LUISS

Department of Business & Management

How marketing communication shapes consumer choices toward healthier foods

Prof. Cinzia Calluso.
SUPERVISOR

Prof. Regis Thouvarecq
SUPERVISOR

Ms. Jun He
CANDIDATE

Prof. Rumen Pozharliev
CO-SUPERVISOR

Prof. Pierpaolo Iodice
CO-SUPERVISOR

Academic Year 2024/2025

Acknowledgement

I would like to express my deepest gratitude to my thesis supervisors, Cinzia Calluso, Rumen Pozharliev, Regis Thouvarecq, and Pierpaolo Iodice, for their invaluable hands-on guidance, patience, kindness, and constant support in every possible way over the years.

Thank you, Cinzia. Thank you for bringing me the opportunity to have a double PhD and experience two different PhD lives, both in Italy and in France. Over the years, you have encouraged me, helped me, supported me, and nurtured me much more than a supervisor could. Your amazing feminine strength is both powerful and compassionate. I will always remember you sitting next to me, teaching me R code line by line to overcome my fear of programming, sharing your previous behavioral experiments with stars in your eyes, and showing me your struggles to tell me I'm not alone. Your constant reminder has been both empowering and comforting: do whatever you believe will be best for your career and future.

Thank you, Rumen. You helped me build my research capabilities from scratch and provided me with amazing learning opportunities. The constant research interactions with you have been enriching and rewarding. Working with you has been very cool; you have helped me develop my research tastes in pursuing exciting projects. You have always motivated me to go one step further than I thought I could and shown me the importance of taking timely action. I deeply appreciate the time and energy you have invested in me.

Thank you, Regis. You helped me to quickly feel at home in France and become a part of CETAPS. More than that, you guided me in the transition from being a student to becoming a researcher. Although we are not in the same field, you took the effort to understand my methodology, which helped bridge our interdisciplinary gap. Your support has been inspiring in helping me grow into both a more professional researcher and a kind person. While my graduation would definitely make you feel relieved (yeahhhh, no more questions), I know I will miss the times when you always had a solution for me.

Thank you, Pierpaolo. My 'everything can be solved' supervisor. Your calmness is truly remarkable. Whenever I felt I was in a stressful situation, whether the experiments didn't work, the visa never arrived, or the research process was slow, you were always calm and ensured me that there would be a solution. You have encouraged me to communicate in an increasingly direct

yet gentle manner, which has strengthened my coordination skills and leadership abilities. You broadened my way of seeing this world, understanding and adapting to cultural differences.

Thank you, my special unofficial supervisor, Professor Marco Francesco Mazzù. Collaborating with you has been a truly rewarding part of my PhD journey, marked by challenges, achievements, and personal growth. You have shown me what it means to pursue goals with professionalism and determination, and I have learned a great deal from your approach to managing projects with efficiency and clarity. Your trust in me has strengthened both my confidence and my capabilities, for which I am deeply grateful.

I thank Luiss University for giving me the opportunity to start this exciting journey and for providing me with a very structured training process. I would like to thank Professors Valentina Meliciani, Antonio Majocchi, and Fabian Homberg. The interview feels like yesterday; I still remember that Fabian asked me, “Why do you want to do research?" I replied because the research process is like a game, full of challenges and a lot of fun. The smiles from you made me feel quite assured, because I understood that you all had fun on your paths. After four years, I still find it a lot of fun, and more importantly, it is more meaningful than I thought it would be.

I thank Valentina Meliciani and Matteo De Angelis, our PhD directors, and the PhD office at LUISS, with special thanks to Francesca, Nina, and Gianluca, for your tolerance of my numerous emails and doubts, and for providing help throughout these four years.

I thank Olivier Sirost, our lab director, and the PhD office at CETAPS and the PhD school at the University of Rouen, with special thanks to Annie, Cloe, and Catherine, and many members I did not contact directly (Thanks to Regis and Pierpaolo again for the continuous coordination) for supporting my research activities and my stay in Rouen smoothly.

I would like to extend my sincere gratitude to all my wonderful co-authors: Matteo de Angelis, Richard Bagozzi, Adriana Madzharov, Angelo Baccelloni, and Carmela Donato. All your working styles have been inspiring examples for me. The concise comments you provided on the manuscripts, the cool ideas you proposed, your patient guidance during challenging moments, and your remarkable attention to detail have all enriched my PhD experience and shaped the way I approach research. This journey with all of you has been fruitful and exciting. I hope to carry forward some of your approach in my future endeavors.

Thank you, my amazing mentor Andrea Pelaez Martinez. You provide me with a new lens for seeing all the challenges as opportunities. You understand all my struggles and help with all that you can. If I ever become a confident researcher, it will be thanks to the early seeds of inspiration you planted in me.

Thank you, my fantastic mentor, JianChuan Luo. Thank you for bearing with my endless naïve questions and for always providing honest feedback and generous, genuine support. Your wise suggestions have always hit my point and motivated me overcome challenges.

Thank you, my writing lifesaver, Tanvi Mehta. Thank you for accompanying me through my dissertation writing process. You understand all my struggles as a Chinese writer, and I've learned so much from you. Thanks to your support, I find writing more and more enjoyable.

There are many more professors that I would like to thank, including Costas, Alice, Alesandro, Keith, Selin, Susan, Kelly, Puneet, Deniz, Zeynep, Francisco, and Gabrielle, for your instructive courses, mentoring sessions, insightful talks, advice, and help you have provided.

Thank you, Rui Jiang, for providing me with the opportunity to connect with food practitioners and many professors, and for offering me valuable suggestions on how to land collaborations more effectively.

Thank you, my PhD cohort from Luiss, Alexandra, Elisa, Gabrielle, Konstantin, Madhavi, and Nelly. This journey with all of you has been a lot of fun. We started the journey together and shared a lot of coffee time. While we conduct research in various fields, I always have someone to refer to whenever I have doubts about different methodologies. You have helped and impressed me in many aspects, including your competence in reading, writing, proofreading, and presentation, as well as your benevolence in warmly offering help and sharing your altruistic beliefs throughout your research.

Thank you, my lab mates from CETAPS: Gisele, Amine, Aya, Clement, Giorgia, Miloš, Inge, Guigui, and the cat troop. This journey with you has made the French rainy days in my memory also cute. You've opened my eyes to the world of behavioral research, with all the enthusiastic conversation about embodied decision-making, the cool behavioral experiments you have shown and explained to me (plus scooter fun learning session), the generous methodology and key literature list you shared, and the patient, detailed explanations you provided. We come from

such different backgrounds, but you are so generous in including me as part of your team. I also miss all the great mealtime (special thanks to Emma for the wonderful cupcakes) and gym moments we shared.

Thank you, my dear friends: Xiao Ming, for helping me overcome the most difficult period (lockdown) at the beginning of my PhD; Qiu Lin, for the joyful meals, exercise, study time, and a lot of deep talks we shared; Valerio, for showing me the Italian warmth and hospitality. I will always remember you guiding T08 colleagues walking around the city center, introducing us to everything about Rome, and helping us get involved in Rome. Thank you for always giving sincere and practical advice; Shima, my Asian tiger sister, for all the tasty gelato times together, for always encouraging me and pushing me toward a better version of me, for always giving me honest words and making me awake to face the reality; Evelyn, for telling me and behaving that 'Because you are human and we ought to help ourselves as human', for your amazing strength in overcoming difficulties; Onur and Turan, for all the calm talks and childish moments we shared, staying with you makes life look easier and more beautiful; Teja, for giving me all the timely and sincere advice like a brother; Martina, for all the sincere talks and advice that you give to me; Sai, my job hunting buddy, it's nice to share the difficult times together; Jia Qing, for instructing me towards the most clever move; Sai Ma, for listening to me and giving the most gentle comfort whenever I need; Yong chao, for our mutually inspiring friendship; Chen Nuo, for your trust and continuous cheers on me; Xiao Rui, for taking me to have fun with your friends together whenever I'm free and showing me how another life that I desire for works out; Xiao Yu, for being the greatest listener; Lu Xin, for providing me help whenever needed; You Wen, for all the medical advice from your parents and all the funny moments together. Thank you, my little cutie Italian sisters, Erichetta, Marilisa, and Fabrizia. You are like three little elves accompanying me through the last mile of my PhD journey and showing me authentic Italian lives. I'm a lucky Chinese girl to have been spoiled with all your amazing Italian homemade recipes and fantastic trips together.

Thank you, Michele, Giovanna, and the Torre family, for loving me from day one and embracing me into the family day by day. I feel at home when I'm with you. Special thanks go to Giacomo for showing off your Chinese Zia in school, which made me kind of proud; Olivia for teaching

me Italian with your cute primary school books; Sara, Matilde, and Letizia for enjoying Chinese songs together.

Thank you, my Davide. Your unconditional love and support are more than everything I ever wished for from this adventure in Italy. You are the magic that turns all my days into good ones. You are my stability in all the turbulence, my calm in every storm, my greatest support through every challenge, and will always be my best teammate in future adventures. I love you.

谢谢我的虎妈猫爸，贺满情和谭买容，你们俩的完美配合让我面对困难毫不退缩，达成小目标时不骄不躁，因为你们已经给我设定了下一个小目标。这些年虽然我离家很远，每年也是聚少离多，但网络一线牵，我们的心也随视频一直连在一起。谢谢我的宝贝奶奶，聂金娥，家有一老如有一宝，你是我们全家的幸运和幸福。谢谢我的爷爷，贺春芳，我相信你一直陪伴在我的身边，很多我的梦境，我的幻觉，我的幸运，也许就是你在引领和帮助我做对的事情。谢谢我的爱姐姐，贺莉，我最大的优点就是我有一个姐姐，我的每一步都离不开你无条件的支持，你支持我独立思考，不断试错，失败了就爬起来或者躺平又如何，你是我最大的底气。请你们和我一起继续看向下一个目标，吃好喝好睡好，一起做有意义有价值的事情，咱们一家老小向前冲，我爱你们。

Table of Contents

1. General Introduction

An unhealthy diet constitutes a major risk factor for numerous chronic diseases, such as cardiovascular disease—the leading cause of death globally (WHO, 2025a). These adverse health outcomes place a significant financial burden on society and deeply affect individuals and their families. The dominance of unhealthy products in food marketing creates a choice environment where healthier options are less visible and less appealing to consumers (Ikram et al., 2021; WHO, 2025b).

In response, policymakers, public health practitioners, healthy food marketers, and many other stakeholders have been actively engaging in healthy eating communication (Andrews et al., 2022; Van Royen et al., 2022). Marketing communication research similarly shows a rise in efforts to promote healthy food; indeed, healthy food communication practices have grown in number, and academic research on food communication has highlighted promising opportunities for promoting healthier eating patterns (Andrews et al., 2022; Chandon and Wansink, 2012; Van Royen et al., 2022).

Based on the American Marketing Association's (AMA) adapted definition of marketing, marketing communication can be understood as '*the activity, set of institutions, and processes specifically focused on communicating offerings that have value for customers, clients, partners, and society at large*' (AMA, 2025). The importance of marketing communication in shaping consumers' healthier food choices was exemplified by the collaboration between the National Cancer Institute in 1984 and Kellogg's–the iconic breakfast cereals company–which promoted dietary changes toward high-fiber, low-fat foods (Freimuth and Hammond, 1988). Specifically,

Kellogg's advertising practice has shown significant influence in shaping the food consumption system—raising consumer awareness of scientific findings on the relationship between diet and health, increasing sales of healthier foods (i.e., all-bran cereal), prompting individuals to seek guidance from health organizations, and encouraging competitors to develop and communicate healthier food alternatives.

Over the last three decades, the most widely studied marketing communication approaches of healthy eating remain food labeling research, followed by regulated disclosure of nutritional information and other healthy foods marketing communication practices, such as advertising (Silchenko et al., 2020). These studies have played a significant role in driving real-world transformations in healthy food marketing and public health communication, particularly by testing the relative effectiveness of different communication tools prior to their implementation, as well as evaluating the impact after use (Silchenko et al., 2020). For instance, one of the increasingly trendy topics in the food healthiness communication research is related to front-of-pack nutritional labeling, where researchers have shown how different types of front-of-pack nutritional labels can increase consumer attention to nutritional information, leverage a better understanding of product healthiness, and shape purchase intention (Ikonen et al., 2020). Similarly, advertising research explores various communication strategies—such as different framing valences (Nan et al., 2018) and types of motivational appeal (Samson et al., 2021)—to assess their effectiveness in fostering more positive evaluations of healthy foods and increasing consumer intentions to make healthier choices.

Building on prior research, this thesis adopts a diagnostic approach focused on key stakeholders within the context of healthy eating communication (Van Royen et al., 2022), with a particular focus on the close relevance between public policy and healthy food marketing (Andrew et al.,

2022). Specifically, this thesis comprises four empirical papers that trace the current marketing communication practices of healthy foods by policymakers (e.g., front-of-pack nutritional labels; food package information regulation), public health organizations (e.g., public service advertising), and healthy food marketers (e.g., advertising appeals). It critically examines current marketing communication practices, identifies the limitations and challenges that result in the ineffectiveness of healthy food persuasion, and explores alternative strategies for promoting healthy foods.

The first study unveils the mechanisms through which front-of-pack nutritional labels (FOPLs) may inadvertently become a part of conflicting nutrition information (CNI) (Nagler, 2014) and diminish the credibility and evaluation of sources that were designed based on scientific evidence, regulated by policymakers, and promoted for the purpose of consumer wellbeing (Canada.ca, 2025; European Commission, 2020; FDA, 2025). Across three experimental studies (N = 699), our findings show that directive FOPLs, when incongruent with other sources of nutrition information—such as external sources (e.g., scientific information about the product) or internal sources (e.g., consumers' prior knowledge about the product's healthiness)—can contribute to conflicting nutrition information. Such incongruence perception leads consumers to perceive the FOPLs as less credible and ultimately reduces consumers' attitudes and intentions to adopt FOPLs.

The second study reveals how public service advertising (PSA) that emphasizes the importance of healthy eating triggers consumer psychological reactance towards the messages that are intended to motivate consumers toward healthier food choices (NHS, 2022; USDA, 2024). Furthermore, the study also investigates how message framing interacts with individuals' traits, namely promotion focus and concern for face. Through three experimental studies (N = 701), our findings show that messages framed as loss, as opposed to gain, are more likely to elicit resistance among individuals who score low on the promotion focus trait or high on the concern for face trait.

This reactance response, in turn, leads to less favorable attitudes toward the PSA and a reduced willingness to engage with future messages from the same healthy food communicator. Beyond these findings, this research contributes to the literature by addressing a significant gap in the study of healthy food advertising literature (Web Appendix 1). Indeed, while prior work has largely emphasized the comparative advantages of different framing types in enhancing positive consumer evaluations, the role of consumer resistance in response to healthy eating communications has been relatively overlooked (Nan et al., 2018). This oversight is increasingly problematic in an era of highly personalized communication environments (Areeb et al. 2023), where consumers are more likely to receive content recommendations based on their personal preferences. In other words, if individuals avoid viewing, clicking, liking, or following healthy eating communication, such content would be less likely to be presented again in the future. By examining the conditions under which healthy eating messages trigger resistance rather than persuasion, this paper highlights the importance of incorporating negative consumer responses into models of health communication effectiveness. It encourages future research to further explore resistance and avoidance responses in the context of healthy eating communication.

The third study explores how psychological reactance can serve as a motivational state (Brehm, 1966) that empowers consumers to resist misleading information on food packaging, such as by spreading negative word-of-mouth about deceptive foods. This research builds on the findings of the second paper and explores how public health communicators unintentionally restrain consumers' perceived freedom of food choices. The authors note that psychological reactance has primarily been viewed as a response directed against 'virtuous agents'—figures like family members, policymakers, teachers, or healthy food marketers—who, while aiming to encourage healthier choices, may inadvertently threaten individuals' perceived freedom of food choices.

However, by revisiting the origins of psychological reactance theory (Brehm, 1966), this paper argues that reactance can also be triggered by 'villain agents.' In this context, food companies that use misleading information to present their products as healthier than they actually can be perceived as such villainous agents, as they attempt to manipulate and control consumer food choices. In such circumstances, reactance responses can be directed against the misleading information, hence favoring a healthier food consumption. Across three studies (N = 763), we report that persuasion knowledge about the misleading information, such as revealing the lying intention of the deceptive companies, is more likely to prompt consumers to spread negative word-of-mouth than health knowledge, such as information about the unhealthiness of the products. This effect is mediated by psychological reactance, which drives consumers to restore their perceived freedom of choice when it is threatened by food companies that carry misleading information. Furthermore, we examined the moderating role of the institutional endorsement and found that the presence of institutional cues significantly enhances the impact of health knowledge information, and therefore also calls for further involvement from policymakers in the communication stage.

The fourth study explores how social appeals can outperform other typical food communication appeals, such as healthy or tasty appeals, in the context of a particular food—insect-based food, which is sustainable, healthy, and considered a delicacy in some parts of the world. Still, it is barely accepted as a regular food choice in the Western food culture. This paper aims to understand the underlying mechanism of the ineffectiveness of typical marketing strategies on insect-based food and propose more effective communication approaches for such particular foods. Across four studies (N = 856), our findings demonstrated that social appeals, compared to sensory appeals or utilitarian appeals, can reduce consumer disgust more effectively, which is due to an increase in perceived normality of the insect-based foods. Moreover, the indirect effect of social appeals over

sensory appeals on consumer willingness to try insect-based food only manifests in the public context, not in the private context.

The food market can be seen as a battlefield, where unhealthy and healthy foods compete for consumer attention through a variety of marketing strategies. Historically, unhealthy foods have held the upper hand, while healthier alternatives have faced challenges in securing comparable visibility and appeal. This thesis seeks to investigate how marketing communication strategies can be leveraged more effectively to promote healthy food choices, hence contributing to the long-standing aspiration that the good may ultimately triumph over the bad—ideally, sooner rather than later. Table 1 below summarizes the four studies included in this thesis.

Table 1: Overview of the four studies.

Study	Main Research Question	Theory	Key Findings	Contribution to key stakeholders
Study 1: Unveiling the Impact of Front-of-Pack Nutritional Labels in Conflicting Nutrition Information – A Congruity Perspective on Olive Oil	This research aims to investigate whether Front-of-Pack Labels (FOPLs) contribute to conflicting nutritional information, to identify which types of FOPLs (non-directive vs. directive) are more likely to be involved in such conflicts, and to examine the underlying mechanisms	Congruity theory	The exposure to directive FOPL, when compared with consumer pre-existing knowledge or scientific information, generates conflicting nutrition information, while non-directive FOPL does not. Compared to the non-directive FOPL, directive FOPL leads to a reduction of perceived congruence when combined with pre-existing knowledge in mind or scientific evidence. This decreased congruence will then affect perceived credibility,	The study's results have implications for policymaking, in particular, policymakers should be cautious of involving in contributing to conflicting nutrition information.

	driving these effects.		attitude, and adoption intention towards the FOPLs.	
Study 2: Framing Health: Understanding Consumer Resistance to Gain and Loss Messages	This research aims to explore why loss framing, compared to gain framing messages, either significantly increases psychological reactance or has no effect. We propose that this inconsistency may be attributed to variations in consumer personality traits, particularly the extent to which individuals feel compelled to maintain their self-image.	Psychological reactance theory	Across three experiments, we found that loss framing, compared to gain framing messages, increases psychological reactance among individuals with a lower promotion focus trait and among individuals with a higher concern for face. This increased psychological reactance leads to a less favorable attitude towards the messages, which, in turn, results in a lower willingness to receive further information from the content provider.	The study offers insights for public health communication. Specifically, health communicators, such as public health communicators (e.g., WHO, NHS), healthy food advertisers, should be cautious about consumer resistance towards messages, particularly among those who are susceptible to self-image concern.
Study 3: Turn Anger into Action: How Persuasion Knowledge Activation Outperforms Health Knowledge Intervention —the Empowering Mechanism of	Our research focuses on how different types of knowledge about misleading information on food packages activate varying motivational state (i.e., reactance	Psychological reactance theory	Our findings show that communicating persuasion knowledge (i.e., revealing the lying intention behind misleading information), compared to health knowledge (i.e., revealing the unhealthiness of seemingly healthy foods with misleading information), is either more effective or	The study contributes to understanding effective public health education. Policymakers, educators, NGOs, food advocates (e.g., Food watch, food advocacy groups etc.) could consider

Psychological Reactance	response). This, in turn, leads to increased negative word-of-mouth.		equally effective in directly increasing consumer NWOM, or indirectly increasing NWOM intentions through anger and counterarguing.	using stronger language to trigger consumer reactance response and achieve more effective communication.
Study 4: How Social and Sensory Appeals Shape Aversion in Diverging Ways Toward Insect-Based Food.	This research aims to examine the relative effectiveness of social, sensory, and utilitarian appeals in reducing consumer disgust toward insect-based foods, with a focus on whether socially driven appeals outperform other strategies in shaping attitudes toward entomophagy.	Socially constructed disgust.	We found that hedonic (vs. utilitarian) appeals and social (vs. sensory) appeals are more effective in decreasing consumers' perceived disgust toward insect-based food. Moreover, social (vs. sensory) hedonic appeals mitigate consumers' disgust toward insect-based food in public, but not in private settings. Furthermore, social (vs. sensory) hedonic appeals decrease perceived social norm deviation, which decreases perceived disgust, which in turn increases consumers' attitude and willingness to try insect-based food.	The results have implications for advertising, particularly in the promotion of insect-based foods. Advertisers should leverage social appeal as a strategic approach to alleviating consumer disgust toward insect-based foods.
General Conclusion	The thesis aims to identify the barriers that prevent consumers from achieving healthy eating and to explore solutions to overcome them.	A multi-theoretical framework explains how marketing communication shapes consumer responses to healthy eating.	Taken together, the four papers demonstrate that consumer responses to health-related food messages are shaped by the interplay between message design, individual traits, and underying psychological mechanism, such as	Overall, this thesis offers implications for a wide range of healthy eating stakeholders, including policymakers, public health communicators, educators,

			cognitive responses and emotional reactions.	NGOs, and advertisers.

2. Study 1: Unveiling the Impact of Front-of-Pack Nutritional Labels in Conflicting Nutrition Information – A Congruity Perspective on Olive Oil.[1]

Abstract

The increasing awareness of the importance of healthy eating has prompted consumers to gather nutritional cues from various sources, often resulting in conflicting nutrition information for the same food. This conflicting information can lead to unintended consequences, such as decreased consumer interest in dietary information and even behaviors contrary to general health recommendations, especially when the conflicting sources are perceived as highly credible.

In a series of three experiments, we aim to uncover the underlying cognitive mechanisms connected to complementary information provided by Front-of-Pack Nutritional Labels, exploring if conflicting nutrition information is generated when consumers integrate the labels' information with other sources. Using olive oil as a case of products associated with conflicting nutrition information, Experiment 1 shows that directive labels (e.g., Nutri-Score) generate conflicting nutrition information when combined with either internal entities (i.e., consumers' pre-existing health knowledge) or external entities (i.e., health knowledge from scientific information). In contrast, non-directive labels (e.g., NutrInform Battery) do not, in either condition. Experiment 2 explains that consumers establish a lower level of congruence between information provided by

[1] Study 1 has been accepted in *Food Quality and Preference*. Acknowledgements and Author Contributions: MM: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. JH: Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Formal analysis, Data curation, Conceptualization. AB: Writing – review & editing, Visualization, Validation, Software, Investigation, Formal analysis, Conceptualization.

the internal entity and Front-of-Pack Nutritional labels when the label is directive. Experiment 3 confirms a lower level of congruence between the information available from the external entities (i.e., scientific information) and Front-of-Pack Nutritional labels when the label type is directive, compared to non-directive. Furthermore, this diminished congruence has a significant negative impact on consumer attitudes and their intentions to adopt Nutritional Labels.

Overall, this research delves into the interactions among various information sources from a congruence perspective, offering actionable insights for managers and policymakers to avoid becoming entangled by conflicting nutrition information.

Keywords: Front-of-Pack nutritional labels, Olive Oil, NutrInform Battery, Nutri-Score, perceived congruency, perceived credibility, conflicting nutrition information.

2.1. Introduction

A survey involving 8,000 participants from the US, UK, France, and Germany revealed that half of the respondents take healthy eating as a top priority to improve their health (Grimmelt et al, 2022). In practice, consumers turn to various sources to seek nutritional information (Vijaykumar et al., 2021; Feick et al., 1986), often coming across conflicting messages that offer non-uniform guidance on whether to consume or avoid a specific food item (Nutraceuticals World, 2017). Conflicting Nutrition Information (CNI) may involve not only misinformation, but also conflicting nutrition opinions about a particular food – especially regarding the balance between its potential risks and benefits (Spiteri Cornish and Moraes, 2015; Nagler, 2014).

Recent studies raised concerns about the detrimental impact of different nutrition-relevant information on consumer healthiness as their variety might generate confusion (Hong 2023; Ngo

et al., 2023; Nagler *et al.*, 2022) and even lead to unhealthy dietary decisions (Vijaykumar et al, 2021). Moreover, research suggests that when this conflicting nutrition information has a greater impact when originates from trusted sources – such as health professionals -, compared to when it is encountered on social media or health websites (Vijaykumar et al., 2021).

When confronted with credible sources displaying contradictory information, consumers might devalue the credibility of scientific information by perceiving it as uncertain and showing negative attitudinal responses (Chang 2015), sometimes leading to lower trust and interest in scientific health information (Lyons et al., 2020). This carryover effect might lead to backlash against general healthy recommendations and behavior, such as decreased vegetable consumption and exercise due to the belief that "*scientists don't really know which foods are good for you*" (Vijaykumar et al, 2021; Hong 2023; Ngo et al., 2023). Hence, prior studies have emphasized two important research directions: i., nutrition promotion initiatives should consider the complex effects of conflicting nutrition information when providing consumers with dietary recommendations (Ngo et al., 2023), and ii., the need for additional research to investigate how consumers cognitively process and integrate conflicting information (Carpenter et al., 2016).

A currently unexplored credible source of conflicting information is Front-of-Pack Nutritional Labels (FOPLs), whose effects have primarily been examined in previous research for their positive impact, and mostly in isolation (Dubois et al., 2021; Grunert & Wills, 2007). Placed on products both in-store and at home, FOPLs remain constantly visible to consumers, subtly shaping their preferences (García-Madariaga et al., 2019), and with the potential to continuously interact with other consumers' sources of information.

The present work – focusing on products subject to CNI which are culturally relevant in some traditional diets, such as olive oil in the mediterranean diet – aims to understand under which

conditions information from various types of FOPLs might generate CNI. In recent years, olive oil has been, on the one side, categorized as negative by some Labels (e.g., Nutri-Score C or D) and considered negative nutrient due to its high calorie attribute (Ihekweazu, 2023). On the other side, olive oil is classified as a positive nutritional element containing essential nutrients (Pichierri *et al.*, 2021; Fletcher, 2019) associated with health benefits when consumed regularly and in moderation, such as decreasing the risk of cardiovascular diseases (Donat-Vargas *et al.*, 2022), helping in preserving kidney function (Podadera-Herreros *et al.*, 2022), and aiding in weight loss (Galvão Cândido *et al.*, 2018). In daily practices, the internet has presented consumers with conflicting claims about the benefits and risks of dietary oils (Harvard Health, 2020; Crosby, 2018).

In order to understand how FOPLs information becomes entangled in CNI, this research draws upon congruity theory (Maille and Fleck, 2011; Rokeach and Rothman, 1965; Osgood and Tannenbaum, 1955), exploring a set of nutritional information available to consumers. More specifically, the aim is to investigate how the interaction between different types of FOPLs and other sources of information, such as pre-existing internal health knowledge and external scientific input, affects consumers' cognitive processing. Congruity theory suggests that neutral information is more easily assimilated when faced with directive judgments (Osgood and Tannenbaum, 1955). However, when two different stimuli represent opposing arguments, both serving as directive judgments, the combined configuration gives rise to conflicting information, leading to consumer cognitive compromise (Osgood and Tannenbaum, 1955). In the context of conflicting nutrition information, this cognitive compromise echoes the negative attitude towards the corresponding nutritional sources and general backlash towards healthy behavior mentioned above (Hong 2023; Ngo *et al.*, 2023; Chang, 2015).

Following the current EU taxonomy, we differentiated FOPLs based on their directiveness (EU Commission, 2021). We utilized the NutrInform Battery to represent neutral and non-directive FOPLs, providing consumers with neutral and factual nutrient information, without directive cues, and Nutri-Score to represent *directive* labels, which include specific instructive cues such as colors or stop signs aimed at shaping food healthiness perceptions. These labels often summarize the "healthiness" of a product without displaying detailed nutritional information (EU Commission, 2021).

Our results suggest that, when combined with another entity, directive labels produce conflicting nutrition information, whereas non-directive labels do not. In terms of underlying mechanisms, the current findings show that directive labels, compared with non-directive labels, result in a lower level of congruence when paired with either internal or external nutritional information. This reduced congruence leads to consumers perceiving the information provided by the nutritional labels as less credible, further decreasing consumers' willingness to use FOPLs in the future.

Theoretically, this research advances knowledge related to the creation mechanisms of CNI, employing the comparative framework of congruity theory (Maille and Fleck, 2011) to test the effects of information provided by different typologies of FOPL in interactions with other internal or external nutritional information sources. Moreover, within the context of the "From-farm-to-fork" strategy, it offers managers and policymakers a perspective regarding the differential effects of generating CNI from different FOPLs and insights to select credible sources that consumers can continuously rely on in resolving conflicting nutrition information.

2.2. Theoretical Background and Hypothesis Development

2.2.1. Conflicting Nutrition Information

Conflicting nutrition information (CNI) is defined as the co-existence of contradictory information about eating the same food and the potential distinct outcomes the specific food may bring (Ihekweazu, 2023; Nagler, 2014). The formation of CNI is due to the presence of information in multiple sources (Ngo *et al.*, 2023; Spiteri Cornish and Moraes, 2015), such as social media, mass media (e.g., TV, newspaper), government health communication, and scientific reports, as well as those derived from Front-of-Pack Nutritional Labels. In this landscape, misinformation and advocative statements might be present (Ngo *et al.*, 2023; Spiteri Cornish and Moraes, 2015); for example, non-registered dietitian bloggers might provide conflicting and non-evidence-based nutrition proposals on social media to advocate for nutrition-based alternatives against conventional medicine to attract public attention and gain commercial benefits (Chan *et al.*, 2020).

However, conflicting nutrition information is not necessarily misinformation when evidence-based contexts are clarified so that consumers can believe in conflicting information at the same time (Ihekweazu 2023). Exposure to CNI generates consumer negative cognitive perceptions, such as a decrease in cognitive acuteness and accuracy (Barnwell *et al.*, 2022), an increase in nutritional confusion (Ngo *et al.*, 2023; Hong 2023), and perceived ambiguity (Ahn and Kahlor, 2022). In turn, consumers might form a belief that scientists keep changing opinions (Nagler, 2014) and therefore devalue the credibility of media and scientific information, perceive scientific information as uncertain, and show negative attitudinal responses (Nagler *et al.*, 2022; Chang 2015). Moreover, the confusion about the nutritional information might lead to nutritional backlash in the form of decreased consumer intention to follow professional guidance (Lyons *et al.*, 2020) or reduction of vegetable consumption and exercise (Hong 2023; Ngo *et al.*, 2023; Nagler *et al.*,

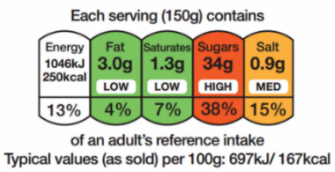
2022; Nagler, 2014). Interestingly, Vijaykumar et al (2021) reported that CNI from health professionals increases backlash while the social media involved in CNI do not result in a backlash effect. This might be due to the disregard of non-credible information from social media and the increased cognitive processing of credible information from health professionals (Ngo et al., 2023; Hong, 2023). Consequently, researchers highlighted the importance of considering the complex backlash effects of CNI exposure when policymakers design dietary recommendations (Ngo *et al.*, 2023).

2.2.2. Front-of-Pack Nutritional Labels as a Component of Conflicting Nutrition Information

Front-of-Pack Nutritional Labels provide consumers with nutritional information on the front of the food package, with the aim of making the nutritional content more salient and understandable (Newman *et al.*, 2018). According to the European Union taxonomy (EU Commission, 2021), FOPLs are classified by the level of their directive guidance (Hodgkins *et al.*, 2012) (Table 2).

Table 2 – Front-of-Pack Labels Taxonomy

Taxonomies		Examples
Non-directive: Front-of-Pack Nutritional labels that include information elements only, such as nutrient names, grams, and percentages.	• **Numerical Labels**: non-interpretative (non-evaluative) labels, providing numerical information on the content of four nutrients (fat, saturates, sugars, salt) and on the energy value, as well as on how much this represents as a percentage of the daily reference intake	• **NutrInform Battery** 

Semi-directive: Front-of-Pack Nutritional labels that include nutritional information and are complemented by evaluative elements such as specific colours according to nutrient levels.	• **Colour-Coded Labels**: labels providing numerical information on the content of four nutrients (fat, saturates, sugars, salt) and the energy value, as well as on how much this represents as a percentage of the daily reference intake. Colours are used to classify those nutrients as "low" (green), "medium" (amber), or "high" (red)	• **Multiple Traffic Light** 
Directive: Front-of-Pack Nutritional labels that include the least amount of information, often aggregated in one symbol or icon.	• **Endorsement Logos**: labels providing a synthetic appreciation of a product's overall nutritional value through a positive (endorsement) logo that is applied only to foods that comply with nutritional criteria	• **Keyhole logo** 
	• **Graded Indicators**: labels providing a synthetic appreciation of a product's overall nutritional value through a "graded indicator" that provides graded information on the nutritional quality of foods that is applied on all food products	• **Nutri-Score** 

Source: Adapted from Storcksdieck *et al.* (2020).

The advocacy for a harmonized Front-of-Pack nutritional labeling system – recently recommended as a mandatory directive by the European Commission – aims to ensure consistent provision and accessibility of nutritional information to consumers across the EU (European Commission, 2021).

The standardization of FOPLs underscores the necessity for policymakers to address potential adverse ramifications, as these labels may introduce conflicting nutrition information (Vijaykumar et al., 2021). Nevertheless, existing literature predominantly concentrates on established sources of Consumer Nutrition Information such as television, social media, and scientific reports (Ngo et al., 2023; Vijaykumar et al., 2021; Nagler et al., 2014) while neglecting the upcoming mandatory FOPLs as a potentially widespread source of CNI.

CNI essentially arises from diverse information that suggests the contradictory health outcomes of a particular food or nutrient (Ihekweazu, 2023; Nagler, 2014). In this context, while the independent use of the FOPLs as extrinsic stimuli in changing consumer perceptions of the pack is widely studied, limited attention has been given to how different nutrition information interacted with different types of Nutritional labels (Mauri et al, 2021; Ikonen et al, 2020). In fact, FOPLs serve not only as nutrition information per se but might help make sense of conflicting information toward healthier food decisions. In this respect, they should be considered a full part of the information system available to customers when assessing the healthiness of a specific food.

Therefore, in the context of FOPL exposure, the potential difference in perceived healthiness between the information exposure of a product without a label and the same condition with added labeling indicates the potential for CNI arising from the label.

Prior investigations have demonstrated that diverse FOPLs elicit varying degrees of perceived healthiness when attached to identical food items (He et al, 2023; Pettigrew et al, 2022; Ikonen et al., 2020; e.g., Newman et al., 2014; Andrews et al., 2011). Notably, findings from a meta-analysis (Ikonen et al., 2020) indicate that the directive labels might alter the perceived healthiness of food, while non-directive FOPLs do not. These outcomes suggest the emergence of directive FOPL exposure as an integral component of CNI. Consequently, we posit the following hypothesis:

H1: Directive (vs. non-directive) FOPL leads to the generation of CNI, as indicated by the deviation (vs. absence) in the perceived healthiness of the product with the presence of the FOPL compared to the condition without FOPL.

2.2.3. The Underlying Mechanism of the Generation of CNI: Healthiness Perception Congruence

Congruence is defined as "two information entities going well together" (Maille and Fleck, 2011; Osgood and Tannenbaum, 1955). Entities can be either external (e.g., media, website information) or internal information (e.g., the schema in mind, self-conception); in the context of food consumption, the external entities can be associated with information channels (e.g., FOPLs scientific media) -, while internal entities are related to consumer previous knowledge.

