The Influence of Health Motivation and Calorie Ending on Preferences for Indulgent Foods

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Food and beverage manufacturers now regularly display "just below" calorie amounts (e.g., 99, 199, 299) in advertisements, presumably to appeal to health-motivated consumers. "Just below" values are those that fall one or more digits below a round number, most commonly seen as nine-ending numbers. However, although nine-ending prices are known to stimulate purchase intent, it is unclear whether or when nine-ending calorie labeling shapes food preferences. The present research shows that when consumers view indulgent foods with just-below (vs. round-ending) calorie amounts, they exhibit higher consumption intentions, purchase intent, and consumption behavior, yet only if they are high in health motivation. This is due to a tendency for health-motivated consumers to overweigh the leftmost digit in multidigit numbers—a cognitive bias known as the "level effect." This bias results in the perception that just-below (vs. round) -ending indulgent foods have relatively fewer calories, decreasing anticipated guilt and increasing consumption intentions and behavior. The superiority of just-below calorie presentation under health motivation is attenuated with the addition of reference intake labeling (i.e., % daily calorie intake values), which equalizes the magnitude of nine- and round-ending calorie indulgent foods.

Keywords: health motivation, indulgent foods, calories, calorie ending, level effect, nutrition labels

As a result of recent cultural and policy shifts, calorie information is becoming increasingly available to consumers. McDonald's and Starbucks voluntarily include calorie counts on their menu boards, and all restaurant chains are now required to post calorie information (Filloon 2018). Further, FDA changes to food labels effective in January 2020 will make calories more prominent by placing them in larger, bold type (FDA.gov 2018). Notably, while a great deal of research has examined whether the presence or absence of calorie labeling influences eating behaviors (with mixed results; Bollinger, Leslie, and Sorensen 2011; Elbel et al. 2009; Haws and Liu 2016; Swartz, Braxton, and Viera 2011), there has been little attention paid to how minute changes in the calorie content itself can shape consumption preferences.

In particular, companies have recently been experimenting with "just below" calorie labeling (e.g., 99 vs. 100, 799 vs. 800), which often targets health-motivated consumers. For example, beer staples such as Corona and Budweiser

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advertise 99 calorie "light" versions in the US, and Nestlé and PepsiCo relaunched popular snacks into 99 calorie lines in Europe (Talking Retail 2008, 2009). Further, online content, from Cooking Light to the BBC, touts a myriad of "under 200 calorie" desserts. This raises the question of how consumers—and specifically, health-motivated consumers—respond to this type of presentation in terms of their consumption intentions, purchase intentions, and eating behavior.

Although research has yet to investigate the influence of this type of calorie presentation, the psychological pricing literature has long recognized the power of such numbers. Setting prices just below a round number is referred to as "just below" or "odd" pricing (Stiving and Winer 1997). One widely studied type of just-below pricing is that of nine-ending numbers (Macé 2012; Schindler and Kirby 1997; Thomas and Morwitz 2005). A price ending in nine (e.g., $3.99) generates more sales than a round-ending price just one cent higher (e.g., $4.00; Anderson and Simester 2003; Schindler and Kibarian 1996; Stiving and Winer 1997). One explanation for this phenomenon, and the focus of the present investigation, is the left-digit or "level" effect, which describes how people tend to overweigh the leftmost digit of a number, thereby underestimating just-below and nine-ending prices (Anderson and Simester 2003; Bizer and Schindler 2005; Macé 2012; Schindler 1991; Schindler and Kirby 1997; Stiving and Winer 1997; Thomas and Morwitz 2005).[1] In this case, $4.00 is perceived as greater in magnitude than $3.99 or $3.93 because its left digit is higher, while $3.99 and $3.93 are viewed similarly.

The level effect is typically considered automatic and universal (Thomas and Morwitz 2005), but little work has examined its generalizability in numerical processing. Except for Thomas and Morwitz's (2005) work with quality ratings, level effects for non-price-related numbers have not been studied. There are distinctions between prices and calories that could influence the processing of multidigit numbers, such as the demarcation of lesser values by a decimal point (e.g., $1.99) and the use of superscript (e.g., 1^{99}) in prices but not calories. Further, the overrepresentation of nine-ending and just-below numbers in prices relative to other contexts (Schindler and Kirby 1997) produces more opportunities to rely on the level effect in interpreting prices and may, over time, render the effect more automatic in this domain.

There are hints that level effects are more pronounced in contexts susceptible to motivational influences, though motivation itself has not been systematically explored. For example, level effects were more prominent among consumers motivated to save money and erased when goals shifted to social motivations (Manning and Sprott 2009), presumably because consumers who want to save money are motivated to see prices as lower. Relatedly, for consumers high in need for cognition or among those instructed to think carefully about price, level effects were mitigated (Bizer and Schindler 2005), raising the possibility that an implicit motivation to see these numbers more accurately—and a lack of motivation to see these numbers as lower—played a role in attenuating the level effect. Taken together, this research suggests that consumers are cognitively attuned to focusing on the left digit in numerical processing, but leaves open the possibility that calories may operate distinctly from prices, and that people may be more or less prone to this bias depending on salient goals.

The present research lies at the intersection of motivation and the numerical processing of calorie information for indulgent foods. A large literature has identified several ways motivation influences perception and consumption decisions. On one hand, people motivated to be healthy should be less interested in indulgent foods. People motivated to stick to long-term goals in the face of temptation have a suite of self-regulatory controls (Fishbach and Trope 2005; Myrseth, Fishbach, and Trope 2009; Trope and Fishbach 2000). For instance, when presented with chocolate bar options, gym-goers lower their ratings of the chocolate's perceived appeal and anticipated enjoyment (Myrseth et al. 2009). Further, absent nutrition information, people with stronger dieting goals overestimate the calories in a treat (Zhang, Huang, and Broniarczyk 2010) and anticipate feeling guilty if they indulge (Mohr, Lichtenstein, and Janiszewski 2012), which has been shown to curb consumption (Giner-Sorolla 2001).

