descriptions are shown below.

> Teddy Graham Crackers
>
> This classic favorite is all about good taste. Every cracker is filled with 100% graham goodness, and its delicious, sweet taste has a delightful crunch with every bite. It's a great way to enjoy a delicious snack.
>
> Lean & Fit Teddy Graham Crackers
>
> This classic flavor now has a new healthy twist. Every cracker maintains the great taste of Teddy Grahams while the fat, calories, and sodium have all been reduced. It's a great way to be "Lean & Fit" and still enjoy a delicious snack.

Participants were then given a bowl with 30 grams of the snack. Participants were first directed to eat only a single piece of the snack and rate "How much did you enjoy this bite?" and "How much would you like to eat more of your snack?" on 9-point scales (1 = not at all, 9 = very much so). Participants next completed a filler word search task after being told they should feel free to keep eating the snack. After 10 minutes, participants received a small cup with more of the Mini Teddy Grahams. They were asked to eat only one piece of the snack and rate their enjoyment on the same two 9-point scales as before. They also rated "How much would you like to eat more of the snack you had today again tomorrow?" (1 = not at all, 9 = very much so). After some unrelated tasks, participants completed the 13-item Tangney et al. (2004) general self-control scale. Finally, participants rated "How unhealthy was the snack you ate today?" (1 = not at all unhealthy, 7 = very unhealthy). Following the session, the amount of snack remaining for each participant was recorded.

## Results

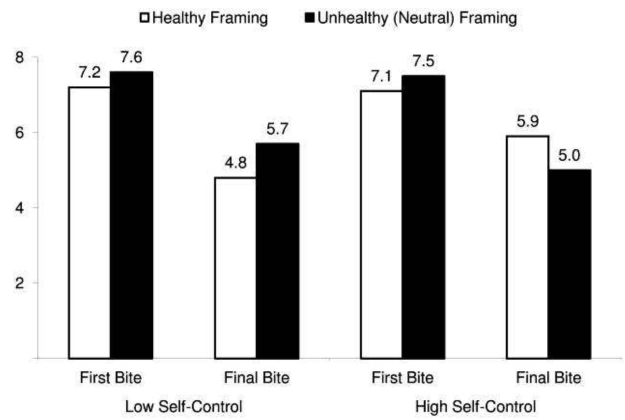
We verified that participants in the unhealthy (i.e., neutral) framing condition rated the snack as more unhealthy than those in the healthy framing condition ($M_{unhealthy} = 4.4$ vs. $M_{healthy} = 3.6$, $t(152) = 4.34$, $p < .0001$). We also ran an ANCOVA analysis on the percentage of the snack eaten and found no significant effects for snack type, self-control, or their interaction (all $t < 1$, NS). As intended, the quantity eaten was approximately the same across the constructs of interest, and 63% of participants ate the entire snack. We then combined the enjoyment measures into single indices for the first bite ($\alpha = .81$) and the last bite ($\alpha = .90$). We also created an index ($\alpha = .81$) of self-control as the mean of the items after appropriate reverse coding and verified that it was unaffected by the healthiness manipulation ($t < 1$, NS).

The two enjoyment indices were submitted to a repeated-measures ANCOVA with health framing (healthy or unhealthy) as a between-subjects factor, timing within the consumption episode (first bite or last bite) as a within-subjects factor, and the self-control index (mean-centered) as a continuous measured factor. We also included mean-centered covariates for the initial desire and the percentage of the snack eaten. The model revealed an expected main effect of timing as enjoyment dropped over time ($F(1, 148) = 149.87$, $p < .0001$). More important, there was the predicted three-way interaction of timing × self-control × health framing ($F(1, 148) = 7.91$, $p < .01$). The pattern of means (see fig. 2) indicates that the three-way interaction reflects differences in the rate of satiation and not initial liking. None of the other factors reached statistical significance (all had $p > .05$) except the initial desire covariate ($F(1, 148) = 15.60$, $p < .0001$).

We also performed a spotlight analysis to understand the drop in enjoyment (i.e., initial rating minus final rating) for lower and higher self-control participants. At 1 SD above the mean of self-control, participants with higher self-control satiated more when the snack was framed as unhealthy ($M_{unhealthy} = 2.5$ vs. $M_{healthy} = 1.2$, $t(148) = 2.83$, $p < .01$). In contrast, in a spotlight analysis at 1 SD below the mean of self-control, participants with lower self-control satiated the same regardless of the apparent healthiness of the snack ($M_{unhealthy} = 1.9$ vs. $M_{healthy} = 2.4$, $t(148) = 1.17$, $p > .24$). We found similar results when running an ANCOVA with the desire to have more of the snack tomorrow as the dependent variable. The analysis found an interaction between health framing and self-control ($F(1, 147) = 6.04$, $p < .02$) in addition to the initial desire covariate ($b = .68$, $t(147) = 4.37$, $p < .0001$) and a main effect of food type ($F(1, 147) = 5.32$, $p < .03$). A spotlight analysis at 1 SD above the mean showed that people with higher self-control had less desire to keep eating the snack when it was framed as unhealthy ($M_{unhealthy} = 5.3$ vs. $M_{healthy} = 6.3$, $t(147) = 2.14$, $p < .04$). An analysis at 1 SD below the mean found that low self-control people showed no statistically significant difference but suggested the reverse pattern if anything ($M_{unhealthy} = 5.9$ vs. $M_{healthy} = 5.3$, $t(147) = 1.39$, $p > .16$).

