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Information Framing Effects on Diet Choices Among Chinese Urban Residents

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ABSTRACT

Unhealthy diets have become a leading contributor to death and disability globally. The current Chinese diet falls short of a healthy diet, including too much meat, oil, salt, and sugar while having insufficient levels of whole grains, fruits, nuts, and milk. Transforming Chinese dietary patterns has become urgent. This paper compares the effectiveness of information framing effects on enhancing Chinese consumers' healthy diet choices, varied by information content, source, and presentation. The survey is conducted across six Chinese cities, with a sample of 3150 urban consumers. Chinese consumers' healthy diet choices are measured using an online discrete choice experiment. Four different diet patterns were used to label each of the product alternatives in the experiment, which varied in taste and cost. Results reveal that compared to positive information; negatively framed healthy information is more effective in increasing Chinese consumers' valuations for healthy diets. Consumer valuation of a healthy whole diet is significantly enhanced when the information is from social celebrities, compared to information from a scientific source. Moreover, when health information is disclosed via social media, its effectiveness in promoting healthy diet choices is significantly reduced. Our findings have implications for designing and implementing nutrition policies and programs in China and other developing countries.

JEL Classification: Q18, Q11

1 | Introduction

An unhealthy dietary pattern has been a leading factor in deaths and disabilities globally (Afshin et al. 2019). Chinese consumers overeat meat while having insufficient consumption of whole grains, fruits, nuts, and milk (Sheng et al. 2021)—this divergence from healthier dietary guidelines, such as the Chinese Food Guide Pagoda and EAT-Lancet diets. As a result, China has the highest rate of diet-related cardiovascular disease deaths and cancer deaths worldwide (Afshin et al. 2019). The burden has reduced human capital and hampered economic growth (WHO and Diet 2003), which highlights the urgency of transforming the Chinese diet into a healthier one.

Health information provision has been proven to be effective in promoting healthy behaviors among individuals (Guillaumie, Godin, and Vezina-Im 2010; Guan, Lin, and Jin 2024). For instance, health educational interventions, such as scientific dietary knowledge propagation, could promote children's healthy eating behavior (Van Cauwenberghe et al. 2010; Morgan et al. 2010) by enhancing individuals' health awareness. Nevertheless, the effectiveness of health information may depend on the way in which information is presented and the

content of the information itself (Lusk 2004; Kariuki and Hoffmann 2021; Dolgopolova et al. 2022). While previous studies have predominantly focused on attribute framing (e.g., Levin and Gaeth 1988; Dolgopolova et al. 2022) and the effects of gain-framed versus loss-framed information (O'Keefe and Jensen 2008; Roosen et al. 2009; Hilverda, Kuttschreuter, and Giebels 2017; Lee et al. 2018; Cui, Fam, and Zhao 2019), these investigations have typically centered on special food items. The impact of the information framing on diet choices is less well investigated. This study supplements the literature by evaluating the effectiveness of different health information frames in promoting healthy diets among urban Chinese consumers, taking into account the variations in information content, source, and presentation.

Additionally, in contrast to the predominant focus on special food products in existing studies within the field of food economics, this research adds to the literature by centering on diets—combinations of food products that collectively contribute energy and essential nutrients. The selection of a diet is consistent with real-world grocery shopping situations, where consumers purchase many food items as a package. In practice, consumers find it difficult to place a specific food item within a dietary plan (Cowburn and Stockley 2005). Even if consumers can make a healthy choice of one particular food, previous research demonstrates that they may rebound and engage in unhealthy eating (Finkelstein and Fishbach 2010; Tønnesen et al. 2022). This is because people often overcompensate themselves with some sort of indulgence, yielding a net negative impact on their diets (Raghunathan, Naylor, and Hoyer 2006; Coelho do Vale, Pieters, and Zeelenberg 2008). In addition, understanding how people choose a diet would be more informative for diet-related health consequences. The diet accounts for the potential correlation of different food items, has a direct link to nutrition components, and has a stronger impact on diet-related disease risks (De Ridder et al. 2017). For example, higher consumption of whole grains is related to a lower risk for chronic diseases and cancers, whereas processed meat consumption is associated with a higher risk (Ley et al. 2014). This makes inferences about the net health effect of one food particularly challenging if a person consumes both whole grains and processed meat. Therefore, while examining the choices of any single food product is convenient, accounting for the preferences of a diet is important and informative.

This study designs and implements an online discrete choice experiment (DCE) with a between-subject design to explore information framing effects on Chinese consumers' diet selections. DCEs are effective tools for simulating shopping scenarios, thereby enhancing our understanding of individual behavior. They have been widely applied in various contexts to inform consumer food choices (e.g., Burton, 2001; Loureiro and Umberger 2007; Kamphuis, De Bekker-Grob, and Van Lenthe 2015). While choice experiments are particularly valuable when actual products are unavailable in the market; however, they are also commonly employed to gauge consumer preferences for existing products (e.g., Kamphuis, De Bekker-Grob, and Van Lenthe 2015; Livingstone et al. 2021). In this paper, hypothetical choice experiments allow us to include healthy and sustainable diets that are not chosen frequently by Chinese residents. In particular, the survey is conducted across six Chinese cities, with a sample of 3150 urban consumers. Our results indicate that urban Chinese consumers are more responsive to negative health information, compared to positive information. Comparing the impacts of information sources, consumers' valuation of healthy diets is significantly improved when the information is from a scientific association or celebrity influencer. But, consumers are mite inclined to trust celebrities, even if the two types of information are completely consistent. When health information is disclosed via social media, its effectiveness in promoting healthy diet choices is reduced. We also assess heterogeneous responses to health information treatments and find that information interventions are more effective in low-income groups. These results enrich the theoretical framework and content of framing effects in health behavior research and provide new insights for policy interventions targeting healthy diet behavior change.

The remainder of the study is organized as follows. Section 2 introduces the research hypotheses and experimental design. Section 3 describes the main empirical strategy. Section 4 illustrates the data source, respondents' demographic characteristics, and food purchasing behavior. Section 5 presents the results of the impact of information framing on urban Chinese consumers' healthy diet choices. Conclusions and discussions are presented in Section 6.

2 | Experimental Design

2.1 | Research Hypotheses

We propose the following hypotheses to be tested based on previous literature and real-world facts.

First, regarding informational content, the positively framed information in our design indicates the benefits of increasing the intake of healthy foods, while the negatively framed information offers potential risks of insufficient intake of healthy foods. Several studies reported that consumers placed greater weight on negative information compared to positive information on special food choices (Roosen et al. 2009; Lee et al. 2018). People are typically loss-averse, that is they prefer to avoid losses than acquire equivalent gains (Kahneman and Tversky 1979). Therefore, we hypothesize that negative information about health threats will increase consumer acceptance of healthy diets, compared to positive information (H_1).

Second, concerning information sources, previous research has indicated the significant influence of celebrity influencers on enhancing consumer preference for healthy foods or brands (Dutta and Singh 2013; Phua, Jin, and Kim 2019). However, trusted scientific associations are progressively gaining importance in the global food system as reliable sources of information (Drewnowski and Specter 2004; Rupprecht et al. 2020). Consequently, given the authority of scientific associations in healthy nutrition knowledge, we hypothesize that the information from scientific institutions will be more valuable than that disseminated from celebrity influencers (H_2).

Third, WeChat Official Accounts is used as a social media application to present health information in our experiment setting. As the rapidly emerging social media in China, WeChat has become the most popular social media platform, with more than 1.3 billion users worldwide by the end of 2023[1]. A popular functional module of WeChat, WeChat Official Accounts enables users to subscribe and receive selected news or information. By the end of 2022, the number of registered WeChat Official Accounts has reached 20 million[1], providing WeChat with enormous potential to affect public health in China (Wu et al. 2019). However, prior studies have suggested that there is too much healthy nutrition information on social media, which may confuse consumers, instead of informing them (Milgram 1970; De Ridder et al. 2017). Therefore, we assume the diet information coming from social media weakens the effect on consumers' healthy diet choices, compared to all the other sources (H_3).

Finally, this paper further explores the heterogeneous effectiveness of information framing among different economic status respondents. Prior studies suggest that consumers with higher economic status place more importance on the health attributes of specific food products (Kamphuis, De Bekker-Grob, and Van Lenthe 2015). Conversely, low-income individuals may face difficulties affording healthy diets (Herforth et al. 2020; Laborde, Martin, and Vos 2021). As a result, consumers with lower economic status may possess more potential for adopting a healthy diet. Therefore, we assume that information intervention would be mixed among different income subgroups (H_4).