At the same time, motivation influences visual perception and interpretation, leading people to view stimuli in a goal-consistent manner (Balcetis and Dunning 2006). Because health-motivated consumers are more likely to desire lower-calorie food choices (Chernev 2011; Koenigstorfer and Baumgartner 2016; Papies and Veling 2013; Versluis and Papies 2016), they may also be more likely to use strategies that lead them to perceive calorie amounts as lower in magnitude, such as focusing on the leftmost digit. In support of this motivated perception argument, research has found that weight-conscious individuals are more likely to underestimate the calorie content of meals comprising healthy and unhealthy foods (Chernev 2011).

Both a tendency to avoid unhealthy food and a desire to perceive calorie amounts as lower should influence how health-motivated consumers evaluate indulgent treats. Specifically, while typical (round-ending) indulgent foods are more likely to be interpreted negatively (Myrseth et al. 2009; Zhang et al. 2010) and elicit lower consumption intentions when consumers want to eat healthfully, just-

[1] A second explanation for the superiority of nine-ending prices is the "image effect," whereby people tend to assume nine-ending prices are on sale or discounted (Schindler and Kibarian 2001; Stiving and Winer 1997). However, since nine-ending calorie presentation is relatively new, it is less likely that consumers have already ascribed specific images to these calorie endings.

below calorie content should mitigate this effect due to the goal-directed perception of it as relatively lower in magnitude. In other words, consumers high in health motivation should perceive just-below calorie foods to be significantly lower than their round-ending counterparts (due to the level effect), which elicits less anticipated guilt and increases consumption intentions (Belei et al. 2012; Mohr et al. 2012). By contrast, consumers low in health motivation are less inclined to avoid indulgent foods and less motivated to interpret foods as lower in calories; hence, they should be less susceptible to the level effect and be similarly inclined to consume just-below versus round-ending calorie indulgent foods.

We present four experiments establishing this phenomenon using both measured and manipulated motivation across various types of indulgent foods and calorie amounts. Study 1 shows the effect in a behavioral context with a serving of chocolate candies. Study 2 examines a currently marketed beverage and includes 93, 99, and 100 calorie options to investigate the level effect on purchase intentions and generalize the reliance on the left digit beyond nine endings. Study 3 provides evidence for our proposed mechanism whereby just-below calorie presentation lowers calorie magnitude judgments and, in turn, lowers anticipated guilt, which increases consumption intentions only when consumers are motivated to be healthy. Finally, study 4 introduces a boundary condition with policy implications for menu labeling.

STUDY 1

We first demonstrate that just-below calorie amounts manipulated through an ad appeal can influence eating behavior. We measure consumption of Hershey's Kisses depicted as having nine- or round-ending calories per serving among people who vary on health motivation.

Method

Participants and Design. Two hundred eighty-four public university students completed this study and were randomly assigned to a 2 (calories: 199 vs. 200) × continuous (health motivation) between-subjects design. Two people withdrew from the study and one did not complete the health motivation measure, leaving a final sample of 281 ($M_{age} = 20.7$, three unknown ages; 37% female).

Procedure. Participants were told that we were conducting a study about advertisements and food. Participants were first asked to answer two questions about their chronic health motivation: (1) "How important is being healthy to who you are as a person?" (1 = Extremely unimportant, 7 = Extremely important); and (2) "How motivated are you to live a healthy lifestyle?" (1 = Not at all motivated, 7 = Very motivated; $r = .77$; $M = 5.23$, SD = 1.14). We created this measure to explicitly capture the influence of a general motivation to be healthy (which could also be primed), rather than the more specific (though related) individual differences examined in prior research, such as restrained eating (Scott et al. 2008), dieting goals (Zhang et al. 2010), health hazard avoidance (Moorman 1990), or weight consciousness (Chernev 2011).

On a subsequent screen, participants were told we would first evaluate their perceptions of a series of Hershey's Kisses advertisements—the food they would later be testing. These ads were actually our calorie-ending manipulations. Depending on condition, the ads reported that one serving of chocolate (nine kisses) had 199 or 200 calories. To increase involvement, participants selected their favorite ad (see appendix A). Next, participants were told we were interested in how food and video pairings enhance consumer experiences. Participants received a plastic bag containing seven Hershey's Kisses and were told they could eat as few or as many chocolates as they wanted while watching a short, 2.5 minute video about the Hershey's brand.[2] To track consumption, we labeled each bag with a unique number that the participant entered into the computer. Once the video ended, participants raised their hands and a research assistant took away any uneaten chocolate and recorded the number of chocolates consumed. Participants then completed filler questions to bolster the cover story (e.g., How much did you enjoy eating the Hershey's Kisses while watching the video? How much did you enjoy the video?[3]), answered demographic questions, and were debriefed (see web appendix A for methodological details).

Results and Discussion

Analysis of the number of Kisses eaten revealed a significant interaction of health motivation (continuous; mean-centered) and calorie ending (categorical; 199 = 1, 200 = 0) (unstandardized $b = 0.42$, SE = .20, $t(277) = 2.14$, $p = .033$; see figure 1); main effects were NS ($ps > .10$). A spotlight analysis revealed that participants consumed more chocolate after the 199 (vs. 200) calorie ad when health motivation was higher (+1 SD, $b = 0.82$, SE = .31, $t(277) = 2.63$, $p = .009$) but not lower (–1 SD, $p = .680$). In calorie terms, participants higher in health motivation consumed 2.48 (vs. 1.66) Kisses, equivalent to 18 additional calories eaten in 2.5 minutes.

Study 1 shows that highly health-motivated consumers are more likely to consume chocolates labeled as having 199 versus 200 calories per serving, and end up consuming significantly more calories than the one-calorie difference on the nutrition label. The pattern of results supports our

[2] https://www.youtube.com/watch?v=TMEJotxwZ9E&t=5s.

