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The effects of combining front-of-pack nutritional labels on consumers' subjective understanding, trust, and preferences

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Abstract

The decision to adopt a unique mandatory front-of-pack nutritional label (FOPL) has currently been delayed by the European Union (EU) as contrasting evidence exists on which one might consistently better encourage customers toward healthier diets. In this context, little attention has been dedicated to investigating the potential effects of having more than one front-of-pack nutritional label on food products. This study aims to verify if a combination of front-of-pack nutritional labels (i.e., a "bundle") performs better for consumer understanding, trust, and preferences (such as liking) toward the label by helping consumers make healthier and more informed food choices. With this in mind, the study focused on three front-of-pack nutritional labels developed by public institutions that are central to the research and the recent EU policy-making debate. In three controlled experiments, building upon the "*directiveness*" front-of-pack nutritional label schemes, we find that the combination of a nondirective (i.e., NutrInform Battery) and a directive (i.e., Keyhole) label outperforms both the combination of two directive labels (i.e., Nutri-Score and Keyhole) and a single-directive front-of-pack nutritional label (i.e., Keyhole) on subjective understanding, trust in the label and liking. Results cast light on the bundling of front-of-pack nutritional labels as a potentially different approach that might be further analyzed by researchers and provide a substantive contribution to managers and policy-makers in their decision toward a unified front-of-pack nutritional label within the European Community.

KEYWORDS

European Union, front-of-pack nutritional labels, Keyhole, liking, NutrInform Battery, Nutri-score, preferences, subjective understanding, trust

1 | INTRODUCTION

Front-of-pack nutritional labels are labels, symbols, or tags placed on the front of food product packaging that provide information on the energy value and nutritional content of food products (van der Bend & Lissner, 2019). Those labels have been identified by the World Health Organization (WHO) as (i) part of the set of actions to contrast the rise in the number of obese and overweight people (WHO, 2020), and (ii) an important tool to promote healthier diets, effectively decreasing the information asymmetry between consumers and food

TABLE 1 European taxonomy on front-of-pack nutritional labels.

Nondirective	Nondirective schemes include information elements only, such as nutrient names, grams, and percentages (e.g., NutrInform Battery, Guideline Daily Amounts, and Reference Intakes).
Semidirective	Semidirective schemes include labels where not only is the nutritional information provided, but where this is complemented by evaluative elements such as specific colors according to nutrient levels (e.g., the Multiple Traffic Lights and the UK MTL label). Specifically, the label provides numerical information on the content of four nutrients (fat, saturates, sugars, salt) and on energy value, as well as on how much this might be as a percentage of the daily reference intake. Colors are used to classify those nutrients as "low (green), "medium" (amber), or "high" (red).
Directive	Directive schemes may be distinguished into:
	- *Endorsement schemes*, which are those including the least amount of information, often aggregated in one symbol or icon (e.g., Keyhole logo, Heart/Health logos, and Healthy Choice). The label provides 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.
	- *Graded Indicator schemes*, which are those that provide 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 to all food products (e.g., Nutri-Score).

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

producers (Verbeke, 2005) to make more informed (Hodgkins et al., 2012) and healthier food choices (e.g., Goodman et al., 2018; Packer et al., 2021).

Over time, European countries' governmental bodies developed distinct typologies of front-of-pack nutritional labels (e.g., van der Bend & Lissner, 2019); thus, multiple systems with different underlining approaches and impacts (Mazzù et al., 2022a) co-exist today in the European Union (EU).

The presence of diverse types of front-of-pack nutritional labels in the marketplace might, however, create problems such as consumer confusion and misunderstanding (e.g., Draper et al., 2013; Wąsowicz et al., 2015). In this context, the 2020 "*Farm-to-Fork*" EU strategy, affirmed the need to have a single mandatory front-of-pack nutritional label for EU customers. The final decision has currently been delayed as contrasting evidence exists (e.g., Fialon et al., 2022; Mazzù et al., 2021) on which front-of-pack nutritional label might better support all relevant dimensions of EU consumers toward healthier and more informed food choices.

While extant research concentrated its effort on assessing and benchmarking the relative effectiveness of different systems (e.g., Egnell et al., 2018a; Mazzù et al., 2022a, 20022b), limited attention has been devoted to understanding if combining existing relevant front-of-pack nutritional labels might strengthen the effectiveness of nutritional labels during specific steps of food customers' decision-making.

To explore such matter, this research takes the perspective of the Label's "*degree of directiveness,*" utilizing a recent EU taxonomy[1] (see Table 1) to form alternative combinations (i.e., bundle) of front-of-pack nutritional labels, and build upon the suggestion provided by Hodgkins et al. (2012) on the necessity to explore systems that combine directive and nondirective components.

[1]https://ec.europa.eu/food/system/files/2020-05/labelling-nutrition_fop-report-2020-207_en.pdf

Specifically, the work confronts the effects of front-of-pack nutritional labels' combination on specific steps of food decision-making, as subjective understanding, trust, and preferences, deemed relevant by previous research (Grunert & Wills, 2007; Mazzù et al., 2022b) to drive healthier and more informed food choices (Hawley et al., 2013; Kanter et al., 2018), and overlooked in the perspective of bundling of labels.

The research aims then at providing a substantive contribution to the current debate in the EU by demonstrating how a proper combination of front-of-pack nutritional labels might be beneficial to end consumers. Our results show that a specific combination of front-of-pack nutritional labels schemes has meaningful and measurable effects in enhancing consumer understanding, and these differences concurrently alter trust, which in turn alters consumer preference (such as front-of-pack nutritional label liking).

The remaining part of the paper is structured as follows. First, we review prior research on consumer reactions to front-of-pack nutritional labels and decision-making and derive the hypotheses. We then present the results of the research. Finally, we discuss the main implications, pointing out the limitations of our work and potential new avenues of future research.

2 | CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

2.1 | Theoretical background

Front-of-pack nutritional label influences consumer behavior in several ways such as in terms of consumers' attention (e.g., Cowburn & Stockley, 2005), preferences and acceptance (e.g., Talati et al., 2017), and understanding (e.g., Savoie et al., 2013). These studies have highlighted how consumers may use front-of-pack nutritional labels as a support tool in their evaluation processes. Specifically, compared with the Nutrition Facts Panel—which provides, generally

on the back of the packaging, comprehensive information about the nutritional content of the food, such as the amount of fat, sugar, sodium, and fiber—the front-of-pack nutritional label utilizes numbers, symbols and rating systems to summarize the key nutritional aspects of food products in an easily digestible format. The primary goal of the front-of-pack nutritional label, in fact, is to simplify the process of accessing and understanding nutritional information for consumers, with the aim of promoting healthier food choices (Ikonen et al., 2020; Institute of Medicine, 2010). In this direction, synthesizing the nutritional information of a foodstuff, the front-of-pack nutritional labels could be considered as marketing tools that reduce one's effort in decision-making situations and are especially relevant for individuals who are not willing to engage in more extensive forms of processing. The next sections review existing research on front-of-pack nutritional labels, by considering the directiveness level of front-of-pack nutritional labels. These studies highlighted that one of the main criticisms deals with the lack of a standardized format by suggesting considering a combination of front-of-pack nutritional labels Hodgins et al. (2012). The following review provides the theoretical foundations for the proposed conceptual framework, which includes the research hypotheses.

2.1.1 | Front-of-pack nutritional labels research

According to the EU taxonomy (2020), the front-of-pack nutritional labels can be related to the level of *"directiveness"* of the scheme, in brief, to what extent the label provides a direct indication of whether the product is nutritionally good for the consumer or not (Hodgkins et al., 2012). In this respect, front-of-pack nutritional labels might be distinguished between nondirective front-of-pack nutritional labels, which only provide factual nutritional information, semi-directive front-of-pack nutritional labels, which combine information with understandable visuals, and directive front-of-pack nutritional labels, which summarize the "healthiness" of a product without providing any nutritional data (van der Bend & Lissner, 2019). Features such as color coding that are easy to process quickly could be classified as a directive, while numerical nutritional details that require more deliberation could be classified as nondirective (Hodgins et al., 2012).