2.2 | The Design of Information Intervention

This study employs a between-subject design to test the aforementioned four research hypotheses. Consumers were randomly assigned to one of the nine groups[2]. As shown in Table 1, Group 1 is the control group in which subjects are not provided with any health information. Group 2 and Group 3 provide individuals with health information without any source, and the health information is positively and negatively framed in Groups 2 and 3, respectively. Individuals in Group 2 are presented with positively framed information, referring to Scientific Research Report on Dietary Guidelines : "Increasing the intake of fruits and vegetables will reduce the risk of cardiovascular disease, cancer, and tumors (such as gastric cancer, lung cancer, esophageal cancer, breast cancer, and other diseases)." Negatively framed information in Group 3 is stated: "Insufficient intake of fruits and vegetables will increase the risk of cardiovascular disease, cancer, and tumors (such as gastric cancer, lung cancer, esophageal cancer, breast cancer, and other diseases)." Groups 4 and 5 add to Groups 2 and 3 by stating that the information is from the Chinese Nutrition Society, respectively. Groups 6 and 7 provide the same information as Groups 4 and 5 but present the information as shown on WeChat Official Accounts. WeChat Official Accounts is a popular functional module of the most popular social media platform in China. It enables users to subscribe and receive selected news or information. Groups 8 and 9 similarly utilize WeChat Official Accounts to present health information, but they differ from Groups 6 and 7 by clarifying that this information originates from a well-known celebrity Account. The celebrity Account referred to is among the top 10 most followed accounts in the health and nutrition field on WeChat Official Accounts in 2021. Supporting Information S1: Appendix A displays the detailed health information treatment for each group.

2.3 | Choice Experiment Design

This study employs labeled choice experiments to clarify the attributes and features of the options available to participants. To simulate real-world shopping scenarios and reduce the number of choice options, an efficient design is utilized to create a practical set of 6 choice tasks for respondents to evaluate (Rose et al. 2008), with a D-efficiency of 86%. Each selection task consists of four diet alternatives and one opt-out option. The Opt-out options are provided with the following opt-out reminder: "If you don't prefer any of the four diet options, you can choose to keep your current diet." Including this option would potentially mitigate hypothesis bias in DCE responses (Hensher 2010; Jiang, Penn, and Hu 2022). Figure 1A shows an example choice task, where each alternative could be enlarged, and Figure 1B presents a sample diet option. To avoid potential ordering effects, the order of the choice scenarios and diet options is randomized. A full list of the six choice scenarios is presented in Supporting Information S1: Appendix B. These

TABLE 1 | Information treatments.

	Description
Group 1	Diet choices only
Group 2	Positive information + Diet choices
Group 3	Negative information + Diet choices
Group 4	Positive information from scientific association + Diet choices
Group 5	Negative information from scientific association + Diet choices
Group 6	Positive information from scientific association + presenting in social media + Diet choices
Group 7	Negative information from scientific association + presenting in social media + Diet choices
Group 8	Positive information from celebrity + presenting in social media + Diet choices
Group 9	Negative information from celebrity + presenting in social media + Diet choices

Source: Authors' own work.

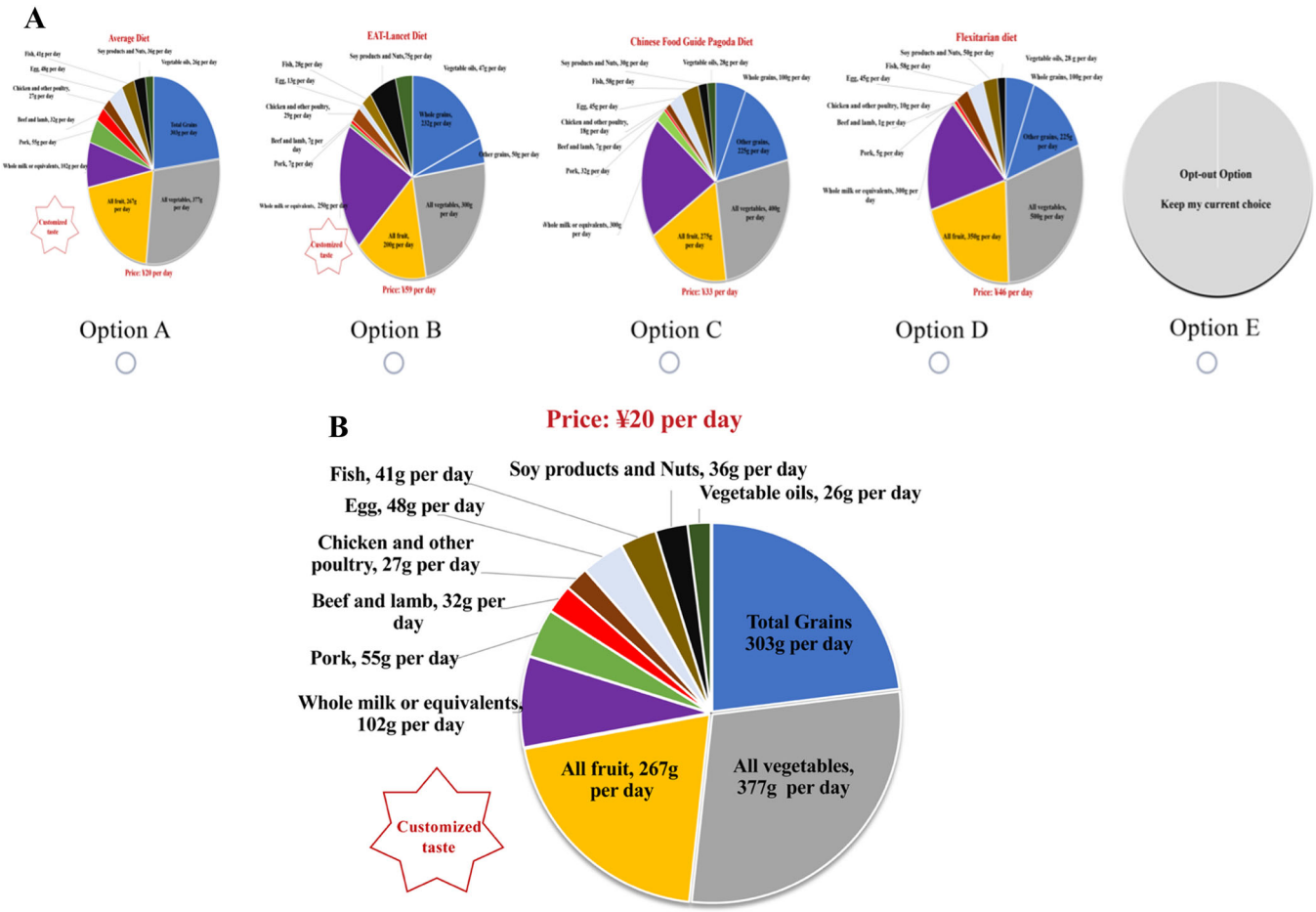

FIGURE 1 | (A) sample choice task. The order of choice questions and the order of options within a choice question were randomized. Each option can be enlarged. *Source:* Authors' own work. (B) The Average diet of urban residents in Beijing. The order of choice questions and the order of options within a choice question were randomized. Each option can be enlarged. To make sure respondents understand the meaning of the various pie charts, we first employ pilot testing. Second, to help respondents establish realistic quantities associated with food products, before the choice questions, they were asked to compare their actual diets with the average diet based on the National Bureau of Statistics (2020). We also provide examples to illustrate the quantity of each food product in a diet. For example, a tomato or a cucumber typically weighs 250 g, an apple weighs approximately 200 g, a pack of milk weighs about 250 g, and an egg weighs 50 g (Supporting Information S1: Appendix D details the comparisons and examples). *Source:* Authors' own work.

choice scenarios are visually presented to respondents as plates, like Figure 1A, while concealing the diet labels.

Product attributes are important dimensions that affect consumer choices (Lancaster 1966). Previous studies have consistently revealed the major driving forces leading to food choices (Kamphuis, De Bekker-Grob, and Van Lenthe 2015; Jaeger et al. 2021; Livingstone et al. 2021). In particular, food healthiness and nutrient content play a crucial role as individuals increasingly prioritize their well-being and seek out options that align with their dietary goals (Kamphuis, De Bekker-Grob, and Van Lenthe 2015). We use four quality-differentiated patterns of "product alternatives" to imply the healthiness of diets, including the Average diet, the Chinese Food Guide Pagoda diet, the EAT-Lancet diet, and the Flexitarian diet. Sensory appeal also influences consumers' perceptions of a particular food item. Consumers are more likely to select foods that they find palatable and enjoyable and avoid those that they find unpleasant or unappealing (Kamphuis, De Bekker-Grob, and Van Lenthe 2015; Livingstone et al. 2021). Therefore, we include diet taste as an attribute. Furthermore, price also impacts purchasing decisions. Research has shown that individuals often weigh the cost-effectiveness of a food item against its perceived value and quality (Bai, Herforth, and Masters 2022). Low-income consumers are unable to buy healthy diets even if they desire to do so. Therefore, the four diet alternatives are then offered at various cost levels. Table 2 presents the selected products and attribute levels employed in experimental design.