**FIGURE 2**

MEAN ENJOYMENT INDEX RATINGS IN STUDY 2




NOTE.—See note from figure 1.

## Discussion

This study replicates the prior findings using a different snack. Individuals with higher trait self-control satiated faster on a given snack when it was framed as unhealthy versus healthy (relative to those with lower self-control). The findings in this study also demonstrate the role of perceived healthiness in satiation. We showed that simply altering the description of the snack to seem more or less healthy still resulted in the predicted pattern of satiation rates. Thus, our results confirm our key interaction and indicate that the differential patterns of rates of satiation are not solely driven by any internal physiological signals produced by eating a certain food.

In the previous study, low self-control people satiated on both foods at a slow rate similar to that for high self-control people eating a healthy food. As a consequence, trait self-control was correlated with the satiation rate more for unhealthy than for healthy foods. In contrast, this study found that the relationship between trait self-control and the drop in enjoyment was directionally stronger for healthy foods ($r = -.29$, $t(74) = 2.58$, $p < .02$) than for unhealthy foods ($r = +.17$, $t(76) = 1.47$, $p > .14$). This may reflect the inherent limitations of framing the healthiness of a given food and the lack of a truly unhealthy product description.

It also points to the mixed nature of our effects in that the differences in the rate of satiation exhibited by high self-control people can appear as either slower satiation on healthy foods, faster satiation on unhealthy foods, or a combination of the two. Regardless of the underlying combination, the net result is still that high trait self-control people satiate faster on unhealthy than on healthy foods relative to those with low self-control.

## STUDY 3

The previous two studies demonstrated that the extent to which satiation rates differ across food types depends on one's trait self-control. We theorized earlier that these effects would emerge as a result of differences in monitoring of the amount eaten. Specifically, when a food is viewed as more unhealthy, high self-control people pay more attention to the quantity consumed, and this leads them to satiate at a faster rate. In contrast, low self-control people do little to regulate their attention on the basis of what they are eating, so their satiation rate varies less across food types.

We now test our explanation by directly manipulating the proposed attention mediator per the procedures recommended by Spencer, Zanna, and Fong (2005). For low self-control consumers, we predict that increasing their attention to the quantity being consumed will accelerate satiation regardless of the type of food (i.e., a main effect of attention). In contrast, high self-control consumers already regulate their attention on their own, so the attention cue should affect the satiation rate less. For an unhealthy food, external cues of quantity should have no effect on the satiation rate because high self-control people already highly monitor these foods on their own. For a healthy food, the prediction is less clear as it depends on the receptivity of high self-control consumers to external cues that might alter their normal patterns of behavior. The satiation rate will be unchanged if they rely on their own internal monitoring and ignore the cue (i.e., just a main effect of snack type as in the previous studies). Alternatively, the satiation rate may increase if they rely on the cue since they would otherwise not closely monitor their quantity (i.e., also an interaction between attention and food type). Finding these patterns of results would lend strong support to attention as an underlying mechanism.

### Method

Four hundred and sixty-five undergraduates completed this study in exchange for course credit. The study employed a 2 (food type: healthy vs. unhealthy) × 2 (attention: cued vs. not cued) between-subjects design with trait self-control as a measured factor. Participants chose a snack to eat from either cereal/granola bars (healthy condition) or chocolate candies (unhealthy condition). The healthy options included Fruit & Nut Chewy Trail Mix bars, Nutri-Grain Apple Cinnamon cereal bars, and Market Pantry Yogurt-Coated Mixed Berry Chewy granola bars. The unhealthy options consisted of Hershey's Milk Chocolate Nuggets, Kit Kat Milk Chocolate Minis, and Reese's Miniature Peanut Butter Cups. We chose these snack options so they would differ in healthiness between (but not within) the two conditions, be generally liked and familiar, and be similar in mass and other features.

Participants received a bowl with their chosen snack. For the healthy snacks, the bowl contained 1.5 bars (ranging from 52 to 55 grams and from 180 to 225 calories) cut into six equally sized pieces. For the unhealthy snacks, the bowl had six unwrapped pieces of the chosen candy (ranging from 52 to 57 grams and from 252 to 270 calories). Thus, every participant had six morsels of the snack that we carefully controlled to be nearly the same size across all snacks.

Participants next ate a single piece of the snack and then rated their enjoyment on "How much did you enjoy this bite of your snack?" and "How much would you like to eat more of your snack?" They did so by placing an X on a 14.5 centimeter–long line anchored on not at all and very much so. Participants then learned that they could continue eating their snack during the next task. However, before doing so, participants in the cued attention group were told that the researchers were interested in knowing how many times they swallowed as they ate their snack. To help them do this, they were each given a clicker designed to count pitches in baseball. The no attention cued participants were not given a clicker or instructed to monitor the number of times they swallowed.

The counting task should increase attention on food consumption without explicitly highlighting the actual quantity consumed, the unhealthiness of the snack, or a strong social norm to limit intake. A pretest confirmed this as using a counter while eating a snack increased attention ($M_{\text{count}} = 5.3$ vs. $M_{\text{no count}} = 3.8$, $t(42) = 2.93$, $p < .01$) on an index ($\alpha = .86$) of four 7-point Likert items (e.g., "I tracked how much I was eating," "I monitored myself while eating the snack"). The clicker task did not affect feelings of guilt ($t < 1$, NS) or the perceived healthiness of the snack ($t = 1.21$, $p > .23$).