The congruity theory (Osgood and Tannenbaum, 1955) offers a useful framework for explaining the emergence of CNI, particularly in contexts involving exposure to multiple information sources. Specifically, the congruence level is high when different pieces of information align. However, when the information is contradictory, the congruence between the two pieces decreases. Notably, neutral sources that avoid explicit judgments facilitate congruence with other presented sources.

In the context of FOPLs (Storcksdieck et al., 2020), our proposition posits that directive labels will result in a diminished perceived congruence relative to other explicit entities (e.g., scientific knowledge, prior health perceptions of the food). This effect is particularly pronounced in situations where existing health knowledge is present and conflicting, exemplified by the case of

olive oil. In contrast, non-directive labels, such as the NutrInform Battery, serving as neutral entities for judgment, are more likely to exhibit congruence when compared to other explicit entities like scientific knowledge and prior health knowledge present in the consumer's mind, especially in comparison to directive labels like Nutri-Score. Hence, it is hereby hypothesized:

H2: Directive (vs. non-directive) FOPLs lead to a reduction level of perceived congruence when compared with another directive entity.

2.2.4. Perceived Credibility, Attitude, and Adoption Intention Towards the FOPL

Perceived credibility of nutritional information by consumers is represented by their personal subjective perception of how believable the information is - a critical element in shaping their attitudes and consequent health behavior (Jeong and Jang, 2017; Chang 2015; Metzger and Flanagin, 2015). Previous studies have shown that credibility enhances the perceived usefulness of the information and facilitates consumer decision-making (Mazzù et al., 2023b; Flavián et al., 2023; Jaeger and Weber, 2020). When the perceived credibility of the information is low, consumers do not believe in the sources and avoid the exposure to relevant information (Chang 2015). In fact, according to the truth-default theory (Levine, 2014), individuals tend to naturally assume that the information communicated by others is credible. However, the message's credibility is undermined when there is a lack of coherence in the message content or a mismatch between the communication and existing knowledge of reality.

In the context of nutritional labels, Garretson and Burton (2000) revealed that when consumers perceive incongruity between health claims and nutritional labels concerning the fat content and its corresponding perception of healthiness, they tend to perceive the health claims as lacking

credibility. However, this incongruence does not appear to trigger credibility concerns regarding Nutritional Labels. This observation could be attributed to the inherently promotional nature of health claims, making them less credible.

Moreover, Sicillia et al. (2023) recently reported that the condition where FOPL and credible influencer convey incongruent content, this leads to a reduction in consumers' perceived credibility of FOPL. On the contrary, under congruent conditions, the influencer content seems to amplify the credibility of FOPLs.

To this end, in the present paper, we hypothesize that incongruence between FOPLs and other nutritional informational sources devoid of commercial interests could impact the perceived credibility of the Front-of-Pack Nutritional Labels. Specifically, a higher perceived congruence between FOPLs and non-commercial entities, either scientific knowledge (represented as an external entity) or consumer pre-existing nutritional knowledge (represented as an internal entity) will lead to higher consumer credibility perceptions of the information provided by FOPLs. In turn, a higher perceived credibility of FOPL will generate a more positive attitude toward the label itself, as well as a greater adoption intention of the label. This encompasses utilizing the label for food purchases and intending to recommend its use to friends for food purchases. Hence, we formulate the following hypothesis.

> *H3: a reduced perceived congruence between nutritional information about olive oil from FOPLs and another entity will lead to lower perceived credibility of the information provided by the FOPL, which in turn reduces consumer attitude towards the FOPL and intention to adopt FOPL as a reference for nutritional information.*

To test our hypothesis, we developed a series of three studies (Figure 1)

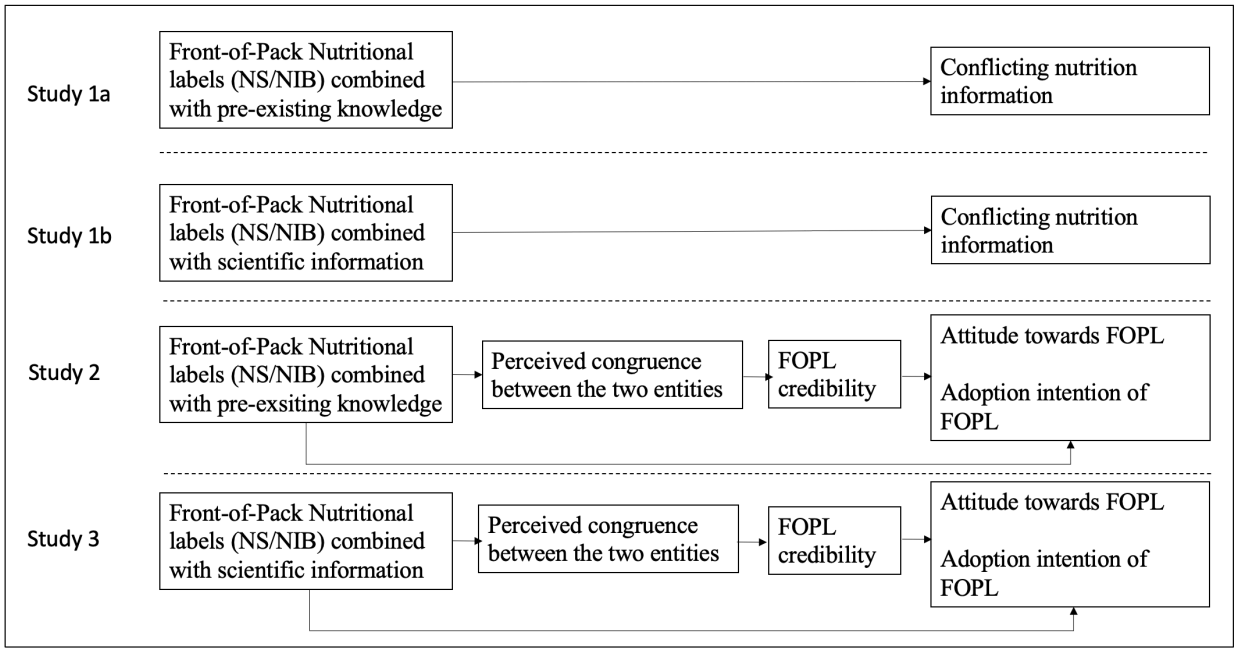


Figure 1 - Conceptual model and series of studies

Specifically, in Experiment 1a, we first tested H1 by assessing whether exposure to different types of FOPLs (namely, Nutri-Score and Nutrinform Battery) leads to the activation of CNI when consumers integrate label information with the internal entity (i.e., consumer knowledge about the healthiness of olive oil) and, in Experiment 1b, an external entity, as the scientific knowledge about the healthiness of olive oil. In Experiment 2, we tested H2 and H3 by examining the underlying mechanism and the outcomes of the entanglement of FOPLs as part of CNI in the context of combining with the internal entity presented by congruence perception, perceived credibility, and acceptance of the front-of-pack nutritional labels. In Experiment 3, we tested H2 and H3 again by examining how the combined and contemporary exposure of individuals to different types of FOPLs and the external entity leads to the activation of CNI. We also explored the consequences of CNI by exploring perceived congruence, the credibility of nutritional information, attitude, and adoption intentions towards the FOPLs.

2.3. Experiment 1. Effects of Exposure to Front-of-Pack Nutritional Labels

2.3.1. Experiment 1a: The Emergence of CNI From the FOPL Exposure When Compared with Consumer Nutritional Knowledge about Olive Oil.

2.3.1.1. Methods

We conducted a between-subject preliminary test to determine whether the exposure to FOPLs generates varying levels of CNI, measured by the deviation of consumer perceived healthiness (Ares and Gámbaro, 2007) from the condition where no FOPL is present. 210 participants (M_{age} = 36.43, SD = 8.79, 35.7% female) were recruited through the Prolific platform in exchange for a nominal payment from European Union EU countries, except for France, Germany, Belgium, and Luxembourg that have widely adopted the Nutri-Score. Participants were shown one of the three conditions (i.e., Nutri-Score, NutrInform Battery, No FOPLs) attached to the same olive oil package. Next, participants had to indicate on a 7-point Likert scale the extent to which they perceive the olive oil as healthy, based on Ares and Gámbaro (2007) scale (Appendix A).

2.3.1.2. Results and Discussion

The results show the consumer perception of the healthiness of olive oil when exposed to Nutri-Score (M_{NS} = 4.67, SD_{NS} = 1.09), NutrInform Battery (M_{NIB} = 5.63, SD_{NIB} = 0.98), and No FOPLs ($M_{Control}$ = 5.70, $SD_{Control}$ = 1.24). An Oneway ANOVA test confirms the deviation of the perceived healthiness between the three groups ($F(2, 209) = 18.78$, $P < 0.01$).

We then conduct Levene's test and confirm the assumption of homogeneity of variances (Levene's Statistic = 0.28, $p = 0.76 > 0.05$). The Post Hoc analyses via the Tukey method test the mean deviation of FOPLs exposure from the control group and report that $Mean_{(Control-NS)}$ = 1.03, p

< 0.01, suggesting that consumer perceived healthiness is deviated from the general consumer existing knowledge about olive oil when they are exposed to directive labels (i.e., Nutri-Score); $Mean_{(Control-NIB)} = 0.07$, $p = 0.92$, suggesting that consumer perceived healthiness are not deviated from the general consumer existing knowledge about olive oil when they are exposed to non-directive labels (i.e., NutrInform Battery).

As a result, experiment 1a confirms H1. Specifically, the results suggest that, in the case of olive oil, the exposure to directive FOPL, when compared with consumer pre-existing knowledge, generates CNI regarding the healthiness of the product, while non-directive FOPL does not.

2.3.2. Experiment 1b. The Emergence of CNI From the FOPL Exposure When Paired with Scientific Nutritional Knowledge about Olive Oil.

2.3.2.1. Methods

We conducted a similar between-subject preliminary test to confirm whether the contemporary exposure to FOPLs and scientific information generates varying levels of conflicting nutrition information. We then measured the deviation of consumer perceived healthiness (Ares and Gámbaro, 2007) from the condition where only scientific information is present. 207 participants were recruited ($M_{age} = 36.80$, SD = 8.52, 63.8% male, 35.3% female, 1% non-binary) from the European Union, excluding countries already adopting Nutri-Score as France, Germany, Belgium, and Luxembourg, through Prolific in exchange for a nominal payment. Participants were shown one of the three conditions attached to the same olive oil (i.e., Nutri-Score combined with scientific evidence, NutrInform Battery combined with scientific evidence, and scientific evidence alone).

Next, participants had to indicate on a 7-point Likert scale the extent to which they perceived the olive oil as healthy.

2.3.2.2. Results and Discussion

The results report the consumer perception of the healthiness of olive oil when exposed to Nutri-Score combined with scientific evidence ($M_{NS} = 5.00$, $SD_{NS} = 1.21$), NutrInform Battery combined with scientific evidence ($M_{NIB} = 5.58$, $SD_{NIB} = 0.87$), and the control group that provides scientific evidence alone ($M_{Control} = 5.94$, $SD_{Control} = 1.10$). An Oneway ANOVA test confirms the deviation of the perceived healthiness between the three groups ($F(2, 206) = 13.10$, $p < 0.01$).

We then confirmed the assumption of homogeneity of variances (Levene's Statistic = 1.78, $p = 0.17$). The Post Hoc analysis via the Tukey method reports the mean deviation of the combination of FOPL and scientific evidence from the control group Mean $_{\text{(scientific evidence alone-NS with scientific evidence)}} = 0.94$, $p < 0.01$, suggesting that consumer perceived healthiness of olive oil deviates from scientific evidence alone when they are exposed to a combination of directive labels (i.e., Nutri-Score) and scientific evidence. In contrast, when consumers are exposed to a combination of non-directive labels (i.e., NutrInform Battery) and scientific evidence, there's no significant deviation in consumer perceived healthiness from the healthiness perception of olive oil indicated by scientific evidence alone Mean $_{\text{(scientific evidence alone-NIB with scientific evidence)}} = 0.36$, $p = 0.13$.

As a result, experiment 1b confirms H1. Specifically, in the case of olive oil, the results confirm that directive FOPL, when combined with the external entity (i.e., scientific evidence), generates CNI regarding the healthiness of the product. In contrast, the non-directive FOPL does not generate CNI when combined with the same external entity.

2.4. Experiment 2. The Underlying Mechanism of Consumer Response to FOPL When Compared with Consumer Nutrition Knowledge.

We then explore the underlying mechanism and the outcome of CNI by investigating how different types of FOPLs (i.e., directive vs. non-directive FOPL), when engaged with the pre-existing nutritional knowledge of olive oil, shape congruence perception, credibility, attitudinal and behavioural responses.

Stimuli and measurement scales

We utilized a real package of an olive oil product, removing all branding elements to avoid potential bias toward the specific brand, and virtually stickering FOPLs in a visible part of the pack. Following official guidelines, we paid attention to generating FOPLs specific to the olive oil product. Nutri-Score was selected as representative of the directive label and the NutrInform Battery as representative of the non-directive ones, as they are at the center of the policy-making debate at the EU level, relevant for the "From Farm to Fork" strategy and belong to the polarizing extremes of the European taxonomy. Except for the types of FOPLs, stimuli remained uniform in the conditions with the Nutri-Score and the NutrInform Battery.

In terms of measurement, we used pre-validated scales from extant literature (Appendix A), measured with a 7-point Likert scale.

2.4.1. Methods

We conducted an online experiment with a sample of 143 participants (M_{age} = 36.48, SD = 8.81, 62.2% male) recruited through the Prolific platform. Respondents were informed that the experiment is about an assessment of consumers' responses regarding food FOPLs, and participants were randomly assigned to one of the two tested conditions (i.e., Nutri-Score and NutrInform Battery). Participants were asked to engage in evaluation tasks, utilizing their pre-existing nutritional knowledge about the healthiness perception of olive oil accompanied by one FOPL.

We measured participants with the same scale as Experiment 1, which confirmed their reliability for perceived congruence (α = .79), perceived credibility of FOPLs (α = .87), and attitude towards the FOPLs (α = .95), and adoption intention towards FOPLs (α = .89).

2.4.2. Results and Discussion

Based on our comparative analyses, Nutri-Score showed significantly lower values than NutrInform Battery in terms of *Perceived congruence* (M_{NIB} = 5.25, SD_{NIB} = 0.96 vs. M_{NS} = 3.97, SD_{NS} = 1.03, t (141) = 7.68, p<0.01; Cohen's d = 1.28). *Perceived Credibility of FOPLs* (M_{NIB} = 5.53, SD_{NIB} = 0.92 vs. M_{NS} = 4.61, SD_{NS} = 1.27, t (141) = 4.98, p<0.01; Cohen's d = 0.83). *Attitude towards FOPLs* (M_{NIB} = 5.58, SD_{NIB} = 0.98 vs. M_{NS} = 4.50, SD_{NS} = 1.27, t (141) = 5.70, p<0.01; Cohen's d = 0.95). *Adoption intention for FOPLs* (M_{NIB} = 4.80, SD_{NIB} = 1.28 vs. M_{NS} = 4.20, SD_{NS} = 1.48, t (141) = 2.57, p = 0.01; Cohen's d = 0.43).

Serial Mediation Analysis. We found a significant negative effect of Nutri-Score, compared to NutrInform Battery, on consumer attitude towards FOPLs (b = -0.54, [SE] = 0.10, t (141) = -5.70,

P < 0.01) and adoption intention (b = -0.30, [SE] = 0.12, t (141) = -2.57, P = 0.01) towards the FOPLs. The mediation model was run with PROCESS macro for SPSS (Model 6; Hayes 2017), with FOPLs types (NutrInform Battery = -1; Nutri-Score = 1) as the independent variable, perceived congruence and perceived credibility as the mediators, and attitude and adoption intention as the dependent variables. To test the proposed underlying process, we used bias-corrected bootstrapping to generate a 95% confidence interval around the indirect effect of perceived congruence and credibility, where mediation occurs if the confidence interval excludes zero (Hayes, 2018). The analysis (5,000 bootstrap samples; bias-corrected confidence intervals estimated and reported) revealed a significant indirect effect for congruence (ab = -0.30, [SE] = 0.06; 95%LLCI = -0.44, 95%ULCI = -0.19) but not for perceived credibility (ab = -0.06, [SE] = 0.04; 95%LLCI = -0.15, 95%ULCI = 0.02) on consumer attitude towards FOPLs; no significant indirect effect for congruence (ab = -0.15, [SE] = 0.09; 95%LLCI = -0.33, 95%ULCI = 0.01) or credibility (ab = -0.06, [SE] = 0.05; 95%LLCI = -0.18, 95%ULCI = 0.02) on consumer adoption intentions for the FOPLs. Importantly, the serial indirect effect was significantly different from zero for the attitude (ab = -0.14, [SE] = 0.04; 95%LLCI = -0.23, 95%ULCI = -0.07) and the adoption intentions (ab = -0.16, [SE] = 0.05; 95%LLCI = -0.28, 95%ULCI = -0.07).

The results show that, compared to NutrInform Battery, Nutri-Score reduced perceived congruence, which decreased perceived credibility, subsequently negatively affecting consumer attitude and adoption intention toward the FOPLs (Figure 2 and Figure 3).

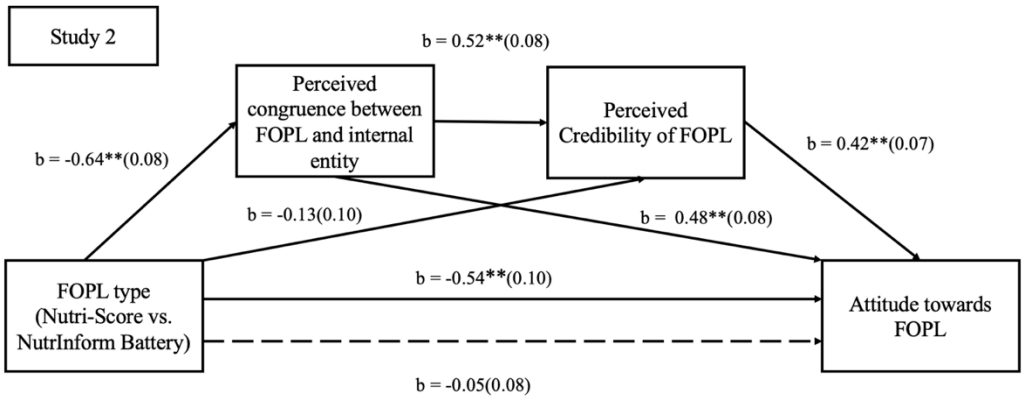


Figure 2. Serial mediation model on attitude toward FOPL

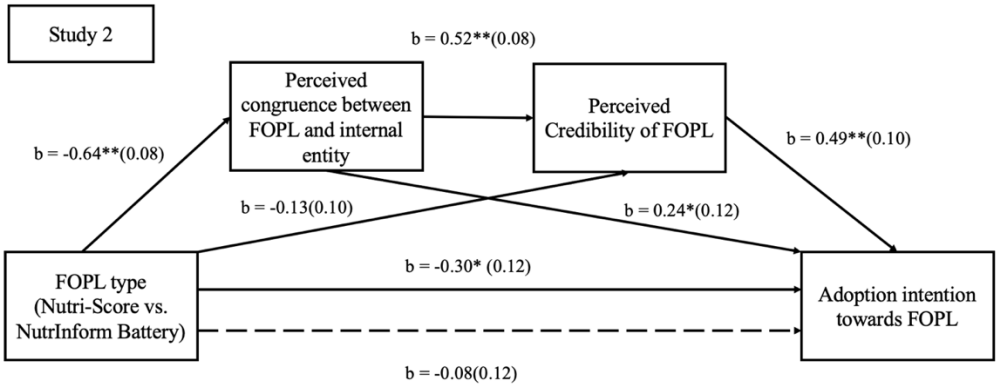


Figure 3. Serial mediation model on adoption intention toward FOPL

2.5. Experiment 3. The Underlying Mechanism of Consumer Response to FOPL When Compared with Scientific Knowledge.

Experiment 3 aimed first to confirm the effect of directive FOPLs in generating CNI when shown to consumers in the presence of scientific information.

Stimuli and measurement scales

Scientific information included in the stimuli were based on the content present in extant academic literature (e.g., Podadera-Herreros et al, 2022; Galvão Cândido et al, 2018; Owen et al, 2000), which remained consistent in both tested conditions. The experiment then explores the underlying mechanism and compares the impact of combining information derived from different Nutritional Labels (Nutri-Score vs. NutrInform Battery) with scientific evidence on consumers' perceived congruence, credibility, and attitudinal and behavioural responses.

2.5.1. Methods

We conducted an online experiment with a sample of 139 participants recruited through Prolific (M_{age} = 36.84, SD = 8.69; 31.7% female) with the same criteria as the pre-test. Respondents were informed that the experiment is about FOPLs, were randomly assigned to one of the two conditions (i.e., Nutri-Score combined with scientific evidence and NutrInform Battery combined scientific evidence), and engaged in an evaluation task after looking carefully at both the scientific evidence and the product label. We then measured on a 7-point Likert scale (see Appendix A): we measured perceived congruence with three items measured (1 = "Strongly disagree", 7 = "Strongly agree"; Rifon *et al.,* 2004; α = .70.); perceived credibility of the label with three items (Block and Keller, 1995; α = .80); attitude towards the label with three items (Burnkrant and Unnava, 1995; α = .94); adoption intention of Front-of-Pack Nutritional Label (Mazzù *et al.*, 2022c; α = .89).

2.5.2. Results and Discussion

Nutri-Score combined with scientific evidence showed significantly lower results than the ones of NutrInform Battery combined with scientific evidence in terms of *Perceived congruence* (M_{NIB} = 4.84, SD_{NIB} = 1.09 vs. M_{NS} = 4.40, SD_{NS} = 1.03, t (137) = 2.46, p = 0.02; Cohen's d = 0.42).

Perceived Credibility (M_{NIB} = 5.51, SD_{NIB} = 0.96 vs. M_{NS} = 4.92, SD_{NS} = 1.27, t (137) = 3.07, p < 0.01; Cohen's d = 0.52). *Attitude towards Front-of-Pack Nutritional Label* (M_{NIB} = 5.69, SD_{NIB} = 1.04 vs. M_{NS} = 4.67, SD_{NS} = 1.42, t (137) = 4.83, p < 0.01; Cohen's d = 0.82). *Adoption intention for Front-of-Pack Nutritional Label* (M_{NIB} = 4.71, SD_{NIB} = 1.33 vs. M_{NS} = 4.25, SD_{NS} = 1.41, t (137) = 2.01, p = 0 .05; Cohen's d = 0.34).

Serial mediation Analysis. The mediation model was run with PROCESS macro for SPSS (Model 6; Hayes 2017), with Front-of-Pack Nutritional Label types (NutrInform Battery combined with scientific evidence = -1, Nutri-Score combined with scientific evidence = 1) as the independent variable, the perceived congruence between the scientific knowledge and Front-of-Pack Nutritional Label types, and perceived credibility as the mediators, and attitude and adoption intention as the dependent variables. The serial mediation analyses are reported below (Figure 4 and Figure 5). We used bootstrapping to generate a 95% confidence interval around the indirect effects of perceived congruence and credibility, as well as the indirect effect through both mediators in a serial order, where mediation occurs if the confidence interval excludes zero (Hayes, 2018).

The analysis (5,000 bootstrap samples) revealed a significant indirect effect for perceived congruence (ab = -0.12, [SE] = 0.06; 95%LLCI = -0.25, 95%ULCI = -0.03), and credibility (ab = -0.09, [SE] = 0.04; 95%LLCI = -0.19, 95%ULCI = -0.01) on attitude towards the FOPL; a significant indirect effect for perceived congruence (ab = -0.12, [SE] = 0.05; 95%LLCI = -0.22, 95%ULCI = -0.03), and credibility (ab = -0.08, [SE] = 0.04; 95%LLCI = -0.18, 95%ULCI = -0.01) on consumer adoption intentions toward the FOPL. Moreover, the serial indirect effect was significantly different from zero for the attitude (ab = -0.04, [SE] = 0.02; 95%LLCI = -0.09,

95%ULCI = -0.01) and the adoption intentions (ab = -0.04, [SE] = 0.02; 95%LLCI = -0.08, 95%ULCI = -0.01).

The results show that, compared to the NutrInform Battery, Nutri-Score leads to a reduction of perceived congruence when combined with scientific evidence. This decreased congruence will then affect perceived credibility, attitude, and adoption intention towards the FOPLs.

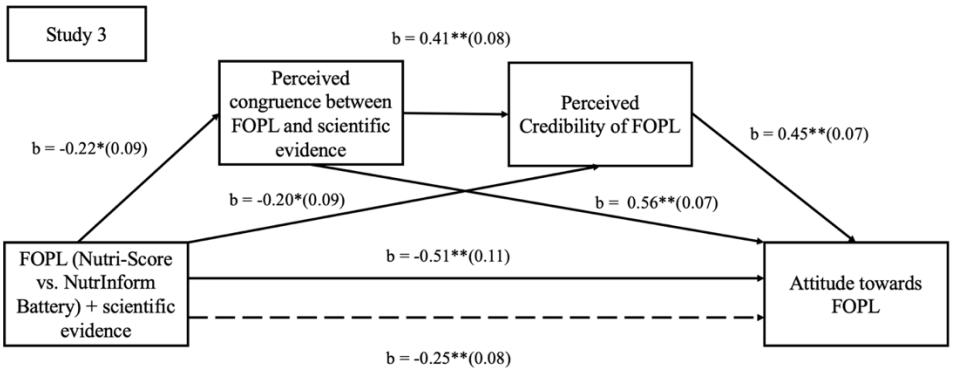


Figure 4. Serial mediation model on attitude toward FOP

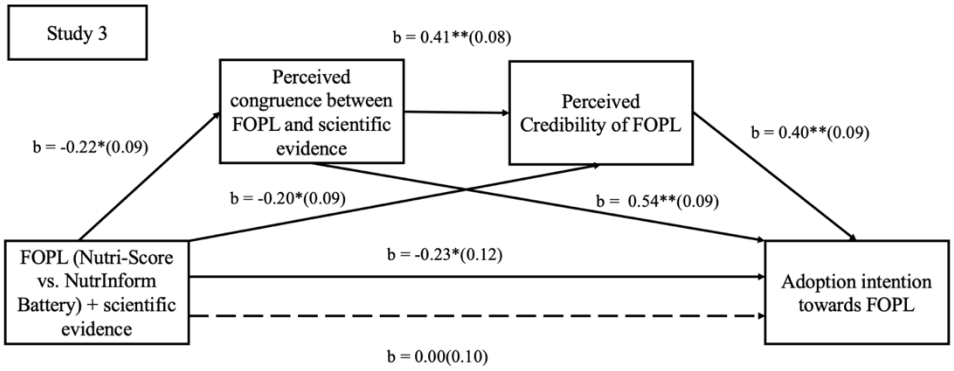


Figure 5. Serial mediation model on adoption intention toward FOPL

2.6. General Discussion for Study 1

Consumers are increasingly relying on nutritional information to guide their food choices toward healthier dietary habits. However, the abundance of sources, easily accessible via multiple media channels, can lead to information overload, sometimes conflicting, with the risk of yielding adverse consequences for the appropriateness of food selection by consumers (Hong 2023; Ngo *et al.*, 2023; Nagler *et al.*, 2022).

In markets where Front-of-Pack Nutritional Labels have been introduced, they are a key source of information for customers to gauge the nutritional value of their food purchases. The push for a standardized Nutritional Label across the European Union presents a chance to make the widespread nutritional information available for consumers. This holds the potential for policymakers to offer explicit guidelines for promoting health-conscious food consumption.

In fact, while the previous literature predominantly compared the advantages of different types of FOPLs in instructing consumers toward healthy eating, both cognitively and behaviorally (Dubois *et al.*, 2021; Grunert & Wills, 2007), the potential harm that FOPLs can bring remains scant in the literature. Moreover, as existing literature (Mauri et al, 2021; Ikonen et al, 2020) predominantly evaluated the immediate and isolated impacts of different types of labels in shaping perceptions of food healthiness and the consequent formation of attitudes and behaviors we propose that these labels should be viewed as integral components within a broader nutritional information system. The system entails interactions with various sources of information, such as nutritional information from scientific reports, consumers' pre-existing nutritional knowledge, as well as data and opinions available on internet from sources that might be judged as credible by consumers, even in absence of scientific backing.

Delving into the underlying mechanism, this study draws on congruity theory and uses the case of olive oil—characterized by conflicting nutrition information from multiple sources—to investigate the potential backfire effects that may arise when Front-of-Pack Labels (FOPLs) are entangled in such inconsistencies

Anchored in the comparative congruity model (Maille and Fleck, 2011), the research analyzes the perceived congruence - a vital explanatory mechanism shaping consumer perceptions, attitudes and behaviors - across dual information entities, investigating the cases of the external-external congruity between entities (i.e., nutritional information available from FOPLs and scientific reports), and the external-internal one (i.e., nutritional information available from FOPLs and from consumers' pre-existing nutritional knowledge). We focused our investigation on the comparison of the effects between directive Nutritional labels (Nutri-Score) and non-directive/neutral (NutrInform Battery), supporting the evidence that different types of Front-of-Pack Nutritional Labels generate different levels of perceived congruence.

Our empirical results therefore offer policymakers a cautionary perspective in terms of sustaining the credibility and encouraging consistent utilization of mandatory FOPLs. More specifically, Experiment 1 shows that, compared to the condition without FOPL exposure, a combined exposure of directive FOPL and another entity, either internal or external, leads to the generation of CNI. On the other hand, CNI does not emerge when participants are exposed to the combination of non-directive FOPL and another entity. In experiment 2, we examine the underlying mechanism and report that when consumers assimilate the nutritional information from the Front-of-Pack Nutritional Label into their internal entity (i.e., pre-existing knowledge about olive oil), the Nutri-Score, compared with NutrInform Battery, leads to a reduction of perceived congruence between the label information and their pre-existing nutritional understanding. This

decreased congruence subsequently contributes to undermine the perceived credibility of the FOPL, which in turn decreases consumers' favorable attitudes and adoption intention of FOPL. Complementarily, the results of Experiment 3 show that "Nutri-Score combined with scientific evidence", compared with "NutrInform Battery combined with scientific evidence," decreases perceived congruence, which then decreases consumers perceived credibility of Front-of-Pack Nutritional Label and consumers' attitude and adoption intention towards the FOPL. While prior investigations predominantly concentrated on the effects of the nutritional label in isolation, with limited exceptions such as the examination of the combined effects of distinct types of labels (Mazzù *et al*, 2023a), nutritional labels alongside health claims (Garretson and Burton, 2000), and FOPL paired with influencer posts (Sicilia et al, 2023), this study extends the exploration of combined nutritional information effects of labels and scientific reports.

Experiment 2, combined with experiment 3, empirically examined the comprehensive comparative congruence framework (Maille and Fleck, 2011), showing that the congruence effect is activated in both external-external and external-internal entity comparison and indicates that consumers find Nutri-Score less congruent when combined with nutritional information from the pre-existing nutritional knowledge or scientific reports about the healthiness of olive oil. Additionally, the studies emphasize the causal influence of a reduced level of perceived congruence, leading to a decrease in perceived credibility, attitudinal and further adoption intentions towards FOPLs in the case of olive oil. Despite the recent updated version of Nutri-Score adjusting olive oil to more favorable levels (Sarda et al., 2024), the olive oil available on the shelves remains labeled as low in healthiness. This healthiness discrepancy for the same product (i.e., olive oil) from the same FOPL source (i.e., Nutri Score) might pose higher risk of credibility backlash. Furthermore, comparative graphs of product distribution in various countries show that

the adoption of the new algorithm presents a rigid shift in nutritional evaluation, potentially leading to new misalignments. As in the Dutch case, the updated FOPL presents a 19% misinterpretation of healthy foods as unhealthy and a 25% error in evaluating unhealthy foods as healthy, in categories such as cheese, solid milk products, fish, potatoes, and tubers (Gerritsen et al., 2024).

While this study has introduced a novel perspective by considering Nutritional Labels as vital constituents within the broader nutritional information system, it presents several limitations. Firstly, it focuses on the case of olive oil, a typical daily dietary ingredient renowened for being perceived as healthy both in scientific literature and public attention, where the incongruence information from directive FOPL can undermine the general label credibility of the category. While in terms of generalizability, the same mechanism might be replicated on other products, such as some dairy products (Thorning et al, 2016; Lorenzen and Astrup, 2011), dark chocolate (Lippi et al., 2009; Araujo et al, 2016) or specific kind of cheese as parmesan (Summer et al., 2017), more research should be developed to explore other food categories to understand potential differential effects.

Furthermore, this research also tests congruity effects on countries that were not exposed to Nutritional Label. Future research might then examine the impact of previous usage of nutritional labels in influencing the perception of conflicting nutrition information with other sources. The research also does not analyze the potentially different impacts as a function of the type of external sources used, including social media, mass media, recommendations from peers and family members, and more. Future research could also explore how Front-of-Pack Nutritional Labels interact with these sources and analyze the impact of different socio-demographics on the perceived trust of different sources.

2.7. Conclusion

While Front-of-Pack Nutritional Labels have the potential to be a relevant guiding factor in directing consumers towards healthier food choices, they pose the risk of being entangled in conflicting nutrition information. As an integral component within the nutritional information system, different Nutritional Labels present different congruity effects, accounting for the underlying mechanism of the emergence of CNI when FOPL is in combination with another entity (either internal or external entities of nutritional information). Across the experiments conducted in this research, the results of experiment 1a and experiment 1b confirmed hypothesis 1 by reporting that directive FOPL, when compared with either consumer knowledge of the healthiness of olive oil or scientific information about olive oil, generates CNI, rather than non-directive FOPL. Experiment 2 and experiment 3 confirmed hypothesis 2 and hypothesis 3 by revealing the underlying mechanism of the emergence of CNI in the olive oil FOPL exposure process and suggesting that directive labels, such as the Nutri-Score, compared to non-directive labels, like the NutrInform Battery, reduce perceived congruence, and perceived credibility of FOPL, when interacting with other nutritional information, either from scientific reports (representing external entity) or consumers' pre-existing nutritional information (representing internal entity). Policymakers should then further consider the impact of diverse Front-of-Pack Nutritional Labels within a more comprehensive communication environment.

2.8. Limitations and future directions

This research is limited to a specific context, olive oil. While the choice is representative and relevant for studying conflicting nutrition information, given its association with both positive and negative health outcomes in consumers' minds, future studies should examine additional product categories to enhance the generality of the findings.

3. Study 2: Framing Health: Understanding Consumer Resistance to Gain and Loss Messages[2]

Abstract

In response to the growing prevalence of overweight and obesity, public health campaigns have highlighted the benefits of healthy diets (gain framing) and warned against the negative consequences of unhealthy eating (loss framing). While these strategies are effective in motivating healthier habits, consumer resistance—particularly psychological reactance to them—has been largely overlooked in the literature. In an era where content platform algorithms personalize information exposure, individuals now engage with health content only if they actively interact with it. This shift in how information is consumed heightens the need to minimize resistance to health messages. 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 lower promotion focus trait or higher concern for face. This increased reactance results in more negative attitudes toward the messages and further reduces willingness to engage with the provider.

3.1. Introduction

To promote consumer wellbeing, leading health institutions and policymakers have actively promoted the importance of healthy eating, using both gain framing and loss framing messages. 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*

[2] Study 2 is under review at the *Journal of Retailing and Consumer Service*.

risk of chronic diseases" (GOV.UK 2023; Health Canada 2020; 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*" (NHS 2022; USDA 2024; 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). In the context of healthy eating communication, messages that explicitly highlight healthy items (e.g., "a healthy option") generate more psychological reactance than those with implicit cues (e.g., "a red checkmark symbol") (Lu and Cai 2023). Similarly, messages that encourage avoiding unhealthy food (e.g., chocolate beans) in a restrictive manner (e.g., "you are not allowed to eat…"), rather than in a suggestive way (e.g., "it is better if you do not eat…"), also provoke greater psychological reactance (Stok et al 2015). When psychological reactance is activated by these messages, consumers strive to restore their freedom either by opposing the suggested behavior or by abandoning the "threatening source" (Fitzsimons and Lehmann 2004). Specifically, consumers ignore or avoid information (Fitzsimons and Lehmann 2004), express negative attitudes (Morimoto and Chang 2006), and display a decreased willingness to get further useful services (Lee and Lee 2009). 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, and even news platforms (Google 2024; 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 response

(Goodrow 2021; Mosseri 2023; Tik Tok 2020). For healthy eating content to be prioritized by the algorithm and sustain consumer engagement, it must align with consumer preferences, gain "likes", and ensure that they are willing to continuously receive information from these healthy eating promotors (Areeb et al. 2023).

