



Smart food policy for healthy food labeling: Leading with taste, not healthiness, to shift consumption and enjoyment of healthy foods



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ABSTRACT

Smart food policy models for improving dietary intake recommend tailoring interventions to people's food preferences. Yet, despite people citing tastiness as their leading concern when making food choices, healthy food labels overwhelmingly emphasize health attributes (e.g., low caloric content, reductions in fat or sugar) rather than tastiness. Here we compared the effects of this traditional health-focused labeling approach to a taste-focused labeling approach on adults' selection and enjoyment of healthy foods. Four field studies (total $N = 4273$) across several dining settings in northern California in 2016–2017 tested whether changing healthy food labels to emphasize taste and satisfaction rather than nutritional properties would encourage more people to choose them (Studies 1–2), sustain healthy purchases over the long-term (Study 3), and improve both the perceived taste of and mindsets about healthy foods (Study 4). Compared to health-focused labeling, taste-focused labeling increased choice of vegetables (OR = 1.73, 95% CI: 1.32, 2.26), salads (OR = 2.06, 95% CI: 1.06, 4.06), and vegetable wraps (OR = 3.09, 95% CI: 1.73, 5.65) in Studies 1–2. In Study 3, taste-focused labeling sustained vegetarian entrée purchases over a two-month period, while health-focused labeling led to a 45.1% decrease. In Study 4, taste-focused labeling significantly enhanced post-consumption ratings of vegetable deliciousness and improved mindsets about the deliciousness of healthy foods compared to health-focused labeling. These studies demonstrate that taste-focused labeling is a low-cost strategy that increased healthy food selection by 38% and outperforms health-focused labeling on multiple smart food policy mechanisms.

1. Introduction

Poor dietary intake is a leading risk factor for disease burden worldwide (Lim et al., 2013). While many approaches for improving dietary intake have been tested, including those targeting individuals (e.g., dieting, goal-setting) and the environment (e.g., choice architecture, taxes and subsidies), few reliably shift food choice (Gortmaker et al., 2011; Hawkes et al., 2015; Roberto et al., 2015). Perhaps the most widely researched and implemented intervention over the last decade has been nutritional labeling. Nutritional labeling includes calorie counts, symbols (e.g., checkmark), colors (green, red), and verbal descriptions (e.g., heart-healthy, lighter choice) that emphasize health qualities or nutritional benefits. In a clear victory for public health, nutritional labeling has incentivized restaurants to offer lower-calorie options (Bleich et al., 2017b; Block and Roberto, 2014; Hawkes et al., 2015). However, though a few studies show that labeling calories or nutrients encourages some people to order healthier some of the time (Bleich et al., 2017a; Roberto et al., 2010), multiple meta-analyses show that emphasizing caloric content does not improve people's food

choices (Bleich et al., 2017a; Fernandes et al., 2016; Kiszko et al., 2014; Long et al., 2015). Despite a lack of evidence that health-focused labeling improves ordering behavior, calorie labeling is now mandatory in many locations. A majority of top-selling American restaurants even feature their lowest calorie items in a “healthy” menu and describe these items with health-focused descriptions (e.g., lighter fare, under 600 cal) that emphasize nutritional qualities and health benefits (Turnwald et al., 2017c). It may seem intuitively beneficial to emphasize health attributes so that people can identify healthy choices, but is health-focused labeling of healthy foods capitalizing on the principles of smart food policy?

In their recent synthesis of evidence from behavioral economics, public health, nutrition, and psychology, Hawkes et al. (2015) concluded that no efforts to date fully meet the recommendations for “smart food policies,” evidence-based actions that improve dietary intake. Smart food policies should target the interaction between people's food preferences (whether people like a food and in what quantities they eat it) and the environments in which those preferences are learned, acted upon, and reassessed (Hawkes et al., 2015). To do so,

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food policies should, first and foremost, be tailored to people's food preferences. Smart food policies should also work through the following mechanisms: (1) provide an enabling environment for learning healthy food preferences, (2) encourage reassessment of existing unhealthy preferences at the point-of-purchase, (3) overcome barriers (e.g., income, availability) to expression of healthy preferences, and (4) stimulate a food systems response that improves health qualities of foods (Hawkes et al., 2015).