[3] There was no interaction between health motivation and calorie ending on any of the filler measures ($ps > .33$).

argument that higher health motivation leads to decreased interest in consuming (round-ending) indulgent foods, yet also shows that nine-ending presentation mitigates this drop among highly health-motivated individuals.

It is possible that these results emerged not because of the level effect (i.e., overweighting of the leftmost digit), but because health-motivated consumers are more sensitive to lower calorie amounts—even just one calorie lower—or find nine-ending calorie amounts less credible. In study 2, we address these two alternative explanations with a product commonly marketed as having nine-ending calories and provide further support for our contention that health-motivated consumers are more susceptible to the level effect.

STUDY 2

Beer varies significantly in its calorie amount, from Budweiser Select 55 (55 calories per 12 ounces) to Guinness Extra Stout (176 calories per 12 ounces), with many light beers targeted toward health-motivated consumers. Currently, Budweiser, Corona, and Heineken advertise 99 calorie beers, but it is unclear whether they are more desirable to health-motivated individuals than their 100 calorie counterparts. While light beer is marketed as diet-friendly, beer does not have inherent nutritional value, and consumers focused on living a healthy lifestyle tend to limit or forgo sources of "empty calories." We propose that health-motivated consumers want to see the calorie content of this beverage as lower, and are thus more susceptible to the level effect.

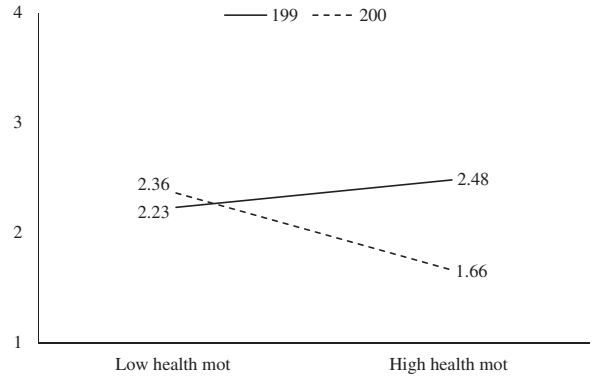
We test this prediction with a Corona Light ad using three calorie amounts: 93, 99, and 100. If health motivation influences the level effect, then health-motivated consumers in the 99 calorie and 93 calorie conditions should view both options similarly, despite their six-calorie difference, because of their identical left digit. Such a pattern should not be evident for consumers low in health motivation. Thus, this study examines: (1) the level effect as the cognitive mechanism, and (2) the alternative explanation of sensitivity to minute differences in calorie amount. We also assess the perceived credibility of the calorie amount as a potential alternative explanation for this effect.

Method

Participants and Design. Four hundred seventy-four Amazon Mechanical Turk (MTurk) participants (M_{Age}= 37.72, 52.4% female, one unknown age) completed the study and were randomly assigned to a 3 (calories: 93 vs. 99 vs. 100) × continuous (health motivation) between-subjects design. Individuals were filtered from another survey such that only those aged 21 or over took part in this study.

FIGURE 1

HEALTH MOTIVATION × CALORIE-ENDING ON NUMBER OF CHOCOLATES CONSUMED



Procedure. Participants were first asked background questions that included their age and the same health motivation index from study 1 (r = .67; M = 5.63, SD = 1.07). Next, following a filler survey, participants evaluated a new ad for Corona Light, depicted as having 93, 99, or 100 calories depending on condition (see appendix B). We then measured purchase intentions by asking, "If you were to go to the grocery store, the chance of you purchasing a six-pack of Corona Light is: Very unlikely/Very likely, Very improbable/Very probable, and Very impossible/Very possible," all on nine-point scales (adapted from MacKenzie, Lutz, and Belch 1986; α = .98). Finally, to assess credibility, participants rated their agreement with the statements: (1) I believed the calorie information, and (2) the calorie information was credible (1 = Completely disagree, 7 = Completely agree; r = .78; see web appendix B for methodological details).

Results and Discussion

Analysis of purchase intentions revealed an omnibus interaction of health motivation (mean-centered) and calorie ending (93/99/100) (F(2, 468) = 4.51, p = .012); main effects were NS (ps > .4). In follow-up analyses, the planned interaction contrast of the 93 and 99 calorie endings was NS (unstandardized b = –.35, SE = .301, t(468) = –1.15, p = .25). We therefore collapsed and contrasted the 93 and 99 calorie endings against the 100 calorie endings: this interaction contrast was significant (b = –.73, SE = .26, t(470) = –2.78, p = .006; see figure 2). A spotlight analysis reveals that participants had higher purchase intentions for the 93/99 (vs. 100) calorie beer when health motivation was higher (+1 SD, b = –.96, SE = .404, t(470) = –2.39, p = .018) but not lower (–1 SD, b = .59, SE = .389, t(470) = 1.53, p = .126).

Credibility. There were no significant effects of health motivation, calorie level, or their interaction on credibility (*p*s > .10).

Discussion. These results reveal our focal effect with a real 99 calorie product. The similar pattern for the 93 and 99 calorie conditions provides additional support for the level effect in driving our results. We also note that a second behavioral study in web appendix E provides convergent support for the level effect by comparing 180, 199, and 200 calorie chocolates. Under manipulated health motivation, chocolates advertised as 199 and 180 calories were equally likely to be consumed, and more likely to be consumed than 200 calorie chocolates. Finally, study 2 rules out calorie sensitivity and credibility as alternative explanations.

Next, we examine the underlying mechanism of this focal effect with a new calorie amount, food, and manipulated health motivation.

STUDY 3

Study 3 looks at the process underlying consumer preferences for nine-ending foods under health motivation: perceived calorie magnitude and guilt. If consumers focus on the leftmost digit, as the level effect would suggest and as study 2 implies, they should perceive the magnitude of a nine- (vs. round-) ending calorie indulgent food as relatively lower, which has been shown to reduce perceived guilt (Mohr et al. 2012), increasing consumption intentions. We also generalize our effect by using an incidental health motivation prime rather than a chronic measure, and include two control conditions (a primed control and a baseline "no prime" condition) to ensure that any observed effects are not due to idiosyncrasies of the manipulation.

