

Short Article

The Dieter's Paradox

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Abstract

Despite the vast public policy efforts to promote the consumption of healthy foods and the public's growing concern with weight management, the proportion of overweight individuals continues to increase. An important factor contributing to this obesity trend is the misguided belief about the relationship between a meal's healthiness and its impact on weight gain, whereby people erroneously believe that eating healthy foods in addition to unhealthy ones can decrease a meal's calorie count. This research documents this misperception, showing that it is stronger among individuals most concerned with managing their weight—a striking result given that these individuals are more motivated to monitor their calorie intake. This finding has important public policy implications, suggesting that in addition to encouraging the adoption of a healthier lifestyle among overweight individuals, promoting the consumption of healthy foods might end up facilitating calorie overconsumption, leading to weight gain rather than weight loss.

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Promoting the consumption of healthy foods is rooted in the actions of many agencies—including the FDA, USDA, and WHO—that aim to educate the public about the importance of eating nutrient-rich meals to maintain a healthy lifestyle and control weight gain (Thompson & Veneman, 2005; CDC, 2006). “Almost everyone needs to eat more fruits and vegetables” asserts CDC's Web site, dedicated to helping consumers develop a healthy eating plan (CDC, 2010). Adding healthy options to one's daily regimen is also the cornerstone of many diets and public policy initiatives concerned with managing weight gain. Yet, even in light of individuals' growing concern with managing their weight and the increase in the number of healthier options available, the proportion of overweight individuals continues to increase (Chandon & Wansink, 2007a; Wansink & Chandon, 2006).

So why, despite the vast public policy efforts to promote the consumption of healthy foods, has there been little change in the obesity trend? It is commonly thought that one of the main behavioral factors contributing to weight gain is people's lack of willpower to regulate their consumption behavior (Fishbach & Dhar, 2005; Fishbach & Zhang, 2008; Wertenbroch, 1998).

While willpower clearly plays a role, this research argues that overconsumption might also stem from people's misguided belief about the relationship between a meal's healthiness and its impact on weight gain.

In particular, this research argues that people behave as though healthy foods—such as fruits and vegetables—have “halos” that extend to all aspects of the meal, including its effect on weight gain. Because healthier meals are perceived to be less likely to promote weight gain, people erroneously assume that adding a healthy item to a meal decreases its potential to promote weight gain. This argument can be illustrated by the finding that people tend to believe that adding a healthy option (e.g., a side salad) to an unhealthy one decreases, rather than increases, the calorie content of the combined meal (Chernev & Gal, 2010). I refer to this misperception as the negative calorie illusion.

The existence of a bias in estimating a meal's calorie content naturally raises the question of how to correct it. Prior decision research has suggested that because biases often occur due to low-involved, nonsystematic processing of available information, they are less likely to occur when the level of involvement is high (Payne, 1976; Bettman, Luce, & Payne, 1998; Tversky & Kahneman, 1974). In the domain of food consumption, this implies that calorie estimation biases are less likely to occur among individuals who are most concerned with managing their

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weight. In fact, increased awareness of one's weight has been identified as a key aspect of behavioral modification aimed at reducing overconsumption (Eckel, 2008). This line of reasoning leads to the prediction that people concerned with managing their weight will be able to more accurately determine a meal's calorie content and, hence, are less likely to be susceptible to estimation biases, such as the negative calorie illusion.

As this research will demonstrate, however, this is not the case. The belief that adding a healthy item reduces a meal's potential to promote weight gain is not attenuated among individuals concerned with managing their weight. In fact, just the opposite occurs: It is much stronger for those individuals. Thus, weight-conscious individuals, including those on a diet, are *more* likely to believe that a meal's tendency to lead to weight gain can be decreased by simply adding a healthy item. I refer to this phenomenon as the "dieter's paradox."