Contrary to smart food policy recommendations, health-focused labeling is not tailored to people's preferences in the moment of food choice. For decades, taste has been the primary driver of food decisions, prioritized far above healthiness (Aggarwal et al., 2016; Glanz et al., 1998; Lennernäs et al., 1997; Verbeke, 2006). Making matters worse, health-focused labeling works in direct opposition to taste preferences. Many people hold the mindset (conscious or subconscious cognitive association leading to a particular set of expectations) (Crum and Zuckerman, 2017; Crum et al., 2017) that the healthier a food is, the worse it tastes (Raghunathan et al., 2006) and less filling it is (Suher et al., 2016); indeed, lab studies show that people experience foods with health-focused labels as less tasty (Fenko et al., 2016; Lähteenmäki et al., 2010; Raghunathan et al., 2006), less filling (Finkelstein and Fishbach, 2010; Suher et al., 2016), and less appealing (Fenko et al., 2016; Lähteenmäki et al., 2010). Emphasizing health characteristics of food is even associated with decreased physiological satiety (Crum et al., 2011) and less rewarding neural responses (Grabenhorst et al., 2013; Veldhuizen et al., 2013). These negative experiences and negative mindsets suggest that emphasizing only nutritional qualities makes people less likely to learn preferences for healthy foods and reassess unhealthy preferences at the point-of-purchase, not more. By failing to associate healthy foods with proximal rewards of taste and satisfaction, health-focused labeling also relies on people to exert restriction and self-control to make healthy choices (Giuliani et al., 2013; Metcalfe and Mischel, 1999), a challenging and often unsuccessful strategy in the moment of food choice (Hofmann et al., 2010; Mann et al., 2015; Mann et al., 2007), particularly for individuals trying to control their weight (Hofmann et al., 2010; Mann et al., 2015; Mann et al., 2007). How then should healthy foods be labeled to encourage people to choose them? The present studies examine a novel labeling strategy for healthy foods: taste-focused labeling.

Taste-focused labeling associates healthy foods with tastiness, people's primary preference when choosing what to eat (Aggarwal et al., 2016; Glanz et al., 1998; Lennernäs et al., 1997). Fig. 1 outlines a testable model for taste-focused labeling in the context of smart food

policy. By promoting healthy foods on proximal rewards of taste, satisfaction, and pleasure, taste-focused labeling has the potential to enhance the expected taste (Liem et al., 2012) and the actual experienced taste (Raghunathan et al., 2006) of healthy foods, making consumption on repeated occasions more likely. By enhancing the perceived tastiness of foods, taste-focused labeling of healthy foods could encourage reassessment of existing unhealthy preferences and stimulate an environment for learning healthy food preferences, two of the major mechanisms through which smart food policies should function (Hawkes et al., 2015). Taste-focused labeling does not trick people into thinking that healthy foods are unhealthy; rather it shifts attention to the tasty, indulgent, and rewarding properties of healthy foods. In so doing, taste-focused labeling challenges the typical construal of healthy foods as bland and unsatisfying, and has the potential to replace it with a mindset that healthy foods can be delicious. This mindset shift has the potential to transfer across environments by changing the way an individual construes healthy foods in general (Crum and Zuckerman, 2017; Crum et al., 2011), a benefit over choice architecture approaches that capitalize on mindless decisions and defaults (Thaler and Sunstein, 2008; Walton and Wilson, 2018).

Here we argue that the beneficial effects of taste-focused labeling should be harnessed for healthy foods. While most work to date consists of lab studies that investigated the effects of taste-focused and health-focused labels on snack, ambiguous, or unhealthy foods (e.g., cookies, crackers, milkshakes, soups, popcorn), one large field study reported increased intake of vegetables when labeled as taste-focused instead of as health-focused. This provides preliminary evidence that taste-focused labeling may be a promising approach for promoting healthy foods in real-world settings (Turnwald et al., 2017a). In this article we describe four studies (total N = 4273) that compare the efficacy of taste-focused labeling to health-focused labeling, using smart food policy guidelines to examine why taste-focused labeling increases healthy food choices in field settings.