Prior research evidenced that the purpose of front-of-pack nutritional labels is to facilitate consumer understanding of food nutrition information with the aim of making more aware and healthier food choices (Goodman et al., 2018; Ikonen et al., 2020; Packer et al., 2021). According to Grunert and Wills (2007), the consumers' subjective understanding relates to the meanings that consumers derive from the perceived label information and the extent to which consumers believe they have understood the communication in a relevant way. As stated by previous research (e.g., Egnell et al., 2019; Grunert & Wills, 2007; Mazzù et al., 2021; Möser et al., 2010), consumer subjective understanding is a multidimensional construct composed of the following sub-dimensions: comprehensibility (i.e., the ability to facilitate interpretation), help to shop (i.e., the ability to make the food choice easier), and complexity reduction (i.e., the ability to simplify learning). The present literature on the effects of front-of-pack nutritional labels on consumer understanding has provided controversial evidence by suggesting that not all front-of-pack nutritional labels are the same in how the consumer understand the message. Emrich et al. (2014), by separately testing two directive labels and two nondirective labels, provided evidence that the nondirective front-of-pack nutritional labels system performs better in terms of consumer understanding. Mazzù et al. (2021), by comparing nondirective front-of-pack nutritional labels (i.e., NutrInform Battery) and directive front-of-pack nutritional labels (i.e., Nutri-Score), provide evidence that the nondirective front-of-pack nutritional labels system improves consumer subjective understanding. Similar evidence has been provided by Graça et al. (2019), Rincon Gallardo Patino et al. (2019), and Sulong et al. (2019) by showing that nondirective front-of-pack nutritional labels were easier to understand, especially by consumers in higher socioeconomic conditions. In the same direction, other studies reported that directive front-of-pack nutritional labels (i.e., Warning Labels) had the worst score in terms of understanding (e.g., Ares et al., 2018; Singh et al., 2022; Vargas-Meza et al., 2019).

Moreover, Hodgins et al. (2012) suggested that a nondirective label can enhance trust for the consumer. Concerning the latter, consumers may feel that the source of information can be more trustworthy due to this extra detail, even if extra details are not used in decision-making. In contrast, Egnell et al. (2020) have shown that the directive front-of-pack nutritional labels (i.e., Nutri-Score) were effective in terms of consumer understanding (compared to nondirective labels—Reference Intakes). Other studies suggested that directive front-of-pack nutritional labels (e.g., graded indicators) leads to better consumer understanding (Pettigrew et al., 2020, 2021; Pongutta et al., 2019; De Temmerman et al., 2021). Overall, prior studies (e.g., Grunert & Wills, 2007; Hodgkins et al., 2012) reported that some consumers prefer directive labels because they lead to a quick decision, while other consumers may react negatively to being told something is "healthful" in the absence of detailed nutritional information. These studies, then, suggested that an ideal front-of-pack nutritional label would include both directive (e.g., colors) which may facilitate use, and nondirective details which may enhance trust while satisfying the consumer need to believe they are acting rationally. Therefore, while it has been previously theorized that a scheme combining both directive and nondirective elements can be an effective front-of-pack nutritional labels format (Hodgkins et al., 2012), this has never been empirically tested. Our research taps into this theoretical gap and studies what a combination of front-of-pack nutritional labels can do in terms of consumer understanding and trust.

2.1.2 | The information processing theory

In the context of the front-of-pack nutritional label, the "directiveness" of the label has a fundamental role in how information is processed by consumers (Muller & Ruffieux, 2020) and how attitudes

are formed (Grunert & Wills, 2007). Since front-of-pack nutritional label information is often complex for consumers to understand (e.g., Claro et al., 2012; Feunekes et al., 2008; Viswanathan et al., 2009), if the information transfer through front-of-pack nutritional label could be provided in a format that is accessible for consumers (i.e., understandable), the consumer attitude and subsequent willingness to use this front-of-pack nutritional label may increase. Therefore, a greater front-of-pack nutritional label subjective understanding could help consumers take more responsibility for their health by consciously choosing food products. As stated before, consumer understanding of front-of-pack nutritional labels could vary (e.g., Draper et al., 2013; Drichoutis et al., 2006; Mauri et al., 2021; Medina-Molina et al., 2021; Sundar et al., 2021) as not all front-of-pack nutritional labels are the same in how the consumer process the information and comprehends the message. Simpler label formats (e.g., directive labels, such as Health logos), can be more effective in helping consumers understand the information (e.g., Andrews et al., 2011; Roberto et al., 2012); nutrient-specific labels (e.g., nondirective labels, such as Reference Intake labels) can be time-consuming and difficult for consumers to interpret (e.g., Hawley et al., 2013; Hersey et al., 2013; Talati et al., 2017).

Building upon the information processing theory (Bettman, 1970), different forms of information can be combined to facilitate understanding. Since directive information is information that explicitly tells us what to do or how to do something, while nondirective information is information that provides context or background information without giving specific instructions, combining directive and nondirective information can facilitate understanding because it allows individuals to comprehend the meaning of the information, as well as the context in which it is relevant.

According to the information processing theory, an increase in the redundancy of information decreases the marginal value of gathering and processing information (e.g., Einhorn & Hogarth, 1981; Einhorn et al., 1979; Hagerty & Aaker, 1984; Katrichis, 1988). Especially in the context of food, multiple health and nutrition labels representing redundant or similar information could significantly decrease product preference (Barreiro-Hurle et al., 2010). Therefore, proper combinations of different labels are characterized by complementary information (Drexler et al., 2018).

2.1.3 | The cognitive-affective-conative (CAC) model

As evidenced by Ikonen et al. (2020), the purpose of front-of-pack nutritional labels is to facilitate consumer understanding of food nutrition information with the aim of making more aware and healthier food choices (Goodman et al., 2018; Packer et al., 2021). Consequently, a relevant stream of research focused attention on investigating the effectiveness of those labels (e.g., Kelly & Jewell, 2018) in terms of consumer attitudes. One of the most widely used models to explain consumer attitude is the CAC model (Bagozzi, 1992). According to the CAC model, the cognitive component of consumer attitudes involves individual knowledge and perception of objects expressed as beliefs and understanding. The affective component of the consumer attitude involves individual feelings and is conveyed as liking and trust of the object. The conative component of the consumer attitude describes consumer behavior intentions toward an object. As stated by Lin et al. (2022), in the CAC framework, cognition refers to the object understanding that directly affects actual outcomes such as trust in the object and, consequently, the liking of the object. Affect subsequently influences conation. Conation is the deliberate component of attitude that drives an individual to execute the behavior (i.e., cognition → affect → conation → behavior). For the purpose of this study, the front-of-pack nutritional label (as part of the typical food nutritional information) is regarded as the object. The CAC framework serves as an appropriate theoretical framework for our investigation by focusing on the first two components of the attitude (i.e., cognitive and affective), in which the *affective* aspects, such as trust and liking of the front-of-pack nutritional label, may be predicted by the cognitive aspect, that is the subjective understanding of the front-of-pack nutritional label.

2.2 | Research hypotheses

To conduct this research, we considered three front-of-pack nutritional labels developed in the EU by State Governments in different defining moments of front-of-pack nutritional label history development (Mazzù et al., 2022a), that are currently central to the scientific, academic, and policy-making debate. NutrInform Battery (nondirective), Nutri-Score (directive, graded indicator scheme), and Keyhole[2] (directive, endorsement scheme) each demonstrated to have specific strengths in some steps of consumer decision-making (e.g., Storcksdieck et al., 2020).

