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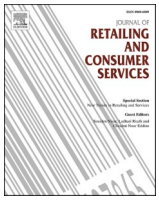

Self-image matters: Examining individual differences in resistance to loss framing messages

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ABSTRACT

In response to the growing prevalence of overweight and obesity, public service advertisements (PSAs) promoting healthy eating have been placed throughout consumers' online retail experiences. Some of these advertisements highlight the benefits of healthy diets (gain framing), while others warn against the negative consequences of unhealthy eating (loss framing). Understanding consumer resistance to PSAs, particularly psychological reactance, has become increasingly important due to shifts in how people access information. In an era when content platform algorithms personalize information exposure, health content continues to appear only if consumers actively engage with it. Yet consumer reactance, which often leads to information avoidance, can substantially reduce continued exposure. Through three online experiments, we found that loss framing messages are more likely to elicit greater psychological reactance compared to gain framing, particularly among individuals with a lower promotion focus trait or higher concern for face. This increased reactance results in more negative attitudes toward PSAs and further reduces willingness to engage with the information provider. This research offers practical insights for public health communicators and online food retailers on the effective placement of PSAs.

1. Introduction

Imagine you are browsing through an online grocery store, deciding what to add to your cart as you plan for your meals for the week, and coming across a banner that reads, "Eat well today to protect your heart tomorrow"—a positively framed public service advertisement (PSA). Now imagine the same setting, but the message reads, "Poor eating habits today will damage your heart tomorrow"—a negatively framed version. How might you respond to these different messages? Would you be inclined to choose healthier foods, overlook the message, or disengage entirely by leaving the website?

As food retailers have shown an increasing interest in promoting healthier choices (Grandi et al., 2021; Otterbring and Shams, 2019; Perfetti et al., 2025; Steils, 2021), these PSAs can be incorporated into the consumer's online retail experience at varying frequences, appearing either once or multiple times, on elements such as online retail banners, product images, and detailed product descriptions (Sainsbury's, 2025; Tesco, 2025). Food-related PSAs typically emphasize the importance of healthy eating using both gain framing and loss framing messages from trusted health institutions and policymakers. Gain framing messages emphasize the positive outcomes of a healthy diet, such as stating that "*eating a healthy, balanced diet is an important part of maintaining good health and reducing the risk of chronic diseases*" (WHO, 2024a). Conversely, loss framing messages focus on the negative consequences of unhealthy eating, such as highlighting that "*an unhealthy diet is one of the major risk factors for a range of chronic diseases*" (WHO, 2024b).

Although both messages have been demonstrated to improve consumers' motivation to eat healthier, they can create unintended negative consequences due to the activation of psychological reactance – i.e., a negative motivational reaction arising from a perceived threat to one's freedom (Brehm, 1966; Miron and Brehm, 2006). When psychological reactance is activated, consumers strive to restore their freedom either by opposing the suggested behaviour or by abandoning the "threatening source" (Fitzsimons and Lehmann, 2004). This dynamic is especially

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relevant in online retail environments, where consumers can easily avoid the messages with a single click (Wu et al., 2025). Despite this well-documented negative effect, the impact of psychological reactance on consumer attitudes toward healthy eating communication remains relatively underexplored (Nan et al., 2018).

Moreover, reducing psychological reactance to healthy eating communication is becoming particularly important, given the widespread adoption of personalized recommendation algorithms by content platforms, such as search engine servers, social media, news platforms, and even AI-enabled agents (Kim et al. 2023a, 2025; Li, 2017; Meta, 2024). These algorithms are based on consumer feedback metrics such as clicks, time spent, likes and dislikes, comments, content subscriptions, influencer follows, and platform survey responses (Goodrow, 2021; Mosseri, 2023). For healthy eating content to be prioritized by algorithms and maintain consumer engagement, it must align with user preferences, garner positive reactions ("likes"), and ensure a sustained willingness to receive information from health promoters, rather than being avoided or even blocked by consumers (Wu et al., 2025).

Previous research on message framing in health communication has often identified psychological reactance as a mediator explaining why loss framing, compared to gain framing, can trigger more consumer resistance to health messages (Nan et al., 2018; Shen, 2015; Zimmerman et al., 2014). Yet, other studies have reported that the mediating effect of psychological reactance was not significant (More et al., 2024; Richards et al., 2021). These mixed findings suggest that boundary conditions may determine when psychological reactance serves as a mediator. Therefore, the primary objective of the present research is to identify these potential boundary conditions and clarify why, and for whom, loss-framed messages are more likely to evoke psychological reactance compared to gain-framed messages, and how this reactance mediates their effects on consumer attitudinal and behavioural intentions toward the messages. Accordingly, we extended prior research by identifying two personality traits that may moderate the relationship between message framing and reactance: promotion focus trait and concern for face. This extension is grounded in the speculation that individuals' internal defensive systems for preserving a positive self-image may be the key mechanism underlying the relationship between loss (versus gain) framing and psychological reactance (Steele, 1988). Specifically, eating behaviour has been considered a way of expressing self-image, as proposed by the stereotype eating research with the famous catchphrase: "you are what you eat" (Vartanian, 2015; Vartanian et al., 2007). When it comes to food healthiness, individuals with a healthy diet are usually considered to have high self-control, while consumers with an unhealthy diet are perceived as low in willpower (Watkins et al., 2022). Building on the observation that, within the healthy eating context, gain-framed messages convey a healthy and positive self-image, whereas loss-framed messages emphasize an unhealthy and negative self-image resulting from failing to eat healthily (Garg et al., 2021), we suggest that the drive to maintain a positive self-image plays a critical role in triggering psychological reactance. Along these lines, we introduce two moderators that influence self-image perception from contrasting perspectives: promotion focus trait, defined as an individual's aspirations and willingness to achieve a positive self-image, in our context, being healthy (Ferrer et al., 2017); and concern for face, defined as an individual's desire to preserve self-image and remain socially acceptable (Chan et al., 2009; Goffman, 1967), with the former one focus on individual's self-perception and the other on how they believe others perceive them. Specifically, consumers with a higher promotion focus trait find it easier to associate themselves with a positive, healthy self (Ferrer et al., 2017). This association helps restore a positive self-image (McGregor et al., 2007), thereby mitigating the impact of image-damaging messages, such as loss framing, that portray one as unhealthy. On the other hand, consumers with a higher concern for face show a heightened sensitivity to respond negatively under image-threatening conditions (White et al., 2004), which are more likely to result from loss framing messages.

To conclude, the primary objective of this research is to clarify for whom loss framing healthy eating messages elicit greater psychological reactance than gain framing messages, by examining the moderating roles of two boundary conditions: promotion focus trait and concern for face. This reactance, in turn, mediates the effects of these interactions on consumer attitudes and behavioural intentions.

Across three experiments, we found that loss framing messages, compared to gain framing messages, increase psychological reactance among individuals with lower promotion focus traits (Studies 1 and 2) and among individuals with higher concern for face (Study 3). This heightened psychological reactance leads to a less favourable attitude toward the messages, which, in turn, reduces the willingness to receive further information from the content provider (Studies 1, 2, and 3).

