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When Do Nutri-Score Labels Shift Food Choices? Evidence for Moderation by Health-Goal Activation and Prior Beliefs

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Nutri-Score front-of-package labels are designed to guide consumers toward healthier food choices, yet evidence on their effectiveness is mixed. We examined when Nutri-Score shifts purchasing choices and whether its impact depends on making health goals salient at the moment of choice and whether Nutri-Score ratings confirm versus contradict consumers' preexisting beliefs about which product is healthier. In a randomized online experiment with Italian adults (N = 792), participants made purchase choices across 30 pairs of familiar grocery products. Nutri-Score presence (present vs. absent) and a brief health-goal prompt ("Which product is healthier?"; present vs. absent) were manipulated between participants. We also categorized product pairs based on whether Nutri-Score ratings aligned with participants' prelabel healthiness judgments. Overall, displaying Nutri-Score increased the selection of the higher Nutri-Score option. This shift was largest when the label confirmed prior beliefs and the health-goal prime was present. When Nutri-Score contradicted prior beliefs, the label shifted choices even without the prime. These findings suggest that Nutri-Score effectiveness depends on goal salience and on whether the label provides expectation-consistent versus expectation-inconsistent information; in some cases, unexpectedly favorable ratings on tempting products may also be experienced as more permissible, a possibility that policymakers should consider.

Public Significance Statement

This study reveals that Nutri-Score labels most effectively promote healthier food choices when they surprise consumers (e.g., showing frozen fries as healthier than expected) or when paired with interventions activating health goals. These findings can guide policymakers in designing label systems that follow psychological principles to combat diet-related diseases while cautioning that labels alone may not change behavior without consumer engagement.

Keywords: Nutri-Score, prior beliefs, health-goal priming, front-of-package labels, consumer behavior

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Making healthy food choices can be difficult despite full access to nutritional information about products. One main reason is that food choices are driven by hedonic and instinctive processes that favor tasty and rewarding foods (Davis et al., 2004). A second reason is that nutritional information, even when made fully available, can be difficult to process because of an inherent difficulty or because consumers are not sufficiently motivated to do so (Grunert & Wills, 2007; Harris et al., 2009; Leigh Gibson, 2006). To address these last

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issues, simplified front-of-package labels have been proposed (e.g., Egnell, Boutron, et al., 2019).

However, the effectiveness of simplified labels such as the Nutri-Score (see Figure 1) in promoting healthy choices has been questioned. Nutri-Score was introduced in France in 2017 and is computed per 100 g/100 ml using the Food Standards Agency nutrient profiling system (FSA-NPS), which balances negative nutrients (energy, sugars, saturated fat, sodium) against positive components (e.g., fiber, protein, fruits, vegetables, legumes, nuts, and certain oils) to yield a final A–E grade (Julia & Hercberg, 2017; Julia et al., 2018). While some studies demonstrated beneficial effects of Nutri-Score (Crosetto et al., 2020; Ducrot et al., 2016), others reported null findings or even paradoxical outcomes where labels inadvertently promoted less healthy choices (Godden et al., 2023; Julia et al., 2015; Talati et al., 2019; Vandevijvere & Berger, 2021).

Several mechanisms may account for such paradoxical outcomes. A lack of attention can explain the null findings: When health-related goals are not salient, consumers may overlook the label and rely primarily on taste expectations or other fast, implicit responses (Raghunathan et al., 2006). Labels may also attract little attention when they add no information beyond prior beliefs. By contrast, a score that contradicts prior beliefs can increase the label's salience. For tempting products, an unexpectedly favorable Nutri-Score may even function as a "permission" cue, reducing perceived need for restraint and increasing choice of the desired option. This last explanation is consistent with self-regulated choice frameworks in which healthier decisions reflect a balance between reward valuation and cognitive control processes (Hare et al., 2009; Lim et al., 2018). These perspectives motivate the focus of the present research on health-goal activation and on whether Nutri-Score ratings confirm versus contradict consumers' prior beliefs as moderators of the Nutri-Score effect on choice.

Despite extensive testing of front-of-package labels, it remains unclear when and why Nutri-Score shifts choices, particularly as a function of health-goal salience and belief (in)consistency. Although health-goal activation manipulations are known to shift food choices toward healthier options (e.g., Hare et al., 2011), they have rarely been examined as boundary conditions for the effects of front-of-package labels such as Nutri-Score, especially in combination with whether label information confirms versus disconfirms consumers' prior beliefs. Here, we test whether health-goal activation strengthens Nutri-Score's tendency to shift choices toward the higher Nutri-Score option and whether effects differ when the ratings confirm versus contradict consumers' prior beliefs about which product is healthier.

To systematically investigate the role of these moderators, our study implemented an experimental approach. We developed a 2 × 2 × 2 mixed factorial design where participants were randomly assigned to one of four between-subject conditions, testing how Nutri-Score labels interacted with health-goal activation and prior belief (in)consistency. Half of our participants viewed products featuring the Nutri-Score label, while the other half saw identical products without the label. Importantly, we also manipulated health-goal activation (Hare et al., 2011): Half of the participants received an intervention designed to prime health consciousness, while the other half completed the task without this activation. Last, our experimental design also incorporated prior beliefs (Chandon & Wansink, 2007; Kardes et al., 2004; Tangari et al., 2019): Each participant chose between multiple product pairs where the nutritional labeling either confirmed or disconfirmed consumers' prior beliefs about which option was healthier.