Previous research on message framing in health communication has found that loss framing, compared to gain framing, is more likely to induce psychological reactance (Shen 2015; S. Zimmerman et al. 2014). However, these findings are not fully conclusive (Lee and Cameron 2017; More et al. 2024; Richards et al. 2021), with Lee and Cameron (2017) calling for further investigation in the context of healthy eating communication. Moreover, the underlying mechanism explaining why higher reactance is associated with loss framing compared to gain framing remains underexplored in the literature.

We propose 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 behavior has been considered a way of expressing self-image, as proposed by the stereotype-based eating research, often summarized by 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 considered to be low in willpower (Watkins et al. 2022). Grounded in the observation that, in the healthy eating context, gain framing messages depict a healthy and positive self-image, while loss framing messages highlight an unhealthy and negative self-image resulting from failure to eat healthily (Garg et al. 2021), we suggest that self-image maintenance is a critical force in the activation of psychological reactance.

To further explore this mechanism, we introduce two moderators that influence self-image perception from contrasting perspectives. The first is promotion focus trait, reflecting an individual's aspirations and orientation towards achieving a positive self-image, which in this context relates to being healthy (Ferrer et al. 2017). The second is concern for face, defined as an individual's desire to preserve self-image and maintain social acceptability (Chan et al. 2009; Goffman 1967). 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 portrays 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.

This research aims to explore why loss framing, compared to gain framing messages, either significantly increases psychological reactance or hse no effect. We propose that this inconsistency may be attributed to variations in consumer personality traits, particularly the extent to which individuals feel compelled to maintain their self-image. Across three experiments, we found that loss framing, compared to gain framing messages, increases psychological reactance among individuals with a lower promotion focus trait (Experiment 1, 2) and among individuals with a higher concern for face (Experiment 3). This increased psychological reactance leads to a less favorable attitude towards the messages, which, in turn, results in a lower willingness to receive (hereafter, WTR) further information from the content provider (Experiments 1, 2, 3).

The paper is organized as follows: we first describe the effect of message framing in healthy eating communication and explain why psychological reactance is particularly relevant today. We

then summarize the impact of message framing on psychological reactance and discuss how concerns about self-image may clarify the inconsistent findings in the literature on healthy communication. Furthermore, we introduce two personality traits—promotion focus trait and concern for face—to develop our conceptual model. In the methodology section, we test the conceptual model and explain the mechanisms by which message framing influences individuals' WTR. Finally, we discuss our theoretical contributions and practical implications for policymakers to improve communication strategies.

3.2. Theoretical Background and Hypothesis Development

3.2.1. Message Framing in the Food Consumption Context

Message framing, the technique of presenting information to emphasize either positive or negative outcomes, is divided into two categories: gain framing and loss framing (Chang et al. 2015; Maheswaran & Meyers-Levy 1990; Xu 2019). Gain framing highlights positive outcomes, such as achieving a gain or avoiding a loss, while loss framing focuses on negative outcomes, such as failing to achieve a gain or experiencing a loss (Rothman et al. 2006).

In the context of healthy eating (Cucchiara et al. 2015; Garg et al. 2021), gain framing messages highlight how eating well translates into achieving a healthier condition or avoiding unhealthy outcomes. Conversely, loss framing messages emphasize the drawbacks of poor eating habits, namely potential harmful conditions or loss of healthiness.

In recent years, several empirical studies have compared the effectiveness of gain framing versus loss framing in the healthy eating context (see Web Appendix 1). In particular, previous literature identifies two dominant theoretical approaches: i.) Prospect theory (Tversky and Kahneman 1981) highlights that people tend to be more responsive to potential losses than gains.

As a result, framing information in terms of losses is considered more effective in capturing attention and promoting behavioral intentions toward healthier food choices (Britwum and Yiannaka 2019; Eguren et al. 2021; Garg et al. 2021); ii.) Regulatory focus theory argues that matching gain framing with a promotion focus and loss framing with a prevention focus, strengthens consumers' motivation to maintain a healthy diet, ultimately encouraging the adoption of healthier eating behavior (Shimul et al. 2021; Cesario et al. 2004; Lee and Aker 2004; Tam et al. 2010). For instance, consumers are more willing to pay for more expensive beef treated with safety interventions (e.g., cattle vaccines) when the persuasive messages are framed as a loss (Britwum and Yiannaka 2019). Additionally, dual-process theory (Nan et al. 2018; Cucchiara et al. 2015; Maheswaran and Meyers-Levy 1990) has also investigated how message framing interacts with the way in which individuals process messages leads to healthier behavior. In particular, the theory suggests that when consumers have a higher motivation to process and comprehensively scrutinize the information provided, loss framing is more effective in enhancing consumer attitudes and encouraging behavioral intentions that follow the communicated messages.

Independently of the theoretical perspective adopted to explain the effect of message framing in health contexts, previous research (see Web Appendix 1) has largely focused on the positive effects of these messages in proactively stimulating and intensifying the motivations for healthy behavior. However, message framing can backfire due to psychological reactance (Miron and Brehm 2006). Psychological reactance is defined as a motivational state that would occur when people feel that their free choices or behaviors are restricted or threatened (Brehm 1966; Clee and Wicklund 1980; Miron and Brehm 2006). When promoting specific eating behaviors, the framing of messages can elicit varying levels of psychological reactance. For example, aggressive and emotionally charged messages demanding consumers stop eating meat, such as "*completely*

renounce meat products from now on!" tend to provoke stronger psychological reactance compared to more neutral messages like "*Today's sedentary lifestyles are not well suited to high-energy meat products*", even though both encourage the same behavior (Sprengholz et al. 2023). The backfire effects are surprisingly understudied in the message framing literature (Nan et al. 2018), and the objective of this research is to focus on the potential negative responses toward healthy eating messages from the psychological reactance perspective.

According to previous research on health communication (Lee and Cameron 2017; Reynolds-Tylus et al. 2019; Reynolds-Tylus and Schill 2022), loss framing, compared to gain framing messages, generally increases consumer psychological reactance, although the effect size is often small or may not always reach statistical significance. Specifically, loss framing is reported to increase psychological reactance when persuading people to promote voter registration (Reynolds-Tylus and Schill 2022), sun protection (Shen 2015), marijuana inhibition (S. Zimmerman et al. 2014), organ donation (Quick et al. 2015). On the other hand, no statistically significant effects of loss versus gain framing were found to influence psychological reactance in the promotion of physical exercise (More et al. 2024), and HPV vaccine (Richards et al. 2021). Notably, Lee and Cameron (2017) compared the loss and gain framing in the context of healthy eating for weight control and reported a null effect on psychological reactance.

Since psychological reactance drives consumers to restore their freedom by rejecting the advisory sources or engaging in behaviors contrary to those suggested (Fitzsimons and Lehmann 2004), in the context of healthy eating, this translates into consumers focusing more on information that supports the restricted food consumption (Sprengholz et al. 2023), cultivating more negative attitude towards the healthy eating behavior (Ungar et al. 2015), and reducing their purchase intentions for healthy items (Lu and Cai 2023). This psychological reactance can also prompt

consumers to abandon food providers, as evidenced by students quitting lunch programs when chocolate milk is replaced with plain milk (Hanks et al. 2015) or when a vegetarian day is enforced weekly (Lombardini and Lankoski 2013). Furthermore, consumers may engage in behaviors contrary to those recommended by healthy eating messages. These behaviors include an increased desire for unhealthy choices (Pham et al. 2016), like eating fewer vegetables and fruits (Ungar et al. 2015), purchasing more unhealthy foods (Irmak et al. 2020), and eating more unhealthy food (Stok et al. 2015).

3.2.2. Self-Image Concern as the Force to Generate Psychological Reactance

Self-affirmation theory posits that people adopt an internal defensive mechanism that helps them maintain a positive self-image that is "*competent, good, coherent, unitary, stable, capable of free choice, capable of controlling important outcomes, and so on*" (Steele 1988, p. 262). Steele (1988) argued that when self-image is threatened by persuasive messages, individuals are motivated to restore their positive integrity either by acting against the negative self-image or by finding alternative ways to enhance their general self-image. Loss framing messages, despite being reported as more effective than gain framing messages in encouraging healthier choices (see Web Appendix 1), depict a negative self-image of being unhealthy or failing to maintain a healthy diet. This negative self-image may act as a force imposed on consumers, echoing the threat to freedom highlighted in psychological reactance theory, making loss framing messages more likely to activate psychological reactance (Brehm 1966). In the next two sections, we will introduce two individual traits associated with self-image perceptions to understand the underlying mechanism of these inconsistent effects derived from message framing exposure. Specifically, we will introduce promotion focus trait, which is linked to positive self-image restoration, and concern for

face, which is associated with heightened sensitivity to situations that may threaten one's self-image.

3.2.3. Promotion Focus Trait for Self-Image Restoration

Regulatory focus theory (Higgins 1998) posits that people have two types of regulatory focus, namely promotion focus and prevention focus. The difference between these two lies in their sensitivity and ease of access to desired end-states. Specifically, a promotion focus is concerned with achieving positive end-states, such as hope, aspirations, and accomplishments, whereas a prevention focus is concerned with avoiding negative outcomes and fulfilling duties and responsibilities (Higgins 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, promotion focus 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 promotion focus 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 promotion focus trait tend to give more positive assessments of both their own and their peers' work. 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 exposure. 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. We thus formulate the following hypothesis:

> *H1: Individuals with low promotion focus trait will experience higher psychological reactance in loss framing messages, as compared to gain framing messages, leading to less favorable attitudes toward the messages and, in turn, decreasing WTR.*

3.2.4. Concern for Face

Concern for face is defined as the extent to which individuals are concerned about preserving their self-image in social interactions with others (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 behavioral 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 negotiations involving face-threatening interactions, these individuals perceive their relationship with negotiators more negatively and are more likely to reject a mutually beneficial choice (White et al. 2004).

As 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 place a high value on maintaining a positive image will be more sensitive to loss framing messages than gain framing messages. This heightened sensitivity will consequently lead to a higher level of psychological reactance. Therefore, the following hypothesis is formulated:

> *H2: Individuals with high concern for face will experience higher psychological reactance when presented with loss framing messages, as compared to gain framing messages, leading to less favorable attitudes toward the messages, resulting in a reduced WTR.*

Overview of Experiments

We present three experiments designed to test our two hypotheses regarding the impact of message framing on promoting healthy eating (see Figure 6 for the conceptual model). Through experiment 1, we demonstrate that the negative effect of loss framing message on consumer WTR, mediated by psychological reactance and attitude towards messages, only manifests for consumers with a low promotion focus trait (H1). Experiment 2 aims to replicate the objectives and procedures of experiment 1 (H1) by employing a different format of information exposure (i.e., multiple exposures). Through experiment 3, we demonstrate that the negative effect of loss framing messages on consumer WTR, explained by psychological reactance and attitude towards messages, only manifests for consumers with a high concern for face (H2).

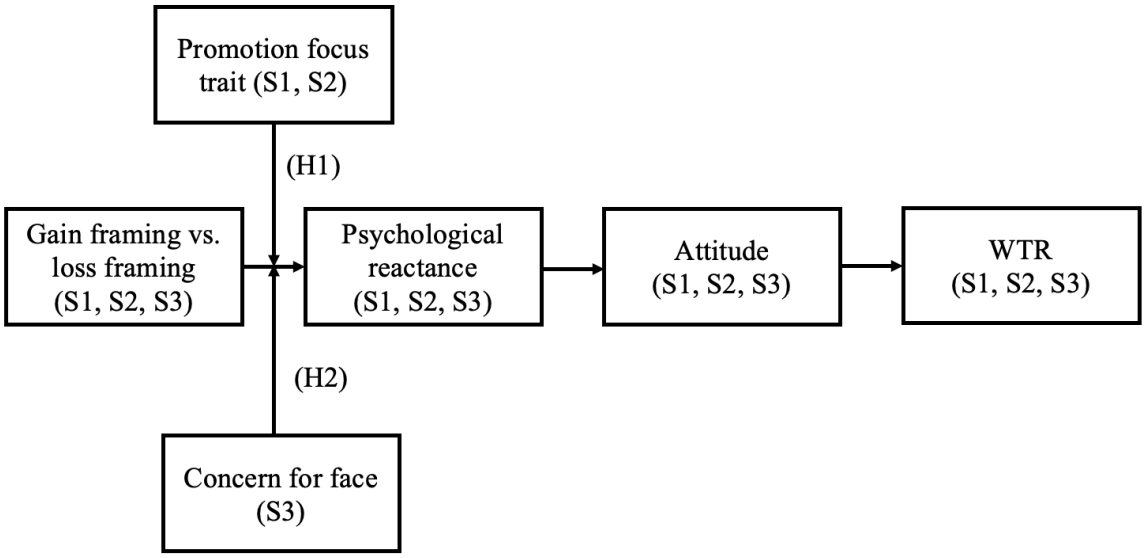


Figure 6: Full conceptual framework.

3.3. Experiment 1: Manipulating One-Time Exposure of Gain Framing versus Loss Framing Messages in the Healthy Eating Context

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

3.3.1. Methods

Stimuli validation

We recruited 80 participants on 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, each consisting of eight sentences outlining all health benefits typically included governmental

health communications (adapted from CDC 2024), except for pregnancy-related benefits, which were not applicable to most participants (e.g., '*Healthy eating may help you live longer"* or *'unhealthy eating may shorten your lifespan*', see Appendix C 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 Aker 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; $t\ (79) = 15.33$, $p < 0.01$).

Main study participants and procedure

We conducted an online experiment through Prolific. The sample included 200 participants (94.5% UK, 5.5% US) ($M_{age} = 38.12$, *SD* = 10.42, 34.5% male, 64% female and 1.5% non-binary). All participants were first exposed to a picture of dietary guidance, introducing the composition of a healthy diet. The purpose of this guideline was to establish a common baseline to ensure participants consistently understood the concept of 'healthy eating', as interpretations may vary across people (Bisogni et al. 2012). 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 C).

We measured participants' psychological reactance (Massi Lindsey 2005; 4-item, α = .94; see Appendix B for the scale items); attitude towards the messages (Burnkrant and Unnava 1995; 3-item, α = .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)—promotion focus trait (Ferrer et al. 2017; 6-item, α = 0.85).

3.3.2. Results and Discussion

An independent t-test 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, t (198) = 1.64, p = 0.10), 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, t (198) = -1.90, p = 0.06). 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, t (198) = -0.90, p = 0.37).

Moderated Mediation. We employed 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.

The results of the PROCESS analysis using ordinary least squares (OLS) estimation 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 Figure 7), 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* < .05). 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* < .05). In turn, an increase of psychological reactance led to 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; $p < 0.01$).

Both the direct effect of message framing on WTR (b = -0.02; [SE] = 0.09; p = 0.78) and the indirect effect of message framing on WTR, through attitude (b = 0.04; [SE] = 0.04; [CI] = [-0.03-0.11]) were not significant. However, and more 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, as mediated by reactance as the key mechanism.

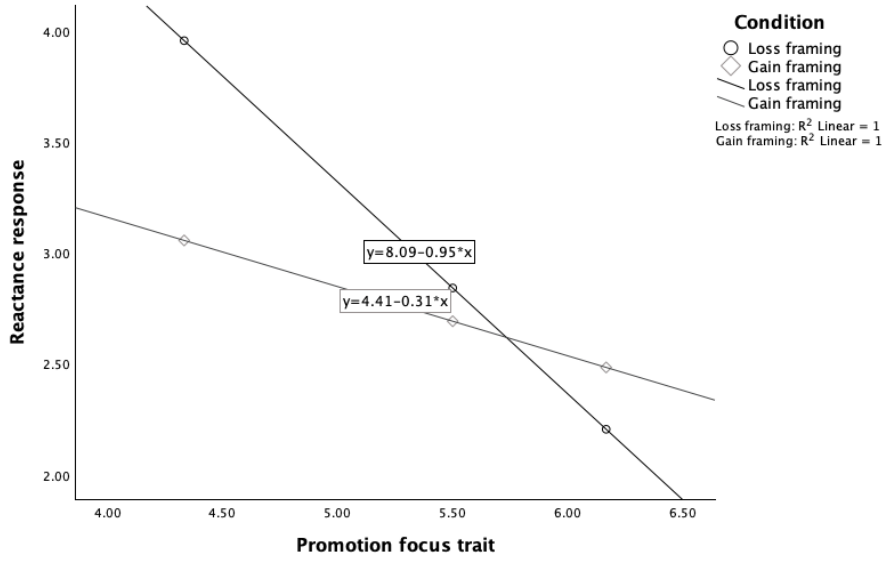


Figure 7. The moderating effect of the promotion focus trait.

The results of experiment 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.

3.4. Experiment 2: Manipulating Gain Framing versus Loss Framing Messages in a Frequent Exposure Format in the Healthy Eating Context

Experiment 2 aimed to replicate the findings of Experiment 1 while enhancing the generalizability of our results by shifting from a one-time exposure to a multiple-time exposure format, without any other difference. This approach was intended to approximate the repeated exposure consumers experience on social media, where they frequently encounter similar messages through algorithms that continuously present related content based on their online

behaviours and interests. By mimicking this real-life exposure pattern, we aimed to improve the external validity of our findings.

3.4.1. Methods

Stimuli validation

We recruited 80 participants on Prolific platform (US, 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 the gain framing and loss framing messages (same as experiment 1) (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 for 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, $p < 0.01$).

Main study participants and procedure

We conducted an online experiment through Prolific. Among our sample of 201 participants (94% UK, 6% US, M_{age} = 37.38, *SD* = 8.98, 48.8% male, 49.8% female and 1.5% non-binary), all participants were first exposed to the dietary guidance (same as experiment 1). They 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.

To approximate multiple exposures typical of social media, in experiment 2, participants read one sentence per page for a minimum of 3 seconds (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 experiment 1 but distributed across eight separate pages (Appendix C).

We measured participants' psychological reactance (Massi Lindsey 2005; 4-item, α = .97; see Appendix B); attitude (Burnkrant and Unnava 1995; 3-item, α = .97); WTR (Gershoff et al. 2007; one item); promotion focus trait (Ferrer et al. 2017; 6-item, α = .87).

3.4.2. Results and Discussion

An independent t-test analysis revealed that compared to gain framing, loss framing messages increased participants' psychological reactance ($M_{gain} = 2.77$, $SD_{gain} = 1.41$ vs. $M_{loss} = 3.24$, $SD_{loss} = 1.71$, t (199) = 2.14, $p = 0.03$, Cohen's d = 0.30), generated less favourable attitude from participants ($M_{gain} = 5.64$, $SD_{gain} = 1.24$ vs. $M_{loss} = 5.10$, $SD_{loss} = 1.68$, t (199) = -2.63, $p = 0.01$), and led to marginally lower WTR ($M_{gain} = 4.53$, $SD_{gain} = 1.53$ vs. $M_{loss} = 4.18$, $SD_{loss} = 1.73$, t (199) = -1.50, $p = 0.13$).

Moderated Mediation. We employed 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.

The results of the PROCESS analysis using ordinary least squares (OLS) estimation 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 Figure 8), 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* < .05). No significant differences between gain framing and loss framing messages emerged for

reactance when promotion focus trait scores higher than 5.48. In turn, an increase of reactance led to 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 WTR (b = 0.46, *t* (197) = 5.42; $p < 0.01$).

Both the direct effect of message framing on WTR (b = -0.05; [SE] = 0.08; p = 0.56) and the indirect effect of message framing on WTR, through attitude ((b = 0.04; [SE] = 0.03; [CI] = [-0.01-0.11]) were not significant. However, and more 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 experiment 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.

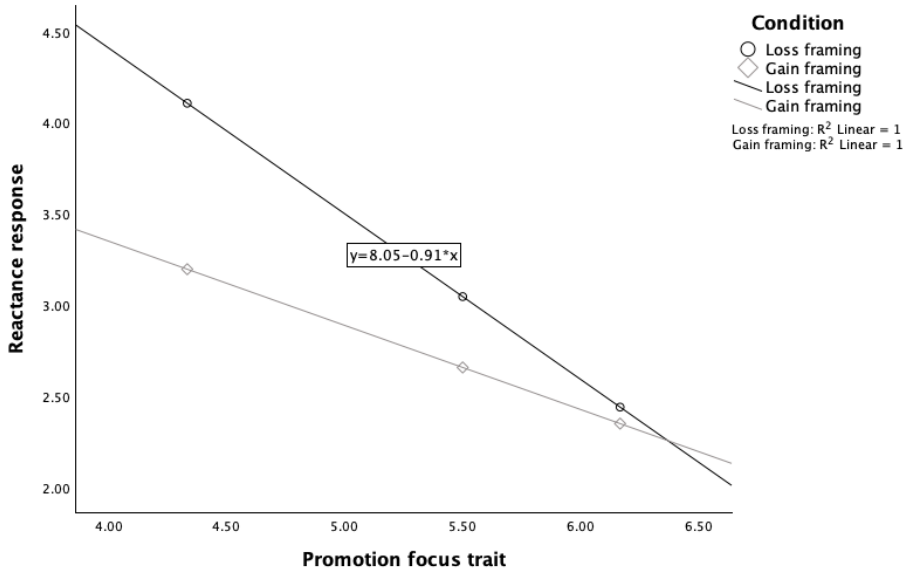


Figure 8. The moderating effect of the promotion focus trait.

The results of experiment 2 also supported H1 and concluded that the 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.

3.5. Experiment 3: Manipulating Gain Framing versus Loss Framing Messages in a Frequent and Concrete Exposure Format in the Healthy Eating Context

Experiment 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 C). 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 experiment 2, we employed a multiple exposure format, where participants read the messages sentence-by-sentence across multiple pages, reflecting how consumers repeatedly encounter health-related messages through social media algorithms and other online platforms.

3.5.1. Methods

Main study participants and procedure

We pre-registered this experiment (AsPredicted #168139) and conducted it as an online experiment through Prolific. Among our sample of 300 participants (97.7% UK, 2.3% US) (M_{age}

= 39.54, *SD* = 10.80, 32.3% male, 67.7% female), 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 C).

We measured participants' reactance (Massi Lindsey 2005; 4-item, α = .95; see Appendix B); attitude (Burnkrant and Unnava 1995; 3-item, α = .96); WTR (Gershoff et al. 2007; one-item); concern for face (Chan et al. 2009; 3-item, α = .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).

3.5.2. 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 second independent t-test 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, t (298) = 1.31, p = 0.19). Moreover, compared to gain framing, loss framing messages generated less favourable attitude (M_{gain} = 5.57, SD_{gain} = 1.35 vs. M_{loss} = 5.19, SD_{loss} = 1.48, t (298) = -2.32, p = 0.02), and less WTR (M_{gains} = 4.70, SD_{gains} = 1.58, vs. M_{loss} = 4.23, SD_{loss} = 1.61, t = -2.60, p = 0.01).

Moderated mediation. We employed 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* < .05). No significant differences between gain framing and loss framing messages emerged for concern for face scored lower than 5.26 (see Figure 9).

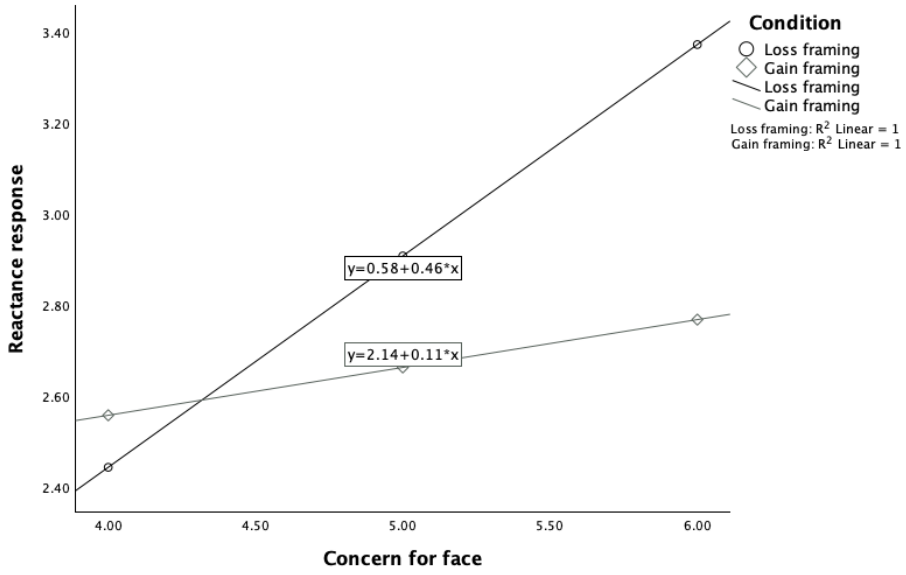


Figure 9. Results of experiment 3.

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, $p < 0.01$).

Both the direct effect of message framing on WTR (b = 0.10; [SE] = 0.07; p = 0.12) and the indirect effect of message framing on WTR, through attitude (b = 0.06; [SE] = 0.03; [CI] = [-0.001-0.13]) were not significant. However, and more 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 experiment 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.

3.6. General Discussion for Study 2

Across three experiments, we examined how different message framing and individual personality traits (i.e., promotion focus trait and concern for face) influence resistance to healthy eating communication. Specifically, experiment 1 found that loss framing, compared to gain framing, marginally increased reactance responses, with the effect significantly stronger among individuals with lower promotion focus trait. This increased reactance led to less favorable attitudes, reducing their willingness to receive further information from the provider. Experiment 2 replicated the findings of experiment 1 and extended the generalizability of the research by varying the frequency of message exposure. Furthermore, experiment 3 indicated that loss framing did not significantly enhance reactance responses compared to gain framing. The variation in

reactance response was significant only among individuals with high concern for face and not among those with low concern for face. The heightened reactance led to less favorable attitudes, then reduced their willingness to receive further dietary information.

3.7. Theoretical Contributions

Our studies have several theoretical contributions. Firstly, we advance the message framing literature (i.e., message valence that includes gain and loss) by examining consumer resistance to healthy eating persuasion through the lens of psychological reactance. Previous studies have largely focused on the comparative positive effects of gain versus loss framing on improving consumer health behavior (Cucchiara et al. 2015; Eguren et al. 2021; Tam et al. 2010). Notably, a substantial body of this research is rooted in prospect theory, which emphasizes the motivating effect of loss framing over gain framing in increasing consumer aversion to health-related losses (Nan et al. 2018). However, some researchers have expressed concerns on the over-reliance on prospect theory in health message framing and have called for alternative theoretical approaches to better explain the underlying mechanisms (Nan et al. 2018; Van't Riet et al. 2016). Our research responds to this call by exploring the comparative negative effects of gain versus loss framing on consumer responses to messages through psychological reactance as a complementary, yet relatively underexplored, factor in the health message framing effect.

Second, we address the empirical inconsistencies in applying psychological reactance theory within health message framing research. While previous studies have found that loss framing, compared to gain framing, triggers higher psychological reactance (Shen 2015; Zimmerman et al. 2014), others have reported null effects (Lee and Cameron 2017; More et al. 2024; Richards et al. 2021). Notably, Lee and Cameron (2017) found this null effect in the context of healthy eating promotion. Our research replicated both the significant effect of message framing

on consumer reactance (experiment 2) and the null effects (experiments 1 and 3). Through three experiments, we demonstrate that the mixed results in the literature can be attributed to the relatively small effect size of message framing in the general population, with effects varying significantly among individuals with specific personality traits related to self-image concerns, such as low promotion focus and high concern for face.

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 negative self-image framing. Promotion focus trait has been associated with a more positive self-image evaluation, which in turn helps individuals achieve better outcomes for their objectives and tasks (Liu and Yao 2019; Scholer et al. 2014). Building on this stream, 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 by examining the concept from the perspective of avoiding impairments to one's self-image in food consumption contexts. Concern for face is composed by two aspects—motivation to gain face and avoid losing face (Wang et al. 2020; Zhang et al. 2011). Li and Cui (2021) found that consumers with a higher concern for face are more inclined to purchase organic food, as this behavior is considered as face-gaining due to the moral prestige associated with organic products. While healthy eating behavior 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.

3.8. Practical Implications

These findings offer important insights for policymakers, leading health promoters, and healthy food marketers in designing more effective and persuasive messages for healthy eating. Both gain framing and loss framing messages are frequently employed in public health communication due to their positive impact on improving consumer motivations toward healthier eating habits. However, with the growing prevalence of algorithm-driven content platforms, the ability of health communication to attract and engage consumers has become increasingly crucial. Consumer responses influence the algorithms that shape their interests, which in turn affect the likelihood of further exposure to health-related content. In other words, if consumers do not engage with healthy eating messages, such as spending time browsing, liking, or following, these messages are likely to be considered uninteresting by the algorithm and receive less exposure in the future. Therefore, it is essential not only to consider the advantages of different message framing strategies but also to focus on reducing consumer resistance to health communication. Our findings suggest that loss framing messages are more likely to provoke consumer resistance. Therefore, practitioners should carefully consider when using loss framing messages to avoid unintended negative reactions.

On the other hand, loss framing messages, compared to gain framing messages, do not generate higher resistance among groups with particular characteristics, such as in a high promotion focus trait and low concern for face. The potential to tailor content through personalized messaging on an algorithm-driven platform presents an opportunity for healthy food advertisers

and public health educators. 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 with health communication efforts. 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.

3.9. Limitations and Future Research

Across three experiments, this research demonstrates that self-image relevant personality traits moderate the relationship between exposure to gain framing versus loss framing messages and consumer reactance, which subsequently shapes consumer attitudes and behavioral intentions. However, the direct effects of message framing on attitudes and willingness to receive further information were not consistent across experiments. Specifically, in experiments 2 and 3, gain versus loss framing significantly influenced attitude, and in experiment 3, it also significantly affected willingness to receive further information. In other cases, direct effects were non-significant. These inconsistencies may stem from differences in message exposure. For instance, in experiments 2 and 3, participants were exposed to messages multiple times, which likely

increased their level of involvement. Future research should examine how different modes and frequences of exposure moderate framing effects.

While our research has shown the underlying mechanism of consumer resistance to healthy eating communications, it does not address potential solutions for mitigating reactance. Future research could explore how marketing interventions might mitigate psychological reactance in health communication. For example, while our study did not specifically investigate the impact of message attributes on consumer reactance, preliminary findings suggest that more detailed messages—such as those emphasizing the consumption of adequate vegetables—may help reduce reactance compared to more general healthy eating messages, as indicated by studies 2 and 3. Moreover, our studies are limited to the healthy eating context, while self-image concern may also be applicable to other pro-social communication contexts, such as physical exercise, donation, and environmental protection.

4. Study 3: Turn Anger into Action: How Persuasion Knowledge Activation Outperforms Health Knowledge Intervention—the Empowering Mechanism of Psychological Reactance

Abstract

The global rise of overweight and obesity is placing a greater health burden on individuals and is raising costs for public health systems. In response, public health promoters and policymakers have actively been involved in scientific health knowledge interventions, aiming to enhance

consumer understanding and support informed decision-making. However, marketers sometimes employ manipulative strategies, utilizing misleading information, reducing the effectiveness of policymakers attempts to increase health-knowledge among end-customers. Through the lens of psychological reactance theory, this study aims to compare how persuasion knowledge (i.e., informing consumers of the manipulative intent of companies) versus health knowledge (i.e., informing consumers of the unhealthiness of the product) interventions affects consumers' reactance response, and in turn influence consumer negative word-of-mouth (NWOM) regarding products with misleading information. Moreover, we tested the effectiveness of these interventions both in the presence and absence of Front-of-Pack Nutritional Labels (FOPLs), which have been reported as solutions for providing consumers with reliable information and mitigating misleading information. Additionally, we examined the moderating role of the institutional tagline, through which knowledge interventions about misleading information are typically communicated. In three experiments conducted in the European Union, we found that persuasion knowledge, compared to health knowledge intervention, increases consumer reactance, and in turn leads to higher negative word-of-mouth. This indirect effect holds both in the presence of different typologies of Front-of-Pack Nutritional Labels (i.e., Nutri Score, or NutrInform Battery) and in their absence, with the effect moderated by the presence of European commission tagline.

Keywords: misleading information; persuasion knowledge; front-of-pack nutritional labels; reactance; negative word-of-mouth; institutional endorsement.

4.1. Introduction

Overweight and obesity have been linked to an increased risk of chronic and non-communicable diseases, such as cardiovascular diseases, cancer, and chronic respiratory diseases (WHO, 2024). Despite the increased awareness of the risks, the prevalence of overweight and obesity kept raising significantly worldwide—43% of adults are today classified as overweight and 16% are living with obesity (WHO, 2024). Studies have found that the prevalent use of deceptive and misleading information on food packaging, such as false nutrient content and misleading health claims, may exacerbate the issue (André et al., 2019; Pérez-Ferrer et al., 2019; Perry et al., 2018; Pulker et al., 2018). This misleading effect is particularly harmful for consumers interested in pursuing a healthier diet, who may purchase less healthy foods due to the presence of misleading information (Miklavec et al., 2015). Parents in particular (mis)interpret foods with potentially misleading health information as being healthier and show a higher intention to buy these less healthy options for their children, which is contrary to their actual intentions (Harris et al., 2011). For example, parents may interpret the "antioxidants and vitamins" claim on the packaging as proof that the product can help prevent their children from getting sick, even if the nutrient content of the product is below-average in quality for the category.

In response, policymakers actively implement regulations and communicate health knowledge about food labels, such as educating consumers on effectively recognizing and understanding the misleading elements on the food packaging (European Commission, 2025b). Sometimes policymakers also provide scientific information on the implications of various claims. For example, a "low fat" label signifies that "the product contains no more than 3 g of fat per 100 g for solids or 1,5 g of fat per 100 ml for liquids" (European Commission, 2024), with an emphasis on ensuring an unbiased assessment of the product's healthiness and empowering consumers to

make informed, healthy food choices (de Boer, and Bast, 2015). Empirical research has also shown that informing consumers with health-related knowledge is effective in addressing misleading information (Wilson and Lusk, 2020). Specifically, providing consumers with health-debiasing information that highlights misleading claims (i.e., redundant nutrition labels with no meaningful value) reduces their willingness to pay a premium price for the product.

On the other hand, both legislation and health knowledge communication has shown limitations in resolving misleading information, including low levels of compliance, challenges in monitoring real adoption, and notably, the persistence of misleading practices that fall into a grey zone (Clement et al., 2017; Nocella and Kennedy, 2012; Pulker et al., 2018). For instance, recent research gathered 3,813 products from supermarket packaged food and reported that 67% of the products include health-related cues which do not relate to higher nutritional value and cannot be a health indicator (Alcaire et al., 2023). Moreover, marketers often comply with legislation in wording, while still being potentially misleading (Clement et al., 2017; Schermel et al., 2016). Specifically, they may legally and factually highlight the rich vitamin and mineral content of a product through nutrition claims, even though the product as a whole is unhealthy due to high sugar content (Pérez-Ferrer et al., 2019). Similarly, to meet the criteria for a "low fat" claim, practitioners may significantly reduce the fat content while adding other caloric ingredients to compensate for taste, resulting in a product that is less healthy overall (Schermel et al., 2016). Other packaging cues (de Sousa et al, 2022)—such as "free from palm oil" or "free from genetically modified organism" (Hartmann et al., 2018), natural claims (Hooker et al., 2018), health trade labels (Berry and Romero, 2021), health related images (e.g., a brain image) (Delivett et al., 2022), packaging color and ecological claims (Hallez et al, 2023)—may also lead consumers to misinterpret the healthiness of the food.