This research contributes to resolving inconsistencies in the health message framing literature (Nan et al., 2018). While prior studies have shown that loss framing (vs. gain framing) messages can trigger greater psychological reactance but sometimes produce null effects, this research demonstrates that consumers' susceptibility to self-image influences can explain such variability. Specifically, those who are low in promotion focus or high in concern for face are more likely to show reactance to loss framing messages.

Our findings also provide important practical implications for health communicators. We suggest that loss framing should be used with caution, considering factors such as the communicator's access to public attention, the primary objective of the message, and the message recipients' susceptibility to self-image concerns.

2. Theoretical background and hypothesis development

The success of online retailers relies not only on attracting more consumers to make immediate purchases but also on increasing the frequency of repeat purchases (Kim et al., 2024a, 2024b). Several empirical studies have compared the positive effects of gain framing versus loss framing in proactively stimulating and intensifying the motivations for healthy food consumption. For instance, framing information in terms of losses is considered more effective in capturing attention and promoting behavioural intentions toward healthier food choices (Britwum and Yiannaka, 2019; Eguren et al., 2021; Garg et al., 2021). Yet in digital contexts, where consumers can easily dismiss messages with a single click (Wu et al., 2025), understanding potential resistance has become as important as examining consumer motivation to engage (Jan et al., 2023). This motivational tension further underscores the role of individual differences in message processing, particularly due to the increasing use of AI-powered chatbots in retailing settings and the potential of AI-mediated communication in adapting to consumer preferences (Chong et al., 2021; Aggarwal et al., 2023; Khan et al., 2024; Kim et al., 2023b).

2.1. Message framing effect on psychological reactance

Health communication research (Nan et al., 2018) has shown that loss framing generally tends to increase consumer psychological reactance compared to gain framing. This effect has been observed in various contexts, including promoting voter registration (Reynolds-Tylus and Schill, 2022), sun protection (Shen, 2015), marijuana inhibition (S. Zimmerman et al., 2014), and organ donation (Quick et al., 2015). However, studies examining the promotion of physical exercise (More et al., 2024) and HPV vaccination (Richards et al., 2021) did not find significant differences between loss and gain framing in eliciting psychological reactance. Additionally, Lee and Cameron (2017) found limited evidence of increased psychological reactance when comparing loss and gain framing in the context of healthy eating for weight control.

Accordingly, although prior research generally demonstrates a significant effect of loss framing versus gain framing messages in increasing psychological reactance, occasional nonsignificant findings suggest the presence of boundary conditions. Thus, this study investigates the

moderating role of individual personality traits to clarify for whom this effect is most pronounced.

2.2. Psychological reactance in health advertising: the moderating role of self-image traits in triggering resistance

Elevated psychological reactance not only redirects consumers' attention toward information that favours restricted food consumption (Sprengholz et al., 2023), engenders more negative attitudes toward healthy eating (Ungar et al., 2015), and avoid health advertising messages (Wu et al., 2025), but it also reduces their intentions to purchase healthy items (Lu and Cai, 2023) and may prompt a greater desire for unhealthy options—such as eating fewer fruits and vegetables (Ungar et al., 2015), buying more unhealthy foods (Irmak et al., 2020), and consuming greater amounts of unhealthy items (Stok et al., 2015). Among these outcomes, attitudes are particularly relevant to the present research, as they reflect consumers' evaluative responses to persuasive health messages and serve as key predictors of consumer engagement (Donato and Adıgüzel, 2022; Kareklas et al., 2014). One important aspect of such engagement is consumers' willingness to receive further information, which reflects the potential for sustained exposure (Jan et al., 2023). Understanding this relationship is crucial for enhancing the effectiveness of health advertising. Therefore, this research examines the effect of psychological reactance on consumer attitudes toward messages and its subsequent impact on their willingness to receive further messages from the information provider.

We propose that individual traits act as moderators in the heightened psychological reactance triggered by loss framing compared to gain framing. According to self-affirmation theory, individuals seek to maintain a positive self-image, which encompasses qualities such as competence, coherence, and stability (Steele, 1988). When persuasive messages threaten this self-image, individuals are motivated to restore it, either by resisting the negative portrayal or by finding ways to enhance their overall self-perception. Loss framing messages, although more effective in promoting healthier choices, often highlight a negative self-image—such as being unhealthy or failing to maintain a healthy diet. This perceived threat to one's self-image may trigger psychological reactance, as it invokes a sense of loss of freedom (Brehm, 1966). In the following sections, we will introduce two individual traits—promotion focus and concern for face—which moderate the effects of message framing by influencing how individuals perceive threats to their self-image. Promotion focus is linked to positive self-image restoration, while concern for face relates to heightened sensitivity to situations that threaten one's self-image.

2.2.1. Promotion focus trait for self-image restoration

Promotion focus trait reflects the orientation toward achieving positive end-states, such as hope, aspirations, and accomplishments (Higgins, 1998, 2002). In the healthy eating context, promotion focus trait is characterized by easier accessibility and retrieval of a positive self-image associated with eating healthy—e.g., "I frequently imagine how I can achieve a state of ideal health." (Cecchini et al., 2021; Ferrer et al., 2017).

Promotion focus has been positively associated with self-image perceptions in previous studies (Scholer et al., 2014; Park, 2010; Leonardelli et al., 2007; McGregor et al., 2007). In particular, a promotion focus state is associated with self-evaluation inflation, and this increased overall self-image perception is instrumental in achieving ongoing tasks (Liu and Yao, 2019; Scholer et al., 2014). When primed with a promotion focus state that emphasizes positive self-presentation, individuals tend to find their interactions with others more engaging and positive (Newheiser et al., 2015). Moreover, individuals scoring high in their promotion focus trait tend to give more positive assessments of both their own work and that of their peers. They also show greater satisfaction with feedback from others, whether the feedback is positive or negative (Pastor and Baruffaldi, 2021).

Therefore, we anticipate that individuals with a higher promotion focus trait, who are better at retrieving a positive self-image, will exhibit resilience to the negative self-image depicted by loss framing messages, resulting in psychological reactance similar to that observed from gain framing messages. Conversely, individuals with a lower promotion focus trait are expected to show higher psychological reactance in response to loss framing messages compared to gain framing messages. Meanwhile, regulatory focus theory (Higgins, 2002; Cesario et al., 2004; Lee and Aaker, 2004) demonstrates the positive motivational effects of regulatory fit, such as promotion focus with gain framing, or prevention focus with loss framing messages, on healthy food consumption. To rule out the potential parallel influence of regulatory focus fit as an alternative explanation for mitigating consumer resistance (i.e., psychological reactance), we also measured the prevention focus trait.

We thus formulate the following hypothesis:

H1. *The mediation effect of message framing on willingness to receive (hereafter, WTR) further information from the content provider through psychological reactance and attitude is moderated by the promotion focus trait. Specifically, individuals with lower promotion focus trait will experience higher psychological reactance in loss framing messages, as compared to gain framing messages, leading to less favourable attitudes toward the messages and, in turn, decreasing WTR.*

2.2.2. Concern for face

Concern for face is defined as the extent to which individuals are concerned about preserving their image in the perceptions of others during social interactions (Chan et al., 2009; Goffman, 1967).

