Overcoming congruity issues of Nutritional information through Front-of-Pack Nutritional Labels: an investigation on the relative effects of Nutri-Score and NutrInform Battery

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Abstract: The growing rates of overweight and obesity stimulated an increasing number of individuals to actively pursue healthier lifestyles and seek nutrition information to enhance their wellbeing. As consumers gather nutritional cues from different sources (e.g., information from Front-of-Pack Nutritional Labels, scientific reports, mass media, advertising, peer recommendation etc.), they are sometime offered Conflicting Nutritional Information. Recent studies have highlighted the detrimental effects of Conflicting Nutritional Information, making it relevant for policymakers to understand the role of Front-of-Pack Nutritional Labels in assisting consumers to make sense of the broader nutritional information system, particularly in the presence of contrasting messages. Our findings highlight that non-directive labels, compared to directive labels, increase the perceived congruence between the nutritional information provided by the Nutritional Labels and other external information entities, which in turn influence the perceived credibility, attitudinal, and adoption intention to the Front-of-Pack labels.

Introduction

According to the latest World Health Organization Regional Obesity Review (WHO, 2022), Europe is reported to be the second most obese region in the world (Gregory, 2022), with direct consequences on the probability to suffer from Noncommunicable Diseases. Consumers are reported to be exposed to diverse nutrition-relevant information that might generate processing confusion. The conflicting nutritional information, often easily accessible on the web, includes both misinformation and contradictory opinions from nutrition scientists. Examples are the evolving updated contradictory information regarding benefits and risks of wine, fish, and coffee (Spiteri Cornish and Moraes, 2015; Nagler, 2014). The detrimental impact of Conflicting Nutrition Information (CNI) on consumer healthiness has been recorded in the recent studies (Hong 2023; Ngo et al, 2023; Nagler et al, 2022). Specifically, consumers have shown tendency to devalue the credibility of scientific information (Chang 2015) and leading to lower trust in scientific health information (Lyons et al, 2020). This dynamic might lead to work against general healthy recommendations and behaviour, including vegetable consumption and physical training (Hong 2023; Ngo et al, 2023). Hence, prior studies have emphasized (a) that policymakers should consider the complex effects of conflicting nutritional information when promoting nutritional initiatives, such as the design of dietary recommendations (Ngo et al, 2023), and (b) the need for transdisciplinary research to comprehensively investigate how consumers cognitively process and integrate conflicting information (Carpenter et al., 2016).

As per policy-making objectives, Front-of-Pack Nutritional Labels provide consumers with nutrition information available on the front of the food package, aiming to make the content more salient and understandable (Newman et al, 2018). While the use of the different typology of Front-of-pack Nutritional Labels as extrinsic stimuli in changing consumer perceptions and affecting their attitudes and behaviour is widely studied (Ikonen et al, 2020), limited attention has been given to how different information interacts with the ones available from different types of Front-of-Pack Nutritional labels, except for a limited number of studies that analyse bundled labels (Mazzù, 2023a).

Leveraging the congruity theory (Maille and Fleck, 2011; Rokeach and Rothman, 1965; Osgood and Tannenbaum, 1955), this research aims to investigate, on the olive oil case, a product sometime subject to conflicting information, the effect the interplay on consumer cognitive processing of information offered to consumers by different typologies of Front-of-Pack Nutritional Labels when combined with other typologies of information and endorsement.

The following short paper is divided as follows: after an overview of the underlying theoretical frameworks, we discuss our research methodology and then highlight the main implications of our studies.

Conceptual Framework and Extant Literature

Encountering conflicting information when browsing for nutritional knowledge is an increasingly scenario that consumers are confronted with, as they are presented with diverse nutritional guidance that steers their dietary choices in varying directions. The conflicting nutritional information has been reported to yield detrimental outcomes for health-relevant behaviour, encompassing tendencies to resist pertinent healthy information and, in some cases, revert to less healthful behaviours (Hong 2023; Ngo et al, 2023; Chang, 2015).

