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Understanding the Calorie Labeling Paradox in Chain Restaurants: Why Menu Calorie Labeling Alone May Not Affect Average Calories Ordered

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Abstract

Menu calorie labeling is now required nationwide for chain restaurants in the United States; however, a number of studies have found that calorie labeling does not reduce average calories ordered. This research examines how different food value orientations are associated with divergent consumer responses to restaurants providing calorie information on menus and menu boards. Results from two pilot studies and two experiments, including a restaurant field experiment, indicate that calorie labeling is effective in decreasing the number of calories ordered by health value–oriented consumers. However, for quantity value and taste value–oriented consumers, menu calorie labeling may result in an *increase* in calories ordered. These influences counterbalance one another, leading to an overall nonsignificant effect of calorie labeling on calories ordered in restaurant settings. These findings offer a compelling explanation for the many studies showing nonsignificant effects of menu calorie labeling and inform ongoing policy debates regarding chain restaurants nationally implementing menu calorie labeling. The conceptual contributions and implications of these findings for public policy and consumer well-being are discussed.

Keywords

calorie labeling, food choice, information disclosures, nutrition labeling

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The prevalence of obesity is increasing across the globe (Roberto et al. 2015; The GBD 2015 Obesity Collaborators 2017). In the United States, over 64% of adults are either overweight or obese (CDC 2017; ERS 2017). Changes to the food environment and food systems that affect consumers' food choices and diets are believed to be the primary driver of obesity (Swinburn et al. 2011). Given that obesity contributes to mortality (Flegal et al. 2005) and has major health care cost implications (Finkelstein et al. 2009), developing a better understanding of consumers' food choices is a critically important issue for public policy both in the United States and globally. In particular, there continues to be substantial interest in communicating nutrition information to consumers at the point of purchase as a strategy to potentially counter obesity and improve consumer health. For example, the Affordable Care Act (Public Law 111–148) mandated in May 2018 that chain restaurants with 20 or more locations must provide calorie information on menus and menu boards. Many policy makers and public health advocates have argued that this will reduce the prevalence of obesity by helping consumers make more informed and potentially more healthful food choices (Bassett et al. 2008; Burton et al. 2006; FDA 2014; Pomeranz and Brownell 2008; Long et al. 2015).

However, the menu calorie labeling compliance date was extended multiple times due to industry criticism (Dewey 2018; FDA 2014, 2016, 2017a). Furthermore, most recent field experiments have found little or no effect of calorie information provision on calories ordered across heterogeneous samples of diners (Cantu-Jungles et al. 2017; Long et al. 2015). Therefore, we construct and test a conceptual framework on the

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basis of consumers' food value orientations to better understand consumers' responses to menu calorie labeling. Our findings offer a compelling potential explanation for the plethora of studies showing nonsignificant effects of menu calorie labeling on calories ordered.

In contrast to prior research, we consider consumers' restaurant consumption decisions from a multifaceted food value orientation perspective (i.e., quantity, taste, and healthfulness orientations). That is, some consumers are more typically attracted to enhancing the amount of food received in exchange for the price, whereas others typically focus primarily on the taste or healthfulness of the meal given the price paid. Although we recognize these three orientations are not necessarily mutually exclusive and consumers certainly will not always follow their general predisposition across all situations and contexts, we suggest that consumers differ in their orientations toward the values derived from these three food attributes (Glanz et al. 1998). Thus, consumers' food consumption decisions, including meal expectations and calories ordered, are expected to be directly related to these enduring food value orientations. In addition to the direct influence of consumers' food value orientations on their consumption decisions, we also propose that consumers' orientations influence their responses to menu calorie labeling. Consequently, we argue that these differing food value orientations need to be taken into direct consideration when evaluating the success or failure of initiatives aimed at improving consumer food choices and overall health.

We contend that considering consumers' food value orientations will provide policy makers with a better understanding of the overall efficacy of menu calorie labeling (Stewart and Martin 1994). That is, differences in consumers' food value orientations are likely to influence how consumers utilize and respond to objective calorie information. These differences may potentially result in asymmetric calorie information provision effects that influence consumer choice outcomes (e.g., calories ordered) in ways that are not well understood by the public policy and public health communities. Our conceptualization may provide some insights into why many prior restaurant field studies failed to find an effect of calorie disclosures on calories ordered. Specifically, we argue that the lack of overall market-based effects of menu calorie labeling on calories ordered is due to the moderating role of differences in consumers' food value orientations, which obscure both increases and decreases in the calorie content of purchased food items. Therefore, the primary objective of this research is to demonstrate how different food value orientations are associated with divergent consumer responses to the provision of calorie information on menus. By doing so, we aim to provide an initial but more complete understanding of the consequences of calorie information provision on restaurant menus.

To achieve this objective, we first provide a brief policy-related background on restaurants providing calorie labeling on menus and menu boards. We then conceptualize our food value orientations and construct a conceptual framework using these orientations to better understand consumers' responses to menu calorie labeling. We conduct two pilot studies to assess the internal consistency and validity of the food value orientation constructs. The initial pilot studies are followed by two experiments, including both a longitudinal experiment and a restaurant field experiment, which test the incremental effects of the food value orientations and their interactions with calorie labeling on calories ordered. Specifically, we use the longitudinal experiment to simulate the marketplace change that recently occurred as chain restaurants introduced nationwide menu calorie labeling. We then use the restaurant field experiment to bolster the external validity of our findings, which is particularly important given the differences between the direct effects of calorie labeling on consumer food choice found in laboratory experiments and those found in field experiments (Burton and Kees 2012; Cantu-Jungles et al. 2017; Long et al. 2015). As we propose, our results show that the food value orientations can moderate the effects of objective calorie information, resulting in consequences both intended and unintended by policy makers and consumer health advocates. We conclude with a discussion of the conceptual contributions and the potential public policy and consumer health implications of this research. We also outline many opportunities for future research to extend our findings to other contexts and to consider more complex interactions with diverse situational cues and nudges at the point of purchase.

Menu Calorie Labeling Background

The Nutrition Labeling and Education Act of 1990 (NLEA) (Public Law 101–535) authorized the Food and Drug Administration (FDA) to design a mandatory nutrition label for packaged food items. This Nutrition Facts panel (NFP), mandated on most food packages since 1994, was designed to convey product-specific information about serving sizes, calories, and nutrients (e.g., total fat, saturated fat, cholesterol, and sodium). By increasing the accessibility of nutrition information at the point of sale, a primary objective of the NFP was to increase awareness and enable consumers to make more informed and healthful consumption decisions in the context of their daily diet (FDA 2010; Kozup, Creyer, and Burton 2003). The NFP has been shown to have beneficial outcomes on consumers' intentions, attitudes, and beliefs, especially among consumers who have greater motivation to process nutrition information (e.g., Balasubramanian and Cole 2002; Ford et al. 1996; Howlett, Burton, and Kozup 2008; Keller et al. 1997; Kozup, Creyer, and Burton 2003; Mitra et al. 1999).

Although the NFP on packaged food products has been required for some 25 years, retailers that offer food prepared for immediate consumption were exempt from such requirements (e.g., restaurants, grocery store delicatessens, vending machines [FDA 1993]). Over time, this omission became a critical concern for several reasons. Away-from-home foods account for approximately half of the total food sales in the United States each year (ERS 2017), and Americans consume about one-third of their total calories from these foods (Lin, Guthrie, and Frazão 1999). In addition, away-from-home foods are often higher in calories and lower in overall nutrition quality (Guthrie, Lin, and Frazão 2002; Nestle 2003; Roberto, Schwartz, and Brownell 2009; Todd, Mancino, and Lin 2010). Research indicates that many consumers drastically underestimate the calorie, fat, and sodium content of these meals, and this is especially true for less healthful meal options (e.g., Burton et al. 2006; Burton, Howlett, and Tangari 2009). The proportion of food sales consisting of away-from-home foods, combined with the number of calories consumed from these meals (Variyam 2005), made restaurants and other retail food establishments not covered by the NLEA an obvious target for the provision of nutrition information aimed at helping to decrease the prevalence of obesity in the United States (Downs et al. 2013).

Beginning in 2005, menu calorie labeling was recommended by the Institute of Medicine as a strategy to help consumers make more healthful away-from-home food choices and thus counter rising obesity rates (Institute of Medicine 2005; Long et al. 2015). By 2009, several states and a number of cities and counties throughout the United States had passed menu calorie labeling legislation (Roberto, Schwartz, and Brownell 2009). Federal legislation was initially passed as part of the Patient Protection and Affordable Care Act of 2010. After the FDA extended the compliance date multiple times (FDA 2014, 2016, 2017), chain restaurants and other retail food establishments with 20 or more locations became required to provide calorie information on their menus and menu boards. However, Congress passed this legislation despite some concerns that it may not result in the desired widespread reductions in calories consumers order (Breck et al. 2017; Burton and Kees 2012; Cantu-Jungles et al. 2017; Elbel et al. 2009; Elbel, Gyamfi, and Kersh 2011; Ellison, Lusk, and Davis 2014; Finkelstein et al. 2011; Harnack and French 2008; Harnack et al. 2008; Long et al. 2015; Loewenstein 2011; Tandon et al. 2011; Swartz, Braxton, and Viera 2011).