Studies 1 and 2 tested whether labeling healthy foods as tasty (versus healthy) led more people to choose them in isolation and in competition with other desirable foods. To test the long-term effects of taste-focused labeling, Study 3 tested the cumulative impact of repeated exposure to taste-focused versus health-focused labeling on purchasing of vegetarian entrées over a two-month period. Finally, Study 4 tested whether taste-focused labels enhance the experienced tastiness of healthy foods and improve the mindset that healthy foods can be tasty. All taste-focused descriptions were constructed from a large database of appealing words, collated from previous work (Turnwald et al., 2017c)

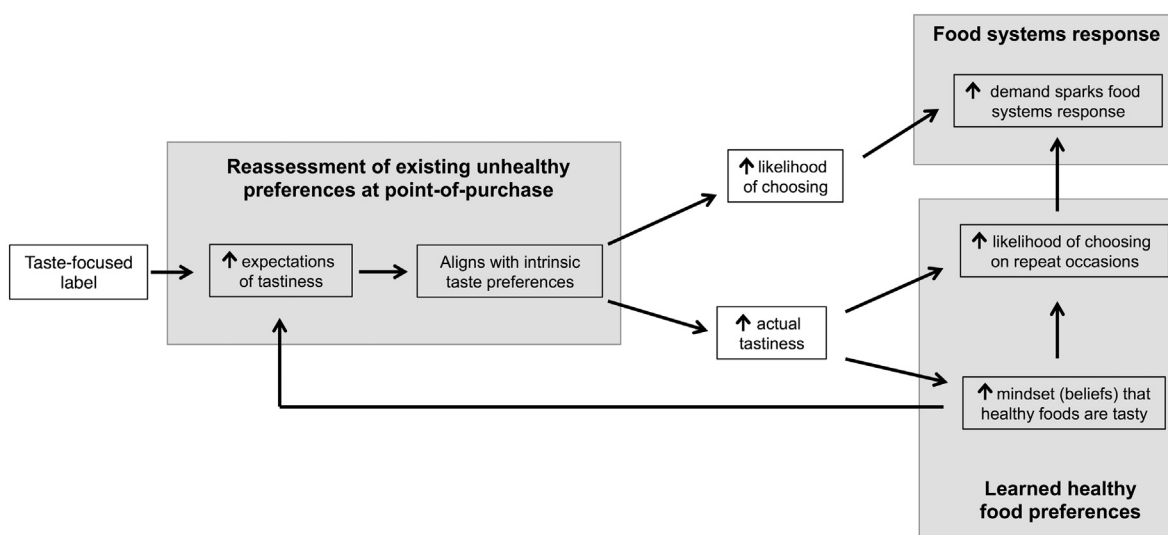


Fig. 1. Proposed mechanism for taste-focused labeling as a smart food policy. Gray boxes represent three of the major mechanistic pathways (bolded text) through which smart food policies affect dietary intake.

that categorized thousands of restaurant menu descriptions of enticing foods. All studies were approved by the Stanford University IRB. Data are available on the Open Science Framework at the following link: https://osf.io/7vamh/?view_only=2c06eba05e03425582bbb5d37d8022d3.

2. Study 1

Study 1 was run at a tasting table in a university cafeteria, serving 52.5% undergraduate students, 32.5% graduate students, and 15.1% staff/other. Sex demographics from all studies are displayed in Table S1. On each of two test days, two cafeteria staff members prompted each diner (total $N = 1116$) upon entry to try a serving of mixed vegetables (carrots, jicama, and green beans) with miso dipping sauce. One day the vegetables were labeled with a health-focused description (“Fiber-packed vegetables with nutritious miso sauce”) and verbally described as “healthy,” “nutritious,” and “good for you” by staff members. On the other day the same dish was labeled as tasty (“Crispy veggie straws with decadent miso dip”), and described as “delicious” and “tasty.” Results of a logistic regression revealed that significantly more people selected the vegetables when they were labeled as tasty (33.11%) than as healthy (22.27%) (odds ratio (OR) = 1.73, 95% CI: 1.32, 2.26; Fig. 2, Table S2). This represents a 48.7% increase in the amount of people choosing vegetables with taste-focused labels compared to health-focused labels. To check the robustness of these findings, Studies 2–4 tested whether taste-focused labeling enticed more people to choose healthy foods than health-focused labeling, in the absence of social interaction or additional prompting besides the label alone.