In recent years, governments and institutions have introduced Front-of-Nutritional Labels (FOPLs) to provide a synthetic form of trusted and reliable information that can support customers toward healthier and more informed dietary regime. FOPLs could be categorized as directive and non-directive labels (Table 1) based on the extent to which the labels are indicative in terms of food healthiness (EU commission, 2021).

FOPLs are one of the several elements that consumers are stimulated with in order to derive their nutritional information. Thus, customers are immersed in a "ecosystem of nutritional information" that comprise FOPLs as well as other – not always converging - information form a multitude of external source.

Table 1. Taxonomy of Front-of-Pack Nutritional Labels.

Non-directive Labels	
Front-of-Pack Nutritional labels that include information elements only, such as nutrient names, grams, and percentages.	• **Numerical Labels** (e.g., NutrInform) • **Colour-Coded Labels** (e.g., Multiple Traffic Light)
Directive Labels	
Front-of-Pack Nutritional labels that include the least amount of information, often aggregate in one symbol or icon.	• **Endorsement Logos** (e.g., Keyhole logo) • **Graded Indicators** (e.g., Nutri-Score)

In this regard, the congruity theory holds explanatory potential concerning consumer cognitive processes and behavioural intentions toward the relative integration of information available by FOPLs with other information. Drawing upon this theory, and logically linking to the different categories of FOPLs, non-directive stimuli, due to their neutral property, tend to exhibit congruence with and assimilation into various types of directive stimuli within the information system (Osgood and Tannenbaum, 1955). On the other hand, the congruence process involving directive stimuli is more complex when interacting with other information; this complexity becomes particularly evident when consumers are confronted with conflicting information, which causes confusion within the information system, ultimately leading to a compromise in consumer cognitive processes (Osgood and Tannenbaum, 1955). The impact of perceived congruence in improving attitudinal and persuasion has been mainly studied in contexts such as celebrity endorser and advertisement (von Mettenheim and Wiedmann, 2021; Till et al, 2008), brand extensions (d'Astous et al, 2007), brand image and self-concept (Zhu et al, 2019), and understudied in the context of nutritional information.

Additionally, variables as perceived credibility, should be considered, as it might enhance the perceived usefulness of the sources that provide nutritional information and facilitate 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 of the relevant information (Chang 2015). Despite individuals tend to naturally assume that the information communicated by others is credible, as per truth-default theory (Levine, 2014), trust in message is undermined when there is a lack of coherence in the message content or a mismatch between the communication and existing knowledge of reality.

It is thus possible that consumers may feel the information less credible from the Front-of-Pack Nutritional Labels information that is less congruent with other available nutritional information sources.

Research Objectives

Based on the comparative congruity theory model, we aim to compare the perceived congruence between a neutral stimulus (i.e., NutrInform Battery) vs. a directive one (i.e., Nutri-Score) when interacting with external health knowledge (i.e., scientific information) and internal information (i.e., consumer health knowledge in mind about olive oil respectively). We then compare how perceived credibility mediates the process as the underlying mechanism, and in turn, change consumer attitudes and future adoption intentions for the Front-of-Pack Nutritional label. Our hypotheses to test are listed below.

H1: Non-directive (vs. directive) Front-of-Pack Nutritional Labels obtain a higher level of perceived congruence when compared with external directive entities as scientific nutritional information about olive oil.

H2: A higher perceived congruence level will lead to higher perceived credibility of the information provided by the labels, and in turn, generate more positive attitude and higher adoption intentions toward the Front-of-Pack Nutritional Labels.

Methods and Materials

Study Population: We collected from all European Union participants countries, excluding already adopting Nutri-Score as France, Germany, Belgium, and Luxembourg. All surveys were performed in English.

