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# Reducing food waste and promoting sustainable consumption: the role of message framing and controllability attributions in ugly produce marketing

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Food waste due to consumer rejection of aesthetically imperfect produce poses significant challenges to food security and environmental sustainability. We construct a matching model between the marketing message framing of ugly produce and the controllability attributions of ugly appearance to drive consumers' purchase intentions. Through theoretical deduction and randomized scenario experiments, we validate this model by demonstrating that consumers' purchase intentions increase when the gain-framed (vs. loss-framed) messages for marketing ugly produce match with the high-level (vs. low-level) controllability attributions of ugly appearance. In addition, we introduce the concept of consumers' perceived information processing fluency as a mediator in this relationship. The findings provide actionable insights for produce retailers, suggesting that effective and cost-efficient marketing strategies could reduce food waste and its associated environmental impacts by driving consumers' purchasing intentions to ugly produce, contributing to the achievement of Sustainable Development Goal 2 (SDG 2) and promoting sustainable food systems.

## KEYWORDS

food security, ugly produce, message framing, controllability attributions, sustainable consumption

## 1 Introduction

The issue of food waste has increasingly captured public and academic attention due to its implications for society and the environment (Aka and Buyukdag, 2021). Annually, over 1.3 billion tons of food go to waste within the supply chain (Amicarelli et al., 2020). A significant factor contributing to this waste is consumer bias against the appearance of agricultural

products, leading to a large amount of avoidable waste and environmental strain (Giménez et al., 2021; Grewal et al., 2019; Loebnitz and Grunert, 2018; Wang et al., 2024). This bias has prompted retailers to prioritize aesthetically pleasing produce, inadvertently escalating the waste of unappealing items (Loebnitz et al., 2015). The disposal of ugly produce not only wastes resources but also aggravates environmental issues like soil degradation and greenhouse gas emissions (Lagerkvist et al., 2023). Moreover, reducing food waste can be seen as an effective means to enhance global food security (Liao et al., 2022). Therefore, addressing this issue through effective marketing strategies to alter consumer perceptions and behaviors is an essential area of research, particularly in the context of achieving Sustainable Development Goal 2 (SDG 2) and ensuring food security.

In parallel, scholarly interest in the impact of message framing on pro-environmental behavior has surged. Message framing refers to the practice of presenting essentially identical information in different linguistic forms, leading recipients to develop distinct perceptions and judgments, thereby enhancing the persuasive power of the language and generally categorized into gain framing and loss framing (Van de Velde et al., 2010). Nonetheless, the efficacy of different framing approaches remains inconsistent in existing literature. Some studies advocate that gain-framed messages, which highlight positive outcomes, are more persuasive (Lagerkvist et al., 2023), while others argue for the greater effectiveness of loss-framed messages, emphasizing negative consequences (Amatulli et al., 2020). This suggests that the persuasive power of message framing likely varies with specific situational factors (Ku et al., 2018). For example, White et al. (2011) found in their study on the persuasive effects of green advertising on consumers that loss-framed (gain-framed) communication messages matched with consumers' concrete (abstract) thinking patterns to better enhance consumers' willingness towards environmental recycling. Nevertheless, there is a notable gap in these previous studies that promote pro-environmental behavior among consumers, no research has yet explored how message framing for marketing ugly produce matches with controllability attributions of ugly appearance to drive consumers' purchasing intention.

In the context of marketing communication for ugly produce, the ugly appearance of these products is a critical negative factor affecting their sale. When consumers seek to understand the reasons behind this occurrence, they can assess it through the lens of controllability attribution (Hess et al., 2003). Controllability attributions plays a critical role in how consumers assign causes to negative events (Hess et al., 2003). Understanding this dynamic is critical in marketing communication for ugly produce, a category facing inherent sales challenges due to its appearance. Therefore, the research question of this study is: how the message framing for marketing ugly produce match with the controllability attributions of ugly appearance to drive consumers' purchase intentions?

Addressing this gap and our research question, we propose a novel model grounded in regulatory focus theory. This model is designed to navigate the complexities of "what to say" and "how to say it" in the marketing communication of ugly produce effectively. Our hypothesis posits that consumers' purchase intentions are likely to be higher when there is a matching between the type of message framing and the level of controllability attributions of ugly appearance. Specifically, we theorize that gain-framed messages for marketing ugly produce, which emphasize positive aspects, should align with contexts eliciting

higher levels of controllability attributions of ugly appearance. Conversely, loss-framed messages, highlighting negative consequences, are predicted to be more effective when combined with information eliciting lower levels of controllability attributions of ugly appearance. Furthermore, we explore the mediating role of perceived information processing fluency in this matching process.

This research aims to provide produce retailers with actionable insights for crafting marketing communications strategies. By understanding and leveraging these dynamics, retailers can address the significant issues of waste and environmental consequences resulting from consumer rejection of ugly produce. In addition, the findings of this research have significant implications for achieving Sustainable Development Goal 2 (SDG 2) and promoting sustainable food systems, particularly in the face of global challenges such as climate change, economic crises, and food price hikes.

## 2 Theory and hypothesis development

Ugly produce is defined as visually imperfect fruits or vegetables that differ from the conventional appearance within their respective food categories (Qi et al., 2022; van Giesen and de Hooze, 2019; Xu et al., 2021). Importantly, these imperfections solely pertain to visual distinctions and do not compromise intrinsic quality or safety (Adel et al., 2022; Grewal et al., 2019; Suher et al., 2021). Even though ugly produce rarely differs meaningfully in intrinsic attributes versus normal-looking counterparts, consumer resistance persists due to an unjustified aesthetic bias that has been coined "beauty is good, ugliness is risky" (Castagna et al., 2021). For example, consumers frequently perceive higher risks in ugly produce (Castagna et al., 2021), make less favorable assessments about their quality (Loebnitz and Grunert, 2018), and harbor more negative self-perceptions when considering ugly produce purchases (Grewal et al., 2019).