Method

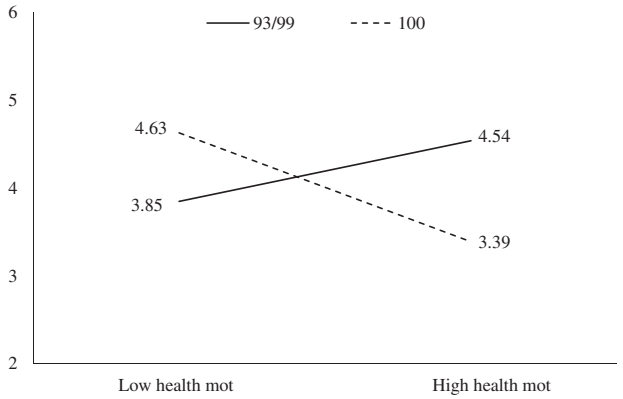
Participants and Design. Two hundred ninety-six MTurk participants (42% female, M_{age} = 35.8 years) completed the study and were randomly assigned to a 3 (motivation: health vs. control vs. baseline) × 2 (calorie ending: nine [199] vs. round [200]) between-subjects experiment.

Procedure. Participants completed two ostensibly separate studies. The first, a sentence-unscrambling priming task (May and Irmak 2014; Srull and Wyer 1979), was described as measuring recognition of company slogans. Participants in the health motivation condition saw 10, four- to five-word scrambled sentences: seven health-related (e.g., "commit to be fit") and three neutral (e.g., "solutions for a small planet"). Those in the control condition saw 10 neutral sentences.[4]4 Participants in the baseline condition did not complete this task.

In the second study, ostensibly about "popular snacks," participants were shown a cinnamon and sugar donut with 199 or 200 calories (see web appendix C). Participants rated their consumption intentions for the donut using the three items adapted from MacKenzie et al. (1986), as in study 2 (α = .96). Next, to capture the subjective nature of calorie magnitude perceptions, participants rated the calorie amount relative to other foods: "How would you compare the dessert you saw to other types of desserts?" (1 = It has relatively fewer calories, 7 = It has relatively more calories). To assess consumption guilt (Lee-Wingate and Corfman 2010), we asked participants, "How guilty/regretful/uneasy/hesitant/reluctant/sorry would you feel about ordering this dessert?" (1 = Not at all, 7 = Extremely; α = .96).

FIGURE 2

CALORIE-ENDING × HEALTH MOTIVATION ON PURCHASE INTENTIONS



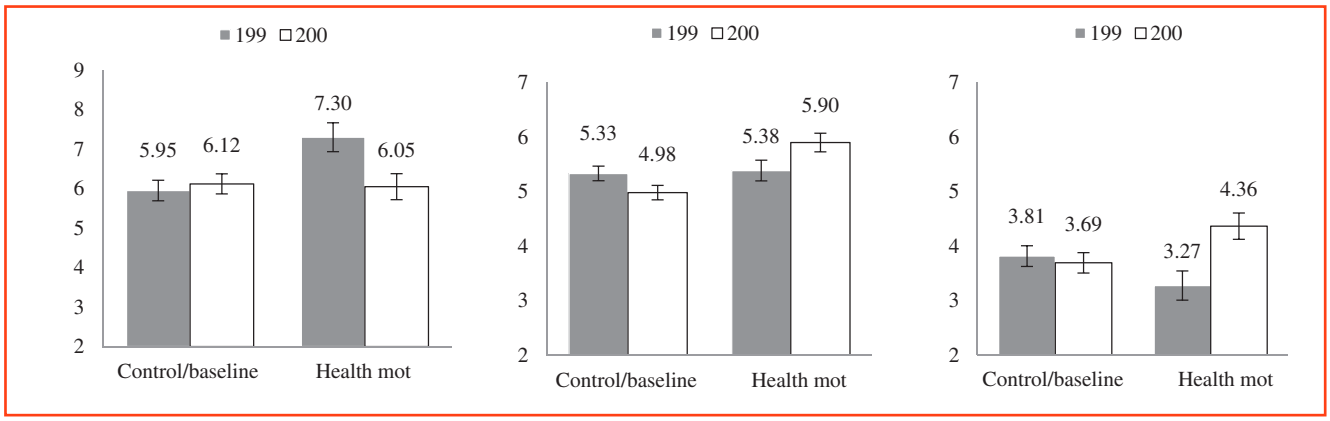
Results and Discussion

Consumption Intentions. We combined the control and baseline conditions in subsequent analyses because no differences were observed on any dependent variables. A 2 × 2 ANOVA of consumption intentions revealed main effects of health motivation and calorie ending (respectively, $F(1, 292) = 4.34$, $p = .038$, $\eta_p^2 = .015$; $F(1, 292) = 3.13$, $p = .078$, $\eta_p^2 = .011$), qualified by their two-way interaction ($F(1, 292) = 5.35$, $p = .021$, $\eta_p^2 = .018$). As expected, the 199 (vs. 200) calorie donut elicited higher consumption intentions under health motivation ($M_{199} = 7.30$, $SD_{199} = 1.87$ vs. $M_{200} = 6.05$, $SD_{200} = 2.74$; $F(1, 292) = 6.44$, $p = .012$, $\eta_p^2 = .022$), but not at control/baseline ($M_{199} = 5.95$, $SD_{199} = 2.57$ vs. $M_{200} = 6.12$, $SD_{200} = 2.59$; $F(1, 292) = .209$, $p = .648$; see figure 3, left).