All participants then began a computer study positioned as a relaxing break while the next study was being prepared. Specifically, a screen displayed "Now Playing . . . Nature Sounds" while it played nature sounds for 6 minutes. For participants in the cued attention condition, a box popped up every 90 seconds asking them to enter the number on their click counter. This helped ensure that the manipulation kept attention focused on consumption. Participants in the no attention cued condition simply listened to the nature sounds while eating the snack.

After the nature sounds finished playing, participants rated how much they enjoyed the last bite of the snack. They did so using the same two visual analog scales as before for enjoyment and desire for more. As in prior studies, participants also rated their satiation using "How much do you want to eat this snack again tomorrow?" on a 9-point scale (1 = not at all, 9 = very much so). We also assessed feelings of goal fulfillment and indulgence by asking "To what extent do you feel like the snack met a need to treat yourself?" and "To what extent do you feel like the snack provided a bit of indulgence?" on 11-point scales (0 = not at all, 10 = very much so). Participants then completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen 1988) to see if our effects could be linked to positive or negative affect. Finally, after a filler task, participants completed the 13-item brief self-control scale from Tangney et al. (2004). Participants finished by rating "How unhealthy do you think your snack is?" on an 11-point scale (0 = not at all unhealthy, 10 = very unhealthy). As in study 2, after participants left the quantity remaining was recorded to use as a covariate.

## Results

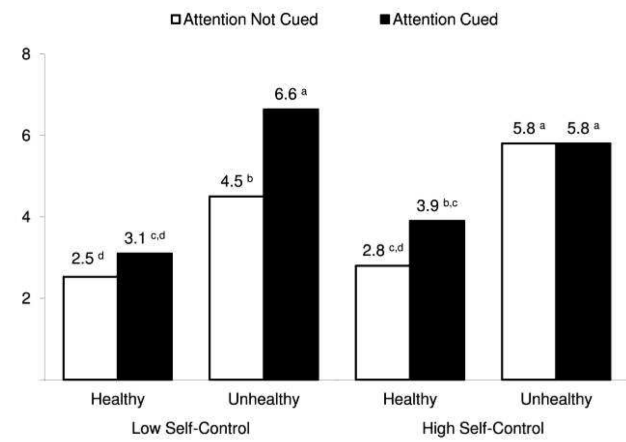
We verified that participants in the unhealthy condition viewed their snack as more unhealthy than those in the healthy condition ($M_{unhealthy} = 7.7$ vs. $M_{healthy} = 3.4$, $t(463) = 24.93$, $p < .0001$). We also ran an ANCOVA analysis on the percentage of the snack eaten and found no significant effects of snack type, attention, self-control, or their interactions (all $p > .05$). The amount eaten did not differ across our theoretical constructs, likely because over 65% of participants ate the entire snack. We then created indices as the means of the two enjoyment ratings taken after the first bite ($\alpha = .86$) and the last bite of the snack ($\alpha = .83$) as well as the general self-control scale ($\alpha = .82$) as in studies 1 and 2. We also verified that the index of self-control did not differ across the two manipulations or their interaction (all $t < 1$, NS).

We analyzed the two indices of enjoyment using a repeated-measures ANCOVA with snack type (healthy or unhealthy) and attention (cued or not cued) as between-subjects factors, timing within the consumption episode (first bite or last bite) as a within-subjects factor, and the self-control index (mean-centered) as a measured factor. The percentage of the snack eaten was also included as a covariate. There were main effects for timing ($F(1, 456) = 760.42$, $p < .0001$) and attention ($F(1, 456) = 17.08$, $p < .0001$). The timing also interacted with attention ($F(1, 456) = 8.47$, $p < .01$) and with snack type ($F(1, 456) = 67.44$, $p < .0001$). In contrast to our other studies, there was universally faster satiation for unhealthy snacks that may reflect unintended differences in the specific snacks we used (e.g., extent of general liking, nutritional content, unusual format of the snack, richness, etc.). Regardless, and more important, everything was qualified by the predicted four-way interaction ($F(1, 456) = 4.18$, $p < .05$). Other factors did not attain statistical significance (all $p > .05$).

To better understand the underlying patterns of our results and the numerous interactions, we tested our predictions using a spotlight analysis on the drop in enjoyment (i.e., initial less final enjoyment rating). At 1 SD below the mean of self-control, there was the key predicted main effect of attention. Giving participants with low self-control a counter made them satiate faster ($M_{cued} = 4.9$ vs. $M_{not\ cued} = 3.5$, $t(456) = 2.99$, $p < .01$). As shown in figure 3, this effect was somewhat more evident with the unhealthy foods ($M_{cued} = 6.6$ vs. $M_{not\ cued} = 4.5$, $t(456) = 3.16$, $p < .01$) than with the healthy foods ($M_{cued} = 3.1$ vs. $M_{not\ cued} = 2.5$, $t(456) = 1.08$, $p > .28$). However, this difference did not reach statistical significance ($t(456) = 1.64$, $p > .10$), so it must be interpreted with caution. The spotlight analysis at 1 SD above the mean of self-control followed a different pattern. There was the key predicted main effect of snack type as high self-control participants satiated faster on unhealthy than on healthy snacks ($M_{unhealthy} = 5.8$ vs. $M_{healthy} = 3.3$, $t(456) = 5.49$, $p < .0001$). There was no main effect of attention ($t(456) = 1.20$, $p > .22$) or interaction between attention and snack type ($t(456) = 1.23$, $p > .21$). Cues of the quantity consumed had less effect on the change in enjoyment ratings for high self-control people, presumably because they perform their own monitoring, so the attention manipulation served as a redundant cue. In fact, a salient observation about figure 3 is that the satiation rate for an unhealthy snack was lowest only when (*a*) there was low trait self-control and (*b*) there was no counter to focus attention on the amount consumed.