To address this issue, previous works have concentrated heavily on remedial strategies like price discounts or informative marketing communications. However, discounting ugly produce risks perpetuating quality concerns by implying a substandard nature (Aschemann-Witzel et al., 2020; Qi et al., 2022). Consequently, the focus has shifted towards identifying more effective, cost-efficient communication strategies. For example, anthropomorphized ugly produce can elicit positive emotions in consumers, thereby increasing their purchase intentions (Cooremans and Geuens, 2019). Similarly, anthropomorphized unattractive produce can evoke perceived empathy from consumers, which in turn enhances their purchase intentions for unattractive produce (Chen et al., 2021). Additionally, by providing external informational cues that can enhance consumers' positive self-perceptions, such as "You are Fantastic! Pick ugly produce!," the rejection of consumers towards unattractive produce can be reduced (Grewal et al., 2019). Labeling strategies are another marketing communication approach for ugly produce that has been investigated by scholars. For instance, labeling ugly produce as "ugly" can improve consumers' attribute inferences about ugly produce, thereby increasing consumers' purchase intentions for ugly produce (Mookerjee et al., 2021).

A factor receiving extensive recognition as impactful in guiding pro-environmental behavior is message framing (Amatulli et al., 2020; Lagerkvist et al., 2023; White et al., 2011). Message framing involves presenting the same core information in different linguistic styles to

shape interpretation and persuasiveness (Van de Velde et al., 2010). In this study, for marketing communication messages about ugly produce, gain-framed messages emphasize personal or social benefits from purchasing them like enabling waste reduction and environmental conservation, while loss-framed appeals highlight consequences from not buying such as food waste accumulation and ecological harm.

Equally important to communication outcomes are consumers' attributions regarding the underlying causes of problems or issues being addressed (Weiner, 1985). Weiner (1979) dissects how people assign responsibility for behaviors or events, assessing loci of causality along dimensions like internality, stability, and controllability. Controllability attributions judge the degree of volitional control versus situational imposition over causal factors and have robust attitudinal implications (Weiner, 1979). Transitioning to the agricultural context, for agricultural items, growth irregularities plausibly arise more from unstable, external causes like weather conditions or improper farming practices. As such, we concentrate primarily on exploring controllability attributions given their greater relevance in judging ugly produce appearance. In this research, adapting from Hildebrand et al. (2017), controllability attribution of ugly appearance refers to whether there is a human agent who can control the occurrence of the ugly appearance of agricultural products. Specifically, when imperfections get blamed on uncontrollable natural forces like anomalous weather or climate patterns, controllability attributions of ugly appearance are low. In contrast, if flaws are traced to regulated or controllable human activities like improper farming methods or transportation handling, controllability attributions of ugly appearance are high. The controllability attributions of ugly appearance, as revealed by its definition, is closely related to the level of consumers' perceived control over the factors causing appearance flaws. Low or thwarted control activates a prevention focus, making individuals more attuned to loss and negative aspects of information (Wang and Lee, 2006), while amplified control spurs promotion focus and opportunity-seeking behaviors, making individuals more responsive to gains and positive of information (Bateson, 1985). This manifests in regulatory focus orientations derived from Regulatory Focus Theory (RFT) (Higgins, 1997). RFT posits two goal pursuit orientations: prevention or promotion focus. A prevention focus increases awareness of potential negatives, while a promotion orientation enhances responsiveness to potential gains and positive outcomes (Higgins, 1997). Applying these insights to the context of ugly produce, when uncontrollable factors like weather drive appearance flaws, low control could stimulate consumers' loss-averse prevention focus highly attentive towards negative outcomes. Loss-framed (vs. gained-framed) messages align with heightened negativity sensitivity by underscoring adverse consequences like food waste and environmental harm from avoiding ugly produce. Thus, we propose:

*H1: When the controllability attributions of ugly appearance in produce are low, consumers exhibit higher purchase intentions for ugly produce when exposed to loss-framed messages than gain-framed messages.*

Conversely, when human elements like farming techniques causally contribute to appearance imperfections, amplified control may conversely activate promotion-focused mentalities targeting opportunities and gains (Bateson, 1985; Wang and Lee, 2006). Based

on this, we expect that gain-framed (vs. loss-framed) appeals resonate better with promotion focus by highlighting merits and benefits like ecological conservation gains from ugly produce acceptance. Thus, we propose:

*H2: When the controllability attributions of ugly appearance in produce are high, consumers exhibit a higher purchase intention for ugly produce when exposed to gain-framed marketing messages than loss-framed messages.*

What ultimately drives message persuasiveness is the enhanced perceived information processing fluency when incoming communications information is readily assimilated within individuals' active mental outlooks (Cho and Schwarz, 2006; Yoon et al., 2011). Perceived information processing fluency is the ease with which an individual processes stimulus information (Cho and Schwarz, 2006). When message content resonates with an individual's regulatory focus, it increases perceived processing fluency and message persuasiveness. For example, individuals with a prevention focus are receptive towards negativity-accentuating losses, while those with a promotion focus welcome positivity-underscoring gains (Lee et al., 2009; Lin et al., 2012). Building on this and combining it with the aforementioned discussions, we suggest that low (high) controllability attributions of ugly appearance activate prevention (promotion) focus in consumers. Consequently, loss-framed (gain-framed) messages for marketing ugly produce matched with low (high) controllability attributions of ugly appearance are likely to enhance information processing fluency. Namely, the match between message framing and controllability attributions of ugly appearance positively affects perceived information processing fluency. The more fluently information is processed, the more favorable an individual's reactions and preferences tend to be (Kostyk et al., 2021). Hence, consumers' perceived information processing fluency will positively affect their purchasing intention for ugly produce. Finally, we propose:

*H3: The impact of the match between message framing and controllability attributions of ugly appearance on consumers' purchasing intentions is mediated by perceived information processing fluency.*

### 3 Overview of studies

Our research approach involved a comprehensive experimental design, consisting of two pilot studies and two main studies, to rigorously test our hypotheses. Pilot Study 1 served as the foundation for creating stimuli for Main Study 1. In Main Study 1, we focused on ugly potatoes as our primary stimulus to examine Hypotheses 1, 2, and 3. The choice of potatoes aimed to provide a robust initial test of our theoretical model in a single, widely consumed agricultural product category.

Building on the findings from Main Study 1, Study 2 expanded the scope of our research to include a different category of agricultural products: fruits. This shift was to assess the generalizability of our findings across diverse product types. A preliminary pilot Study was conducted specifically for Study 2 to develop effective stimulus materials. In this Study, ugly mangoes were chosen as the stimulus,

allowing us to validate and extend the findings from Study 1. The inclusion of mangoes aimed to enhance the external validity of our research, demonstrating the applicability of our model to a broader array of agricultural products.