[4] A pretest of this prime showed participants were more likely to care about healthy eating following the health (vs. control) scrambled sentence task ($M_{Health} = 4.44$, $SD_{Health} = 1.61$ vs. $M_{Control} = 3.27$, $SD_{Control} = 2.09$; $F(1, 138) = 13.68$, $p < .001$). See web appendix F.

FIGURE 3

MOTIVATION × CALORIE-ENDING ON CONSUMPTION INTENTIONS (LEFT), RELATIVE CALORIE MAGNITUDE (CENTER), AND ANTICIPATED GUILT (RIGHT)



Relative Calorie Magnitude. ANOVA of relative calorie magnitude revealed a main effect of health motivation but not of calorie ending (respectively, $F(1, 292) = 9.26$, $p = .003$, $\eta_p^2 = .031$; $F(1, 292) = .262$, $p = .609$), qualified by their two-way interaction ($F(1, 292) = 7.34$, $p = .007$, $\eta_p^2 = .025$). As expected, the 199 (vs. 200) calorie donut was seen as relatively lower in calories under health motivation ($M_{199} = 5.38$, $SD_{199} = 1.38$ vs. $M_{200} = 5.90$, $SD_{200} = .93$; $F(1, 292) = 4.01$, $p = .046$, $\eta_p^2 = .014$). Unexpectedly, this contrast was marginally reversed at control/baseline ($M_{199} = 5.33$, $SD_{199} = 1.29$ vs. $M_{200} = 4.98$, $SD_{200} = 1.47$; $F(1, 292) = 3.43$, $p = .065$, $\eta_p^2 = .012$), though this effect did not replicate across other variables or studies (see figure 3, center).

Anticipated Consumption Guilt. ANOVA of anticipated consumption guilt revealed a main effect of calorie ending but not of health motivation (respectively, $F(1, 292) = 4.64$, $p = .032$, $\eta_p^2 = .016$; $F(1, 292) = .085$, $p = .771$), qualified by their two-way interaction ($F(1, 292) = 7.30$, $p = .007$, $\eta_p^2 = .024$). Consistent with our theory, the 199 (vs. 200) calorie donut reduced anticipated guilt for health-motivated participants ($M_{199} = 3.27$, $SD_{199} = 1.81$ vs. $M_{200} = 4.36$, $SD_{200} = 1.73$; $F(1, 292) = 9.10$, $p = .003$, $\eta_p^2 = .03$) but not for control/baseline participants ($M_{199} = 3.81$, $SD_{199} = 1.89$ vs. $M_{200} = 3.69$, $SD_{200} = 1.87$; $F(1, 292) = .214$, $p = .644$; see figure 3, right). (See web appendix I for descriptive statistics for all variables.)

Moderated Serial Mediation. We conducted a moderated serial mediation analysis using 10,000 bootstrap samples (Blanchard, Carlson, and Hyodo 2016; Hayes 2015). Calorie ending was included as the predictor (X: 199 = 1, 200 = 0), consumption intentions as the outcome (Y), relative calorie magnitude as the first mediator (M_1), anticipated guilt as the second mediator (M_2), and motivation as the moderator (W: health motivation = 1, control/baseline = 0). As predicted, there was a significant indirect effect of calorie ending on consumption intentions through relative calorie magnitude and anticipated guilt in series ($B = .1145$; 95% CI: .0194 to .2823). Further, under health motivation, the indirect effect through only anticipated guilt was significant ($B = .5826$; 95% CI: .1663 to 1.060), as was the indirect effect through only calorie magnitude ($B = –.1557$; 95% CI: –.3916 to –.0225). In the control/baseline condition, we found no evidence of indirect effects through guilt alone or through calorie magnitude and guilt in series. Interestingly, we did find an indirect effect through magnitude alone ($B = .1062$; 95% CI: .0007 to .2866), though we do not draw further inferences because, as described, the effect of calorie ending on consumption intentions was not significant in the control/baseline condition (see web appendix G for mediation analysis details).

Discussion. Using a new food and consumption context, study 3 shows that health-motivated consumers continue to desire the nine- (vs. round-) ending calorie food. Our mediation analysis suggests that this is driven by health-motivated consumers estimating that the indulgent food with 199 calories has relatively fewer calories than the same food with 200 calories, which decreases their anticipated guilt. This serial mediation path was not significant for non-health-motivated consumers. Thus, study 3 provides further support for our argument that the level effect occurs primarily among health-motivated consumers.

We note that the study 3 consumption intentions measure did reveal a slightly different pattern from our theorizing and prior studies, such that health motivation (vs. control/baseline) increased consumption intentions for the nine-ending condition, as opposed to decreased intentions

for the round-ending condition. However, this pattern was not evident for the calorie magnitude or guilt results, which both revealed a self-regulatory pattern whereby participants perceived the highest calorie magnitudes and highest feelings of guilt under health motivation in the round-ending condition. We discuss this discrepancy further in the general discussion.

STUDY 4

In our final study, we examine a potential boundary condition for this effect. Since the level effect stems from the distorted perception of nine-ending calorie content as significantly lower than its round-ending counterpart, interventions that equalize the two calorie amounts should attenuate the effect. An example of such an intervention is evident in certain food labels in the European Union and the United States, where nutritional information is accompanied by a number indicating the proportion of daily recommended calories and nutrients in each serving of the food, otherwise known as the "% reference intake" (FDA 2016). In Europe, percent reference intake values on nutrition labels have been required since 2011 (Referenceintakes.EU 2018).

We test such an intervention in a restaurant web page context with a higher calorie magnitude (799/800) and an integrated health motivation prime. We expect such an intervention to be particularly effective for two reasons. First, because the level effect relies on the overweighting of the leftmost digit, this effect should be mitigated when nine- and round-ending calories are equalized, such as when the same proportion of calorie intake is presented for both amounts (e.g., 40% of daily intake). Second, in both Europe and the United States, restaurant menu and nutrition labels include recommended daily calories (typically 2,000 for an adult). We included this value for realism as a potential policy intervention, with the acknowledgment that providing this reference point or comparison standard is likely to further strengthen this intervention. Thomas and Morwitz (2005) showed that the level effect was mitigated when the perceived distance between target and comparison standard is large. For example, people judged a pen priced at $3.99 to be significantly lower in price than one at $4.00 if they were given a comparison product that was $5.00, but not $6.00. Thus, we expect that the level effect will be attenuated if consumers are given a high calorie amount (i.e., 2,000) as a comparison standard.