3. Study 2

Study 2 was run at a conference lunch buffet. Diners had their choice of salad, quinoa, vegetable wrap, turkey or steak sandwich, and dessert. Two buffet lines serving $N = 202$ people were discretely observed by research assistants. On one buffet line, the salad and vegetable wrap were given health-focused labels (“Light n’ Healthy Salad” and “Healthy Choice Vegetable Wrap”), and on the other line they were given taste-focused labels (“Indulgent Creations Deluxe Salad” and “Mouthwatering Grilled Vegetable Wrap”). Other items were given the

same, non-descriptive labels on both lines, and labels were not visible to diners before selecting a buffet line. Results of a logistic regression revealed that significantly more diners chose salad (82.79% vs. 70.00%; OR = 2.06, 95% CI: 1.06, 4.06) and vegetable wraps (59.84% vs. 32.50%; OR = 3.09, 95% CI: 1.73, 5.65) labeled as tasty than as healthy (Fig. 3, Table S3). This represented an 18.3% increase and an 84.1% increase, respectively, in the amount of people choosing salads and vegetable wraps when labeled as tasty versus healthy.

Together, Studies 1 and 2 demonstrate that taste-focused labeling enhances adults’ selection of a variety of healthy foods. However, without long-term observations, we do not know whether taste-focused labeling provides a better environment for learning healthy food preferences over time. Additionally, we do not know whether consuming healthy foods when labeled as tasty alters the experienced taste of or mindsets about healthy foods. Studies 3 and 4 addressed these questions.

4. Study 3

Study 3 examined the long-term effects of taste-focused versus health-focused labeling on sustained consumption of vegetarian entrees in competition with meat entrees. Though not all vegetarian foods are healthy (e.g., processed snacks), vegetarian entrees were considered to be a healthier choice than meat entrees in this study because they were wholesome entrees that substituted vegetables, tofu, or gardein (see Table S4 for all entrees). Epidemiological studies show that vegetarian diets are healthier than diets high in meat: increased meat consumption is associated with increased rates of cardiovascular disease (Singh et al., 2003), cancer (Singh et al., 2003), and mortality (Larsson and Orsini, 2013; Singh et al., 2003), while vegetarian diets are associated with decreased rates of cardiovascular disease (Le and Sabaté, 2014), cancer (Huang et al., 2012; Le and Sabaté, 2014), and mortality (Huang et al., 2012; Le and Sabaté, 2014).

The study was conducted at a pay-by-weight café, serving $N = 72.4$ ($SD = 17.9$) diners per hour at lunch during each weekday over a two-month period. Days were randomly assigned to a health-focused or taste-focused labeling condition. Each day, diners served themselves from a food bar consisting of a meat entrée, vegetarian entrée, and starch or other side, and research assistants discretely recorded diners’ food choices. It was not possible to track individual diners’ food choices over the study period, but dining hall staff and our own observations indicated that most diners frequented the café several times per week throughout the study period.

This study took a labeling approach that pitted meat entrées and vegetarian entrées against one another to highlight the contrast that typically exists between the tasty descriptions of meat and the health-focused descriptions of vegetarian options. In the health-focused labeling condition, vegetarian entrées were described as healthy and meat entrées as tasty, representing traditional labeling approaches. In contrast, in the taste-focused labeling condition, vegetarian entrées were described as tasty and meat entrées as healthy (all labels in Table S4). The primary outcome was whether the percentage of people choosing vegetarian entrées changed over the two-month period by labeling condition (total diner observations: $N = 2752$). In this between-participant design, a mixed effects linear regression model (Table S5) tested whether the proportion of people selecting vegetarian entrées varied as a function of the interaction of labeling condition and time (day of study) as fixed effects, with the actual food served as a random effect. Data were missing from two days due to holiday closure and menu substitution.

As hypothesized, we observed a significant effect of labeling condition over time on the proportion of people selecting vegetarian entrées (time \times label condition interaction: $b = 0.75\%$ per day, 95% CI: 0.22, 1.30; Fig. 4). In the health-focused condition, selection of vegetarian entrées significantly decreased ($b = -0.81$, 95% CI: -1.17 , -0.46) by 0.81% per day on average, a 45.1% decrease in the