## 4 Study 1

### 4.1 Pilot study 1

The primary objective of Pilot Study 1 was to develop and refine the stimulus materials for Main Study 1. This preliminary Study was designed with two key goals in mind. The first goal focused on assessing whether variations in the framing of marketing messages (gain-framed vs. loss-framed) and the degrees of controllability attributions associated with the ugly appearance of agricultural products would result in noticeable differences in consumer perception and interpretation. The second goal was centered on ensuring the effective manipulation of the ugly appearance of the agricultural products used in the study. It was imperative to confirm that these visual modifications were not only perceptible to consumers but also impactful in terms of influencing their perceptions and evaluations of the products.

#### 4.1.1 Participants and procedure

For this study, we recruited 150 participants through the Credamo platform. Following initial screening, 2 participants were excluded for failing the attention test, and 3 were removed due to abnormal response times (defined as times falling below or exceeding three standard deviations from the mean). This resulted in a total of 145 valid participants (with 63.07% female participants,  $M_{\text{age}} = 31.600$ ,  $SD = 8.034$ ).

Participants were randomly assigned to a 2 (message framing: gain frame vs. loss frame)  $\times$  2 (level of controllability attributions of ugly appearance: low vs. high) between-subjects experimental design. They were asked to imagine themselves shopping at a fruit and vegetable store. While browsing through the vegetable aisle, participants come across some potatoes on a shelf. Next to the shelf, there is a display board with descriptive text about potatoes. The manipulation of message framing was adapted from Lagerkvist et al. (2023). The gain-framed message for potatoes conveyed the following information: "A substantial number of agricultural products are wasted due to their ugly appearance every year. As a consumer, purchasing these agricultural products will contribute to reducing food waste. Reducing food waste signifies the preservation of ecological resources such as water, land, and the environment. Preserving resources can enhance environmental quality." In contrast, the loss-framed marketing message stated: "A substantial number of agricultural products are wasted due to their ugly appearance every year. As a consumer, refusing to purchase these agricultural products could potentially exacerbate food waste. Exacerbating food waste implies squandering ecological resources like water, land, and others. Prolonged squandering of resources leads to environmental degradation and reduction in environmental quality." Drawing from Hess et al. (2003), the description for low-level controllability attributions of ugly appearance was: "The ugly appearance of the potatoes on the vegetable shelf is primarily attributed to natural factors such as abnormal temperature or rainfall during the potato's

growth process." On the other hand, the high-level controllability attributions of ugly appearance were described as: "The ugly appearance of the potatoes on the vegetable shelf is primarily caused by human factors such as improper land management, inadequate weeding, or insufficient irrigation during the cultivation process." A detailed description of the shopping scenario can be found in Appendix A.

After reviewing the experimental materials, participants completed manipulation checks for message framing and controllability attributions of ugly appearance. The manipulation check for message framing employed a semantic differential scale, where "1 indicated the extent to which participants perceived the text in the shopping scenario describing the positive consequences of buying potatoes, and 7 indicated the extent to which they perceived the negative consequences if refusing to buy the potatoes in the shopping scenario" as outlined in White et al. (2011). The checks for attribution controllability included items such as "To what extent do you believe that the ugly appearance of the potatoes in the shopping scenario can be avoided/prevented/caused by highly controllable human factors?" with a response scale from 1 (to a very small extent) to 7 (to a very large extent), following Hess et al. (2003). In addition, participants assessed the potato appearance with an item stating "You feel the appearance of the potatoes in the shopping scenario is ugly/unattractive," rated on a scale from 1 (strongly disagree) to 7 (strongly agree), based on Chen et al. (2021). Subsequently, the participants reported their demographic variables.

#### 4.1.2 Result

The manipulation check for the appearance of the potatoes yielded significant results. Participants rated the appearance of the potatoes as ugly, with an average score significantly above the midpoint of the scale ( $M = 5.497$ ,  $SD = 1.113$ ,  $t(144) = 16.197$ ,  $p = 0.000$ ). This confirms the successful manipulation of the ugly appearance of the potatoes.

Regarding the message framing, results from a one-way ANOVA indicated significant differences between the gain-framed and loss-framed conditions. Participants in the loss-framed condition were more likely to perceive the marketing message as emphasizing the negative consequences of not purchasing the potatoes ( $M_{\text{loss}} = 4.986$ ,  $SD = 2.330$ ) compared to those in the gain-framed condition ( $M_{\text{gain}} = 2.361$ ,  $SD = 1.689$ ;  $F(1, 143) = 60.180$ ,  $p = 0.000$ ,  $\eta^2 = 0.296$ ). In addition, a one-way ANOVA on the level of controllability attributions revealed a significant difference between the high and low controllability conditions. Participants in the low-level controllability condition perceived the cause of the potatoes' ugly appearance as more uncontrollable due to natural factors ( $M_{\text{low controllability}} = 2.448$ ,  $SD = 1.142$ ) compared to those in the high-level controllability condition ( $M_{\text{high controllability}} = 4.931$ ,  $SD = 1.627$ ;  $F(1, 143) = 113.407$ ,  $p = 0.000$ ,  $\eta^2 = 0.442$ ). The study results show successful manipulation of both message framing and controllability attributions of the ugly appearance of the potatoes.

### 4.2 Main study 1

Main Study 1 extended the groundwork laid by Pilot Study 1, utilizing the stimuli of ugly potatoes to create a simulated shopping scenario. The primary aim was to investigate the effects of matching message framing types with different levels of controllability

attributions of ugly appearance on consumers' purchase intentions (H1 and H2). Additionally, this study sought to examine the mediating role of perceived information processing fluency in this relationship (H3).

### 4.2.1 Participants and procedure

For this study, we recruited 500 participants through the Credamo platform. Following an initial screening, 5 participants were excluded (2 for failing the attention test and 3 for abnormal response times), resulting in a final sample of 495 valid participants (63.232% female,  $M_{age} = 27.832$ ,  $SD = 7.666$ ). For more detailed descriptions of the valid sample statistical characteristics, see Table 1. About basic characteristics of samples in different conditions in study 1, please see Table 2.

Participants were randomly assigned to a 2 (message framing: gain frame vs. loss frame) × 2 (level of controllability attributions: low vs. high) between-subjects design. They were presented with a scenario where they imagined shopping at a fruit and vegetable store, encountering potatoes on a shelf with descriptive information shown on a display board nearby. The manipulation of message framing and controllability attributions followed the same methodology as in Pilot Study 1. Detailed descriptions of the shopping scenario are provided in Appendix A. After engaging with the experimental materials, participants completed manipulation checks for message framing and controllability attributions. They then provided responses related to their purchase intentions, perceived information processing fluency, attention, risk perception, and taste inference regarding the ugly potatoes. The study concluded with participants providing demographic information.