Considering the relative strengths of different schemes, as highlighted in extant research, we then developed different combinations (hereinafter also named "*bundles*") of the directive and nondirective front-of-pack nutritional labels. The first combination, named in this paper as "*double-directive bundle*," was composed of two directive labels, the Keyhole (the oldest and one of the simpler front-of-pack nutritional label in the EU) and the Nutri-Score (one of the most used front-of-pack nutritional label in the EU); the second combination, named in this paper as "*mixed bundle*," was made with one directive label (the Keyhole), and one nondirective label, the NutrInform Battery—one of the newest and most effective (Mazzù et al., 2021, 2022b) front-of-pack nutritional labels released in Europe.

Staring upon the CAC model, the cognitive component applicable to this study concerns consumer subjective understanding of the front-of-pack nutritional label. As evidenced by previous studies (e.g., Claro et al., 2012; Feunekes et al., 2008; Viswanathan et al., 2009),

[2]The choice of the Keyhole as a *single-directive* FOPL is justified by the fact that among the directive FOPL, it is: (a) the oldest; (b) developed by the public, such as Nutri-Score and NutrInform Battery; (c) with a high level of solidity and acceptance in major markets.

consumer understanding of front-of-pack nutritional label information is frequently challenging, However, if the front-of-pack nutritional label information is presented in an accessible and understandable format for consumers, likely, their attitudes towards this type of labeling and their willingness to use it will improve. Therefore, a greater front-of-pack nutritional label subjective understanding could help consumers take more responsibility for their health by consciously choosing food products. Building upon the extant literature, although previous studies suggested that the existence of combined claims on food packaging can result in an overabundance of information that makes choosing healthy food in a retail environment more difficult (e.g., Hieke et al., 2016), other studies provided evidence that when more information on the same topic (e.g., nutrition) is presented in two different ways (e.g., facts panel and claim), the complementary effect is stronger than in other scenarios (e.g., Barreiro-Hurle et al., 2010). According to a study by Sweller in 1994, it is less effective to simultaneously offer the same information in different formats because it will cost individuals more cognitive processing abilities and require additional working memory. As a result, removing redundant representations reduces an unnecessary load on working memory and facilitates learning which is the foundation of the subjective understanding that Grunert and Wills have described (2007).

Moreover, according to Biswas and Grau (2008), a high level of redundant information could inhibit consumer ability to choose. Concerning the interpretation of the information provided in a bundle, an increase in redundancy decreases the marginal value of gathering and processing information (Einhorn & Hogarth, 1981; Einhorn et al., 1979; Hagerty & Aaker, 1984). In the case of noncomplementary bundles where consumers do not receive complementary information (e.g., redundant information), they may underestimate the value of gathering and processing product information (Johnson & Katrichis, 1988). In this perspective, a double-directive front-of-pack nutritional label bundle could generate redundancy information, while a mixed front-of-pack nutritional label bundle may not generate redundancy of information but rather provide complementarity of information. Thus, the mixed front-of-pack nutritional label bundle, characterized by complementary and nonredundant information[3] improves consumer subjective understanding when compared to a double-directive front-of-pack nutritional label bundle characterized by noncomplementary and redundant information[4].

Based on this evidence, this research aims at enhancing previous findings on front-of-pack nutritional label subjective understanding by introducing an alternative front-of-pack nutritional label directiveness-based system. Formally:

H1: *Mixed Bundle of Front-of-Pack nutritional Labels systems increase the consumer's subjective understanding of the Front-of-Pack nutritional Labels compared either to single-directive or double-directive bundles.*

The affective component applicable to this study concerns, sequentially, consumer trust[5] and liking of the front-of-pack nutritional label. Goiana-da-Silva et al. (2021) have reported that the nondirective label (e.g., Reference Intakes label) was more trusted and more informative than the directive label (e.g., Nutri-Score). Additionally, the authors provided evidence that the nondirective label can provide the information needed by the consumer to choose the healthier food product when compared to other options. As highlighted by Mazzù et al. (2022b) by disclosing that directive labels (such as the Nutri-Score) are the result of algorithmic calculations, significant differences are generated in terms of trust and acceptance, recording negative performances when compared to nondirective (Nutrient-Specific) labels, such as the NutrInform Battery. As reported by Talati et al. (2019) through a cross-country investigation, and confirmed by Mazzù et al. (2022b), directive front-of-pack nutritional label (i.e., Nutri-Score) received the lowest mean scores for trust (compared to semi-directive and nondirective).

Moreover, trust in the front-of-pack nutritional label (due to a better understanding of the front-of-pack nutritional label system) is related to the liking of the front-of-pack nutritional label. Ducrot et al., (2015a, 2015b) have shown that nondirective front-of-pack nutritional label system (i.e., Guideline Daily Amounts) compared to semi-directive (i.e., Multiple Traffic Lights and 5-Color Nutrition Label) and directive (i.e., Health Check and Smart Pick) had the highest liking. Savoie et al. (2013) demonstrated that nondirective front-of-pack nutritional label (i.e., Guideline Daily Amounts) was considered more visually appealing and liked and tended to be preferred by most consumers. According to Ducrot et al. (2015a, 2015b), liking front-of-pack nutritional label seems to be an important aspect of acceptability. For example, consumers may like a label for the colors used, by preferring monochromatic labels over black and white labels (e.g., Feunekes et al., 2008; Grunert & Wills, 2007). Grunert and Wills (2007) identify the role of liking in directing consumer utilization of labeling. Specifically, in their literature review, the authors identify some factors that may cause dislike of front-of-pack nutritional label, such as poor legibility of the front-of-pack nutritional label, complicated terminology on front-of-pack nutritional label, inability to interpret simplified front-of-pack nutritional label formats, and consumers that feel intimidated and pressured by health logos to buy products. Additionally, the authors reported that consumers like simplified labels (e.g., directive labels) because they lead to a faster decision but want to know how the information below the label was derived. By testing the effects of two directive front-of-pack nutritional labels (Health Check logo and Smart Pick), and two nondirective ones (Multiple Traffic Light and Nutrition Facts-based) on consumer front-of-pack nutritional label liking, Emrich et al.

[3]That brings together a synthetic appreciation of the product's overall nutritional and detailed nutritional information on specific nutrients.

[4]With a double synthetic appreciation of the product's overall nutritional.

[5]Trust has been researched primarily as a mediator variable (e.g., Kim et al., 2021; Ye et al., 2020) and is considered an important influencing factor in the decision-making process in various contexts (Alhidari & Almeshal, 2017).

(2014) provided evidence that the two nondirective front-of-pack nutritional label systems reported higher evaluations on liking than the two directive front-of-pack nutritional label systems.

In this research, we propose that the cognitive component of the consumer attitude toward the front-of-pack nutritional label (i.e., the consumer's subjective understanding of the directiveness-based front-of-pack nutritional label system) affect, sequentially, the actual components (i.e., trust in the front-of-pack nutritional labels and liking of the front-of-pack nutritional labels) of the consumer attitude toward the front-of-pack nutritional label. Specifically, a more understandable front-of-pack nutritional label (i.e., a format with a combination of complementary and not redundant information) enhances consumer trust in the label which, in turn, enhances consumer liking of front-of-pack nutritional label. Formally:

H2: *The increase in consumer subjective understanding generated by the mixed bundle, lead to a greater consumer trust in the Front-of-Pack nutritional Labels, when compared wither to double-directive or single-directive label, which, in turn, serially mediate consumer liking of the Front-of-Pack nutritional Labels.*

3 | HYPOTHESIS TESTING

3.1 | Study 1—The effects of the front-of-pack nutritional label system on consumer subjective understanding

3.1.1 | Design, participants, and procedure

A total of 272 European primary grocery shoppers from France and Italy aged from 25 to 64 (M_{age} = 27.46, *SD* = 7.16, 49.6% female) were recruited from Prolific, an online panel service provider.