**FIGURE 3**

MEAN DROP IN ENJOYMENT IN STUDY 3




NOTE.—See note from figure 1. Means sharing the same superscript do not differ at the $p < .05$ level.

We also found convergent patterns in an ANCOVA analysis on the desire to have the snack tomorrow, with the first enjoyment rating also added as a covariate ($b = .44$, $t(455) = 11.54$, $p < .0001$). There was a main effect of snack type ($F(1, 455) = 11.16$, $p < .001$) and self-control ($F(1, 455) = 3.98$, $p < .05$) as well as a self-control × attention interaction ($F(1, 455) = 6.02$, $p < .02$). However, all of these were qualified by the predicted three-way interaction ($F(1, 455) = 4.61$, $p < .04$). A spotlight analysis revealed that the nature of the interaction replicated that for the enjoyment ratings. At 1 SD below the mean of self-control, there was a main effect of attention. Those with low self-control given a counter tended to have less desire to eat the snack again ($M_{cued} = 5.8$ vs. $M_{not\ cued} = 6.6$, $t(455) = 3.19$, $p < .01$). There was no main effect of snack type ($t(455) = 1.53$, *p*

> .12) or snack type × attention interaction ($t(455) = 1.28$, $p > .20$). The pattern of results was quite different when the spotlight analysis was run at 1 SD above the mean of self-control. Those with higher self-control showed only a main effect of the snack type as they had less desire to keep eating the unhealthy snack ($M_{\text{unhealthy}} = 5.5$ vs. $M_{\text{healthy}} = 6.3$, $t(455) = 3.28$, $p < .01$). There was no evidence of a main effect of attention ($t < 1$, NS), but the effect of the counter tended to be greater when the snack was healthy; this was not significant ($t(455) = 1.74$, $p > .08$), presumably because they were not spontaneously monitoring their behavior more for this type of food.

We ran two additional ANCOVA analyses with the need to treat oneself and indulgence as the dependent measures. Neither analysis found any evidence that self-control interacted with other factors (all $p > .05$). Furthermore, the drop in enjoyment was not correlated with satisfying the need to either treat oneself ($r = -.06$, $p > .17$) or indulge oneself ($r = .06$, $p > .23$). We also tested for differences in affect after breaking the PANAS scale into its positive ($\alpha = .88$) and negative ($\alpha = .82$) components. Separate ANCOVA analyses for the positive and negative components revealed no evidence that self-control interacted with other factors (all $p > .05$). Finally, when these four factors were added as covariates to the model of the desire for more tomorrow, the key three-way interaction between self-control, attention, and snack type always remained significant ($p < .05$ in each model). Across these analyses, the need to treat oneself, indulgence, and affect did not account for our results.

### Discussion

This study again replicated our findings that high trait self-control people spontaneously exhibit different rates of satiation across snack types more than those with low self-control. In this study, although everyone tended to satiate more on the particular foods used for the unhealthy food treatment, high self-control people still showed a greater difference in satiation rates across the food types. This confirms the key predictions of our theory.

We propose that these effects happen because high self-control people pay particular attention to how much they consume when a food is unhealthy while low self-control people do so to a lesser extent. This study provided moderating evidence for this process account. When attention was focused on the quantity eaten (by counting the number of swallows), the patterns of satiation rates across food types for low and high self-control people became more similar. In particular, for unhealthy foods, the counting task caused low self-control people to satiate just as fast as high self-control people. The counter device appeared to be a substitute for trait self-control. In contrast, the rate of satiation for those with high self-control was generally unaffected by the counting task (especially for unhealthy foods). This group presumably already regulates how much attention they pay to the amount consumed, so an external aid is unnecessary. These results all indicate that the attention construct plays an important underlying role in our effects.

This study also establishes that, of course, it is possible for low self-control people to differ in their rate of satiation across foods. For those participants not given a counter, we indeed found that low self-control people satiated faster on the unhealthy foods here. In spite of this, they still showed less difference in satiation rates across the foods than individuals higher in self-control, producing the interaction at the core of our theory. One possibility for the main effect of food type in this study is that, in order to control for the quantity of food provided, the actual calories provided were substantially higher for the unhealthy versus healthy foods. Regardless, even when low self-control people show a difference in satiation as in the current study, we still find evidence that high self-control people show even greater differences in the rate of satiation across foods.