### 4.2.2 Measures

The manipulation checks in Main Study 1 replicated those used in Pilot Study 1, assessing the message framing, appearance of

agricultural products, and controllability attributions of ugly appearance. Participants were asked to rate their purchase intentions based on items adapted from Chen (2018): "For the potatoes in the shopping scenario, you would intend to buy/consider buying/plan to buy some of those potatoes." This was measured on a seven-point Likert scale (1 = "completely disagree," and 7 = "completely agree"; Cronbach's  $\alpha = 0.909$ ). The participants' assessment of the descriptive message about the ugly potatoes was done using a scale adapted from Sundar and Noseworthy (2014): "You think the information describing potatoes in the shopping scenario is easy to understand/process/clear and logical/well organized/well structured," on a seven-point Likert scale (1 = "completely disagree," and 7 = "completely agree"; Cronbach's  $\alpha = 0.786$ ). Risk perception was measured with a statement adapted from (Loebnitz and Grunert, 2018): "You think these potatoes in the shopping scenario are risky," and taste inference with a statement from Chen et al. (2021): "These potatoes are tasty." Both were rated on a seven-point Likert scale (1 = "completely disagree," and 7 = "completely agree"). Finally, demographic information was collected from the participants.

## 4.3 Results

### 4.3.1 Manipulation check

The manipulation test for the appearance of the potatoes was successful. Participants rated the appearance significantly above the scale's midpoint ( $M = 5.181$ ,  $SD = 1.120$ ,  $t(494) = 23.459$ ,  $p = 0.000$ ), indicating they perceived the potatoes as ugly. A one-way ANOVA revealed that participants in the loss-framed conditions perceived the marketing message as more significantly emphasizing the negative consequences of not purchasing the potatoes ( $M_{loss} = 4.581$ ,  $SD = 2.137$ ) compared to those in the gain-framed conditions ( $M_{gain} = 2.405$ ,  $SD = 1.553$ ;  $F(1,$

TABLE 1 Descriptive statistical analysis of valid samples in main study 1.

Characteristic indicators	Meaning of indicators	Frequency (n)	Percentage (%)	N
Gender	Male	182	36.768	495
	Female	313	63.232	
Age	20 years and under	28	5.657	495
	21 to 30 years	334	67.475	
	31 to 40 years	101	20.404	
	41 to 50 years	19	3.838	
	51 years and above	13	2.626	
Education	Junior high school and below	1	0.202	495
	High school	45	9.091	
	Undergraduate	347	70.101	
	Master's degree or above	102	20.606	
Average monthly income	Less than 3,000 RMB	146	29.495	495
	3,000 (including) - 6,000 RMB	121	24.444	
	6,000 (including) - 9,000 RMB	117	23.636	
	9,000 (including) - 12,000 RMB	59	11.919	
	12,000 (including) - 15,000 RMB	25	5.051	
	More than 1,500 RMB	27	5.455	

TABLE 2 Basic characteristics of samples in different conditions in study 1.

Conditions	Numbers	Mean	Gender
Loss-framed message + Low-level controllability attributions	123	27.090 (7.273)	1.650 (0.479)
Loss-framed message + High-level controllability attributions	125	27.960 (7.263)	1.696 (0.462)
Gain-framed message + Low-level controllability attributions	123	28.024 (7.715)	1.569 (0.497)
Gain-framed message + High-level controllability attributions	124	28.250 (8.400)	1.613 (0.489)

0 = male, 1 = female. The values in parentheses are standard deviations.

493) = 167.732,  $p = 0.000$ ,  $\eta^2 = 0.254$ ). In addition, a significant difference was found in the controllability attributions of ugly appearance ( $M_{\text{high controllability}} = 4.838$ ,  $SD = 1.349$ ;  $M_{\text{low controllability}} = 3.137$ ,  $SD = 1.263$ ;  $F(1, 493) = 209.687$ ,  $p = 0.000$ ,  $\eta^2 = 0.298$ ). These results suggested that the manipulation of message framing and controllability attributions of ugly appearance was successful.

### 4.3.2 The matching effect of message framing and the controllability attributions

A two-way ANCOVA, with risk perception and taste inference as covariates, showed a significant interaction between message framing and controllability attributions on purchase intention ( $F(1, 489) = 29.041$ ,  $p = 0.000$ ,  $\eta^2 = 0.056$ ). Further simple effects analyses revealed that in conditions of low controllability attributions, purchase intentions were higher with loss-framed messages compared to gain-framed messages ( $M_{\text{gain}} = 4.613$ ,  $SD = 1.397$ ;  $M_{\text{loss}} = 5.352$ ,  $SD = 0.933$ ;  $F(1, 489) = 15.012$ ,  $p = 0.000$ ,  $\eta^2 = 0.030$ ). Conversely, in conditions of high controllability attributions, purchase intentions were higher with gain-framed messages ( $M_{\text{gain}} = 5.462$ ,  $SD = 1.165$ ;  $M_{\text{loss}} = 4.832$ ,  $SD = 1.224$ ;  $F(1, 489) = 14.172$ ,  $p = 0.000$ ,  $\eta^2 = 0.028$ , see Figure 1). These findings initially confirm Hypotheses 1 and 2.

### 4.3.3 Mediating analysis

We employed PROCESS model 8 (Hayes, 2013) to investigate the moderated mediating role of perceived information processing fluency. In our model, message framing was specified as the independent variable (0 = loss-framed message, 1 = gain-framed message), with perceived information processing fluency as the mediator. Controllability attributions of ugly appearance were the moderator (0 = low level, 1 = high level), and consumers' purchase intentions of ugly potatoes served as the dependent variable. Risk perception and taste inference were included as covariates. The 10,000 resample bootstrapped confidence intervals indicated a significant moderated mediation process for perceived information processing fluency ( $\beta = 0.109$ ,  $SE = 0.049$ ; 95% CI = [0.023; 0.214]). This finding suggests that the impact of the matching message framing with controllability attributions of ugly appearance on purchase intention was mediated by perceived information processing fluency, thereby supporting Hypothesis 3.