We suggest that when consumers are actively pursuing health-related goals (e.g., shopping with the intention to eat healthily), they may be more responsive to front-of-package labels than when they are not actively pursuing this goal. Additionally, we believe that encountering front-of-package labels that contradict consumers' prior beliefs, such as a favorable score on a product generally perceived as unhealthy (e.g., frozen French fries, Nutri-Score A, paired with mashed potatoes, Nutri-Score B), may attract more attention and thus exert greater influence on choices (i.e., a larger increase in the likelihood of choosing the higher Nutri-Score option when the label is displayed vs. not displayed). Belief-disconfirming labels may exert stronger effects not only because they activate more attention but also because they may change how consumers weigh health versus taste at the moment of choice. Work on expectancy-belief dilemma situations suggests that nutrition information can sometimes operate as a permission cue (e.g., "it is not so bad, I'll eat more" inferences), increasing selection and consumption of tempting options in some contexts (Tangari et al., 2019). Belief-disconfirming labels, especially for a tempting product, may reduce the perceived need for restraint when the score is unexpectedly favorable. Healthier choices, indeed, reflect a balance between reward valuation and cognitive control, and health-related information can shift this balance (Hare et al., 2009; Lim et al., 2018), lowering the perceived cost of indulgence and increasing willingness to choose tempting options (Chandon & Wansink, 2007). These predictions are consistent with dual-process accounts suggesting that labeling effects depend on whether the decision context promotes more deliberate (System 2) versus heuristic (System 1) processing (Evans & Stanovich, 2013). Dual-process theory specifies how choices unfold (default heuristic responses vs. effortful deliberation). The heuristic-systematic model complements this by specifying when nutrition information is likely to be processed superficially versus systematically, especially when cues are goal-relevant or expectancy-disconfirming. Taken together, the two frameworks allow us to shed light on the processes through which the Nutri-Score shifts choices and through which route (reduced reliance on heuristics vs. increased systematic evaluation) and under which boundary conditions.

Importantly, an unexpectedly favorable Nutri-Score for a typically tempting product (e.g., frozen French fries) does not imply that

Figure 1
The Nutri-Score Front-of-Package Labeling

Note. See the online article for the color version of this figure.

such products are “as healthy as” minimally processed foods (e.g., leafy vegetables), nor is our goal to promote indulgent foods as healthy in absolute terms. Instead, Nutri-Score is conceptualized as a relative, within-set cue that can support substitution (choosing the higher Nutri-Score option over the lower one within the same pair) but may also, in some cases, function as a “permission cue” that relaxes restraint when a tempting option is reframed as more permissible.

Our study provides an experimental test of three critical questions: (a) How much does the Nutri-Score influence choices? (b) To what extent does activating health goals amplify this effect? (c) How does the impact vary when labels confirm versus disconfirm consumers’ existing beliefs about a product’s healthiness? The following sections provide a detailed review of the relevant literature, a theoretical framework for understanding the mechanisms underlying food choice, and the development of specific hypotheses.

Nutri-Score and Food Choice

The Nutri-Score labeling system, approved by several European countries, translates food nutritional values into a colored letter scale from “A” (green-best) to “E” (red-worst; see Figure 1). While Nutri-Score and standard nutrition facts panels (NFPs) coexist in many markets, they serve distinct purposes (see Table 1). Nutri-Score provides a simplified front-of-pack summary (grading foods A–E), whereas NFPs offer detailed quantitative data required by European Union, U.S., and Canadian regulations. Nutri-Score enables quick comparisons but lacks information for specific dietary needs, while NFPs provide granular nutritional data but require higher consumer literacy. Notably, Nutri-Score evaluates products per 100 g (standardizing comparisons but ignoring typical serving sizes), whereas NFPs often include both standardized and realistic portion information.

Nutri-Score labeling has been appreciated by consumers for its simplicity and has been shown to help consumers make accurate assessments of food healthiness (Ducrot et al., 2015; Hagmann & Siegrist, 2020). Nutri-Score labeling has the ability to reduce the likelihood that consumers will choose unhealthy products (Egnell, Crosetto, et al., 2019; Song et al., 2021) in both controlled laboratory and real-world settings, leading to a reduction in calorie, sugar, and fat intake (Dubois et al., 2021; Egnell, Boutron, et al., 2019; Hau & Lange, 2024). For example, Nutri-Score tripled the selection of higher-rated options (e.g., muesli) over lower-rated alternatives (e.g., granola) in experimental settings (van den Akker et al., 2022).

Although the Nutri-Score system simplifies nutritional assessment (Julia & Hercberg, 2017) and studies have shown that it can reduce the risk of mortality and obesity (Deschasaux et al., 2020; Julia, 2020), criticisms focus on its oversimplification that does not take into account the complex requirements of a healthy diet that go beyond mere fat and sugar amounts and the potentially misleading effects due to the standardized portion assessment (Carruba et al., 2022; Visioli et al., 2022). It has been pointed out that the system is based on a standardized portion size of 100 g, which may not reflect actual serving sizes, potentially misleading consumers, especially regarding foods such as vegetable pizza or chocolate. In addition, its uniform treatment of all oils and the oversimplified nutrient classification do not take into account the complex health properties of different foods, such as olive oil and parmesan cheese, recognized in the Mediterranean diet (Carruba et al., 2022; Visioli et al., 2022).