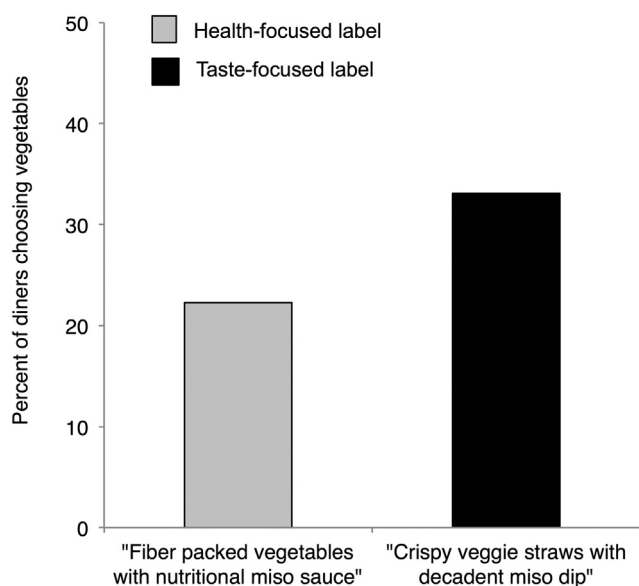


Fig. 2. Food choice by label condition in Study 1. Bars represent the percentage of diners (total $N = 1116$) selecting the vegetables with health-focused and taste-focused labels in Study 1, conducted in northern California in 2016.

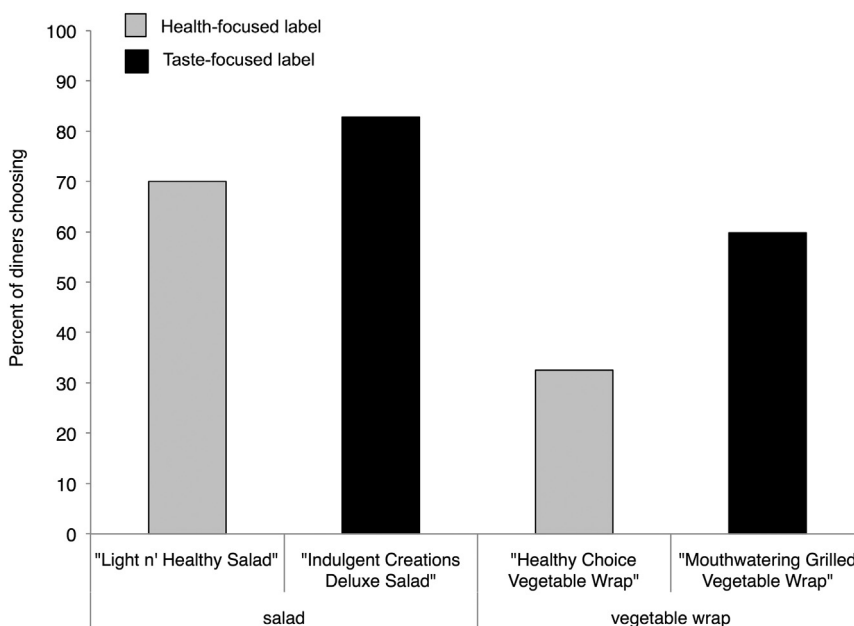


Fig. 3. Food choice by label condition in Study 2. Bars represent the percentage of diners (total $N = 202$) selecting salads and vegetable wraps with health-focused and taste-focused labels in Study 2, conducted in northern California in 2017.

proportion of people choosing vegetarian entrées over the course of two months. However, the taste-focused labeling condition (portraying vegetarian entrées as tasty and indulgent), held selection of vegetarian entrées constant ($b = -0.05$, 95% CI: $-0.41, 0.34$), with a non-significant 3.7% decrease over the course of the study.

At the end of two months, significantly more people were choosing vegetarian entrées when labeled as tasty compared to as healthy (model predicted estimates: 54.8% (95% CI: 45.8, 64.0) vs. 38.4% (95% CI: 30.2, 46.5), Table S5). Because the average mass of food purchased per person per day did not change over time by condition ($b = 0.29$ grams, 95% CI: $-0.88, 1.47$) we can infer that taste-focused labeling of vegetarian entrées displaced some proportion of meat consumption over time compared to health-focused labeling. Indeed, health-focused labeling of vegetarian entrées led to a significantly increased proportion

of diners selecting only meat entrées over time (time \times label condition interaction: $b = -0.71$, 95% CI: $-1.21, -0.21$; simple effect of health-focused condition: $b = 0.79$, 95% CI: 0.45, 1.13).