The rate of satiation increased in study 3 for unhealthy foods when participants had either a counting device or high trait self-control. This would seemingly predict that they would also subsequently eat less of these vices, an outcome of practical importance. We could not test that prediction here, or in the previous studies, because we calibrated our serving sizes so most participants would finish their snack so that our measure of satiation would not simply reflect differences in the quantity consumed. However, study 4 directly addresses consumption quantity.

## STUDY 4

The results so far support our theoretical predictions: people with high trait self-control show a greater difference in rates of satiation across snack types than those with low self-control. We posit that high self-control people satiate faster on unhealthy foods because they pay more attention to their consumption. The previous study directly manipulated this attention to show its critical role in driving our effects. This study will further examine the underlying attentional process but will rely instead on natural differences in attention and test whether such differences mediate our effects. We also assess the potential for guilt and regret to influence our results as they have been linked to self-control failure (Giner-Sorolla 2001).

This study also tests whether differences in satiation rates ultimately translate into healthier eating behaviors. We propose that one reason people with high trait self-control can eat a healthier diet is that they can more strategically manage their desire for unhealthy foods. As such, this study tests to see if the previous effects for satiation rates extend to how much people eat. In contrast to our previous studies, we did not gather enjoyment ratings during consumption of the snack so natural attention mechanisms could emerge. We instead focused on assessing satiation after consumption and used the quantity people naturally consumed as our primary dependent variable in order to further extend the implications of our theory and results.

## Method

Two hundred and twenty-eight undergraduates completed this study for course credit. As in the previous studies, participants chose a snack to eat from either cereal/granola bars (healthy condition) or candy bars (unhealthy condition). These snacks were chosen on the basis of general liking, availability, and equality of volume and general features. The healthy condition options were a Fruit & Nut Chewy Trail Mix bar, a Nutri-Grain Strawberry cereal bar, or a Nature Valley Blueberry Yogurt granola bar. Each of these options was approximately 36 grams and 140 calories. In the unhealthy condition, participants chose between a Snickers, a Milky Way, and a Butterfinger candy bar, each of which was approximately 60 grams and 270 calories.

Participants were given a full regular portion of their chosen snack (e.g., a full granola, cereal, or candy bar). Participants were told to eat the snack as they normally would while they completed an unrelated survey for 10 minutes. After working on another unrelated task for 10 minutes, participants were given a second full serving of their chosen snack. By using two full servings, we expected fewer people to eat the entire snack so effects on quantity consumed could manifest. They were told to eat as much as they wanted while completing an unrelated survey. After approximately 10 minutes, the snack was removed and participants were asked "How much do you want to eat this snack again tomorrow?" (1 = not at all, 9 = very much so) as a gauge of satiation.

Participants next indicated their agreement with statements about the eating experience (using a 9-point scale with 1 = not at all, 9 = very much so). The statements focused on attention to quantity consumed ("I paid careful attention to how much [chosen snack] I was eating while I was eating it"), guilt ("Eating the [chosen snack] made me feel guilty"), and regret ("I regret eating as much [chosen snack] as I did"). Participants next completed the 13-item brief self-control scale from Tangney et al. (2004). Finally, as a manipulation check, participants rated "How unhealthy is the snack you ate today?" (1 = not at all unhealthy, 7 = very unhealthy). Participants were then thanked and dismissed, and the total quantity consumed was recorded.

## Results

We verified that our healthiness manipulation was successful. Participants in the unhealthy group rated their snack as more unhealthy than those in the healthy group ($M_{\text{unhealthy}} = 5.8$ vs. $M_{\text{healthy}} = 2.6$, $t(226) = 8.62$, $p < .0001$). We again created a mean index ($\alpha = .87$) for the general self-control scale and verified that this index was not affected by the snack type manipulation ($t < 1$, NS).

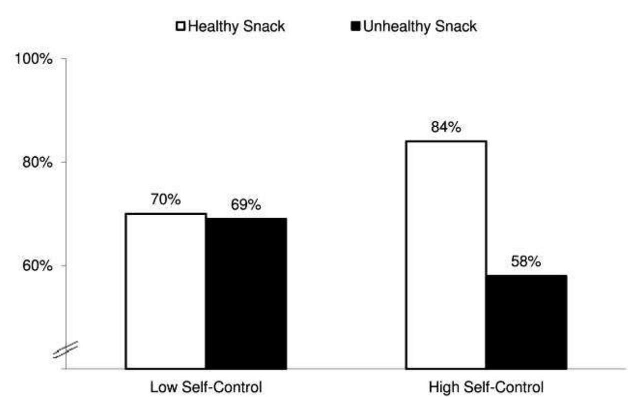
We first tested for differences in satiation as measured by the lingering desire to have the snack again tomorrow. An ANCOVA model included snack type (healthy or unhealthy) as a between-subjects factor and the self-control index (mean-centered) as a continuous measured factor. The analysis found an interaction between snack type and self-control ($F(1, 224) = 6.58$, $p < .01$), with all other factors being nonsignificant (all $p > .05$). As predicted, a spotlight analysis at 1 SD above the mean of self-control showed less desire to continue eating when the snack was unhealthy versus healthy ($M_{\text{unhealthy}} = 2.3$ vs. $M_{\text{healthy}} = 4.3$, $t(224) = 5.00$, $p < .0001$). A spotlight analysis at 1 SD below the mean of self-control found no significant difference ($M_{\text{unhealthy}} = 2.6$ vs. $M_{\text{healthy}} = 3.1$, $t(224) = 1.35$, $p > .17$). This pattern of satiation mirrors that found in earlier studies: the degree of satiation differs by food type for high trait self-control people more than for low self-control people.