Individuals with a higher concern for face are more sensitive to face-threatening situations, exhibiting more negative cognitive, emotional, and behavioural responses (White et al., 2004; Goffman, 1967). When encountering social failures, such individuals experience greater offense and express stronger dissatisfaction (Chan et al., 2009; Kim and Yi, 2017). In particular, during embarrassing service failures that provoke high self-face concern, they show a higher intention to complain, a greater likelihood of switching service providers in the future, and a tendency to spread more negative word of mouth (Li et al., 2016; Qiu et al., 2018; Wan, 2013). Additionally, in the negotiations involving face-threatening interactions, these individuals perceive their relationship with negotiators more negatively and are more likely to reject a mutually beneficial outcome (White et al., 2004).

Because loss framing messages are considered as a more face-threatening form of communication compared to gain framing messages (Jang and Feng, 2018), we propose that consumers who display high concern for face will be more sensitive to loss framing messages versus gain framing messages and therefore contribute to a higher level of psychological reactance.

Therefore, the following hypothesis is formulated:

H2. *The mediation effect of message framing on WTR through psychological reactance and attitude is moderated by concern for face. Specifically, individuals with higher concern for face will experience higher psychological reactance when presented with loss framing messages, as compared to gain framing messages, leading to less favourable attitudes toward the messages, resulting in a reduced WTR.*

(see Fig.1 for the full conceptual model)

3. Research methodology

3.1. Study 1: one-time exposure to general gain versus loss framing messages in healthy eating

Study 1 aimed to test the moderated mediation effect outlined in H1, which claimed that a decrease in consumer willingness to receive further dietary guidance from the national program, when exposed to loss framing (versus gain framing) message, was driven by psychological

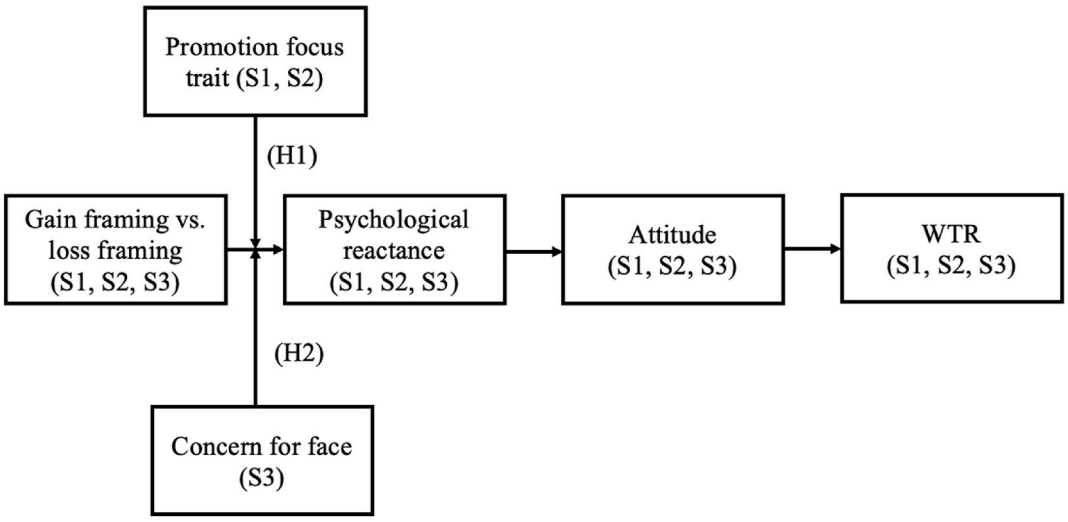

Fig. 1. Full conceptual framework.

reactance and attitudes toward the messages. This effect was moderated by the promotion focus trait.

3.1.1. Methods

3.1.1.1. Stimuli validation. We recruited 80 participants on the Prolific platform (US, UK; Ma_{ge} = 34.68, *SD* = 10.23; 51.2 % female). First, participants were presented with stimuli corresponding to one of two conditions, either gain or loss framing (e.g., 'Healthy eating may help you live longer', or 'Unhealthy eating may shorten your lifespan'. See Appendix A for details.) After reading the stimuli, participants were provided with definitions of the gain framing and loss framing: "*Gain framing messages focus on attaining a positive or not attaining a negative outcome; Loss framing messages focus on attaining a negative or not attaining a positive outcome.*" (Lee and Aaker, 2004). Next, participants indicated the extent to which they thought the messages were framed as loss or gain (1 = loss framing; 7 = gain framing). They were then asked to rate the other condition following the same procedure. The order of the conditions was randomized. The results showed that the manipulation was successful, with gain framing (M = 6.40; *SD* = 0.88) scoring significantly higher than loss framing (M = 2.50; *SD* = 1.97; t (79) = 15.33, $p < 0.01$).

3.1.1.2. Main study participants and procedure. We conducted an online experiment through Prolific, setting the recruitment target at 200 participants. The final sample included 200 participants (94.5 % UK, 5.5 % US). The uneven distribution across countries is due to the data being collected during European working hours, which coincided with nighttime in the USA. M_{age} = 38.12, *SD* = 10.42, 34.5 % male, 64 % female, and 1.5 % non-binary). Participants were then randomly assigned to one of two conditions, with half of the sample receiving gain framing messages and the other half receiving loss framing messages (see Appendix A).

We measured participants' psychological reactance (Massi Lindsey, 2005; 4-item, α = 0.94; see Table 1 in Appendix B for the scale items); attitude towards the messages (Burnkrant and Unnava, 1995; 3-item, α = 0.96); WTR (one item, i.e., To what extent would you like to receive more dietary guidance from the national program? Adapted from Gershoff et al., 2007). After measuring these responses as a transition to disengage from the experimental conditions and minimise their influence on the moderator, we then proceed with measuring the moderator (Chang et al., 2023)—the promotion focus trait (Ferrer et al., 2017; 6-item, α = 0.85). Furthermore, to examine the regulatory focus effect, we also measured the prevention focus trait (Ferrer et al., 2017). To ensure that the stimuli did not influence the trait measurement, we examined the influence of gain versus loss framing messages on the promotion focus trait. An independent *t*-test showed that the promotion focus trait did not differ between conditions (see Appendix C for details).

Table 1
Summary of the studies' results (PROCESS model 83).

Study 1			
Relationship	b	SE	[LLCI, ULCI]
Message framing→WTR	−0.02	0.09	[-0.20, 0.15]
Message framing→attitude→WTR	0.04	0.04	[-0.03, 0.11]
Message framing × promotion focus trait→psychological reactance→WTR	−0.07*	0.04	[-0.17, −0.03]
Message framing × promotion focus trait→psychological reactance→attitude→WTR	−0.08*	0.03	[-0.15, −0.02]
Study 2			
Relationship	b	SE	[LLCI, ULCI]
Message framing→WTR	−0.05	0.08	[-0.20, 0.11]
Message framing→attitude→WTR	0.04	0.03	[-0.01, 0.11]
Message framing × promotion focus trait→psychological reactance→WTR	−0.09*	0.05	[-0.19, −0.002]
Message framing × promotion focus trait→psychological reactance→attitude→WTR	−0.08*	0.04	[-0.16, −0.002]
Study 3			
Relationship	b	SE	[LLCI, ULCI]
Message framing→WTR	0.10	0.07	[-0.03, 0.23]
Message framing→attitude→WTR	0.05	0.03	[-0.001, 0.13]
Message framing × concern for face→psychological reactance→WTR	0.06*	0.04	[0.002, −0.15]
Message framing × concern for face→psychological reactance→attitude→WTR	0.06*	0.03	[0.002, 0.11]

* = $p < 0.05$.