Specifically, the Average diet refers to the diet of an average resident in surveyed cities, where the consumption quantity of each food category is computed based on the at-home consumption level from the National Bureau of Statistics (2020), and adjusted with the proportion of consumption away from home (Sheng et al. 2021). The Chinese Food Guide Pagoda diet is the official dietary guideline in China published by the Chinese Nutrition Society in 2016. The EAT-Lancet diet and the Flexitarian diet are well-recognized healthy diets worldwide. The EAT-Lancet diet was proposed by the EAT-Lancet

TABLE 2 | Attributes and attribute levels used in experimental design.

Alternative specific constants
Average diet
Chinese Food Guide Pagoda diet
EAT-Lancet diet
Flexitarian diet
Taste level
Customized taste
Without Customized taste
Cost level (RMB per day per person)
20
33
46
59
72

Note: 1 RMB ≈ 0.15 Dollars at the time of this study (in 2021.09).
Source: Authors' own work.

Commission in 2019, which is the first diet proposed from a healthiness and environmental sustainability perspective (Willett et al. 2019). The Flexitarian diet suggests that people should eat less meat and more plant-based foods, reducing their total energy intake (Springmann et al. 2018). We construct the Flexitarian diet following Sheng et al. (2021) and Springmann et al. (2018). We note that healthy diets such as the EAT-Lancet diet may be controversial. For example, some questioned the usefulness of promoting this diet, as 3 billion people worldwide cannot afford the minimum cost of the EAT-Lancet diet (Herforth et al. 2020). However, we aim to explore how to revolutionize urban Chinese diets towards healthier ones, so it is important to adopt healthy diets that have been largely endorsed and promoted. Supporting Information S1: Appendix C reveals the types of foods and the corresponding quantities under each diet. Relative to the other three diets, the Average diet includes a higher quantity of animal products but lower amounts of milk and fruits. According to the Chinese Healthy Eating Index (Yuan et al. 2018), the Average diet is unhealthier than the other three diets.

Second, defining taste is challenging as it is subjective and varies based on personal preference. Taste perceptions vary among individuals, influenced by genetic factors, cultural backgrounds, ethnicities, personal preferences, and environmental factors (Bawajeeh et al. 2020). The inclusion of descriptive taste information is employed by food science communities and economists to address this problem (Livingstone et al. 2021). Drawing upon the literature, this study employs descriptive information to operationalize the taste attribute, which is set as a dummy variable (=1, if customized taste) in the experimental design. The concept of customized taste implies that individuals can select diet tastes according to their personal preferences.

Third, the cost of a diet is an important factor influencing healthy eating behaviors (Herforth et al. 2020; Laborde, Martin, and Vos 2021). Low-income consumers may not be able to afford healthy diets even if they desire to do so. The diet cost is initially set based on the minimum cost required for the Chinese Food Guide Pagoda diet and subsequently adjusts using actual food prices at the time when the study is implemented. Specifically, the paper utilizes Consumer Price Index (CPI) data published in the China Statistical Yearbook between 2017 and 2021 to adjust the minimum cost of diets following the report of Food and Agriculture Organization (Herforth et al. 2020) and Yin et al. (2023). The cost attribute has five levels ranging from 20 RMB to 72 RMB per day (roughly from 3.3 to 10.8 US dollars in 2021 September). Our findings show that 72% of respondents spend 10 RMB −70 RMB on their daily diet, meaning that the price levels we designed almost cover the range of reported daily diet expenditure.

We employ several strategies to improve the reliability of the responses in hypothetical choice scenarios and the overall quality of our survey data. First, we pilot-test our instrument to ensure respondents understood the meaning of the various diets (pie charts within the choice tasks). Second, to help respondents establish realistic quantities associated with food products, before the choice questions, they are asked to compare their actual diets with the average diet based on the National Bureau of Statistics (2020). We also provide examples to illustrate the quantity of each food product in the diets. For example, a tomato or a cucumber typically weighs 250 g, an apple weighs approximately 200 g, a pack of milk weighs about 250 g, and an egg weighs 50 g (Supporting Information S1: Appendix D details the comparisons and examples). Third, Supporting Information S1: Appendix E represents a preamble that consumers received before evaluating the decision task. We provide respondents with detailed descriptions of all attribute levels before the choice experiment, ensuring a base level of understanding across consumers with different backgrounds. In particular, we illustrate the examples of food groups once again to help respondents better understand the diet alternatives and improve data quality. Fourth, we employ a cheap-talk script (see Supporting Information S1: Appendix F) to mitigate potential hypothetical bias following Cummings and Taylor (1999). Fifth, we use two attention filter questions to screen out inattentive consumers and mitigate fraudulent responses in online surveys, referring to Kung, Kwok, and Brown (2017) and Goodrich et al. (2023). Sixth, the names of all diet options are excluded from the choice experiment to prevent consumers from making strategic choices by identifying dietary names. Given that many respondents make their choices on smartphones, the options are vertically arranged with the selection buttons placed at the end, requiring respondents to view all options before making a selection. Furthermore, we implement a minimum reading time, preventing choices from being made before thoroughly reviewing the options.

In addition to the choice tasks, we also include questions on demographics and food purchasing behavior, as well as the New Ecological Paradigm scale in the survey (NEP). Specifically, the NEP scale measures individuals' attitudes and cognition toward the environment, and ecology in fifteen questions (Dunlap et al. 2000). We also capture consumers' nutrition knowledge, using 12 questions that are adopted from the China Health and Nutrition Survey.

3 | Empirical Strategy

Based on Lancaster's theory of consumer demand (Lancaster 1966) and random utility theory (McFadden 1972), we use the Random Parameter Logit (RPL) model to estimate consumer preferences. The RPL model relaxes limitations in the multinomial logit model by allowing preferences to vary randomly within a sample according to a specified distribution (McFadden and Train 2000). The utility derived by individual i choosing alternative j under choice task t can be expressed as:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \tag{1}$$

where V_{ijt} is an observable deterministic utility depended on the experimentally designed product attributes for alternative j, and ε_{ijt} is the unobserved and random component of utility. In this study, we use RPL models with utilities specified in preference space to estimate consumers' healthy diet preferences. The consumer's utility can be specified as follows:

$$V_{ijt} = \alpha_p \mathrm{Price}_{ijt} + \beta_{i1}\mathrm{Dieta}_{ijt} + \beta_{i2}Dietb_{ijt} + \beta_{i3}Dietc_{ijt} + \beta_{i4}Dietd_{ijt} + \gamma_{it}\mathrm{Taste}_{ijt} + \mathrm{ASC}_{opt-out}\ \#\# \tag{2}$$

where Price_{ijt} is a continuous variable populated with five levels in the experimental design. Dieta_{ijt}, Dietb_{ijt}, Dietc_{ijt}, and Dietd_{ijt} are dummy variables denoting the Average diet, the Chinese Food Guide Pagoda diet, the EAT-Lancet diet, and the Flexitarian diet, respectively. They all take a value of 1 when the product carries such an attribute, and 0 otherwise. Taste_{ijt} represents whether the diet has a customized taste or not (1 if yes, otherwise 0). The constant for the no-purchase alternative $\mathrm{ASC}_{opt-out}$ (opt-out option) is set to ZERO. Given our use of a labeled design for our choice experiment, setting this option as the reference group is common in the literature, including Lusk and Tonsor (2016), Ortega, Sun and Lin (2022) and Kang et al. (2024). ε_{njt} is the unobserved error term, which follows a Gumbel (extreme value type I) distribution. α_p governs the coefficient of diet cost, γ_t is the estimated coefficient of customized taste, and β_j means the alternative-specific constant indicating utility for alternative j relative to the opt-out option utility. We use NLOGIT 6.0 software (Econometric Software; www.limdep.com) to estimate the RPL.