We then performed this same analysis using quantity consumed as the dependent variable. Because the initial quantities differed in the treatment groups (consistent with the actual size of the granola bars and candy bars), we divided the total quantity eaten by the total quantity given. We used this percentage eaten for all analyses, but using the raw total quantity eaten did not change the conclusions of any statistical tests. The analysis found a main effect of snack type ($F(1, 224) = 5.05$, $p < .01$) whereby participants overall ate a smaller percentage of the larger unhealthy snacks. More important, as shown in figure 4, we found the predicted interaction of snack type and self-control ($F(1, 224) = 9.38$, $p < .001$). A spotlight analysis at 1 SD above the mean of self-control showed that higher self-control participants ate less when given an unhealthy snack versus a healthy snack ($M_{\text{unhealthy}} = 58\%$ vs. $M_{\text{healthy}} = 84\%$, $t(224) = 4.52$, $p < .0001$). An analysis at 1 SD below the mean indicated that lower self-control participants ate the same amount regardless of the snack ($M_{\text{unhealthy}} = 69\%$ vs. $M_{\text{healthy}} = 70\%$, $t < 1$, NS). Therefore, we find clear support for our theory that extends to the actual quantity consumed.

We have posited that the interaction between snack type and self-control for the quantity consumed occurs because

**FIGURE 4**

MEAN QUANTITY CONSUMED IN STUDY 4




NOTE.—See note from figure 1.

of differential satiation rates. Accordingly, we conducted a mediation analysis to determine whether or not the satiation measure (i.e., wanting to have more tomorrow) accounted for the effects on quantity consumed. The snack type (dummy coded as 1 for unhealthy) × self-control interaction as an independent variable influenced the satiation mediator ($\beta = .70$, $t(224) = 2.56$, $p < .02$). The satiation mediator was also related to the dependent variable of quantity consumed ($\beta = .06$, $t(226) = 7.11$, $p < .0001$). When the dependent variable was simultaneously regressed on both the mediator and the independent variable, the mediator remained significant ($\beta = .05$, $t(223) = 5.98$, $p < .0001$) while the coefficient for the independent variable declined from 0.12 ($t(224) = 3.06$, $p < .01$) to 0.08 ($t(223) = 2.23$, $p < .03$). A Sobel test showed that this mediation was significant ($z = 2.35$, $p < .02$). These results establish that the differences in percentage eaten are partially accounted for by differences in satiation.

We have further proposed that the satiation rate differs as a result of changes in the amount of attention paid to the quantity consumed. To fully demonstrate the proposed two-stage process depicted in figure 5, we conducted additional mediation analyses. The attention to quantity mediator was influenced by the snack type × self-control interaction ($\beta = .71$, $t(224) = 2.01$, $p < .05$) and was related to the degree of satiation ($\beta = -.26$, $t(226) = 5.36$, $p < .0001$). When the analysis of the effect of the snack type × self-control interaction on satiation included the attention mediator, the mediator remained reliable ($\beta = -.21$, $t(223) = 4.29$, $p < .0001$), and the interaction coefficient decreased from 0.70 ($t(224) = 2.56$, $p < .02$) to 0.55 ($t(223) = 2.07$, $p < .04$). Attention to quantity partially mediated the effects of the snack type × self-control interaction on satiation (Sobel $z = 1.82$, $p < .07$), and this mediation result became significant at the .05 level when we used more powerful bootstrapping techniques (Zhao, Lynch, and Chen 2010).

Furthermore, attention to quantity affected consumption through its influence on satiation. When an analysis of the quantity consumed also included the satiation mediator, the satiation mediator remained reliable ($\beta = .05$, $t(225) = 5.76$, $p < .001$), and the coefficient for attention to quantity decreased from $-.04$ ($t(226) = 5.06$, $p < .0001$) to $-.02$ ($t(225) = 3.15$, $p < .01$). Satiation partially mediated the effect of attention to quantity on the quantity consumed (Sobel $z = 3.92$, $p < .001$). Finally, when the analysis of the quantity consumed included all of the factors in figure 5, the satiation mediator remained highly significant ($\beta = .05$, $t(222) = 5.07$, $p < .0001$), while the coefficient further dropped to .07 ($t(222) = 2.01$, $p < .05$) for the snack type × self-control interaction.

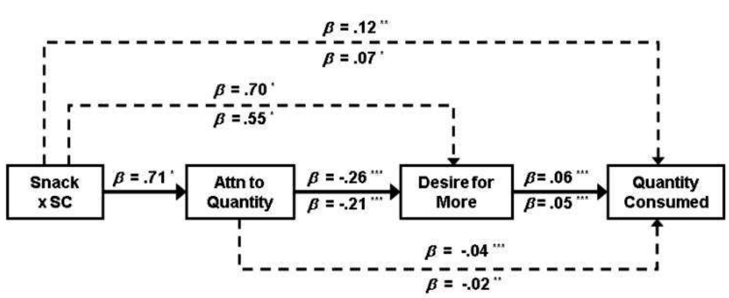
The pattern of results across these analyses of the quantity consumed indicates that the degree of satiation is a proximal mediator and attention to quantity is a distal mediator. We also tested whether guilt or regret played a mediating role. There was some evidence of a main effect of self-control on both guilt ($F(1, 224) = 3.19$, $p < .08$) and regret ($F(1, 224) = 6.05$, $p < .02$), hinting that consumers with higher trait self-control may be more likely to experience these negative emotions in a consumption setting. However, neither of these effects interacted with the snack type (both $p > .80$), nor did guilt ($r = -.06$, $p > .39$) or regret ($r = -.01$, $p > .88$) correlate with the quantity consumed. As such, we do not find support for guilt or regret as mediators.