In a between-subject design, participants were assigned at random to one of three conditions: single-directive front-of-pack nutritional label, double-directive bundle front-of-pack nutritional label, and mixed bundle front-of-pack nutritional label. The design then implied three main intervention groups that were tested, where each respondent in the sample was exposed to only one of the three different front-of-pack nutritional label formats. One group of respondents was exposed to the single-directive front-of-pack nutritional label (Keyhole Logo), a second group to the double-directive bundle of front-of-pack nutritional label (Keyhole Logo and Nutri-Score), and the last group to the mixed bundle front-of-pack nutritional label (Keyhole Logo and NutrInform Battery). The single-directive front-of-pack nutritional label group was formed of 90 respondents, the double-directive bundle front-of-pack nutritional label group was made up of 92 respondents, and the mixed bundle front-of-pack nutritional label group of 90 respondents. All the participants were rewarded at the end of the questionnaire.

The stimuli were designed with the aid of industry experts. Front-of-pack nutritional labels were attached to a pack of unbranded breakfast cereals (see Figure A1) to avoid uncontrolled effects and biases deriving from associations with the brand involved as in another research (Egnell et al., 2018b). We involved breakfast cereals in our study as a common product used in different countries having a relevant penetration in each tested market. On average the survey lasted 6 min per participant. Both stimuli and the questionnaire were adapted to local languages by professional translators. In the first stage, participants were exposed to one of the three manipulations by answering questions related to consumer subjective understanding of the front-of-pack nutritional label by using the Möser et al. (2010) scale. Specifically, to capture the three subjective understanding sub-dimensions of comprehension, help-to-shop, and complexity reduction, we used a set of items from prevalidated and reliable scales. Specifically, for comprehension: "I feel well informed by the food label," "This label is believable and trustworthy," and "This label is easy to interpret" (α = 0.803). For help to shop: "This label helps me to understand the product composition," "This label helps me to understand different nutritional values," and "This label makes it easier to choose food" (α = 0.839). Finally, for complexity reduction: "The food label is rather extensive," and "Using this food label to choose foods is better than just relying on my own knowledge about what is in them" (α = 0.896). All items were measured on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Confirmatory factor analysis highlighted that all items load towards one single factor ($\lambda > 0.7$; see Tables A1 and A2)—the construct of subjective understanding. To test the differences between the three levels of the manipulation we leveraged an analysis of variance (ANOVA) by using consumer subjective understanding as a dependent variable. We coded the single-directive front-of-pack nutritional label as 0, the double-directive bundle as 1, and the mixed bundle as 2 in a categorical variable.

3.1.2 | Results and discussion

As shown in Figure 1, the consumer subjective understanding significantly differs across the three levels of the categorical variable ($F_{(1,271)}$ = 199.649, $p < 0.001$). The subjective understanding was significantly higher for the mixed bundle ($M_{MixedBundle}$ = 4.86, *SD* = 1.19). As for the double-directive bundle ($M_{Double\text{-}directiveBundle}$ = 3.79, *SD* = 1.33), the respondents reported a lower degree of subjective understanding. Moreover, those who were exposed only to the single-directive front-of-pack nutritional label scored a lower mean than the other bundles ($M_{Single\text{-}directive}$ = 2.41, *SD* = 1.17).

Moreover, a Bonferroni post hoc comparison revealed a significant difference among the three levels of the categorical variable in terms of consumer subjective understanding. The subjective understanding of the double-directive bundle of front-of-pack nutritional label significantly differs from the single-directive front-of-pack nutritional label (M_{Diff} = 1.38, $p < 0.001$). Similarly, the difference between the mixed bundle and the single-directive label was significant (M_{Diff} = 2.45, $p < 0.001$) as well as the differential between the mixed bundle and the double-directive label (M_{Diff} = 1.06, $p < 0.001$), confirming the superiority of the combination

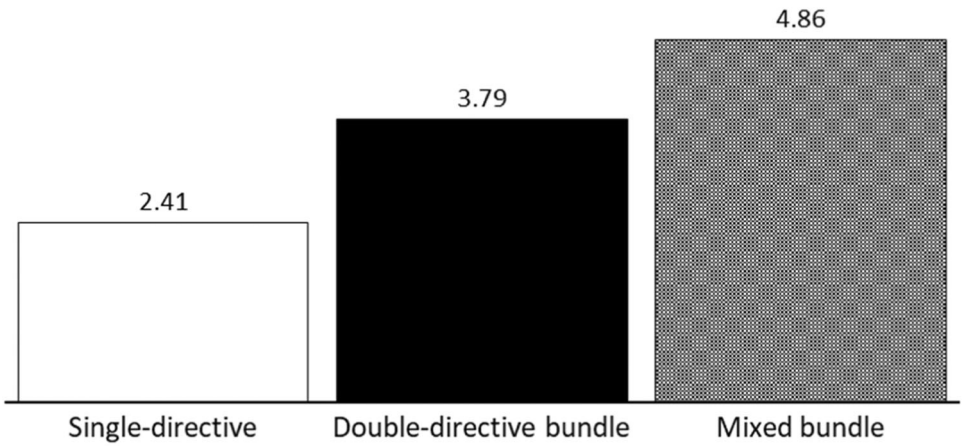

FIGURE 1 The effect of the front-of-pack nutritional label system on consumer subjective understanding.

between a directive and a nondirective label (i.e., mixed bundle) in terms of consumer subjective understanding.

Overall, when consumers are exposed to different front-of-pack nutritional label systems, they experience different degrees of subjective understanding, suggesting that not all are the same in the way in which the consumer comprehends the message. Specifically, consumers exposed to the mixed bundle feel more informed, that the two labels together are more believable and trustworthy, easy to interpret, make it easier to choose the right food, and help to understand and recognize the different nutritional values. The results show a higher degree of informativeness of such a bundle. However, the two remaining labels are less informative and lead to lower degrees of subjective understanding.

The highlights of this study are the effects of different front-of-pack nutritional label compositions on subjective understanding in a setting with real products (i.e., breakfast cereals). The next study, in a between-subjects design, observes whether the serial mediation effects of subjective understanding and trust hold for liking.

3.2 | Study 2—The effect of the front-of-pack label system on consumer label liking: Testing the serial mediation of consumer subjective understanding and trust

3.2.1 | Design, participants, and procedure

Study 2 investigates the impact of the front-of-pack nutritional label system on consumer label liking and observes the serial mediation effects of subjective understanding and trust on the variable. A total of 517 European participants were recruited from Prolific in France and Italy and were compensated for their participation. The participants were aged between 25 and 64 years old (M_{age} = 28.76, SD = 6.11, 45.7% female); the experimental design and stimuli were the same as in Study 1 (see Figure A1).

Participants answered questions related to subjective understanding, and its sub-dimensions, as per Study 1[6]. In addition, three items, derived from a prevalidated scale, were used to assess liking the label by asking participants: "How do you evaluate the label?" and they expressed opinions by answering the following items on a 7-point bipolar scale "bad/good," "unfavourable/favourable," and "negative/positive" (Allen & Janiszewski, 1989). The trust was measured with a prevalidated 7-point Likert scale with the items "The information provided by this label inspires confidence," "The information provided by this label is reliable and trustworthy" (Mazzù et al., 2022b).

As shown in Figure 2, to test the hypothesized effects we ran a serial mediation analysis (Model 6, PROCESS; Hayes & Preacher, 2016). We codified the three stimuli in a categorical variable with single-directive as 0, double-directive bundle as 1, and mixed bundle as 2. Also, we tested the mean differences across the three levels through a one-way ANOVA and performed the contrasts.