Critics also point to inconsistencies in the effect of Nutri-Score labeling on consumer behavior, with some studies indicating positive effects while others show no change or even show negative impacts on healthy food choices (Vandevijvere & Berger, 2021). For example, a study by Julia et al. (2015), which followed a cohort for 13 years, revealed a paradox: Participants whose diets scored as “better” according to the FSA-NPS (i.e., the nutrient-profile basis of Nutri-Score) reported lower energy intake yet showed higher overweight and obesity rates than those with “worse” profile scores on the FSA-NPS. This result is surprising since lower calorie intake is usually correlated with lower rates of obesity. In another study conducted by Talati et al. (2019) with an experimental research design, it was found that while 13.5% of participants chose healthier options with the Nutri-Score labeling, a significant 79.9% did not change their choices despite the presence of the label, suggesting that its impact may be limited to certain foods. Moreover, in a surprising twist, 6.5% of participants actually made fewer healthy choices with the label, indicating the existence of an inconsistent effect of the label in promoting healthier food decisions (Talati et al., 2019). Along the same lines, a large field study conducted by colleagues Vandevijvere and Berger (2021) that analyzed weekly sales data of 58 food categories in 43 stores showed mixed results: No significant impact of the label was observed in 20 categories; a positive impact of the label was found in 17 categories (29% of total food sales), due to increased sales of healthier options or decreased sales of less healthy options, particularly for categories such as vegetables (e.g., fresh ready-to-use vegetables, frozen French fries and potato products, frozen vegetables and soups), fruits (e.g., fresh fruit, dried fruit including nuts), dairy products (e.g., cheeses, yoghurts, soft white cheeses and desserts), and sugar and confectionery; a negative impact was found in 16 categories (24% of total food sales), with decreased sales of healthier options or increased sales of less healthy options, mainly for bread and bakery products. In the remaining five categories, the effects of Nutri-Score were mixed. These studies suggest the need for a broader evaluation of the

Table 1
Comparison of Nutri-Score and Nutrition Facts Panel Labeling Systems

Feature	Nutri-Score	Nutrition facts panel
Purpose	Simplified evaluation	Detailed nutrient disclosure
Information type	Summary score (A–E)	Quantitative nutrient amounts
Portion size	For 100 g	For 100 g and per serving
Regulatory basis	Voluntary front-of-pack	Mandatory back/side-of-pack
Key nutrients	None (aggregate score only)	Energy, macros, selected micros
Strengths	Immediate readability	Accurate for dietary management
Limitations	Oversimplifies food complexity	Requires nutritional knowledge

effect of Nutri-Score labeling on various food products and a better systematic understanding of the mechanisms governing its impact.

Theoretical Background and Hypotheses

The effect of front-of-package labels on consumer choice has not yet been fully explained. Several scholars (Hamlin, 2015; Roberto et al., 2021; Sanjari et al., 2017) have suggested that the dual-process theory of human decision making (Evans & Stanovich, 2013; Kahneman, 2003) might offer a useful framework for understanding this effect. The dual-process theory of decision making proposes the existence of two distinct but interacting systems (Evans, 2003; Frederick, 2005). System 1 operates with reasoning heuristics that produce intuitive responses, while System 2 engages in deliberative and analytical thinking (Kahneman, 2003). The two systems can operate simultaneously, but System 1 is the default system, which activates effortlessly and continually suggests automatic and quick choices, while System 2 replaces System 1 only occasionally when some problem arises that System 1 cannot solve and provided cognitive resources are sufficient (Strack & Deutsch, 2004).

Given this literature, it is reasonable to expect that the influence of Nutri-Score labeling on preferences for higher Nutri-Score options may be ascribed, at least in part, to its ability to activate System 2 analytical processing. The label may work by making consumers' health goals salient (Hau & Lange, 2024; Heeremans et al., 2024) by increasing their ability to perceive and process the healthiness of food products (De Temmerman et al., 2021). Within this theoretical framework, food choice is seen as a behavior driven predominantly by hedonic and instinctive processes, influenced by individual sensitivity to food rewards (Davis et al., 2004), the immediate presence of tempting stimuli (Ensaff, 2021), and hunger states (Read & van Leeuwen, 1998). This process is assumed to be predominantly governed by System 1, which requires no effort to indulge in tempting foods, even if they are known to be unhealthy. In contrast, resisting this temptation, thereby making healthy food choices, involves significant cognitive effort and can be challenging when cognitive resources are limited, such as when one is tired or insufficiently motivated (Pechey & Marteau, 2018; Shiv & Fedorikhin, 1999; van Dillen & van Steenbergen, 2018; Zimmerman & Shimoga, 2014). Nutri-Score labeling may influence food decision-making behavior by activating consumer health goals and engaging System 2 analytical reasoning, thus helping to inhibit impulsive eating behaviors (De Temmerman et al., 2021; Hau & Lange, 2024; Heeremans et al., 2024).

We shed light on the processes through which the label may influence choice by testing the hypothesis that experimentally activating health goals through an intervention that makes them salient before making the choice will increase the impact of the Nutri-Score information on the choice. Specifically, by asking a simple question, "Which of the two products do you think is healthier?" to half of the participants before presenting the Nutri-Score information, we aimed to activate health goals. Such activation should be reflected in a greater impact of Nutri-Score labeling on choices in those participants who received the priming question than those who did not (H2).

Previous studies confirmed that interventions that activate consumers' health goals can promote healthier eating. For example, advice that highlights a food's high-calorie content can make health goals salient, influencing purchase decisions (Banerjee & John, 2021). These mindful interventions prompt consumers to critically evaluate the health value of their food choices, improving their dietary decisions and potentially counteracting the negative effects of an obesogenic environment (Ensaff, 2021; Liberato et al., 2014; Vidgen & Gallegos, 2014). These types of interventions have been shown to leverage top–down factors, such as explicit instructions, to promote deliberate thinking, thereby improving self-control and resistance to unhealthy choices (Daniel & Klaczynski, 2006; Evans et al., 1994). We expect to observe that this type of intervention aligns choices with health goals, thereby increasing the effectiveness of Nutri-Score labeling in influencing food choices toward the higher Nutri-Score options.