These results replicate the beneficial impact of taste-focused labeling observed in Studies 1 and 2 in a different food environment where habitual customers paid by food weight, making consumption very likely, and using vegetarian entrées in direct competition with meat entrées, a difficult and increasingly important preference to target for health and sustainability (Ranganathan et al., 2016). Moreover, these results suggest that rather than being a short-lived effect, the benefit of taste-focused labeling led to sustained levels of vegetarian dish purchases over a two-month period within this café setting, which amounted to increasingly larger benefits over time compared to health-focused labeling. Surprisingly, health-focused labeling outperformed

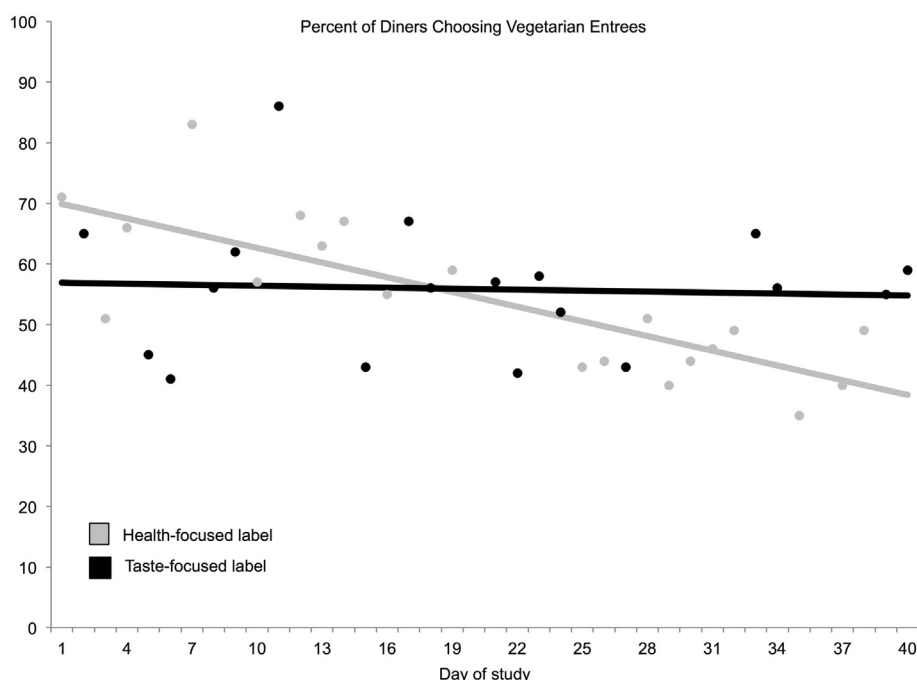


Fig. 4. Food choice by label condition in Study 3. Percent of diners (total $N = 2752$) choosing vegetarian entrées by labeling condition over a two-month period in Study 3, conducted in northern California in 2017. Health-focused labeling (gray lines) described vegetarian entrées as health-focused, and taste-focused labeling (black lines) described vegetarian entrées as tasty and indulgent. Lines represent model estimates from a mixed effects linear regression model with fixed effects of label, time, and their interaction, and a random effect of food type (Table S5). Dots represent raw values observed on each study day for health-focused labeling and taste-focused labeling. The descriptive labels used for each day are presented in Table S4. No data was collected on days 20 or 36 due to holiday closure and menu substitution.

taste-focused labeling initially, which is counter to what Studies 1 and 2 would suggest. Prior research suggests that health-focused labeling may have led to decreased experienced tastiness and satisfaction (Raghunathan et al., 2006; Suher et al., 2016), possibly resulting in fewer diners choosing healthily labeled foods on repeat occasions. In contrast, taste-focused labeling may have led to positive taste experiences and encouraged selection of tastily labeled foods on subsequent occasions. However, because we were unable to survey customers throughout the study without impacting future choices, we do not know the mechanism by which taste-focused labels had increasingly beneficial effects over the long-term compared to health-focused labeling. Study 4 explicitly tested whether taste-focused labeling made people more likely to choose healthy foods because it enhanced the taste experience, improved mindsets about the tastiness of healthy foods, or both.