Why are those most concerned with managing their weight more likely to underestimate the calorie content of a combination of healthy and unhealthy items? Building on prior findings, this research argues that the negative calorie illusion stems from people's tendency to categorize foods as healthy ("virtues") and unhealthy ("vices") according to a good/bad dichotomy (Chernev & Gal, 2010; Rozin, Ashmore, & Markwith, 1996; Wertenbroch, 1998; Knight & Boland, 1989). When presented with a meal that combines both a virtue and a vice, people form an overall impression of this meal's healthiness in a way that the vice/virtue combination is perceived to be healthier than the vice alone. Because people rely on their evaluations of a meal's healthiness to determine its calorie content, they consequently conclude that a meal combining a healthy and an unhealthy item has fewer calories than the unhealthy item alone.

This line of reasoning suggests that the negative calorie illusion is more likely to occur among individuals who have a stronger tendency to categorize foods into virtues and vices. Indeed, if vice/virtue categorization is the basis for underestimating a meal's calorie content, then individuals who are more likely to invoke this categorization are also more likely to believe that adding a virtue to a vice will reduce the calorie content of the combined meal. Building on prior research, I further propose that individuals concerned with their weight are among the most likely to categorize meals according to the good/bad dichotomy into virtues and vices (Polivy & Herman, 1983; Polivy & Herman, 1985; Scott, Nowlis, Mandel, & Morales, 2008; Dholakia, Gopinath, Bagozzi, & Natarajan, 2006; McFerran et al., 2010). Indeed, the cornerstone principle of most nutritional guidelines, as well as many diets, involves promoting the consumption of certain food groups while at the same time reducing the consumption of others (Seiders & Petty, 2004; Nestle et al., 1998; Thompson & Veneman, 2005; Polivy & Herman, 1987). And although particular guidelines and diets vary in the type of foods and nutrients considered "good" or "bad," most share the underlying principle of good/bad categorization of different foods.

Therefore, I posit that since weight-conscious individuals are more likely to categorize foods into a vice/virtue dichotomy,

they will consequently be more likely to underestimate the calorie content of meals containing both unhealthy and healthy items. In this context, I predict that individuals most concerned with managing their weight will be more likely to believe (relative to those less concerned with their weight) that the combination of a healthy item and an unhealthy item is likely to have fewer calories than the unhealthy item alone. The validity of this prediction is empirically examined in the following experiment.

Method

Respondents were 934 participants in a nationwide online research panel who received monetary compensation for taking part in the experiment. Participants in the panel were primarily female (74.2%) and were distributed across different age groups as follows: 5% were 20 or younger, 32% were between ages 21 and 30, 27% were between 31 and 40, 18% were between 41 and 50, and the remaining 18% were over 50.

Respondents were shown four meals and asked to estimate each meal's calorie content. Some of the respondents ($n=457$) were shown a series of relatively unhealthy meals, and others ($n=477$) were shown the same meals combined with a healthy option. Thus, the only difference between meals in these two conditions was the presence of a healthy option. The meals used in this experiment were (the corresponding healthy options are given in parentheses): hamburger (three celery sticks), bacon-and-cheese waffle sandwich (small organic apple), chili with beef (small salad without dressing), and meatball pepperoni cheesesteak (celery/carrot side dish).

To illustrate, in the first scenario, some of the respondents were asked to estimate the calorie content of a hamburger, whereas the others were asked to estimate the calorie content of the same hamburger combined with three celery sticks. The stimuli included both verbal descriptions and pictorial representations. The choice of the stimuli (e.g., a hamburger representing a vice and celery representing a virtue) is consistent with prior research (Chandon & Wansink, 2007b; Wertenbroch, 1998).

At the end of the experiment, respondents were also asked to indicate the extent of their concern with managing their weight on a 5-point scale (1=not at all concerned, 2=slightly concerned, 3=somewhat concerned, 4=moderately concerned, 5=extremely concerned). As a reward for participating in the experiment, respondents were entered into a lottery for several \$50 cash prizes.

Results

Each respondent evaluated several meal scenarios, yielding 2,750 observations: 1,343 observations in the unhealthy-meal condition and 1,407 observations in the unhealthy+healthy meal condition. The data show that respondents believed the unhealthy meal alone to average 691 calories. Logically, one would expect that adding another item to this meal would increase its calorie content. The data show, however, that adding a healthy item resulted in a significant decrease, rather

than an increase, in the meal's perceived calorie content to 648 calories ($F(1,931)=12.97, p<.001$). Thus, adding a healthy item lowered the estimated calorie content of the entire meal by an average of 43 calories, or 6.2%. This bias was observed in all four meals tested, indicating the prevalence of the belief that one can consume fewer calories by simply adding a healthy item to a meal.