## Discussion

This study confirms our predictions that individuals with greater trait self-control tend to satiate at a faster rate on unhealthy foods than on healthy foods, whereas those low in self-control show less discrimination in their patterns of satiation rates. This replicates the primary findings from our previous studies and, more important, establishes that the predicted effects carry over to how much people consume. This suggests that differences in satiation rates may play a pivotal role in patterns of food consumption and ultimately weight management. In this study, our effects were driven

**FIGURE 5**

MEDIATION ANALYSIS IN STUDY 4




NOTE.—Simple tests are shown above each line. Tests in the regression model with the mediator are shown below each line; *$p < .05$, **$p < .01$, ***$p < .001$.

by a negative relationship between trait self-control and the intake quantity for unhealthy foods ($r = -.20$, $t(116) = 2.20$, $p < .03$) and a positive relationship for healthy foods ($r = +.20$, $t(108) = 2.13$, $p < .03$). Thus, as in the previous three studies, we find evidence that higher trait self-control people can satiate both faster on unhealthy foods and slower on healthy foods.

The findings in this study also provide direct evidence that attention paid to consumption is driving the effects on satiation and, in turn, quantity of consumption. People with higher trait self-control pay more attention to what they eat when the food is unhealthy, and this attention leads them to feel more satiated and to eat less. However, when the food is healthy, those high in self-control pay less attention, feel less satiated, and eat more. Taken together with the results in study 3, there are clearly differences in attention that are driving the interactive effects between individual self-control and food type on rates of satiation. The fact that these differences translated into changes in consumption underscores the practical importance of our results.

## GENERAL DISCUSSION

### Summary of Findings and Contributions

Successful self-control is often thought of as a battle between willpower and desire. Past work has typically focused on how much willpower a person has and whether it is enough to control his or her behavior (Baumeister 2002; Hoch and Loewenstein 1991). We focus instead on the desire side of the equation and on how faster drops in desire can make unhealthy behaviors less tempting. Therefore, our research extols the potential for positive or "healthy" effects of satiation and, specifically, changes in the rates of satiation. We demonstrate that consumers higher in trait self-control take advantage of this as they satiate faster on unhealthy foods than on healthy foods. In contrast, those with lower self-control fail to consistently show this differential pattern in their satiation rates. Through both moderating and mediating evidence, we show that high self-control people satiate more on unhealthy foods because they pay more attention to the amount being consumed.

We build on past research that offers numerous psychological explanations for why people eat too much. These include biased estimation of caloric content (Chandon and Wansink 2007; Chernev and Gal 2010), overfocus on what to eat instead of how much (Rozin, Ashmore, and Markwith 1996), underreliance on physiological signals of satiety (Wansink, Payne, and Chandon 2007), feelings that being forced to eat healthy foods makes one hungry (Finkelstein and Fishbach 2010), and vicarious fulfillment of health goals (Wilcox et al. 2009). These mechanisms have all furthered our understanding of the various drivers of obesity, and we add to these perspectives by carefully examining what individuals who successfully control their eating behaviors do well that facilitates healthier consumption.

Our research provides several important contributions to the literature. First, we address a critical consumer issue by revealing important differences that may contribute to ongoing patterns of poor consumption decisions and ultimately obesity. Specifically, although we held consumption at a fairly constant and limited level in the first three studies to tap more directly into the rates of satiation, we document in the final study that differences in satiation lead to differences in the quantity of consumption. This result provides evidence that our effects have important consequences for controlling consumption. Second, for dilemmas requiring self-control, we highlight the important role of desire that has often been somewhat overshadowed by a focus on willpower and restraint. Across our studies, people tended to be initially tempted by foods the same regardless of their general trait self-control. It was only after repeated consumption that differences in desire emerged on the basis of the level of self-control and healthiness of the food. However, clearly there could be cases in which higher self-control consumers have trained themselves to either enjoy certain healthy foods more ("I just love broccoli") or enjoy certain unhealthy foods less ("this is just too rich for me"). Future research should more explicitly examine these possibilities as well as the inherent limitations of classifying foods as either healthy or unhealthy. Third, we provide theoretical contributions to understanding the overall self-control process, including the role of food type and the attention paid to consumption and how this differs on the basis of individual trait self-control. In particular, we highlight the importance of such attention and expect future work to further demonstrate how consumers can take advantage of this mechanism. Finally, we provide a methodological contribution with our attention manipulation procedure using the click counters in study 3 and envision that similar procedures could be utilized in different ways in future research as well as by consumers to facilitate their own healthier eating.