For comparison purposes across treatments, we report the individual-specific Willingness to pay (WTP) values for each healthy diet in different information treatments. Hensher and Greene (2003) suggested that the distributions from which random parameters were drawn should be constrained to derive behaviorally meaningful values. We specify the non-price attributes to follow normal distributions. The price coefficient is specified to follow a constrained triangular distribution following previous studies (like Ortega, Sun, and Lin 2022). In testing the five hypotheses, this study employs the following model to explore the heterogeneous impacts of different information framing on healthy diet selections:

$$\mathrm{WTP}_{ij} = \delta_1\mathrm{Treat}_{1ij} + \delta_2\mathrm{Treat}_{2ij} + \delta_3\mathrm{Treat}_{3ij} + \delta_4\mathrm{Treat}_{4ij} + \delta_5\mathrm{Treat}_{5ij} + \delta_6\mathbf{X_{ij}} + \varepsilon_{ij} \tag{3}$$

where WTP_{ij} is the individual-specific conditional WTP for each diet j of respondent i. $\mathrm{Treat}_1 - \mathrm{Treat}_5$ are dummy variables denoting treatments of positive information, negative information, information from scientific association, information from celebrity and information presented in social media (WeChat Official Accounts), respectively. To elucidate, when a respondent was subjected to Group 2, Treat_1 takes a value of 1, and Treat_2, Treat_3, $\mathrm{Treat}_4$and Treat_5 are assigned 0. For Group 4, both Treat_1 and Treat_3 are 1, with the remainder treatment at 0. For Group 5, Treat_2 and Treat_3 take a value of 1, and 0 for $Treat_1$, $Treat_4$and $Treat_5$. For Group 6, Treat_1, Treat_3 and Treat_5 take a value of 1. For Group 7, Treat_2, Treat_3 and Treat_5 take a value of 1. For Group 8, Treat_1, Treat_4 and Treat_5 take a value of 1. For Group 9, Treat_2, Treat_4 and Treat_5take a value of 1. For each treatment variable, we set the value to 1 for the relevant groups and 0 otherwise, with Group 1 serving as the reference group where all treatment variables are set to 0.

We assess the effectiveness of each information treatment by analyzing changes in WTP. if the information works, we would expect the WTP for healthy diet to be increased; with those most effective information treatment, we expect the WTP for healthy diets to be increased by the largest degree. This approach aligns with existing literature (Lin et al. 2022; Wensing et al. 2020; Kang et al. 2024). Therefore, δ_1 and δ_2 reflects the intervention effectiveness of positive information and negative information on Chinese consumers' WTP for healthy diets, respectively. Therefore, we expect the coefficient δ_2 to be larger than coefficient $\delta_1$if H_1 holds. Similarly, we test H_2 by comparing the coefficient δ_3 and δ_4. δ_3 and δ_4 indicate the intervention effectiveness of information with different sources, where δ_3 represents the information from scientific association and δ_4 represents the information from a celebrity. If $\delta_3 < \delta_4$, we expected that individuals are more inclined to be influenced by the information from a celebrity than a scientific association. δ_5 reflects the intervention effectiveness of health information presented in social media, compared with that presented without social media. We test whether the coefficient δ_5 is negative and significantly different from zero, to verify H_3. We add the interaction terms between income and information treatment dummies in equation (3) to test H_4.

In addition, a number of individuals', households', communities', and environmental factors can affect consumers' food choices (Stok et al. 2017). Consumer characteristics such as gender, age, income, food-related knowledge, and ethical concerns are significant influencers (Blaylock et al. 1999). Similarly, family structure, social dietary culture, food environment, and food-related policies also play important roles in consumers' choices (Young et al. 2020; Qi and Ploeger 2021). Therefore, we include other control variables. Vector $\boldsymbol{X_n}$ includes age, gender, income, education level, religious belief, nutrition scores, NEP scores, chronic disease, family structure, food purchasing behaviors, and city dummies.

4 | Data

Our survey is conducted in August 2021 by an online professional survey company (https://www.lediaocha.com/). Respondents are invited to participate in the survey anonymously. We issue informed consent to all consumers, and the questionnaire would continue only if the participant agrees with the informed consent, otherwise, it would automatically end. All consumers could refuse to participate in the investigation and stop filling out the survey at any time. Informed consent is obtained from all individual consumers included in the study, and we do not collect personally identifiable information. We also obatined the ethics approval from the university before our data collection (no. ZGL202108-1).

To participate in our study, consumers must have been 18 years old and be the primary food-purchasing person in their households. A total of 3150 consumers from 6 big cities geographically widespread in China are collected namely Beijing, Shanghai, Shenyang, Wuhan, Chengdu, and Guangzhou. To ensure our sample is randomly assigned to each group, we conduct a Chi-square test to examine variations in demographic characteristics and food-purchasing behavior across groups. Our findings, as detailed in Supporting Information S1: Appendix G and H, indicate there are no significant differences between the control group and the treatment groups.

As shown in Supporting Information S1: Appendix G, the average respondent is 38 years old, similar to the median age in China (The Population Division of United Nations Department of Economic and Social Affairs 2022). 50% of the sample is female. The respondents are generally highly educated and about 82% of them has received some type of college education. Our online sample tends to be slightly wealthier and more educated than the population in surveyed cities, although the average years of education of the population aged 15 and above in surveyed cities have reached 12 years. The average nutritional knowledge score of respondents is 8.43 out of 12 (higher scores indicate more knowledge), which is consistent with the findings based on CHNS (Yu et al. 2020). The finding indicates that respondents are slightly knowledgeable about nutrition. According to the NEP scale, respondents' environmental concern score is 3.6 on a scale from 1 to 5 (higher scores indicate more concern), similar to the findings from other China-specific studies (Hawcroft and Milfont 2010). Respondents' households have, on average, 2.6 adult members and 0.8 children. The average monthly household income is between RMB 17,000−RMB 22,999 (equivalent to USD 2550−3450).

Supporting Information S1: Appendix H reports respondents and their households' food shopping behavior. We found that more than 50% of households purchase groceries 2−5 times a week, and the weekly food purchase expenditure is between RMB 400 and RMB 549. About half of the families order food delivery more than 2−5 times a week, with the weekly expenditure from RMB 100 to RMB 250. The weekly food expense away from home of most families is between RMB 100 and RMB 249. The average expenditure of individuals' daily diet is between RMB 50 and RMB 70.

5 | Empirical Results

This section first briefly shows the estimation results of the determinants influencing Chinese urban consumers' diet selections. Then, we focus on the empirical results related to Hypotheses 1−3. Lastly, we assess Hypothesis 4 concerning the diverse reactions among income subgroups to healthy information treatments.

5.1 | Factors Influencing Chinese Urban Consumers' Diet Selections

RPL models are estimated using Nlogit 6.0 (see Supporting Information S1: Appendix I for results). The result suggests that in each of the nine groups, the three product attributes significantly affect consumers' diet selections, with expected signs in all coefficients. The estimated coefficients of the diet-specific constants indicate that consumers are more inclined to choose healthier diets than to keep their current diets. The significant and positive sign of the taste attribute coefficient indicates that sensory appeal is an important factor for urban Chinese consumers' diet choices. The price coefficient is negative and statistically significant, which suggests that when other conditions remain constant, consumer utility decreases as the price increases. Table 3 reports the estimated unconditional means WTP values with 95% confidence interval. The results demonstrate that, on average, urban Chinese consumers in the control group would prefer to spend approximately RMB45, RMB47, RMB39, and RMB47, for the Average diet, the Chinese Food Guide Pagoda diet, the EAT-Lancet diet, and the Flexitarian diet per day, respectively.

5.2 | Average Effects of Different Information Framings

Table 4 presents the effects of different information framings on urban Chinese consumers' diet selections (Please see Supporting Information S1: Appendix J for detailed results). Our findings show that urban Chinese respondents are more responsive to negative information, meaning that consumers are sensitive to health threats; H_1 is supported. The result is in line with the findings of Roosen et al. (2009), Machín et al. (2019), Rosenblatt et al. (2019), Silva, Bento and Guaraldo (2022) and Guan, Lin and Jin (2024), showing that people are more responsive to messages communicating health risks than health benefits when they were selecting between two fish species. This result is also consistent with conclusions from the studies focusing on food safety. Those studies show that negative message about the potential risk associated with consuming certain food products leads to more significant demand reduction (Smith, Van Ravenswaay, and Thompson 1988; Schlenker and Villas-Boas 2009). This links with the endowment effect (Kahneman, Knetsch, and Thaler1990) documenting that economic agents attach a higher value to potential losses than potential gains.

Providing information without sources does not significantly increase consumers' WTP for healthy diets and even reduces consumers' WTPs for the EAT-Lancet diet and Chinese Food

TABLE 3 | Simulated unconditional willingness to pay across treatments.