Although some online and laboratory-based studies appear to support the potential effectiveness of menu calorie labeling (Burton, Howlett, and Tangari 2009; Roberto et al. 2010; Howlett et al. 2009; Parker and Lehmann 2014; Wisdom et al. 2010), an increasing amount of evidence from large-scale field experiments suggests that such tactics will be, on average, ineffective in changing consumers' crystallized food purchasing behaviors (see Table 1 for examples of experiments conducted in and outside of restaurant settings to examine the effects of calorie labeling on calories ordered). Specifically, a meta-analysis examining the effectiveness of menu calorie labeling found an 18.1 calorie reduction in calories ordered across the combination of 19 laboratory and field studies examined (Long et al. 2015). However, the results from the controlled field studies alone show that calorie labeling resulted in a nonsignificant 7.6-calorie decrease in calories ordered (Long et al. 2015). Because of this latter finding, the researchers concluded that "despite broad interest among the public health research community and the passage of national menu calorie labeling legislation, there is minimal evidence to support menu calorie labeling as a strategy to directly influence consumer behavior to substantially reduce calories purchased at restaurants" (Long et al. 2015, pp. e21–e22). However, these field studies importantly failed to consider the direct and moderating effects of consumers' food value orientations, which may influence responses to calorie information provision.

Conceptual Framework

Extant research evaluating the effectiveness of menu calorie labeling on calories ordered has generally assumed that all consumers are affected by calorie labeling in a consistent manner (see Table 1). In other words, these studies have considered the effects of menu calorie labeling alone, without considering whether these effects differ according to the food attributes that consumers value or other critical consumer characteristics. However, past research demonstrates that the effectiveness of nutrition information provision in influencing consumers' food product perceptions, attitudes, and intentions often varies according to internal consumer characteristics, leading to differences in responses to the information (Andrews, Netemeyer, and Burton 2009; Balasubramanian and Cole 2002; Howlett, Burton, and Kozup 2008; Keller et al. 1997; Moorman 1990, 1996). For example, research examining the effects of the NFP has considered various enduring consumer characteristics, such as objective and subjective general nutrition knowledge, motivation to process nutrition information, caloric knowledge, and nutrition consciousness (Andrews, Burton, and Kees 2011; Andrews, Netemeyer, and Burton 1998, 2009; Keller et al. 1997; Moorman 1996; Moorman et al. 2004). In addition, other important consumer characteristics, such as consumers' concern for weight watching, have been considered in other (non-NFP) streams of food consumption research (Finkelstein and Fishbach 2010).

Because the healthfulness of consumers' food choices is an important metric for consumer health and public policy researchers, most previously studied consumer characteristics have generally related to concern for nutrition, weight, and similar factors. Although some consumers are clearly concerned with the healthfulness of their food choices, other food attributes unrelated to health and nutrition are also important to consumers when making food choices (i.e., taste and quantity). Thus, a more holistic food value orientation perspective (i.e., considering attributes beyond those primarily related to nutrition and health) may be needed to better understand consumers' food choices and potential differences in responses to calorie information provision. We propose that it is critical to understand the potential relationships between calorie information provision and consumers' food value orientations to determine whether menu calorie labeling is effective for all consumers or whether the provision of this information can have diverging effects based on consumers' food value orientations. We expand on these food value orientations subsequently.

Table 1. Examples of Studies that Examined the Effect of Menu Calorie Information Provision on the Calorie Content of Meal Choices.

Study	Design	Intervention and Control	Setting	Sample	Outcome	Results
Examples of Studies Conducted in Restaurant Settings						
Ellison, Lusk, and Davis (2014)*	Experiment with control	Participants randomly assigned to order from restaurant menu with calorie labeling, labeling plus traffic light, or no labeling	Sit-down university restaurant	138 adults	Calories ordered per meal	Nonsignificant increase in calories ordered
Downs et al. (2013)	Longitudinal experiment without control	Provision of menu calorie labeling in New York City, with participants randomly assigned to receive a calorie per meal recommendation, a daily recommendation, or no recommendation	Fast-food restaurants	1094 adults	Calories ordered per meal	Nonsignificant increase in calories ordered
Krieger et al. (2013)*	Longitudinal experiment with control	Provision of menu calorie labeling in King County, Washington	Fast-food restaurants and coffee chain	7,235 participants over the age of 13	Calories ordered per meal	Coffee chain: significant decrease in calories ordered Fast-food restaurant: effect was nonsignificant
Dumanovsky et al. (2011)	Longitudinal experiment without control	Provision of menu calorie labeling in New York City	Fast-food restaurants	15,798 adults	Calories ordered per meal	Nonsignificant increase in calories ordered
Elbel, Gyamfi, and Kersh (2011)*	Longitudinal experiment with control	Provision of menu calorie labeling in New York City, with no labeling in control city	Fast-food restaurants	349 children and adolescents	Calories ordered per meal	Calorie labeling did not affect calories ordered
Tandon et al. (2011)	Longitudinal experiment without control	Provision of menu calorie labeling in King County, Washington, with no calorie labeling in control county	Fast-food restaurants	133 pairs of parents and children	Calories ordered per meal	Calorie labeling did not affect calories ordered
Bollinger, Leslie, and Sorensen (2011)*	Longitudinal experiment with control	Provision of menu calorie labeling in New York City, with no labeling in Boston and Philadelphia	Large coffee shop chain	Transaction data	Calories per transaction	Minor but significant decrease (−14.4) in calories per transaction
Finkelstein et al. (2011)*	Longitudinal experiment with control	Provision of menu calorie labeling in King County, Washington, with no calorie labeling in control county	Fast-food restaurants	Transaction data	Calories per transaction	Calorie labeling did not affect calories ordered
Elbel et al. (2009)*	Longitudinal experiment with control	Provision of menu calorie labeling in New York City, with no labeling in control city	Fast-food restaurants	1,125 adults	Calories ordered per meal	Calorie labeling did not affect calories ordered
Examples of Studies Not Conducted in Restaurant Settings						
Parker and Lehman (2014)	Randomized experiment (Study 2)	2 (calorie labeling offered vs. not) x 2 (calorie organized vs. not)	Internet	403 adults	Calories ordered for main dish	Significant decrease (−78.3) in calories ordered for the main effect of calorie labeling
Morley et al. (2013)	Randomized experiment	Participants randomly assigned to: (1) no labeling, (2) calorie labeling, (3) calorie + percent daily intake labeling, (4) calorie + traffic light labeling,	Internet	1294 adults	Calories ordered per meal	Significant decrease (−116.6) in calories ordered (no labeling vs. calorie labeling conditions)

(continued)

Table 1. (continued)

Study	Design	Intervention and Control	Setting	Sample	Outcome	Results
		(5) calorie + percent daily intake + traffic light labeling				
Dowray et al. (2013)	Randomized experiment	Participants randomly assigned to order from hypothetical menu with no calorie labeling, calorie labeling, or labeling with the amount of physical activity needed to burn the calories	Internet	802 adults	Calories ordered per meal	Nonsignificant decrease in calories ordered (no calorie labeling vs. labeling conditions)
Liu et al. (2012)	Randomized experiment	Participants randomly assigned to: (1) no calorie labeling, (2) calorie labeling, (3) rank-ordered calories, or (4) colored calories	Internet	419 adults	Calories ordered per meal	Nonsignificant decrease in calories ordered (no calorie labeling vs. calorie labeling conditions)
Roberto et al. (2010)	Randomized experiment	Participants randomly assigned to: (1) no calorie labeling, (2) calorie labeling, or (3) calorie labeling and recommended daily calories	Lab	303 adults	Calories ordered and consumed per meal	Significant decrease in calories ordered in each label condition compared to control
Harnack et al. (2008)	Randomized experiment	2 (calorie labeling offered vs. not) x 2 (value pricing vs. not)	Lab	594 participants over the age of 16	Calories ordered and consumed per meal	Nonsignificant increase in both calories ordered and consumed

Note. This table was adapted from Long et al. (2015) and provides examples of studies conducted to date that examine the effect of menu calorie information provision on calories ordered in both restaurant and non-restaurant settings. On the basis of the six controlled studies conducted in restaurant settings shown in Table 1 (indicated with *), Long et al. (2015) found that calorie information provision resulted in a nonsignificant decrease in calories ordered (i.e., −7.6 calories).