3.2.2 | Results and discussion

Results of a one-way ANOVA revealed that the front-of-pack nutritional label system had significant differences in terms of subjective understanding ($F_{(1,516)}$ = 140.574; p < 0.001). Subsequently, we performed the contrasts which provided evidence that the single-directive label has a lower degree of subjective understanding when compared to the double-directive bundle (M_{diff} = −1.05; p < 0.001) and mixed bundle (M_{diff} = −2.25; p < 0.001). Additionally, findings showed that the mixed bundle significantly differs from the double-directive (M_{diff} = +1.19; p < 0.001) in terms of subjective understanding. These results further support H_1.

Similarly, we observed that trust significantly differs across the levels of the dependent variable ($F_{(1,516)}$ = 74.434; p < 0.001). The

[6]As per study 1, the CFA confirmed the appropriateness of a single construct.

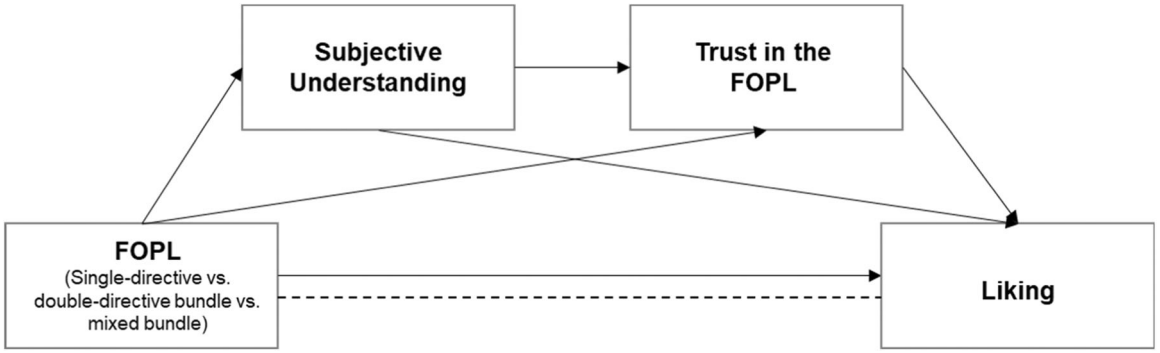

FIGURE 2 The serial mediation model hypothesized.

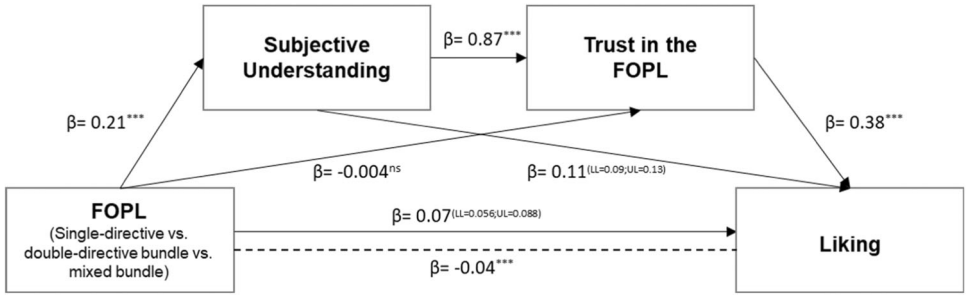

FIGURE 3 The results of the serial mediation model.

trust of the double-directive bundle of front-of-pack nutritional label significantly differs from the single-directive front-of-pack nutritional label (M_{Diff} = +1.061, p < 0.001). Additionally, the difference between the mixed bundle and the single-directive label was significant (M_{Diff} = +1.827, p < 0.001) as well as the difference between the mixed bundle and the double-directive label (M_{Diff} = +0.766, p < 0.001), confirming the superiority of the combination between a directive and a nondirective label (i.e., mixed bundle) in terms of consumer subjective understanding.

Last, the one-way ANOVA proved that the front-of-pack nutritional label system significantly differs in terms of liking ($F_{(1,516)}$ = 58.261; p < 0.001). Specifically, the performed contrasts revealed that the double-directive bundle significantly differs from the single-directive front-of-pack nutritional label (M_{Diff} = +0.940, p < 0.001). Similarly, the liking significantly differed between the mixed bundle and the single-directive label (M_{Diff} = +1.597, p < 0.001) and it negatively differs between the mixed bundle and the double-directive label, indicating a higher degree of liking for the double-directive label (M_{Diff} = −0.657, p < 0.001).

The results of the serial mediation analysis showed that the manipulation (front-of-pack nutritional label system) has a significant direct effect on label liking (β = −0.04; p < 0.001). Moreover, the manipulation significantly affects the first mediator, subjective understanding (β = 0.21; p < 0.001) and trust (β = 0.19; p > 0.05). In turn, subjective understanding exerts a significant effect on trust (β = 0.87; p < 0.001). Finally, the second mediator, trust, significantly affects liking (β = 0.38; p < 0.001). The indirect effect of the front-of-pack nutritional label system on liking through consumer subjective understanding is significant (β = 0.11; LL = 0.0989, UL = 0.1394) while the effect through the second mediator, trust, is not significant (β = −0.004; LL = −0.012, UL = 0.003). In contrast, the indirect effect of front-of-pack nutritional label on liking through subjective understanding and trust is significant (β = 0.072; LL = 0.056, UL = 0.088). It indicates that the effect of the manipulation is serially mediated by the two mediators (see Figure 3). The negative direct effect suggests that the front-of-pack nutritional label liking decreases with the double-directive and mixed bundle. However, the second path, serially mediated by subjective understanding and trust, reports an opposite and positive effect of the manipulation on front-of-pack nutritional label liking. Thus, the positive indirect effect signals a better liking for the mixed bundle, driven by greater understanding and trust.

The results show that consumers form their liking of the label after understanding and trusting it. Such sequences of effects appear to be strengthened by the absence of direct effects of front-of-pack nutritional label manipulation towards liking. Indeed, serial mediation explains the central role of trust which is an outcome of better guidance that serially influences liking the front-of-pack nutritional label. However, before trusting the label, consumers need to develop a subjective understanding of it. Hence, a mixed bundle of front-of-pack nutritional label by offering complementary information increases the informativeness of the front-of-pack nutritional label and in turn the subjective understanding. Consequently, consumers form higher degrees of trust in the labels and, as result, alter front-of-pack nutritional label liking.

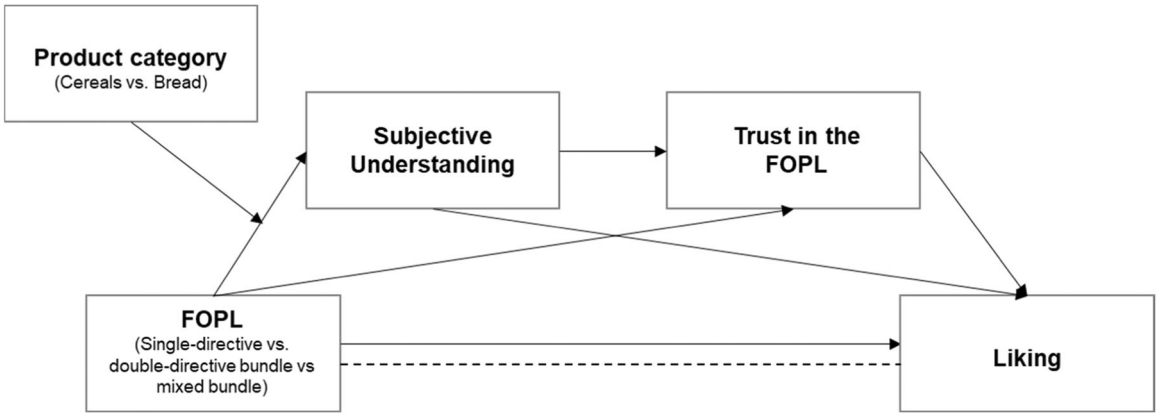

FIGURE 4 The moderated serial mediation hypothesized.