Moreover, we also intended to control for how the effect of Nutri-Score labeling on choices changed with changes in the degree of consistency between a participant's prior beliefs about the healthiness of foods and the Nutri-Score score. We expected to find that the impact of the Nutri-Score labeling would be greater when it contradicted (rather than supported) consumers' preexisting beliefs (H3). Two accounts may explain this effect: The belief-disconfirming label may capture attention through surprise, or (and) it may reduce the perceived need for restraint by reframing the tempting option as healthier than expected. For example, consumers considering frozen French fries typically expect a low Nutri-Score. If they instead discover that fries receive a favorable grade (e.g., Nutri-Score A), the unexpected information may elicit surprise and make the option feel more permissible, thereby increasing the likelihood of choosing it relative to a no-label condition. The heuristic-systematic model of persuasion (Chaiken, 1987; Chaiken et al., 1989) suggests that persuasion will be greater when information contradicts prior beliefs, causing the individual to increase effort to process this information (Edwards & Smith, 1996; Maheswaran & Chaiken, 1991; Roese & Sherman, 2007). Moreover, unexpected label information may elicit surprise, which is known to generate prediction-error signals that support rapid updating of expectations (Rescorla & Wagner, 1972; Schultz et al., 1997). However, belief-disconfirming nutrition information does not necessarily imply greater cognitive control. When a tempting product receives an unexpectedly favorable Nutri-Score (e.g., frozen French fries labeled as healthier than expected), the label may also reduce experienced conflict and the perceived need for restraint, effectively licensing indulgence by shifting how consumers weigh health versus taste at the moment of choice. This account is consistent with self-regulation frameworks in which dietary choices reflect a balance between reward valuation and cognitive control, and health-related information can alter this balance (Hare et al., 2009; Lim et al., 2018). Accordingly, we treat belief (in)consistency as a moderator that can amplify label effects via increased attention and reduced restraint, especially when the disconfirming signal is unexpectedly favorable for a tempting option. Because we did not directly measure attention, experienced conflict, or taste valuation during choice, we cannot adjudicate between these mechanisms; we therefore frame them as plausible pathways linking belief (in)consistency to label effects.

Moreover, we expect that the Nutri-Score labeling, the health-goal activation, and participants' existing beliefs would interact in predicting choice (H4). We predicted that if the Nutri-Score is belief-confirming, the addition of a health-goal activation intervention would further strengthen its effect on choice, leading more participants to prefer the higher Nutri-Score option. Conversely, if the Nutri-Score is belief-disconfirming, we expected the label itself to drive a behavioral shift, regardless of whether a health goal was activated.

Our aim is to shed light on the processes through which the label may influence choice. The dual-process theory, the heuristic–systematic model, and the self-regulation framework specify two ways through which the label can affect decisions. In our view, health-goal activation might increase the motivation to process nutrition information systematically (a top–down process), whereas expectancy-disconfirming labels might capture attention and shift the balance between reward valuation and cognitive control at the moment of choice (a bottom–up process). This distinction might help to set the conditions for when Nutri-Score labels are likely to be effective and when they may have unintended effects.

As a baseline, in line with previous literature, we expected Nutri-Score presence to increase selection of the higher Nutri-Score option (H1). Our primary focus, however, was on two boundary conditions: health-goal activation and whether the Nutri-Score ratings confirm versus contradict consumers' prior beliefs about which product is healthier (H2–H4). In summary, we tested the following predictions.

> *Hypothesis 1 (Nutri-Score main effect):* Displaying the Nutri-Score label will increase the likelihood of choosing the higher Nutri-Score option (vs. no-label control).
>
> *Hypothesis 2 (Health-goal activation moderation):* Health-goal activation will amplify the effect of Nutri-Score labeling on choosing the higher Nutri-Score option (Nutri-Score × Goal Activation).
>
> *Hypothesis 3 (Belief confirmation vs. contradiction):* The Nutri-Score effect will be larger when the Nutri-Score ratings contradict consumers' prior beliefs about which product is healthier than when they confirm those beliefs (Nutri-Score × Belief Confirmation vs. Contradiction).
>
> *Hypothesis 4 (Three-way interaction):* We further examine whether the extent to which health-goal activation strengthens the Nutri-Score effect differs depending on whether Nutri-Score ratings confirm versus contradict consumers' prior beliefs about which product is healthier (Nutri-Score × Goal Activation × Belief Confirmation vs. Contradiction).

These hypotheses, if confirmed, have implications for both theory and practice. From a theoretical perspective, the Nutri-Score may act in two ways: through a top–down process, that is, an increased processing of System 2 thinking (reflective, systematic, analytic), and/or through a bottom–up process, when the Nutri-Score attracts attention by itself. Our hypotheses may shed light on which of these processes underlie the influence of the label on choice and help to explain why, in previous research, sometimes the Nutri-Score had a positive impact, sometimes a negative impact, and sometimes no impact at all.

From an applied perspective, identifying the conditions that amplify or attenuate Nutri-Score effects can inform both label implementation (e.g., when to pair labels with goal-activation prompts) and policy decisions about where such labels are most likely to improve consumer choices. If our hypotheses are confirmed, the effects should be largest when Nutri-Score information is paired with health goals and when it disconfirms consumers' prior beliefs, because expectancy violations are more likely to attract attention and shift attribute weighting during choice.

More broadly, our work is situated at the intersection of public-health labeling policy and behavioral decision interventions. By specifying when Nutri-Score labels change choices and when goal-activation cues amplify or fail to amplify those effects, our results inform how front-of-pack labels might be implemented and complemented in real consumer environments.