While persuasion knowledge has been a central concern for "persuasion marketers" in consumer research —due to its significant role in diminishing the effectiveness of persuasive efforts —its study and application within the domain of food policy remains limited. Persuasion knowledge (Friestad and Wright, 1994) refers to consumers' knowledge of how to recognize and interpret persuasion attempts from persuasion agents, and their own coping strategies, such as ignoring or discounting these persuasion tactics. A recent meta-analysis has shown that persuasion knowledge can counteract marketers' persuasion attempts, by 50% (Eisend and Tarrahi, 2022). Specifically, when consumers recognize and understand the persuasive intent of agents—such as advertisements, brands, companies, and media—they perceive the information as less credible, evaluate these entities more negatively, resist persuasive attempts, and exhibit marketer-unintended reactions, such as avoidance and suspicion (Eisend and Tarrahi, 2022). Misleading information on food packages, often used as a persuasive tactic to make the products appear healthy and influence consumers to purchase them, falls into the category of persuasion attempts. However, the disclosure of such persuasion attempts is both understudied in policy literature and underutilized in practice.

To advance understanding in this aera, this research leverages psychological reactance theory (Brehm, 1966) to explore persuasion knowledge as a potential communication strategy for policymakers. Psychological reactance theory offers a relevant theoretical framework for examining how persuasion knowledge motivates consumers to act to restore their freedom of choice, in response to persuasion attempts that intend to manipulate their decisions. Our research focuses on how different types of knowledge about misleading information on food packages activate varying level of motivational state (i.e., reactance response). This, in turn, leads to increased negative word-of-mouth. This is crucial, because such misleading information is hard to

rectify, and we aim to encourage individuals to share information about these misleading products within their network to make the unknown known.

In this article, we also examine whether our findings hold in the presence of different types of EU Front-of-Pack Nutritional Labels (FOPLs), such as Nutri Score and NutrInform Battery labels (He et al., 2023; Mazzù et al, 2024). This is particularly relevant, as the use of front-of-pack nutritional labels (FOPLs) that are easy to understand, represents a policy prioritized and encouraged by the farm to fork strategy (European Commission, 2020). Moreover, we examined the moderating role of the European Commission tagline to enhance the real-life applicability of our findings.

We carry out three experiments. The first experiment compares the persuasion knowledge about misleading information on packaged foods, and health knowledge, demonstrating that the former leads to higher consumer reactance, which in turn increases consumer willingness to spread negative word-of-mouth about the misleading information. The second experiment replicates this comparison across different types of FOPLs, using a factorial experimental design: 2 (knowledge type: persuasion knowledge versus health knowledge) by 2 (FOPL type: Nutri Score versus NutrInform Battery). We report that the indirect effect of persuasion knowledge versus health knowledge on negative word-of-mouth, mediated by reactance, holds both in the presence of Nutri Score and NutrInform Battery, two labels that differ in terms of directiveness conception (Mazzú et al., 2024). Additionally, we find that consumers spread more negative word-of-mouth when exposed to NutrInform Battery. The third experiment examines the moderating role of the European Commission tagline, using a factorial experimental design: 2 (knowledge type: persuasion knowledge versus health knowledge) by 2 (the presence of European Commission tagline: with tagline versus without tagline). We found that the indirect effect of persuasion

knowledge versus health knowledge on negative word-of-mouth, through reactance, is significant without the tagline, but is not significant when the tagline is present.

4.2. Theoretical Framework

4.2.1. The Empowering Mechanism of Persuasion Knowledge versus Health Knowledge through the Lens of Psychological Reactance

Psychological reactance theory (Brehm, 1966) posits that consumers have a need to feel autonomous, such that when their freedom of choice is threatened, they are motivated to restore their sense of freedom. This motivation state determines a psychological response, which manifests emotionally as anger toward the source restricting their freedom, and cognitively as counterarguing against the persuasive content.

4.2.2. Antecedent to Psychological Reactance: Threat of Freedom

Threat of freedom is primarily defined as the preservation of one's behavior choice set. When this set is limited or reduced, people feel the threat of freedom (Brehm, 1966). For example, when schools implement food policies that replace unhealthy foods with healthier alternatives, students may perceive their choices as limited and experience a threat of freedom (Hanls et al., 2014). Over time, the concept of threat of freedom has been further developed in communication literature, extending beyond direct behavioral constraints to include emotional and attitudinal constraints (Dillard and Shen, 2005). Specifically, when individuals are emotionally or attitudinally discouraged from making certain decisions by communications, such as health warning images on cigarette packages (LaVoie et al, 2017), they experience a perceived threat to their freedom.

Food policies have been widely studied as a potential threat to freedom of choice (Barreiro-Hurle et al., 2023; Debnam 2017; Grummon et al, 2024; Irmak et al., 2020; Lombardini and Lankoski, 2013; Lu and Cai, 2023). Such policies include both regulatory requirements that impose mandatory actions from marketers or consumers—such as extra tax for sweetened beverages (Debnam 2017), or the cancellation of chocolate milk from the canteen menu (Hanks et al, 2014)—and mandatory communication for consumers to make informed decisions—such as health warnings on food packages (Grummon et al, 2024). Few studies have suggested that certain food policies could serve as opportunities to preserve or even enhance consumer freedom of choice, such as by encouraging marketers to replace less appealing unhealthy products with more attractive healthier alternatives (Dowding and Oprea, 2023).

While policymakers are often seen as a threat to consumers' freedom to make unhealthy choices (Amarnath and Jaidev, 2021; Reynolds-Tylus, 2019), the role of marketers in restricting consumers' freedom to make healthy choices remains largely overlooked in the literature. This may be due to the differential persuasion strategies of healthy and unhealthy foods, with the former often emphasizing self-control and external regulations as necessary constraints, and the latter promoting indulgence and pleasure, thus reinforcing the perception of autonomous choice (Alba and Williams, 2013; Laran, 2020). However, although the threats posed by unhealthy food promotion have been largely overlooked in psychological reactance literature, persuasion knowledge (Friestad and Wright, 1994) regarding misleading information on packaged food presents an opportunity for policymakers to help consumers recognize unhealthy food companies as a threatening influence in their food choices. Specifically, exposing the manipulative intent behind such misleading information aligns with the key antecedent of psychological reactance—

threat of freedom—commonly measured by the statement, "The company tried to manipulate my food choice" (Dillard and Shen, 2005).

Therefore, in this research, we propose that compared to the provision of health knowledge, persuasion knowledge will generate a higher level of threat of freedom than health knowledge, serving as manipulation check test.

4.2.3. The Motivational State: Reactance (Anger and Counterarguing) and Restoration of Freedom

When individuals perceive a threat of freedom, they are into a motivational state, i.e., reactance, which manifests as anger and counterarguing (Brehm, 1966; Dillard and Shen, 2005). When reactance is triggered, individuals are motivated to restore their perceptions of freedom. In turn, they develop less favorable attitudes toward policymakers (Song et al, 2018) and may even act contrary to the policy's intentions, such as decreased participation of school lunch when vegetarian day bans meat (Lombardini and Lankoski, 2013) or increasing their intention to purchase unhealthy food (Irmak et al., 2020).

To address the "hidden nature" of misleading information on packaged food—which can sometimes be difficult for consumers to detect and challenging for policymakers to regulate (Alcaire et al., 2023; Pérez-Ferrer et al., 2019)—this research focuses on the effect of reactance responses on negative word-of-mouth, a form of negative behavioral intention. Negative word-of-mouth is characterized by one's expressed intent to discourage others from purchasing or supporting certain products, brands, and companies (Voorhees et al, 2006). When negative word-of-mouth is expressed, it is typically associated with four key objectives: releasing negative feelings, retaliating against the company, helping others avoid similar issues, and seeking advice

(Hennig-Thurau et al, 2004)—all of which help uncover the "unknown" behind misleading information. Hence, the following hypotheses are formulated:

H1: Informing consumers persuasion knowledge about the misleading information (i.e., lying intention of the food company), compared to healthiness knowledge (i.e., the unhealthiness of the food products), results in consumer higher likelihood of spreading negative word-of-mouth about the food.

H2. The effect of different types of knowledge information on consumer negative word-of-mouth (NOWM) intention is mediated by reactance response towards the company.

4.2.4. The Moderating Role of European Commission Endorsement

Food policy adopted in the EU is typically issued by European Commission (European Commission, 2025b). When faced with such regulations, individuals tend to respond in one of two ways: by rationalizing the policy or by exhibiting reactance (Laurin et al, 2012; Proudfoot and Kay, 2014). As for the first way, the presence of European Commission's slogan in information been reported to enhance individual trust in policy, leading individuals to perceive EU-issued policies as more benevolent, honest, and competent (Karens et al, 2016). On the other hand, when the restrictive nature of policy is emphasized, potentially through the presence of the European Commission slogan, individuals may perceive the communicated knowledge as regulation, which could lead to resistance or avoidance of the information provided (Laurin et al, 2013). In this research, we aim to examine the direction of the moderating role of the European Commission's presence on knowledge information and propose the following hypothesis:

H3: The indirect effect of persuasion knowledge versus health knowledge communication on negative word-of-mouth, through reactance response, is moderated by the presence of European Commission slogan.

4.3. Experiment 1: The Effect of Persuasion Knowledge versus Health Knowledge When Exposed to Misleading Information

Experiment 1 aimed to test the main effect outlined in H1, and the mediation effect outlined in H2, which claims that an increase in consumer negative word of mouth of the company, when exposed to persuasion knowledge information versus health knowledge information, is driven by psychological reactance, measured by anger and counterargue intentions.

4.3.1. Methods

The activation of threat of freedom

At the end of the main experiment, a manipulation check was added: participants read the stimuli and then indicated the extent to which they thought the company's misleading information as threat of freedom (Dillard and Shen; 2005; 4-item, i.e., The yogurt company threatened my freedom to choose food. $\alpha = .80$). The results showed that the manipulation was successful, with persuasion knowledge information M = 4.12 (SD = 1.17) scoring significantly higher than health knowledge information M = 3.58 (SD = 1.24) ($t = -3.16$, $df = 198$, $p < 0.01$).

Main study participants and procedure

We conducted an online experiment through Prolific. The sample included 200 participants (all EU countries) (M_{age} = 33.31, SD = 9.78, 54% male, 45% female and 2% non-binary). Participants were then randomly assigned to one of two conditions, with half of the sample receiving a yogurt package that claims "high protein content" together with persuasion knowledge information (e.g., These companies are lying to look like healthy and prevent you from real healthy choices) and the other half receiving the same package together health knowledge information (e.g., These foods are not good for your health and prevent you from building a healthy body) (see Appendix C).

We measured participants' negative word of mouth (Voorhees et al, 2006; 3-item, I will recommend friends to not eat the above-mentioned food. α = .82); anger towards the company (Dillard and Shen; 2005; 4-item, i.e., I feel irritated with the yogurt company. α = .96); counterarguing attention towards the company was measured with two items (i.e., I found myself actively disagreeing with the yogurt company. Adapted from Nabi et al. 2007; α = .58; Pearson Correlation (r) = 0.41). (see Appendix D for the details of the scale items).

4.3.2. Results and Discussion

An independent t-test analysis revealed that persuasion knowledge information, compared to health knowledge information, marginally increased consumer negative word-of-mouth of the company ($M_{persuasion}$ = 5.02, $SD_{persuasion}$ = 1.23 vs. M_{health} = 4.69, SD_{health} = 1.27, t (198) = -1.88, p = 0.06), significantly increased consumer anger towards the company ($M_{persuasion}$ = 4.51, $SD_{persuasion}$ = 1.48 vs. M_{health} = 3.64, SD_{health} = 1.39, t (198) = -4.29, p < 0.01), and significantly increased consumer counterargue intention against the misleading nutrition claim ($M_{persuasion}$ = 4.35, $SD_{persuasion}$ = 1.24 vs. M_{health} = 3.91, SD_{health} = 1.23, t (198) = -2.52, p = 0.01). The main effect of information types on NWOM supports H1.

Serial mediation. We employed serial mediation model implemented in the PROCESS macro for SPSS (Model 6; Hayes 2022), with knowledge information types (health knowledge = -1; persuasion knowledge = 1) as the independent variable, anger and counterargue intention as the serial mediators, negative word-of-mouth as the dependent variable.

The mediation analysis confirms H2 and suggests that when exposed to persuasion knowledge information, compared to the health knowledge, consumers express higher level of anger ($b = 0.43$, $t = 4.28$; $p < 0.01$). This increased anger increases consumer counterargue intention towards the misleading information ($b = 0.46$, $t = 8.94$, $p < 0.01$). In turn, both anger ($b = 0.27$, $t = 4.24$, $p < 0.01$) and counterargue intention ($b = 0.29$, $t = 3.94$, $p < 0.01$) leads to higher negative word-of-mouth.

Specifically, the direct effect of knowledge information types on negative word-of-mouth is not significant ($b = -0.01$, $t = -0.17$, $p = 0.87$). The indirect effect of persuasion knowledge information versus health knowledge information on negative word of mouth through counterargue is not significant ($b = 0.01$, [SE] = 0.02; [CI] = -0.04, 0.05). More importantly, the indirect positive effect of persuasion knowledge information versus health knowledge information on negative word of mouth through anger is statistically significant ($b = 0.12$, [SE] = 0.04; [CI] = 0.05, 0.19). The indirect positive effect of persuasion knowledge information versus health knowledge information on negative word of mouth—through anger and counterargue intention—is statistically significant ($b = 0.06$, [SE] = 0.02; [CI] = 0.02, 0.12).

4.4. Experiment 2: Persuasion Knowledge versus Health Knowledge When Exposed to the Co-Existence of Misleading Information and FOPL

Experiment 2 aimed to test the mediation effect outlined in H2, which claims that an increase in consumer negative word of mouth of the company, when exposed to persuasion knowledge information versus health knowledge information, is driven by psychological reactance, measured by anger and counterarguing intentions. Moreover, in experiment 2, the misleading information is presented along with two types of European FOPLs, as FOPL is expected to become mandatory in EU countries.

4.4.1. Methods

Manipulation check

The base stimuli (i.e., the information manipulation conditions) remain the same as in Experiment One.

Main study participants and procedure

We conducted an online experiment through Prolific. The sample included 403 participants (all EU countries) (M_{age} = 32.45, SD = 9.33, 56.4% male, 42.1% female and 1.5% non-binary). Participants were then randomly assigned to one of four conditions with factorial design 2 (FOPL type: Nutri Score versus NutrInform Battery) * 2 (knowledge type: persuasion knowledge versus health knowledge) (see Appendix E for details).

We measured participants' negative word of mouth (Voorhees et al, 2006; α = .81); anger towards the company (Dillard and Shen, 2005; α = .95); counterarguing intention towards the company was measured with two items (Adapted from Nabi et al. 2007; α = .50; Pearson Correlation (r) = 0.33) (see Appendix D for the scale items).

4.4.2. Results and Discussion

A two-way univariate ANOVA was conducted to examine the effects of information types (persuasion knowledge versus health knowledge information) and FOPL types (Nutri Score versus NutrInform Battery) on negative word-of-mouth, anger, and counterargue intentions respectively. As for negative word-of-mouth, the results showed a significant main effect of FOPL types ($M_{Nutri-score}$ = 4.71, $SD_{Nutri-score}$ = 1.36 vs. $M_{NutrInform}$ = 4.99, $SD_{NutrInform}$ = 1.22, F (1, 400) = 4.92, p = 0.03). However, both the main effect of information types (M_{health} = 4.76, SD_{health} = 1.37 vs. $M_{persuasion}$ = 4.93, $SD_{persuasion}$ = 1.22, F (1, 400) = 1.78, p = 0.18) and the interaction effect were not significant (F (1,400) = 0.004, p = 0.95). As for anger, the results showed a significant main effect of information types (M_{health} = 3.47, SD_{health} = 1.51 vs. $M_{persuasion}$ = 4.26, $SD_{persuasion}$ = 1.48, F (1, 400) = 27.69, p < 0.01). However, the main effect of FOPL types was not significant ($M_{Nutri-score}$ = 3.78, $SD_{Nutri-score}$ = 1.54 vs. $M_{NutrInform}$ = 3.95, $SD_{NutrInform}$ = 1.55, F (1, 400) = 1.40, p = 0.24); the interaction effect was not significant (F (1,400) = 0.31, p = 0.58). As for counterargue intention, the results showed a significant main effect of FOPL types ($M_{Nutri-score}$ = 3.99, $SD_{Nutri-score}$ = 1.26 vs. $M_{NutrInform}$ = 4.22, $SD_{NutrInform}$ = 1.12, F (1, 400) = 3.88, p = 0.05); the main effect of information types was also significant (M_{health} = 3.99, SD_{health} = 1.26 vs. $M_{persuasion}$ = 4.23, $SD_{persuasion}$ = 1.10, F (1, 400) = 4.26, p = 0.04); the interaction effect was not significant (F (1,400) = 0.20, p = 0.66).

Serial mediation. We employed serial mediation model implemented in the PROCESS macro for SPSS (Model 6; Hayes 2022), with knowledge information types (health knowledge = -1; persuasion knowledge = 1) as the independent variable, anger and counterargue intention as the serial mediators, Negative word-of-mouth as the dependent variable. Moreover, we included FOPL types as the covariate, due to the main effect of FOPL types on negative word-of-mouth and counterargue while there was no interaction effect in any of the response variables.

The mediation analysis confirms H2 and suggests that when exposed to persuasion knowledge information, compared to the health knowledge, consumers express higher level of anger ($b = 0.39$, $t = 5.27$; $p < 0.01$). This increased anger increases consumer counterargue intention towards the misleading information ($b = 0.40$, $t = 11.59$, $p < 0.01$). In turn, both anger ($b = 0.42$, $t = 10.39$, $p < 0.01$) and counterargue intention ($b = 0.21$, $t = 4.08$, $p < 0.01$) leads to higher negative word-of-mouth. As for covariate, FOPL did not show any significant effect in response variables, including anger ($b = 0.09$, $t = 1.19$, $p = 0.24$), counterargue intention ($b = 0.08$, $t = 1.58$, $p = 0.11$), and negative word-of-mouth ($b = 0.08$, $t = 1.58$, $p = 0.11$).

Specifically, the direct effect of knowledge information types on negative word-of-mouth is not significant ($b = -0.10$, $t = -1.92$, [CI] = [-0.21, 0.003]). The indirect effect of persuasion knowledge information versus health knowledge information on negative word of mouth through counterargue is not significant ($b = -0.007$, [SE] = 0.01; [CI] = -0.03, 0.01). More importantly, the indirect positive effect of persuasion knowledge information versus health knowledge information on negative word of mouth through anger is statistically significant ($b = 0.16$, [SE] = 0.03; [CI] = 0.10, 0.23). The indirect positive effect of persuasion knowledge information versus health knowledge information on negative word of mouth—through anger and counterargue intention—is statistically significant ($b = 0.03$, [SE] = 0.01; [CI] = 0.01, 0.06).

Moreover, to test the robustness of the serial mediation effect under both FOPL conditions, we also implemented the moderated mediation model in the PROCESS macro for SPSS (model 83), the results have shown that the indirect effect of information types on consumer NWOM, through anger and counterarguing, is significant both under the presence of Nutri-Score ($b = 0.03$, [SE] = 0.01; [CI] = 0.01, 0.06) and NutrInform Battery ($b = 0.04$, [SE] = 0.01; [CI] = 0.01, 0.07).

4.5. Experiment 3: The Underlying Mechanism of Consumer Responses to Persuasion Knowledge versus Health Knowledge Intervention on Potential Misleading Elements

Experiment 3 aimed to test the moderated mediation effect proposed in hypothesis 3, which posits that the indirect effect of persuasion knowledge versus health knowledge communication on negative word-of-mouth, through reactance response, is moderated by the endorsement of the European Commission. To increase the generalizability of our findings, we used different products that are involved in potentially misleading elements in daily life (see Appendix E).

4.5.1. Methods

Main study participants and procedure

We conducted the experiment with 160 students from the Master of Science in Management, participating to the experiment in exchange for a reward, namely extra point for their final exam. Participants (M_{age} = 22.04, SD = 1.12, 46.3% male, 53.8% female), were randomly assigned to one of four conditions in a 2 by 2 factorial design. The factors were knowledge intervention type (persuasion knowledge versus health knowledge) and the presence of European Commission Logo (with European Commission Logo versus without European Commission Logo; see Appendix E).

We measured participants' negative word of mouth for the product (Voorhees et al, 2006; Cronbach's alpha = .85; anger (Dillard and Shen 2005; alpha = .96) and counterarguing (Nabi et al. 2007; alpha = .62) (see Appendix D for scale details).

Manipulation check

After the main experiment, a manipulation check was added with 160 participants from a European University. Participants were asked to indicate the extent to which they perceived threat of freedom from the company with misleading information (Dillard and Shen, 2005, $\alpha = .90$). The results showed that the perceived threat of freedom towards different knowledge information is congruent with the endorsement of the EU. Specifically, when the European Commission tagline was present, the perceived threat of freedom of $M_{(persuasion\ knowledge\_eu)} = 3.25$ (SD = 1.17) and of health knowledge $M_{(health\ knowledge\_eu)} = 3.26$ (SD = 1.10) are not significantly different ($F(1, 156) = 0.002$, $p = 0.96$); while when the European Commission tagline was absent, the perceived threat of freedom of $M_{(persuasion\ knowledge\_non\ eu)} = 3.36$ (SD = 1.37) scores significantly higher than $M_{(health\ knowledge\_non\ eu)} = 2.78$ (SD = 1.19) ($F(1, 156) = 4.58$, $p = 0.03$).

4.5.2. Results and Discussion

We conducted a two-way ANOVA analysis to examine the effects of knowledge intervention (health, persuasion) and the presence of European Commission Logo (with, without) on consumer negative word of mouth of the product, anger towards the company, and counterarguing against the misleading information on the label. As for negative word of mouth, [$M_{(Persuasion\ EU)} = 3.82$, $SD_{(Persuasion\ EU)} = 1.59$; $M_{(Persuasion\ Non\text{-}EU)} = 4.14$, $SD_{(Persuasion\ Non\text{-}EU)} = 1.27$; $M_{(Health\ EU)} = 3.95$, $SD_{(Health\ EU)} = 1.48$; $M_{(Health\ Non\text{-}EU)} = 3.09$, $SD_{(Health\ Non\text{-}EU)} = 1.27$] we found a significant main effect for knowledge intervention ($F(1,156) = 4.19$, $p = 0.042$), indicating that persuasion knowledge, compared to health knowledge intervention, generate higher consumer negative word of mouth. There was no significant main effect for the presence of the European Commission Logo ($F(1,156) = 1.45$, $p = 0.23$). However, there was a significant interaction effect ($F(1,156) = 6.95$, $p = 0.01$), indicating that the effect of knowledge intervention depended on the

presence of European Commission Logo: persuasion knowledge, compared to health knowledge, generated higher negative word of mouth in the absence of European Commission logo, while the negative word of mouth differences generated by persuasion knowledge and health knowledge are not statistically significant in the presence of European Commission Logo. As for anger, $M_{(Persuasion\ EU)} = 3.24$, $SD_{(Persuasion\ EU)} = 1.42$; $M_{(Persuasion\ Non\text{-}EU)} = 3.53$, $SD_{(Persuasion\ Non\text{-}EU)} = 1.75$; $M_{(Health\ EU)} = 2.87$, $SD_{(Health\ EU)} = 1.53$; $M_{(Health\ Non\text{-}EU)} = 2.08$, $SD_{(Health\ Non\text{-}EU)} = 1.24$. We found a significant main effect for knowledge intervention ($F\ (1,156) = 14.86$, $p < 0.01$), indicating that persuasion knowledge, compared to health knowledge intervention, led to higher consumer anger response. There was no significant main effect for the presence of the European Commission Logo ($F\ (1,156) = 1.19$, $p = 0.28$). However, there was a significant interaction effect ($F\ (1,156) = 5.20$, $p = 0.02$), indicating that the effect of knowledge intervention depended on the presence of European Commission Logo: persuasion knowledge, compared to health knowledge, led to higher anger in the absence of European Commission logo, while the anger response differences generated by persuasion knowledge and health knowledge are not statistically significant in the presence of European Commission Logo. As for counterarguing, [$M_{(Persuasion\ EU)} = 3.86$, $SD_{(Persuasion\ EU)} = 1.20$; $M_{(Persuasion\ Non\text{-}EU)} = 3.87$, $SD_{(Persuasion\ Non\text{-}EU)} = 0.94$; $M_{(Health\ EU)} = 3.73$, $SD_{(Health\ EU)} = 1.01$; $M_{(Health\ Non\text{-}EU)} = 3.18$, $SD_{(Health\ Non\text{-}EU)} = 1.10$] we found a significant main effect for knowledge intervention ($F\ (1,156) = 5.89$, $p = 0.02$) indicating that persuasion knowledge, compared to health knowledge intervention, led to higher consumer counterarguing response. There was no significant main effect for the presence of European Commission Logo ($F\ (1,156) = 2.67$, $p = 0.11$) and there was no significant interaction effect ($F\ (1,156) = 2.71$, $p = 0.10$).

Moderated mediation. We employed moderated mediation model implemented in the PROCESS macro for SPSS (Model 83; Hayes 2022), with knowledge intervention types (health

knowledge = -1; persuasion knowledge = 1) as the independent variable, anger and counterarguing as the mediators, negative word of mouth as the dependent variable, and incorporating the presence of EU as the moderator.

The results showed significant effects of knowledge intervention types on consumer anger response (b = 0.46, t = 3.85; p < 0.01), while there was no significant effect of the presence of the European Commission Logo on anger (b = 0.13, t = 1.09; p = 0.28). Importantly, the effect of their interaction (knowledge intervention types * the presence of European Commission Logo) on anger was also significant (b = -0.27, F (1, 156) = 5.20; p = 0.02). Specifically, in the absence of European Commission Logo, persuasion knowledge, compared to health knowledge intervention, significantly increase consumer anger response (b = 0.73, se = 0.17, t = 4.31, p < 0.01, LLCI-ULCI = [0.39, 1.05]); in the presence of European Commission Logo, persuasion knowledge, compared to health knowledge intervention, did not significantly increase consumer anger response (b = 0.19, se = 0.17, t = 1.12, p = 0.26, LLCI-ULCI = [-0.14, 0.51]).

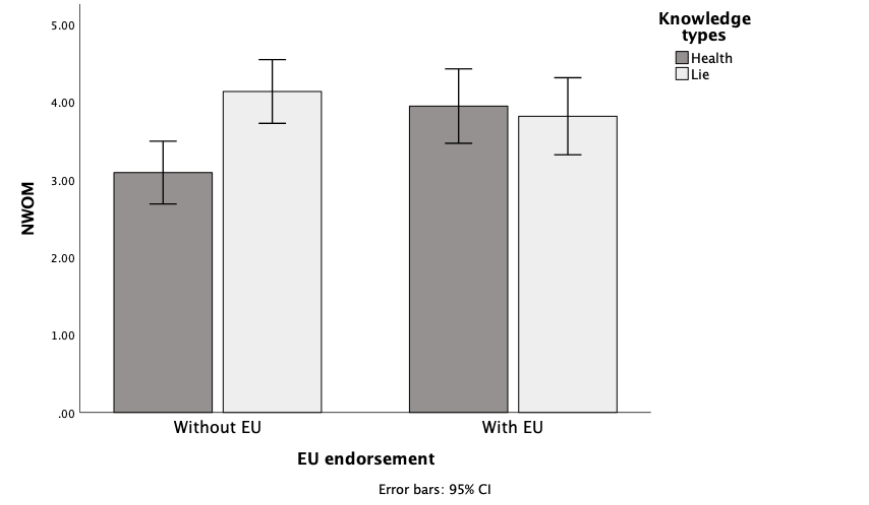


Figure 10. Results of experiment 3.

Anger, in turn, affected the counterarguing and further impacted negative word of mouth. Specifically, we observed a statistically significant positive effect of anger on consumer counterargue (b = 0.37, se = 0.05, t = 7.45, $p < 0.01$). Anger (b = 0.29, se = 0.07, t = 4.07, $p < 0.01$) and counterargue then influenced negative word of mouth (b = 0.53, se = 0.10, t = 5.40, $p < 0.01$). Furthermore, we found a statistically significant index of moderated mediation, indicating the presence of a conditional indirect effect of knowledge intervention types on negative word of mouth (b = -0.15, BootSE = 0.09, BootLLCI = -0.35, BootULCI = -0.02) via anger and counterargue, moderated by the presence of European Commission Logo. Specifically, in the absence of European Commission Logo, the indirect effect of knowledge intervention types on negative word of mouth, through anger and counterargue, is significant (b = 0.14, BootSE = 0.05, BootLLCI = 0.06, BootULCI = 0.25). However, in the presence of European Commission Logo, the indirect effect of knowledge intervention types on negative word of mouth, through anger and counterargue, is not significant (b = 0.04, BootSE = 0.03, BootLLCI = -0.03, BootULCI = 0.11). Although not formally tested, we speculate that a ceiling effect (Shadish et al., 2002, P50) may account for the lack of additional increase for the persuasion knowledge condition. Future research may explore alternative approaches to better understand the interaction effects of institutional endorsement and distinctive knowledge interventions.

The results of Experiment 3 support H3, showing that the effect of knowledge intervention type on consumer negative word of mouth, mediated by anger and counterargue, manifests in the absence of the European Commission Logo.

4.6. General Discussion for Study 3

Within the “Farm-to-fork” framework, a key goal of the European Commission is to enable consumers to make informed decisions. This assertion is backed up by the provisions outlined in

the EU food law, which stipulates that consumers "have the right to safe food and accurate and honest information" (European Commission, 2025b). Under such instructions, food policymakers have primarily focused on providing consumers with 'correct information'. However, this can leave room for deceptive practices that are literally accurate but misleading regarding the overall healthiness of the food (André et al., 2019; Pérez-Ferrer et al., 2019; Perry et al., 2018; Pulker et al., 2018).

Anchored in psychological reactance theory, our findings contribute to the literature by offering a novel perspective: we highlight reactance as a motivational state that can enable individuals to resist manipulative tactics (i.e., the use of misleading packaging) from food companies. Psychological reactance theory conceptualizes reactance as a motivational state triggered by the threat of freedom, without specifying the source of the threat. Prior research has predominantly examined it in the context of autonomy threatening health interventions initiated by policymakers (Debnam 2017; Grummon et al, 2024; Hanks et al, 2014). In contrast, our findings suggest that this perceived threat of freedom can be redirected toward agents that engage in misleading or even deceptive practices. Specifically, experiment 1 demonstrates that framing public communication about misleading food information about companies' manipulative intent triggers a stronger perceived threat of freedom than framing it around the unhealthiness of the products. Notably, while both communication approaches emphasize how misleading elements limit access to healthier outcomes (i.e., these foods are not good for your health and prevent you from building a healthy body vs. these companies are lying to look healthy and prevent you from real healthy choices). However, the stronger reactance observed in the manipulative intent condition reflects the social nature of threat. This aligns with the conceptualization of psychological reactance theory that emphasizes the antecedent of reactance (i.e., threat of freedom)

as socially driven, which arises when individuals perceive their choices to be constrained by social actors who intend to control them.

In experiment 2, we examined the underlying mechanism in the presence of front-of-pack nutritional labels, which are widely regarded as key communication tools for supporting informed consumer decision-making. We found that in the presence of different types of FOPLs (i.e., either Nutri Score or NutrInform Battery), the provision of persuasion knowledge, compared to health knowledge, indirectly increased consumer NWOM intention. This effect was serially mediated by anger and counterargue intention. These findings demonstrate the persuasive effectiveness of communicating persuasion knowledge across different FOPL systems. Moreover, the results indicate that packaging information including the NutrInform Battery, compared to Nutri-Score, leads to higher consumer intentions to spread NWOM. While previous studies have shown that these labels differ in their effectiveness at improving consumer attention, attitude, and purchase intention (Ikonen et al., 2020), our research highlights their distinct influence on consumer willingness to spread NWOM with others. Future research could further explore the underlying mechanism driving this effect.

In experiment 3, we further examined the underlying mechanism within the contextual condition that included the European commission tagline. This reflects the typical setting where policymakers disseminate their regulatory information about misleading content. The findings reveal the moderating role of institutional endorsements in shaping how persuasion knowledge versus health knowledge influence psychological reactance and NWOM. Specifically, in the absence of European Commission tagline, individuals shoed higher psychological reactance response and higher intentions to spread NWOM when exposed to persuasion knowledge, compared to health knowledge. On the other hand, when the tagline was included, these differences

between the two knowledge conditions become non-significant. Notably, the presence of European Commission tagline increased the psychological reactance and NWOM intentions in the health knowledge condition but did not further elevate these responses in the persuasion knowledge condition. This heightened consumer responses toward health knowledge triggered by the presence of the European Commission tagline echoes with the prior research (Fong et al., 2024), which shows that only debunking information (e.g., health knowledge about the safety of fluoride-containing toothpaste) provided by regulators, rather than by media outlets or competing firms, can effectively mitigate the impact of misleading information. Future research may further explore how institutional endorsement enhances the effectiveness of health knowledge. For example, individuals may perceive the endorsed information as more credible, leading to higher involvement with the health content (Luo et al., 2022; Schmuck et al., 2018).

Overall, our findings show that communicating persuasion knowledge (i.e., revealing the lying intention behind misleading information), compared to health knowledge (i.e., revealing the unhealthiness of seemingly healthy foods with misleading information), is either more effective or equally effective in directly increasing consumer NWOM, or indirectly increasing NWOM intentions through anger and counterarguing.

4.7. Policy Implications

Misleading information on food packaging—particularly claims that falsely suggest a product is healthier—is both widespread and increasingly subtle in its presentation, making consumers especially vulnerable (Clement et al., 2017). These potentially misleading elements now appear in various evolving formats, such as redundant labels that carry no extra product information (Wilson and Lusk, 2020), “natural-looking” aesthetics designed to imply a higher level of healthiness (Hagen, 2021), and lookalike labels that mimic the authorized certifications without

meeting the required standards (Schoemann et al., 2024). In the presence of such elements, consumers are more likely to misjudge the healthiness of products, show a greater willingness to purchase them, and express a higher willing to pay premiums due to these misleading elements (Fong et al., 2024; Hagen, 2021; Schoemann et al., 2024; Wilson and Lusk, 2020). Policymakers must recognize the increasingly sophisticated nature of these tactics and update regulatory framework accordingly to effectively identify and mitigate such emerging forms of misleading elements.

Our findings suggest that revealing companies' lying intention presents a promising real-world communication strategy due to its demonstrated effectiveness and compatibility with existing food policy regulations. This approach offers several key advantages: it elicits stronger consumer responses than traditional health knowledge interventions, aligns well with current front-of-pack nutritional labels (FOPLs) system, and is less extreme while more targeted than corrective advertising.

First, compared to the provision of health knowledge, persuasion knowledge that reveals manipulative intent behind misleading information can provoke more advocative consumer reactions, such as an increased negative word-of-mouth (NWOM) intention directly or heightened anger that indirectly leads to higher NWOM intention. While the provision of health knowledge has been a commonly adopted communication strategy by policymakers, its effectiveness remains limited. For instance, disclaimers that inform consumers about the factual ineffectiveness of misleading packaging elements have been shown to reduce misperceptions about product healthfulness in some cases (Hagen, 2021) but often fail to decrease consumers' willingness to pay a premium for such products (Wilson and Lusk, 2020). Providing persuasion knowledge, specifically by revealing companies' lying intention, as a motivation-triggering communication

approach may enable policymakers and public health communicators to more effectively combat misleading information on food packaging. In particular, it activates a motivation state in consumers that empowers them to spread NWOM.

Second, the provision of persuasion knowledge complements another widely promoted regulatory strategy—front-of-pack nutritional labels (FOPLs). Our findings show that the persuasive effect (i.e., NWOM, anger, and counterargue) of revealing companies' lying intention over disclosing the unhealthiness of products with misleading information persists across both directive FOPL format (i.e., Nutri Score) and non-directive format (i.e., NutrInform Battery), demonstrating its adaptability across different labeling systems. Policymakers and public health communicators can leverage FOPLs alongside persuasion knowledge as educational tools to debunk misleading packaging information. For example, while companies may use deceptive packaging to imply their products are healthy, Score D and E on the Nutri Score indicate the overall unhealthiness of foods, while high levels of salt, sugar or saturated fat on the NutrInform Battery label similarly serve as a health warning, advising limited consumption. With the heightened NOWM driven by persuasion knowledge, consumers may also become better equipped to effectively use FOPLs.