3.1.1.3. Results and discussion. A one-way ANOVA analysis revealed that loss framing, compared to gain framing messages, did not increase psychological reactance response (M_{gain} = 2.74, SD_{gain} = 1.32 vs. M_{loss} = 3.08, SD_{loss} = 1.57, F (1, 198) = 2.70, p = 0.10, η^2 = 0.013), and resulted in marginally less favourable attitudes toward the messages (M_{gain} = 5.60, SD_{gain} = 1.24 vs. M_{loss} = 5.25, SD_{loss} = 1.39, F (1, 198) = 3.61, p = 0.06, η^2 = 0.018). Moreover, there were no significant

differences regarding WTR (M_{gains} = 4.36, SD_{gains} = 1.43 vs. M_{loss} = 4.17, SD_{loss} = 1.55, F (1, 198) = 0.81, p = 0.37, η^2 = 0.004).

Moderated Mediation. We employed a moderated mediation model implemented in the PROCESS macro for SPSS (Model 83; Hayes, 2022), with communication message types (loss framing = −1; gain framing = 1) as the independent variable, psychological reactance and attitude toward the messages as the serial mediators, WTR as the dependent variable, and promotion focus trait as the moderator. In order to examine the effect of regulatory fit, a parallel model was tested with the prevention focus trait as the moderator.

The results showed the interaction effect of message types and promotion focus trait on consumer psychological reactance was significant (b = 0.32, F (1, 196) = 10.66; p < 0.01) (see Fig. 2), with the Johnson-Neyman technique (Hayes, 2022, P269) highlighting that for promotion focus trait scores lower than 5.16, respondents expressed significantly higher reactance for loss than for gain framing messages (39.5 %, all *p-values* < 0.05). The results confirm hypothesis 1, demonstrating that among consumers with lower promotion focus trait, loss framing triggers higher psychological reactance than gain framing messages. For promotion focus trait scores higher than 6.81, respondents expressed higher reactance for the gain than for loss framing messages (6.0 %, all *p-values* < 0.05). While a small subgroup of consumers with very high promotion focus (scores above 6,81 out of 7; n = 6 % * 200 = 12) showed significantly higher reactance to gain framing (versus loss framing), this pattern was not anticipated by our hypotheses. Given the small size of this subgroup, these results should be interpreted with caution.

In turn, an increase of psychological reactance led to a less favourable attitude (b = −0.56, t = −10.96; p < 0.01). Furthermore, the more favourable the attitude, the higher the WTR (b = 0.46, t = 5.47; p < 0.01).

Importantly, the indirect effect of message framing on WTR through reactance showed a significant moderated mediation index (b = −0.07; [SE] = 0.04; [CI] = [−0.17–0.03]). Similarly, the indirect effect of message framing on WTR through reactance and attitude also had a significant moderated mediation index (b = −0.08; [SE] = 0.03; [CI] = [−0.15–0.02]). This suggested that the mediation of message framing's effect on WTR, whether solely through reactance or through the combined pathway of reactance and attitude, was moderated by the promotion focus trait. Specifically, as the promotion focus trait increased, the indirect effects of message framing on WTR decreased, mediated by reactance as the key mechanism.

On the other hand, the moderating effect of prevention focus trait on the relationship between message framing and psychological reactance was not significant (see details in Appendix D), indicating that regulatory fit does not account for the alleviation of consumer resistance to health messages.

The results of Study 1 fully supported H1, demonstrating that the effect of message framing on WTR, mediated by psychological reactance and consumer attitude towards the messages, was moderated by the promotion focus trait.

3.2. Study 2: multiple-time exposure to general gain framing versus loss framing messages in healthy eating

Study 2 aimed to replicate the findings of Study 1 while enhancing the generalizability of our results by shifting from a one-time exposure to a multiple-time exposure format, with no other differences. This approach was intended to approximate the repeated exposure to similar but different PSA messages that consumers may experience in online retail settings, where algorithms present related content multiple times based on their online behaviours and interests. By mimicking this real-life exposure pattern, we aimed to improve the external validity of our findings.

3.2.1. Methods

3.2.1.1. Stimuli validation. We recruited 80 participants via the Prolific platform (US and UK; M_{age} = 34.68, SD = 10.23; 51.2 % female). First, participants are exposed to one of two conditions and then read the definitions of gain framing and loss framing messages (the same as those in Study 1) (Lee and Aaker, 2004). Next, participants indicated the

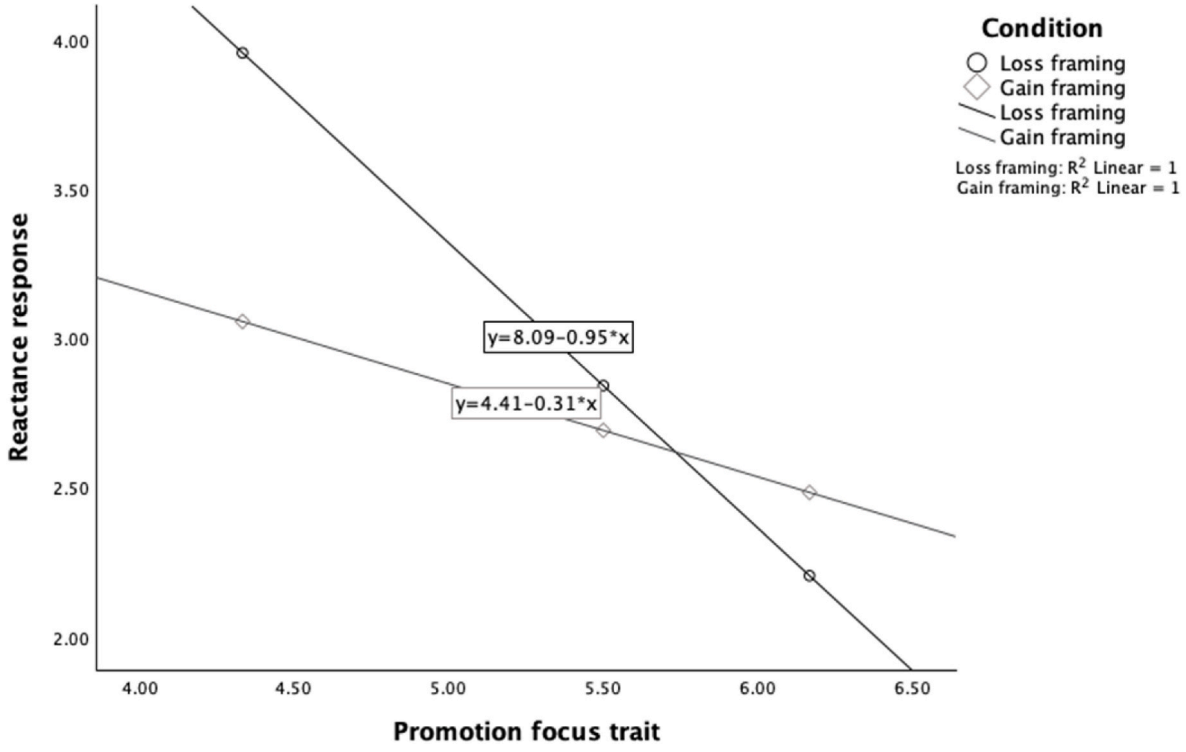

Fig. 2. The moderating effect of the promotion focus trait.

extent to which they thought the messages were framed as loss or gain (1 = loss framing; 7 = gain framing). They were then asked to rate another condition with the same procedure. The order of the conditions was randomized. The results showed that the manipulation was successful, with gain framing M = 6.43 (*SD* = 0.90) scoring significantly higher than loss framing M = 2.34 (*SD* = 1.84) (t (79) = 16.32, $p < 0.01$).