Method

Participants and Design. Seven hundred sixty-seven MTurk participants (56% female, $M_{age} = 36.5$) completed the study and were randomly assigned to a 2 (motivation: health vs. control) × 2 (calorie ending: nine [799] vs. round [800]) × 2 (intervention: percentage of daily recommended calories [40%] vs. no-intervention) between-subjects experiment.

Procedure. Participants were asked to imagine they were living in Chicago and ordering food online from the website of a local restaurant, "The Burnham." On the next screen, they read that the restaurant was surveying consumers about an ad for a new event it was sponsoring. Participants in the health motivation condition saw an ad with the message, "Proud Sponsor of the 2017 Chicago Marathon," while those in the control condition saw the message, "Proud Sponsor of the 2017 Chicago Concert" (see appendix C and web appendix D). As ostensible survey questions about their impressions of the ad, we asked participants to rate their attitude toward the ad as well as two manipulation checks: "When I look at the ad, it motivates me to be healthy"; "When I look at the ad, it motivates me to be interested in music" (1 = Strongly disagree, 7 = Strongly agree).

Next, participants were asked to imagine that they just finished ordering their entrée and were considering ordering dessert. They were presented with a screen of various options and selected the dessert they were most interested in. On the next screen, they saw details about this option, including the ingredients and calorie content (799 vs. 800; see appendix D and web appendix D). This is a conservative calorie amount given that desserts at chain restaurants (e.g., Applebee's, Chili's) routinely exceed 1,000 calories. In the intervention condition, participants saw the reference intake value: "40% of daily calorie intake, based on a 2000 calorie diet." This sentence was left out in the no-intervention condition. Then, participants completed the consumption intentions measure from study 3 ($\alpha = .97$) and answered an intervention manipulation check: "To what extent did the nutritional information about the desserts cause you to think about the proportion the dessert made up of your total calorie intake?" (1 = Not at all, 7 = Very much so).

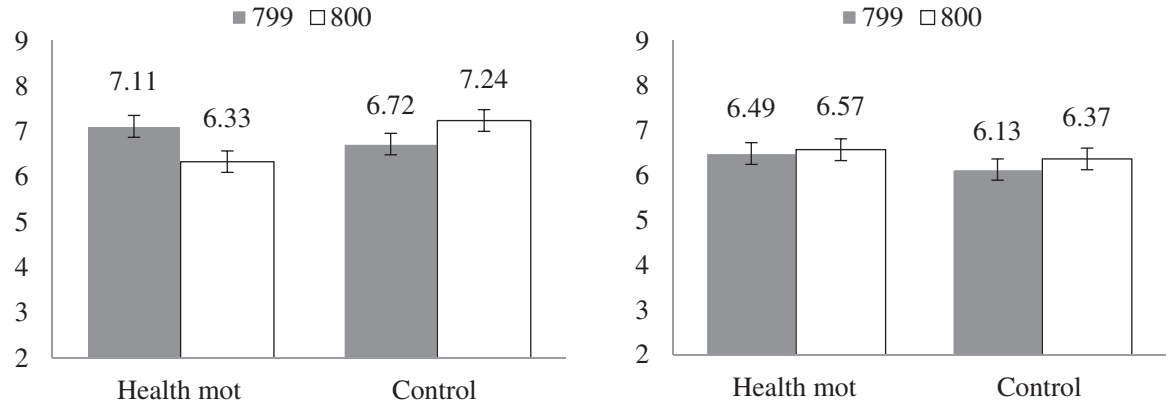
Results and Discussion

Motivation Prime Manipulation Check. A one-way ANOVA revealed that our manipulation was successful, such that participants felt the marathon ad (health prime) made them more motivated to be healthy than the concert ad (control prime) ($M_{Health} = 4.41$, $SD_{Health} = 1.56$ vs. $M_{Control} = 2.77$, $SD_{Control} = 1.41$; $F(1, 765) = 233.47$, $p < .0001$, $\eta_p^2 = .234$). The results reversed for interest in music ($M_{Health} = 2.08$, $SD_{Health} = 1.39$ vs. $M_{Control} = 4.86$, $SD_{Control} = 1.48$; $F(1, 765) = 717.32$, $p < .0001$, $\eta_p^2 = .484$).

Intervention Manipulation Check. A 2 (motivation) × 2 (calorie-ending) × 2 (intervention) ANOVA on the intervention manipulation check revealed that participants thought more about the proportion the dessert made up of their total calorie intake in the intervention condition than in

FIGURE 4

MOTIVATION × CALORIE-ENDING ON CONSUMPTION INTENTIONS FOR NO-INTERVENTION (LEFT) AND INTERVENTION (RIGHT) CONDITIONS



the no-intervention condition ($M_{Intervention}$ = 5.02, $SD_{Intervention}$ = 1.94 vs. $M_{No\text{-}intervention}$ = 4.22, $SD_{No\text{-}intervention}$ = 2.06; $F(1, 759) = 30.81$, $p < .0001$, $\eta_p^2 = .039$). No other main effects or interactions were significant (*p*s > .10).