Method

Study Design and Procedure

The study employed a 2 (Nutri-Score presence: present vs. absent) × 2 (health-goal activation: intervention vs. no intervention) × 2 (product pair type: confirming vs. disconfirming prior beliefs) mixed factorial design, with the first two factors manipulated between-subjects and the third factor varied within-subjects. Participants were randomly assigned to one of the four between-subjects conditions and presented with 30 product pairs for choice decisions (see Table 2). In most pairs, products differed in Nutri-Score grade (allowing identification of a higher vs. lower Nutri-Score option). A subset of pairs had identical Nutri-Score grades and were not included in the confirm versus disconfirm analyses because Nutri-Score did not distinguish between the two options. Pairs were categorized post hoc as belief-confirming or belief-disconfirming based on participants' healthiness ratings (collected in intervention conditions only): Of these pairs, nine were categorized as "confirming" (where the product with the higher Nutri-Score aligned with participants' health perceptions), 11 as "disconfirming" (where the higher Nutri-Score contradicted health perceptions), eight as "weakly disconfirming" (where the Nutri-score was identical but contradicted health perceptions), and the remaining two were categorized as "neutral" (neither confirming nor disconfirming) and excluded from the analyses. In belief-disconfirming pairs, one option was the unexpectedly healthier option relative to participants' prior beliefs (i.e., the option with the higher Nutri-Score), whereas the other was the unexpectedly unhealthier option (i.e., the option with the lower Nutri-Score). Accordingly, greater choice of the higher Nutri-Score option in these pairs indicates a relative shift toward the unexpectedly healthier option. The hypothesis about Nutri-Score effect and prior beliefs' role was preregistered (https://osf.io/fc6xn/overview). The dependent variable was binary product choice (higher Nutri-Score vs. lower Nutri-Score option).

Each participant was presented with 30 pairs of products, and for each pair, they were asked to choose which product they would purchase from the two (see Figure 2A). Participants were given the names, pictures, ingredients, and nutritional table of each product. Participants exposed to Nutri-Score labeling were provided with Nutri-Score ratings when they made their product purchase choice (see Figure 2B). Participants assigned to the health-goal activation intervention were first subjected to the intervention (i.e., they had to answer the question, "Which of the two products do you think is healthier?") and then asked to express their product purchase preference (see Figure 2C). In the condition combining both the intervention and the Nutri-Score, participants were first subjected to the intervention, having to answer the question, and then received the Nutri-Score labeling at the time of product purchase choice (see Figure 2D).

After obtaining informed consent, participants were given the following general instructions, "In the next screens, you will be shown 30 pairs of consumer products." They were asked the following question, "Assuming you could choose between the two

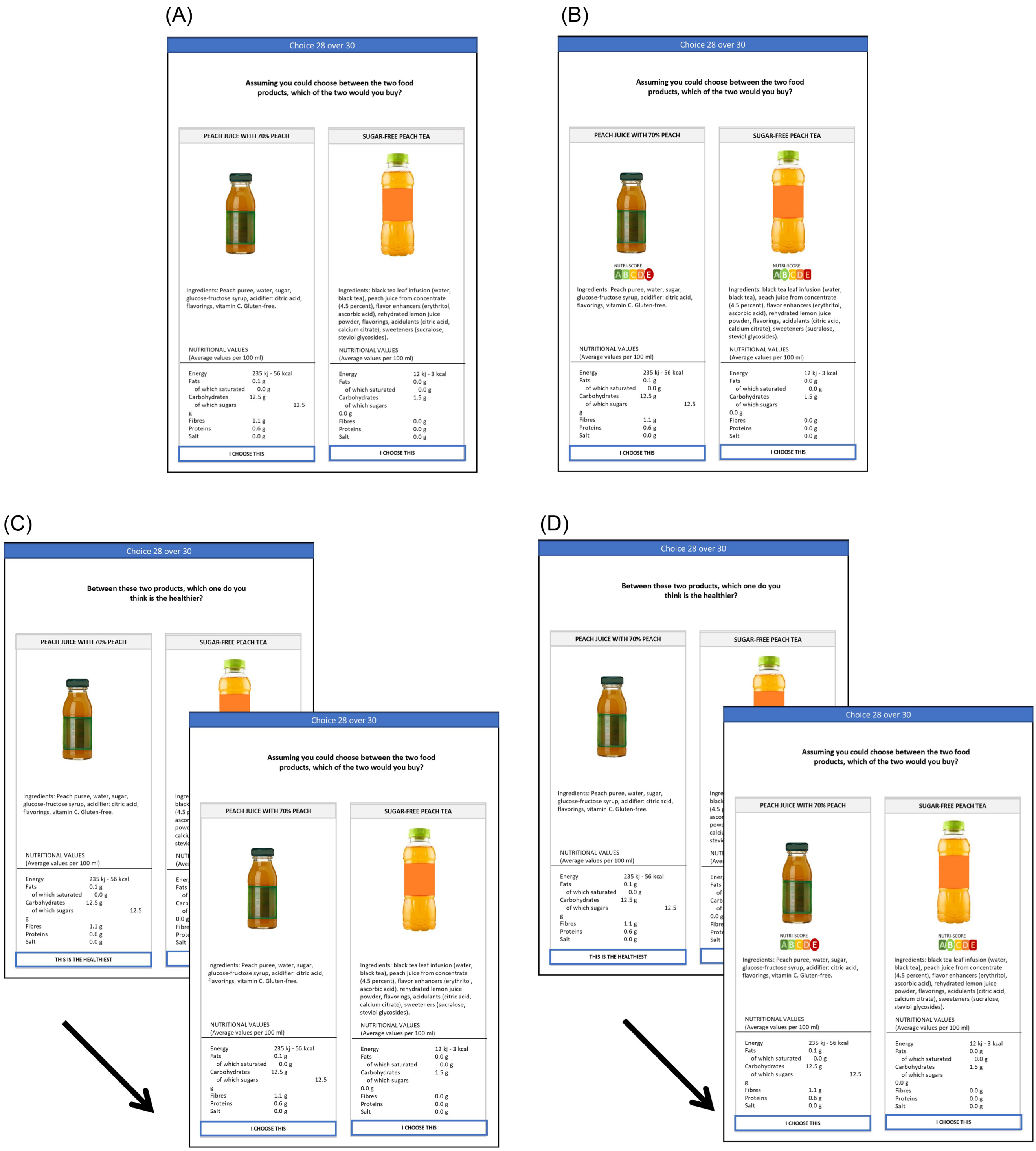
Table 2
Mean Proportion of Times That Each Product Was Chosen in Each Experimental Condition (Columns 6–9)