		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
Average diet	Mean	45.024	47.748	56.888	81.542	211.519	16.168	64.944	40.195	101.661
	95% CI	[36.918, 53.129]	[45.782, 49.714]	[50.359, 63.417]	[75.455, 87.629]	[194.061, 228.978]	[12.197, 20.140]	[59.609, 70.278]	[34.011, 46.379]	[91.837, 111.485]
Chinese Food Guide Pagoda diet	Mean	47.229	41.571	39.882	57.112	218.325	11.455	58.739	30.72	87.909
	95% CI	[44.786, 49.672]	[39.473, 43.669]	[37.205, 42.127]	[53.697, 60.527]	[207.278, 229.371]	[10.871, 12.038]	[55.731, 61.747]	[27.652, 33.788]	[83.456, 92.363]
EAT-Lancet diet	Mean	39.396	36.747	33.581	51.224	206.839	6.076	50.753	14.86	80.235
	95% CI	[35.650, 43.141]	[34.130, 39.363]	[30.689, 36.473]	[47.394, 55.054]	[194.159, 219.519]	[4.870, 7.283]	[47.065, 54.441]	[11.566, 18.154]	[75.349, 85.121]
Flexitarian diet	Mean	46.552	45.036	45.264	67.289	224.91	11.382	69.617	32.864	96.532
	95% CI	[31.778, 61.326]	[34.491, 55.581]	[34.277, 56.251]	[48.977, 85.600]	[173.078, 276.742]	[5.952, 16.812]	[56.007, 83.226]	[21.060, 44.669]	[69.767, 123.297]
Taste	Mean	15.308	12.251	9.588	17.408	11.723	6.078	6.223	15.945	15.95
	95% CI	[12.666, 17.951]	[11.533, 12.969]	[7.564, 11.612]	[13.500, 21.316]	[10.526, 12.920]	[5.777, 6.378]	[5.680, 6.766]	[13.730, 18.160]	[13.685, 18.215]

Source: Author's estimation using online survey data.

TABLE 4 | Estimated effects of information on consumers' WTP for healthy diet.

Y = WTP	Average diet	Chinese food guide pagoda diet	EAT-Lancet diet	Flexitarian diet
Positive information	−25.566***	−45.966***	−40.924***	−32.617***
	(6.882)	(2.865)	(2.594)	(3.632)
Negative information	48.627***	32.105***	34.313***	41.256***
	(6.880)	(2.864)	(2.593)	(3.630)
Information from Scientific association	104.460***	114.627***	102.920***	97.857***
	(5.410)	(2.252)	(2.039)	(2.855)
Information from Celebrity	137.641***	145.145***	123.727***	116.217***
	(7.653)	(3.186)	(2.885)	(4.038)
Information presenting in social media	−120.072***	−122.884***	−111.329***	−103.286***
	(5.409)	(2.252)	(2.039)	(2.854)
Other variables	Yes	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes	Yes
Observations	3150	3150	3150	3150
Adjusted R^2	0.274	0.672	0.682	0.503

Source: Author's estimation using online survey data.
Note: Numbers in parentheses are standard errors. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Guide Pagoda diet (please see Table 3). However, when the information is marked with certain sources, whether scientific source or celebrity source, consumers' WTP for each diet significantly increase by RMB 100 (please see Table 4). Specifically, respondents' WTPs for the Chinese Food Guide Pagoda diet increase the most, followed by the Average diet, the EAT-Lancet diet, and the Flexitarian diet. Possible reasons may be that the Chinese Food Guide Pagoda diet is more realistic as it accords with the dietary habits and food availability in China. The significant valuation found in the information interventions could be attributed to that public trust in scientific experts to assure food safety and quality is strong, and expert labels play an important role in special food selections. Also, studies in the field of marketing suggested that celebrity endorsements can help increase consumer preference for healthy foods or healthy brands (Dutta and Singh 2013; Phua, Jin, and Kim 2019). Between the two information sources, consumers are more likely to adopt the suggestion from a celebrity, although the information received is identical. Based on this result we reject H_2, implying that celebrities are more influential on individual behaviors than scientific institutions.

Results also indicate consumer valuation for healthy diets significantly decreases when the information is presented via WeChat. As seen in Table 4, Chinese respondents' WTP for all diets significantly decrease. Compared to other diets, consumers are less willing to pay for the Chinese Food Guide Pagoda diet when they are intervened by the information presented via social media; this result supports H_3. A possible reason is that consumers are presented with hundreds, if not thousands, of options and pieces of healthy information via social media. Information overload prevents them from making rational decisions (Milgram 1970). Additionally, "actors" in social media are often selling their "healthy products" under the pretext of popularizing healthy dietary knowledge, especially on WeChat Official Accounts. As the main advertising-commercial platform of the most popular social media in China, there are a variety of forms of advertisements full in the WeChat Official Accounts. Therefore, consumers' trust in information presented on social media may be discounted and their WTP for these healthy diets may decrease.

5.3 | Heterogenous Effects of Information Framing

The result of the descriptive statistics shows that there is a significant gap in daily diet expenditure among different income groups. 20% of the respondents with low income spent less than RMB 30, while about 17% of respondents with high income spent more than RMB 100 on a daily diet. Given the importance of economic status on food choices (Drewnowski and Specter 2004; Kamphuis, De Bekker-Grob, and Van Lenthe 2015; Herforth et al. 2020), we explore whether people with different income levels respond differentially to health information treatments. We added the interaction terms between income and three information treatments (including negative information, information from scientific association, and information from celebrity significantly) to equation (3) for testing H_5. More specifically, respondents are divided into high- and low-income subgroups based on the median income, and the variable income equals 1 if an individual belongs to the high-income group.

Supporting Information S1: Appendix K presents the results of the different income groups. Without any information, consumers with high income are significantly inclined to choose healthy diets, while consumers with low income were

significantly inclined to choose the Average diet. In addition, the coefficients of interaction terms between income and information treatments indicate that the effectiveness of information treatments decreases with increasing income, regardless of information content, source, and platform. Such heterogeneity results suggest that it is more effective to implement information interventions for low-income consumers than for their high-income counterparts.

6 | Discussion and Conclusion

Researchers have long explored the role of information provision as a behavioral policy tool to promote healthy dietary behaviors, affecting individual food decision-making (Roosen et al. 2009; Guillaumie, Godin, and Vezina-Im 2010; Guan, Lin, and Jin 2024). However, most existing studies focus on a specific healthy food product or particular nutrients. Different from prior work, this study focuses on a diet composed of a comprehensive set of food products, providing a more accurate indicator of dietary quality and a better predictor of diet-related disease risks (De Ridder et al. 2017). Furthermore, comparison on the effectiveness of different information provision holds significant implications for the design and implementation of public health policies. This study contributes to the literature by evaluating the effectiveness of different health information frames in promoting healthy diets among urban Chinese consumers. Unlike previous studies, we consider variations in information content, source, and presentation, offering a nuanced understanding of how these factors influence dietary choices. This research not only broadens the scope of dietary studies by incorporating a comprehensive set of food products but also offers practical insights for policymakers aiming to encourage healthier eating habits through informed decision-making.

Our findings demonstrate that negatively framed health information is more effective at increasing individual valuation of a healthy diet, relative to positive information. This indicates that health risks, rather than health benefits, tend to receive more attention from consumers, consistent with the work of O'Keefe and Jensen (2008), Machín et al. (2019), Rosenblatt et al. (2019), Silva, Bento and Guaraldo (2022) and Guan, Lin and Jin (2024). This highlights the importance of understanding the psychological mechanisms that drive consumers' attention and decision-making processes (Aguirre-Rodriguez and Torres 2023). Therefore, utilizing a negative framing approach in public health information campaigns could resonate more profoundly with the audience, creating a stronger sense of urgency. This, in turn, increases the likelihood of adopting healthier eating behaviors.

In addition, consumers are more receptive to the information suggested by celebrities than by scientists. This finding is supported by Friedman et al. (2022), who emphasized the significant role of social media and peer support in shaping young adults' health behaviors. Although consumers' WTP significantly increases when the information is noted from a scientific source, this source is not always the preferred choice for food-related suggestions. Scientific information often appears complex or less engaging, which may diminish its immediate impact relative to the more accessible and relatable nature of celebrity endorsements. Celebrities, on the other hand, establish a personal connection with their audience, fostering a sense of relatability and trust that may not be as strong with scientific figures (Trivedi 2018). The influence of celebrities from their visibility and the emotional connection they foster with their followers, which can enhance the perceived credibility of their endorsements. As part of marketing communications strategy, using celebrities is a fairly common practice for major firms in supporting sales or brand imagery. In fact, China has taken some actions with celebrity endorsement to guide people to choose a healthy diet. For example, the Chinese Nutrition Society has recruited well-known stars to popularize the Chinese Dietary Guidelines 2022 and nutrition knowledge. Nevertheless, it is important for policy-makers to carefully consider the choice of a celebrity ambassador, as a poorly chosen celebrity can have negative consequences.

Regarding informational presentations or channels, our results suggest that the information's effectiveness is greatly reduced if the information is disclosed via social media. The reason may be that the internet social media has no filters on the quality or accuracy of health information. Regardless of credentials or expertize, anyone can communicate nutrition information online, putting consumers at risk of receiving unreliable or even harmful suggestions. What's worse, unhelpful food product advertisements often clutter scientific healthy information. This makes the public less trusting of information guiding diet selections delivered via social media. However, it is important to note that online social media is playing an increasingly important role in exchanging health information. There are 4.62 billion social media users around the world in January 2022, representing an increase of over 10% compared to the preceding 12 months.[3] Thus, it is important to regulate and eliminate health rumors and false advertisements on social media. At the same time, the government could create credible social accounts to disseminate scientific dietary information.