Consumption Intentions. ANOVA revealed the expected three-way interaction of health motivation, calorie ending, and intervention ($F(1, 759) = 2.88$, $p = .09$, $\eta_p^2 = .004$) on consumption intentions. For completeness, the main effect of intervention ($F(1, 759) = 7.41$, $p = .007$, $\eta_p^2 = .01$) and the interaction of health motivation and calorie ending were also significant ($F(1, 759) = 4.58$, $p = .033$, $\eta_p^2 = .006$); all other effects were NS (*p*s > .10). Follow-up analyses were conducted at each level of intervention. In the no-intervention condition (consistent with prior studies), the interaction was significant ($F(1, 759) = 7.41$, $p = .007$, $\eta_p^2 = .01$): the 799 (vs. 800) calorie presentation increased consumption intentions for health-motivated participants ($M_{799} = 7.11$, $SD_{799} = 2.04$ vs. $M_{800} = 6.33$, $SD_{800} = 2.62$; $F(1, 759) = 5.32$, $p = .021$, $\eta_p^2 = .007$) but not control participants ($M_{799} = 6.72$, $SD_{799} = 2.37$ vs. $M_{800} = 7.24$, $SD_{800} = 1.97$; $F(1, 759) = 2.38$, $p = .123$). In the intervention condition, all effects were NS (*p*s > .48) (figure 4; see web appendix I for descriptive statistics).

Discussion. As predicted, emphasizing that nine- and round-ending calories are the same in terms of percent daily calorie intake mitigates preferences for nine-ending calorie desserts under health motivation. This pattern supports the notion that one can attenuate the level effect by providing additional information that equalizes nine- and round-ending calories. As described, this study's intervention included both the proportion and recommended daily calorie amount to enhance ecological validity. However, we note that in a study with measured health motivation (see web appendix H), we found that including *only* reference intake information ("Calorie amount constitutes 40% of daily reference intake") was sufficient to mitigate the level effect.

GENERAL DISCUSSION

Across four experiments with hypothetical and behavioral measures, we demonstrate that health-motivated consumers are more likely to rely on the level effect, and hence to consume indulgent foods labeled as having just-below (vs. round-ending) calories. In study 1, we show that this effect holds for real consumption behavior with Hershey's Kisses. In study 2, we investigate this effect in an advertising context with purchase intentions for light beer, a product currently advertised as having just-below calorie amounts, and rule out calorie sensitivity and credibility as alternative explanations. In study 3, we utilize a health motivation prime and show evidence of the underlying process with a donut as an indulgent snack. The results again depict the focal interaction of health motivation and calorie ending on consumption intentions, and show evidence of serial mediation (among health-primed participants) by relative calorie magnitude and anticipated guilt. In study 4, we shift to a restaurant context to identify a boundary condition by showing that the level effect is attenuated when relevant nutrition information equalizing the calorie magnitudes is included through percent reference intake.

Notably, we consistently find that under high health motivation, consumers prefer just-below relative to round-ending calorie indulgent foods, lending support to our contention that health-motivated consumers are more likely to focus on the leftmost digit in perceiving calorie information. This occurs with both measured and manipulated motivation, across calorie amounts (e.g., 93/99 vs. 100, 199 vs. 200, and

799 vs. 800), with different types of foods and beverages, and with different outcome measures (consumption intentions, purchase intent, and actual eating behavior). Because we deal with different types of indulgent foods and both manipulated and measured motivations, it is perhaps not surprising that the pattern relative to the control condition shifted slightly across studies. We typically observed an effect in which interest in the round-ending calorie indulgent options decreased under health motivation, while the just-below calorie option remained flat (studies 1–4 process measures, supplementary study in web appendix H). However, in study 3 we observed that the just-below calorie option increased consumption intentions under health motivation, while the round-ending option remained flat. We speculate that this occurred because eating a relatively low-calorie cinnamon and sugar donut (study 3) is seen as a less significant transgression, increasing its desirability to health-motivated consumers. In all cases, however, we find that people high in health motivation are more likely to consume treats with just-below versus round-ending calories, supporting the presence of the level effect in this context.

Importantly, this research presents preliminary evidence for a motivational account of numerical processing. When consumers are health-motivated, they see just-below calorie amounts for indulgent foods as relatively lower than round-ending amounts, reducing anticipated consumption guilt and raising consumption intentions. Notably, although prior research has suggested that underestimation of just-below numbers is largely universal (Stiving and Winer 1997; Thomas and Morwitz 2005), there has been little work examining the generalizability of the level effect. Our research demonstrates that, in a calorie context, consumers do not typically rely on the level effect at baseline. Rather, health motivation moderates the effect of the left digit on magnitude perceptions. This finding may help explain prior moderators of the level effect. Specifically, its prominence among consumers motivated to save money (Manning and Sprott 2009) may reflect how consumers who want to see lower prices are particularly susceptible to it. Similarly, the backfiring of the level effect in contexts where convenience is paramount (e.g., cash transactions), or for "convenience conscious consumers" (Wieseke, Kolberg, and Schons 2016), suggests that the effect is mitigated by goals that diminish the importance of low prices.

Limitations

A limitation of this work is that we did not completely identify the underlying process. While we have shown preliminary support for the notion that health-motivated individuals rely on the level effect, thereby reducing perceived calorie magnitude and anticipated guilt, other potential antecedents related to motivation may also be present. It is possible that people engage in more explicit forms of motivated reasoning or motivated categorization (Kruglanski 1990; Kunda 1990; Poynor and Haws 2009) to excuse indulgent consumption. For example, by comparing just-below calories to a higher round-ending number, health-motivated consumers may see just-below calorie indulgent foods as more easily justifiable and in line with their health goals relative to other options (i.e., "It's a lot of calories, but it's likely better than other desserts"). This greater ease of justification may occur because the lower perceived calories could make the food seem more diet-friendly. Future research could investigate the possibility of a more comprehensive underlying mechanism.

Another potential limitation of our research is that the just-below numbers we tested were more precise (i.e., have fewer zeros) than the round-ending numbers, and previous research has shown that consumers underestimate the magnitudes of precise numbers (Thomas, Simon, and Kadiyali 2010). However, as described above, a study using 180, 199, and 200 calories (web appendix E) found no differences in consumption between 180 and 199 calories under health motivation, a result that supports a level effect rather than a precision effect account.