## 4.4 Discussion

The results of study 1 provide initial support for Hypotheses 1 and 2. When the level of controllability attributions of ugly appearance was low, consumers exhibited higher purchase intentions with loss-framed messages compared to gain-framed

ones. Conversely, with a higher level of controllability attributions of ugly appearance, gain-framed messages led to increased purchase intentions. In the next study, we aim to reinforce these findings and enhance external validity by examining a different category of agricultural products, following successful stimulus development in a preliminary study.

## 5 Study 2

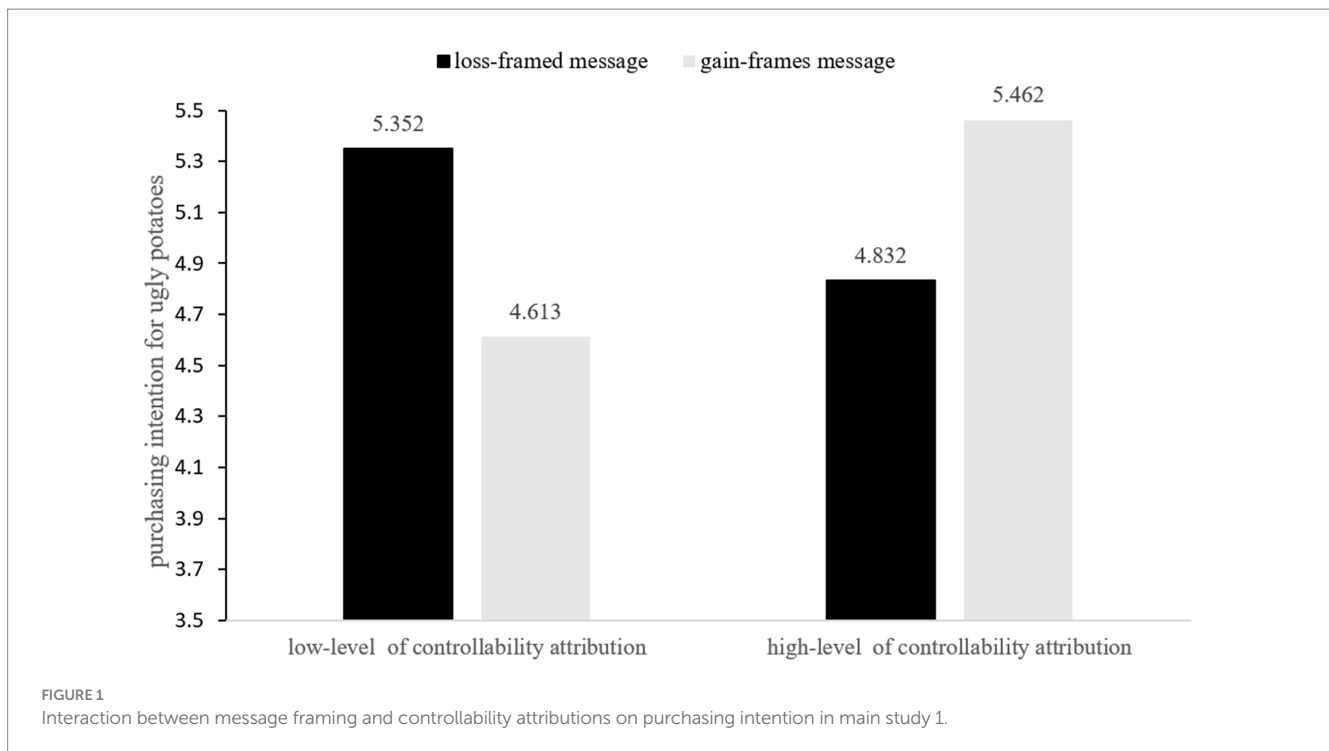
### 5.1 Pilot study 2

Pilot Study 2 was designed to generate stimuli involving a distinct category of agricultural products, different from those used in Study 1, for use in the main Study 2. This Study sought to accomplish two primary goals. The first goal was to determine if variations in gain-framed and loss-framed marketing messages, coupled with different degrees of controllability attributions of ugly appearance, would influence consumer perception and reception of these messages in a new product context. The second goal was to ensure the successful manipulation of the ugly appearance in this new category of agricultural products.

#### 5.1.1 Participants and procedure

We recruited 150 participants for this Study from the Credamo platform. Among them, 1 participant did not pass the attention check, and 5 participants had questionnaire completion times that were considered outliers (lower than the mean completion time minus 3 times the standard deviation or higher than the mean completion time plus 3 times the standard deviation). As a result, we obtained data from 144 valid participants (55.56% female,  $M_{\text{age}} = 30.875$ ,  $SD = 7.630$ ).

Participants recruited were randomly assigned to one of 2 (message framing: gain frame vs. loss frame)  $\times$  2 (level of controllability attributions of ugly appearance: low vs. high) between-subjects design. First, they were asked to imagine themselves shopping at a fresh produce supermarket, where they encountered mangoes on the fruit counter and descriptive information about mangoes on a display board next to the counter. To manipulate the marketing message frame, this Study followed the communication messages used in the Study by Lagerkvist et al. (2023), which were consistent with Study 1. Drawing from Hess et al. (2003), the information of low-level controllability attributions of ugly appearance was presented as "The ugly appearance of the mangoes on the fruit counter is caused by natural factors such as abnormal temperature or rainfall during the mango's growth process." Conversely, the information of high-level controllability attributions of ugly appearance was presented as "The ugly



appearance of the mangoes on the fruit counter is caused by human factors such as forgetting to bag the fruits or not harvesting them at the appropriate time during the cultivation process.” Specific details of the shopping scenario are provided in [Appendix B](#). After reading the experimental materials, participants completed the manipulation check items for message framing, controllability attributions of ugly appearance, and mango appearance, which were consistent with Study 1. Finally, participants answered demographic variables.