To investigate whether individuals concerned with managing their weight were more likely to underestimate the calorie content of meals containing both a healthy and an unhealthy option, I examined their estimates as a function of their self-reported concern with their weight. The data show that respondents most concerned with managing their weight (those who rated their concern with their weight as "extreme" and scored it as 5 on a 5-point scale) perceived unhealthy meals containing a healthy option to have significantly fewer calories (relative to the unhealthy meal alone) than those who indicated lower levels of concern with their weight ($M=615$ vs. $M=711$ for weight-conscious individuals and $M=658$ vs. $M=684$ for those less concerned with their weight; Fig. 1).

Thus, adding a healthy option decreased the perceived calorie content of the combined meal by an average of 96 calories (13.5%) for weight-conscious individuals but only 26 calories (3.8%) for those less concerned with their weight. The dieter's paradox was observed in all four meals tested, lending support to the proposition that weight-conscious individuals are more likely to believe that by simply adding a healthy option one can lower a meal's calorie content (Table 1).

The significance of the above data pattern was tested with a model in which a meal's calorie content was given as a function of the presence of a healthy option, respondents' concern with managing their weight (between-subject factors), the specific

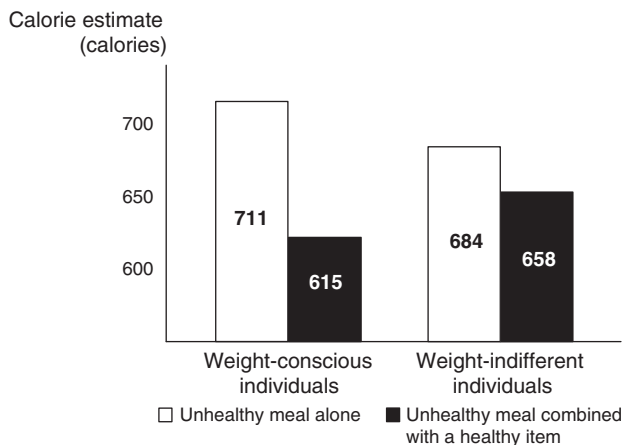


Fig. 1. Weight-conscious individuals are more likely to believe that adding a healthy option to an unhealthy meal decreases this meal's calorie content. Figure bars indicate the average estimates of a meal's calorie content. The difference between the evaluations of the unhealthy meal alone (white bars) and the unhealthy meal combined with a healthy item (black bars) is the negative calorie illusion. The difference in the pattern of white and black bars for weight-conscious individuals and those less concerned with their weight is the dieter's paradox.

meal (within-subject factor), and their interactions (Winer, Brown, & Michels, 1991). The data show that individuals' concern with managing their weight had a significant impact on their belief that adding a healthy item is likely to decrease a meal's potential to promote weight gain ($F(1,931)=6.45, p<.001$), lending support to the dieter's paradox.¹

The data further show the presence of a monotonically increasing trend between respondents' level of concern with their weight and the extent to which they believed that adding a healthy item to a meal can lower its calorie content. Thus, the negative calorie illusion was negligible (2 cal) for those not at all concerned with managing their weight; it was a bit (but not significantly) larger for those slightly and somewhat concerned with managing their weight (13 and 12 cal, respectively), increasing to 39 calories for those moderately concerned, and to 96 calories for those extremely concerned (Table 2). This data pattern reflects a significant linear trend, whereby higher levels of people's concern with their weight translated into a more pronounced negative calorie illusion ($F(1,928)=5.15, p<.05$).