Third, compared to more aggressive regulatory tools like corrective advertising, which requires companies to publicly acknowledge their misleading practices, revealing the lying intention behind misleading elements is less punitive to individual companies while being more precisely targeted at the misleading practices themselves. Corrective advertising can cause spillover harm, not only affecting the specific product involved but also damaging a company's broader brand, unrelated offerings, and even third-party advertisers associated with the product (Darke et al., 2008; Darke and Ritchie, 2007). In comparison, revealing the lying intention of

unnamed or hypothetical companies behind misleading elements, rather than directly naming or penalizing individual companies, avoids excessive brand reputational damage and an overemphasis on specific firms. Yet, it remains effective in triggering a perceived threat to consumer freedom and motivate consumers to spread words about such deceptive packaging cues due to stronger anger toward any company employing them. We speculate that this approach will also incentivize companies to avoid using misleading strategies that could be publicly associated with manipulative intent flagged by regulators.

Our findings also highlight the branding effectiveness of regulatory bodies and suggest that policymakers should strategically leverage their institutional images to enhance the impact of public communication. Specifically, the presence of the European commission tagline amplifies consumer anger towards companies and NWOM intention in the health knowledge condition. This effect stems from increased consumer appraisal involvement when information is perceived as coming from the European commission, as the perceived lying intention behind the misleading information increased even if the messages do not mention lying itself. Given this influential role, policymakers should further consider how their involvement shapes consumer perceptions and take an instructive role in guiding public understanding of misleading practices.

4.8. Limitations and future research

This research has some limitations, particularly regarding its applicability in real-world contexts. For instance, framing corporate labeling practices as explicitly “lying” is not practical for policymakers or companies, as such claims would face strong resistance from retailers and manufacturers. Moreover, labeling practices as ‘lying’ requires clear and rigorous justification, which may not always be feasible. Future research should therefore adopt more realistic communication strategies, such as using more nuanced wording that activates consumers’ existing

persuasion knowledge or situating the messages within advocacy contexts, where activist groups are more likely to use such direct and strong wording.

5. Study 4: How Social and Sensory Appeals Shape Aversion in Diverging Ways Toward Insect-Based Food

Abstract

Insect-based foods have gained increasing attention among practitioners because of their sustainable and nutritional benefits, which align with societal interests. However, the massive promotional efforts by insect-based food advocates have hardly dented Western consumers' strong aversion to entomophagy, and the reason could be that they are focusing on the wrong messages. Across four experiments, we uncover empirical evidence to support this argument and show that hedonic (vs. utilitarian) appeals (experiment 1) and social (vs. sensory) appeals (experiment 2) are more effective in decreasing consumers' perceived disgust toward insect-based food. Experiment 3 reveals that social (vs. sensory) hedonic appeals mitigate consumers' perceived disgust toward insect-based food in public, but not in private consumption settings. Experiment 4 finds that perceived social norm deviation is an antecedent for consumers' disgust reactions. Social (vs. sensory) hedonic appeals decrease perceived social norm deviation, which decreases perceived disgust, which in turn increases consumers' attitude and willingness to try insect-based food. These findings illuminate how different promotional appeals shape affective and behavioral responses to insect-based food, which can help marketers compose more effective communication.

Keywords: social disgust, insect food, consumption context, social appeals, marketing communication

5.1. Introduction

The world has many mouths to feed. Not only is the world population expected to reach 9.7 billion by 2050 (United Nations, 2022), but there are routinely over 768 million people who lack sufficient nutrition every year (FAO, 2021). Feeding that many people is a massive challenge, further complicated by the need to reduce global emissions to counteract climate change. Currently, food systems account for 35% of global human carbon emissions, with animal-based food accounting for 57% of the total (Xu et al. 2021). Thus, there is an urgent need to switch to alternative diets that are not only healthy, but capable of reducing the environmental impact and economic costs of current food consumption patterns. The newest advances in agricultural technology and food safety make insects a promising solution to these global challenges (Godwin, 2021). A recently approved EU food regulation encouraged the adoption of insect-based foods, with yellow mealworms and migrating locusts being the first insects approved for the "novelty food" category (European Commission, 2022).

The main obstacle is adoption (Baker et al., 2016; Kröger et al., 2022): Consumers in Western countries are very reluctant to try insect-based foods and the basic reason seems to be perceived disgust - defined as an automatic reaction of the behavioral immune system that intends to avert interaction with and consumption of potentially noxious substances (Hartmann et al., 2018) - which implies that promoters of insect consumption must find ways to reduce it. Following this

line of reasoning, we begin by considering the strategies that insect-based food advocates currently use to promote entomophagy (i.e., insect consumption by humans).

From private and public sources advocating for entomophagy—we observed that 98% of promotional efforts focused on utilitarian benefits (e.g., health and sustainability), 2% on sensory characteristics (e.g., taste, smell, flavor), and none on the socio-moral aspects of insect-based food consumption. For instance, the Guardian announced that "*If we want to save the planet, the future of food is insect*" (May 9, 2021); Deutsche Welle asserted that "*swapping steaks for crickets can cut greenhouse gas pollution and slow species extinction, but persuading people to eat them will be tricky*" (January 24, 2023); The Washington Post asked, "*Would you eat insects to help save the planet?*" (January 9, 2019).

Although these logic-based arguments have raised people's awareness of the benefits of insect-based food, they have rarely reduced Westerners' negative perceptions about entomophagy. Indeed, the massive promotional efforts have hardly dented Western consumers' strong aversion to entomophagy: for instance, only 10% of European consumers express a willingness to replace meat with insects (Khatsenkova and Elton, 2023). We believe that the reason for the little success of these communication strategies is that they do not focus on one of the main sources of Western consumers' strong aversion to entomophagy, namely the socio-moral aspects of insect-based food consumption.

In Western food culture, eating insect-based foods has been perceived as a negative social practice, conjuring notions of being disgusting (Myers and Pettigrew 2018), offensive (Kostecka et al., 2017) and primitive (Szendrő et al., 2020). Self-presentation theory postulates that people are prone to avoid a stigmatized identity; thus, they conform with social norms when they encounter situational cues that signal the potential to be evaluated by others, such as when

consuming insect-based foods (Jensen Schau and Gilly, 2003). In other words, consumers often construct their self-image in accordance with contextual social factors (Jensen Schau and Gilly, 2003). Building on evidence that low social appropriateness is a key affective antecedent of consumers' disgust response to insect-based food (Barsics et al., 2017; Jensen and Lieberoth, 2019), we propose that different promotional appeals are differently able to reduce disgust responses toward insect-based foods. Specifically, we compare the effectiveness of the most widely used communication approach, which focuses on the utilitarian benefits, against appeals that promote the hedonic benefits of insect-based food consumption. Our basic idea is that, if Westerners' disgust toward insect-based food consumption is generally a product of cultural transmission, like with many food aversions and taboos, then promoting benefits such as health, sustainability, and sensory characteristics like taste should not be very effective in reducing consumers' resistance to entomophagy.

In line with this reasoning, we decompose the concept of "hedonic appeal" into two different types that might characterize food producers' promotional efforts: sensory ("It's yummy") and social ("Enjoy with family") appeals. Sensory appeals are already widely used due to their effectiveness in promoting traditional food consumption (Belei et al., 2012; Raghunathan et al., 2006). Social appeals, meanwhile, are thought to be effective at persuading consumers to adopt sustainable practices (Ardoin and Prinyawiwatkul, 2021; Samson et al., 2021). However, the literature is unclear about how social and sensory appeals differently shape consumers' aversion to entomophagy. We argue that, if the perceived disgust toward insect-based food in Western culture is socially driven, then social appeals should outperform both sensory and utilitarian appeals in reducing such disgust. Across four controlled experiments, we uncover empirical evidence to support this argument.

Our work makes several research contributions. First, we contribute to the general field of entomophagy (Baker et al., 2016; Kröger et al., 2022; Pozharliev et al., 2023). Recent studies in this domain have studied possible strategies for reducing consumers' disgust toward insect-based food, such as presenting participants with educational information (Gumussoy et al., 2021), decreasing the visibility of insects (Myers and Pettigrew, 2018), and making the image of the insect on the product packaging more humanlike (Pozharliev et al., 2023). The present research extends this literature by revealing how and under which conditions the largely neglected use of social appeals can help insect-based food advocates—including food producers, private actors and public media—reduce Western consumers' aversion to entomophagy.

Second, we contribute to the literature on the effective use of marketing strategies to promote sustainable food consumption (Bezawada et al., 2013; Chitturi et al., 2008; Kivetz and Zheng, 2017). While utilitarian and hedonic appeals have been widely studied for their role in generating positive food associations, such as positive taste anticipation (Moore and Lee, 2012), memory (Samson et al., 2021), and perceived healthiness (Choi et al., 2012), the field lacks knowledge on how these appeals counteract negative responses. We fill this gap by comparing different promotional appeals' effectiveness in decreasing consumers' negative responses (e.g., perceived disgust) toward insect-based food. We find that hedonic appeals are more effective than utilitarian, and that social appeals are more effective than sensory appeals.

Third, while the previous literature on insect-based food acceptance has focused on the effects of those sensory characteristics that can only be evaluated during or after product consumption (e.g., taste, texture, smell) (Sogari et al., 2018; Tan et al., 2016), we compare the effectiveness of different communication appeals that can reduce pre-consumption disgust feelings and, consequently, encourage a greater willingness to try (hereafter WTT) insect-based foods.

Finally, we responded to the call for research on the role of contextual factors in shaping consumers' emotional and behavioral responses to insect-based food (House et al., 2016; Pozharliev et al., 2023) by studying the effectiveness of marketing communication appeals under different contexts: specifically, public vs. private consumption contexts.

5.2. Theoretical Background and Hypothesis Development

5.2.1. Disgust Toward Insect Food

As we said before, disgust represents the main reason for Westerners reluctance to try insect-based food (Ruby et al., 2015). Past research suggests that consumer disgust responses toward insect-based food derive mainly from poor taste expectations (Barsics et al., 2017) and social concerns (Oaten and Stevenson, 2009). In terms of the former, gustatory distaste disgust is triggered automatically by unpleasant taste expectation, which is reduced when the food is shown with insect component labels without insect elements inside (Barsics et al., 2017). From the latter perspective, consumer disgust is seen as a socially learned behavior, since people from different cultures show different disgust responses toward insect-based food (Jensen and Lieberoth, 2019). Specifically, the adaptationist theory of Tybur et al. (2009, 2013) suggests that disgust evolved as a solution to multiple adaptive problems, such as avoiding substances associated with disease-causing agents in an ancestral environment, as well as individuals who inflict social costs on oneself or members of one's social network. While there is documented evidence that humans evolved an aversion to snakes and spiders, no empirical evidence currently exists for a similar insect-based disgust (see, e.g., Jensen and Lieberoth, 2019). That said, previous research suggests that socially learned disgust responses are contagious at the group level (Curtis et al., 2011).

Following this line of reasoning, we argue that the perceived disgust toward insect-based food consumption—originally only a core food-related emotion—expanded both biologically and culturally to become a learned social response.

Despite the urgent need for concrete actions that can reduce Western consumers' aversion toward insect-based food there is scant research on the marketing strategies that can help people overcome those feelings and try insect-based foods (Koch et al., 2021). Importantly, most of the proposed strategies address self-reported concerns and expectations by highlighting factual data, such as the environmental and health benefits associated with insect-based food consumption (Hartmann et al., 2015). However, Gmuer et al. (2016) showed that directly addressing consumers' self-reported concerns (such as, e.g., edible insects may carry diseases) does not overcome their aversion to food containing edible insects (or it takes a significant amount of time to prove effective). In the present study, we investigate how different promotional appeals might produce immediate results in terms of encouraging consumers to try insect-based food products.

5.2.2. Hedonic or Utilitarian Appeals

People seek both hedonic and utilitarian benefits when they consume goods (Babin et al., 1994), with the former emphasizing pleasurable experiential benefits and the latter conferring instrumental benefits. Regulatory focus theory suggests that hedonic (vs. utilitarian) appeals direct consumers toward the promotion of affective aspirational responses (vs. prevention security-seeking responses) (Chitturi et al., 2008). The previous literature on food consumption posits that hedonic appeals are more effective in creating positive affective reactions (Samson et al., 2021)

that contribute to impulsive eating behavior. Utilitarian appeals are more effective at improving consumers' cognitive judgments of food, such as the health benefits (Choi et al., 2012) and environmental impact (Kim and Hall, 2020) of consumption, thereby leading to positive behavioral intentions. While scholars have deeply studied the different mechanisms that drive promotion versus prevention appeals' ability to shape people's affective and behavioral responses to traditional food, there is limited understanding about their effectiveness in decreasing consumers' negative responses to insect-based food. We fill this gap by comparing the effectiveness of hedonic ("It's delicious") vs. utilitarian ("It's sustainable") appeals in shaping consumer disgust responses and behavioral intentions toward insect-based food.

Past research suggests that utilitarian appeals—which emphasize environmental and nutritional value—are effective at triggering consumers' cognitive processes, improving consumers' awareness and health knowledge, and increasing consumers' attitude and purchase intention for healthy food (Bublitz and Peracchio, 2015; Choi et al., 2012). Relying on this widely known research, many insect-based food advocates primarily promote the environmental and nutritional benefits of insect-based foods in order to reduce consumer aversion to entomophagy (Godwin, 2021).

Although these logic-based arguments have raised people's awareness of the benefits of insect-based food, they have rarely reduced Westerners' negative perceptions about entomophagy (Pozharliev et al., 2023). According to Raghunathan et al. (2006), even though utilitarian appeals are effective in communicating the healthiness information, they do not motivate consumers to make healthy choices. In the context of insect-based food, previous research shows that providing information on the nutritional (Gumussoy et al., 2021) and environmental (Higa, Ruby, and Rozin,

2021) benefits neither suppresses consumers' negative responses toward insect-based foods, nor bolsters their intention to try them.

Thus, hedonic appeals might offer a more promising option. Previous research suggests that these appeals—which emphasize the pleasurable experience of food—attract more attention (Bublitz and Peracchio, 2015), help consumers visualize a positive consumption experience (Turnwald et al., 2019), stimulate the impulsive consumption of food (Ye and Mattila, 2021), and enhance people's memory for promotional messages (Samson et al., 2021). While previous literature has shown the promising effects of hedonic appeals in increasing consumers' positive responses to traditional food, scholars have yet to evaluate their effectiveness in reducing consumers' disgust responses to insect-based food. We fill this gap by studying whether consumers' perceived disgust toward insect-based food can be more effectively reduced by hedonic (i.e., eat insect-based food and enjoy the delicious flavors with your friends) compared to utilitarian (i.e., eat insect-based food to improve your health and protect the environment) appeals. In short, we propose that hedonic appeals are potentially superior to utilitarian appeals for reducing consumers' disgust response and enhancing their WTT insect-based food.

5.2.3. Sensory or Social Appeals

In the food literature, sensory appeals refer to the importance of taste, texture, and smell in food choices (Kröger et al., 2022)—in other words, the pleasure of the gustatory experience. Food marketers have widely adopted the use of sensory appeals (Raghunathan et al., 2006). Previous research suggests that foods that taste better boost enjoyment, consumption desire, and purchase

inclination (Belei et al., 2012; Crolic and Janiszewski, 2016). Drawing on this widely known research alone, it is no wonder that most of the previous literature on food promotion refers to the hedonic pleasure in food consumption in terms of its sensory characteristics such as taste, flavor, and smell (Samson et al., 2021). In the context of insect-based food consumption, taste has been the most widely studied sensory characteristic (Barsics et al., 2017; Hartmann et al., 2015; Pozharliev et al., 2023). However, prior research has produced conflicting results on how taste expectations influence the acceptance of insect-based foods. Some studies show positive (Onwezen et al., 2019) or no (Kornher et al., 2019) influence, while others suggest that emphasizing sensory aspects in daily food choices inhibits the acceptance of insect-based foods (Grasso et al., 2019). Tan et al. (2016) suggested that flavor affects consumers' evaluation of novel foods but this is insufficient for galvanizing the desire to try them. Of course, the sensory-affective qualities (e.g., taste and texture) of insect-based food can only be assessed after the product is actually consumed. Thus, it is unsurprising that promoting the taste of such products has minimal effects on consumers' perceived disgust.

However, what people perceive as edible depends not only on the product's sensory characteristics, such as taste and smell, but also on socio-cultural factors (Veeck et al., 2018). With regard to entomophagy, consumers may see insect consumption as socially inappropriate (Tan et al., 2016). That said, the insect food literature contains few explorations of social appeals (which emphasize the pleasure of eating with close others), even though previous qualitative studies have identified the enjoyment of interacting with close others as a hedonic reason for shopping (Arnold and Reynolds, 2003). We expect the same would be true for eating insect-based food. The eating norms of proximal social groups are associated with social judgements, which are effective at changing consumer attitudes and behaviors, especially when there is high uncertainty around the

'correct' behavior in food consumption (Higgs, 2015). This is applicable to insect-based food, which is novel and unfamiliar in Western countries. Thus, we expect that social influences, such as subjective norms (i.e., the social pressure resulting from one's perception of the extent to which important others want one to perform a certain behavior; Trafimow and Finlay, 1996), are likely to shape affective and behavioral responses to insect-based food consumption. While there is no evidence explicitly linking the effectiveness of social appeals to an increase in insect food consumption, a few studies stress the importance of social factors in shaping food consumption (Ardoin and Prinyawiwatkul, 2021; Veeck et al., 2018). Because people desire to fit into a group, they tend to find a consumption experience more pleasurable after sharing congruent and similar attitudes and feelings with psychologically close friends (Raghunathan and Corfman, 2006). Recently, Samson et al. (2021) found that social appeals in marketing communication—such as showing pictures of friends enjoying vegetables together with smiling faces—make healthy food more salient in consumers' minds and incline them to make healthier long-term eating decisions. Importantly, the use of social appeals does not aim to improve the expected sensory-affective qualities (e.g., taste) of an insect food, but instead to mitigate the perceived social inappropriateness of insect food consumption. Based on the above arguments, we propose that social appeals are superior to sensory appeals in reducing consumers' disgust responses and enhancing their WTT insect-based food.

5.2.4. Consumption Context

Self-presentation theory suggests that consumers have different affective and behavioral intentions under public vs. private contexts due to self-image management (Baumeister, 1982). In the public

context, normative social cues put pressure on people to manage their self-image; such pressure does not exist in the private context (Sundar et al., 2017). In the public consumption context, consumers are less sensitive to pricing (Wakefield and Inman, 2003) and more likely to adopt technological innovations (Kulviwat et al., 2009) that are aligned with their desired identities in others' eyes. In terms of food consumption, overweight consumers have been found to eat more healthy foods in a public context in order to repair their stigmatized identities but eat more unhealthy foods in private contexts when the pressures of social norms disappear (Sinha, 2016).

Several studies suggest that eating insect-based foods is associated with a negative social identity in Western countries (Kostecka et al., 2017; Myers and Pettigrew, 2018; Szendrő et al., 2020). Specifically, Szendrő et al. (2020) found that Hungarian consumers perceived insect-based food consumption as primitive; Myers and Pettigrew (2018) reported that western Australian consumers saw insect-based foods as disgusting; Kostecka et al. (2017) showed that Polish consumers felt offended when presented with the idea of eating insect-based food. Moreover, the Western aversion toward insect-based food also influences consumers' perceptions of other people and their own willingness to disclose their real behavior.

As mentioned above, the point of using social appeals is to incline consumers to imagine having a pleasurable time eating insect-based foods with close others (e.g., friends or family). In other words, social appeals might serve as external cues that alleviate the social norm pressure by treating the practice of eating insect-based food as normative (Ratner and Kahn, 2002). On this basis, we expect that social appeals will be more effective in reducing disgust and increasing the WTT insect-based foods, especially in public (vs. private) consumption settings. Specifically, social appeals will relieve active social norm pressure—manifested in people's relatively lower

disgust response and higher intentions toward insect-based food—in public as opposed to private consumption settings.

Overview of the experiments

Overall, then, we suggest that social appeals should outperform sensory and utilitarian appeals in reducing consumer aversion toward insect-based foods. Specifically, they should decrease the perceived disgust, which will in turn increase the attitude and WTT. Further, we suggest that this is driven by the social appeal's effects on perceived social norm deviation, which are likely to be more effective in public consumption settings. Specifically, social appeals should decrease the belief that eating insect-based food with others is perceived as a deviation from social norms, which should decrease perceived disgust and, in turn, boost attitude and WTT.

We tested these possibilities in a series of experiments. Experiment 1 compared how utilitarian ("Protect the environment") vs. hedonic ("Have fun with friends") appeals shape perceived disgust and WTT insect-based food. In experiment 2, we investigated how sensory ("Enjoy the delicious flavors") vs. social ("Enjoy with friends") appeals affect perceived disgust and WTT insect-based food. Experiment 3 examined how sensory ("Indulge your senses") vs. social ("Enjoy the experience with friends") appeals impact perceived disgust and WTT insect-based food in public (e.g., at a restaurant) vs. private (e.g., at home) consumption settings. Experiment 4 delved into how sensory ("Eat insect-based food and relish the amazing taste") vs. social ("Share insect-based food and spend quality time with your friends and family") appeals impact perceived social norm deviation, perceived disgust, consumer attitude, and WTT insect-

based food in public (restaurant) consumption settings. Appendix G presents an overview of the stimuli used in all the studies.

5.3. Experiment 1: Manipulating Hedonic versus Utilitarian Appeal

Experiment 1 aimed to test the effects of hedonic versus utilitarian appeals on consumers' disgust and WTT insect-based food.

5.3.1. Method

Stimuli validation

We conducted a stimuli validation test on the hedonic and utilitarian appeals with a sample of 134 participants recruited through the Prolific platform in exchange for a nominal payment. First, participants were given a definition of the two types of message appeals (i.e., hedonic appeals focus on product attributes that are pleasant and fun; utilitarian appeals focus on product attributes that are practical and useful; Philipp-Muller et al., 2022). Next, participants had to indicate on a 7-point Likert scale the extent to which they thought the appeal was utilitarian or hedonic (1 = utilitarian appeal; 7 = hedonic appeal). The results show that the manipulation was successful, with hedonic ("Have fun with friends"), M = 5.51 (SD = 1.76), scoring significantly higher than utilitarian ("Good for you and the environment"), M = 2.57 (SD = 1.66) ($t = 13.26$, $df = 133$, $p < 0.01$.).

Main study participants and procedure

We conducted an online survey with a sample of 242 participants (only from the UK, US, EU, and Australia) recruited through the Prolific platform (M_{age} = 38.65, SD = 11.77, 57.9% female, 82.6% respondents had not tried insect-based foods before). The experiment was presented as an assessment of consumers' responses regarding food preferences.

Each participant was randomly assigned to one of the two experimental conditions. We created two Instagram promotional posts with the same introduction (i.e., an insect-based food company recently promoted their new product on Instagram) and product image, which specified that the product was made with insects (i.e., cricket chips). The conditions differed in their message appeal: the utilitarian condition emphasized the functional benefits of insect-based food (i.e., "Eat insect-based food to improve your health and protect the environment. #Good for you and the environment"); the hedonic condition focused on the pleasurable benefits of insect-based food (i.e., "Eat insect-based food and take a yummy break with your friends. #Have fun with friends") (see Appendix G, Experiment 1).

We measured participants perceived disgust with two items measured on a 7-point Likert scale (1 = "Strongly disagree", 4 = "Neither agree nor disagree", 7 = "Strongly agree"; Argo et al., 2006; Cronbach's alpha = .97; see Web Appendix F, Supplementary Materials for scale items). We measured the WTT the food with a single-item assessed on a 7-point Likert scale (Pozharliev et al., 2023). Previous experience was measured at three levels (1 = no; 2 = yes, once; 3 = yes, more than once). Previous studies report that age (Tan et al., 2016), gender (Barsics et al., 2017), and previous experience (Hartmann et al., 2015) can affect consumer responses toward insect-based food. Therefore, we included those factors at the end of the survey in order to test them later as covariates.

5.3.2. Results and Discussion

WTT. Compared to utilitarian appeal, hedonic appeal increased WTT ($M_{hedonic} = 3.39$, $SD_{hedonic} = 2.01$ vs. $M_{utilitarian} = 2.70$, $SD_{utilitarian} = 2.05$, $F(1, 240) = 7.01$, $p < 0.01$).

Disgust. Compared to utilitarian appeal, hedonic appeal decreased perceived disgust ($M_{hedonic} = 3.89$, $SD_{hedonic} = 1.79$ vs. $M_{utilitarian} = 4.41$, $SD_{utilitarian} = 1.83$, $F(1, 240) = 4.96$, $p = 0.03$).

Mediation. We employed a mediation model implemented in the PROCESS macro for SPSS (Model 4; Hayes 2017), with promotional appeals (utilitarian = -1; hedonic = 1) as the independent variable, perceived disgust as the mediator, and WTT as the dependent variable. The results show that the hedonic (vs. utilitarian) appeal decreased the perceived disgust response ($b = -0.24$, $t = -2.20$; $p = 0.03$), which then affected WTT. Specifically, we found a statistically significant negative effect of perceived disgust on WTT ($b = -.86$, $t = -19.00$, $p < .001$), indicating that consumer WTT increased when perceived disgust decreased. Finally, the indirect positive effect of hedonic appeal, through perceived disgust emotions, on WTT was statistically significant ($b = 0.20$, boot standard error [SE] = 0.09; confidence interval [CI] = 0.03–0.39).

As for covariates, male (vs. female) participants reported lower disgust ($b = -0.50$; $t = -2.27$; $p = 0.02$) and higher WTT ($b = 0.37$; $t = 2.39$; $p = 0.02$). In terms of previous experience, participants who had already tried insect-based food (vs. participants who had never tried) reported lower disgust ($b = -1.25$; $t = -6.19$; $p < 0.01$) and higher WTT ($b = 0.31$; $t = 2.03$; $p = 0.04$). We observed no significant results related to age for disgust ($b = 0.008$; $t = 0.89$; $p = 0.37$), or WTT ($b = -0.01$; $t = -1.73$; $p = 0.08$).

The results of experiment 1 suggest that, compared to utilitarian appeals, hedonic appeals result in lower perceived disgust and more WTT insect-based foods, with perceived disgust fully mediating the effect.

5.4. Experiment 2: Manipulating Social versus Sensory Appeal

Experiment 2 aimed to test the effects of social versus sensory appeals on consumers' disgust and WTT insect-based foods. Moreover, to test the generalizability of our findings, experiment 2 used a different product category (e.g., cricket pasta).

5.4.1. Methods

Stimuli validation

First, participants read the definitions of the two types of hedonic message appeals: Social appeals focus on pleasantness and fun from eating together and interacting with family or close friends; sensory appeals focus on pleasantness and fun associated with the taste of food (Arnold and Reynolds, 2003; Philipp-Muller et al., 2022). Next, participants used a 7-point Likert scale to indicate the extent to which they thought the appeal was social or sensory (1 = social appeal; 7 = sensory appeal). The results show that the manipulation was successful, with sensory "#Food lover's delight" M = 5.76 (SD = 1.51) scoring significantly higher than social "#Delight for the family" M = 2.60 (SD = 1.80) ($t = -13.80$, $df = 133$, $p < 0.01$).

Main study participants and procedure

We conducted an online survey through Prolific and provided monetary compensation. Among our sample of 207 participants (only UK, US, EU, and Australia) (M_{age} = 36.24, SD = 10.76, 78.7% female), 87.9% had not tried insect-based foods before. All participants were exposed to an Instagram post of an international restaurant promoting a pasta made with cricket flour. They were randomly assigned to one of two conditions, with half of the sample shown a post with the social appeal (i.e., delight for the family) and the other half shown a sensory appeal (i.e., food lover's delight) (see Appendix G, experiment 2).

We measured participants' perceived disgust with two items rated on a 7-point Likert scale (1 = "Strongly disagree", 4 = "Neither agree nor disagree", 7 = "Strongly agree"; Argo et al., 2006; Cronbach's alpha = 97; see Appendix G, Supplementary Materials for scale items). We measured the WTT the food with a single item on a 7-point Likert scale (Pozharliev et al., 2023), while previous experience was measured at three levels (1 = no; 2 = yes, once; 3 = yes, more than once). We include age, gender, and previous experience as covariates, like before.

5.4.2. Results and Discussion

WTT. Compared to sensory appeal, social appeal increased participants' WTT (M_{social} = 2.70, SD_{social} = 1.85 vs. $M_{sensory}$ = 2.16, $SD_{sensory}$ = 1.53, F (1, 205) = 5.24, p = 0.02).

Disgust. Compared to sensory appeal, social appeal decreased participants' perceived disgust (M_{social} = 4.41, SD_{social} = 1.68 vs. $M_{sensory}$ = 4.93, $SD_{sensory}$ = 1.58, F (1, 205) = 5.39, p = 0.02).

Mediation. We employed a mediation model implemented in the PROCESS macro for SPSS (Model 4; Hayes 2017), with communication message appeals (sensory = -1; social = 1) as

the independent variable, perceived disgust as the mediator, and WTT as the dependent variable. Moreover, we used gender, age, and previous experience as covariates in the regression analysis.

The results showed that social appeals decreased perceived disgust ($b = -0.25$, $t = -2.38$; $p = 0.02$), which then affected WTT. We observed a statistically significant negative effect of perceived disgust on WTT ($b = -0.77$, $t = -16.56$, $p < .001$), indicating that consumer WTT increased when perceived disgust decreased. Moreover, the indirect positive effect of social appeals on WTT, through perceived disgust, was statistically significant ($b = 0.20$, [SE] = 0.08; [CI] = 0.03–0.37).

As for the covariates, males (vs. females) reported non-significant differences in terms of disgust ($b = -0.41$; $t = -1.55$; $p = 0.12$) and WTT ($b = 0.23$; $t = 1.32$; $p = 0.19$). Concerning previous experience, participants who had already tried insect-based foods (vs. participants who had never tried) reported lower disgust ($b = -1.43$; $t = -5.07$; $p < 0.01$) and higher WTT ($b = 0.62$; $t = 3.13$; $p < 0.01$). In terms of age, we observed no significant results for disgust ($b = -0.004$; $t = -0.44$; $p = 0.66$) or WTT ($b = -0.002$; $t = -0.28$; $p = 0.78$).

The results of Experiment 2 confirm that social appeals, compared to sensory appeals, decrease consumer perceived disgust, which in turn increases WTT.

5.5. Experiment 3: Manipulating the Consumption Settings

Experiment 3 examined how social versus sensory appeals impact perceived disgust and WTT insect-based foods in public (e.g., restaurant) versus private (e.g., at home) consumption settings.

5.5.1. Methods

Stimuli validation

Experiment 3 adopted the same manipulation check procedure for message appeals as in Experiment 2. In the public scenario, participants read the following instruction: "This is an Instagram post promoting the consumption of insect-based food in public (e.g., restaurant) settings. Imagine being exposed to this promotional message when sitting in a restaurant with friends or family members. Please carefully read the Instagram post and provide answers to the following questions. In the private scenario, they read the following instruction: "This is an Instagram post promoting the consumption of insect-based food in private (e.g., at home) settings. Imagine being exposed to this promotional message when sitting alone on your sofa in your home. Please carefully read the Instagram post and provide answers to the following questions".

For each consumption setting, participants indicated the extent to which they considered the consumption of the described product as a private or public context (1 = private context, 7 = public context). Participants who were exposed to the public setting "sitting in the restaurant with friends or family members" (M_{public} = 5.04; SD = 1.80) scored higher than those in the private setting "sitting alone on your sofa in your home" ($M_{private}$ = 3.93; SD = 2.14; (t = 4.66, df = 94, p < 0.01). For message appeal (1 = social appeal, 7 = sensory appeal), participants who were exposed to the sensory "#Food lover's delight" scored significantly higher than those shown the social "#Have fun with friends" ($M_{sensory}$ = 5.40; SD = 1.60 vs. M_{social} = 2.75; SD = 1.81; t = 12.09, df = 133, p < 0.01).

Main study participants and procedure

We conducted an online survey with a sample of 204 participants (only UK, US, EU, and Australia) (M_{age} = 33.66, SD = 21.02, 52% female) recruited through the Prolific platform in exchange for a nominal payment. Of those, 82.8% had not tried insect-based foods before.

Experiment 3 used the same procedure and measures from experiment 2. Participants were randomly assigned to one of the four conditions (public/social appeal, public/sensory appeal, private/social appeal, private/sensory appeal). In the public scenario, participants read the following introduction: “This is an Instagram post promoting the consumption of insect-based food in public (e.g., restaurant) settings. Imagine being exposed to this promotional message when sitting in a restaurant with friends or family members. Please carefully read the Instagram post and provide answers to the following questions.” In the private scenario, participants read the following introduction: “This is an Instagram post promoting the consumption of insect-based food in private (e.g., at home) settings. Imagine being exposed to this promotional message when sitting alone on your sofa in your home. Please carefully read the Instagram post and provide answers to the following questions.”

We measured participants' perceived disgust with two items rated on a 7-point Likert scale (1 = "Strongly disagree", 4 = "Neither agree nor disagree", 7 = "Strongly agree"; Argo et al., 2006; Cronbach's alpha = .94; see Appendix F, Supplementary Materials for scale items). We measured the WTT the food with a single item rated on a 7-point Likert scale (Pozharliev et al., 2023), while previous experience was measured at three levels (1 = no; 2 = yes, once; 3 = yes, more than once). We include age, gender, and previous experience as covariates, like before.

5.5.2. Results and Discussion

Disgust. A 2x2 ANOVA revealed the appeal type X consumption context interaction (F (1, 203) = 4.55; $p = 0.03$). Social appeal (vs. sensory appeal) decreased consumers' perceived disgust ($M_{social} = 3.53$, $SD_{social} = 1.95$ vs. $M_{sensory} = 4.40$, $SD_{sensory} = 1.82$, F (1, 200) = 5.20, $p = 0.02$) in the public context, while it had no impact in the private context ($M_{social} = 3.84$, $SD_{social} = 1.93$ vs. $M_{sensory} = 3.55$, $SD_{sensory} = 1.98$, F (1, 200) = 0.55, $p = 0.46$).

Moderated mediation. We employed a moderated mediation analysis (PROCESS model 7; Hayes 2017), incorporating consumption context as a moderator of advertising appeal type's effects on perceived disgust. We found a significant moderated mediation on WTT (b = – 0.61, 95% CI = – 1.13, -0.08). The effect of appeal type on the WTT insect-based food was driven by disgust (b = -0.81, SE = 0.04, t = -18.11, p < 0.01). In the public context, the social appeal reduced participants' disgust (b = – 0.45, SE = 0.19, t = –2.38, p = 0.02), thus increasing WTT (b = 0.36, 95% CI = 0.07, 0.66). In the private context, the social appeal had no effect on disgust (b = 0.16, SE = 0.19, t = 0.83, p = 0.40), while the mediation on the WTT insect-based food was no longer significant (b = – 0.13, 95% CI = – 0.44, 0.17).

Our model for testing the hypotheses included social vs. sensory appeals as independent variables, WTT as a dependent variable, perceived disgust as a mediator, while controlling for age, gender and previous experience. With disgust as the outcome variable, the results show that age was nonsignificant (b = 0.001; se = 0.006; t = 0.21; p = 0.83); gender was significant (b = -0.68; se = 0.27; t = -2.56; p = 0.01), indicating that males perceived significantly less disgust toward insect-based foods; and previous experience was also significant (b = -0.58; se = 0.29; t = -2.02; p = 0.04). With WTT as the outcome variable, the results show that age was not significant (b = -0.0002; se = 0.004; t = -0.04; p = 0.96), but gender was significant (i.e., males were significantly

more willing to try the food) (b = 0.38; se = 0.17; t = 2.22; p = 0.03) and previous experience was nonsignificant (b = 0.14; se = 0.18; t = 0.76; p = 0.45).

The results of experiment 3 show that, compared to sensory appeals, social appeals decrease participants' perceived disgust, which in turn, increases their WTT, but only in the public consumption context.

5.6. Experiment 4: Testing the Underlying Process

Experiment 4 has two main goals. First, we tested the hypothesized underlying process: that using social (vs. sensory) appeals increases WTT by making the consumption of insect-based food seem less socially deviant. This, in turn, makes said food seem less disgusting, which increases consumers' attitude and WTT. Second, to test the generalizability of our findings, experiment 4 used a different product category (e.g., insect-based burger) and different message appeals.