### 5.1.2 Result

The manipulation check results for mango appearance revealed that the average ratings for mango appearance were notably above the midpoint value of 4 on the scale ( $M = 5.476$ ,  $SD = 1.083$ ,  $t(143) = 16.354$ ,  $p = 0.000$ ). This finding indicates that participants perceived mango appearance as distinctly ugly, confirming the successful manipulation of ugly mango appearance. In the analysis of message framing, a One-way ANOVA showed that consumers exposed to loss-framed messages were more likely to perceive the negative consequences of not purchasing the described mangoes compared to those exposed to gain-framed messages ( $M_{gain} = 1.722$ ,  $SD = 1.078$ ;  $M_{loss} = 6.014$ ,  $SD = 1.389$ ;  $F(1, 142) = 429.087$ ,  $p = 0.000$ ,  $\eta^2 = 0.751$ ). Furthermore, the study’s results for the controllability attributions manipulation check highlighted a significant distinction between high and low levels of controllability attributions conditions ( $M_{high\ controllability} = 5.488$ ,  $SD = 1.276$ ;  $M_{low\ controllability} = 2.388$ ,  $SD = 1.180$ ;  $F(1, 142) = 229.337$ ,  $p = 0.000$ ,  $\eta^2 = 0.618$ ). Participants in conditions with high-level controllability attributions for ugly appearance perceived the cause of mango’s ugly appearance as more controllable by human factors compared to those in low-level controllability conditions. These study findings underscored the effective manipulation of the ugly appearance of

mangoes, along with the message framing and controllability attributions.

## 5.2 Main study 2

Study 2 has two main objectives. Firstly, main Study 2 used the stimuli that were successfully developed in the pilot study to test H1, H2, and H3 again and to demonstrate the robustness of the conclusions from Study 1. Secondly, Study 2 involved replacing the stimulus with a different agricultural product category (vegetables) compared to Study 1. By using mango as the stimulus, we increased the external validity of the studies in addition to repeating the pattern of results of Study 1.

### 5.2.1 Participants and procedure

This Study recruited 600 subjects in Credamo platform. Among them, 16 subjects failed the attention test, 9 subjects took too long to answer the questionnaire (higher than the mean + 3 times the standard deviation of the answer time), and 575 valid subjects were obtained (73.739% female,  $M_{age} = 27.906$ ,  $SD = 7.958$ ). For more detailed descriptions of the valid sample statistical characteristics, see [Table 3](#). About basic characteristics of samples in different conditions in study 2, please see [Table 4](#).

Participants were randomly assigned to one of 2 (message framing: gain frame vs. loss frame)  $\times$  2 (level of controllability attributions of ugly appearance: low vs. high) between-subjects scenarios. Firstly, they were asked to imagine themselves shopping at a fresh produce supermarket, where they encountered mangoes displayed on the fruit counter, along with descriptive information about mangoes on nearby display boards. Detailed descriptions of the shopping scenario are provided in [Appendix B](#). The approach for manipulating message framing and controllability attributions of ugly

TABLE 3 Descriptive statistical analysis of valid samples in main study 2.

Characteristic indicators	Meaning of indicators	Frequency (n)	Percentage (%)	N
Gender	Male	151	26.261	575
	Female	424	73.739	
Age	20 years and under	39	6.783	575
	21 to 30 years	380	66.087	
	31 to 40 years	108	18.783	
	41 to 50 years	34	5.913	
	51 years and above	14	2.434	
Education	Junior high school and below	0	0.000	575
	High school	76	13.217	
	Undergraduate	393	68.348	
	Master's degree or above	106	18.435	
Average monthly income	Less than 3000RMB	208	36.174	575
	3,000 (including) - 6,000 RMB	117	20.348	
	6,000 (including) - 9,000 RMB	111	19.304	
	9,000 (including) - 12,000 RMB	74	12.870	
	12,000 (including) - 15,000 RMB	33	5.739	
	More than 1,500 RMB	32	5.565	

TABLE 4 Basic characteristics of samples in different conditions in study 2.

Conditions	Numbers	Mean	Gender
Loss-framed message + Low-level controllability attributions	144	28.750 (8.425)	0.757 (0.430)
Loss-framed message + High-level controllability attributions	143	27.336 (7.947)	0.769 (0.423)
Gain-framed message + Low-level controllability attributions	141	27.667 (7.858)	0.674 (0.471)
Gain-framed message + High-level controllability attributions	147	27.863 (7.569)	0.748 (0.435)

0 = male, 1 = female; The values in parentheses are standard deviations.

appearance mirrored the methodology used in Pilot Study 2. Upon reviewing the stimulus materials, subjects undertook manipulation checks for message framing and controllability attributions of ugly appearance. This was followed by assessments of purchase intention, perceived information processing fluency, attention, risk perception, and taste inference related to the ugly mangoes. Finally, participants provided their demographic information.

### 5.2.2 Measures

The measurements for manipulation check of mangoes' appearance, message framing, controllability attributions of ugly appearance, purchase intention (Cronbach's  $\alpha = 0.927$ ), perceived information processing fluency (Cronbach's  $\alpha = 0.866$ ), risk perception and taste inference for ugly mangoes were same as previous studies.

### 5.3 Results

*Manipulation check.* The manipulation check for the appearance of mangoes revealed that participants rated the appearance significantly above the scale's median value of 4 ( $M = 5.220, SD = 1.124, t(574) = 26.023, p = 0.000$ ), indicating a pronounced perception of

ugliness, thereby confirming the successful manipulation of the ugly appearance of mangoes. Analysis via a one-way ANOVA demonstrated that participants in loss-framed conditions were more inclined to perceive the marketing message's emphasis on the adverse effects of not purchasing the described mangoes, compared to those in gain-framed conditions ( $M_{\text{gain}} = 2.708, SD = 1.633; M_{\text{loss}} = 4.460, SD = 1.952; F(1, 573) = 136.250, p = 0.000, \eta^2 = 0.192$ ). Additionally, one-way ANOVA for the effect of controllability attributions on perceptions of ugly appearance showed significant differences between high and low controllability conditions ( $M_{\text{high controllability}} = 5.103, SD = 1.106; M_{\text{low controllability}} = 3.261, SD = 1.232; F(1, 573) = 356.256, p = 0.009, \eta^2 = 0.383$ ), indicating effective manipulation of message framing and controllability attributions of ugly appearance.

*The matching effect of message framing and the controllability attributions of ugly appearance.* The two-way ANCOVA analyzing purchase intention indicated a significant interaction between message framing and controllability attributions of ugly appearance, considering participants' risk perception and taste inference of ugly mangoes as covariates ( $F(1, 569) = 30.351, p = 0.000, \eta^2 = 0.051$ ). Further analysis showed that under low controllability conditions, purchase intentions for ugly mangoes were higher with loss-framed messages than with gain-framed messages ( $M_{\text{gain}} = 4.497, SD = 1.288; M_{\text{loss}} = 5.095, SD = 1.293; F(1, 569) = 9.143, p = 0.003, \eta^2 = 0.016$ ).