5. Study 4

Study 4 tested whether taste-focused labeling of healthy foods enhanced the experienced taste of healthy food as well as improved mindsets about healthy foods (i.e., the degree to which people associate healthy foods with tastiness). Green beans were served in a large university cafeteria, labeled on one day as healthy (“Light n’ Low Carb Green Beans and Shallots”) and on another as tasty (“Sweet Sizzlin’ Green Beans and Crispy Shallots”). On both days, diners who consumed green beans (total $N = 203$) were administered a survey during their meal that asked them to rate the green beans on healthiness, tastiness, and indulgence (1 = not at all, 5 = very). Diners’ mindsets about the tastiness of healthy foods were measured by indicating the extent to which they thought that healthy foods, in general, taste delicious (1 = strongly disagree, 7 = strongly agree).

Results of a two-tailed t -test demonstrated that diners who consumed green beans with a taste-focused label rated them as significantly more delicious ($M_{\text{difference}} = 0.57$, 95% CI: 0.26, 0.88) and indulgent ($M_{\text{difference}} = 0.53$, 95% CI: 0.18, 0.88), but as no less healthy ($M_{\text{difference}} = -0.10$, 95% CI: -0.37, 0.16) compared to diners who ate green beans with a health-focused label (Fig. 5). Furthermore, diners who consumed green beans with taste-focused labels were more likely to endorse the mindset that healthy foods taste delicious compared to diners who consumed green beans labeled as healthy ($M_{\text{difference}} = 0.46$, 95% CI: 0.01, 0.90). These results suggest that labeling healthy foods as

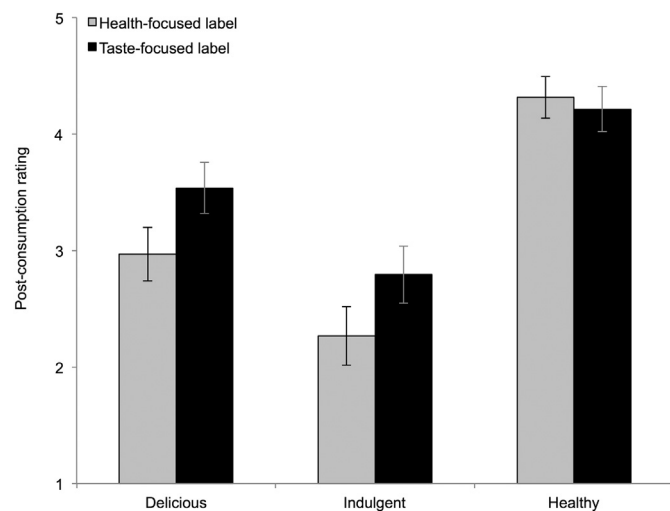


Fig. 5. Post-consumption ratings by label condition in Study 4. Bars represent means (95% CI) of $N = 203$ diners’ ratings of green bean deliciousness, indulgence, and healthiness on a five-point scale (1 = not at all, 5 = very much) immediately post-consumption when labeled as healthy (gray bars) and as tasty (black bars) in Study 4, conducted in northern California in 2016.

tasty, compared to as healthy, not only leads more diners to choose healthy foods, but also enhances the taste experience when consuming healthy foods and helps establish the mindset that healthy foods can be delicious.

6. Discussion

In an attempt to improve dietary intake, governmental policy and commercial industry increasingly emphasize health qualities and nutritional benefits of healthy foods. However, our results suggest that taste-focused labeling may be more effective. Compared to health-focused labeling, taste-focused labeling increased selection of healthy foods by an average of 38% across Studies 1–3 (calculated as the mean percent increase across Studies 1 (48.7%), 2 (18.3% and 84.1%), and 3 (main effect when time was mean-centered = 2.4%)). Taste-focused labeling also sustained purchases of vegetarian entrees over a two-month period while health-focused labeling resulted in plummeting sales by 45.1%. Finally, taste-focused labeling enhanced the taste experience and mindsets about the tastiness of healthy foods compared to when people consumed the same foods with health-focused labels.