Conceptualization of Food Value Orientations

In general, consumers seek out and choose products that maximize perceived value (Dodds, Monroe, and Grewal 1991; Zeithaml 1988). Perceived value has been defined as "the consumer's overall assessment of the utility of a product based on what is received and what is given" (Zeithaml 1988, p. 14). Thus, perceived value is positively influenced by the benefits consumers expect to receive when acquiring and consuming a product and negatively influenced by the costs related to the exchange (Grewal, Monroe, and Krishnan 1998). We view the perceived value of food choices similarly. That is, we evaluate consumers' perceptions of the benefits they receive from food options relative to the price they paid for those food items (Zeithaml 1988).

An initial review of the food choice literature revealed no existing psychometrically sound multi-item measures focusing on food benefits (or attributes) received for monetary resources expended. However, it is well-known that consumers often consider a number of salient product characteristics when evaluating food alternatives, including taste, quantity, and healthfulness (e.g., Connors et al. 2001; Furst et al. 1996; Glanz et al. 1998). When choosing a restaurant meal and given its specific purchase price, some consumers may be more oriented toward obtaining a healthful option, whereas others may be more strongly oriented toward enhancing taste value or quantity value. Although each of these characteristics may be relevant to most consumers, we contend that the relative value derived from food choice options varies among consumers (Finkelstein et al. 2011; Glanz et al. 1998).

Effects of Food Value Orientations on Meal Choice and Calories Ordered

Our conceptual framework leads us to expect enduring food value orientations to directly influence consumers' choices and to moderate the effects of restaurants providing objective nutrition information. Taste is clearly an important and significant driver of food choice for most consumers (Glanz et al. 1998). However, many consumers are also very concerned about a food's health value (Keller et al. 1997; Kozup, Howlett, and Burton 2003). Similarly, the quantity of food received for a given price may be a primary factor that influences the perception of value and choice (Loewenstein 2011). In general, consumers who value health should strive to make more healthful food consumption decisions by ordering meals that they expect to be nutritious while placing somewhat less emphasis on taste and quantity. Similarly, consumers oriented toward taste value or quantity value should prefer restaurant food items that best align with their orientations, and they should be relatively less concerned about healthfulness.

Because consumers typically order meals that align with their personal preferences, we propose that food value orientations are associated with the objective healthfulness of consumers' food choices and the number of calories consumers order in restaurant settings. Given that health value–oriented consumers focus on health, health value orientation (HVO) is predicted to be negatively related to the number of meal calories ordered. In contrast, because consumers tend to have a "tasty = unhealthy" intuition (Raghunathan, Naylor, and Hoyer 2006), we predict taste oriented consumers will infer that lower calories are associated with decreased tastiness. Consequently, to maximize taste, these consumers should prefer higher calorie foods. Similarly, because the quantity of food is generally positively related to calorie levels, and because consumers tend to have a "healthy = less filling" intuition, quantity oriented consumers should choose higher calorie foods (Loewenstein 2011; Suher, Raghunathan, and Hoyer 2016; VanEpps et al. 2016). In summary, taste value orientation (TVO) and quantity value orientation (QVO) should be positively related to calories ordered. However, TVO and QVO should be somewhat less strongly associated with calorie levels than HVO because these orientations are not as directly aligned with food items' objective calorie levels.

Moderating Roles of Food Value Orientations on Responses to Menu Calorie Labeling

Beyond the fundamental direct effects of the food value orientations, we propose that these orientations also moderate the effects of calorie information provision. Activation theory suggests that consumers have a semantic memory network of food attributes (e.g., concepts such as calorie levels, healthfulness, taste, and quantity). When one concept is triggered by exposure to objective information (e.g., calorie information), other related concepts are also activated (e.g., overall healthfulness, taste, expected serving size [e.g., Berry et al. 2017]). Thus, when relatively little is known about a specific menu item, consumers may use any available information to make inferences about the product that extend beyond the specific objective information provided (Andrews, Netemeyer, and Burton 1998; Sowa 2014). The strength of these inferences is greater when there is a stronger conceptual association between the product attributes (e.g., calorie levels may be more closely related to the concept of healthfulness than taste), and this activation process diminishes as concepts spread further away from the more focal network concepts (e.g., Broniarczyk and Alba 1994; Sowa 2014).

According to our conceptualization, low-calorie levels should be positively related to perceived healthfulness but negatively related to perceptions of tastiness and quantity (e.g., Raghunathan, Naylor, and Hoyer 2006; Suher, Raghunathan, and Hoyer 2016). Consumers are likely to strongly associate the concepts of calorie content and healthfulness in their semantic networks. However, identifying and ordering healthful, low-calorie restaurant meals can still be difficult in limited-information environments where actual calorie levels are often substantially higher than expected (e.g., Burton et al. 2006; Burton, Howlett, and Tangari 2009). Thus, calorie information should be useful to consumers with high HVOs when making inferences about missing or ambiguous attributes (e.g., product healthfulness) and is likely to ultimately reduce the calories they order. In contrast, calorie information provision will be much less effective for consumers with lower HVOs, which indicates a significant moderating role of HVO. Therefore, considering HVO and its interaction with calorie information provision should help begin to explain the restaurant calorie labeling paradox.

Relatedly, given that consumers tend to have "unhealthy = tasty" (Raghunathan, Naylor, and Hoyer 2006) and "healthy = less filling" intuitions (Suher, Raghunathan, and Hoyer 2016), they are likely to infer that higher (lower) calorie items are more (less) tasty and filling. In turn, consumers utilize inferences about taste and quantity drawn from objective calorie information in attempts to align their choice with their individual food value orientations. That is, taste value– and quantity value–oriented consumers should use calorie information to help them improve their choices and better identify options that are most likely to maximize taste value and quantity value, respectively. This suggests that taste value– and quantity value–oriented consumers should typically be more likely to select somewhat higher-calorie meal choices in response to menu labeling. From an FDA or public health perspective, this would appear to be a surprising, unanticipated consequence of information provision; however, from an information processing perspective, consumers simply utilize the calorie information to enhance the perceived value of their choices.

In summary, food value orientations should have both a direct and moderating influence on the number of calories consumers order. The moderating influence should occur because calorie information is likely used differently among consumers to help them maximize their own choice-related value. This conceptualization suggests asymmetric effects of calorie information provision across food value orientations on the number of calories in a chosen meal. Specifically, the combined effects of consumers' HVO and its interaction with calorie information provision should explain incremental variance in calories ordered, beyond the effect of calorie labeling in isolation. These effects should generally decrease calories ordered. Furthermore, we propose that TVO, QVO, and their interactions with calorie information provision should explain additional incremental variance in calories ordered (beyond the combined effects of calorie labeling, HVO, and the calorie information provision × HVO interaction). These effects should generally increase calories ordered. From a health policy perspective, this (unintended) increase in calories ordered due to the direct and moderating effects of TVO and QVO potentially offsets the (intended) decrease in calories ordered resulting from the effects of HVO and calorie information provision. The following propositions summarize the expected incremental effects of the direct and moderating roles of these food value orientation measures and should help better explain the calorie labeling paradox suggested by recent field studies (e.g., Long et al. 2015).

P_1: Beyond the variance explained by calorie information provision and demographic controls, the addition of consumers' HVO and the HVO × calorie information provision interaction will increase the variance explained in calories ordered. These incremental effects will tend to *decrease* calories ordered.

P_2: Beyond the variance explained by calorie information provision, HVO, HVO × calorie information provision, and controls, the addition of consumers' TVO, QVO, and these orientations' interactions with calorie information provision will further increase the variance explained in calories ordered. These incremental effects will tend to *increase* calories ordered.

Given these proposed incremental effects, we use hierarchical regressions in longitudinal and field experiments to assess these propositions.[1] In general, we anticipate that when considered in aggregate, the increases and decreases in calories ordered due to calorie information provision and consumers' food value orientations should offset one another, offering a conceptual explanation for the many nonsignificant effects found in restaurant field experiments (see Table 1). After evaluating and confirming the psychometric properties for the multi-item food value orientation scales developed and examined in the initial pilot studies, we assess the incremental impact of the direct and moderating roles of the orientation measures in a longitudinal experiment (Study 1) and field experiment (Study 2).