Furthermore, our finding of the heterogeneous effects has implications for public policymakers to get a better understanding of the efficacy of information intervention. Consumers with high income are significantly inclined to choose healthy diets without any information, while consumers with low income were significantly inclined to choose the unhealthy diet. The result is consistent with previous studies that people with high socioeconomic status are more likely to eat a healthy diet, compared with those of lower socioeconomic status (Drewnowski and Specter 2004; Kamphuis, De Bekker-Grob, and Van Lenthe 2015). High socioeconomic groups may find long-term behavioral consequences (e.g., health effects) to be more important. In addition, our heterogeneous results targeting different income groups show that information interventions are more effective on lower socioeconomic status individuals. People with low income have more potential for improvements in healthy diet selections, while individuals with high economic status have already placed focus on healthy diets before health information interventions. Furthermore, our results suggest diet selections can be influenced by diet costs, which may be a barrier to dietary improvement, especially among low-income respondents. These findings inform

policymakers to offer subsidies or other support for nutritious foods at lower prices to poor families.

Our analysis of the control group data reveals that consumers tend to dislike meatless diets, such as the EAT-Lancet and Flexitarian diets. Although our choice experiment primarily provides information focusing on the health impacts of diet, we also recognize the potential environmental benefits of healthier diets, particularly those involving reduced meat consumption. However, Guo et al. (2022) highlight a potential caveat: while reducing meat intake can lower CDG emissions, this benefit might be counterbalanced by higher emissions from increased consumption of fruits, vegetables, and dairy products. The production and consumption of these items present a complex interplay of effects on both human well-being and environmental sustainability. Therefore, it is crucial to carefully consider the environmental and health trade-offs when contemplating potential dietary shifts in China. This suggests that additional efforts are needed to develop diets that can achieve both sustainability and health objectives concurrently.

Finally, this study also has several limitations. First, our finding is based on a geographically diverse sample, however, the sample may not be fully representative of the entire Chinese population. The online consumer panel primarily composed of younger, wealthier, and more educated consumers, although this demographic is becoming the main decision-makers in households. The effectiveness of information may vary across different cultural contexts and individual characteristics (Shepherd et al. 2012). Future research could explore how cultural differences and personal health motivations interact with the framing of health information to influence dietary choices and behaviors. Second, we define the taste attribute based on descriptive information and the amount of certain flavor enhancers, to mitigate their impact on taste perception. However, we do not control other ingredients like sugar and salt, making it difficult to compare taste preferences and diet patterns accurately. Third, the potential for information overload due to the design of choice sets is a limitation. Although we aim to provide a broad range of choices, this complexity may have affected the decision-making process. Future research should consider simplifying the choice sets to enhance clarity and ease of decision-making. In addition, while we employ various strategies to ensure response quality in stated preference surveys, the method of stated preference experiments simulating real shopping scenarios may induce consumers to overestimate their WTP and the possibility of hypothetical bias. Therefore, verifying our findings through real experiments or revealed preference data will be a potential research topic.

Author Contributions

Kevin Chen: conceptualization; funding acquisition; project administration; writing–review and editing; supervision; resources; writing–original draft. **Luyun Yu:** writing–original draft; methodology; validation; visualization; writing–review and editing; formal analysis; investigation. **Wen Lin:** conceptualization; writing–original draft; methodology; writing–review and editing; formal analysis; investigation. **David L. Ortega:** writing–review and editing; conceptualization.

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Ethics Statement

This study has been reviewed and approved by the Institutional Review Board of Zhejiang Univeristy (no. ZGL202005-1).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

[1] Data source: https://www.tencent.com/zh-cn/investors.html. Search time:2023.03.14.

[2] Following De Bekker-Grob et al. (2015), we calculated the minimum sample size requirements based on the statistical power of hypothesis tests on the estimated coefficients. A minimum of 264 respondents is needed to achieve a statistical power of 0.8 and an $\alpha = 0.10$. Furthermore, several studies have reached effective conclusions based on sample sizes smaller than 300 respondents in the choice experiment of healthcare and food choice (e.g., De Bekker-Grob et al. [2015]; Livingstone et al. [2021]). Therefore, obtaining a sample size of 350 for each group will ensure robust estimations.

[3] Source: https://wearesocial.com/uk/blog/2022/01/digital-2022-another-year-of-bumper-growth-2/

References

Afshin, A., P. J. Sur, and G. Ferrara, et al. 2019. "Health Effects of Dietary Risks in 195 Countries, 1990–2017: A Systematic Analysis for the Global Burden of Disease Study 2017." *The Lancet (British Edition)* 393, no. 10184: 1958–1972. https://doi.org/10.1016/S0140-6736(19)30041-8.

Aguirre-Rodriguez, A., and P. Torres. 2023. "The Roles of Trait Prudence and Desire in Consumer Self-Control for Temptations." *Journal of Consumer Marketing* 40, no. 3: 380–391. https://doi.org/10.1108/JCM-12-2019-3537.

Bai, Y., A. Herforth, and W. A. Masters. 2022. "Global Variation in the Cost of a Nutrient-Adequate Diet by Population Group: An Observational Study." *The Lancet Planetary Health* 6, no. 1: e19–e28. https://doi.org/10.1016/S2542-5196(21)00285-0.

Bawajeeh, A. O., S. A. Albar, H. Zhang, M. A. Zulyniak, C. E. L. Evans, and J. E. Cade. 2020. "Impact of Taste on Food Choices in Adolescence—Systematic Review and Meta-Analysis." *Nutrients* 12: Article 1985. https://doi.org/10.3390/nu12071985.

De Bekker-Grob, E. W., B. Donkers, M. F. Jonker, and E. A. Stolk. 2015. "Sample Size Requirements for Discrete-Choice Experiments in Healthcare: A Practical Guide." *The Patient - Patient-Centered Outcomes Research* 8, no. 5: 373–384. https://doi.org/10.1007/s40271-015-0118-z.

Blaylock, J., D. Smallwood, K. Kassel, J. Variyam, and L. Aldrich. 1999. "Economics, Food Choices, and Nutrition." *Food Policy* 24, no. 2–3: 269–286. https://doi.org/10.1016/S0306-9192(99)00029-9.

Burton, M. 2001. "Consumer Attitudes to Genetically Modified Organisms in Food in the Uk." *European Review of Agriculture Economics* 28, no. 4: 479–498. https://doi.org/10.1093/erae/28.4.479.

Van Cauwenberghe, E., L. Maes, H. Spittaels, et al. 2010. "Effectiveness of School-Based Interventions in Europe to Promote Healthy Nutrition in Children and Adolescents: Systematic Review of Published and 'Grey' Literature." *British Journal of Nutrition* 103, no. 6: 781–797. https://doi.org/10.1017/S0007114509993370.

Coelho do Vale, R., R. Pieters, and M. Zeelenberg. 2008. "Flying Under the Radar: Perverse Package Size Effects on Consumption Self-Regulation." *Journal of Consumer Research* 35, no. 3: 380–390. https://doi.org/10.1086/589564.

Cowburn, G., and L. Stockley. 2005. "Consumer Understanding and Use of Nutrition Labelling: A Systematic Review." *Public Health Nutrition* 8, no. 1: 21–28. https://doi.org/10.1079/phn2005666.

Cui, H. J., K. S. Fam, and T. Y. Zhao. 2019. "Regulatory Focus and Message Framing's Effects on Intention to Consume Ethnic Food in China." *British Food Journal* 122, no. 6: 1969–1982. https://doi.org/10.1108/BFJ-09-2018-0637.

Cummings, R. G., and L. O. Taylor. 1999. "Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method." *American Economic Review* 89, no. 3: 649–665. https://doi.org/10.1257/aer.89.3.649.

Dolgopolova, I., B. Li, H. Pirhonen, and J. Roosen. 2022. "The Effect of Attribute Framing on Consumers' Attitudes and Intentions Toward Food: A Meta-Analysis." *Bio-Based and Applied Economics* 10, no. 4: 253–264. https://doi.org/10.36253/bae-11511.

Drewnowski, A., and S. Specter. 2004. "Poverty and Obesity: The Role of Energy Density and Energy Costs." *The American Journal of Clinical Nutrition* 79, no. 1: 6–16. https://doi.org/10.1093/ajcn/79.1.6.

Dunlap, R. E., K. D. Van Liere, A. G. Mertig, and R. E. Jones. 2000. "New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale." *Journal of Social Issues* 56, no. 3: 425–442. https://doi.org/10.1111/0022-4537.00176.

Dutta, K., and S. Singh. 2013. "Healthy Food Behavior and Celebrity Endorsement for Healthy Food Brands: A Study of Indian Housewives." *IUP Journal of Brand Management* 10, no. 3: 33–46. https://www.questia.com/library/journal/1P3-3150244021/healthy-food-behavior-and-celebrity-endorsement-for.