The calorie content of the combination of healthy and unhealthy options was perceived to be lower by those most concerned with managing their weight (615 vs. 658 cal; $F(1,931)=4.96, p<.01$) than by those less concerned—a finding consistent with the dieter's paradox. In contrast, the calorie content of the unhealthy option alone was perceived to be greater by individuals more concerned with managing their weight than by those less concerned (711 vs. 684 cal; $F(1,931)=1.85, p<.10$), suggesting that the observed underestimation bias was particular only to meals combining healthy and unhealthy items and did not occur in the case of unhealthy meals considered alone.

Could this calorie estimation bias have been caused simply by people's belief that the healthy item itself had "negative" calories (e.g., because the energy used to digest these foods exceeds their calorie content)? To address this question, a separate group of 80 respondents from the same population was asked to estimate the amount of calories in the healthy items used in the main study. The data show that respondents believed that the healthy option alone contained a positive amount of calories ($M=62; N=256$). Moreover, none of the respondents estimated the healthy items to have negative calories, and only 10 responses (4%) estimated the healthy item to have zero calories. These findings suggest that the observed effect is not a function of respondents' beliefs about the calorie content of the healthy item itself but rather stems from combining healthy and unhealthy items.

Discussion

The existence of a bias in evaluating a meal's calorie content raises the question of identifying strategies to eliminate, or at least to reduce, this bias. One such strategy involves evaluating

¹ Grouping respondents who were either *extremely or moderately* concerned with managing their weight (per their ratings on a 5-point scale) and comparing their responses to those who indicated lower levels of concern with managing their weight yielded similar results ($F(1,931)=3.95, p < .05$).

Table 1

The impact of adding a healthy option on a meal's perceived calorie content as a function of individuals' concern with managing their weight.

Meal	Weight-conscious individuals			Weight-indifferent individuals		
	Unhealthy meal alone	Unhealthy meal+healthy item	Negative calorie illusion (%)	Unhealthy meal alone	Unhealthy meal+healthy item	Negative calorie illusion (%)
Burger	734 (107)	619 (110)	15.6	697 (349)	642 (364)	7.9
Sandwich	626 (106)	560 (111)	10.5	621 (349)	620 (364)	0.2
Chili	697 (57)	621 (53)	10.8	700 (159)	667 (176)	4.8
Cheesesteak	840 (57)	714 (53)	15.0	779 (159)	762 (176)	2.1
Average	711 (327)	615 (327)	13.5	684 (1,016)	658 (1,080)	3.8

Numbers indicate respondents' estimates of a meal's calorie content; the corresponding sample size is given in parentheses. The negative calorie illusion reflects the difference in the calorie estimates of the unhealthy meal alone and the healthy/unhealthy meal combination. The dieter's paradox is the difference between the strength of the negative calorie illusion for weight-conscious individuals and those less concerned with their weight.

a meal's components in a piecemeal fashion. This approach builds on prior research documenting that piecemeal estimation tends to improve people's ability to correctly estimate the calorie content of a meal (Chandon & Wansink, 2007b). To test the impact of piecemeal evaluation on the dieter's paradox, a separate group of 189 respondents from the same population was asked to estimate the calorie content of the individual components of each of the four meals used in this study. The meals viewed by respondents were exactly the same as in the healthy/unhealthy condition; the only difference was that respondents were asked to evaluate the calorie content only of the unhealthy item. The data show that the unhealthy option was believed to have essentially the same amount of calories when it was paired with the healthy option and when considered alone—an effect consistent for both weight-conscious and weight-indifferent individuals ($M=698$, $N=119$ vs. $M=711$, $N=327$ for the weight-conscious individuals and $M=706$, $N=500$ vs. $M=684$, $N=1,016$ for the weight-indifferent; $F(1,644) = .67$, $p > .20$). Moreover, in the piecemeal condition, weight-concerned and weight-indifferent respondents came up with essentially the same calorie estimate of the vice (698 vs. 706 cal; $F(1,644) < 1$, ns).

The data from piecemeal evaluation further suggest that the observed negative calorie illusion cannot be attributed to the fact

that the mere presence of the healthy item increased the perceived healthiness of the unhealthy meal. This is important because one might argue that the negative calorie illusion stemmed from participants' belief that the unhealthy item was perceived to be somewhat healthier (and hence more likely to have fewer calories) just because it was next to a very healthy item. The data show, however, that merely placing a healthy item next to an unhealthy one did not decrease its calorie content. This suggests that the dieter's paradox cannot simply be attributed to a change in people's perception of the healthiness of the individual components of a meal (e.g., due to a "spillover" effect) and is rather a function of people's holistic evaluation of combinations of healthy and unhealthy items.