Pilot Studies

Pilot Study 1

Method. Prior to examining the direct and moderating influence of consumers' food value orientations on the effect of calorie labeling on calories ordered, we developed multi-item measures designed to assess consumers' food value orientations. Each of these measures was similar in length and form. We

[1] Although prior research clearly supports the importance of considering consumer values and characteristics when evaluating consumers' food consumption decisions and the effectiveness of nutrition information provision, we recognize that consumers' short-term motivations at times do differ from their enduring characteristics. For example, a health value–oriented consumer may decide to temporarily deviate from their diet to celebrate a special occasion. In addition, enduring food value orientations could also gradually shift over time. Examples of this occurring include the following: (1) overweight consumers losing substantial weight and becoming less health value–oriented, (2) middle-aged or older consumers gradually becoming more health value–oriented over time, or (3) consumers on a tighter budget becoming more quantity value–oriented. We also recognize that there may be other situational cues or nudges that impact a given dining episode (Cadario and Chandon 2018). Thus, although food value orientations are conceptualized as important consumer characteristics that influence food choices and responses to information provision, we do not anticipate that these orientations ever completely explain consumer-level choices in complex restaurant choice environments. Given this, we offer fundamental propositions rather than formal hypotheses for this initial assessment. We believe that the aforementioned situational and contextual variables and short-term motivations may further interact with food value orientations and calorie information provision, representing potentially fruitful future research avenues. We suggest some possibilities in the "General Discussion" section.

obtained a national sample of 310 adults (i.e., aged 18 years or older) using an online national convenience sample from Amazon Mechanical Turk (MTurk) (Kees et al. 2017a; 2017b) to examine the reliability and structure of the food value orientation measures.[2] The mean age of the sample was 33 years, women made up 62% of the sample, the median annual household income was $40,000–$49,999, and 44% of the sample had obtained a four-year college degree.

Participants were instructed that "this survey contains questions about your perceptions of food value." Following these instructions, participants responded to multi-item, seven-point Likert scales used to assess HVO, TVO, and QVO (see Appendix A). After participants responded to the focal food value orientation measures, we measured their nutrition knowledge, nutrition motivation, perceived self-risk of heart disease or stroke, and reported height and weight to examine the nomological validity of the food value orientation measures. We used three seven-point scale items to assess each of the following constructs: (1) subjective nutrition knowledge ($\alpha = .92$; Burton, Garretson, and Velliquette 1999), (2) motivation to process nutrition information ($\alpha = .94$; Howlett et al. 2009; Keller et al. 1997; Moorman 1990), and (3) perceived health risk ($\alpha = .92$; i.e., "Compared with other men and women of your age, do you consider your risk of heart disease or stroke to be:" with endpoints of "much lower than others/much higher than others," "less likely/more likely," and "much better than average/much worse than average"). We used participants' reported height and weight to calculate each participant's body mass index. Finally, participants provided some basic demographic information. All participants who completed the measures were included in the analyses.

Results. We performed confirmatory factor analysis to examine the measurement model consisting of the three proposed food value orientations. The fit indices for the proposed three-factor correlated measurement model indicate adequate fit (comparative fit index = .98, Tucker–Lewis index = .98, root mean square error of approximation = .04; Hu and Bentler 1999). Appendix A shows the factor loadings, reliabilities, and average variance extracted for each food value orientation measure. All these assessments of internal consistency and item convergence exceed recommended levels. We also examined the correlations between the orientations (see Web Appendix A). Specifically, the correlation between HVO and QVO was negative ($r = -.12$; $p < .05$), whereas the correlation between QVO and TVO was positive ($r = .23$; $p < .01$). The HVO–TVO correlation was nonsignificant ($r = .06$; $p > .05$). Furthermore, tests of discriminant validity were supported for each pair of orientations (Fornell and Larker 1981).

Tests of nomological validity for the relationships of the food value orientations and other established constructs were supportive (see Web Appendix A). There was a negative correlation between consumers' income and QVO ($p < .01$), age and QVO ($p < .05$), and education and QVO ($p < .05$). There were positive relationships between HVO and both nutrition knowledge and nutrition motivation (both ps $< .01$) but negative relationships between HVO and both BMI and self-risk (both ps $< .05$). We also conducted three independent samples t-tests with gender as the independent variable and each of the food value orientations as dependent variables to examine potential gender differences in orientations. Men were lower than women in HVO ($t_{(308)} = 3.12$, $p < .01$), but men did not differ from women in either TVO or QVO (ps $> .05$).

Pilot Study 2

Method. We conducted a second pilot study using a national sample of adults (i.e., aged 18 years or older) obtained from MTurk ($n = 63$) to further consider the relationships between the food value orientations and other established constructs, as well as to demonstrate that enduring orientations are not related to state-based variables (e.g., hunger). The mean age of the sample was 37.2, women made up 41.3% of the sample, the median annual household income was $50,000–$59,999, and 50.8% of the sample had obtained a four-year college degree. Participants first responded to several measures of state-based variables, including hunger (Finkelstein and Fishbach 2010) and how healthfully they had eaten in the past day. The latter was measured using the following seven-point item: "How healthy have you eaten in the last 24 hours?" The endpoints were "not at all healthy/very healthy." After responding to these measures, we assessed participants' food value orientations, concern for weight watching (Finkelstein and Fishbach 2010), and nutrition knowledge (Burton, Garretson, and Velliquette 1999). Finally, participants provided some demographic information. All participants who completed the measures were included in the analyses.

Results. Hunger was not related to any of the three food-value orientation measures (all ps $> .05$), indicating that consumers' food value orientations do not appear to shift away from health (or toward taste or quantity) when hungry. As expected, self-reported healthy eating was positively correlated with HVO ($r = .54$; $p < .001$), but the negative correlations with TVO ($r = -.25$) and QVO were nonsignificant (ps $> .05$). These results support the enduring nature of the orientations because consumers are not shifting away from HVO if they have eaten healthy meals recently. Building on extant literature (Finkelstein and Fishbach 2010), a shift in motivational priority does not appear to be occurring in this context because consumers who are choosing to eat healthfully are already concerned with their health; thus, their consumption of healthy food reflects their commitment to a healthy diet. Finally, as anticipated and partially replicating the results of the first pilot study, HVO was positively related to concern for weight watching ($r = .58$, $p < .001$) and nutrition knowledge ($r = .50$, $p < .001$), further demonstrating nomological validity. Discriminant validity was

[2] The authors generated these items and/or adapted them from measures in the literature. Support for the psychometric properties of the scales from the pilot study extends to the two experiments reported subsequently.

supported for all measures. After successfully confirming the psychometric properties of the food value orientation scales and demonstrating their relationships with other established constructs, we next turn to Study 1 to examine how these orientations interact with calorie information provision.

Study 1

Study 1 uses a longitudinal pretest–posttest experimental design with a control group to assess the direct and moderating effects of consumers' food value orientations on meal expectations and meal calories ordered. Herein, we seek to provide greater insight into the factors that influence food choice and determine whether calorie information provision can have asymmetric effects on calories ordered. Consistent with prior field and laboratory research, and given the policy objective to improve public health through more healthful consumption, calories ordered is the primary dependent measure of interest in the next two studies. This longitudinal design simulates the marketplace change (FDA 2017) and is consistent with the general designs used in many previous studies to examine the marketplace implementation of menu calorie labeling in locations such as New York City and King County, Washington (see Table 1).

Method

Design, procedure, and sample. We used a longitudinal pretest–posttest experimental design with a control group to examine the proposed effects of menu calorie labeling and food value orientations on consumers' expectations about their chosen meal and the countervailing effects on calories ordered. Participants were again recruited from MTurk. In the description of the study, participants were asked to participate in a longitudinal study about food. They were compensated $.75 for their participation in Time 1 (T1) and $1.00 for their participation in Time 2 (T2). After agreeing to participate, participants responded to screening questions to ensure that they were at least 18 years old and had eaten meals purchased from a restaurant in the last month. All participants who completed the measures at both T1 and T2 were included in the analyses, resulting in a final sample of 271 adults. Participants' mean age was 39.3, women made up 57.6% of the sample, the median household income was $40,000–$49,999, and 48.0% of the sample had received a four-year college degree.

At T1, 401 participants ordered from a fictitious menu with no calorie information (see Appendix B) and responded to the food value orientation and demographic measures. One month later, at T2, the same participants were contacted, and 271 (68%) of them agreed to participate. These participants again ordered from the same fictitious menu. However, at T2, the participants were randomly assigned to the calorie labeling manipulation in which there were two conditions: (1) a menu with no calorie information or (2) a menu with calorie information.[3] To increase realism, we obtained all menu items and calorie levels from major table-service chain restaurants. At both T1 and T2, we asked participants to order from the menu as they would for their evening meal on an ordinary day, including an entrée and, if desired, side(s) and a drink. The primary dependent variable was the number of calories ordered at T2. After participants had indicated their meal choices at T2, we also measured their expectations (healthfulness, taste, and quantity) about their chosen meals to provide some additional evidence for the predictive validity of the food value orientation measures.

Measures. At T1, we assessed HVO, TVO, and QVO using the items established in the pilot studies. Coefficient alphas all exceeded .90. The reliabilities, means, standard deviations, and correlations for these measures are provided in Web Appendix B. The focal dependent measure of meal calories ordered at T2 was the sum of the objective calories contained in the entrée, side(s), and drink that participants ordered for themselves. We also calculated meal calories for participants' orders at T1. This measure was used as a control variable in the analyses to account for meal preferences when calorie information was not present.