When consumers are exposed to the mixed bundle of front-of-pack nutritional label they have higher levels of subjective understanding, which in turn affects trust and liking. However, after considering the direction of the effect, the single-directive and double-directive labels report lower levels of subjective understanding, indicating that the two manipulations are less informative for consumers than the mixed bundle.

This study contributes to the extant research by introducing a novel path to front-of-pack nutritional label liking formation in a setting with a real product. The next study aims to further support the effects of front-of-pack nutritional label based on the investigation of different product categories. Specifically, we expect no moderation effect of product category on the serial mediation model analyzed in the present study, as the effects of front-of-pack nutritional label systems on subjective understanding, trust, and liking should be nondependent from product categories.

3.3 | Study 3—Test the generalizability of the effects of the front-of-pack label system on consumer label liking

3.3.1 | Design, participants, and procedure

The third study further investigates the serial mediation of subjective understanding and trust in the effect of our manipulation to gather further support for H_1 and H_2 and test the generalizability of the effects observed in Study 2 by adding another product category (i.e., bread). The 1028 European participants were recruited online on Prolific from France and Italy. The average age of the participants was 28.76 years with a standard deviation of 7.17, and 47.6% of them were female.

Study 3 was a 3 (front-of-pack nutritional label system: single-directive label, double-directive bundle, and mixed-bundle) × 2 (product category: breakfast cereals *vs.* bread) between-subjects experimental design (see Figure A2). Participants responded to questions related to subjective understanding[7], trust and liking as per Study 2.

To test the hypothesized effects, a serial mediation analysis with the type of product as a moderator (Model 83 PROCESS; Hayes & Preacher, 2016) was conducted. The three front-of-pack nutritional labels were coded into a categorical variable with single-directive as 0, double-directive bundle as 1, and mixed bundle as 2, and the product category in a two-level categorical variable with breakfast cereals as 0 and bread as 1 (see Figure 4).

3.3.2 | Results and discussion

Findings of the one-way ANOVA confirmed that subjective understanding ($F_{(1,1027)} = 259.571$; $p < 0.001$), is positively affected by the front-of-pack nutritional label directiveness-based system (by again supporting the H_1). Specifically, the contrasts confirmed a positive difference between mixed bundle and, respectively, single-directive front-of-pack nutritional label ($M_{diff} = +2.23$; $p < 0.001$), and double-directive bundle ($M_{diff} = +1.14$; $p < 0.001$); additionally, a positive difference between double-directive bundle and single-directive front-of-pack nutritional label ($M_{diff} = +1.08$; $p < 0.001$) was reported.

As concerns trust, the one-way ANOVA revealed that it significantly varies across the levels of the independent variable ($F_{(1,1027)} = 158.369$; $p < 0.001$). The contrasts reported a significant difference between single-directive front-of-pack nutritional label and, respectively, mixed bundle ($M_{diff} = -1.952$; $p < 0.001$), and double-directive bundle ($M_{diff} = -1.168$; $p < 0.001$). Also, the mixed bundle positively differs from the double-directive bundle ($M_{diff} = -0.784$; $p < 0.001$).

Last, the liking significantly differed across the three levels of the independent variable ($F_{(1,1027)} = 119.426$; $p < 0.001$). Specifically, the performed contrasts revealed that the double-directive bundle significantly differs from the single-directive front-of-pack nutritional

[7]As per study 1 and 2, the CFA confirmed the appropriateness of a single construct.

label (M_{Diff} = +1.004, $p < 0.001$). Similarly, the liking significantly differs between the mixed bundle and the single-directive label (M_{Diff} = + 1.655, $p < 0.001$) while the difference between the mixed bundle and the double-directive label is negative, indicating a higher degree of liking for the double-directive label (M_{Diff} = −0.651, $p < 0.001$).

The results of the moderated serial mediation have shown that the direct effect of the front-of-pack nutritional label system on liking was not significant ($p > 0.05$). However, the results suggest an alternative path toward the development of liking. The manipulation indeed significantly affects trust ($\beta = 0.56$; $p < 0.05$) and subjective understanding ($\beta = 0.93$; $p < 0.001$) which, in turn, affects trust ($\beta = 0.87$; $p < 0.001$). Finally, the analysis revealed that trust positively affects liking ($\beta = 0.41$; $p < 0.001$).

As for the indirect effects, the manipulation is significantly mediated by subjective understanding ($\beta = 0.57$; LL = 0.438, UL = 0.732) while trust does not mediate ($\beta = 0.05$; LL = −0.015, UL = 0.117). Conversely, the serial mediation through subjective understanding and trust is significant ($\beta = 0.35$; LL = 0.252, UL = 0.472). Since the direct effect is not significant, this study confirms the full mediation already observed in Study 2 (see Figure 5).

Moreover, the moderating effect of the product category on the subjective understanding was not significant ($\beta = 0.02$; LL = −0.082, UL = 0.125) indicating that the observed effects do not differ across the different product categories. In addition to the evidence discussed in Study 2, the results show that consumers form their liking of the label after understanding and trusting it, regardless of the product they are exposed to. Indeed, consumers exposed to the different categories do not report any significant difference. As a result, the mixed bundle of front-of-pack nutritional label relies on higher degrees of subjective understanding which leads to higher levels of trust and, as a result, front-of-pack nutritional label liking. Single-directive front-of-pack nutritional label and the double-directive bundle of front-of-pack nutritional label, in turn, are associated with lower levels of subjective understanding. Therefore, this study extends the evidence of Study 2 by excluding the potential moderating effects of the product category.

4 | GENERAL DISCUSSION AND CONCLUSION

This paper focuses on the use of the front-of-pack nutritional label system directiveness-based (single-directive *vs.* double-directive bundle *vs.* mixed bundle) in affecting the cognitive component (i.e., consumer subjective understanding), and the affective component (i.e., trust and liking) of consumer attitudes. In the current debate, originated by the "From-Farm-to-Fork" strategy on which front-of-pack nutritional label might better support EU consumers toward healthier and more informed food choices, policy-makers might rely on the valid alternative of considering a proper combination of front-of-pack nutritional labels as a new common standard for prepackaged foods. Through a series of three studies, this research initiates with the three most studied and most debated front-of-pack nutritional labels developed in recent years by local EU governments (NutrInform Battery, Nutri-Score, and Keyhole), to widen the traditional set of choices available to policy-makers.

Looking at the different levels of directiveness of front-of-pack nutritional label systems (i.e., single-directive, double-directive bundle, and mixed bundle) have been researched to offer initial evidence on which typology of front-of-pack nutritional label might be more beneficial to EU consumers. Specifically, our results demonstrated that the front-of-pack nutritional label directiveness-based scheme seems to be effective in the way consumers understand the message. This is important because consumer comprehension is linked to trust and ultimately, consumer preference (i.e., liking).

Understanding is a fundamental factor to be considered by institutional bodies in their decision toward a unified front-of-pack nutritional label at the EU level, as it includes factors such as helpfulness in food purchase, reduction in the complexity of the information provided by the label to the benefit of customers, and its ease of understanding. Thus, we demonstrated that different labeling schemes have meaningful and measurable effects on consumer understanding, and these differences concurrently alter trust in the label, which in turn alters consumer preferences such as front-of-pack nutritional label liking.