Conclusion

This research examined how consumers' concern with managing their weight influences their belief that adding a healthy option to a meal is likely to decrease this meal's calorie content. In particular, it demonstrates that those most concerned with managing their weight are also most likely to underestimate the calorie content of meals containing both healthy and unhealthy items—a striking result given that these individuals tend to be more motivated to monitor a meal's potential to promote weight gain.

From a conceptual standpoint, this research adds to the decision literature by providing new insights on the impact of decision biases on value judgments. Contrary to the popular view that higher levels of involvement and motivation tend to attenuate decision biases, this research documents the opposite: The negative calorie bias is more pronounced for more involved/motivated individuals. Thus, when evaluating vice/virtue combinations, greater motivation does not necessarily result in greater accuracy but instead can lead to more biased judgments.

This research further contributes to the literature by identifying the motivational antecedents of decision biases in deriving numeric estimates. Prior research has suggested that the negative calorie illusion is a cognitive bias that is likely to precede biases caused by motivational factors (Chernev & Gal, 2010; Chernev & Chandon, in press). In this context, it was proposed that calorie underestimation could further promote

Table 2

The impact of adding a healthy option on a meal's perceived calorie content as a function of individuals' concern with managing their weight.

Concern with gaining weight	Unhealthy meal alone	Unhealthy meal+ healthy item	Negative calorie illusion (%)
Not at all concerned	707 (74)	705 (52)	0.3
Slightly concerned	664 (139)	651 (208)	2.0
Somewhat concerned	673 (278)	662 (346)	1.7
Moderately concerned	692 (525)	653 (472)	5.6
Extremely concerned	711 (327)	615 (327)	13.5

The numbers in each cell indicate respondents' estimates of a meal's calorie content; the corresponding cell size is given in parentheses. The dieter's paradox is reflected in the fact that the negative calorie illusion is stronger for those more concerned with managing weight.

licensing effects (Khan & Dhar, 2006; Wansink & Chandon, 2006), whereby misconstruing a vice/virtue option as a “healthy” choice can provide individuals with an “excuse” to prefer a vice over a virtue in a subsequent choice. In contrast, this research documents that cognitive biases, such as the negative calorie illusion, in addition to potentially contributing to motivational biases, can themselves be a result of an individual’s motivation.

The finding that individuals’ motivation can lead to decision biases raises the question of identifying the psychological underpinnings of this process. In this context, one could argue that the dieter’s paradox can be attributed to the fact that individuals are rationalizing their decisions in such a way that those most concerned with managing their weight are also most motivated to think that the combination of a vice and a virtue has fewer calories. While this motivated-reasoning account for the negative calorie illusion has its appeal, the data reported in this research cannot be explained by a rationalization argument. Indeed, the experimental manipulation presented respondents with a calorie-estimation task that did not involve actual consumption and, consequently, consumers had no reason to rationalize their behavior. Moreover, if motivated reasoning were the sole driver of the observed effects, then the negative calorie illusion should have been observed for both joint and piecemeal evaluations—a prediction inconsistent with the experimental data.

Recognizing the possibility that calorie estimates can be influenced by an individual’s motivated reasoning, this research suggests that an individual’s motivation can also follow an indirect route to influencing numeric estimates by altering the likelihood that individuals form vice/virtue stereotypes of food items. Because vice/virtue categorization is a key factor contributing to the negative calorie illusion (Chernev & Gal, 2010), individuals that are more likely to invoke this categorization are also more likely to believe that adding a virtue to a vice will reduce the calorie content of the combined meal. Thus, by influencing the propensity to categorize meals based on their healthiness, individuals’ motivation can indirectly influence their susceptibility to the negative calorie illusion.