At T2, we assessed meal expectations using three distinct measures: (1) expected meal healthfulness, (2) expected meal taste, and (3) expected meal quantity. We measured healthfulness expectations of the specific meals participants ordered using two seven-point items adapted from prior research (Kozup, Creyer, and Burton 2003): "Overall, how would you rate the level of nutritiousness of the entire meal that you ordered?" with endpoints of "not nutritious at all/very nutritious" and "I think the nutrition level of the meal I ordered is:" with endpoints of "poor/good." We measured taste expectations using a seven-point scale item adapted from prior food labeling research: "I believe that the taste of this meal would be:" with endpoints of "very poor/excellent." We measured quantity expectations using two seven-point items: "Based on your order, how much food would you expect to receive?" with endpoints of "a little/a lot" and "When my meal is delivered, I would expect to receive a large quantity of food" with endpoints of "strongly disagree/strongly agree" (Berry et al. 2015). Supporting reliability, Pearson product-moment correlations between items in these multi-item measures all exceeded .83 ($ps < .001$).

[3] Given that participants were randomly assigned to focal calorie labeling conditions at T2, as expected, the three food value orientations did not differ between the no labeling control condition and calorie labeling condition ($ps > .20$ for each; see Web Appendix B for means and standard deviations). We also compared differences in the food value orientations of participants who participated at both T1 and T2 to the participants who only participated at T1. According to the results of t-tests of differences between the means, the health and taste value orientations of these two groups did not differ ($ps > .10$ for both). The quantity value orientation of those who did not participate at T2 ($M = 5.30$, $SD = 1.40$) was slightly higher than those who participated at both T1 and T2 ($M = 4.99$, $SD = 1.48$; $t_{(399)} = 2.03$, $p = .04$).

Results

Effects on consumers' expectations for their chosen meal. In line with our conceptualization, we expected consumers' HVO, TVO, and QVO to be related to the expected healthfulness, taste, and quantity of their selected food items, respectively. To assess these predicted relationships, we estimated three regression models. Specifically, each of the three meal expectations was regressed on HVO, TVO, QVO, calorie information provision (calories provided on the menu = 1 and calories not provided = 0), and the three calorie information provision × food value orientation interactions. The predictors, including calorie information provision, were centered at their means prior to creating these three interaction terms (Aiken and West 1991).[4] We used these tests to provide an initial assessment of the conceptual foundation and the predictive validity of the measures by examining how the HVO, TVO, and QVO scales (all measured at T1) related to expectations of meal choices (measured at T2).

As predicted, HVO was positively related to the expected healthfulness of the specific meal choice (b = .34, SE = .05, $t_{(263)} = 6.40$, $p < .001$). Similarly, QVO was positively related to the amount of food participants expected to receive for their chosen meal (b = .22, SE = .05, $t_{(263)} = 4.86$, $p < .001$). Lastly, TVO was positively related to expectations about taste (b = .19, SE = .05 $t_{(263)} = 3.79$, $p < .001$). In all three regression models, the food value orientations x calorie information provision interactions were nonsignificant, supporting the fundamental idea that consumers choose specific meals that they expect to align with their food value orientations. These results offer support for the predictive validity of the measures.

Effects on calories ordered. Calories ordered is the focal outcome because of its great interest to the consumer health and public policy communities (see Table 1). We used hierarchical multiple regression to estimate four models. These results, including the model fit statistics for each model, are shown in Table 2. In Model 1, calories ordered at T2 was regressed on calories ordered at T1 (a control that accounts for general meal preferences) and the manipulation of calorie information provision. As shown in Table 2, calorie information provision significantly reduced calories ordered. This is an effect that is consistent with a number of other experiments conducted outside of actual restaurant settings (Burton, Howlett, and Tangari 2009; Parker and Lehmann 2014; Roberto et al. 2010; Howlett et al. 2009). We entered demographic controls (i.e., age, gender, income, and education) in Model 2.[5] These controls significantly increased the amount of the variance explained (R^2 change = .03; $F_{(4, 264)} = 2.45$, $p < .01$), with age being negatively related to calories ordered. In Model 3, we hierarchically added HVO and the HVO calorie information provision interaction to the regression model, which resulted in a significant increase in R^2 (R^2 change = .02; $F_{(2, 262)} = 3.89$, $p < .01$). This result supports P_1.

As also shown in Model 3 of Table 2, HVO and the HVO x calorie information provision interaction were negatively related to calories ordered. To examine the effects of food value orientations unrelated to health value, we hierarchically added the predictors expected to increase calories ordered in Model 4. These predictors included TVO, QVO, and their interactions with calorie information provision. As proposed in P2 and shown in Model 4 of Table 2, the inclusion of these predictors led to a significant incremental increase in R^2 (R^2 change = .06; $F_{(4, 258)} = 4.71$, $p < .01$). Both TVO and QVO were positively related to calories ordered.

Although calorie information provision decreased calories ordered in this online experiment, the direct effects of calorie information provision and HVO were qualified by the calorie information provision × HVO interaction. To examine the moderating role of HVO on the effect of calorie information provision on calories ordered, we tested the effect of calorie information on total calories ordered at five percentile levels of HVO using model 1 of PROCESS (Hayes 2013). As shown in Figure 1, the effect of calorie information provision on calories ordered became significant when HVO reached the 50th percentile (b = −179.29, SE = 52.00, t = −3.45, $p < .001$), and the effect strengthened as HVO increased (75th percentile: b = −245.95, SE = 64.60, t = −3.81, $p < .001$; 90th percentile: b = −312.70, SE = 90.21, t = −3.47, $p < .001$). However, this effect on calories ordered was not significant when HVO was at the 25th percentile or below (*p*s > .05). This pattern of results suggests that calorie information provision will only reduce calories ordered for health value–oriented consumers.

Discussion

Study 1 supports our conceptualization of food value orientations by demonstrating that consumers choose meals that align with their enduring predispositions. In support of P_1, the effects of consumers' HVO and the calorie information × HVO interaction decreased calories ordered and explained significantly more variance than calorie information provision and controls (Model 3 in Table 2). Specifically, HVO was negatively associated with calories ordered, and consumers oriented toward health value ordered fewer calories in response to calorie information provision. That is, because the calorie provision effect was qualified by the calorie provision × HVO interaction, results indicate that providing consumers with additional

[4] We are interested in the ability of food value orientations to predict consumers' specific expectations about their chosen meals and calories ordered. Therefore, in both studies, we centered the dummy-coded calorie information provision predictor at its mean so that the effects of the food value orientations are the weighted average effects across the two experimental conditions (see Hayes 2013, p. 230).

[5] We entered calorie information provision before the controls to initially test the effect of calorie labeling alone. However, in both the longitudinal and field experiments, we conducted the analyses reversing the order of entry, with the demographic controls entered in Model 1 and calorie information provision in Model 2. This order is more consistent with typical hierarchical regression procedures. Importantly, there are no differences in the basic conclusions, regardless of the order of entry in stages one and two.

Table 2. Longitudinal Experiment (Study 1): Hierarchical Regression Results for Calories Ordered at Time 2.

	Model 1	Model 2	Model 3	Model 4
Constant	1209.66***	1219.16***	1220.22***	1219.50***
Model 1: Calorie Provision				
Calories Ordered at T1	.29***	.27***	.27***	.25***
Calorie Provision (CP)	−188.65***	−191.19***	−184.03***	−170.36***
Model 2: Controls				
Education	—	−24.18	−16.19	16.15
Income	—	−2.84	−2.95	8.97
Age	—	−5.67***	−5.52***	−6.77***
Gender	—	25.51	6.88	19.40
Model 3: Independent Variables Predicted to Decrease Calories Ordered				
HVO	—	—	−41.12**	−25.31
CP × HVO	—	—	−64.09*	−62.88*
Model 4: Independent Variables Predicted to Increase Calories Ordered				
TVO	—	—	—	84.52**
QVO	—	—	—	36.88*
CP × TVO	—	—	—	79.10
CP × QVO	—	—	—	−55.53
R^2	.14	.17	.19	.25
Model F value	$F_{(2, 268)} = 21.00$***	$F_{(6, 264)} = 8.79$***	$F_{(8, 262)} = 7.71$***	$F_{(12, 258)} = 7.00$***
F for change in R^2	—	$F_{(4, 264)} = 2.45$**	$F_{(2, 262)} = 3.89$**	$F_{(4, 258)} = 4.71$***

Notes. The dependent variable was total meal calories for the meal chosen at Time 2. In this online setting, we asked participants to order from the menu as they would for their evening meal on an ordinary day, including an entrée and, if desired, side(s) and a drink. We gathered calorie levels from menu items at major table-service restaurants. HVO is healthfulness value orientation, TVO is taste value orientation, and QVO is quantity value orientation. We centered predictors at their means prior to creating interaction terms and conducting the analyses.
*$p < .10$; **$p < .05$; ***$p < .01$.