Finkelstein, S. R., and A. Fishbach. 2010. "When Healthy Food Makes You Hungry." *Journal of Consumer Research* 37, no. 3: 357–367. https://doi.org/10.1086/652248.

Friedman, V. J., C. J. C. Wright, A. Molenaar, T. McCaffrey, L. Brennan, and M. S. C. Lim. 2022. "The Use of Social Media as a Persuasive Platform to Facilitate Nutrition and Health Behavior Change in Young Adults: Web-Based Conversation Study." *Journal of Medical Internet Research* 24, no. 5: e28063. https://doi.org/10.2196/28063.

Goodrich, B., M. Fenton, J. Penn, J. Bovay, and T. Mountain. 2023. "Battling Bots: Experiences and Strategies to Mitigate Fraudulent Responses in Online Surveys." *Applied Economic Perspectives and Policy* 45, no. 2: 762–784. https://doi.org/10.1002/aepp.13353.

Guan, L., W. Lin, and S. Jin. 2024. "Effectiveness of Front-of-Pack Nutritional Labels: Evidence From Sugar-Sweetened Beverages in China." *Applied Economics* 1–15. https://doi.org/10.1080/00036846.2024.2364923.

Guillaumie, L., G. Godin, and L. A. Vezina-Im. 2010. "Psychosocial Determinants of Fruit and Vegetable Intake in Adult Population: A Systematic Review." *International Journal of Behavioral Nutrition and Physical Activity* 7, no. 1: Article 12. https://doi.org/10.1186/1479-5868-7-12.

Guo, Y., P. He, T. D. Searchinger, et al. 2022. "Environmental and Human Health Trade-Offs in Potential Chinese Dietary Shifts." *One Earth* 5: 268–282. https://doi.org/10.1016/j.oneear.2022.02.002.

Hawcroft, L. J., and T. L. Milfont. 2010. "The Use (And Abuse) of the New Environmental Paradigm Scale Over the Last 30 Years: A Meta-Analysis." *Journal of Environmental Psychology* 30, no. 2: 143–158. https://doi.org/10.1016/j.jenvp.2009.10.003.

Hensher, D. A. 2010. "Hypothetical Bias, Choice Experiments and Willingness to Pay." *Transportation Research Part B: Methodological* 44, no. 6: 735–752. https://doi.org/10.1016/j.trb.2009.12.012.

Hensher, D. A., and W. H. Greene. 2003. "The Mixed Logit Model: The State of Practice and Warnings for the Unwary." *Transportation* 30: 133–176. https://doi.org/10.1023/A:1022558715350.

Herforth, A., Y. Bai, A Venkat, K. Mahrt, A Ebel, and W. A. Masters. 2020. "Cost and Affordability of Healthy Diets Across and Within Countries: Background Paper for The State of Food Security and Nutrition in the World." In *FAO Agricultural Development Economics Technical Study*. Rome: Food & Agriculture Organization. https://openknowledge.fao.org/handle/20.500.14283/cb2431en.

Hilverda, F., M. Kuttschreuter, and E. Giebels. 2017. "Social Media Mediated Interaction With Peers, Experts and Anonymous Authors: Conversation Partner and Message Framing Effects on Risk Perception and Sense-Making of Organic Food." *Food Quality and Preference* 56: 107–118. https://doi.org/10.1016/j.foodqual.2016.09.003.

Jaeger, S. R., C. M. Roigard, D. C. Hunter, and T. Worch. 2021. "Importance of Food Choice Motives Vary With Degree of Food Neophobia." *Appetite* 159: 105056. https://doi.org/10.1016/j.appet.2020.105056.

Jiang, Q., J. Penn, and W. Hu. 2022. "Real Payment Priming to Reduce Potential Hypothetical Bias." *Journal of Choice Modelling* 45: 100383. https://doi.org/10.1016/j.jocm.2022.100383.

Kahneman, D., J. L. Knetsch, and R. H. Thaler. 1990. "Experimental Tests of the Endowment Effect and the COASE Theorem." *Journal of Political Economy* 98, no. 6: 1325–1348. https://doi.org/10.1086/261737.

Kahneman, D., and A. Tversky. 1979. "Prospect Theory: An Analysis of Decision Under Risk." *Econometrica* 47, no. 2: 263–292. https://doi.org/10.2307/1914185.

Kamphuis, C. B., E. W. De Bekker-Grob, and F. J. Van Lenthe. 2015. "Factors Affecting Food Choices of Older Adults From High and Low Socioeconomic Groups: A Discrete Choice Experiment." *The American Journal of Clinical Nutrition* 101, no. 4: 768–774. https://doi.org/10.3945/ajcn.114.096776.

Kang, Q., C. E. Carpio, M. Garcia, C. Wang, T. Boonsaeng, and D. Hudson. 2024. "Chinese Consumers' Preferences for Imported Beef Products." *Agribusiness* 1–24. https://doi.org/10.1002/agr.21968.

Kariuki, S. W., and V. Hoffmann. 2021. "Can Information Drive Demand for Safer Food? Impact of Brand-Specific Recommendations and Test Results on Product Choice." *Agricultural Economics* 53, no. 3: 454–467. https://doi.org/10.1111/agec.12685.

Kung, F. Y. H., N. Kwok, and D. J. Brown. 2017. "Are Attention Check Questions a Threat to Scale Validity?" *Applied Psychology* 67, no. 2: 264–283. https://doi.org/10.1111/apps.12108.

Laborde, D., W. Martin, and R. Vos. 2021. "Impacts of COVID-19 on Global Poverty, Food Security, and Diets: Insights From Global Model Scenario Analysis." *Agricultural Economics* 52, no. 3: 375–390. https://doi.org/10.1111/agec.12624.

Lancaster, K. J. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74, no. 2: 132–157. https://doi.org/10.1086/259131.

Lee, J. Y., M. P. Popp, E. J. Wolfe, et al. 2018. "Information and Order of Information Effects on Consumers' Acceptance and Valuation for Genetically Modified Edamame Soybean." *PLoS One* 13, no. 10: e0206300. https://doi.org/10.1371/journal.pone.0206300.

Levin, I. P., and G. J. Gaeth. 1988. "How Consumers Are Affected by the Framing of Attribute Information Before and After Consuming the Product." *Journal of Consumer Research* 15, no. 3: 374–378. https://doi.org/10.1086/209174.

Ley, S. H., O. Hamdy, V. Mohan, and F. B. Hu. 2014. "Prevention and Management of Type 2 Diabetes: Dietary Components and Nutritional Strategies." *The Lancet* 383, no. 9933: 1999–2007. https://doi.org/10.1016/S0140-6736(14)60613-9.

Lin, W., D. L. Ortega, D. Ufer, V. Caputo, and T. Awokuse. 2022. "Blockchain-Based Traceability and Demand for Us Beef in China." *Applied Economic Perspectives and Policy* 44, no. 1: 253–272. https://doi.org/10.1002/aepp.13135.

Livingstone, K. M., G. Abbott, K. E. Lamb, K. Dullaghan, T. Worsley, and S. A. McNaughton. 2021. "Understanding Meal Choices in Young Adults and Interactions With Demographics, Diet Quality, and Health Behaviors: A Discrete Choice Experiment." *The Journal of Nutrition* 151, no. 8: 2361–2371. https://doi.org/10.1093/jn/nxab106.

Loureiro, M. L., and W. J. Umberger. 2007. "A Choice Experiment Model for Beef: What Us Consumer Responses Tell Us About Relative Preferences for Food Safety, Country-Of-Origin Labeling and Traceability." *Food Policy* 32, no. 4: 496–514. https://doi.org/10.1016/j.foodpol.2006.11.006.

Lusk, J. L. 2004. "Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food: Evidence From Experimental Auctions in the United States, England, and France." *European Review of Agriculture Economics* 31, no. 2: 179–204. https://doi.org/10.1093/erae/31.2.179.

Lusk, J. L., and G. T. Tonsor. 2016. "How Meat Demand Elasticities Vary With Price, Income, and Product Category." *Applied Economic Perspectives and Policy* 38, no. 4: 673–711. https://doi.org/10.1093/aepp/ppv050.

Machín, L., M. R. Curutchet, A. Giménez, J. Aschemann-Witzel, and G. Ares. 2019. "Do Nutritional Warnings Do Their Work? Results From a Choice Experiment Involving Snack Products." *Food Quality and Preference* 77: 159–165. https://doi.org/10.1016/j.foodqual.2019.05.012.

McFadden, D. 1972. "Conditional Logit Analysis of Qualitative Choice Behavior." *Frontiers in Econometrics* 105–142. https://ci.nii.ac.jp/naid/10007461386.

McFadden, D., and K. Train. 2000. "Mixed Mnl Models for Discrete Response." *Journal of Applied Econometrics* 15, no. 5: 447–470. https://doi.org/10.1002/1099-1255(200009/10)15:5.