3.2.1.2. Main study participants and procedure. We conducted an online experiment through Prolific, setting the recruitment target at 200 participants. Our final sample included 201 participants (94 % UK, 6 % US; M_{age} = 37.38, *SD* = 8.98; 48.8 % male, 49.8 % female, and 1.5 % non-binary), due to Prolific occasionally delivering slightly more or fewer participants than the requested number. All participants were first exposed to the dietary guidance (same as study 1). They were then randomly assigned to one of two conditions: half received gain framing messages, and the other half received loss framing messages, with multiple exposures. Specifically, participants read one sentence per page (e.g., Page 1: "Healthy eating may help you live longer") and had to click 'Next' to proceed to the following sentence. In total, they read the same eight sentences as those in Study 1 but distributed across eight separate pages (Appendix A).

We measured participants' psychological reactance (Massi Lindsey, 2005; 4-item, α = 0.97; see Appendix B), attitude (Burnkrant and Unnava, 1995; 3-item, α = 0.97), WTR (Gershoff et al., 2007; one item), promotion focus trait (Ferrer et al., 2017; 6-item, α = 0.87), and prevention focus (Ferrer et al., 2017).

3.2.1.3. Results and discussion. A one-way ANOVA analysis revealed that compared to gain framing, loss framing messages increased participants' psychological reactance (M_{gain} = 2.77, SD_{gain} = 1.41 vs. M_{loss} = 3.24, SD_{loss} = 1.71, F (1, 199) = 4.60, $p = 0.03$, $\eta^2 = 0.023$), generated less favourable attitude from participants (M_{gain} = 5.64, SD_{gain} = 1.24 vs. M_{loss} = 5.10, SD_{loss} = 1.68, F (1, 199) = 6.89, $p = 0.01$, $\eta^2 = 0.033$), and led to marginally lower WTR (M_{gain} = 4.53, SD_{gain} = 1.53 vs. M_{loss} = 4.18, SD_{loss} = 1.73, F (1, 199) = 2.28, $p = 0.13$, $\eta^2 = 0.011$).

Moderated Mediation. We employed a moderated mediation model implemented in the PROCESS macro for SPSS (Model 83; Hayes, 2022), with communication message types (loss framing = −1; gain framing = 1) as the independent variable, psychological reactance and attitude as the serial mediators, WTR as the dependent variable, and promotion focus trait as the moderator. A parallel model was also tested with the prevention focus trait as the moderator.

The results showed the interaction effect of message types and promotion focus trait on consumer reactance was also significant (b = 0.22, F (1, 197) = 4.76; $p = 0.03$) (see Fig. 3), with the Johnson-Neyman analysis highlighting that for promotion focus trait scores lower than 5.48, respondents expressed higher reactance for loss framing than for gain framing messages (49.25 %, all *p-values* < 0.05). No significant differences between gain framing and loss framing messages emerged for reactance when promotion focus trait scores higher than 5.48. The results confirm that loss framing triggers higher psychological reactance than gain framing messages for consumers with a lower promotion focus trait. In turn, an increase of reactance led to a less favourable attitude (b = −0.74, *t* (197) = −18.04; $p < 0.01$). Furthermore, a more favourable attitude towards the messages led to an increase in WTR (b = 0.46, *t* (197) = 5.42; $p < 0.01$).

Importantly, the indirect effect of message framing on WTR through reactance was significant (b = −0.09; [SE] = 0.05; [CI] = [−0.19–0.002]), indicating the presence of a moderated mediation index. Similarly, the indirect effect of message framing on WTR through reactance and attitude also had a significant moderated mediation index (b = −0.08; [SE] = 0.04; [CI] = [−0.16–0.002]). The results replicated the findings from Study 1 and suggested that the mediation of message framing's effect on WTR, through reactance as the key mediator, was moderated by the promotion focus trait.

On the other hand, similar to study 1, the moderating effect of prevention focus on the relationship between message framing and psychological reactance was not significant (see details in Appendix D), suggesting that regulatory fit does not have a parallel effect in alleviating consumer resistance to health messages.

The results of Study 2 also supported H1, concluding that the

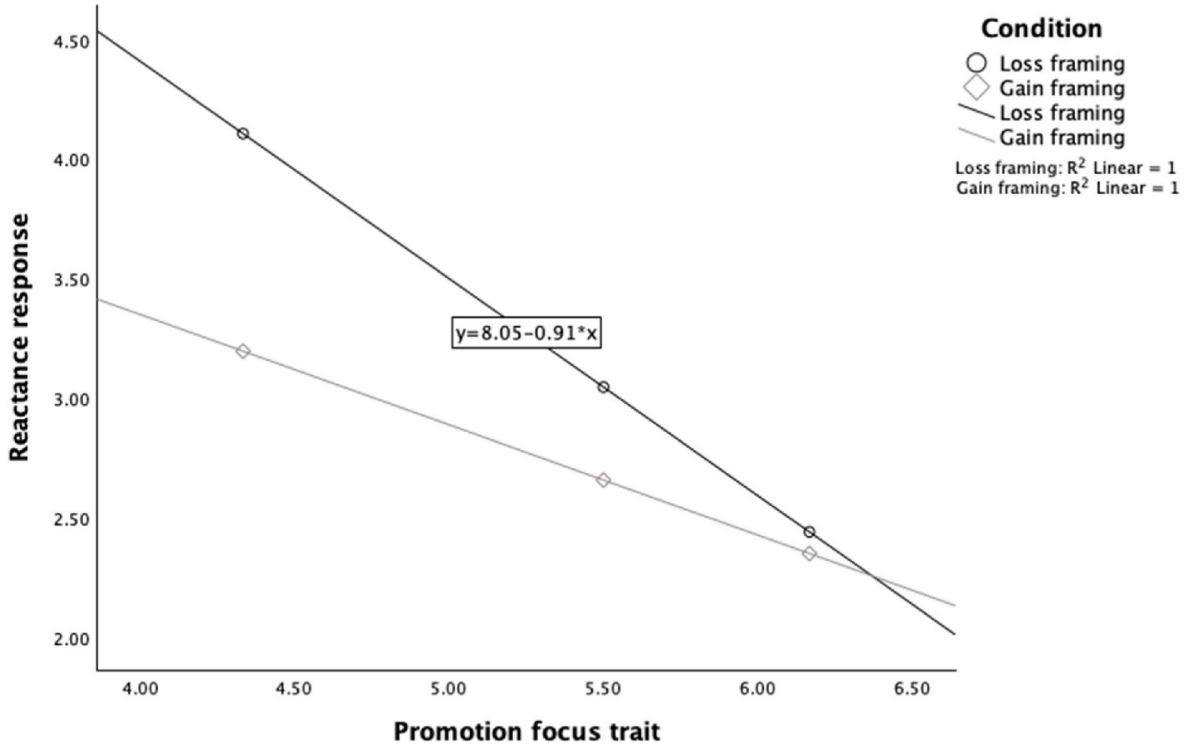

Fig. 3. The moderating effect of the promotion focus trait.

differential effect of message framing types on consumer WTR, mediated by psychological reactance and consumer attitude towards the messages, was moderated by the promotion focus trait.