In the current research, we focused on the level effect as the primary explanation for the superiority of just-below calories for health-motivated consumers. However, as alluded to in footnote 1, the image effect (Macé 2012; Schindler 2006; Schindler and Kibarian 2001; Schindler and Kirby 1997) might also influence calorie-ending consequences. Research has identified two types of symbolic associations consumers have with nine-ending prices in particular: a price image effect, such that products with nine-ending prices are discounted or on sale, and a quality image effect, such that products with nine-ending prices are lower in quality than those with round-ending prices. Because of the newness of nine-ending calorie foods, it is less likely that consumers have gleaned meaning specifically from this calorie presentation. However, increased usage and visibility of these calorie amounts may ultimately result in analogous connotations for such foods, such as diet-friendly or lacking in taste. Future research could monitor the presence of image effects over time for calorie information.

Practical Implications

Our results have a number of practical implications. First, because the level effect operates unconsciously (Thomas and Morwitz 2005), consumers may not recognize the degree of their indulgent behavior. This is problematic, as in our behavioral studies (study 1 and web appendix E), the one-calorie drop from a round-ending calorie option led people to consume at least 18 calories more under health motivation, within approximately 2 minutes. This number could easily multiply if one were snacking for longer periods of time (e.g., while watching TV) or over the course of a day. Further, if such consumers are unaware

they are underestimating how many calories they consumed, they may be less likely to later compensate for such indulgence through calorie restriction or exercise.

Our results are also important for policy makers. Because people tend to consume more calories from a restaurant than from foods prepared at home (Mancino and Kinsey 2008), and due to mandated franchise restaurant calorie labeling (Filloon 2018), testing a reference intake intervention in this context is especially appropriate. Study 4 suggests that including such reference information can be beneficial to consumers in two ways. First, it limits overall consumption intentions of highly indulgent desserts, and second, it curbs health-motivated consumers' consumption intentions of nine- (vs. round-) ending desserts. This study highlights the potential for reference intake information to help consumers make more informed choices, particularly in situations where they are tempted to indulge. It is possible to present reference intake information using just-below numbers (e.g., 39% of intake), but such an intervention is less likely given that the function of reference intake information is to contextualize and clarify calorie magnitude. Nevertheless, future research could investigate how motivation can impact perception of reference intake magnitudes themselves, especially when they are low or non-round (e.g., 15% vs. 40% of reference intake).

Study 2's results with a Corona Light ad also carry important implications for retailers and manufacturers. These findings highlight the effectiveness of extant nine-ending and just-below marketing with beer, the success of which may be imitated by other companies as calorie information becomes more ubiquitous. Prior research has shown that marketing actions that reduce guilt, such as low-fat labels, portion, or serving size reductions, can increase consumption (Aydinoğlu and Krishna 2011; Mohr et al. 2012; Wansink and Chandon 2006). Nine-ending calorie information within a "light" indulgent food may therefore be particularly insidious, as such an option would already be likely to elicit higher consumption among health-motivated individuals relative to foods not marketed as diet-friendly. The results on purchase intentions also show that health-motivated consumers are more likely to bring nine-ending indulgent products home, facilitating increased consumption over time.

In sum, the present research begins to inform our understanding of motivation on numerical processing, resulting in implications for consumers and policy makers who strive for a healthier society, as well as food manufacturers and retailers who aim to cater to these tastes and goals.

DATA COLLECTION INFORMATION

The data for study 1 (fall 2017) were collected by research assistants at the University of Kansas behavioral lab under the supervision of the second author, and analyzed by the second author. The data for study 2 (winter 2017) were collected and analyzed by the third author using MTurk participants. The data for study 3 (winter 2015) and study 4 (spring 2017) were collected and analyzed by the first author using MTurk participants. The data for the supplementary study with Hershey's Nuggets (web appendix E; spring 2015) were collected by research assistants at the University of Kansas behavioral lab under the supervision of the second author, and analyzed by the second author. The data for the supplementary study with measured health motivation and reference intake intervention condition (web appendix H; spring 2017) were collected by the second author and analyzed by the third author using MTurk participants. The data for the pretest for study 3 (web appendix F; spring 2017) were collected and analyzed by the second author using MTurk participants.

APPENDIX A

STUDY 1 STIMULI (199 CALORIE VERSION)

Instructions: Ad Evaluation Task

In this part of the study, we're interested in what snacks go with different videos. First, we'll ask you to pick your favorite Hershey's Kisses Ad. After this, you will be given the opportunity to eat the Kisses while watching a short video. On the next screen, you will see 3 different ads for Hershey's Kisses. Look at each one carefully.

APPENDIX B

STUDY 2 STIMULUS (99 CALORIE VERSION)

Participants completed a prior filler study that filtered out those individuals over 21.

Instructions:

Now, in this separate study, we are interested in your perceptions of another ad. Please view it below.

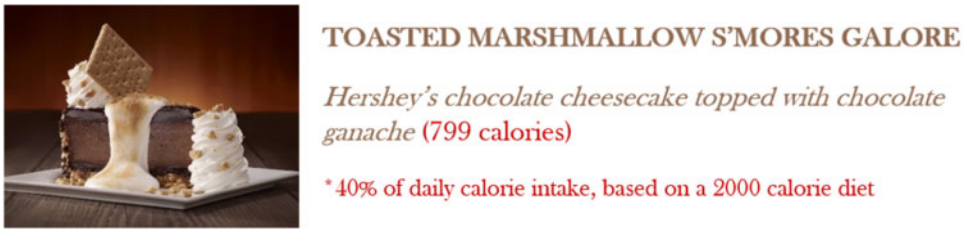
APPENDIX C

STUDY 4 HEALTH MANIPULATION ADVERTISEMENTS

APPENDIX D

STUDY 4 SAMPLE STIMULUS (INTERVENTION CONDITION)

Please see web appendix D for instructions and all dessert options.



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