Milgram, S. 1970. "The Experience of Living in Cities." *Science* 167, no. 3924: 1461–1468. https://doi.org/10.1126/science.167.3924.1461.

Morgan, P. J., J. M. Warren, D. R. Lubans, K. L. Saunders, G. I. Quick, and C. E. Collins. 2010. "The Impact of Nutrition Education With and Without a School Garden on Knowledge, Vegetable Intake and Preferences and Quality of School Life Among Primary-School Students." *Public Health Nutrition* 13, no. 11: 1931–1940. https://doi.org/10.1017/S1368980010000959.

National Bureau of Statistics. 2020. *China Statistical Yearbook*. Beijing: China Statistics Press.

O'Keefe, D. J., and J. D. Jensen. 2008. "Do Loss-Framed Persuasive Messages Engender Greater Message Processing Than Do Gain-Framed Messages? A Meta-Analytic Review." *Communication Studies* 59: 51–67. https://doi.org/10.1080/10510970701849388.

Ortega, D. L., J. Sun, and W. Lin. 2022. "Identity Labels As an Instrument to Reduce Meat Demand and Encourage Consumption of Plant Based and Cultured Meat Alternatives in China." *Food Policy* 111: 102307. https://doi.org/10.1016/j.foodpol.2022.102307.

Phua, J., S.-A. A. Jin, and J. H. Kim. 2019. "The Roles of Celebrity Endorsers' and Consumers' Vegan Identity in Marketing Communication About Veganism." *Journal of Marketing Communications* 26, no. 8: 813–835. https://doi.org/10.1080/13527266.2019.1590854.

Qi, X., and A. Ploeger. 2021. "An Integrated Framework to Explain Consumers' Purchase Intentions Toward Green Food in the Chinese Context." *Food Quality and Preference* 92: 104229. https://doi.org/10.1016/j.foodqual.2021.104229.

Raghunathan, R., R. W. Naylor, and W. D. Hoyer. 2006. "The Unhealthy Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products." *Journal of Marketing* 70, no. 4: 170–184. https://doi.org/10.1509/jmkg.70.4.170.

De Ridder, D., F. Kroese, C. Evers, M. Adriaanse, and M. Gillebaart. 2017. "Healthy Diet: Health Impact, Prevalence, Correlates, and Interventions." *Psychology & Health* 32, no. 8: 907–941. https://doi.org/10.1080/08870446.2017.1316849.

Roosen, J., S. Marette, S. Blanchemanche, and P. Verger. 2009. "Does Health Information Matter for Modifying Consumption? A Field Experiment Measuring the Impact of Risk Information on Fish Consumption." *Review of Agricultural Economics* 31, no. 1: 2–20. https://doi.org/10.1111/j.1467-9353.2008.01423.x.

Rose, J. M., M. C. J. Bliemer, D. A. Hensher, and A. T. Collins. 2008. "Designing Efficient Stated Choice Experiments in the Presence of Reference Alternatives." *Transportation Research Part B: Methodological* 42, no. 4: 395–406. https://doi.org/10.1016/j.trb.2007.09.002.

Rosenblatt, D. H., H. Dixon, M. Wakefield, and S. Bode. 2019. "Evaluating the Influence of Message Framing and Graphic Imagery on Perceptions of Food Product Health Warnings." *Food Quality and Preference* 77: 32–42. https://doi.org/10.1016/j.foodqual.2019.05.003.

Rupprecht, C. D. D., L. Fujiyoshi, S. R. McGreevy, and I. Tayasu. 2020. "Trust Me? Consumer Trust in Expert Information on Food Product Labels." *Food and Chemical Toxicology* 137: 111170. https://doi.org/10.1016/j.fct.2020.111170.

Schlenker, W., and S. B. Villas-Boas. 2009. "Consumer and Market Responses to Mad Cow Disease." *American Journal of Agricultural Economics* 91, no. 4: 1140–1152. https://doi.org/10.1111/j.1467-8276.2009.01315.x.

Sheng, F., J. Wang, K. Z. Chen, S. Fan, and H. Gao. 2021. "Changing Chinese Diets to Achieve a Win–Win Solution for Health and the Environment." *China & World Economy* 29, no. 6: 34–52. https://doi.org/10.1111/cwe.12393.

Shepherd, R., M. Dean, P. Lampila, et al. 2012. "Communicating the Benefits of Wholegrain and Functional Grain Products to European Consumers." *Trends in Food Science & Technology* 25, no. 2: 63–69. https://doi.org/10.1016/j.tifs.2012.01.002.

Silva, C. P., A. C. Bento, and E. Guaraldo. 2022. "The Impact of Front-Of-The-Packaging Nutrition Labelling Warnings on Consumer Habits: A Scoping Review Exploring the Case of the Chilean Food Law." *British Food Journal* 124, no. 13: 66–80. https://doi.org/10.1108/BFJ-05-2021-0463.

Smith, M. E., E. O. Van Ravenswaay, and S. R. Thompson. 1988. "Sales Loss Determination in Food Contamination Incidents: an Application to Milk Bans in Hawaii." *American Journal of Agricultural Economics* 70, no. 3: 513–520. https://doi.org/10.2307/1241489.

Springmann, M., M. Clark, D. Mason-D'Croz, et al. 2018. "Options for Keeping the Food System Within Environmental Limits." *Nature* 562, no. 7728: 519–525. https://doi.org/10.1038/s41586-018-0594-0.

Stok, F. M., S. Hoffmann, D. Volkert, et al. 2017. "The Done Framework: Creation, Evaluation, and Updating of an Interdisciplinary, Dynamic Framework 2.0 of Determinants of Nutrition and Eating." *PLoS One* 12, no. 2: e0171077. https://doi.org/10.1371/journal.pone.0171077.

The Population Division of United Nations Department of Economic and Social Affairs.2022. *World Population Prospects 2022: Summary of Results*. New York: the United Nations. https://www.un.org/development/desa/pd/content/World-Population-Prospects-2022.

Trivedi, J. 2018. "Measuring the Comparative Efficacy of Endorsements By Celebrities Vis-À-Vis Animated Mascots." *Journal of Creative Communications* 13, no. 2: 117–132. https://doi.org/10.1177/0973258618761407.

Tønnesen, M. T., S. Hansen, A. V. Laasholdt, and L. Lähteenmäki. 2022. "The Impact of Positive and Reduction Health Claims on Consumers' Food Choices." *Food Quality and Preference* 98: 104526. https://doi.org/10.1016/j.foodqual.2022.104526.

Wensing, J., V. Caputo, L. Carraresi, and S. Bröring. 2020. "The Effects of Green Nudges on Consumer Valuation of Bio-Based Plastic Packaging." *Ecological Economics* 178: 106783. https://doi.org/10.1016/j.ecolecon.2020.106783.

WHO, J. and Diet, N.F.E.C.O. 2003. *Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation*. World Health Organization eBooks. http://ci.nii.ac.jp/ncid/BA6263076X.

Willett, W., J. Rockström, B. Loken, et al. 2019. "Food in the Anthropocene: The Eat–Lancet Commission on Healthy Diets From Sustainable Food Systems." *The Lancet* 393, no. 10170: 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4.

Wu, Q., Y. Huang, M. H. Van Velthoven, W. Wang, S. Chang, and Y. Zhang. 2019. "The Effectiveness of Using a Wechat Account to Improve Exclusive Breastfeeding in Huzhu County Qinghai Province, China: Protocol for a Randomized Control Trial." *BMC Public Health* 19, no. 1: Article 1603. https://doi.org/10.1186/s12889-019-7676-2.

Yin, J., J. Hua, X. Zhang, A. Tuyishimire, and D. Yang. 2023. "Healthy Eating for All? The Challenge of Adhering to Dietary Guidelines for Low-Income Groups in China." *Nutrients* 15, no. 12: 2704. https://doi.org/10.3390/nu15122704.

Young, L., M. Rosin, Y. Jiang, et al. 2020. "The Effect of a Shelf Placement Intervention on Sales of Healthier and Less Healthy Breakfast Cereals in Supermarkets: A Co-Designed Pilot Study." *Social Science & Medicine (1982)* 266: 113337. https://doi.org/10.1016/j.socscimed.2020.113337.

Yu, J., X. Han, H. Wen, J. Ren, and L. Qi. 2020. "Better Dietary Knowledge and Socioeconomic Status (SES), Better Body Mass Index? Evidence From China—An Unconditional Quantile Regression Approach." *Nutrients* 12, no. 4: Article 1197. https://doi.org/10.3390/nu12041197.

Yuan, Y. Q., F. Li, H. Wu, et al. 2018. "Evaluation of the Validity and Reliability of the Chinese Healthy Eating Index." *Nutrients* 10, no. 2: Article 114. https://doi.org/10.3390/nu10020114.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.