3.3. Study 3: multiple-time exposure to concrete gain framing versus loss framing messages in healthy eating

Study 3 aimed to test the moderated mediation effect proposed in H2, which posited that a decrease in consumers' WTR caused by loss (vs. gain) framing messages, through psychological reactance and attitude towards messages, was moderated by concern for face. To enhance the generalizability of our findings, we developed 11 different healthy eating messages, each focusing on one specific food component (e.g., protein, sugar, salt, vegetables) (e.g., "Adequate protein eating supports muscles", see Appendix A). These messages were designed to be more specific (Miller et al., 2007) and were adapted from those commonly communicated by health promotion organizations (CDC, 2024; WHO, 2024a). As in Study 2, we employed a multiple-time exposure format, where participants read the messages sentence by sentence across multiple pages, reflecting how consumers frequently encounter health-related messages throughout their online retail journey.

3.3.1. Methods

3.3.1.1. Main study participants and procedure. We conducted an online experiment through Prolific, setting the recruitment target at 300 participants. Our final sample included 300 participants (97.7 % UK, 2.3 % US) (M_{age} = 39.54, *SD* = 10.80; 32.3 % male, 67.7 % female), and all subjects were randomly assigned to one of two conditions, with half of the sample exposed to gain framing messages (e.g., "Adequate beans eating may help you live longer.") and the other half to loss framing messages (e.g., "Inadequate beans eating may shorten your lifespan.") (see Appendix A).

We measured participants' reactance (Massi Lindsey, 2005; 4-item, α = 0.95; see Appendix B), attitude (Burnkrant and Unnava, 1995; 3-item, α = 0.96), WTR (Gershoff et al., 2007; one-item), and concern for face (Chan et al., 2009; 3-item, α = 0.63). Moreover, we administered a one-item manipulation check, where participants indicated the extent to which they thought the message was framed as loss or gain (1 = loss framing; 7 = gain framing).

3.3.1.2. Results and discussion. The results of a first independent *t*-test showed that the manipulation was successful, with M_{loss} = 3.62 (*SD* = 2.10) scoring significantly lower than M_{gain} = 5.30 (*SD* = 1.75) (t (298) = −7.56, $p < 0.01$), demonstrating that participants correctly perceived the manipulation.

Then, a one-way ANOVA analysis reported that loss framing, compared to gain framing messages, did not lead to higher psychological reactance (M_{gain} = 2.68, SD_{gain} = 1.35 vs. M_{loss} = 2.90, SD_{loss} = 1.59, F (1, 298) = 1.73, p = 0.19, η^2 = 0.006). Moreover, compared to gain framing, loss framing messages generated a less favourable attitude (M_{gain} = 5.57, SD_{gain} = 1.35 vs. M_{loss} = 5.19, SD_{loss} = 1.48, F (1, 298) = 5.42, p = 0.02, η^2 = 0.018), and less WTR (M_{gains} = 4.70, SD_{gains} = 1.58, vs. M_{loss} = 4.23, SD_{loss} = 1.61, F (1, 298) = 6.77, p = 0.01, η^2 = 0.022).

Moderated mediation. We employed a moderated mediation model implemented in the PROCESS macro for SPSS (Model 83; Hayes, 2022), with communication message types (loss framing = −1; gain framing = 1) as the independent variable, psychological reactance and attitude as the mediators, WTR as the dependent variable, and incorporating concern for face as the moderator.

The linear interaction results showed the interaction effect of message framing and concern for face on consumer reactance was also significant (b = −0.18, F(1, 296) = 4.18; p = 0.04), with the Johnson-Neyman analysis highlighting that for respondents scores higher than 5.26 for concern for face expressed lower psychological reactance for the gain framing than for the loss framing (48 %, all *p-values* < 0.05). No significant differences between gain framing and loss framing messages emerged for concern for face scored lower than 5.26 (see Fig. 4). The results confirm hypothesis 2, demonstrating that among consumers with higher concern for face, loss framing triggers higher psychological reactance than gain framing messages.

Reactance, in turn, affected the attitude and further impacted WTR. Specifically, we observed a statistically significant negative effect of psychological reactance on consumer attitude (b = −0.62, se = 0.04, t = −14.75, $p < 0.01$). Attitude then positively influenced WTR (b = 0.52, se = 0.06, t = 8.62, $p < 0.01$).

Importantly, the indirect effect of message framing on WTR through reactance was significant (b = 0.06; [SE] = 0.04; [CI] = [0.002–0.15]), demonstrating the presence of the proposed moderated mediation effect. Similarly, the indirect effect of message framing on WTR through reactance and attitude was also significant (b = 0.06; [SE] = 0.03; [CI] = [0.002–0.11]). These results suggested that the mediation of message framing's effect on WTR—whether solely through reactance or through the combined pathway of reactance and attitude—was moderated by concern for face. Specifically, as concern for face increased, the indirect effects of message framing on WTR increased, as mediated by reactance.

The results of Study 3 supported H2, showing that the effect of message framing on consumer WTR, mediated by psychological reactance and attitude, was moderated by concern for face. The summary of all studies' results is available in Table 1.

4. Conclusion and contributions

4.1. Conclusion

In summary, our studies suggest that the effect of message framing valence on reactance responses is not universal; rather, it depends on consumers' personality traits (i.e., promotion focus trait and concern for face). These boundary conditions contribute to resolving the inconsistencies in previous research regarding the relationship between message framing valence and psychological reactance (Nan et al., 2018), particularly from the perspective of self-image concerns. In contrast, the impact of psychological reactance on consumer attitudes toward the PSAs, and its subsequent effect on willingness to engage with further messages from the information provider, appears to be universal. These findings align with the well-established detrimental effects of psychological reactance on consumer attitudes and health-related behavioural intentions in other advertising contexts, such as vaccination and health risk communication campaigns (Kim et al., 2009), underscoring the importance of considering reactance generated by healthy food PSAs and the need to alleviate it.