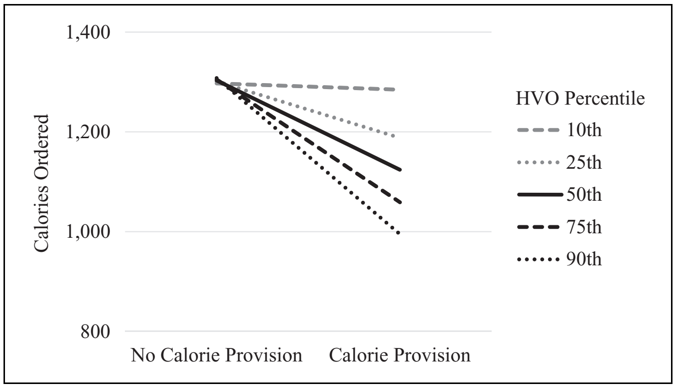

Figure 1. Study 1: Effect of the calorie information provision x healthfulness value orientation (HVO) interaction on calories.
Note: This plot shows the results of the calorie information provision x HVO interaction on calories ordered, accounting for the effects of HVO, TVO, QVO, calorie information provision, and the TVO and QVO calorie information provision interactions.

information regarding calorie content was effective in decreasing the number of calories ordered by health value–oriented consumers. However, in contrast, calorie labeling did not influence meal calories ordered by consumers with lower health value orientations.

Another primary interest in this study was the potential opposing influence of consumers' TVO, QVO, and each of their interactions with calorie information provision on calories ordered. Findings show that consumers oriented toward taste value or quantity value ordered meals that they expected to be tasty and large, respectively, and that contained more calories. In support of P_2, the aggregated effects of consumers' TVO, QVO, and the interaction of each of these orientations with calorie information provision further increased the incremental variance explained (Model 4 of Table 2), and the sum of these coefficients appeared to result in an unintended increase in calories ordered. Therefore, these predictors offer a counterbalancing influence on the intended decreases in calories ordered attributable to calorie information provision, HVO, and their interaction. These incremental increases in variance explained, shown in Models 3 and 4 of Table 2, support our two basic propositions and provide a possible explanation for the many studies showing nonsignificant effects of menu calorie labeling on calories ordered.

Study 2

Although Study 1 results show a direct and interactive effect of menu calorie labeling on calories ordered, prior research demonstrates that such effects found in controlled laboratory experiments may not extend to actual restaurant settings (Cantu-Jungles et al. 2017; Long et al. 2015). This is because there are key differences between lab and field study environments that may challenge the effectiveness of menu calorie labeling in decreasing calories ordered (Burton and Kees 2012; Cantu-Jungles et al. 2017). Thus, Study 2 seeks to build on the findings from prior field experiments, which have generally reported no effect of calorie labeling on calories ordered (see Table 1), by examining the countervailing influences that calorie labeling can have across food value orientations in a restaurant setting.

Method

Design, procedure, and sample. In this restaurant field study, we assessed and utilized consumers' food value orientations to examine the proposed asymmetric influences that calorie information provision can have across restaurant patrons (see P_1 and P_2). This field study was a between-subjects experiment (i.e., no calorie information provision vs. calorie information provision) conducted in a restaurant to again examine the effects of calorie labeling on calories ordered. We conducted the study for six consecutive days at a restaurant located in the South. Throughout the week, objective calorie information was either disclosed or not disclosed on menus and menu boards on a rotating daily basis. Appendix C provides a one-page example of the multipage menu for each experimental condition. Patrons were asked if they would like to participate in the study immediately after placing their order. If they agreed to participate, we recorded their meal order and immediately instructed them to respond to food value orientation and demographic measures.

There was a 65% response rate among patrons who visited the restaurant while we were conducting the study and who had not already dined at the restaurant during the study period. All participants were at least 18 years old, and we confirmed that they only visited the restaurant during either lunch or dinner hours once during the test period to ensure that no participant responded more than once. This resulted in a final sample of 233 complete responses that we included in all analyses. As in prior studies, we included all participants who completed the questionnaire in the analyses.[6] The mean age of the sample was 47.4 years, women made up 67% of the sample, the median annual household income was $80,000–$89,999, and 56.3% had obtained a four-year college degree. We included demographics as controls when testing the effects of menu calorie labeling.

Measures. We assessed food value orientations using the measures developed in the pilot studies and used in Study 1. Coefficient alphas again all exceeded .90. The reliabilities, means, standard deviations, and correlations for these measures are provided in Web Appendix B, Panel B. The focal dependent measure in this study was the total number of overall calories contained in the entrée, side(s), and drink(s) participants ordered for themselves, which is also consistent with Study 1.

Results

We again used hierarchical multiple regression to examine the effects of menu calorie labeling and food value orientations on calories ordered for selected menu items. After mean centering the predictors (Aiken and West 1991), including the dummy-coded calorie information provision (calories provided on the menu = 1 and no calories on the menu = 0), we created three interaction terms using the product of calorie information provision and each of the three food value orientations. Overall, we estimated four regression models, and these results, including the model fit statistics for each model, are included in Table 3.

Model 1 regressed calorie information provision alone on calories ordered. As expected and consistent with other studies conducted in restaurant settings (Table 1), calorie information provision alone did not have a significant effect on calories ordered. We entered demographic controls in Model 2, which significantly increased R^2 (R^2 change = .14; $F_{(4, 227)} = 8.87$, $p < .001$). Age was negatively related to calories ordered, and men ordered foods that had significantly more calories than the foods women ordered. In Model 3, we added HVO and the HVO × calorie information provision interaction to the regression model. Supporting P1, and as demonstrated by the significant change in R^2 (R^2 change = .04; $F_{(2, 225)} = 5.88$, $p < .01$), the addition of these HVO-related predictors improved the prediction of calorie levels compared to the model that only included calorie information provision and demographic controls. More specifically, HVO and its interaction with calorie information provision were negatively related to calories ordered, as expected. The predictors expected to increase calories ordered were added to the regression in Model 4, and these included TVO, QVO, and their interactions with calorie information provision. As expected, the pooled coefficients are positive, and the inclusion of these predictors resulted in an additional increase in R^2 (R^2 change = .06; $F_{(4, 221)} = 2.93$, $p < .05$). This result provides support for P2. QVO increased calories ordered, which further supports our general conceptualization. Although the influence of TVO (alone) on calories ordered did not reach significance in this specific field study, the calorie information provision × TVO interaction was significant.

Note that, consistent with prior field studies (see Table 1), menu calorie labeling alone did not influence the calorie levels of the chosen menu items in any of the four models. This result demonstrates the importance of considering consumers' food value orientations when evaluating the effect of menu calorie labeling. Specifically, Model 4 shows that the calorie information provision × HVO interaction on calories ordered was again

[6] We asked 454 restaurant patrons to participate in the study, 297 agreed to participate, and 233 participants fully completed the questionnaire. The response rate was 62% in the no calorie labeling control condition and 70% in the calorie labeling condition ($z = 1.79$, $p > .05$). This resulted in an overall response rate of 65%.

Table 3. Restaurant Field Experiment (Study 2): Hierarchical Regression Results for Calories Ordered.

	Model 1	Model 2	Model 3	Model 4
Constant	1008.86***	995.17***	995.41***	1005.07***
Model 1: Calorie Provision				
Calorie Provision (CP)	−9.35	12.98	19.68	1.01
Model 2: Controls				
Education	—	−28.40	−31.48*	−25.19
Income	—	−1.48	−.07	5.32
Age	—	−5.23***	−4.48***	−4.55***
Gender	—	157.02***	131.75***	140.98***
Model 3: Independent Variables Predicted to Decrease Calories Ordered				
HVO	—	—	−53.58***	−48.76**
CP × HVO	—	—	−51.43	−74.69**
Model 4: Independended Variables Predicted to Increase Calories Ordered				
TVO	—	—	—	−8.63
QVO	—	—	—	40.18**
CP × TVO	—	—	—	113.74**
CP × QVO	—	—	—	−31.29
R^2	.00	.14	.18	.22
Model F-value	$F_{(1, 231)} = 0.04$	$F_{(5, 227)} = 7.10$***	$F_{(7, 225)} = 6.97$***	$F_{(11, 221)} = 5.66$***
F for change in R^2	—	$F_{(4, 227)} = 8.87$***	$F_{(2, 225)} = 5.88$***	$F_{(4, 221)} = 2.93$**

Notes. The dependent variable was total meal calories for the chosen meal. As shown in Appendix C, this restaurant was a fast-casual restaurant with a range of menu options. HVO is healthfulness value orientation, TVO is taste value orientation, and QVO is quantity value orientation. We centered independent variable predictors at their means prior to creating interaction terms and conducting the analyses.
*$p < .10$; **$p < .05$; ***$p < .01$.

significant. This indicates that calorie information provision was only effective in decreasing calories ordered among health value–oriented consumers and that the negative influence of HVO on calories ordered was strengthened by menu calorie labeling. As in Study 1, the effect of menu labeling on calories ordered was tested at five percentile levels of HVO. This technique allowed us to further examine the moderating role of HVO on the effect of calorie information provision on calories ordered (Hayes 2013). As shown in Figure 2, the effect of calorie information provision on calories ordered was negative and significant when HVO was at or above the 90th percentile ($b = -135.51$, $SE = 68.06$; $t_{(271)} = -1.99$, $p < .05$). However, note that although the slopes were negative for those at the 50th and 75th percentiles and positive for the 25th and 10th percentiles, the effects of calorie information provision on calories ordered did not reach significance when HVO was at or below the 75th percentile ($ps > .05$). These interaction results provide further initial support for the moderating role of HVO on the effect of calorie information provision on calories ordered.