5.6.1. Methods

Stimuli validation

The manipulation check procedure for the message appeals in experiment 4 matched that of Studies 2 and 3. Next, participants used a 7-point Likert scale to indicate the extent to which they thought the appeal was social or sensory (1 = social hedonic message appeal; 7 = sensory hedonic message appeal). The results show that the manipulation was successful: sensory "#Eat

insect-based food and relish the amazing taste" M = 6.18 (SD = 1.34) scored significantly higher than social "#Share insect-based food and spend quality time with your friends and family" M = 1.71 (SD = 1.12) ($t = -19.26$, $df = 78$, $p < 0.01$).

Main study participants and procedure

We conducted an online survey through Prolific and provided monetary compensation. Our sample encompassed 203 participants (only from the UK, US, EU, and Australia) (M_{age} = 38.12, SD = 11.54, 58% female), 88.4% of whom had not tried insect-based foods before. All participants were exposed to an Instagram post promoting the consumption of an insect-based burger in public settings. Each participant was randomly assigned to one of two experimental conditions: half the sample saw an Instagram post with a social appeal (i.e., "Share insect-based food and spend quality time with your friends and family") and the other half saw a sensory appeal (i.e., "Eat insect-based food and relish the amazing taste") (see Appendix G, experiment 4).

We measured participants' perceived social norm deviation with a single-item rated on a 7-point Likert scale (Jensen and Lieberoth, 2019) and their perceived disgust with two items, also on a 7-point Likert scale (1 = "Strongly disagree", 4 = "Neither agree nor disagree", 7 = "Strongly agree"; Argo et al., 2006; Cronbach's alpha = .96; see Appendix F). We measured participants' attitude toward insect-based food with three items on a 7-point Likert scale (Bagozzi, 2022; see Appendix F) and WTT the food with a single item rated on a 7-point Likert scale. Previous experience was measured at three levels (1 = no; 2 = yes, once; 3 = yes, more than once). We include age, gender, and previous experience as covariates, like before. We also considered other socially relevant individual traits that may affect insect-based food consumption, such as hunger

(Pozharliev et al., 2023), public self-awareness (1 = "Strongly disagree", 4 = "Neither agree nor disagree", 7 = "Strongly agree"; Dabholkar and Bagozzi, 2002), self-product connectedness (White and Dahl, 2007); need to belong (Loveland et al., 2010), and the normality of eating insect-based food (Koch et al., 2021).

5.6.2. Results and Discussion

Social deviation. Compared to sensory appeal, social appeal decreased participants' perceived social deviation ($M_{social} = 4.22$, $SD_{social} = 1.94$ vs. $M_{sensory} = 4.76$, $SD_{sensory} = 1.82$, $F(1, 201) = 4.30$, $p = 0.04$).

Disgust. Compared to sensory appeal, social appeal decreased participants' perceived disgust ($M_{social} = 4.30$, $SD_{social} = 1.74$ vs. $M_{sensory} = 4.87$, $SD_{sensory} = 1.85$, $F(1, 201) = 5.13$, $p = 0.03$).

Serial mediation. We employed a mediation model implemented in the PROCESS macro for SPSS (Model 6; Hayes, 2017), with communication message appeals (sensory = -1; social = 1) as the independent variable, perceived social norm deviation and perceived disgust as the mediators, and attitude and WTT as the dependent variables. Moreover, we used gender, age, previous experience, hunger, public self-awareness, self-product connectedness, need to belong, and the normality of eating insect-based food as covariates in the regression analyses.

The results show that, compared to sensory appeals, social appeals decreased perceived social deviation ($b = -0.27$, $t = -2.18$; $p = 0.03$), which then affected perceived disgust ($b = 0.44$, $t = 7.21$, $p < 0.01$). In other words, participants' perceived disgust decreased when perceived social norm deviation decreased. Furthermore, perceived disgust affected participants' attitude ($b = -0.58$, $t = -12.20$; $p < 0.01$) and WTT ($b = -0.67$, $t = -11.73$; $p < 0.01$). Specifically, the indirect positive effect of social appeals on attitude—through perceived social norm deviation and then

perceived disgust—was statistically significant (b = 0.07, [SE] = 0.03; [CI] = 0.006–0.14). The indirect positive effect of social appeals on WTT—through perceived social norm deviation and then perceived disgust—was also statistically significant (b = 0.08, [SE] = 0.04; [CI] = 0.008–0.16).

Control variables. Table 3 reports the effectiveness of appeal types on perceived social deviation and the coefficients for our control variables.

Table 3: Social vs. Sensory appeal in changing perceived deviation

	(1) Base Model	**(2) Inc. controls**
DV: Perceived social deviation.	-.27 * (.04)	-.27* (.03)
Controls		
Age		-.02 (.16)
Gender		.003 (.99)
Previous experience		-.07 (.83)
Hunger		-.16* (.04)
Public self-awareness		-.14 (.24)
Self-product relatedness		-.18 (.44)
The need to belong		-.006 (.97)
Normality of insect-based food		-.36** (0.00)
Intercept	4.49** (.000)	6.19** (.000)

* p <.05, ** p <. 01

NOTE. — Gender (1 = female, 2 = male); previous experience (1 = no, 2 = yes, once, 3 = yes, more than once).

The results of experiment 4 show that, compared to sensory appeals, social appeals decrease perceived social norm deviation, which then decreases consumer perceived disgust, which finally increases consumers' attitude and WTT insect-based foods.

5.7. General Discussion for Study 4

Insect-based food consumption has long been perceived as a disgusting practice, especially in Western food culture, despite the practice's benefits for human health and environmental sustainability. Therefore, a key challenge in promoting the entomophagy diet is helping advocates of insect-based foods decrease consumers' perceived disgust.

Through a series of experimental studies, we provide some insightful and practical solutions to this issue. Specifically, we examined when and how different types of marketing communication appeals, interacting with consumption contexts, can decrease consumer disgust toward insect-based foods and thereby increase WTT. Our results demonstrate that hedonic (more than utilitarian) appeals decrease people's perceived disgust toward insect-based foods, thereby increasing their WTT them. We went further by scrutinizing the types of hedonic appeals, finding that social (vs. sensory) appeals are more effective in the public context. Interestingly, the two appeals showed equal effectiveness in a private setting. These findings shed light on how practitioners can develop more appropriate marketing strategies, especially in public contexts.

5.8. Theoretical contribution

First, we contribute to the insect-based food marketing practice literature (Baker et al., 2016; Pozharliev et al., 2023) by comparing different advertising appeals in terms of reducing consumers' disgust feelings and bolstering their willingness to try. Previous studies mainly focused on the communication of utilitarian benefits, like healthiness and sustainability values (Pozharliev et al., 2023; Verneau et al., 2016); thus, the literature lacks tests of hedonic appeals' beneficial effects. We filled this gap by comparing the effectiveness of different types of hedonic appeals in changing consumers' affective and behavioral responses. Our empirical results demonstrate that hedonic (compared to utilitarian) appeals are more effective at decreasing consumers' perceived disgust of insect-based foods, thereby increasing their WTT them. One possible explanation for the limited efficacy of utilitarian appeals may lie in the fact that eating insects is currently promoted as a dietary practice with little to no immediate rewards (Koch et al., 2021). Indeed, utilitarian arguments exclusively promote the long-term benefits, such as being environmentally friendly or personally healthy. Changing one's eating habits to achieve those long-term benefits would require high levels of cognitive effort and control. Moreover, previous research suggests that disgust-eliciting cues unconsciously attract more attentional resources and therefore decrease inhibitory control, which is required to change behavior (Berger et al., 2018) and is reported to positively affect people's acceptance of insects as food sources (Kröger et al., 2022). Furthermore, core disgust is an automatic emotional response of the evolutionary immune system; thus, it is no wonder that rational persuasion strategies have failed to reduce the negative responses to insect-based foods.

Second, we provide novel insights for the literature on marketing appeals' effectiveness. While prior literature has been anchored in self-regulatory focus theory, emphasizing the effectiveness of utilitarian vs. hedonic advertising appeals in orienting consumers toward prevention or promotion goals (Babin et al., 1994; Voss et al., 2003), the field has not assessed their effectiveness in decreasing negative affective responses. We filled this gap by comparing different types of advertising appeals in terms of reducing consumers' disgust feelings in the context of insect-based food consumption.

Third, previous literature on food considers taste appeals as the only representative of hedonic appeals, whereas the hedonic literature suggests that hedonic value, which is also referred to as pleasurable value, is generated from different sources (Arnold and Reynolds, 2003; Pozharliev et al., 2015; Veeck et al., 2018). We add to the richness of the latter by showing how social hedonic appeals exceed their sensory counterparts in decreasing consumers' disgust feelings toward insect-based foods. The superior effectiveness of social appeals is likely rooted in the phenomenon of preadaptation, whereby a system that originally evolved for one purpose is reused in a new context (Rozin and Fallon, 1987; Rozin and Haidt, 2013). Indeed, prior research suggests that disgust is a critical emotion for not only eating regulation, but also social interaction (Tybur et al., 2013). Moreover, past evidence has suggested that the disgust toward insect foods primarily stems from social and cultural learning, such as Westerners' stereotypical associations of insects with decay matter (Berger et al., 2018). Our results are consistent with the idea that humans' rejection impulse, characteristic of distaste, may have been co-opted and expanded to reject offensive stimuli in the socio-moral domain (Chapman et al., 2009). Therefore, using social appeals represents an effective communication tool for reducing the disgust evoked by socio-cultural transgressions.

Finally, we contributed to the scant literature on the contextual factors that influence insect-based food adoption. Specifically, we showed that consumers' disgust toward such foods is higher in the public context than the private domain. In public, consumers are more likely to feel monitored and evaluated by others, whereas this pressure fades when they are in private (Sundar et al., 2017). More importantly, social appeals are especially effective in public settings for bolstering attitudes and WTT.

5.9. Practical implications

Our research has some practical implications for marketing managers. While prior literature has highlighted the urgency of uncovering ways to reduce consumers' disgust feelings toward insect-based foods, there are few studies on this critical issue (Koch et al., 2021). First, our results challenge the utility of existing campaigns that promote entomophagy by highlighting its health and environmental benefits. Instead, we suggest that insect-based food marketers should use hedonic message appeals to decrease consumers' disgust toward insect-based foods. The hedonic appeal should focus not only on the pleasure that consumers can derive from tasty experiences, but also on the fun had with close friends and family members. For example, on February 16, 2023, a sit-down restaurant chain in Milan, Italy launched a new Cricket Cheeseburger using the following promotional appeals on their Instagram account: "*What are you waiting for!? Come and savor the taste of innovation*" and "*Get ready to jump out of your chair thanks to a taste never experienced before*". Major local newspapers covered the introduction of the insect burger by highlighting the product's sustainability and innovativeness. Our results suggest that all entities involved would be better served by emphasizing the social experiences related to the consumption of this food product, such as "*What are you waiting for!? Come and*

savor the taste of innovation with your friends and family" and "*You and your friends should get ready to jump out of your chairs thanks to a taste never experienced before*". Here, the use of social appeals is likely to reduce the subjective sensitivity to—and by extension, the negative evaluations of—eating insect food as a socially inappropriate behavior. After all, Westerners' disgust response is generally rooted in the false belief that insects represent a pathogen risk.

Marketers should also consider the implicit or explicit pressure from potential social scrutiny, which can generate extra disgust in the public context. Therefore, marketers are highly encouraged to use social hedonic appeals to alleviate this response. Recently, a trendy restaurant located in Manhattan's East Village promoted a new dessert containing caramel ants by calling it "a surreal eating experience". Our results suggest that changing the promotional message to emphasize friends or family could further alleviate the implicit and explicit pressure from potential social scrutiny associated with eating caramel ants.

Finally, our research suggests that hedonic and social appeals might be effective strategies for non-insect-based products or services. For consumers who struggle with exercising, dieting, or taking medicines, hedonic and social appeals might be more persuasive than solely emphasizing the instrumental benefits.

5.10. Limitations and Future Research

One interesting question is whether the effects of social appeals are moderated by consumers' socio-cultural background. In this paper, we studied the effectiveness of different marketing communication appeals in reducing Westerners' aversion toward insect-based foods (we

used a cross-cultural sample including respondents from the US, EU, UK, and Australia). However, given that entomophagy is a widespread practice in South and East Asia, as well as Central Africa, it would be valuable to examine the effectiveness of these appeals on consumers who see insect-eating as appropriate and commonplace. It could be that social appeals are less effective than sensory or utilitarian appeals in those regions, due to a lower perception that eating insects represents a violation of social and moral norms. Future studies could thus evaluate how our results break down across cultural schemas.

This research is limited to a single product category, insect-based food. While this focus is theoretically and practically justified, it constrains the generalizability of the findings. Consumer responses to persuasive appeals may differ across product categories, and future research should investigate whether the effects observed in this research can extend to other product categories, or whether category-specific factors moderate the relative effectiveness of hedonic versus utilitarian, or social versus sensory appeals.

It would also be interesting to examine other individual differences. Across our four controlled experiments, we accounted for age, gender, previous experience, public self-awareness, need to belong, and self-product relatedness, all of which indirectly relate to the social domain of insect-based food consumption. However, one could argue that, due to the social dimension of insect-based food, individual differences in social behavior could moderate disgust responses. One example would be attachment styles, which describe the systematic pattern of affective and behavioral responses in a human-human interaction (Mende et al., 2013). Prior research has found that attachment styles moderate negative reactions to and behavioral responses with brands and products in a social context (Thomson et al., 2012). For example, the avoidant attachment style is frequently associated with behavioral patterns that are incongruent with socio-cultural norms

(Mende et al., 2019). Therefore, one could speculate that avoidant-attachment people would be less sensitive to the socio-cultural dimension of disgust responses toward insect-based food consumption. Given their lower sensitivity toward being stigmatized or rejected by others, such individuals may respond better to sensory or utilitarian appeals than social ones. In short, future studies could test our model in relation to attachment style.

Lastly, our studies focused on language, but future research could also examine images. Prior research has shown that product orientation or dynamic imagery affect people's responses to products (Elder and Krishna, 2012; Van Kerckhove and Pandelaere, 2018). Moreover, previous research on entomophagy has demonstrated that the visual characteristics (e.g., shape, human-likeness) of the insect image moderate people's disgust responses to insect-based foods (Pozharliev et al., 2023). Thus, it could be that presenting an image of people having fun while eating insect-based foods together reduces the core disgust response in the same way that social appeals do. Moreover, future research could study how social appeals that jointly mix language and imagery reduce disgust responses toward entomophagy. Research increasingly demonstrates the value of image data for marketing insights (Li and Xie, 2020; Hartmann et al., 2021), making this a fruitful area to explore further.

In conclusion, the current research confirms that subtle shifts in promotional style can have meaningful effects on consumers' perceptions and adoption of insect-based food products. In doing so, this work deepens our general understanding of marketing communication appeals and their effects on consumer behavior.

6. General Conclusion

Taken together, our findings trace key marketing communication practices and uncover ongoing challenges—such as intensifying information confusion (e.g., a healthy label can become a part of conflicting nutrition information) (Nagler, 2014)—that may lead people to perceive their freedom of choice as threatened (Brehm, 1966). This thesis provides concrete empirical evidence to re-emphasize the importance of guiding healthy food communication practitioners toward more holistic approaches (Van Royen et al., 2022).

Firstly, drawing on congruity theory (Feick et al., 1986; Osgood and Tannenbaum, 1955), we propose that rather than focus solely on isolated exposure, health knowledge or general communication should be understood as part of a broader, dynamic nutritional information system. This system involves continuous interaction with multiple sources, such as regulated nutritional guidelines, consumers' pre-existing knowledge, words from family or friends, and random online content. Intriguingly, the information from different sources can have a valid rationale from their perspectives, although somewhat conflicting. For example, from a quantitative standpoint, it is reasonable to limit olive oil consumption due to its high caloric density. However, from a qualitative perspective, olive oil is rich in beneficial compounds, and its regular intake has been associated with positive health outcomes. Yet, when the above information is delivered to the receivers altogether, the combination of the information results in conflicting nutrition information (Nagler, 2014). We have shown that the mechanism of the creation of conflicting nutrition information, that is, the combination of two contrasting directive nutrition information, does not happen when the combination is between directive and non-directive nutrition information. Therefore, healthy eating communicators must rethink the proper combination of different sources of nutrition information to retain credibility and acceptance among consumers.

Secondly, through the lens of psychological reactance theory (Brehm, 1966), we stress the importance of avoiding negative consumer responses toward healthy eating communication per se (e.g., negative attitude towards the information; decreased willingness to follow the information), which is complementary to the dominant framing research that compares positive effectiveness of different types of marketing communication approaches in consumer food choices (e.g., purchase intention towards healthier foods over unhealthy ones). This is becoming particularly important in an algorithm-driven landscape where consumers are less likely to receive content they are unwilling to click, view for a longer time, like, comment, and follow (Areeb et al., 2023). Therefore, communication practitioners should view consumers as active, selective information seekers, rather than passive recipients who are willing to get healthy communication information by default. Our findings also indicate that such negative responses to marketing communications, such as psychological reactance, are not universal but vary based on individual personality traits, such as the promotion focus trait and the concern for face trait. These individual differences highlight an opportunity for communicators to leverage algorithms to tailor messages, delivering personalized content that aligns more closely with the recipient's psychological traits.

Thirdly, building on psychological reactance theory (Brehm, 1966), we empirically show that while reactance response is always considered as barrier to healthy food communication, it can also become a force against unhealthy food companies that pretend to be healthier. By framing health communication differently, the perceived threat freedom of choice can be redirected from 'benevolent agents' toward the 'evil agents', namely unhealthy food marketers. This shift can transform reactance into a motivational state characterized by anger and counterarguing intention, ultimately encouraging consumers to spread negative word-of-mouth about the misleading products. Furthermore, institutional endorsements, such as the presence of the European

Commission tagline, have also demonstrated a capacity to empower consumers against misleading information, suggesting the critical role of institutional involvement in health communication efforts.

Fourthly, contextualized in a particular sustainable and healthy food—insect-based food, we propose social appeals, emphasizing that shared consumption with other people, compared to utilitarian or sensory appeals, can contribute to consumer willingness to adopt healthier and more sustainable choices. We also examined and demonstrated that it was due to an increased perceived normality of eating insect-based food, decreasing consumer disgust towards it. This research extended our understanding of healthy foods beyond their attributes, such as healthiness or tastiness, to include the social meaning of eating behavior as a potentially more effective factor. While our research focused on novel foods, future research could investigate whether food-irrelevant attributes are similarly effective in promoting healthy eating more broadly.

Through the exploration of real-world practices and existing literature on how marketing communication influences consumer decisions around healthy eating, this research highlights the challenges for healthy eating promoters from two aspects. The first challenge lies in communication-related obstacles, such as sustaining consumer perceived credibility and their acceptance of healthy eating communication. The second lies in consumer-side barriers, such as their emotional negative response to the foods per se, such as disgust, to novel foods (i.e., insect-based food). On the other hand, employing marketing communication more strategically has the potential to reduce psychological and perceptual barriers against healthy eating communication and healthy foods themselves, and may even transform these barriers into motivating forces. These insights highlight the need for future research to better identify and address such barriers in order to enhance the effectiveness of healthy food communication strategies.

7. Reference

Ahn, J., & Kahlor, L. A. (2022). When Experts Offer Conflicting Information: A Study of Perceived Ambiguity, Information Insufficiency, Trustworthiness and Risk Information Behaviors. *Health Communication*, 1-11.

Alba, J. W., & Williams, E. F. (2013). Pleasure principles: A review of research on hedonic consumption. *Journal of consumer psychology*, 23(1), 2-18.

Alcaire, F., Vidal, L., Machín, L., Antúnez, L., Giménez, A., Curutchet, M. R., & Ares, G. (2023). Health-related cues on the packages of processed and ultra-processed products: Prevalence and policy implications. *British Journal of Nutrition*, 130(1), 174-184.

AMA (2025). Definitions of Marketing. Available at: *https://www.ama.org/the-definition-of-marketing-what-is-marketing/* (Accessed: 10 June 2025).

Amarnath, D. D., & Jaidev, U. P. (2021). Toward an integrated model of consumer reactance: a literature analysis. *Management Review Quarterly*, 71, 41-90.

André, Q., Chandon, P., & Haws, K. (2019). Healthy through presence or absence, nature or science?: A framework for understanding front-of-package food claims. *Journal of Public Policy & Marketing*, 38(2), 172-191.

Andrews, J. C., Burton, S., & Kees, J. (2011). Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. *Journal of Public Policy & Marketing*, 30(2), 175-190.

Andrews, J. C., Burton, S., Gundlach, G. T., Hill, R. P., Kees, J., Netemeyer, R. G., & Walker, K. L. (2022). What exactly is marketing and public policy? Insights for JPPM researchers. *Journal of Public Policy & Marketing*, 41(1), 10-33.

Araujo, Q. R. D., Gattward, J. N., Almoosawi, S., Parada Costa Silva, M. D. G. C., Dantas, P. A. D. S., & Araujo Júnior, Q. R. D. (2016). Cocoa and human health: From head to foot—A review. *Critical reviews in food science and nutrition*, 56(1), 1-12.

Ardoin, R., & Prinyawiwatkul, W. (2021). Consumer perceptions of insect consumption: A review of western research since 2015. *International Journal of Food Science & Technology*, 56(10), 4942-4958.

Areeb, Q. M., Nadeem, M., Sohail, S. S., Imam, R., Doctor, F., Himeur, Y., ... & Amira, A. (2023). Filter bubbles in recommender systems: Fact or fallacy—A systematic review. W*iley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 13(6), e1512.

Ares, G., & Gámbaro, A. (2007). Influence of gender, age and motives underlying food choice on perceived healthiness and willingness to try functional foods. *Appetite*, 49(1), 148-158.

Argo, J. J., Dahl, D. W., & Morales, A. C. (2006). Consumer contamination: How consumers react to products touched by others. *Journal of Marketing*, 70(2), 81-94.

Arnold, M. J., & Reynolds, K. E. (2003). Hedonic shopping motivations. *Journal of Retailing*, 79(2), 77-95.

Babin, B. J., Darden, W. R., & Griffin, M. (1994). Work and/or fun: measuring hedonic and utilitarian shopping value. *Journal of Consumer Research*, 20(4), 644-656.

Bagozzi, R. P. (2022). Philosophical foundations of concepts and their representation and use in explanatory frameworks. In Measurement in Marketing, 19, 5-52. *Emerald Publishing Limited*.

Baker, M. A., Shin, J. T., & Kim, Y. W. (2016). An exploration and investigation of edible insect consumption: The impacts of image and description on risk perceptions and purchase intent. *Psychology & Marketing*, 33(2), 94-112.

Barnwell, P. V., Fedorenko, E. J., & Contrada, R. J. (2022). Healthy or not? The impact of conflicting health-related information on attentional resources. *Journal of Behavioral Medicine*, 1-12.

Barreiro-Hurle, J., Dessart, F. J., Rommel, J., Czajkowski, M., Espinosa-Goded, M., Rodriguez-Entrena, M., ... & Zagorska, K. (2023). Willing or complying? The delicate interplay between voluntary and mandatory interventions to promote farmers' environmental behavior. *Food Policy,* 120, 102481.

Barsics, F., Caparros Megido, R., Brostaux, Y., Barsics, C., Blecker, C., Haubruge, E., & Francis, F. (2017). Could new information influence attitudes to foods supplemented with edible insects?. *British Food Journal*, 119(9), 2027-2039.

Baumeister, R. F. (1982). A self-presentational view of social phenomena. *Psychological Bulletin*, 91(1), 3.

Belei, N., Geyskens, K., Goukens, C., Ramanathan, S., & Lemmink, J. (2012). The best of both worlds? Effects of attribute-induced goal conflict on consumption of healthful indulgences. *Journal of Marketing Research*, 49(6), 900-909.

Berger, S., Bärtsch, C., Schmidt, C., Christandl, F., & Wyss, A. M. (2018). When utilitarian claims backfire: advertising content and the uptake of insects as food. *Frontiers in Nutrition*, 88.

Berry, C., & Romero, M. (2021). The fair trade food labeling health halo: Effects of fair trade labeling on consumption and perceived healthfulness. *Food Quality and Preference*, 94, 104321.

Bezawada, R., & Pauwels, K. (2013). What is special about marketing organic products? How organic assortment, price, and promotions drive retailer performance. *Journal of Marketing*, 77(1), 31-51.

Block, L. G., & Keller, P. A. (1995). When to accentuate the negative: The effects of perceived efficacy and message framing on intentions to perform a health-related behavior. *Journal of marketing research*, 32(2), 192-203.

Bone, P. F., & France, K. R. (2001). Package graphics and consumer product beliefs. *Journal of Business and Psychology*, 15, 467-489.

Brehm, J. W. (1966). A theory of psychological reactance.

Britwum, K., & Yiannaka, A. (2019). Consumer willingness to pay for food safety interventions: The role of message framing and issue involvement. *Food Policy*, 86, 101726.

Bublitz, M. G., & Peracchio, L. A. (2015). Applying industry practices to promote healthy foods: An exploration of positive marketing outcomes. *Journal of Business Research*, 68(12), 2484-2493.

Burnkrant, R. E., & Unnava, H. R. (1995). Effects of self-referencing on persuasion. *Journal of consumer research*, 22(1), 17-26.

Canada.ca (2025). Nutrition labelling: Front-of-package nutrition symbol. *https://www.canada.ca/en/health-canada/services/food-nutrition/nutrition-labelling/front-package.html* (Accessed: 10 June 2025).

Carpenter, D. M., Geryk, L. L., Chen, A. T., Nagler, R. H., Dieckmann, N. F., & Han, P. K. (2016). Conflicting health information: a critical research need. *Health Expectations*, 19(6), 1173-1182.

CDC. 2023. About Us, Centers for Disease Control and Prevention. Available at: *https://www.cdc.gov/nccdphp/dnpao/division-information/aboutus/index.htm* (Accessed: 06 January 2024).

Cecchini, M., Bagozzi, R., & Vagnani, G. (2021). Promotion and prevention focus orientation in mitigating the disposition effect. *Journal of Neuroscience, Psychology, and Economics*, 14(2), 81.

Cesario, J., Grant, H., & Higgins, E. T. (2004). Regulatory fit and persuasion: Transfer from" feeling right.". *Journal of personality and social psychology*, 86(3), 388.

Chandon, P., & Wansink, B. (2012). Does food marketing need to make us fat? A review and solutions. *Nutrition reviews*, *70*(10), 571-593.

Chan, T., Drake, T., & Vollmer, R. L. (2020). A qualitative research study comparing nutrition advice communicated by registered Dietitian and non-Registered Dietitian bloggers. *Journal of Communication in Healthcare*, 13(1), 55-63.

Chan, H., Wan, L. C., & Sin, L. Y. (2009). The contrasting effects of culture on consumer tolerance: Interpersonal face and impersonal fate. *Journal of Consumer Research*, 36(2), 292-304.

Chang, C. (2015). Motivated processing: How people perceive news covering novel or contradictory health research findings. *Science Communication*, 37(5), 602-634.

Chang, H., Zhang, L., & Xie, G. X. (2015). Message framing in green advertising: The effect of construal level and consumer environmental concern. *International Journal of Advertising*, 34(1), 158-176.

Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science*, 323(5918), 1222-1226.

Chitturi, R., Raghunathan, R., & Mahajan, V. (2008). Delight by design: The role of hedonic versus utilitarian benefits. *Journal of Marketing*, 72(3), 48-63.

Choi, H., Paek, H. J., & Whitehill King, K. (2012). Are nutrient-content claims always effective? Match-up effects between product type and claim type in food advertising. *International Journal of Advertising*, 31(2), 421-443.

Churchill, S., & Pavey, L. (2013). Promoting fruit and vegetable consumption: the role of message framing and autonomy. *British journal of health psychology*, 18(3), 610-622.

Cinelli, M., De Francisci Morales, G., Galeazzi, A., Quattrociocchi, W., & Starnini, M. (2021). The echo chamber effect on social media. *Proceedings of the national academy of sciences*, 118(9), e2023301118.

Clee, M. A., & Wicklund, R. A. (1980). Consumer behavior and psychological reactance. *Journal of consumer research*, 6(4), 389-405.

Clement, J., Smith, V., Zlatev, J., Gidlöf, K., & Van de Weijer, J. (2017). Assessing information on food packages. *European Journal of Marketing*, 51(1), 219-237.

Cotte, J., Coulter, R. A., & Moore, M. (2005). Enhancing or disrupting guilt: The role of ad credibility and perceived manipulative intent. *Journal of Business Research*, 58(3), 361-368.

Crolic, C., & Janiszewski, C. (2016). Hedonic escalation: When food just tastes better and better. *Journal of Consumer Research*, 43(3), 388-406.

Crosby, G. (2018) Do cooking oils present a health risk?, IFT.org. Available at: *https://www.ift.org/news-and-publications/food-technology-magazine/issues/2018/may/features/do-cooking-oils-present-a-health-risk* (Accessed: April 29, 2023).

Cucchiara, C., Kwon, S., & Ha, S. (2015). Message framing and consumer responses to organic seafood labeling. *British Food Journal*, 117(5), 1547-1563.

Curtis, V., De Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. Philosophical Transactions of the Royal Society B: *Biological Sciences*, 366(1563), 389-401.

Dabholkar, P. A., & Bagozzi, R. P. (2002). An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors. *Journal of the Academy of Marketing Science*, 30, 184-201.

Darke, P. R., & Ritchie, R. J. (2007). The defensive consumer: Advertising deception, defensive processing, and distrust. *Journal of Marketing Research*, 44(1), 114-127.

Darke, P. R., Ashworth, L., & Ritchie, R. J. (2008). Damage from corrective advertising: Causes and cures. *Journal of Marketing*, 72(6), 81-97.

Debnam, J. (2017). Selection effects and heterogeneous demand responses to the Berkeley soda tax vote.

de Boer, A., & Bast, A. (2015). International legislation on nutrition and health claims. *Food Policy*, 55, 61-70.

de Bruijn, G. J., Visscher, I., & Mollen, S. (2015). Effects of previous fruit intake, descriptive majority norms, and message framing on fruit intake intentions and behaviors in Dutch adults across a 1-week period. *Journal of nutrition education and behavior*, 47(3), 234-241.

Delivett, C. P., Farrow, C. V., Thomas, J. M., & Nash, R. A. (2022). Front-of-pack health imagery on both 'healthy'and 'unhealthy'foods leads people to misremember seeing health claims: Two memory experiments. *Appetite*, 174, 106013.

Donat-Vargas, C., Sandoval-Insausti, H., Peñalvo, J. L., Iribas, M. C. M., Amiano, P., Bes-Rastrollo, M., ... & Pilar, G. C. (2022). Olive oil consumption is associated with a lower risk of cardiovascular disease and stroke. *Clinical Nutrition*, 41(1), 122-130.

de Sousa, Â. L., Casais, B., & Soares, A. M. (2022, July). Healthvertising on food packaging and its impact on consumers: a systematic literature review. In International congress on public and nonprofit marketing (pp. 179-199). *Cham: Springer International Publishing*.

Dowding, K., & Oprea, A. (2023). Nudges, regulations and liberty. *British Journal of Political Science*, 53(1), 204-220.

Dubois, P., Albuquerque, P., Allais, O., Bonnet, C., Bertail, P., Combris, P., ... & Chandon, P. (2021). Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. *Journal of the Academy of Marketing Science*, 49(1), 119-138.

Eguren, J., Antúnez, L., Otterbring, T., Curutchet, M. R., & Ares, G. (2021). Health gain through loss frames: Testing the effectiveness of message framing on citizens' use of nutritional warnings. *Appetite*, 166, 105469.

Elder, R. S., & Krishna, A. (2012). The "visual depiction effect" in advertising: Facilitating embodied mental simulation through product orientation. *Journal of Consumer Research*, 38(6), 988-1003.

European Commission (2020). Nutrition labelling. *https://food.ec.europa.eu/food-safety/labelling-and-nutrition/food-information-consumers-legislation/nutrition-labelling_en* (Accessed: 10 June 2025).

European Commission (2024). Nutrition claims. Available at: *https://food.ec.europa.eu/safety/labelling-and-nutrition/nutrition-and-health-claims/nutrition-claims_en* (Accessed: 20 August 2024).

European Commission (2025). Labelling and nutrition. Available at: https://food.ec.europa.eu/food-safety/labelling-and-nutrition_en (Accessed: 7 July 2025).

European Commission (2022). COMMISSION IMPLEMENTING REGULATION (EU) 2022/169 of 8 February 2022. Official Journal of the European Union. Available at: *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri = CELEX:32022R0169* (last accessed March 01, 2023).

EU Commission (2021)—Inception Impact Assessment. Food Labelling—Revision of Rules on Information Provided to Consumers. 2021. Available online: *https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12749-Food-labelling-revision-of-rules-on-information-provided-to-consumers_en* (accessed on 27 July 2023).

European Commission (2020). Farm to Fork strategy for a fair, healthy and environmentally-friendly food system. Available at: *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri = CELEX:52020DC0381* (Accessed: 12th March 2025).

FAO (2021). The state of the food security and nutrition in the world 2021: The world is at a critical juncture. Food and Agriculture Organization of the United Nations. Available at: *https://www.fao.org/state-of-food-security-nutrition/2021/en/* (last accessed March 01, 2023).

FDA (2024). TITLE 21--FOOD AND DRUGS. Available at: *https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr = 101.62* (Accessed: 20 August 2024).

FDA (2025). Front-of-Package Nutrition Labeling. https://www.fda.gov/food/nutrition-food-labeling-and-critical-foods/front-package-nutrition-labeling (Accessed: 10 June 2025).

Feick, L. F., Herrmann, R. O., & Warland, R. H. (1986). Search for nutrition information: a probit analysis of the use of different information sources. *Journal of Consumer Affairs*, 20(2), 173-192.

Ferrer, R. A., Lipkus, I. M., Cerully, J. L., McBride, C. M., Shepperd, J. A., & Klein, W. M. (2017). Developing a scale to assess health regulatory focus. *Social Science & Medicine*, 195, 50-60.

Fitzsimons, G. J., & Lehmann, D. R. (2004). Reactance to recommendations: When unsolicited advice yields contrary responses. *Marketing Science*, 23(1), 82-94.

Flavián, C., Akdim, K., & Casaló, L. V. (2023). Effects of voice assistant recommendations on consumer behavior. *Psychology & Marketing*, 40(2), 328-346.

Fletcher, J. (2019) Macronutrients: Definition, importance, and food sources, Medical News Today. MediLexicon International. Available at: *https://www.medicalnewstoday.com/articles/what-are-macronutrients#definition* (Accessed: April 29, 2023).

Fong, J., Guo, T., & Rao, A. (2024). Debunking misinformation about consumer products: Effects on beliefs and purchase behavior. *Journal of Marketing Research*, 61(4), 659-681.

Freimuth, V. S., Hammond, S. L., & Stein, J. A. (1988). Health advertising: prevention for profit. *American Journal of Public Health*, *78*(5), 557-561.

Friestad, M., & Wright, P. (1994). The persuasion knowledge model: How people cope with persuasion attempts. *Journal of consumer research*, 21(1), 1-31.

Galvão Cândido, F., Xavier Valente, F., da Silva, L. E., Gonçalves Leão Coelho, O., Gouveia Peluzio, M. D. C., & Gonçalves Alfenas, R. D. C. (2018). Consumption of extra virgin olive oil improves body composition and blood pressure in women with excess body fat: a randomized, double-blinded, placebo-controlled clinical trial. *European journal of nutrition*, 57(7), 2445-2455.

García-Madariaga, J., López, M. F. B., Burgos, I. M., & Virto, N. R. (2019). Do isolated packaging variables influence consumers' attention and preferences?. *Physiology & behavior*, 200, 96-103.

Garg, N., Govind, R., & Nagpal, A. (2021). Message framing effects on food consumption: A social marketing perspective. *Australian Journal of Management*, 46(4), 690-716.

Garretson, J. A., & Burton, S. (2000). Effects of nutrition facts panel values, nutrition claims, and health claims on consumer attitudes, perceptions of disease-related risks, and trust. *Journal of Public Policy & Marketing*, 19(2), 213-227.

Gerretsen, I. (2021). Insects are a nutrition-dense source of protein embraced by much of the world. Why are some of us so squeamish about eating them?. *BBC*. Available at: https://www.bbc.com/future/article/20210420-the-protein-rich-superfood-most-europeans-wont-eat (last accessed March 01, 2023).