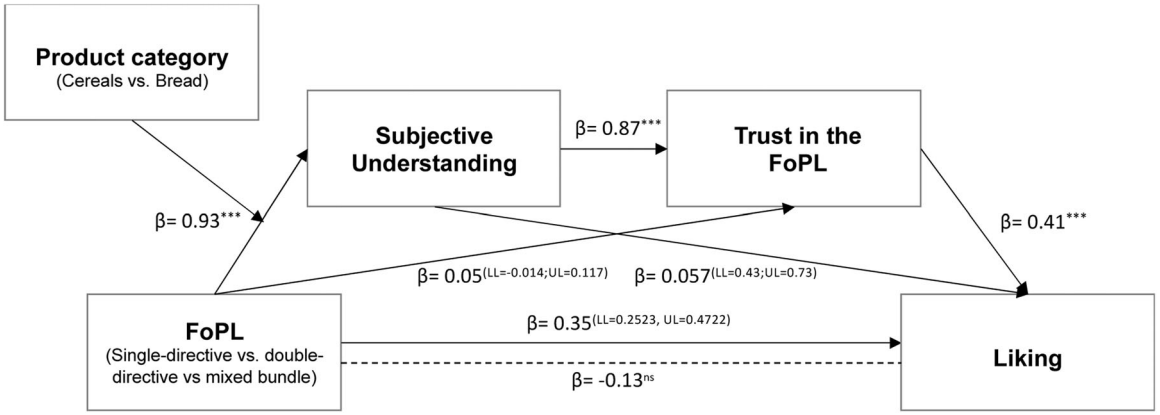

FIGURE 5 The results of the moderated serial mediation.

Specifically, the findings of Study 1 suggest that the subjective understanding of the mixed-directive front-of-pack nutritional label bundle is significantly better than both its double-directive alternative and the single-directive label. In line with the reference literature on the bundle (Barreiro-Hurle et al., 2010; Grunert & Wills, 2007; Sweller, 1994; Darveau & d'Astous, 2014) and the reference literature on front-of-pack nutritional labels (Barreiro-Hurle et al., 2010; Hieke et al., 2016), we reported that the combination of a directive and a nondirective front-of-pack nutritional label (in this paper identified as "mixed bundle") performed better than the combination of two directive front-of-pack nutritional labels ("double-directive bundle") in terms of consumer subjective understanding. This might imply that the combined presence of two labels belonging to two complementary systems strengthens the effects on subjective understanding for the benefit of customers, while the opposite happens in the case of front-of-pack nutritional labels of the same category (i.e., two directive labels). Furthermore, coherent with previous research (e.g., Einhorn & Hogarth, 1981; Einhorn et al., 1979; Hagerty & Aaker, 1984), we find that redundancy may decrease the marginal value of gathering and processing information, leading consumers toward more demanding and more superficial decision-making when exposed to redundant information, as in the case of the double-directive bundle.

Although previous research has provided support that directive and semi-directive labels increase the understanding of nutritional information more than nondirective labels (Feunekes et al., 2008; van der Bend & Lissner, 2019), our research has shown that the simultaneous presence of a directive and a nondirective label (i.e., mixed bundle) could improve consumer subjective understanding. A mixed bundle of front-of-pack nutritional label that includes both a directive label (allowing for a quicker decision) and a nondirective label (providing detailed nutritional information) may in fact be an ideal solution for consumers, as it combines understandable information with more in-depth detail. A decrease in front-of-pack nutritional label directiveness can result in a greater amount of information for the consumer to process (Hodgkins et al., 2012).

Moreover, evidence from Study 1 strengthens and widens the results of previous studies, that showed how the subjective understanding of a nondirective label, such as the NutrInform Battery, was better than that of a directive label, such as the Nutri-Score (Mazzù et al., 2021). While several studies confirmed stable results on EU consumers (Baccelloni et al., 2021; Mazzù et al., 2021) when single labels are compared, this study offers a perspective on the validity of these results, also when adding a second label, and that a proper combination of front-of-pack nutritional label might reinforce the benefits to end-customers.

In Study 2, we investigate our predictions that the directiveness-based front-of-pack nutritional label system (single-directive *vs*. double-directive bundle *vs*. mixed bundle), by influencing the consumer subjective understanding of the front-of-pack nutritional label, affects consumer trust in front-of-pack nutritional labels and, in turn, affects consumer preference, such as liking the front-of-pack nutritional label. The findings support subjective understanding and trust as serial underlying mechanisms for the relationship between directiveness-based front-of-pack nutritional label system and front-of-pack nutritional label liking. The complementary message brought by a combination between a directive and a nondirective front-of-pack nutritional label is then seen as generating more favorable trust and liking versus the case where directive messages are reinforced by two labels. Directive and nondirective labels follow, in fact, two profoundly different and complementary approaches to how customers should be considered by governmental bodies, i.e., more guided (directive label) *versus* more empowered in their decisions (nondirective). Evidence suggests that the mixed-directive option, as a combination of labels that might both empower customers in their own individual food intake decisions, while guiding them with a synthetic nutritional quality symbol that can make it easier for everyone to make healthier choices while grocery shopping, might be an effective combination to the benefit of end-users.

Furthermore, coherent with the evidence of El-Abbadi et al. (2020), we reported that having labels that are understandable, accurate, and consistent can increase consumer trust and use of the system. In addition, following the results of Goiana-da-Silva et al. (2021), we registered that the mixed bundle was more trusted and more informative than the double-directive bundle. Additionally, the results provided evidence that the nondirective label can provide the information needed by the consumer to choose the healthier food product when compared to other options. This evidence is also valid across products with different degrees of healthiness. Indeed, in separate pretests, we observed that the Nutritional level of the front-of-pack nutritional label does not have a direct effect on Subjective Understanding, and its moderating effect of Nutritional Levels on the relationship between front-of-pack nutritional label and Subjective Understanding was also not significant. The same evidence has been also highlighted in two subsequent experimental studies aimed at comparing the bundles against the Nutri-Score alone (as a single-directive front-of-pack nutritional label) and the NutrInform Battery alone (as a single nondirective front-of-pack nutritional label). In the first case, by assuming the Nutri-Score as a baseline (i.e., single-directive front-of-pack nutritional label), we observed that the Nutri-Score reported a mean higher than the combination between Keyhole and Nutri-Score and lower that Keyhole and NutrInform Battery in terms of subjective understanding. In the second case, by assuming the NutrInform Battery as a baseline (i.e., single non-directive front-of-pack nutritional label), NutrInform Battery has a higher mean than the combination between Keyhole and Nutri-Score and lower that Keyhole and NutrInform Battery (Table A3). It further confirms the different degrees of informativeness provided by the NutrInform Battery and Nutri-Score and the different subjective understandings associated with them.

Finally, in Study 3, we further support H_1 and H_2 by demonstrating that the above results are not affected by the typology of food but remain stable in different situations.

With these findings, we hope to contribute additional insights to both policymakers on the use of front-of-pack nutritional label bundles leading to healthier consumption habits and more informed

food choices, as well as practitioners on the use of these labels to signal healthiness to consumers. Based on the assumption that obesity is one of the leading causes of illness in the world (WHO, 2020), and that close to two billion people worldwide are obese, causing long-term medical problems and reducing lifespan (Wharton et al., 2020). Providing evidence on how institutions can support consumers to make healthier and more informed choices is a critical task and goal. According to the findings of this research, using a combination of front-of-pack nutritional labels (i.e., front-of-pack nutritional label bundles) able to simultaneously, offer brief and detailed information, ensuring complementarity of information and avoiding redundancy of it (i.e., a mixed-directive bundle) leads to greater consumer subjective understanding of nutritional information, providing a comprehensive and exhaustive rather than a synthetic frame (i.e., compared to a single-directive) rather than a redundant frame (i.e., compared to a double-directive front-of-pack nutritional label). In turn, this could increase the likelihood of making a healthier consumer choice. The results of the right combination of front-of-pack nutritional label would also solve the potential theme that, in some cases, different directive labels, linked to the way the underlying algorithm of those labels are built, might provide different guidance to customers, thus directing them to potentially different dietary habits.