The notion that individuals most concerned with managing their weight are also more prone to categorizing food items into vices and virtues further implies that decision biases in calorie estimation are not limited to combinations of simultaneously presented healthy and unhealthy items and can be observed in other decision contexts as well. For example, recent research has documented that sequential evaluations of vice/virtue combinations can lead to contrast effects, whereby a vice is believed to have more calories when preceded by a virtue than when preceded by another vice (Chernev, *in press*). The motivated categorization account for the negative calorie illusion advanced in this research predicts that the contrast effects in evaluating virtue/vice sequences will be stronger among those most concerned with managing their weight. It is also likely that the dieter’s paradox is not limited to estimating a meal’s calorie content but is likely to occur for other numeric estimates as well (e.g., fat, sodium, and carbohydrates). In this context, investigating the role of motivation in generating

numeric estimates across different domains is a promising area for future research.

Another area for further investigation involves identifying the boundary conditions of the dieter’s paradox. Because the dieter’s paradox stems from the negative calorie illusion, the boundary conditions of the latter will also hold for the dieter’s paradox. In particular, the negative calorie illusion has been shown to be less pronounced when individuals pay attention to the quantity of the combined items, instead of focusing solely on the healthy/unhealthy aspects of the items (Chernev & Gal, 2010). In this context, one can argue that the dieter’s paradox is likely to be a function of the type of diet followed by individuals. Diets vary in the degree to which they rely on classifying foods into virtues and vices: To some diets (such as the South Beach and Atkins diets), the vice/virtue categorization of foods is central, while others are more focused on the actual quantity (and calories) consumed (such as Weight Watchers). As a result, one can expect the dieter’s paradox to be more pronounced for those following diets classifying foods according to a good/bad dichotomy and less pronounced for those who pay more attention to the actual quantity consumed. Determining the impact of specific types of diet on an individual’s likelihood to underestimate the calorie content of vice/virtue combinations is a fruitful area for further research.

From a public policy standpoint, the findings reported in this research imply that encouraging the adoption of a healthier lifestyle among weight-conscious individuals by simply promoting the consumption of healthy foods can lead to calorie underestimation and end up facilitating weight gain rather than loss. This paradoxical outcome raises the question of identifying public policy strategies that are likely to avert undesirable outcomes. Specifically, this research attributed the dieter’s paradox to the misguided belief about the relationship between a meal’s healthiness and its impact on weight gain, whereby people erroneously believe that eating healthy foods in addition to unhealthy ones can decrease a meal’s calorie count. An important aspect of public policy, therefore, should involve educating consumers about the differences between a meal’s healthiness and its calorie count—in particular that although adding a healthy item can make a meal healthier, it cannot lower its calories. This is especially important in light of the recent trend to rate a meal’s healthiness by the presence of nutrients and other healthy ingredients without considering its less healthy aspects, such as calories (e.g., the Smart Choices front-of-pack nutrition labeling program). This research shows that focusing only on virtues can implicitly promote the erroneous belief that the healthy aspects of the meal can compensate for its unhealthy aspects, and that an unhealthy meal can be made healthier and less likely to promote weight gain by simply adding a healthy item or ingredient.

Another public policy issue raised by this research concerns the viability of promoting the very notion of stereotyping foods into vices and virtues. Despite its intuitive appeal as a decision heuristic to simplify choice, vice/virtue categorization focuses consumers’ attention only on one aspect of the meal and ignores other important aspects such as its overall quantity. Regulating the total consumption quantity is an important component of

managing overall calorie intake, which has been overshadowed by the excessive focus on a meal's healthiness. Thus, focusing the public's attention on the quantity of the consumed meal can help eliminate the negative calorie illusion and, in turn, eliminate the dieter's paradox.

In general, this research argues that a higher level of motivation to manage one's weight is a necessary but insufficient condition for achieving one's weight-management goals. Higher levels of motivation lacking the corresponding knowledge can lead to counterproductive outcomes. In this context, public policy should focus not only on encouraging consumers to manage their weight but also on educating them about important aspects of healthy eating, such as the difference between a meal's healthiness and its propensity to promote weight gain, as well as the importance of monitoring the overall quantity consumed.

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