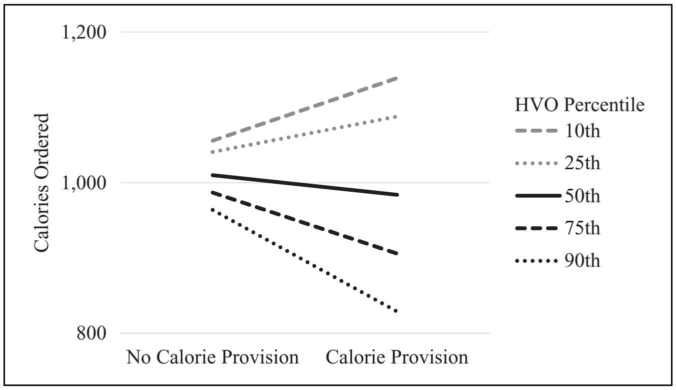

Figure 2. Study 2: Effect of the calorie information provision x HVO interaction on calories. *Note:* This plot shows the results of the calorie information provision x HVO interaction on calories ordered, after accounting for the effects of HVO, TVO, QVO, calorie information provision, and the TVO and QVO calorie information provision interactions.

Discussion

This between-subjects field experiment extends the results of the longitudinal experiment (Study 1) by testing the propositions and the counterbalancing effects of consumers' food value orientations in a restaurant setting. HVO and the calorie provision × HVO interaction explained variance beyond calorie provision and controls, resulting in an aggregate decrease in calories ordered, which supports P1. Specifically, the results show a negative relationship between HVO and calories ordered that is qualified by a significant calorie labeling ×

HVO interaction. Thus, these findings provide additional support that menu calorie information provision only leads to decreases in the number of calories ordered by consumers who are highly health value oriented. Furthermore, Model 4 supports P_2 by demonstrating a significant increase in variance explained by TVO, QVO, and the interaction of these orientations with calorie provision. Specifically, Model 4 results show a positive relationship between QVO and calories ordered, irrespective of calorie labeling, as well as a significant calorie labeling × TVO interaction. The latter result indicates that calorie labeling leads to an increase in calories ordered among taste value–oriented consumers. Conclusions and implications of these findings are discussed subsequently.

General Discussion

Policy makers have focused strongly on the provision of nutrition information as a key way to potentially address the prevalence of obesity. For example, the Nutrition Facts panel, initially mandated by the NLEA (1990), is now being updated to include more prominent calorie and serving size information, as well as levels of added sugars (FDA 2016). In addition, although the NLEA (1990) exempted restaurants from nutrition disclosures, the Affordable Care Act of 2010 mandated the provision of calorie information on the menus and menu boards of restaurant chains and other large retail food establishments. Although the compliance date was delayed on multiple occasions (Dewey 2018; FDA 2014, 2016, 2017), the FDA began enforcing this mandate on May 7, 2018 (FDA 2018). The goal of this policy decision was to help consumers make more informed, healthful food choices (FDA 2014). However, the popular press often highlights the plethora of findings from controlled experiments conducted in restaurant settings that suggest, on average, that calorie labeling has not been effective in changing consumers' food consumption behaviors (e.g., Berman 2017; Brown 2018).

Herein, we argue that results from these controlled restaurant field experiments are affected by not explicitly considering specific differences in responses to calorie labeling based on consumers' individual food value orientations. We propose that consumers differ in how they derive value from their food choices. That is, consumers may be more or less oriented toward maximizing specific food attributes (i.e., quantity, taste, and healthfulness) relative to the price paid for those food items (Zeithaml 1988). These differences across consumers explain additional variance in calories ordered while obscuring both increases and decreases in calories ordered in response to calorie labeling. Thus, the objective of this research is to empirically examine the predicted asymmetric, countervailing effects of menu calorie labeling due to enduring food value orientations (QVO, TVO, and HVO) and to test the incremental explanatory power associated with these three orientations.

Calorie labeling alone did not decrease calories ordered on average across all consumers in the restaurant field experiment; however, as policy makers and proponents of menu calorie labeling would hope, findings demonstrate that calorie labeling has its intended and desirable effect on some consumers (those high in HVO). At the same time, for consumers high in TVO or QVO, menu calorie labeling may either be ineffective or potentially associated with an increase in calories ordered. The latter highlights a potential unintended consequence of the menu calorie labeling mandate (at least from a public policy perspective). It also represents an important and key finding for future policy decisions and studies that address the effectiveness of menu calorie labeling in the United States. These specific results suggest that when the countervailing influences of food value orientations are considered in combination, they can counterbalance the effects of one another, leading to an overall nonsignificant or weak effect of calorie labeling on calories ordered in restaurant settings. Although additional studies are warranted, our findings offer an intriguing explanation for the many studies showing nonsignificant effects of calorie labeling on meal calories ordered in restaurants and potentially provide a more nuanced understanding of the calorie labeling paradox.

Specifically, Study 1 used a longitudinal framework to illustrate the potential counterbalancing influences of consumers' food value orientations on the effect of calorie labeling on calories ordered. Findings indicate calorie information provision decreases the amount of calories that health value–oriented consumers order; however, according to Model 4 results, TVO and QVO may be positively associated with calories ordered. Extending these findings to a restaurant setting, Study 2 shows that differences in HVO, TVO, and QVO are associated with asymmetric choice responses to calorie information disclosure. Because consumers use calorie information in different ways, the overall net effect of calorie information on the calorie levels of selected menu items may be negligible on average (cf. Long et al. 2015). Consistent with many prior studies in which researchers only considered the main effect of menu calorie labeling in a restaurant setting, we found no effect of such labeling in Study 2 (see Table 3). However, menu calorie labeling did have its desired effect on the responses of health value–oriented consumers. The results in Models 3 and 4 in Table 3 show that food value orientations increase the variance explained for calories ordered, which directly supports our propositions.

Conceptual Contributions for Consumer Health and Policy Researchers

This research offers a new conceptual framework that can potentially help policy makers better understand consumers' food consumption decisions and responses to nutrition information provision. Specifically, this initial set of findings provides a more complete understanding of enduring, individual-level factors that have direct and moderating influences on consumers' food consumption decisions and calories ordered. Although objective nutrition information such as menu calorie labeling may lead to shifts in consumers' food choices because consumers are more informed, our results show that consumers generally strive to align their choices with their food value orientations regardless of whether they are provided with objective nutrition information.

Understanding how consumers' enduring food value orientations interact with objective nutrition information disclosures seems essential for researchers, policy makers, and the public health community. These interactions resulted in the expected, favorable outcomes among health value–oriented consumers but resulted in some unintended outcomes for consumers with other food value orientations (Stewart and Martin 1994, 2004). Although prior research has identified some consumer predispositions such as high levels of motivation and knowledge that enhance the effects of nutrition information on important outcomes (i.e., more healthful choices; Howlett et al. 2009), the use of the multi-item measures developed here shows that other consumer predispositions and their interactions with nutrition disclosures result in some consumers ordering *more* calories.

For the menu calorie labeling context, this pattern of results extends prior conceptualizations and findings that have failed to show such increases that would have helped explain a counterbalancing effect in the marketplace. Specifically, our findings provide a theoretical explanation for the plethora of nonsignificant effects of menu labeling in prior field studies by showing that consumers' food value orientations can have both positive and negative direct and moderating effects on calories ordered. Beyond this, the food value orientation scales developed here may also be used to explain consumer responses to other forms of food-related communications in other contexts (e.g., promotional claims on packages).

Implications for Public Policy and Consumer Well-Being

Although our primary focus has been on the moderating influence of food value orientations, the consumer health and public policy communities should also be interested in the direct effects. Findings show that health value–oriented consumers tend to order fewer calories from restaurant menus as part of their meal, whereas quantity value– and taste value–oriented consumers may order *more* calories from restaurant menus. This appears to be because health value–oriented consumers strive to order more healthful meals, which tend to have fewer calories. In contrast, quantity value–oriented consumers are drawn to larger meals, and taste value–oriented consumers prefer tasty meals. Such meals are often more likely to be higher in calories and negative nutrients (e.g., saturated fat, sugar, sodium). These trends reinforce the importance of considering consumers' food value orientations in subsequent evaluations of the effectiveness of the menu labeling provisions in Public Law 111–148. They also suggest possibilities for future research that assesses various public service announcements and healthy eating "nudges" that might be helpful in targeting specific types of consumers (Cadario and Chandon 2018).