From a theoretical point of view, our research contributes to the stream of studies on the CAC model in the attitudinal research domain (Bagozzi, 1992), by exploring the effect of the front-of-pack nutritional label directiveness-based system (single-directive *vs*. double-directive bundle *vs*. mixed bundle) on consumer subjective understanding (i.e., the cognitive component), and trust and liking (i.e., affective components). This research shows a greater front-of-pack nutritional label bundle performance than single front-of-pack nutritional label by highlighting that an appropriate combination of front-of-pack nutritional labels (i.e., the mixed bundle) might improve consumer subjective understanding. This evidence is relevant since comprehension is linked to consumer trust and ultimately, consumer preference. Additionally, the evidence from this research supports previous literature on the concepts of complementarity and redundancy information. Precisely, our findings highlight that bundles designed to offer complementary and not redundant information have better performance in terms of understanding, trust, and label liking. Furthermore, familiarity with the front-of-pack nutritional label had no moderating effect on the results, confirming the results of extant research on cross-country comparison of front-of-pack nutritional label performances (Egnell et al., 2018b; Mazzù et al., 2021), where while front-of-pack effectiveness might be assumed context-dependent with consumers tending to prefer already implemented front-of-pack which are familiar to them (e.g., Neal et al., 2017 on Health Star Rating in Australia; Crosetto et al., 2016 for NutriScore), the influence of familiarity is actually larger on self-reported evaluations than on actual choices (Van Herpen et al., 2012).

Moreover, this research provides insights to policymakers and firms. In response to the need to reach an agreement among EU members on the front-of-pack nutritional label system, governmental bodies interested in helping consumers make better and healthier food choices could regulate the use of a combination of front-of-pack nutritional label as opposed to the single front-of-pack nutritional label. Considering the better performance of the mixed bundle (*vs*. double-directive), in terms of subjective understanding, trust, and preference, this combination might be assessed more as it provides more information, which might help shopping and reduces the complexity of processing nutritional information.

This study is also a support to policy-makers, when faced with the risk of having to select directive labels that might, at the current status, provide contrasting directions toward healthier and more informed food choices, due to their underlying algorithm calculations.

Our findings also have implications for firms, given the fact that the combination of different front-of-pack nutritional labels should be carefully considered in packaging design since it represents an environmental first, providing decision-making guidance in supermarkets (Barreiro-Hurle et al., 2008, 2010; Hieke et al., 2016). There is an increasing segment of the population who aims at a healthier way of living, crowning that by making healthier food choices. For this segment, the healthiness of the food items must be clearly communicated, allowing them to make better choices. To ensure this, our findings suggest that marketers would more effectively address the needs of this segment by using mixed front-of-pack nutritional label bundles rather than a double-directive bundle or a single label. For practitioners interested in implementing our findings, we suggest a specific design for the bundle: NutrInform Battery plus Keyhole. In this way firms may better enhance their product composition and highlight their efforts of making the product as healthy as possible.

As with any research, this is not without limitations, which can stimulate further investigation into the effects of front-of-pack nutritional label bundles. First, this study has only involved European consumers, therefore future research could be expanded to other nations within the EU and in the wider world (Canada, the United States, China, etc.). Second, we have taken into consideration three front-of-pack nutritional labels and combined them in three different combinations. Further research could seek to explore more front-of-pack nutritional labels and more combinations in the experiment to better understand the effect of front-of-pack nutritional label bundles. Third, covariates like gender, age and occupation have not been considered in this research. Future research could seek to investigate whether these variables have an impact on the consumer decision-making process regarding front-of-pack nutritional label bundles. Additionally, this research considers the CAC model by focusing on the cognitive and affective components. Future research could also consider the conative component of the model by, for example, investigating actual purchase behavior. As a large part of the extant literature is largely laboratory-based, and a very limited number of studies have investigated the impact in a grocery setting (e.g., Dubois et al., 2021; Maesen et al., 2022), in-store experiments could be run—in partnership with retailers—to explore the effects of a front-of-pack nutritional label directiveness-based system on consumer behavior and whether the labels are effective in changing

actual consumer decisions. Additionally, future research could empirically test the underlying mechanism of the relationship between combinations of front-of-pack nutritional label directiveness-based systems and consumer understanding. In particular, as imagined in the development of our hypotheses, a better understanding of the label could be due to the complementarity of information (*vs.* redundancy) in the case of mixed bundles (*vs.* the double-directive bundles). Finally, considering the recent evidence in color research (e.g., Chung & Saini, 2022; Lee & Yi, 2019; Marozzo et al., 2020), future research could also consider color as a boundary condition in the relationships tested in the present work.

CONFLICTS OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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APPENDIX A

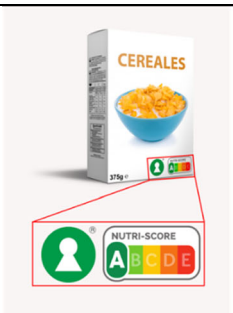
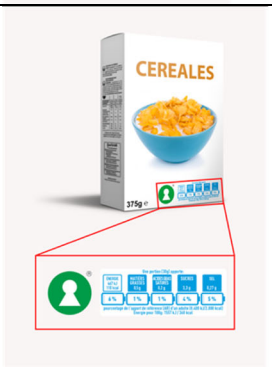
FOPL system	
Single-directive FOPL	
Double-directive bundle FOPLs	
Mixed bundle FOPLs	

FIGURE A1 Mock-up products for Studies 1 and 2 (example for the French market).

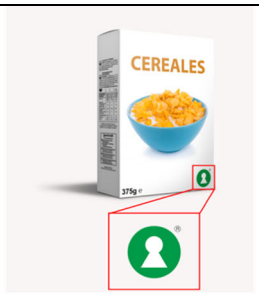
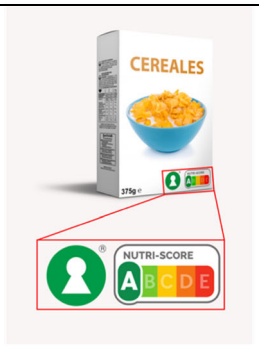
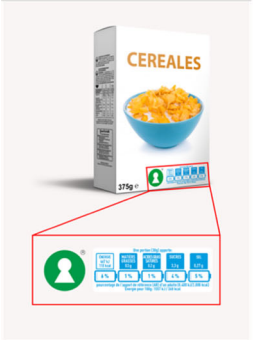
FOPL s system	Product category	
	Breakfast Cereal	*Bread*
Single-directive FOPL		
Double-directive bundle FOPLs		
Mixed bundle FOPLs		

FIGURE A2 Mock-up products for Study 3 (example for the French market).

Item	1	2	3	4	5	6	7	8
Comprehensibility_1	1							
Comprehensibility_2	0.729	1						
Comprehensibility_3	0.765	0.652	1					
Help-to-shop_1	0.623	0.529	0.54	1				
Help-to-shop_2	0.715	0.613	0.63	0.736	1			
Help-to-shop_3	0.727	0.638	0.715	0.616	0.685	1		
Complexity_1	0.665	0.542	0.524	0.722	0.73	0.611	1	
Complexity_2	0.611	0.537	0.52	0.593	0.627	0.602	0.715	1

TABLE A1 CFA—Correlations among items.

TABLE A2 CFA—Factor loadings for Promax rotated five-factor solution for 8 items.

	Factor loadings 1
Comprehensibility_1	0.884
Comprehensibility_2	0.789
Comprehensibility_3	0.807
Help-to-shop_1	0.809
Help-to-shop_2	0.869
Help-to-shop_3	0.846
Complexity_1	0.832
Complexity_2	0.783

TABLE A3 Comparison of bundles versus single labels.

	Mean Nutri-Score (*SE*)	Mean Keyhole + Nutri-Score (*SE*)	Mean Keyhole + NutrInform Battery (*SE*)
Nutri-Score (*n* = 480)	3.895 (0.078)	3.798 (0.140)	4.860 (0.141)
	Mean NutrInform Battery (*SE*)	**Mean Keyhole + Nutri-Score (*SE*)**	**Mean Keyhole + NutrInform Battery (*SE*)**
NutrInform Battery (*n* = 475)	4.825 (0.070)	3.798 (0.125)	4.860 (0.126)