Our studies establish an empirical relationship between trait self-control and satiation as well as evidence that attention helps explain this relationship. Interestingly, the nature of this relationship can be interpreted in two ways: (1) higher self-control people strategically manage their desire and rates of satiation to influence their consumption, and (2) some people naturally satiate faster, and this helps them to have better control over their consumption. The fact that the regulation of attention helps account for our results and that we can mimic these effects with counting the number of swallows provides evidence for the first interpretation. That being said, we believe that the relationship between self-control and satiation rate likely works in both directions. That is, differing levels of trait self-control influence the rate of satiation, and differing rates of satiation help one to better control one's behavior. Future work should consider both of these relationships and examine how moderators (e.g., goals, varying levels of food healthiness) could possibly trigger each one. A related limitation of our research is that although we tried to separate the measurement of trait self-control from our primary measures as much as possible, stronger causal claims could be made if this measurement were further separated in time.

In our studies, we focused on comparing the differential patterns for vices and virtues between high and low self-control consumers, but we also briefly examined whether rates of satiation systematically differ within each food type by examining correlations between self-control and rates of satiation for the two food types. To further address this issue, we utilized meta-analytic procedures (Rosenthal and Rosnow 1991) to examine the pattern of effects across our studies. Specifically, we computed weighted average correlations between the satiety measures and trait self-control across the four studies (including only the uncued condition in study 3). We find that for unhealthy foods, an overall effect emerged across the four studies, with corresponding correlations of .18 ($p < .01$) for the drop in enjoyment measure (studies 1–3) and −.17 ($p < .01$) for the want more tomorrow measure (studies 1–4), indicating faster satiation for those with higher trait self-control. For the healthy foods, the evidence was mixed. For the drop in enjoyment measure, we find a marginally significant negative effect ($r = -.11$, $p < .07$), suggesting that those higher in self-control satiate more slowly on healthier foods. However, this effect was not significant for the want more tomorrow measure ($r =$ .01, NS). As such, high self-control people's faster rates of satiation on unhealthy foods appear to be the more robust driver of our pattern of effects, with mixed evidence that slower satiation on healthy foods also contributes. Clearly, future research should more systematically examine the underlying patterns contributing to our effects and identify when the slower satiation on healthier foods might be the more important driver of differential rates of satiation. It could be that it largely depends on how contextual factors affect the base rate of satiation for low self-control consumers. When this baseline is low, high self-control people will be more likely to show faster satiation on unhealthy foods and vice versa.

## Future Directions and Conclusions

Future research should explore how our findings can be optimally applied to benefit consumers. To begin, attention to consumption was an important part of our theory and findings. We manipulated attention here by having people count how many times they swallow. Although effective for unhealthy foods, these techniques may prove somewhat counterproductive if they also reduce the desire for healthy foods. Beyond attention to the quantity consumed, we also point to the broader concept of mindfulness, which leads individuals to very carefully think about the variety of physical sensations they are experiencing. Baer et al. (2006) conceptualize mindfulness as acting with great awareness and carefully attending to sensations, thoughts, and feelings. Attention appears to be but a subset of this broader construct. Although we believe that attention is the aspect of the mindfulness construct that most directly explains our effects, future research may examine the broader concept of mindfulness.

In addition, there are likely other mechanisms contributing to our effects. We did not find evidence that guilt or regret mediated our effects. However, we cannot claim with certainty that emotion does not play a role in our effects or the rate of satiation more generally. It is well established that emotions, both positive and negative, affect consumption patterns (Cools, Schotte, and McNally 1992; Winterich and Haws 2011), and presumably changes in various emotions could affect the attentional processes contributing to satiation. Future research should tease apart the role of the more cognitive (e.g., attention paid to consumption) and more affective processes (e.g., guilt) contributing to attention, satiation rate, and the decision to stop consuming.

Although we have examined self-control as an individual trait variable, future research should address how the current results are affected by situationally induced changes in self-control. We explored this notion in two separate studies in which we manipulated self-control using ego depletion approaches designed to temporarily decrease self-control. In both cases, rather than participants showing signs of ego depletion by paying less attention to the food they ate, they seemed to carry over a tendency to pay attention to consumption, consistent with the findings of Dewitte, Bruyneel, and Geyskens (2009), who show that engaging in one task can enhance performance on a subsequent one when self-regulation requires similar control processes.

Future research should also test how our effects generalize along several dimensions. For example, if a food is extremely unhealthy (e.g., triple-layer chocolate cake of death), then perhaps everyone watches what they eat regardless of inherent self-control. Similarly, it is obvious that not every single food will show the patterns found in the present research (e.g., even in study 3 there was an unanticipated main effect of food type). Although we have no reason to expect that consumers low in self-control will never show any discrimination in their satiation patterns, we do expect (and find) less pronounced differences in the rate of satiation across food types for them versus those high in self-control. Further exploration of boundaries where low self-control consumers do show distinction in their rates of satiation may be enlightening.

Overall, the present research speaks to the great potential for the use of moderation as a way to limit food consumption. Such moderation could obviously be of great benefit to consumers as our findings suggest that reducing dietary intake is possible with small changes to the way they think about food. In particular, when consumers focus on the unhealthy aspects and simply pay more attention to how much they are eating, they may find that they stop enjoying the food sooner than usual. This monitoring process makes controlling one's behavior much easier as there is less desire to overcome, and therefore fewer resources are expended in the process. Recognition of the differences in rates of satiation and related adjustments to behavior can potentially lead to more optimal consumption patterns and improved well-being.

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