					Experimental condition					
					Without intervention			With intervention		
Id	P_{id}	NS	M_{ph}	Type	No Nutri-Score M	With Nutri-Score M	Sign. p	No Nutri-Score M	With Nutri-Score M	Sign. p
1	p56	B	0.01	D	0.25	0.34	.056	0.22	0.37	.001
	p72	C	0.99		0.75	0.66		0.78	0.63	
2	p63	C	0.02	C	0.31	0.18	.002	0.16	0.06	.001
	p10	A	0.98		0.69	0.82		0.84	0.94	
3	p56	B	0.06	WD	0.45	0.53	.087	0.39	0.38	.757
	p46	B	0.94		0.55	0.47		0.61	0.62	
4	p63	C	0.11	WD	0.19	0.16	.479	0.16	0.11	.184
	p59	C	0.89		0.81	0.84		0.84	0.89	
5	p63	C	0.01	C	0.22	0.15	.046	0.12	0.10	.514
	p55	A	0.99		0.78	0.85		0.88	0.90	
6	p44	A	0.37	WD	0.73	0.67	.254	0.59	0.60	.838
	p36	A	0.63		0.27	0.33		0.41	0.40	
7	p44	A	0.48	N	0.82	0.76	.155	0.71	0.72	.824
	p26	A	0.52		0.18	0.24		0.29	0.28	
8	p53	A	0.50	N	0.32	0.50	<.001	0.40	0.65	<.001
	p43	D	0.50		0.68	0.50		0.60	0.35	
9	p39	A	0.26	D	0.57	0.72	.003	0.57	0.69	.009
	p52	B	0.74		0.43	0.28		0.43	0.31	
10	p37	A	0.22	WD	0.69	0.70	.947	0.63	0.53	.067
	p38	A	0.78		0.31	0.30		0.37	0.47	
11	p61	E	0.04	C	0.40	0.44	.351	0.39	0.19	<.001
	p31	C	0.96		0.60	0.56		0.61	0.81	
12	p27	E	0.01	C	0.35	0.37	.731	0.33	0.21	.009
	p68	C	0.99		0.65	0.63		0.67	0.79	
13	p60	B	0.05	C	0.46	0.43	.486	0.42	0.30	.016
	p14	A	0.95		0.54	0.57		0.58	0.70	
14	p11	A	0.04	D	0.52	0.46	.270	0.47	0.37	.053
	p14	C	0.96		0.48	0.54		0.53	0.63	
15	p16	A	0.10	WD	0.35	0.41	.290	0.33	0.39	.250
	p14	A	0.90		0.65	0.59		0.67	0.61	
16	p33	B	0.10	WD	0.39	0.51	.011	0.42	0.46	.362
	p7	B	0.90		0.61	0.49		0.58	0.54	
17	p20	C	0.06	C	0.45	0.42	.552	0.43	0.26	<.001
	p65	B	0.94		0.55	0.58		0.57	0.74	
18	p6	B	0.23	WD	0.30	0.37	.127	0.28	0.28	1.000
	p64	B	0.77		0.70	0.63		0.72	0.72	
19	p45	A	0.39	D	0.60	0.66	.222	0.47	0.73	<.001
	p8	B	0.61		0.40	0.34		0.53	0.27	
20	p9	D	0.25	D	0.37	0.58	<.001	0.46	0.53	.191
	p21	E	0.75		0.63	0.42		0.54	0.47	
21	p15	D	0.13	C	0.58	0.44	.005	0.53	0.38	.003
	p12	C	0.87		0.42	0.56		0.47	0.62	
22	p13	C	0.08	WD	0.23	0.33	.039	0.17	0.20	.434
	p19	C	0.92		0.77	0.67		0.83	0.80	
23	p79	B	0.28	D	0.44	0.46	.606	0.40	0.55	.004
	p88	E	0.72		0.56	0.54		0.60	0.45	
24	p82	B	0.27	D	0.36	0.50	.004	0.35	0.48	.008
	p86	C	0.73		0.64	0.50		0.65	0.52	
25	p80	B	0.41	D	0.42	0.61	<.001	0.43	0.72	<.001
	p90	E	0.59		0.58	0.39		0.57	0.28	
26	p79	B	0.24	D	0.47	0.45	.620	0.36	0.48	.015
	p87	D	0.76		0.53	0.55		0.64	0.52	
27	p83	B	0.16	D	0.19	0.23	.289	0.15	0.27	.003
	p89	D	0.84		0.81	0.77		0.85	0.73	
28	p91	C	0.29	C	0.53	0.46	.160	0.47	0.28	<.001
	p84	B	0.71		0.47	0.54		0.53	0.72	
29	p78	D	0.26	C	0.51	0.48	.547	0.53	0.40	.009
	p25	C	0.74		0.49	0.52		0.47	0.60	
30	p75	C	0.16	D	0.08	0.25	<.001	0.10	0.15	.093
	p74	D	0.84		0.92	0.75		0.90	0.85	

Note. For WD pairs, Nutri-Score grades are identical; therefore, no "higher" Nutri-Score product is defined. For D pairs, the "higher" Nutri-Score product corresponds to the unexpectedly healthier option relative to participants' prior beliefs; effects should be interpreted as relative shifts in choice probability, not necessarily reversals of dominant choice within each pair. Id = pair id; P_{id} = product id; NS = Nutri-Score rating; M_{ph} = mean proportion of subjects that rated the product as healthier than the competitor; C = confirming; D = disconfirming; WD = weakly disconfirming; N = neutral; M = mean proportion of times the item was chosen; p = significance level of the effect of the presence (vs. absence) of the Nutri-Score (Pearson chi-square); Sign. = significance.