These changes were consistent with three target mechanisms by which smart food policy should improve dietary intake (Hawkes et al., 2015). First, the behavioral evidence suggests that taste-focused labeling encouraged people to reassess existing food preferences at the point-of-purchase, with more people ultimately reassessing healthy foods with taste-focused labels as more consistent with preferences than the same foods with health-focused labels. Second, taste-focused labeling provided an enabling environment for learning healthy food preferences. Not only did more individuals choose healthy foods with a taste-focused label, they experienced these foods as more delicious and indulgent. Moreover, taste-focused labeling improved mindsets about the deliciousness of healthy foods, helping to combat the pervasive, negative association between healthiness and tastiness that most individuals hold (Raghunathan et al., 2006). In the present work, mindset was measured as the explicit (conscious) belief that healthy foods taste good, but mindsets can also operate at the implicit (subconscious) level (Crum and Zuckerman, 2017; Crum et al., 2013; Dweck, 2008). Indeed, other research suggests that cognitive changes regarding the filling and tasty nature of foods also occur implicitly (unconsciously) (Raghunathan et al., 2006; Suher et al., 2016). These observed changes in cognition and behavior represent processes that compliment and mutually reinforce one another: consuming healthy foods with taste-focused labels enhances the taste experience, the positive taste experience improves mindsets about healthy foods, and improved mindsets increase the likelihood of selecting healthy foods again in the future. Third, though empirically testing a food systems response is outside the scope of most study designs, Hawkes et al. (2015) considered interventions that increased demand for and purchasing of healthy foods, as observed in the present studies, as stimulating a food systems response.

Addressing the fourth mechanism of smart food policy, it is important that healthy foods are accessible for groups of low socioeconomic status, across demographic groups, and across geographic regions. Though we did not directly examine this mechanism, existing evidence suggests that groups of low socioeconomic status and racial-ethnic minorities may view health-focused labeling as incongruent with their group identity (Oyserman et al., 2007). Future research is needed to test whether taste-focused labeling is perceived as more identity-congruent for these groups and encourages healthier food choices. In the present research, participants were primarily students and staff who dined at various settings on a college campus, perhaps limiting the generalizability of the findings. Additionally, Study 3 used a between-subjects design rather than a within-subjects design to measure the overall labeling effects on group-level behavior at the cafe, which limited the ability to quantify changes at the level of the individual.

Future studies should also explore how to communicate necessary nutritional information without using health-focused labeling for

individuals with dietary restrictions. For the minority of individuals that prioritize healthiness more than tastiness, we expect that taste-focused labeling would be less effective because these individuals may seek health-focused language to affirm their desires to choose something that is, above all else, healthy (Campos et al., 2011; Chen et al., 2012; Hawkes et al., 2015). An interesting question not tested in the present work is whether combining taste-focused and health-focused language would be effective. Perhaps leading with taste-focused labeling while including subtle nutrition-related symbols would be effective, as one study suggests that subtler health symbols are more effective than explicit health-focused language (Wagner et al., 2015). The present results do not mean that health messages, namely health warnings, should not be used on *unhealthy* foods such as those especially high in sugar or sodium (Donnelly et al., 2018; Roberto et al., 2016). Improving dietary health requires both enhancing the appeal of healthy foods as well as reducing the availability and lure of unhealthy foods. Efforts to prepare healthy foods deliciously are also important (Turnwald et al., 2017b). The effects of taste-focused labeling may not hold for foods of exceptionally poor quality. Finally, more research is needed to understand the long-term effects of taste-focused labeling on individuals' mindsets about healthy foods, as only short-term effects on mindset were measured in the present work. Widespread efforts to enhance the way that healthy foods are portrayed could improve societal perceptions of healthy foods, perhaps helping to challenge the mindset that healthy foods are not tasty.

7. Conclusions

Labeling healthy foods with an emphasis on nutritional qualities and health benefits is becoming increasingly common. However, taste-focused labeling more effectively harnesses the recommendations for smart food policy design. Across four studies in a variety of real-world dining settings and a variety of healthy foods, taste-focused labeling increased selection of healthy foods by 38% compared to traditional health-focused labeling. By making the healthy choice and the delicious choice one and the same, taste-focused labeling represents a low-cost, scalable strategy that holds potential for increasing consumption of healthy foods.

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Author contributions

The corresponding author had full access to all of the data in the studies and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: BPT, AJC.

Data acquisition and statistical analysis: BPT.

Drafting of the manuscript: BPT.

Critical revision of the manuscript for intellectual content: BPT, AJC.

Study Supervision: AJC.

Declaration of interests

The authors have no conflicts of interest to report.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpmed.2018.11.021>. Data sets are available on the Open Science Framework at the following link: https://osf.io/7vamh/?view_only=2c06eba05e03425582bbb5d37d8022d3.

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