Conversely, under high controllability conditions, purchase intentions were higher with gain-framed messages ( $M_{\text{gain}} = 5.200$ ,  $SD = 1.198$ ;  $M_{\text{loss}} = 4.126$ ,  $SD = 1.315$ ;  $F(1, 569) = 23.505$ ,  $p = 0.000$ ,  $\eta^2 = 0.040$ , see Figure 2). This finding supports Hypotheses 1 and 2.

**Mediating analysis.** Using PROCESS model 8, this study examined the moderated mediating role of perceived information processing fluency, with message framing as the independent variable, perceived information processing fluency as the mediator, controllability attributions of ugly appearance as the moderator, and purchase intentions as the dependent variable, including risk perception and taste inference as covariates. The moderated mediation was significant ( $\beta = 0.132$ ,  $SE = 0.061$ ; 95% CI = [0.021; 0.260]), suggesting that the impact of the matching message framing with controllability attributions of ugly appearance on consumers' purchase intention was mediated by perceived information processing fluency, thus supporting Hypothesis 3 again.

We also employed the stepwise regression method for testing mediation effects (Baron and Kenny, 1986). All regression models include participants' gender, age, education, average monthly income, risk perception, and taste inference as control variables. The analytical results are presented in Table 5. According to regression model 1, the interaction between the message framing and controllability attributions significantly affects the purchase intention ( $\beta = 1.003$ ,  $p < 0.001$ ). Then, based on regression model 2, the interaction between the message framing and controllability attributions significantly influences the perceived fluency of information processing ( $\beta = 0.350$ ,  $p < 0.05$ ). Finally, in regression model 3, after incorporating the perceived fluency of information processing into the regression equation, the coefficient of the interaction between the message framing and the controllability attributions remains significant but is significantly smaller than in the interaction term of regression model 1 ( $\beta = 0.870$ ,  $p < 0.001$ ).

Thus, the mediating role of perceived information processing fluency in the impact of the interaction between message framing and controllability attribution on consumers' purchase intention is significant. Therefore, the mediating effect of perceived information processing fluency holds true even when tested with different mediation analysis methods.

## 5.4 Discussion

The results of Study 2 provided further support for our research hypothesis. When the level of the controllability attributions of ugly appearance was low, consumers exhibited higher purchase intentions for ugly mangoes with the loss-framed marketing message compared to the gain-framed message. However, when the level of the controllability attributions of ugly appearance was high, consumers exhibited higher purchase intentions for ugly produce with a gain-framed marketing message compared to the loss-framed message. This study, using a different agricultural product category, not only enhances the external validity of our findings but also replicates the results of Study 1, reinforcing the reliability of our research across different contexts.

## 6 General discussion

### 6.1 Theoretical implications

This research contributes to the broader understanding of consumer behavior in the context of sustainable consumption and offers valuable strategies for reducing food waste. We found that matching of message framing and controllability attribution of ugly

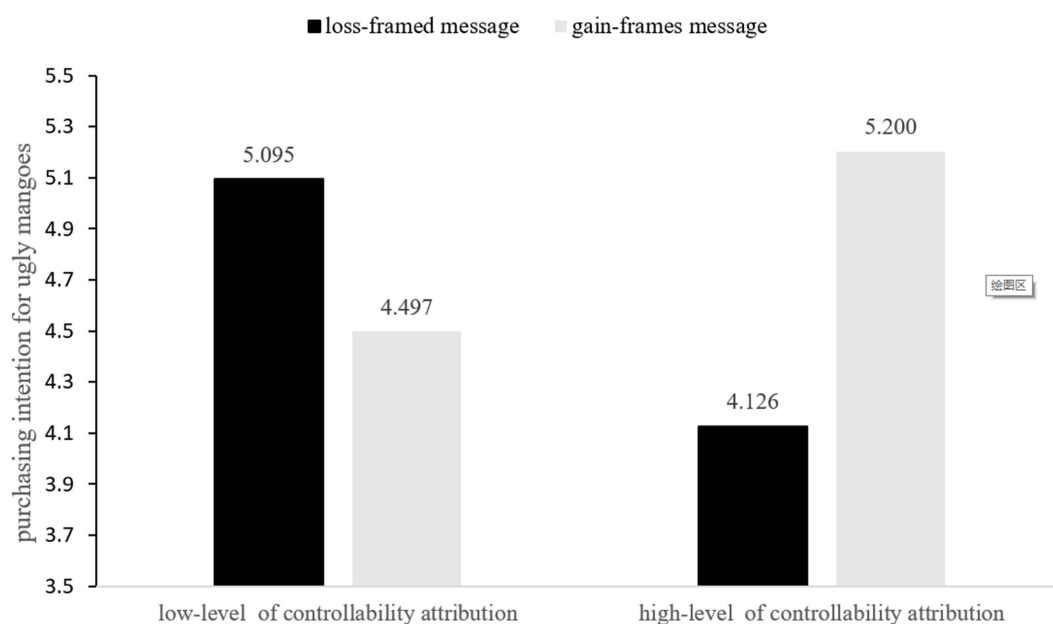


FIGURE 2  
Interaction between message framing and controllability attributions on purchasing intention in main study 2.

TABLE 5 Results of regression analysis on the mediating role of perceived information processing fluency.

	Variable	Purchasing intention	Perceived information processing fluency	Purchasing intention
Independent variables		Model 1	Model 2	Model 3
	Message framing	-0.725***	-0.374***	-0.582***
		(0.125)	(0.104)	(0.120)
	Controllability attributions	-0.386**	-0.127	-0.338**
		(0.126)	(0.105)	(0.120)
	Message framing×Controllability attributions	1.003***	0.350*	0.870***
(0.181)		(0.150)	(0.172)	
Mediation variable	Perceived information processing fluency			0.381***
				(0.048)
Control variables	Gender	-0.098	0.133	-0.148
		(0.103)	(0.086)	(0.098)
	Age	0.004	0.004	0.003
		(0.007)	(0.006)	(0.006)
	Education	0.045	0.032	0.033
		(0.069)	(0.058)	(0.066)
	Average monthly income	0.062 (0.035)	-0.023 (0.029)	0.071* (0.033)
	Risk perception	-0.092***	-0.108**	-0.051***
		(0.038)	(0.032)	(0.037)
	Taste inference	0.663***	0.150***	0.605***
(0.050)		(0.042)	(0.048)	
Constant term		1.880	4.886***	0.016
		(0.555)	(0.461)	(0.576)
R <sup>2</sup>		0.397	0.108	0.458
F		41.374	7.632	47.641