Figure 2

Experimental Design and Task Procedure Across Nutri-Score and Intervention Conditions



Note. Panel A: Choice without Nutri-Score and without intervention. Panel B: Choice with Nutri-Score and without intervention. Panel C: Choice without Nutri-Score and with intervention. Panel D: Choice with Nutri-Score and with intervention. See the online article for the color version of this figure.

food products, which one would you buy?" The products chosen to form each pair were substitute products, such as chocolate spread and strawberry jam, which are both spreads. In the conditions that incorporated Nutri-Score labeling information, participants were informed once at the beginning of the experiment,

> Each product will be accompanied by a Nutri-Score. The Nutri-Score label is a nutritional label that translates the nutritional value of foods and beverages into an understandable score. It is based on a scale of 5 colors and letters: A in green indicates the best nutritional quality, while E in dark orange the lowest. The Nutri-Score displayed next to each product was derived using the official algorithm provided by the Ministry of Health.

Participants were also shown an illustrative representation of the four Nutri-Score labels, as shown in Figure 1. In the conditions with the health-goal activation intervention, prior to making the product purchase choice, participants were asked to choose the healthier of the two products ("Which of the two products do you think is healthier?") and then make the purchase choice (see Figure 2C and 2D).

We used a controlled online choice task to isolate the effects of Nutri-Score labeling, health-goal activation, and whether Nutri-Score ratings confirmed versus contradicted participants' prior beliefs about which product was healthier while keeping product information constant across conditions. We chose a controlled randomized experiment rather than a field study because, although field settings strengthen external validity, they introduce uncontrolled influences (e.g., pricing and promotions, shelf placement, time pressure) that can obscure mechanism-focused tests.

Sample Size and Data Analysis

Data were analyzed using mixed logit regression with random intercepts for participants and product pairs to account for within-subject correlations, focusing primarily on interaction effects between the experimental factors to determine how Nutri-Score labeling and health-goal activation jointly influenced product choices across different types of product pairs.

We conducted an a priori power analysis using the R package simr (Green & MacLeod, 2016), which supports simulation-based power estimation for generalized linear mixed models. The power analysis focused on the key three-way interaction between Nutri-Score presence, health-goal activation, and product type. Fixed effect sizes were specified based on values commonly interpreted as medium in the literature (log-odds ≈ 0.41–0.53; OR = 1.5–1.7; Cohen's $d \approx 0.22$–0.29), reflecting the smallest effects considered theoretically meaningful. Assuming a binomial outcome, random intercepts for participants, and 30 trials per subject, we tested a range of sample sizes (N = 740–820), with $\alpha = .05$ and power set to .80. The model used for the simulations matched the structure of the primary analysis. The analysis revealed that statistical power to detect the target interaction exceeded 80% at $N = 760$; accordingly, we planned for a slightly larger final sample ($N = 792$) to allow for potential exclusions. The estimated power at this sample size was approximately 84%. Effect sizes in both the power analysis and reported results are expressed in log-odds units (B coefficients), with odds ratios, Exp(B), included for interpretability. The full R code and output are available on the Open Science Framework (https://osf.io/fc6xn/overview).

Participants and Recruitment

Italian adults (n = 792) were recruited on the Prolific platform (420 females, 367 males, four "prefer not to say," one missing; M_{age} = 29.5 ± 8.65, min 19 max 71 years). The only eligibility requirement was being Italian and residing in Italy (and thus able to evaluate the stimuli), because all products used in the choice task were common Italian grocery products. We did not prescreen participants on diet, nutrition knowledge, attitudes toward Nutri-Score, or other lifestyle characteristics. Most participants had a high level of education: PhD (6%), master's degree (29%), bachelor's degree (30%), and high school diploma (34%). A portion of the sample were full-time (28%) or part-time workers (13%), while others were unemployed (20%), were starting a new job (3%), had no paid work (6%), or other (12%). Twenty percent did not provide this information. The target sample size was determined via the a priori power analysis reported above. We did not collect information on urban versus rural residence, sport activity, or whether participants were the primary household grocery decision-maker.

Materials

The list of product pairs used in the experiment is given in the Supplemental Table S1. At the time of data collection, these products did not display Nutri-Score on-pack. Nutri-Score grades were computed by the authors from the nutrition facts per 100 g/100 ml using the official Nutri-Score calculator (original algorithm) provided by Santé publique France (n.d.) and following the official Nutri-Score guidance (Santé publique France, 2025). The product pairs belonged to different categories: dairy products and dairy drinks (e.g., mozzarella cheese, yogurt and yogurt drinks), bakery and pastry products (e.g., cookies, pizza), meat and fish (e.g., sliced chicken for salad, sausage, tuna), snacks (e.g., potato French fries, crackers, chocolate bar), jams and spreads (e.g., jam, chocolate cream), pasta and cereals (e.g., pasta, pasta sauce), fruits and nuts (e.g., dried fruits), frozen and precooked meals (e.g., French fries), beverages (e.g., diet cola, orange juice), and oils and condiments (e.g., olive oil, mayonnaise, ketchup, salad dressing). In each pair, we matched products that could be competitors. For example, participants were asked to choose between French fries and mashed potatoes because they were both side dishes or between olive oil and salad dressing because they were both condiments.

Posttask Questionnaire

At the end of the experiment, we collected information about the baseline characteristics of the sample and measured the effectiveness of the intervention manipulation. These measures were collected for descriptive purposes and robustness checks and were not used as eligibility criteria for recruitment.