Gerritsen, J., Verhagen, H., & Peters, S. (2024, February). The Updated Algorithm of Front-of-Pack Label Nutri-Score Is Not in Line with Dutch Food-Based Dietary Guidelines: Results of Calculations with Dutch Food Composition Database. In Proceedings (Vol. 91, No. 1, p. 326). *MDPI*.

Gershoff, A. D., Mukherjee, A., & Mukhopadhyay, A. (2007). Few ways to love, but many ways to hate: Attribute ambiguity and the positivity effect in agent evaluation. *Journal of Consumer Research*, 33(4), 499-505.

Gmuer, A., Guth, J. N., Hartmann, C., & Siegrist, M. (2016). Effects of the degree of processing of insect ingredients in snacks on expected emotional experiences and willingness to eat. *Food quality and preference*, 54, 117-127.

Godwin, R. (2021). If we want to save the planet, the future of food is insects. *The Guardian*. Available at: https://www.theguardian.com/food/2021/may/08/if-we-want-to-save-the-planet-the-future-of-food-is-insects (last accessed March 01, 2023).

Goffman, E. (1967). Interaction ritual: essays on face-to-face interaction. *Aldine*.

Gokani, N. (2024). Healthier Food Choices: From Consumer Information to Consumer Empowerment in EU Law. *Journal of Consumer Policy*, 1-26.

Goodrow, C. (2021). On YouTube's recommendation system, blog. YouTube Available at: *https://blog.youtube/inside-youtube/on-youtubes-recommendation-system/* (Accessed: 31 July 2024).

Google. (2024). How results are automatically generated. Available at: *https://www.google.com/search/howsearchworks/how-search-works/ranking-results/* (Accessed: 31 July 2024).

GOV.UK. (2023). Healthy eating: Applying all our health. Available at: *https://www.gov.uk/government/publications/healthy-eating-applying-all-our-health/healthy-eating-applying-all-our-health* (Accessed: 24 July 2024).

Grasso, A. C., Hung, Y., Olthof, M. R., Verbeke, W., & Brouwer, I. A. (2019). Older consumers' readiness to accept alternative, more sustainable protein sources in the European Union. *Nutrients*, 11(8), 1904.

Grimmelt, A. et al. (2022) Hungry and confused: The winding road to conscious eating, McKinsey & Company. Available at: *https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/hungry-and-confused-the-winding-road-to-conscious-eating* (Accessed: 06 December 2023).

Grummon, A. H., Lee, C. J., Campos, A. D. A., Whitesell, C., Brewer, N. T., Lazard, A. J., ... & Hall, M. G. (2024). Health harms that discourage alcohol consumption: A randomized experiment of warning messages. *Addictive Behaviors*, 159, 108135.

Grunert, K. G., & Wills, J. M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of public health*, 15(5), 385-399.

Gumussoy, M., Macmillan, C., Bryant, S., Hunt, D. F., & Rogers, P. J. (2021). Desire to eat and intake of 'insect' containing food is increased by a written passage: The potential role of familiarity in the amelioration of novel food disgust. *Appetite*, 161, 105088.

Hagen, L. (2021). Pretty healthy food: How and when aesthetics enhance perceived healthiness. *Journal of Marketing*, 85(2), 129-145.

Hallez, L., Vansteenbeeck, H., Boen, F., & Smits, T. (2023). Persuasive packaging? The impact of packaging color and claims on young consumers' perceptions of product healthiness, sustainability and tastiness. *Appetite*, 182, 106433.

Hanks, A. S., Just, D. R., & Wansink, B. (2014). Chocolate milk consequences: a pilot study evaluating the consequences of banning chocolate milk in school cafeterias. *PloS one*, 9(4), e91022.

Harris, J. L., Thompson, J. M., Schwartz, M. B., & Brownell, K. D. (2011). Nutrition-related claims on children's cereals: what do they mean to parents and do they influence willingness to buy?. *Public health nutrition*, 14(12), 2207-2212.

Hartmann, C., Hieke, S., Taper, C., & Siegrist, M. (2018). European consumer healthiness evaluation of 'Free-from'labelled food products. *Food quality and preference*, 68, 377-388.

Hartmann, Jochen, Heitmann, Mark, Schamp, Christina, & Netzer, Oded (2021). The Power of Brand Selfies. *Journal of Marketing Research*, 58(6), 1159-1177.

Hartmann, C., Ruby, M. B., Schmidt, P., & Siegrist, M. (2018). Brave, health-conscious, and environmentally friendly: Positive impressions of insect food product consumers. *Food Quality and Preference*, 68, 64-71.

Hartmann, C., Shi, J., Giusto, A., & Siegrist, M. (2015). The psychology of eating insects: A cross-cultural comparison between Germany and China. *Food Quality and Preference*, 44, 148-156.

Harvard Health (2020). What's the beef with Red Meat?, Harvard Health. Available at: *https://www.health.harvard.edu/staying-healthy/whats-the-beef-with-red-meat* (Accessed: 26 July 2023).

Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. *Guilford publications*.

Hayes, A. F. (2018). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach (Second Edition). New York, NY: *Guilford Press*.

Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach (Third Edition). *Guilford publications*.

He, J., Mazzù, M. F., & Baccelloni, A. (2023). A 20-Country Comparative Assessment of the Effectiveness of Nutri-Score vs. NutrInform Battery Front-of-Pack Nutritional Labels on Consumer Subjective Understanding and Liking. *Nutrients*, 15(13), 2852.

Health Canada. (2020). Nutrition and Healthy Eating, Canada.ca. Available at: *https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating.html* (Accessed: 24 July 2024).

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves on the internet?. *Journal of interactive marketing*, 18(1), 38-52.

Higa, J. E., Ruby, M. B., & Rozin, P. (2021). Americans' acceptance of black soldier fly larvae as food for themselves, their dogs, and farmed animals. *Food Quality and Preference*, 90, 104119.

Higgins, E. T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. *In Advances in experimental social psychology* (Vol. 30, pp. 1-46). Academic Press.

Higgins, E. T. (2002). How self-regulation creates distinct values: The case of promotion and prevention decision making. *Journal of Consumer Psychology*, 12(3), 177-191.

Higgs, S. (2015). Social norms and their influence on eating behaviours. *Appetite*, 86, 38-44.

Hodgkins, C., Barnett, J., Wasowicz-Kirylo, G., Stysko-Kunkowska, M., Gulcan, Y., Kustepeli, Y., ... & Raats, M. (2012). Understanding how consumers categorise nutritional labels: a consumer derived typology for front-of-pack nutrition labelling. *Appetite*, 59(3), 806-817.

Hong, S. J. (2023). The paradox of self-efficacy: the underlying mechanisms between exposure to contradictory information and nutritional backlash. *Current Psychology*, 1-14.

Hooker, N., Simons, C. T., & Parasidis, E. (2018). "Natural" food claims. *Food and Drug Law Journal*, 73(2), 319-337.

House, J. (2016). Consumer acceptance of insect-based foods in the Netherlands: Academic and commercial implications. *Appetite*, 107, 47-58.

Ihekweazu, C. (2023). Is coffee the cause or the cure? Conflicting nutrition messages in two decades of online New York Times' nutrition news coverage. *Health Communication*, 38(2), 260-274.

Ikonen, I., Sotgiu, F., Aydinli, A., & Verlegh, P. W. (2020). Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. *Journal of the academy of marketing science*, 48, 360-383.

Ikram, M. I., Hill, K. H., & Williams, K. (2021). Marketing mortality? Healthy vs. unhealthy food in television advertising. *European Heart Journal*, 42(Supplement_1), ehab724-2436.

Irmak, C., Murdock, M. R., & Kanuri, V. K. (2020). When consumption regulations backfire: The role of political ideology. *Journal of Marketing Research*, 57(5), 966-984.

Jaeger, A. K., & Weber, A. (2020). Can you believe it? The effects of benefit type versus construal level on advertisement credibility and purchase intention for organic food. *Journal of Cleaner Production*, 257, 120543.

Jan, I. U., Ji, S., & Kim, C. (2023). What (de) motivates customers to use AI-powered conversational agents for shopping? The extended behavioral reasoning perspective. *Journal of Retailing and Consumer Services*, 75, 103440.

Jang, J., & Feng, B. (2018). The effects of gain-and loss-framed advice messages on recipients' responses to advice. *Journal of Language and Social Psychology*, 37(2), 181-202.

Janssen, L., & Bogaert, E. A. (2023). Nutri-Score Vs. Nutrition Claim: The Effects of Incongruent Front-of-Pack Nutritional Information on Consumer Perceptions of Product Healthiness, Brand Attitude, and Purchase Intention. *Journal of Food Products Marketing*, 29(2-3), 69-81.

Jensen, N. H., & Lieberoth, A. (2019). We will eat disgusting foods together–Evidence of the normative basis of Western entomophagy-disgust from an insect tasting. *Food Quality and Preference*, 72, 109-115.

Jensen Schau, H., & Gilly, M. C. (2003). We are what we post? Self-presentation in personal web space. *Journal of Consumer Research*, 30(3), 385-404.

Jeong, E., & Jang, S. (2017). Heuristic evaluation of healthy menus: examining the effect of brand image congruity. *International Journal of Contemporary Hospitality Management*, 29(10), 2514-2534.

Karens, R., Eshuis, J., Klijn, E. H., & Voets, J. (2016). The impact of public branding: An experimental study on the effects of branding policy on citizen trust. *Public Administration Review*, 76(3), 486-494.

Khatsenkova, S., & Elton, C. (2023). Fact check: Is the EU really going to force us to eat insects without our knowledge. Available at: *https://www.euronews.com/green/2023/02/02/fact-check-is-the-eu-really-going-to-force-us-to-eat-insects-without-our-knowledge* (accessed 27.02.2023).

Kim, M. J., & Hall, C. M. (2020). Can sustainable restaurant practices enhance customer loyalty? The roles of value theory and environmental concerns. *Journal of Hospitality and Tourism Management*, 43, 127-138.

Kim, S. Y., & Yi, Y. (2017). Embarrassed customers: the dark side of receiving help from others. *Journal of Service Management*, 28(4), 788-806.

Kivetz, R., & Zheng, Y. (2017). The effects of promotions on hedonic versus utilitarian purchases. *Journal of Consumer Psychology*, 27(1), 59-68.

Klein, A. (2019). Would you eat insects to help save the planet? These companies are betting yes. The Washington Post. Available at: *https://www.washingtonpost.com/lifestyle/2019/01/09/would-you-toss-roasted-insects-into-your-meal-this-health-app-is-betting-yes/* (last accessed March 01, 2023).

Koch, J. A., Bolderdijk, J. W., & van Ittersum, K. (2021). Disgusting? No, just deviating from internalized norms. Understanding consumer skepticism toward sustainable food alternatives. *Journal of Environmental Psychology*, 76, 101645.

Kornher, L., Schellhorn, M., & Vetter, S. (2019). Disgusting or innovative-consumer willingness to pay for insect based burger patties in Germany. *Sustainability*, 11(7), 1878.

Kostecka, J., Konieczna, K., & Cunha, L. M. (2017). Evaluation of insect-based food acceptance by representatives of polish consumers in the context of natural resources processing retardation. *Journal of Ecological Engineering*, 18(2).

Kröger, T., Dupont, J., Büsing, L., & Fiebelkorn, F. (2022). Acceptance of insect-based food products in western societies: a systematic review. *Frontiers in Nutrition*, 8, 1186.

Kulviwat, S., Bruner II, G. C., & Al-Shuridah, O. (2009). The role of social influence on adoption of high tech innovations: The moderating effect of public/private consumption. *Journal of Business Research*, 62(7), 706-712.

Kuo, K. S., Chuang, S. C., Huang, M. C. J., & Wu, P. Y. (2019). Fit or not? Bringing regulatory fit into the frame on health food preferences. *Asia Pacific Journal of Marketing and Logistics*, 31(5), 1388-1404.

Laran, J. (2020). Self‐control: Information, priorities, and resources. *Consumer Psychology Review*, 3(1), 91-107.

Laurin, K., Kay, A. C., & Fitzsimons, G. J. (2012). Reactance versus rationalization: Divergent responses to policies that constrain freedom. *Psychological Science*, 23(2), 205-209.

Laurin, K., Kay, A. C., Proudfoot, D., & Fitzsimons, G. J. (2013). Response to restrictive policies: Reconciling system justification and psychological reactance. *Organizational Behavior and Human Decision Processes*, 122(2), 152-162.

LaVoie, N. R., Quick, B. L., Riles, J. M., & Lambert, N. J. (2017). Are graphic cigarette warning labels an effective message strategy? A test of psychological reactance theory and source appraisal. *Communication Research*, 44(3), 416-436.

Lee, A. Y., & Aaker, J. L. (2004). Bringing the frame into focus: the influence of regulatory fit on processing fluency and persuasion. *Journal of personality and social psychology*, 86(2), 205.

Lee, H., & Cameron, G. T. (2017). Utilizing audiovisual and gain-framed messages to attenuate psychological reactance toward weight management health messages. *Health communication*, 32(1), 72-81.

Lee, G., & Lee, W. J. (2009). Psychological reactance to online recommendation services. *Information & Management*, 46(8), 448-452.

Leonardelli, G. J., Lakin, J. L., & Arkin, R. M. (2007). A regulatory focus model of self-evaluation. *Journal of Experimental Social Psychology*, 43(6), 1002-1009.

Levine, T. R. (2014). Truth-default theory (TDT) a theory of human deception and deception detection. *Journal of Language and Social Psychology*, 33(4), 378-392.

Lippi, G., Franchini, M., Montagnana, M., Favaloro, E. J., Guidi, G. C., & Targher, G. (2009). Dark chocolate: consumption for pleasure or therapy?. *Journal of thrombosis and thrombolysis*, 28, 482-488.

Li, Y. (2017). The news reads you in China—and people can't get enough of IT - WSJ. Available at: *https://www.wsj.com/articles/the-news-reads-you-in-chinaand-people-cant-get-enough-of-it-1503570085* (Accessed: 31 July 2024).

Li, M., & Cui, H. J. (2021). Face consciousness and purchase intention of organic food: the moderating effect of purchase situation and advertising appeal. *British Food Journal*, 123(9), 3133-3153.

Li, M., Qiu, S. C., & Liu, Z. (2016). The Chinese way of response to hospitality service failure: The effects of face and guanxi. *International Journal of Hospitality Management*, 57, 18-29.

Li, Yiyi & Xie, Ying (2020). Is a Picture Worth a Thousand Words? An Empirical Study of Image Content and Social Media Engagement. *Journal of Marketing Research*, 57(1), 1-19.

Liu, H., & Yao, M. (2019). Regulatory Focus Profiles Among Chinese Pre-adolescents and Adolescents and Their Relationship to Personality and Psychological Outcomes. *Journal of Happiness Studies*, 20(6).

Lyons, B. A., Merola, V., & Reifler, J. (2020). Shifting medical guidelines: Compliance and spillover effects for revised antibiotic recommendations. *Social Science & Medicine*, 255, 112943.

Lombardini, C., & Lankoski, L. (2013). Forced choice restriction in promoting sustainable food consumption: Intended and unintended effects of the mandatory vegetarian day in Helsinki schools. *Journal of consumer policy*, 36, 159-178.

Lorenzen, J. K., & Astrup, A. (2011). Dairy calcium intake modifies responsiveness of fat metabolism and blood lipids to a high-fat diet. *British Journal of Nutrition*, 105(12), 1823-1831.

Loveland, K. E., Smeesters, D., & Mandel, N. (2010). Still preoccupied with 1995: The need to belong and preference for nostalgic products. *Journal of Consumer Research*, 37(3), 393-408.

Lu, L., & Cai, R. (2023). Healthy, but say it out loud? The messaging effect on restaurants' healthy food promotion. *Journal of Hospitality & Tourism Research*, 47(8), 1399-1424.

Luo, M., Hancock, J. T., & Markowitz, D. M. (2022). Credibility perceptions and detection accuracy of fake news headlines on social media: Effects of truth-bias and endorsement cues. *Communication Research*, 49(2), 171-195.

Madrigal, R., Armstrong Soule, C. A., & King, J. (2024). Manipulating consumers with the truth: Relative-difference claims in advertising and inferences of manipulative intent. *Journal of Advertising*, 1-18.

Maheswaran, D., & Meyers-Levy, J. (1990). The influence of message framing and issue involvement. *Journal of Marketing research*, 27(3), 361-367.

Maille, V. and Fleck, N. (2011), "Perceived congruence and incongruence: toward a clarification of the concept, its formation and measure", *Recherche et Applications En Marketing (English Edition)*, 26(2), 77-113.

Massi Lindsey, L. L. (2005). Anticipated guilt as behavioral motivation: An examination of appeals to help unknown others through bone marrow donation. *Human communication research*, 31(4), 453-481.

Mauri, C., Grazzini, L., Ulqinaku, A., & Poletti, E. (2021). The effect of front‐of‐package nutrition labels on the choice of low sugar products. *Psychology & marketing*, 38(8), 1323-1339.

Mazzù, M. F., Romani, S., Baccelloni, A., & Gambicorti, A. (2021). A cross-country experimental study on consumers' subjective understanding and liking on front-of-pack nutrition labels. *International journal of food sciences and nutrition*, 72(6), 833-847.

Mazzù, M. F., Baccelloni, A., & Finistauri, P. (2022a). Uncovering the effect of European policy-making initiatives in addressing nutrition-related issues: a systematic literature review and bibliometric analysis on front-of-pack labels. *Nutrients*, 14(16), 3423.

Mazzù, M. F., Romani, S., Baccelloni, A., & Lavini, L. (2022b). Introducing the Front-of-Pack Acceptance Model: The role of usefulness and ease of use in European consumers' acceptance of Front-of-Pack Labels. *International Journal of Food Sciences and Nutrition*, 73(3), 378-395.

Mazzù, M. F., Baccelloni, A., Romani, S., & Andria, A. (2022c). The role of trust and algorithms in consumers' front-of-pack labels acceptance: a cross-country investigation. *European Journal of Marketing*, 56(11), 3107-3137

Mazzù, M. F., Marozzo, V., Baccelloni, A., & Giambarresi, A. (2023a). The effects of combining front‐of‐pack nutritional labels on consumers' subjective understanding, trust, and preferences. *Psychology & Marketing*.

Mazzù, M. F., Pozharliev, R., Andria, A., & Baccelloni, A. (2023b). Overcoming the blockchain technology credibility gap. *Psychology & Marketing*.

Mazzù, M. F., Baccelloni, A., & Romani, S. (2023c). Counteracting noncommunicable diseases with front-of-pack nutritional 'labels' informativeness: an inquiry into the effects on food acceptance and portions selection. *British Food Journal*, 125(13), 562-578.

Mazzù, M. F., He, J., & Baccelloni, A. (2024). Unveiling the impact of front-of-pack nutritional labels in conflicting nutrition information–A congruity perspective on olive oil. *Food Quality and Preference*, 118, 105202.

McGregor, I., Gailliot, M. T., Vasquez, N. A., & Nash, K. A. (2007). Ideological and personal zeal reactions to threat among people with high self-esteem: Motivated promotion focus. *Personality and Social Psychology Bulletin*, 33(11), 1587-1599.

Medina-Molina, C., & Perez-Gonzalez, B. (2021). Nutritional labelling and purchase intention interaction of interpretative food labels with consumers' beliefs and decisions. *British Food Journal*, 123(2), 754-770.

Mende, M., Bolton, R. N., & Bitner, M. J. (2013). Decoding customer–firm relationships: how attachment styles help explain customers' preferences for closeness, repurchase intentions, and changes in relationship breadth. *Journal of Marketing Research*, 50(1), 125-142.

Mende, M., Scott, M. L., Garvey, A. M., & Bolton, L. E. (2019). The marketing of love: How attachment styles affect romantic consumption journeys. *Journal of the Academy of Marketing Science*, 47, 255-273.

Meta. (2024). How Facebook distributes content. Available at: *https://www.facebook.com/business/help/718033381901819?id=208060977200861* (Accessed: 31 July 2024).

Metzger, M. J., & Flanagin, A. J. (2015). Psychological approaches to credibility assessment online. *The handbook of the psychology of communication technology*, 445-466.

Miklavec, K., Pravst, I., Grunert, K. G., Klopčič, M., & Pohar, J. (2015). The influence of health claims and nutritional composition on consumers' yoghurt preferences. *Food Quality and Preference*, 43, 26-33.

Miller, C. H., Lane, L. T., Deatrick, L. M., Young, A. M., & Potts, K. A. (2007). Psychological reactance and promotional health messages: The effects of controlling language, lexical concreteness, and the restoration of freedom. *Human communication research*, 33(2), 219-240.

Ministerio de Salud (2016). Ley de Alimentos – Nuevo etiquetado de alimentos. Available at: *https://www.minsal.cl/ley-de-alimentos-nuevo-etiquetado-de-alimentos/* (Accessed: 20 August 2024).

Miron, A. M., & Brehm, J. W. (2006). Reactance theory-40 years later. *Zeitschrift für Sozialpsychologie*, 37(1), 9-18.

Moore, D. J., & Lee, S. P. (2012). How advertising influences consumption impulses. *Journal of Advertising*, 41(3), 107-120.

More, K. R., More, C., Burd, K. A., Mentzou, A., & Phillips, L. A. (2024). Does messaging matter? A registered report on appearance-versus health-based message framing in exercise appeals targeted towards women. *Psychology of Sport and Exercise*, 70, 102555.

Morimoto, M., & Chang, S. (2006). Consumers' attitudes toward unsolicited commercial e-mail and postal direct mail marketing methods: intrusiveness, perceived loss of control, and irritation. *Journal of Interactive Advertising*, 7(1), 1-11.

Mosseri. (2023). Instagram ranking explained, Instagram Blog. Available at: *https://about.instagram.com/blog/announcements/instagram-ranking-explained* (Accessed: 31 July 2024).

Myers, G., & Pettigrew, S. (2018). A qualitative exploration of the factors underlying seniors' receptiveness to entomophagy. *Food Research International*, 103, 163-169.

Nagler, R. H. (2014). Adverse outcomes associated with media exposure to contradictory nutrition messages. *Journal of health communication*, 19(1), 24-40.

Nagler, R. H., Vogel, R. I., Gollust, S. E., Yzer, M. C., & Rothman, A. J. (2022). Effects of prior exposure to conflicting health information on responses to subsequent unrelated health messages: Results from a population-based longitudinal experiment. *Annals of Behavioral Medicine*, 56(5), 498-511.

Nan, X., Daily, K., & Qin, Y. (2018). Relative persuasiveness of gain-vs. loss-framed messages: A review of theoretical perspectives and developing an integrative framework. *Review of Communication*, 18(4), 370-390.

Newheiser, A. K., Barreto, M., Ellemers, N., Derks, B., & Scheepers, D. (2015). Regulatory focus moderates the social performance of individuals who conceal a stigmatized identity. *British Journal of Social Psychology*, 54(4), 787-797.

Newman, C. L., Burton, S., Andrews, J. C., Netemeyer, R. G., & Kees, J. (2018). Marketers' use of alternative front-of-package nutrition symbols: An examination of effects on product evaluations. *Journal of the Academy of Marketing Science*, 46, 453-476.

Newman, C. L., Howlett, E., & Burton, S. (2014). Shopper response to front-of-package nutrition labeling programs: Potential consumer and retail store benefits. *Journal of Retailing*, 90(1), 13-26.

Ngo, L., Lee, J., Rutherford, S., & Phung, H. (2024). A call to action in review of the Australian Dietary Guidelines: Impacts of conflicting nutrition information: A mixed methods study. *Health Promotion Journal of Australia*, 35(1), 154-164.

Niranjan, A. (2023). Insects on the menu as EU approves two for human consumption. Deutsche Welle. Available at: *https://www.dw.com/en/eu-insects-climate-change/a-64503440* (last accessed March 01, 2023).

NHS (2022). Eating a balanced diet. Available at: *https://www.nhs.uk/live-well/eat-well/how-to-eat-a-balanced-diet/eating-a-balanced-diet/* (Accessed: 10 June 2025).

Nobrega, L., Ares, G., & Deliza, R. (2020). Are nutritional warnings more efficient than claims in shaping consumers' healthfulness perception? *Food Quality and Preference*, 79, 103749.

Nocella, G., & Kennedy, O. (2012). Food health claims–What consumers understand. *Food Policy*, 37(5), 571-580.

Nutraceuticals World (2017). Conflicting nutrition information affects consumer diets, Nutraceuticals World. Available at: *https://www.nutraceuticalsworld.com/issues/2017-07/view_breaking-news/conflicting-nutrition-information-affects-consumer-diets/* (Accessed: 26 July 2023).

Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin*, 135(2), 303.

Onwezen, M. C., Van den Puttelaar, J., Verain, M. C. D., & Veldkamp, T. (2019). Consumer acceptance of insects as food and feed: The relevance of affective factors. *Food Quality and Preference*, 77, 51-63.

Osgood, C. E., & Tannenbaum, P. H. (1955). The principle of congruity in the prediction of attitude change. *Psychological review*, 62 (1), 42.

Owen, R. W., Giacosa, A., Hull, W. E., Haubner, R., Würtele, G., Spiegelhalder, B., & Bartsch, H. (2000). Olive-oil consumption and health: the possible role of antioxidants. *The lancet oncology*, 1(2), 107-112.

Park, L. E. (2010). Responses to self‐threat: Linking self and relational constructs with approach and avoidance motivation. *Social and Personality Psychology Compass*, 4(3), 201-221.

Pastor, J. C., & Baruffaldi, L. (2021). The role of regulatory focus on a peer-feedback process: A longitudinal study with MBA students. *Academy of Management Learning & Education*, 20(4), 539-561.

Pavey, L., & Churchill, S. (2014). Promoting the avoidance of high-calorie snacks: Priming autonomy moderates message framing effects. *PloS one*, 9(7), e103892.

Pérez-Ferrer, C., Auchincloss, A. H., de Menezes, M. C., Kroker-Lobos, M. F., de Oliveira Cardoso, L., & Barrientos-Gutierrez, T. (2019). The food environment in Latin America: a systematic review with a focus on environments relevant to obesity and related chronic diseases. *Public health nutrition*, 22(18), 3447-3464.

Perry, A., Chacon, V., & Barnoya, J. (2018). Health claims and product endorsements on child-oriented beverages in Guatemala. *Public health nutrition*, 21(3), 627-631.

Pettigrew, S., Jongenelis, M., Jones, A., Hercberg, S., & Julia, C. (2022). An 18-country analysis of the effectiveness of five front-of-pack nutrition labels. *Food Quality and Preference*, 104691.

Pham, N., Mandel, N., & Morales, A. C. (2016). Messages from the food police: how food-related warnings backfire among dieters. *Journal of the Association for Consumer Research*, 1(1), 175-190.

Philipp-Muller, A., Costello, J. P., & Reczek, R. W. (2022). Get Your Science Out of Here: When Does Invoking Science in the Marketing of Consumer Products Backfire?. *Journal of Consumer Research*, 49(5), 721-740.

Pichierri, M., Peluso, A. M., Pino, G., & Guido, G. (2021). Communicating the health value of extra-virgin olive oil: an investigation of consumers' responses to health claims. *British Food Journal*, 123(2), 492-508.

Podadera-Herreros, A., Alcala-Diaz, J. F., Gutierrez-Mariscal, F. M., Jimenez-Torres, J., de la Cruz-Ares, S., Arenas-de Larriva, A. P., ... & Yubero-Serrano, E. M. (2022). Long-term consumption of a mediterranean diet or a low-fat diet on kidney function in coronary heart disease patients: The CORDIOPREV randomized controlled trial. *Clinical Nutrition*, 41(2), 552-559.

Pozharliev, R., De Angelis, M., Rossi, D., Bagozzi, R., & Amatulli, C. (2023). I might try it: Marketing actions to reduce consumer disgust toward insect-based food. *Journal of Retailing*, 99(1), 149-167.

Pozharliev, R., Verbeke, W. J., Van Strien, J. W., & Bagozzi, R. P. (2015). Merely being with you increases my attention to luxury products: Using EEG to understand consumers' emotional experience with luxury branded products. *Journal of Marketing Research*, 52(4), 546-558.

Proudfoot, D., & Kay, A. C. (2014). Reactance or rationalization? Predicting public responses to government policy. *Policy Insights from the Behavioral and Brain Sciences*, 1(1), 256-262.

Pulker, C. E., Scott, J. A., & Pollard, C. M. (2018). Ultra-processed family foods in Australia: nutrition claims, health claims and marketing techniques. *Public Health Nutrition*, 21(1), 38-48.

Qiu, S., Li, M., Mattila, A. S., & Yang, W. (2018). Managing the face in service failure: the moderation effect of social presence. *International Journal of Contemporary Hospitality Management*, 30(3), 1314-1331.

Quick, B. L., Kam, J. A., Morgan, S. E., Montero Liberona, C. A., & Smith, R. A. (2015). Prospect theory, discrete emotions, and freedom threats: An extension of psychological reactance theory. *Journal of Communication*, 65(1), 40-61.

Raghunathan, R., & Corfman, K. (2006). Is happiness shared doubled and sadness shared halved? Social influence on enjoyment of hedonic experiences. *Journal of Marketing Research*, 43(3), 386-394.

Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, 70(4), 170-184.

Rahman, M. S., Bag, S., Hossain, M. A., Fattah, F. A. M. A., Gani, M. O., & Rana, N. P. (2023). The new wave of AI-powered luxury brands online shopping experience: The role of digital multisensory cues and customers' engagement. *Journal of Retailing and Consumer Services*, 72, 103273.

Ratner, R. K., & Kahn, B. E. (2002). The impact of private versus public consumption on variety-seeking behavior. *Journal of Consumer Research*, 29(2), 246-257.

Reynolds-Tylus, T. (2019). Psychological reactance and persuasive health communication: A review of the literature. *Frontiers in Communication*, 4, 56.

Reynolds-Tylus, T., & Schill, D. (2023). An application of psychological reactance theory to college student voter registration and mobilization. In Political Marketing and the Election of 2020 (pp. 61-73). *Routledge*.

Richards, A. S., Qin, Y., Daily, K., & Nan, X. (2021). African American parents' perceived vaccine efficacy moderates the effect of message framing on psychological reactance to HPV vaccine advocacy. *Journal of Health Communication*, 26(8), 534-544.

Rifon, N. J., Choi, S. M., Trimble, C. S., & Li, H. (2004). Congruence effects in sponsorship: The mediating role of sponsor credibility and consumer attributions of sponsor motive. *Journal of Advertising*, 33(1), 30-42.

Ringbeck, D., Seeberger, D., & Huchzermeier, A. (2019). Toward personalized online shopping: Predicting personality traits based on online shopping behavior. Available at *SSRN 3406297*.

Rokeach, M., & Rothman, G. (1965). The principle of belief congruence and the congruity principle as models of cognitive interaction. *Psychological Review*, 72(2), 128.

Rosenblatt, D. H., Bode, S., Dixon, H., Murawski, C., Summerell, P., Ng, A., & Wakefield, M. (2018). Health warnings promote healthier dietary decision making: Effects of positive versus negative message framing and graphic versus text-based warnings. *Appetite*, 127, 280-288.

Rosenblatt, D. H., Dixon, H., Wakefield, M., & Bode, S. (2019). Evaluating the influence of message framing and graphic imagery on perceptions of food product health warnings. *Food Quality and Preference*, 77, 32-42.

Rothman, A. J., Bartels, R. D., Wlaschin, J., & Salovey, P. (2006). The strategic use of gain-and loss-framed messages to promote healthy behavior: How theory can inform practice. *Journal of communication*, 56(suppl_1), S202-S220.

Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, 94(1), 23.

Rozin, P., & Haidt, J. (2013). The domains of disgust and their origins: Contrasting biological and cultural evolutionary accounts. *Trends in cognitive sciences*, 17(8), 367-368.

Ruby, M. B., Rozin, P., & Chan, C. D. (2015). Determinants of willingness to eat insects in the USA and India. *Journal of Insects as Food and Feed*, 1(3), 215-225.

Samson, L., Nanne, A. J., & Buijzen, M. (2021). Remember the motivationally relevant appeals? The influence of social and sensory appeals on memory for pronutritional messages promoting healthy foods. *International Journal of Advertising*, 40(4), 582-601.

Sarda, B., Kesse-Guyot, E., Deschamps, V., Ducrot, P., Galan, P., Hercberg, S., ... & Julia, C. (2024). Consistency of the initial and updated version of the Nutri-score with food-based dietary guidelines: a French perspective. *The Journal of Nutrition,* 154(3), 1027-1038.

Schermel, A., Wong, C. L., & L'Abbé, M. R. (2016). Are foods with fat-related claims useful for weight management?. *Appetite*, 96, 154-159.

Schindler, R. M., Morrin, M., & Bechwati, N. N. (2005). Shipping charges and shipping‐charge skepticism: Implications for direct marketers' pricing formats. *Journal of Interactive marketing*, 19(1), 41-53.

Schmuck, D., Matthes, J., & Naderer, B. (2018). Misleading consumers with green advertising? An affect–reason–involvement account of greenwashing effects in environmental advertising. *Journal of Advertising*, 47(2), 127-145.

Schnettler, B., Ares, G., Sepúlveda, N., Bravo, S., Villalobos, B., Hueche, C., & Adasme-Berríos, C. (2019). How do consumers perceive reformulated foods after the implementation of nutritional warnings? Case study with frankfurters in Chile. *Food quality and preference*, 74, 179-188.

Schoemann, M., van de Mosselaar, P., Perkovic, S., & Orquin, J. L. (2024). A method for measuring consumer confusion due to lookalike labels. *International Journal of Research in Marketing*.

Scholer, A. A., Ozaki, Y., & Higgins, E. T. (2014). Inflating and deflating the self: Sustaining motivational concerns through self-evaluation. *Journal of Experimental Social Psychology*, 51, 60-73.

Shadish, W. R., T. D. Cook, and D. T. Campbell 2002. Experimental and quasi-experimental designs for generalized causal inference. *Houghton, Mifflin and Company*.

Shan, L., Diao, H., & Wu, L. (2020). Influence of the framing effect, anchoring effect, and knowledge on consumers' attitude and purchase intention of organic food. *Frontiers in Psychology*, 11, 2022.

Shen, L. (2015). Antecedents to psychological reactance: The impact of threat, message frame, and choice. *Health communication*, 30(10), 975-985.

Shimul, A. S., Cheah, I., & Lou, A. J. (2021). Regulatory focus and junk food avoidance: The influence of health consciousness, perceived risk and message framing. *Appetite*, 166, 105428.

Sicilia, M., López, M., & Palazón, M. (2023). The combined effect of front-of-package labels and influencer recommendations on food choice decisions. *Appetite*, 191, 107074.

Silchenko, K., Askegaard, S., & Cedrola, E. (2020). Three decades of research in health and food marketing: A systematic review. *Journal of Consumer Affairs*, *54*(2), 541-580.

Sinha, J. (2016). We are where we eat: How consumption contexts induce (un) healthful eating for stigmatized overweight consumers. *Journal of Consumer Psychology*, 26(2), 289-297.

Sogari, G., Menozzi, D., & Mora, C. (2018). Sensory-liking expectations and perceptions of processed and unprocessed insect products. *International Journal on Food System Dynamics*, 9(1012-2018-4129).

Song, H., McComas, K. A., & Schuler, K. L. (2018). Source effects on psychological reactance to regulatory policies: The role of trust and similarity. *Science Communication*, 40(5), 591-620.

Spiteri Cornish, L., & Moraes, C. (2015). The impact of consumer confusion on nutrition literacy and subsequent dietary behavior. *Psychology & Marketing*, 32(5), 558-574.

Sprengholz, P., Tannert, S., & Betsch, C. (2023). Explaining boomerang effects in persuasive health communication: How psychological reactance to healthy eating messages elevates attention to unhealthy food. *Journal of Health Communication*, 28(6), 384-390.

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In Advances in experimental social psychology (Vol. 21, pp. 261-302). *Academic Press*.

Steenis, N. D., van Herpen, E., van der Lans, I. A., & van Trijp, H. C. (2023). Partially green, wholly deceptive? How consumers respond to (in) consistently sustainable packaged products in the presence of sustainability claims. *Journal of Advertising*, 52(2), 159-178.

Stok, F. M., de Vet, E., de Wit, J. B., Renner, B., & de Ridder, D. T. (2015). Communicating eating-related rules. Suggestions are more effective than restrictions. *Appetite*, 86, 45-53.