Table 2. Study population

Study	Population	Description
Study 1	139	• Independent t-test to check the main effect of Front-of-Pack Nutritional Labels. • Serial mediation test (external-external nutritional information comparison)
Study 2	140	• Independent t-test to check the main effect of Front-of-Pack Nutritional Labels. • Serial mediation test (external-internal nutritional information comparison)

We used SPSS Statistics for reliability tests, independent t-test, and Hayes (2017) process model.

Research design: In the manipulation check, participants from European Union EU countries (except for French, Germany, Belgium, and Luxembourg that have widely adopted the Nutri-Score) were recruited through Prolific platform in exchange for a nominal payment. Participants were shown one of the two tested labels attached to the same olive oil. Next, participants had to indicate on a 7-point Likert scale the extent to which they perceive the olive oil as healthy.

In our study, 139 respondents were informed that the study is about Front-of-Pack Nutritional Labels, have been 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 their responses to the perceived congruence between the nutritional information provided by the scientific evidence and Front-of-Pack Nutritional Labels, perceived credibility, attitudes, and adoption intention towards the of Front-of-Pack Nutritional Labels.

Analysis:
First, we conducted independent t-test to check the main effect of Front-of-Pack Nutritional Labels. Then, we employed serial mediation test with label types as independent variable, perceived congruence (i.e., external-external nutritional information comparison) and perceived credibility as two serial mediators, attitude, and adoption intention of the labels as dependent variables.

Results
The independent t-test (Table 3) shows that the condition of NutrInform Battery combined with congruent scientific reports is better valued by consumers than the condition of Nutri-Score combined with congruent scientific information, in terms of perceived congruence, perceived credibility, attitude toward the FOPL and label adoption intention.

Table 3. Results

	Nutri-Score combined with scientific reports	NutrInform Battery combined with scientific reports	T-value	p-value
Perceived congruence	4.40	4.84	-2.46	0.02
Perceived Credibility	4.92	5.51	-3.07	<0.01
Attitude towards FOPLs	4.67	5.69	-4.83	<0.01
Adoption intention	4.25	4.71	-2.01	0.05

A further serial mediation suggested that NutrInform Battery, compared to the Nutri-Score, obtained higher level of congruence when interacting with scientific evidence (b = 0.22, t = 2.46; p = 0.02). This congruence effect then affected perceived credibility (b = 0.41, t = 4.85, p < 0.01). Furthermore, perceived credibility affected participants' attitude (b = 0.45, t = 6.39; p < 0.01) and adoption intention (b = 0.40, t = 4.54; p < 0.01). Specifically, the indirect positive effect of NutrInform Battery on attitude—through perceived congruence and then perceived credibility—was statistically significant (b = 0.04, [SE] = 0.02; [CI] = 0.007, 0.09). The indirect positive effect of NutrInform Battery combined with scientific evidence (vs. Nutri-Score combined with scientific evidence) on adoption behaviour—through perceived congruence and then perceived credibility—was statistically significant (b = 0.36, [SE] = 0.02; [CI] = 0.006, 0.08). The results of the study show that, compared to "Nutri-Score combined with scientific evidence", "NutrInform Battery combined with scientific evidence" reaches higher level of perceived congruence, consequently, increases consumer perceived credibility of Front-of-Pack Nutritional Label, and thus finally increases consumers' attitude and adoption intention towards the labels.

Conclusion: Different types of Front-of-Pack Nutritional labels, namely directive and non-directive labels, are reported to be effective in attracting consumer attention and enabling consumers to identify healthier choices. However, extant research failed to uniquely identify a clear superiority between directive labels and non-directive labels regarding their effectiveness in instructing consumers to make correct food healthfulness rating (Ikonen et al, 2020, He et al, 2023; Pettigrew et al, 2022). The situation might be worsened when in presence of Conflicting Nutritional Information. It is then relevant to investigate how different typologies of FOPLs behaves in presence of other information derived from different alternative trusted sources in terms of customer attitude and behaviour formation.