4.2. Theoretical contributions

Our results offer several theoretical contributions. First, we contribute to explaining the mechanism of consumer resistance to healthy food advertising, thereby expanding the understanding of psychological reactance theory (Brehm, 1966; Miron and Brehm, 2006; Shen, 2015) within the context of health communication. While healthy food advertising research has primarily focused on the comparative positive impact of various message attributes in fostering favourable attitudes and shaping behavioural intentions (e.g., Choi et al., 2012; Kim et al., 2009; Sundar et al., 201), our research emphasizes consumer negative responses, such as psychological reactance. Message valence research in healthy eating is mostly grounded in prospect theory (Tversky and Kahneman, 1981), which explains that loss framing can be more motivating by increasing the perceived weight of health-related losses, and in turn, encourages consumers to follow message recommendations (Nan et al., 2018). However, some researchers have criticized over-reliance on prospect theory and called for alternative approaches to better explain the mechanisms at play (Nan et al., 2018;

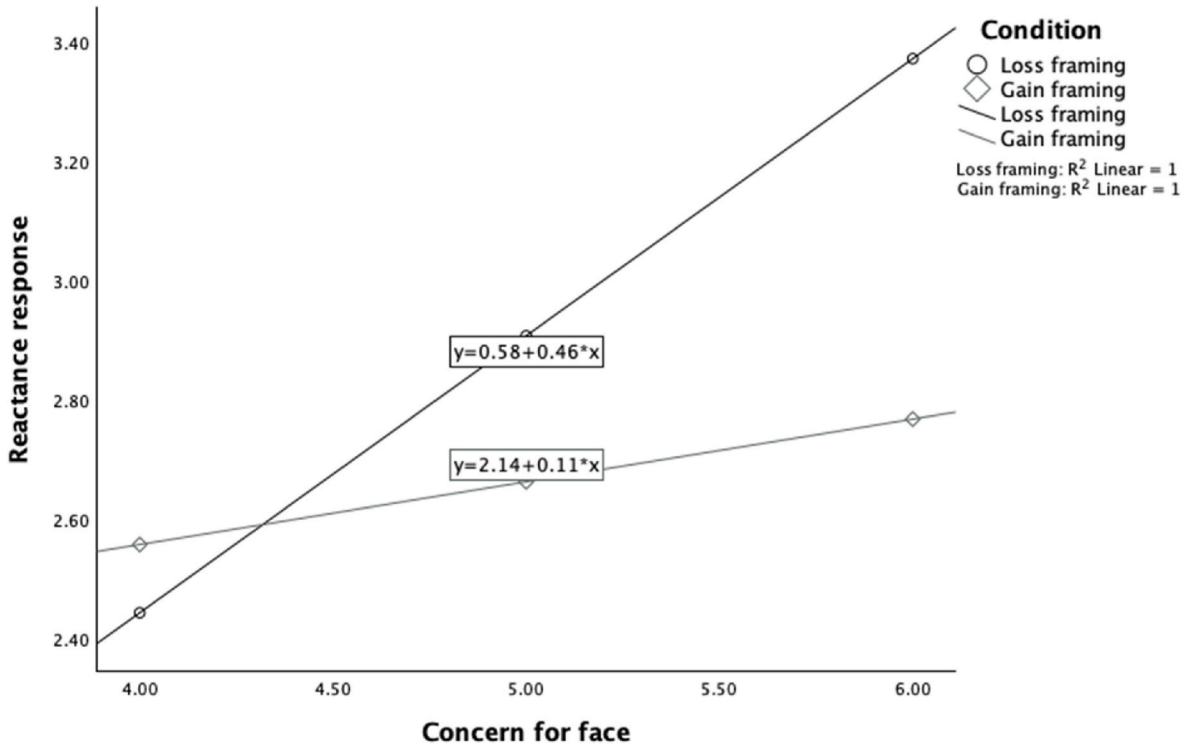

Fig. 4. Results of study 3.

Van't Riet et al., 2016). Our study addresses this criticism by investigating how psychological reactance, a relatively underexplored factor, explains the negative effects of gain versus loss framing on consumer responses to health messages.

Second, we apply self-affirmation theory (Steele, 1988) by demonstrating how personality traits related to self-image concerns moderate consumer negative responses (i.e., psychological reactance) to different framing types. While previous research has focused on the general impact of gain versus loss framing on consumer reactance (Nan et al., 2018), little attention has been given to the individual characteristics that may amplify or mitigate psychological reactance in response to these messages. We propose that personality traits associated with self-image concerns (Steele, 1988)—specifically lower promotion focus and higher concern for face—moderate the comparative effect of loss versus gain framing on reactance responses, such that individuals with these characteristics are more susceptible to reactance. By considering these individual differences, our study offers a more nuanced perspective on the mechanisms underlying reactance to health message framing.

Third, we contribute to research on promotion focus as a personality trait by demonstrating its protective role in preserving a positive self-image in response to loss framing. These findings highlight that the same trait is relevant both within the traditional regulatory focus framework as a function of motivation improvement and in the context of self-image maintenance as a function of resistance alleviation, thereby extending the scope of promotion focus research. Previous research on regulatory focus theory (Higgins, 1998) has shown that a fit between gain framing and a promotion focus, or loss framing and a prevention focus, strengthens consumers' motivation to maintain a healthy diet, ultimately encouraging the adoption of healthier eating behaviour (Shimul et al., 2021; Cesario et al., 2004; Lee and Aaker, 2004; Tam et al., 2010). The interaction effect between message framing (gain versus loss) and regulatory focus (promotion focus versus prevention focus) plays a focal role: individuals with a promotion focus consider the health messages as more persuasive and have higher intentions to eat healthier when exposed to gain framing messages, while individuals with a prevention focus show more favourable responses when exposed to loss framing messages (Cesario et al., 2004). In this research, we ruled out the parallel effect of regulatory fit by demonstrating that the fit between promotion focus and gain framing, or between prevention focus and loss framing, does not account for the reduction of negative responses (psychological response). On the other hand, beyond this fit mechanism, the promotion focus trait has also been associated with a more positive self-image evaluation, which in turn helps individuals achieve better outcomes in their objectives and tasks (Liu and Yao, 2019; Scholer et al., 2014). While past research has primarily examined how promotion focus enhances receptivity to gain framing messages (Cesario et al., 2004; Lee and Aaker, 2004), our study makes a complementary contribution by exploring how the promotion focus trait can act as a mechanism for self-image protection, mitigating the negative self-image effects triggered by loss framing messages.

Fourth, we contribute to the literature on concern for face (Chan et al., 2009) by examining the concept from the perspective of avoiding impairments to one's social image in food consumption contexts. Concern for face is composed of two aspects—motivation to gain face and to avoid losing face (Wang and Fu, 2020; Zhang and Cao, 2011). Li (2021) found that consumers with a higher concern for face are more inclined to purchase organic food, as this behaviour is considered to be face-gaining due to the moral prestige associated with organic products. While healthy eating behaviour is generally perceived as face-gaining (Watkins et al., 2022), exposure to loss framing messages that emphasize a consumer's failure to maintain a healthy diet or being unhealthy can result in a face-loss situation. Our hypothesis aligns with existing research on face-threatening situations, which suggests that consumers with a higher concern for face tend to show more negative responses to social failures (Chan et al., 2009) and embarrassing service situations (Qiu et al., 2018). Empirically, our study demonstrates that individuals with a high concern for face tend to show greater reactance when exposed to face-threatening conditions, specifically loss framing messages in our context.