Stoltze, F. M., Busey, E., Taillie, L. S., & Carpentier, F. R. D. (2021). Impact of warning labels on reducing health halo effects of nutrient content claims on breakfast cereal packages: A mixed-measures experiment. *Appetite*, 163, 105229.

Storcksdieck, G. B. S., Marandola, G., Ciriolo, E., VAN, B. R., & Wollgast, J. (2020). Front-of-pack nutrition labelling schemes: a comprehensive review.

Summer, A., Formaggioni, P., Franceschi, P., Di Frangia, F., Righi, F., & Malacarne, M. (2017). Cheese as functional food: The example of Parmigiano Reggiano and Grana Padano. *Food technology and biotechnology*, 55(3), 277-289.

Sundar, A., Dinsmore, J. B., Paik, S. H. W., & Kardes, F. R. (2017). Metaphorical communication, self-presentation, and consumer inference in service encounters. *Journal of Business Research*, 72, 136-146.

Szendrő, K., Tóth, K., & Nagy, M. Z. (2020). Opinions on insect consumption in Hungary. *Foods*, 9(12), 1829.

S. Zimmerman, R., Cupp, P. K., Abadi, M., Donohew, R. L., Gray, C., Gordon, L., & Grossl, A. B. (2014). The effects of framing and fear on ratings and impact of antimarijuana PSAs. *Substance Use & Misuse,* 49(7), 824-835.

Talati, Z., Pettigrew, S., Neal, B., Dixon, H., Hughes, C., Kelly, B., & Miller, C. (2017). Consumers' responses to health claims in the context of other on-pack nutrition information: A systematic review. *Nutrition reviews*, 75(4), 260-273.

Tam, L., Bagozzi, R. P., & Spanjol, J. (2010). When planning is not enough: the self-regulatory effect of implementation intentions on changing snacking habits. *Health Psychology*, 29(3), 284.

Tan, H. S. G., Fischer, A. R., van Trijp, H. C., & Stieger, M. (2016). Tasty but nasty? Exploring the role of sensory-liking and food appropriateness in the willingness to eat unusual novel foods like insects. *Food Quality and Preference,* 48,293-302.

Terren, L., & Borge, R. (2021). Echo chambers on social media: *A systematic review of the literature*.

Tik Tok. (2020). How Tiktok recommends videos #Foryou | tiktok newsroom. Available at: *https://newsroom.tiktok.com/en-us/how-tiktok-recommends-videos-for-you* (Accessed: 31 July 2024).

Thomson, M., Whelan, J., & Johnson, A. R. (2012). Why brands should fear fearful consumers: How attachment style predicts retaliation. *Journal of Consumer Psychology*, 22(2), 289-298.

Thorning, T. K., Raben, A., Tholstrup, T., Soedamah-Muthu, S. S., Givens, I., & Astrup, A. (2016). Milk and dairy products: good or bad for human health? An assessment of the totality of scientific evidence. *Food & nutrition research*, 60(1), 32527.

Trafimow, D., & Finlay, K. A. (1996). The importance of subjective norms for a minority of people: Between subjects and within-subjects analyses. *Personality and Social Psychology Bulletin*, 22(8), 820-828.

Turnwald, B. P., Bertoldo, J. D., Perry, M. A., Policastro, P., Timmons, M., Bosso, C., ... & Crum, A. J. (2019). Increasing vegetable intake by emphasizing tasty and enjoyable attributes: A randomized controlled multisite intervention for taste-focused labeling. *Psychological Science*, 30(11), 1603-1615.

Tversky, A., & Kahneman, D. (1980). The framing of decisions and the rationality of choice (*No. TR2*).

Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology*, 97(1), 103.

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: evolved function and structure. *Psychological Review*, 120(1), 65.

Ungar, N., Sieverding, M., Schweizer, F., & Stadnitski, T. (2015). Intervention-elicited reactance and its implications. *Zeitschrift für Psychologie*.

United Nations Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022: Summary of Results. *UN DESA/POP/2022/TR/NO. 3*.

USDA. 2024. How does an unhealthy diet affect a person's life? What will eating badly do to me? How will my bad/poor diet affect my health? Available at: *https://ask.usda.gov/s/article/How-does-an-unhealthy-diet-affect-a-persons-life-What-will-eating-badly-do-to-me-How-will-my-bad-poo* (Accessed: 10 June 2025).

Van Kerckhove, A., & Pandelaere, M. (2018). Why are you swiping right? The impact of product orientation on swiping responses. *Journal of Consumer Research*, 45(3), 633-647.

Van Royen, K., Pabian, S., Poels, K., & De Backer, C. (2022). Around the same table: Uniting stakeholders of food-related communication. *Appetite*, *173*, 105998.

Vartanian, L. R. (2015). Impression management and food intake. Current directions in research. *Appetite*, 86, 74-80.

Vartanian, L. R., Herman, C. P., & Polivy, J. (2007). Consumption stereotypes and impression management: How you are what you eat. *Appetite*, 48(3), 265-277.

van't Riet, J., Werrij, M. Q., Nieuwkamp, R., de Vries, H., & Ruiter, R. A. (2013). Message frame and self-efficacy influence the persuasiveness of nutrition information in a fast-food restaurant. *Food Quality and Preference*, 29(1), 1-5.

Van't Riet, J., Cox, A. D., Cox, D., Zimet, G. D., De Bruijn, G. J., Van den Putte, B., ... & Ruiter, R. A. (2016). Does perceived risk influence the effects of message framing? Revisiting the link between prospect theory and message framing. *Health psychology review*, 10(4), 447-459.

Vartiainen, O., Elorinne, A. L., Niva, M., & Väisänen, P. (2020). Finnish consumers' intentions to consume insect-based foods. *Journal of insects as food and feed*, 6(3), 261-272.

Veeck, A., Yu, H., Zhang, H., Zhu, H., & Yu, F. G. (2018). Social eating patterns, identity and the subjective well-being of Chinese teenagers. *European Journal of Marketing*, 52(12), 2356-2377.

Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giudice, T., & Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite*, 106, 30-36.

Vidal, G., Machín, L., Aschemann-Witzel, J., & Ares, G. (2019). Does message framing matter for promoting the use of nutritional warnings in decision making?. *Public health nutrition*, 22(16), 3025-3034.

Vijaykumar, S., McNeill, A., & Simpson, J. (2021). Associations between conflicting nutrition information, nutrition confusion and backlash among consumers in the UK. *Public Health Nutrition*, 24(5), 914-923.

Voorhees, C. M., Brady, M. K., & Horowitz, D. M. (2006). A voice from the silent masses: an exploratory and comparative analysis of noncomplainers. *Journal of the academy of marketing science*, 34(4), 514-527.

Voss, K. E., Spangenberg, E. R., & Grohmann, B. (2003). Measuring the hedonic and utilitarian dimensions of consumer attitude. *Journal of Marketing Research*, 40(3), 310–320.

Wakefield, K. L., & Inman, J. J. (2003). Situational price sensitivity: the role of consumption occasion, social context and income. *Journal of Retailing*, 79(4), 199-212.

Wan, L. C. (2013). Culture's impact on consumer complaining responses to embarrassing service failure. *Journal of Business Research*, 66(3), 298-305.

Wang, H., Fu, H., & Wu, Y. (2020). To gain face or not to lose face: the effect of face message frame on response to public service advertisements. *International Journal of Advertising*, 39(8), 1301-1321.

Watkins, T., Patel, A. S., & Antoine, G. E. (2022). You are what you eat: How and when workplace healthy eating cultivates coworker perceptions and behaviors. *Journal of Applied Psychology*, 107(9), 1459.

Wentzel, D., Tomczak, T., & Herrmann, A. (2010). The moderating effect of manipulative intent and cognitive resources on the evaluation of narrative ads. *Psychology & Marketing*, 27(5), 510-530.

Wilkins, S., Beckenuyte, C., & Butt, M. M. (2016). Consumers' behavioural intentions after experiencing deception or cognitive dissonance caused by deceptive packaging, package downsizing or slack filling. *European Journal of Marketing*, 50(1/2), 213-235.

Wilson, A. E., Darke, P. R., & Sengupta, J. (2022). Winning the battle but losing the war: Ironic effects of training consumers to detect deceptive advertising tactics. *Journal of business ethics*, 1-17.

Wilson, L., & Lusk, J. L. (2020). Consumer willingness to pay for redundant food labels. *Food Policy*, 97, 101938.

White, K., & Dahl, D. W. (2007). Are all out-groups created equal? Consumer identity and dissociative influence. *Journal of Consumer Research*, 34(4), 525-536.

White, J. B., Tynan, R., Galinsky, A. D., & Thompson, L. (2004). Face threat sensitivity in negotiation: Roadblock to agreement and joint gain. *Organizational Behavior and Human Decision Processes*, 94(2), 102-124.

WHO, (2022). WHO European Regional Obesity Report 2022. [online] Who.int. Available at: *https://www.who.int/europe/publications/i/item/9789289057738* [Accessed: 7 July 2025].

WHO. (2023). Cardiovascular diseases. World Health Organization. Available at: *https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1* (Accessed: 01 July 2024).

WHO. (2024a). Healthy diet. Available at: *https://www.who.int/initiatives/behealthy/healthy-diet* (Accessed: 24 July 2024).

WHO. (2024b). Unhealthy Diet. World Health Organization. Available at: *https://www.emro.who.int/noncommunicable-diseases/causes/unhealthy-diets.html* (Accessed: 24 July 2024).

WHO (2024c). Policy and strategy. Available at: *https://www.who.int/europe/teams/nutrition-physical-activity-and-obesity/policy-and-strategy* (Accessed: 21 August 2024).

WHO (2025a). Obesity and overweight. Available at: *https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight* (Accessed: 10 June 2025).

WHO (2025b). Marketing of unhealthy food and beverages. Available at: https://www.emro.who.int/nutrition/resources/marketing-of-unhealthy-foods-and-beverages.html. (Accessed: 10 June 2025).

Xie, G. X., Madrigal, R., & Boush, D. M. (2015). Disentangling the effects of perceived deception and anticipated harm on consumer responses to deceptive advertising. *Journal of Business Ethics*, 129, 281-293.

Xu, J. (2019). The impact of self-construal and message frame valence on reactance: A cross-cultural study in charity advertising. *International Journal of Advertising*, 38(3), 405-427.

Xu, X., Sharma, P., Shu, S., Lin, T. S., Ciais, P., Tubiello, F. N., ... & Jain, A. K. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nature Food*, 2(9), 724-732.

Ye, Tian, and Anna S. Mattila. (2021), The effect of ad appeals and message framing on consumer responses to plant-based menu items. *International Journal of Hospitality Management*, 95, 102917.

Zhang, X. A., Cao, Q., & Grigoriou, N. (2011). Consciousness of social face: The development and validation of a scale measuring desire to gain face versus fear of losing face. *The Journal of social psychology*, 151(2), 129-149.

8. Appendix

Appendix A. Measurement Scales for Study 1

Construct/variable	Source	Scale
1. perceived healthiness	Ares, G., & Gámbaro, A. (2007). Influence of gender, age and motives underlying food choice on perceived healthiness and willingness to try functional foods. *Appetite*, 49(1), 148-158.	Please indicate how healthy you perceived the above-mentioned olive oil (with 7-Likert scale). Q1: Not at all healthy—very healthy
2. perceived congruence	Rifon, N. J., Choi, S. M., Trimble, C. S., & Li, H. (2004). Congruence effects	(S2) Please express your opinion on the relationship between the nutritional

	in sponsorship: The mediating role of sponsor credibility and consumer attributions of sponsor motive. *Journal of advertising*, 33(1), 30-42.	information included in the front-of-pack label and your previous knowledge about the healthiness of the olive oil (with 7-Likert scale). (S3) What do you think of the relationship between the scientific knowledge of olive oil and the nutritional information from the front-of-pack label: Q1: Not compatible—compatible Q2: Not a good fit—good fit Q3: Congruent—Not congruent
3. Perceived credibility of the message	Block, L. G., & Keller, P. A. (1995). When to accentuate the negative: The effects of perceived efficacy and message framing on intentions to perform a health-related behavior. *Journal of marketing research*, 32(2), 192-203.	What do you think of the front-of-pack label information about olive oil above: Q1: The information from the front-of-pack label is credible. Q2: I think the information from the front-of-pack label is exaggerated. Q3: I think the information from the front-of-pack label is unbelievable.
4. Attitude toward the Front-of-pack Nutritional Label	Burnkrant, R. E., & Unnava, H. R. (1995). Effects of self-referencing on persuasion. *Journal of consumer research*, 22(1), 17-26.	Please indicate your attitude towards the Front-of-pack label: Q1: Negative-positive Q2: Bad-Good Q3. Unfavorable-Favorable
5. Adoption intention of the Front-of-pack Nutritional Label	Mazzù, M. F., Baccelloni, A., Romani, S., & Andria, A. (2022c). The role of trust and algorithms in consumers' front-of-pack labels acceptance: a	Q1. I will use this front-of-pack label for food purchases in the future. Q2. I will recommend this front-of-pack label for food purchases to my friends.

	cross-country investigation. *European Journal of Marketing*, 56(11), 3107-3137

Appendix B: Measurement Scales for Study 2

Construct/variable	Source	Scale
1. Reactance	Massi Lindsey, L. L. (2005). Anticipated guilt as behavioral motivation: An examination of appeals to help unknown others through bone marrow donation. *Human Communication Research*, *31*(4), 453-481.	To what extent do you agree with the statements below (1 = "strongly disagree," 7 = "strongly agree") Q1: I am uncomfortable being told how to feel about the importance of healthy eating. Q2: I do not like that I am being told how to feel about the importance of healthy eating. Q3. It irritates me that the guidelines told me how to feel about the importance of healthy eating. Q4. I dislike that I am being told how to feel about the importance of healthy eating.
2. Attitude	Burnkrant, R. E., & Unnava, H. R. (1995). Effects of self-referencing on persuasion. *Journal of consumer research*, *22*(1), 17-26.	What's your attitude towards the above dietary guidelines? Q1: Negative-positive Q2: Bad-Good Q3. Unfavorable-Favorable
3. Willingness to receive further information from the provider (adjusted)	Gershoff, A. D., Mukherjee, A., & Mukhopadhyay, A. (2007). Few ways to love, but many ways to hate: Attribute ambiguity and the positivity effect in agent evaluation.	To what extent would you like to receive more dietary guidance from the national program? 1=not at all, 7=very much

	Journal of Consumer Research, 33(4), 499-505.	
4. Promotion focus trait	Ferrer, R. A., Lipkus, I. M., Cerully, J. L., McBride, C. M., Shepperd, J. A., & Klein, W. M. (2017). Developing a scale to assess health regulatory focus. *Social Science & Medicine*, *195*, 50-60.	To what extent do you agree with the statements below? Q1: I frequently imagine how I can achieve a state of "ideal health." Q2: I think of good health as a key to a happy life. Q3. Doing healthy things gives me a sense of accomplishment. Q4. When I engage in healthy behaviors, I am pleased with myself. Q5. I would do anything to maintain a good, healthy body. Q6. I admire people who do things that make them very healthy
5. Concern for face (adjusted)	Chan, Haksin, Lisa C. Wan, and Leo Y. M. Sin (2009), "The Contrasting Effects of Culture on Consumer Tolerance: Interpersonal Face and Impersonal Fate," Journal of Consumer Research, 36 (2), 292-304.	To what extent do you agree the following statement? Q1: I care about praise and criticism from others. Q2: I hate being taken lightly. Q3. I will be very upset if I am criticized in public.
6. Prevention focus trait	Ferrer, R. A., Lipkus, I. M., Cerully, J. L., McBride, C. M., Shepperd, J. A., & Klein, W. M. (2017). Developing a scale to assess health regulatory focus. Social Science & Medicine, 195, 50-60.	To what extent do you agree with the statements below? Q1: I often worry that I am not doing the best I can to improve my health. Q2: I often imagine myself being ill in the future. Q3: I am anxious that I am not following through on my obligations and being as responsible as I should about taking care of my health.

	Q4: When I see people who are very sick because they did not take care of their health, I get scared thinking that could be me in the future. Q5: I often worry about not feeling as healthy as I used to be. Q6: Thinking about my health usually makes me worry.

Appendix C: Experiment design: Details for stimulus exposure for Study 2.

Experiment 1

Research procedure: participants will be exposed to the same dietary guidance in the beginning of the experiment with the following introduction. Participants are exposed to the message for at least 5 seconds.

The messages below are dietary guidance from national nutrition program.

In the gain framing condition, participants are exposed to 8 messages, including “Healthy eating may help you live longer”; “Healthy eating keeps skin, teeth, and eyes healthy”; “Healthy eating supports muscles”; “Healthy eating

boosts immunity"; "Healthy eating strengthens bones"; "Healthy eating lowers risk of heart disease, type 2 diabetes, and some concerns"; "Healthy eating helps the digestive system function"; "Healthy eating helps achieve and maintain a healthy weight". All messages are presented on one single page and are exposed to consumers for at least 8 seconds.

In the loss framing condition, participants are exposed to 8 messages, including "Unhealthy eating may shorten your lifespan"; "Unhealthy eating may lead to skin, teeth, and eye problems"; "Unhealthy eating hinders muscle health"; "Unhealthy eating weakens immunity"; "Unhealthy eating weakens bones"; "Unhealthy eating increases the risk of heart disease, type 2 diabetes, and some health concerns"; "Unhealthy eating impairs the digestive system's function"; "Unhealthy eating impedes achieving and maintaining a healthy weight". All messages are presented on one single page and are exposed to consumers for at least 8 seconds.

We will ask participants to respond their psychological reactance (Massi Lindsey 2005; 4-item, see Table 1 in Appendix A for the scale items); attitude towards the messages (Burnkrant and Unnava 1995; 3-item); WTR was measured with a single item (i.e., To what extent would you like to receive more dietary guidance from the national program? Adapted from Gershoff et al. 2007); and promotion focus trait (Ferrer et al. 2017; 6-item). We will include age, gender, education level, and prevention focus trait as control variables).

Experiment 2

Research procedure: participants will be exposed to the same dietary guidance in the beginning of the experiment with the following introduction. Participants are exposed to the message for at least 5 seconds.

The messages below are dietary guidance from national nutrition program.

In the gain framing condition, participants are exposed to 8 messages, including “Healthy eating may help you live longer”; “Healthy eating keeps skin, teeth, and eyes healthy”; “Healthy eating supports muscles”; “Healthy eating boosts immunity”; “Healthy eating strengthens bones”; “Healthy eating lowers risk of heart disease, type 2 diabetes, and some concerns”; “Healthy eating helps the digestive system function”; “Healthy eating helps achieve and maintain a healthy weight”. Each message appears on a separate page and are exposed to consumers for at least 3 seconds.

In the loss framing condition, participants are exposed to 8 messages, including “Unhealthy eating may shorten your lifespan”; “Unhealthy eating may lead to skin, teeth, and eye problems”; “Unhealthy eating hinders muscle health”; “Unhealthy eating weakens immunity”; “Unhealthy eating weakens bones”; “Unhealthy eating increases the risk of heart disease, type 2 diabetes, and some health concerns”; “Unhealthy eating impairs the digestive system's function”; “Unhealthy eating impedes achieving and maintaining a healthy weight”. Each message appears on a separate page and are exposed to consumers for at least 3 seconds.

We will ask participants to respond their psychological reactance (Massi Lindsey 2005; 4-item, see Appendix A); attitude (Burnkrant and Unnava 1995; 3-item); WTR (Gershoff et al. 2007; one item); promotion focus trait (Ferrer et al. 2017; 6-item). Moreover, age, gender, education level, and prevention focus trait will be measured as control variables.

Experiment 3

Research procedure: In the gains framing condition, participants are exposed to 11 messages, including "Adequate beans eating may help you live longer."; "Adequate vegetables eating keeps skin, teeth, and eyes healthy."; "Adequate protein eating supports muscles."; "Adequate fruits eating boosts immunity."; "Adequate dairy eating strengthens bones."; "Adequate unsaturated fats eating lowers risk of heart disease."; "Adequate whole grains eating helps the digestive system function."; "Moderate refined grains eating helps achieve and maintain a healthy weight."; "Limited sodium eating lowers risk of stroke."; "Limited added sugars eating lowers risk of type 2 diabetes."; "Limited saturated fats eating helps feeling fit and energized.". Each message appears on a separate page and are exposed to consumers for at least 3 seconds.

In the loss framing condition, participants are exposed to 11 messages, including "Inadequate beans eating may shorten your lifespan."; "Inadequate vegetables eating may lead to skin, teeth, and eye problems."; "Inadequate protein eating hinders muscle health."; "Inadequate fruits eating weakens immunity."; "Inadequate dairy eating weakens bones."; "Inadequate unsaturated fats eating increases the risk of heart disease."; "Inadequate whole grains eating impairs the digestive system's function."; "Excessive refined grains eating impedes achieving and maintaining a healthy weight."; "Excessive sodium eating increases the risk of stroke."; "Excessive added sugars eating increases the risk of type 2 diabetes."; "Excessive saturated fats eating hinders feeling fit and energized.". Each message appears on a separate page and are exposed to consumers for at least 3 seconds.

We will ask participants to respond their reactance (Massi Lindsey 2005; 4-item, see Appendix A); attitude (Burnkrant and Unnava 1995; 3-item); WTR (Gershoff et al. 2007; one-item); concern for face (Chan et al. 2009; 3-item). Moreover, we also included age, gender, and education level as control variables.

Appendix D. Measurement Scales for Study 3

Construct/variable	Source	Scale
1. Negative word of mouth	Voorhees, C. M., Brady, M. K., & Horowitz, D. M. (2006). A voice from the silent masses: an	To what extent do you agree with the following statements? (1 = "strongly disagree," 7 = "strongly agree")

	exploratory and comparative analysis of noncomplainers. *Journal of the academy of marketing science*, 34(4), 514-527.	Q1: I will recommend friends to not eat the above-mentioned food. Q2: I will say bad things about the above-mentioned food to others. Q3. I will encourage friends and relatives to eat other food instead of the above-mentioned food.
2. Anger	Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. *Communication monographs*, 72(2), 144-168.	To what extent do you agree with the following statements? Q1: I feel irritated with the juice company. Q2: I feel angry with the juice company. Q3. I feel annoyed with the juice company. Q4. I feel aggravated with the juice company.
3. Counterarguing	Nabi, R. L., Moyer-Gusé, E., & Byrne, S. (2007). All joking aside: A serious investigation into the persuasive effect of funny social issue messages. *Communication Monographs*, 74(1), 29-54.	To what extent do you agree with the following statements? Q1. I found myself actively agreeing with the juice company's package information "no sugar added. Q2. I found myself actively disagreeing with the juice company. Q3. I was looking for flaws in the juice company's packages.

		Q4. It was easy to agree with the arguments "no sugar added" the juice company made in the food package.
4. Threat of freedom	Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. *Communication monographs*, 72(2), 144-168.	To what extent do you agree with the following statements? (Strongly disagree = 1; Strongly agree = 7) Q1: The yogurt company threatened my freedom to choose food. Q2: The yogurt company tried to make a food decision for me. Q3. The yogurt company tried to manipulate my food choice. Q4. The yogurt company tried to pressure my food choice.

Appendix E: Experiment design: Details for stimulus exposure for Study 3.

Experiment 1

Persuasion knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These companies are lying to look like healthy and prevent you from real healthy choices.

Health knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These foods are not good for your health and prevent you from building a healthy body.

Experiment 2

Health knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These foods are not good for your health and prevent you from building a healthy body.

Persuasion knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These companies are lying to look like healthy and prevent you from real healthy choices.

Health knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These foods are not good for your health and prevent you from building a healthy body.

Persuasion knowledge:

-Although the yogurt is of high protein content, the sugar content is high in the yogurt. Therefore the overall healthiness level of the product is low.

-These companies are lying to look like healthy and prevent you from real healthy choices.

Experiment 3

Health knowledge:

-There is no sugar added, while the sugar content is already high in the juice before adding more.

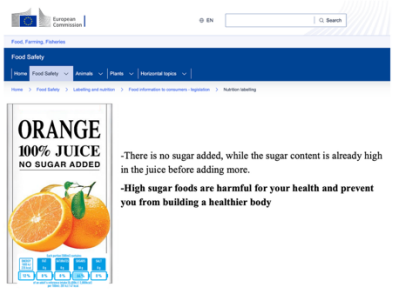
-High sugar foods are harmful for your health and prevent you from building a healthier body

Persuasion knowledge

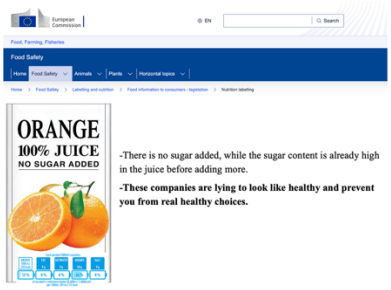
-There is no sugar added, while the sugar content is already high in the juice before adding more.

-These companies are lying to look like healthy and prevent you from real healthy choices.

Health knowledge with EU:



Persuasion knowledge with EU



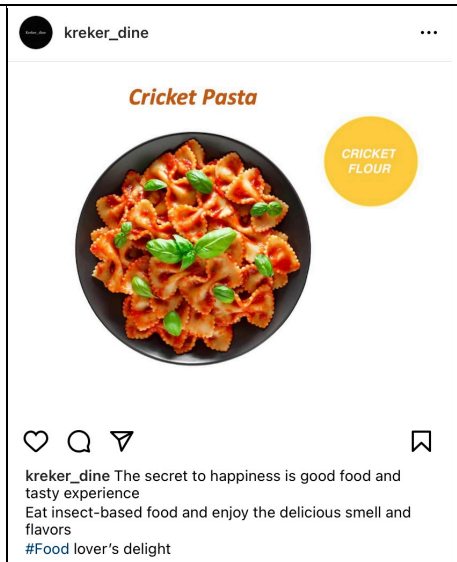
Appendix F. Measurement Scales for Study 4

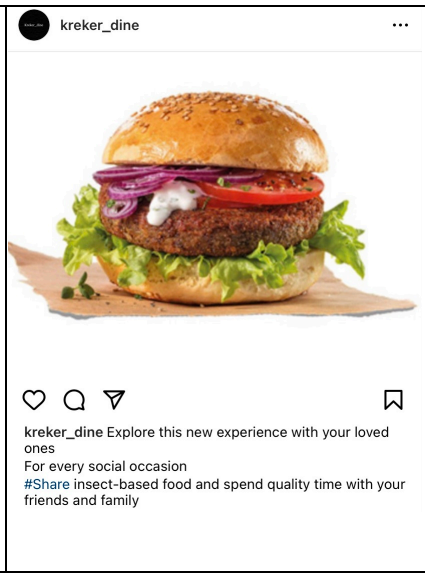
Construct/variable	Source	Scale
1. Disgust (adapted)	Argo, Jennifer J., Darren W. Dahl, and Andrea C. Morales (2006), "Consumer contamination: How consumers react to products touched by others," *Journal of Marketing*, 70 (2), 81-94.	Indicate how would you feel if you are about to try the above-mentioned insect-based food? (with 7-Likert scale) Q1: I feel disgusted about the insect-based food. Q2: I feel revolted about the insect-based food. Note: since we used two items for the scale, we reported both correlation coefficient and Cronbach's alpha in the main text.
2. Pleasure (adapted)	Russell, James A., and Albert Mehrabian (1974), "Distinguishing anger and anxiety in terms of emotional response factors," *Journal of consulting and clinical psychology*, 42(1), 79.	Indicate how would you feel if you are about to try the above-mentioned insect-based food? (Reversed) Q1: Happy-unhappy Q2: Pleased-annoyed Q3: Satisfied-unsatisfied Q4: Relaxed-bored

3. Arousal (adapted)	Russell, James A., and Albert Mehrabian (1974), "Distinguishing anger and anxiety in terms of emotional response factors," *Journal of consulting and clinical psychology*, 42(1), 79.	Indicate how would you feel if you are about to try the above-mentioned insect-based food? (Reversed) Q1: Stimulated-Relaxed Q2: Excited-Calm Q3: Frenzied-Sluggish Q4: Aroused-Unaroused
4. Normality of insect-based food (adapted)	Koch, Jan Andre, Jan Willem Bolderdijk, and Koert van Ittersum (2021), "Disgusting? No, just deviating from internalized norms. Understanding consumer skepticism toward sustainable food alternatives," *Journal of Environmental Psychology*, 76, 101645.	Q1. How normal is eating this food to you? 1 = "Very abnormal"; 5 = "Very normal
5. Perceived innovativeness (adapted)	Kim, Eojina, Liang Rebecca Tang, and Robert Bosselman (2018), "Measuring customer perceptions of restaurant innovativeness: Developing and validating a scale," International *Journal of Hospitality Management*, 74, 85-98.	To what extent do you agree with the following statement (7-Likert scale)? Eating this insect-based food is innovative.
6. Hunger (adapted)	Juanola-Falgarona, Martí, Jordi Salas-Salvadó, Núria Ibarrola-Jurado, Antoni Rabassa-Soler, Andrés Díaz-López, Marta Guasch-Ferré, Pablo Hernández-Alonso, Rafael Balanza, and Mònica Bulló (2014), "Effect of the glycemic index of the diet on weight loss, modulation of satiety, inflammation, and other metabolic risk factors: a randomized controlled trial," *The American journal of clinical nutrition*, 100(1), 27-35.	How hungry do you feel now? Not at all-very much
7. Food neophobia (adapted)	Ritchey, Phillip N., Robert A. Frank, Ulla-Kaisa Hursti, and Hely Tuorila (2003), "Validation and cross-national comparison of the food neophobia scale (FNS) using confirmatory factor analysis," *Appetite*, 40(2), 163-173.	What do you think of the following statement relevant with food (7-Likert scale)? I am afraid to eat things I have never had before.

Appendix G: Experiment design: Details for stimulus exposure for Study 4.

Experiment	Material	
	Hedonic appeal	**Utilitarian appeal**
1		
2	**Sensory appeal**	**Social appeal**

		
3	**Sensory appeal**	**Social appeal**
		
4	**Sensory appeal**	**Social appeal**

Web Appendix 1: Advertising framing effects in the context of healthy eating communication.

Authors, year	Methodology	Participants	Overall comparison of the message framing effects	Key findings
Cesario et al, 2004	Experiment	Study 1: The US, university students, N = 106	No main effect of framing effect, while there are moderating	The match between message framing and regulatory focus (i.e., promotion focus match with gain framing; prevention focus match with loss framing) increases

			effects.	consumer intentions to eat more fruits and vegetables.
Churchill and Pavey, 2013	Longitudinal experiment	England, N_{gain} = 84, N_{loss} = 91.	No main effect	Gain framing is more effective in prompting participants to consume more fruits and vegetables only for those with high autonomy.
Cucchiara et al, 2015	Web-based experiment	An online consumer panel of a regional supermarket chain in the northeast of the USA, N_{gain} = 612, N_{loss} = 560	Gain framing > Loss framing	Gain framing messages are more effective than loss framing messages in persuading consumers to buy organic seafood, which is positioned as healthy food. The issue involvement shows a moderating role: the higher the issue involvement of participants, the more effective the loss framing becomes.

de Bruijn et al, 2015	Longitudinal experiment	Dutch, N = 294 in total for immediate intention measure; N = 177 in total for one-week record.	Mixed results	Loss framing is more effective in increasing immediate intention to intake more fruits, while gain framing is more effective in stimulating fruit intake motivation after a week.
Eguren et al, 2021	Experiment	Uruguayan, N_{loss} = 177, N_{gain} = 166	Gain framing < Loss framing	Loss framing, compared with gain framing, is more effective in moderating consumer importance allocation to the package importance, especially emphasizing the importance of health warning information.
Garg et al, 2021	Experiment	Study 2: Mturk participants, N = 288 in total.	Gain framing < Loss framing	The loss framing is more effective in decreasing consumer preferences for hedonic food (i.e., cookies and chocolates)

Kuo et al, 2019	Experiment	Study 1: Taiwan, N = 160 in total. Study 2: Taiwan, N = 349 in total.	Gain framing < Loss framing	Study 1: The loss framing for healthy food is more effective in increasing advertisement preference and purchase intention towards the food. Study 2: Loss framing is more effective in increasing advertisement preference and purchase intention when participants are primed with promotion focus task, while there's no significant differences when primed with prevention focus.
Lee and Aker, 2004	Experiment	Study 1: The US, university students, N = 116	No main effect of framing effect, while there are moderating effects.	The appropriate match between message framing and regulatory focus (i.e., promotion focus match with gain framing; prevention focus match with loss framing) increases consumer favorable attitude to the

				healthy food brand.
Pavey and Churchill, 2014	Experiment	Study 1: Kingston University students, the UK, N = 152 in total. Study 2: online survey hosting company, N=252 in total.	No main effect of framing effect, while there are moderating effects.	Study 1: There's no main effect of message framing, while for participants that are primed with autonomy is highlighted, gain framing, compared with loss framing, is more effective in increasing intentions to avoid eating unhealthy snacks. Study 2: For participants who are overweight or obese, the gain framing is more effective in increasing intentions to avoid unhealthy snacks while the autonomy cues are embedded in the message, while the loss framing is more effective when the heteronomy cues

				are primed.
Rosenblatt et al, 2018	Lab experiment	96 English speaking participants recruited by the university of Melbourne, N_{gain} (graphic) = N_{loss} (graphic) = N_{gain} (text) = N_{loss} (text) = 16	Gain graphic framing < Loss graphic framing; no clear differences between the textual-only framing	Loss graphic framing exposure, compared to gain graphic framing, is significantly more effective in improving dietary self-control, which is measured with their decision to accept healthy-not tasty items and reject unhealthy-tasty items.
Rosenblatt et al, 2019	Experiment	Study 1: Australia, N = 100 in total. Study 2: Australia, N = 43 in total.	Mixed results	Study 1: No main effects of message framing in perceived efficacy, gain graphic framing shows significantly higher behavioral change than loss graphic framing. No

				significant difference in the text-only comparison. Loss framing generates higher negative emotional responses. Study 2: Main effect of message framing indicates that loss framing is perceived as more effective in changing behavior while gain framing produces significantly greater behavioral change motivation. Loss framing generates more negative emotional responses.
Shan et al, 2020	Experiment	Consumers from Wuxi. China. N_{gain} = 185, N_{loss} = 183	Gain framing < Loss framing	Loss frame messages enhance the persuasion of advertisements of organic food in relation to consumer responses regarding attitudes and purchase intentions. Consumers with less product

				knowledge are more susceptible to the effect.
Shimul et al, 2021	Experiment	Study 3: Australian, N=168 in total	No main effect	The appropriate match between message framing and regulatory focus (i.e., promotion focus match with gain framing; prevention focus match with loss framing) increases the consumer intention to avoid junk food.
Tam et al, 2010	Experiment	The US, N = 323	No main effect	The appropriate match between message framing and regulatory focus (i.e., eating more healthier snacking match with gain framing; avoidance of unhealthy snacking behavior match with loss framing) increases the consumer motivation intensity to improve snacking habits;

				intentions to eat healthier snacks; improve actual snacking behavior according to the subsequent 2 days eating diary record.
van't Riet et al, 2013	Experiment	Customers of fast-food restaurants in the vicinity of Brussels, Belgium, N = 235 in total	No main effect of message framing effects, while there are moderating effects.	There's no main effect of message framing in changing consumer attitudes or intentions to choose healthy products over unhealthy products. However, self-efficacy shows significant effect in moderating the effectiveness of gain framing vs. loss framing effect.
Vidal et al, 2019	Experiment	University students and workers, Uruguay, $N_{gain} = 67$, $N_{loss} = 67$.	Mixed results	Gain framing generates significantly higher perceived credibility and willingness to follow the recommendations that the messages convey. There's no significant difference

				between gain framing and loss framing, regarding the avoidance of unhealthy food. Loss framing is more effective in improving participants fixation time on the nutritional warning labels.
Our research	Experiment	The US and the UK, N = 1101 in total	Gain framing >=Loss framing	Loss framing, compared to gain framing, generates a statistically significant higher psychological reactance response in studies 2, 3, and 4. However, no significant difference was found in studies 1 and 5. Additionally, we also tested the role of promotion focus trait as a moderator in studies 1 and 2, revealing that individuals with a lower promotion focus trait show higher psychological

				reactance towards loss framing messages. In study 5, we observed that individuals who score higher in concern for face also exhibit higher psychological reactance towards loss framing messages.