Considering the extant literature and arguments in the popular press regarding calorie labeling, we view the asymmetric effects of calorie information provision across food value orientations as offering both favorable and unfavorable news from a public policy and consumer welfare perspective. Policy makers and proponents of menu calorie labeling hope consumers will use calorie information to choose more healthful, lower-calorie foods, which could help reduce obesity in the long run. In both experiments, HVO and its interaction with labeling increase the variance explained in calories ordered and show that these desired effects appear to occur for health value–oriented consumers. Furthermore, Study 2 findings suggest that calorie labeling significantly reduces the calories ordered by an average of 136 calories among consumers in the 90th percentile for health value orientation (see Figure 2). Consequently, mandatory calorie labeling may benefit this particular consumer segment, which is a calorie information mandate outcome that the FDA and health advocates in general desire. That is, for health value–oriented restaurant patrons, menu calorie labeling appears to "assist consumers in maintaining healthy dietary practices" (NLEA 1990).

Conversely, taste value– and quantity value–oriented consumers use calorie labeling to identify food items that best align with their orientations, which potentially results in these consumers ordering a greater number of calories. For example, the results of Study 2 indicated that TVO, QVO, and their interactions with calorie labeling explained incremental variance beyond HVO effects (see Table 3, Model 4), and based on the sum of these coefficients, these predictors accounted for an increase of over 100 calories ordered. Thus, calorie information is used by many consumers to enhance food value in ways that diverge from healthy choices, which is an outcome generally not expected by most policy makers, consumer health advocates, and consumer researchers. This is an important point for these communities: Policy makers can mandate that restaurants provide calorie information, but it is far more difficult to control how consumers choose to utilize this information when making product choices.

It should be noted that menu calorie labeling has frequently been debated by some restaurant chains, grocery chains with delis, convenience stores, and other retailers impacted by the labeling legislation because they sell food for immediate consumption. Although some researchers have previously concluded that calorie labeling is not likely to change consumer food choice behavior (Cantu-Jungles et al. 2017; Long et al. 2015), we believe that our findings should help inform current and future debates regarding when, and for whom, menu calorie labeling is beneficial. In addition, these findings offer a number of possibilities for future research.

Limitations and Future Research

Extant research has also found that calorie labeling is most effective when objective calorie levels differ substantially from consumers' calorie expectations (e.g., Breck et al. 2017; Burton and Kees 2012; Burton et al. 2006; Burton et al. 2015). Therefore, researchers could consider consumers' explicit calorie expectations in conjunction with food value orientations in future research. Also, calorie labeling may be more effective in reducing calories ordered at restaurants that have many "surprise items" on the menu that differ from consumers' expectations (e.g., a variety of salads with more than 1,000 calories). In these cases, the direct effect of health value orientation may not be as strong because health value–oriented consumers need the additional information provided by menu calorie labeling to make a healthful, low-calorie menu selection; however, the moderating role of health value orientation may be accentuated. This also highlights the need for future research that examines calorie labeling effects at the item level and longitudinally as consumers become more accustomed to seeing calorie information on menus and menu boards. In other words, food items may differ in how much they deviate from expectations, and the distance between objective calorie levels and consumers' calorie expectations may decrease over time.

We acknowledge that initial conclusions that might be drawn from our findings are based on only two experiments (and two pilot studies) and that there are many contextual factors that influence food choices. Additional research should be conducted to further our understanding of the consequences of menu calorie labeling as a strategy to improve the healthfulness of consumers' choices. For example, the effects of menu calorie labeling should be examined across restaurant settings (e.g., more vs. less healthful restaurants, fast-food vs. table-service restaurants) and other retail food establishments (e.g., grocery store delicatessens). Upon being exposed to menu calorie labeling, consumers may decide to visit restaurants that they believe align with their food value orientations (Berry, Burton, and Howlett 2018). This may lead to consumers perceiving different restaurants to be aligned with different food value orientations, resulting in different food value orientation profiles across restaurants. Subsequently, the effects of calorie labeling may differ across these settings. Furthermore, the restaurant context itself may provide cues, primes, or "nudges" that temporarily enhance or reduce a specific orientation. Examining and distinguishing between these possibilities presents important avenues for future research.

Although our research has focused on the moderating role of consumers' enduring food value orientations, we acknowledge that there are many environmental and contextual factors that influence choices and could also potentially moderate the effect of calorie information provision. For example, how do "nudges" promoting more healthful choices offered at the point-of-purchase differentially affect consumers based on their food value orientations? How does menu item organization and presentation affect evaluations and choices when calorie information is available versus unavailable? When calorie information is provided, do nudges improve the healthfulness of choices that taste value– and/or quantity value–oriented consumers make? Are there nudges that can further improve choices for HVO consumers who are already attempting to make healthful choices? Are there practical manipulations of short-term consumer goals that differ across more enduring orientations? Clearly, consumers do not always make choices consistent with their food value orientations, so a further understanding of these interactions in the new information environment based on Public Law 111–148 is a fruitful direction for future studies. However, although these shifts are important, it is difficult if not impossible for the FDA (or other policy makers) to control the contextual environments in restaurants in an effort to promote healthier choice outcomes. These contextual and situational cues could, however, be practical and useful for restaurants wanting to encourage more healthful consumption. In addition to considering the potential interactions of food value orientations with short-term goals and motivations, contextual and situational cues, and nudges, it is also important for researchers to consider ways to encourage consumers to become more health value–oriented (and less quantity value– and taste value–oriented). This is consistent with the long-term goals of the public policy and public health communities and will continue to be important as obesity and obesity-related diseases and premature deaths remain a prominent issue. To truly improve consumer well-being, longer-term shifts that help many consumers redefine how they value food may be needed (Bublitz et al. 2013; Block et al. 2011).

Though not a focus of the current research, consumers' food value orientations may also interact with restaurant positioning, different promotional efforts, and disclosures on consumer packaged goods to affect restaurant patronage and food consumption behaviors. Our findings can be used to guide related future research efforts on the effects of various value appeals that appear on packages and in advertising that may be influential to different consumer segments depending on their food value orientations (e.g., "Improved Taste!," "Healthy!," "Get 6 oz. Free!"). In addition, are there asymmetric differences in how price changes affect demand for differing *types* of restaurant meals (e.g., more healthful vs. very large quantity) across these food value consumer segments? The combined effects of front-of-package product claims, front-of-package calorie and nutrient disclosures, and food value orientations is an important area for future research.

In summary, effects related to the introduction of calorie labeling in restaurants and other food retailers affected by calorie labeling provisions in Public Law 111–148 are extremely complex due to the integrated matrix of enduring consumer orientations, contextual and environmental factors, restaurant positioning, and food item–related characteristics and caloric perceptions. No one set of experimental studies will be able to examine all these possible interacting factors influencing individual consumer choices in a comprehensive fashion. However, we believe the conceptualization and findings reported here offer a number of directions for future studies now that menu calorie labeling has been introduced into the U.S. marketplace.

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Appendix A

Pilot Study 1: Factor Loadings, Variance Extracted, and Reliabilities for the Measures

Food Value Orientations	Factor Loadings
Taste Value Orientation (TVO)	
I often consider the taste of different foods to be sure that I get my money's worth.	.74
I often consider how certain foods taste to be sure that I get the tastiest food for the money I spend.	.84
When I make food choices, I often consider factors associated with taste.	.88
When purchasing a food product, I try to maximize the tastiness I receive for the money I spend.	.85
When considering whether or not food is a good value, taste is an important consideration.	.84
Variance Extracted	.69
Construct Reliability	.92
Healthfulness Value Orientation (HVO)	
When I buy food products, I like to be sure that I am getting my money's worth in terms of how healthy the food is.	.84
I often consider how healthy different foods are to be sure that I get nutritious food for the money I spend.	.90
It is important to me to get healthy foods for the money I spend.	.87
When purchasing a food product, I try to maximize the healthiness of the product for the money I spend.	.90
Variance Extracted	.77
Construct Reliability	.93
Quantity-Value Orientation (QVO)	
I don't feel like I get my money's worth if I pay a lot of money for food and only get a small amount.	.74
When purchasing a food product, I try to maximize the amount I receive for the money I spend.	.82
When considering whether or not food is a good value, quantity is an important consideration.	.80
It is important for me to get a lot of food for the money I spend.	.91
As I increase my spending on food, I should receive higher quantities of food.	.84
Variance Extracted	.68
Construct Reliability	.91

Appendix B

Study 1: Online Experimental Stimuli

No Calorie Information Provision

Calorie Information Provision

Appendix C

Study 2: Field Experiment Menu Stimuli

Calorie Information Provision

No Calorie Information

Note: The stimuli examples shown are a single page from a multiple page menu.