5. Practical implications

Our findings provide valuable insights for promoting healthy eating in general, especially within the context of online retail, where consumers are increasingly exposed to health-related information and promotional messages through PSA feeds, online retail banners, product images, and other digital touchpoints. While retail research has largely focused on in-store strategies, such as in-store food preparation education (Steils, 2021), strategic food placement (Grandi et al., 2021; Perfetti et al., 2025), and the use of overweight imagery on menus (Otterbring and Shams, 2019), the growing importance of digital retailing calls for greater attention to online interventions. This research complements the previous research by examining the role of PSAs within the online retail environment. Specifically, we tested the typical communication content, messages that emphasize the importance of healthy eating, used by public health communicators (i.e., WHO, CDC), presenting it once or multiple times to simulate the potential frequency of PSA exposure in online retail settings. Our findings suggest that loss (vs. gain) framing messages are more likely to provoke consumer reactance, especially when the exposure is more frequent. This reactance response leads to less favourable reactions towards the PSAs. Over time, this could result in diminished effectiveness, with messages being filtered out by algorithm systems when applicable, and even potentially leading to consumer avoidance of the retail platforms (Wu et al., 2025).

Practitioners designing health communication must carefully consider how their messages will reach and engage consumers over time. Those whose continued exposure relies on consumer preference engagement, such as retailers and commercial advertisers, should limit the frequency of loss-framed messages in health product promotion. Overexposure to loss framing, especially among consumers with self-image concerns, could increase reactance, reduce engagement over time, and even result in consumer attrition. On the other hand, based on prospect theory (Tversky and Kahneman, 1981) and its extensive empirical research (Britwum and Yiannaka, 2019; Eguren et al., 2021; Garg et al., 2021), loss framing messages that emphasize the prevention of negative outcomes can sometimes be more effective in motivating consumers toward healthier behaviours. Therefore, practitioners who are less concerned with consumer attrition, such as governmental regulators and NGOs, whose messages often reach audiences through unavoidable channels like public boards, community announcements, or news, can more strategically employ loss framing when appropriate.

For health campaigns to be effective, it is essential to distinguish whether the primary objective is to encourage sustained behaviour change or to prompt a one-time decision. An appropriate balance between loss and gain framing is essential to leverage the motivational benefits of loss framing while minimizing potential consumer negative reactions. Concerns about consumer resistance are particularly critical when the success of advertising campaigns depends on sustained and long-term message exposure. For example, in healthy eating initiatives, the UN digital campaign for '#ActOnFacts' lasted 6 weeks (UNICEF, 2022), emphasizing the importance of ongoing engagement. On the other hand, in health advertising campaigns where success depends on a single decision rather than repeated exposure or long-term retention, such as one-time vaccination, advertisers may prioritize the motivational benefits of framing effects while placing less weight on potential message resistance.

Lastly, the findings offer valuable insights for health advertising by helping to tailor health messages more effectively to specific target audiences. Specifically, for consumers with a low promotion focus or a high concern for face, gain-framed messages may be more effective in reducing resistance and fostering positive engagement. Practitioners can measure consumer personality traits by incorporating image-concern relevant questions into consumer satisfaction surveys and analysing consumers' online browsing behaviour, such as mouse clicks, mouse movements, hover behaviour, and time spent on specific sections of the webpage (Ringbeck et al., 2019). These clickstream data can be systematically collected through platforms like Google Analytics and subsequently incorporated into computational models designed to infer personality traits. Moreover, with the growing integration of generative AI chatbots into the retail journey (Jan et al., 2023; Rahman et al., 2023), the machine learning models have the potential for predicting consumer personality traits based on consumers' interactions. For instance, consumer responses to AI chatbots reflect these personality traits, such that promotion-focused individuals are more receptive to chatbot recommendations, while prevention-focused individuals tend to emphasize potential risks (Khan et al., 2024; Kim et al., 2023b). By segmenting audiences based on these traits, advertisers can integrate psychological profiles into their targeting strategies, improving engagement and receptivity to the health messages.

6. Limitations and future research

Like other research, this study is not without limitations. Firstly, the message exposure stimuli in the experiment design are hypothetical scenarios (Kim et al., 2023a), which may not fully reflect real-world PSA placement in retail settings. Future research could consider using more realistic retail settings, such as incorporating PSAs on product images (TESCO, 2025), or conducting field studies to enhance ecological validity.

Secondly, our sample was primarily composed of online participants from the UK, with over 94 % of respondents from this country, limiting the generalizability of our findings. However, future studies should extend the research to include participants from other countries to better understand geographic differences, particularly in relation to public health communication exposure and the distinct healthcare systems (public vs. private) across nations. Consumers in countries with public healthcare systems may be more familiar with healthy eating PSAs, and as a result, could exhibit different reactance patterns.

Thirdly, we identified a small subgroup ($N = 12$) with high promotion focus scores who exhibited significantly higher reactance to gain framing (versus loss framing). Although these findings should be interpreted with caution due to the small sample size, future research could explore whether highly promotion-oriented individuals perceive gain framing messages as redundant or unhelpful, perhaps because they are already motivated to pursue healthier eating or have already adopted a healthier diet.

Moreover, our research context is limited to the context of health promotion. Future research could examine whether consumers respond differently to framing strategies across industries or product categories, such as luxury apparel, everyday groceries, or functional electronics, given that hedonic products like luxury apparel are often more closely tied to self-image than utilitarian goods. This stronger self-image association may also trigger greater resistance to loss framing messages, which might help explain why luxury advertising seldom employs loss framing appeals such as "Don't miss the chance to own this exclusive item."

Additionally, future research could analyse the moderating role of generative AI in shaping consumers' responses to gain and loss framing messages. On the one hand, GenAI can assist by tailoring messages to individual needs, such as adjusting the proportion of gain and loss framing messages when information overload is high (Kim et al., 2023a). On the other hand, the involvement of GenAI could also provoke consumer suspicion, privacy concern, and lead to greater resistance. For instance, Tsai et al. (2021) demonstrate that the emotional framing of chatbot-delivered vaccine messages can reduce persuasion impact.

Lastly, further studies could examine how communication interventions may help reduce psychological reactance in health messaging. For instance, while this research has examined how personality traits related to self-image concerns moderate consumer responses to messages, future studies could investigate whether self-image affirmation, for example, asking participants to reflect on their positive self-image before information exposure, can reduce resistance to face-

threatening messages. Moreover, although our study did not specifically test the impact of message attributes on reactance, descriptive comparisons between Studies 2 and 3 suggest that average psychological reactance scores may be lower when messages are more detailed, such as those emphasizing the consumption of adequate vegetables, than when they convey broader healthy eating messages. Future research could extend this work to examine these differences more systematically.

CRediT authorship contribution statement

Jun He: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Cinzia Calluso:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Carmela Donato:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Regis Thouvarecq:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Pierpaolo Iodice:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Investigation, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors report there are no competing interests to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jretconser.2025.104583.

Data availability

Data is available upon request from the corresponding autho

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