Message framing: 0 = gain-framed message, 1 = loss-framed framed; 2. Controllability attributions: 0 = high-level controllability attributions, 1 = low-level controllability attributions; 3. \* denotes *p*-value less than 0.05, \*\* denotes *p*-value less than 0.01, \*\*\* denotes *p*-value less than 0.001. 4. Values in parentheses are standard errors.

appearances drives consumers’ purchase intentions. Specifically, when messages emphasize the advantages of purchasing these products (gain-framed messages) and match this with information suggesting that the reason for their ugly appearance is within human control (high-level controllability attributions of ugly appearance), individuals are more likely to purchase. Conversely, when messages focus on potential losses from refusing to purchase these products (loss-framed messages) and pair this with information indicating that the reason for their ugly appearance is beyond human control (low-level controllability attributions of ugly appearances), this strategy similarly increases purchase intentions. Our findings are consistent with previous study that message framing need to be matched with situational variables to be most effective in communicating messages (Ku et al., 2018). The theoretical implications of this research are as follows: Firstly, we enrich the research related to marketing communication strategies for ugly produce. In previous research on marketing strategies for ugly produce, no research has explored the impact of the alignment between information framing and controllable attributions of ugly appearance on consumer purchase intention. We innovatively propose the effects of matching message framing and controllability attributions of ugly appearance, which provides theoretical guidance for agricultural retailers to deal with the food waste and environmental problems caused by consumers’

rejection of ugly produce. Secondly, we expand the existing research on consumers’ pro-environmental behaviors. In the context of the pro-environmental behaviors of consumers of ugly produce, we examined the mediating role of perceived information processing fluency in the process of influencing consumers’ purchase intention by matching the message framing and controllability attributions of ugly appearance through theory and empirical evidence.

### 6.2 Practical implications

Our research contributes to sustainable consumption practices and offers a potential solution to reducing food waste. Our findings could help to reduce food waste, which is a significant social dimension issue due to raising serious concerns about food security and economic and environmental pressures (Talwar et al., 2022). By promoting the consumption of ugly produce, our research has the potential to mitigate the environmental impacts of agriculture, improve food security, and contribute to the sustainable development of the food system, aligning with the objectives of SDG 2. In addition, our research offers practical insights for retailers on marketing unattractive produce without relying heavily on price reductions. Our findings suggest a straightforward yet cost-effective strategy that could prove more sustainable than

continuous discounting. First, we provide produce retailers with effective marketing communication strategies for ugly produce. Specifically, the loss-framed message should be matched with the message that expresses the low-level controllability attributions of ugly appearance, while the gain-framed message should be matched with the message that demonstrates the high-level controllability attributions of ugly appearance. Produce retailers can make consumers more responsive to the consumption of ugly produce through such a matching strategy, thus helping them to cope with the serious food waste and environmental problems caused by consumers' rejection of ugly produce. Second, when developing marketing communication strategies for ugly produce, agro-retailers need to be aware of the critical role of consumer confidence in processing fluency in influencing consumers' willingness to buy. Therefore, when developing marketing communication strategies, they should focus on how to improve consumers' perceived information processing fluency to enhance consumers' willingness to buy and promote their pro-environmental behavior.

Our research helps mitigate the cognitive bias everyday shoppers experience when buying ugly produce. In addition, our research can also help consumers develop a more rational mindset when buying fruits and vegetables. Overall, our study offers practical strategies to enhance consumer preference for ugly produce. These approaches can assist stakeholders in reducing food waste attributed to the rejection of such produce, ultimately contributing to the long-term sustainable development of society.

## 7 Conclusion

This research highlights the influence of marketing strategies on consumers' willingness to purchase ugly produce, demonstrating the potential to reduce food waste through targeted communication. We found that gain-framed (vs. loss-framed) messages for marketing ugly produce match with the high-level (vs. low-level) controllability attributions of ugly appearance can enhance consumers' purchase intentions. This approach not only addresses environmental concerns related to food waste but also offers a practical avenue for retailers to engage consumers in sustainable consumption practices. Furthermore, this research also highlights the mediating role of the perceived information processing fluency, suggesting the importance of perceived information processing fluency in enhancing the persuasiveness of marketing messages. These insights are critical for developing effective communication strategies that resonate with consumers and them to change their behavior. This research also contributes to the broader understanding of consumer behavior in the context of sustainable consumption and offers valuable strategies for reducing food waste. By leveraging insights into message framing and controllability attributions of ugly appearance, retailers can enhance the appeal of ugly produce, aligning consumer purchasing behavior with environmental and food sustainability goals.

### 7.1 Limitations and future research

In this research, we explored strategies to increase consumer purchase intentions for ugly produce, thereby addressing the significant issue of food waste associated with such products. Despite these contributions, our study has certain limitations. Primarily, it focuses on

fresh produce. Future studies could expand this to encompass non-fresh food categories, such as processed foods, to develop more comprehensive strategies against food waste at the societal level. Moreover, our research sample was confined to participants from China. This limitation might affect the generalizability of our findings, as cultural backgrounds and consumer psychology can vary significantly across different countries and regions. The cultural characteristics, social norms, and market environments in China may differ from those in other countries, potentially leading to different attitudes and behaviors towards ugly produce. Therefore, future research is warranted to investigate to examine whether our results hold true in different cultural contexts. For instance, similar studies could be carried out in the United States or other countries to gain a deeper understanding of global consumer responses to ugly produce. Cross-cultural research would provide a more comprehensive understanding of consumer behavior, enhance the generalizability of our findings, and offer stronger theoretical support for international market strategies. Future research could also explore the impact of marketing strategies for ugly produce on food pricing and affordability, as well as their potential to contribute to sustainable agricultural practices and collaborative efforts towards achieving SDG 2.

## Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

## Ethics statement

The studies involving humans were approved by Huazhong Agricultural University Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

MX: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. AR: Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. PQ: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – review & editing. WP: Resources, Validation, Writing – review & editing. RT: Investigation, Visualization, Writing – review & editing. MA: Investigation, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2024.1416142/full#supplementary-material>

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