In this introductory study, that draws on the congruity theory, we explored and benchmarked the effects when consumers are exposed to both FOPLs and trusted scientific information. Our results indicate that consumers find non-directive labels (i.e., NutrInform Battery), more congruent than compared directive labels (i.e., Nutri-Score) when combined with nutritional information from scientific reports.

Our findings suggest that non-directive labels (i.e., NutrInform Battery), compared with directive labels (i.e., Nutri-Score), contribute to a higher perceived congruence when relating to other nutritional sources. This increased perceived congruence in turn, increase the perceived credibility, attitude, and adoption intentions toward the labels.

Unlike the previous literature that perceives Front-of-Pack Nutritional labels as the only external entity to influence consumer food healthfulness judgment, we consider consumer Front-of-Pack Nutritional label use in a more actual context, where more nutritional knowledge channels (i.e., nutritional information from scientific reports; nutritional knowledge in consumer mind) are present.

The study should be considered as a first exploratory study in assessing the impact of nutritional information congruity from different sources on consumer decision making toward healthier dietary regime. The research is not exempt from limitations: the study explores two important FOPL and might be extended to the assessment of other labels; findings do not consider other

potential channel that can generate conflicting nutritional information or pre-existing knowledge available in consumers' mind. Future studies might explore the impact on covariates as age, income, and education, that has been identified as relevant in previous FOPL studies and extend the exploration to countries where Front-of-Pack Nutritional Labels have already been introduced. Further research might also cover the potential role of Institutional Endorsement, as well as other trusted endorsement, of FOPLs in steering consumers attitude toward Conflicting Nutritional Information.

Implications: Our research aims at contributing to the European Debate on Front-of-Pack Nutritional labels by examining the effectiveness of the labels in influencing consumer cognitive and behavioural intentions from the congruity scope in the broader setting of the availability of multiple information sources. Practically, policymakers need to consider the use of Front-of-Pack Nutritional Labels in a more comprehensive environment and be cautious about their endorsement as a strong heuristic cue for consumers to make perceptions towards the Front-of-pack Nutritional Labels.

Reference

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

d'Astous, A., Colbert, F., & Fournier, M. (2007). An experimental investigation of the use of brand extension and co-branding strategies in the arts. *Journal of Services Marketing*, *21*(4), 231-240.

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).

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

Gregory, A. (2022) Obesity 'epidemic' leading to 1.2m deaths a year in Europe, says who, The Guardian. Guardian News and Media. Available at: https://www.theguardian.com/society/2022/may/03/obesity-epidemic-proportions-across-europe-world-health-organization-who (Accessed: January 24, 2023).

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

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

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.

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.

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.

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

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), Vol. 26 No. 2, pp. 77-113.

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.

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.

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.

Ngo, L., Lee, J., Rutherford, S., & Phung, H. (2023). 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.

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

Pettigrew, S., Jongenelis, M. I., Jones, A., Hercberg, S., & Julia, C. (2023). An 18-country analysis of the effectiveness of five front-of-pack nutrition labels. *Food Quality and Preference*, *104*, 104691.

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

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

Till, B. D., Stanley, S. M., & Priluck, R. (2008). Classical conditioning and celebrity endorsers: An examination of belongingness and resistance to extinction. Psychology & Marketing, 25(2), 179-196.

von Mettenheim, W., & Wiedmann, K. P. (2021). The complex triad of congruence issues in influencer marketing. Journal of Consumer Behaviour, 20(5), 1277-1296.

WHO, 2022. WHO European Regional Obesity Report 2022. [online] Who.int. Available at: <https://www.who.int/europe/publications/i/item/9789289057738> [Accessed 17 July 2023].

Zhu, X., Teng, L., Foti, L., & Yuan, Y. (2019). Using self-congruence theory to explain the interaction effects of brand type and celebrity type on consumer attitude formation. *Journal of Business Research*, *103*, 301-309.