Participants were asked a series of questions to assess their health awareness. One of the questions concerned their diet: "How would you rate your diet?" (1 = *not at all healthy*, 7 = *extremely healthy*). Two other questions were about their level of expertise: "How would you rate your level of knowledge in nutrition?" (1 = *extremely low*, 7 = *extremely high*) and "Compared to the average Italian population, how knowledgeable do you consider yourself about food or nutrition?" (1 = *much less knowledgeable*, 7 = *much more knowledgeable*). Participants reported, on average, that they eat a healthy diet

($M = 4.47$; $SD = 0.99$; range 1–7). They considered themselves fairly knowledgeable about nutrition-related topics ($M = 4.44$; $SD = 1.00$; range 1–7) and considered themselves slightly more knowledgeable about food and nutrition than the average Italian citizen ($M = 4.49$; $SD = 0.98$; range 1–7). The responses to the three questions showed good internal reliability (Cronbach's $\alpha = .805$). Accordingly, a mean value was calculated to measure consumer health awareness, which ranged from a low of 1.33 to a high of 7.00, with a mean of 4.47 ($SD = 0.85$).

Participants were asked to express their degree of agreement with a law that would mandate Nutri-Score labeling on all packaged food products in Italy, using a scale of 1 (*strongly disagree*) to 7 (*strongly agree*), with an additional option of 8 to indicate "don't know." On average, participants were moderately supportive of a law requiring Nutri-Score labeling on all packaged food products in Italy ($M = 5.21$; $SD = 1.74$; range 1–7).

All participants were then asked to rate the degree of cognitive engagement in their choice, that is, how carefully they thought through or pondered their purchase decision. The answers to this question were used to check the effect of manipulating health goals. We expect to find higher cognitive engagement in the groups of participants primed with the health-goal activation intervention. In order to increase the validity of the responses, participants were asked to answer honestly, explaining that they would suffer no financial penalty for their response, as we needed their honesty for the research. Responses were given on a scale from 1 (*I chose very instinctively*) to 7 (*I chose very carefully*).

Demographic information was also collected, including age, gender, education level, personal income, and employment status.

Transparency and Openness

The original design of this study (Nutri-Score × Belief Confirmation vs. Contradiction) was preregistered prior to data collection (see https://osf.io/fc6xn/overview). An unregistered expansion added the health-goal activation factor due to evolving research questions, which we acknowledge as a deviation. The Trento University Research Ethics Committee approved the whole experimental protocol (Protocol No. 2022-026) before data collection. All participants expressed informed consent before participating. Data were collected in November 2022. Data and analysis code are available online on the Open Science Framework at (https://osf.io/fc6xn/overview).

Results

The influence of Nutri-Score labeling (presence vs. absence) and the health-goal activation intervention (presence vs. absence) on participants' purchase intentions was assessed by comparing choices across the four experimental conditions. Before testing the effects of the two factors, we conducted a manipulation check to determine the effectiveness of the intervention.

Manipulation Check

To evaluate whether the health-goal activation intervention was effective, we conducted an independent-samples t test on the responses to the question about whether participants evaluated the products carefully or instinctively, with the intervention as an independent variable. Results indicated that participants in the intervention conditions reported more careful evaluation of the products ($M = 4.80$, $SD = 1.47$) compared to participants in the conditions without the intervention ($M = 3.81$, $SD = 1.61$), $t(790) = 9.06$, $p < .001$, $d = 0.644$. This finding is consistent with an increase in participants' deliberation during product selection due to health-goal activation intervention, as hypothesized.

Nutri-Score Impact on Food Choice

The frequency of consumer choice of each product within each pair was compared between the four experimental conditions (see Table 2). For transparency, the full list of product categories and items (with Nutri-Score grades) is reported in Supplemental Table S1, and the complete set of product pairs and their belief-(in) consistency classification is reported in Table 2 and Supplemental Table S2.

We first conducted chi-square tests comparing choice frequencies between the no-label condition and the Nutri-Score label condition, separately for the no-intervention and health-goal activation groups. Overall, when the Nutri-Score label was displayed, purchase preferences shifted toward the product with the higher Nutri-Score rating, confirming H1. Collapsing across intervention and considering all 30 pairs, regardless of statistical significance, displaying the Nutri-Score label produced an average 11 percentage-point shift in choice toward the product with the higher Nutri-Score grade (i.e., % choosing the higher Nutri-Score option with the label minus % choosing it without the label). Regarding statistical significance, Nutri-Score labeling significantly changed purchase intentions in 11 pairs over 30, when it was not accompanied by the health-goal activation, and in 17 pairs over 30 when Nutri-Score labeling information was preceded by the health-goal activation intervention. When analyses were restricted to the pairs showing a significant label effect, the mean label-induced shift was 15 percentage points in the no-intervention group, with a minimum shift of 7% (in Pair 5) up to a maximum shift of 21% (in Pair 20), and 16 percentage points in the health-goal activation group with a minimum of 10% (in Pair 2) to a maximum of 29% (in Pair 25). Together, these results suggest that the presence of a Nutri-Score labeling shifted choices toward the higher Nutri-Score option overall, with significant effects emerging more frequently and with larger average effects when choices were preceded by the health-goal activation intervention.

Before proceeding with a more comprehensive logistic regression analysis on the whole list of product pairs, we categorized each product pair as "confirming" or "disconfirming" prior health beliefs. Health beliefs were elicited as part of the health-goal activation intervention, where participants were asked to choose the healthier product among each pair of products. It is important to note that this spontaneous healthiness assessment was collected before participants saw the Nutri-Score label; therefore, it was not influenced by the presence of the label. Because each belief-disconfirming pair included one product that was unexpectedly higher in Nutri-Score and one that was unexpectedly lower relative to prior beliefs, a Nutri-Score effect in these pairs is interpreted as a relative increase in the probability of choosing the higher Nutri-Score option, that is, the unexpectedly healthier option. This interpretation does not imply that the higher Nutri-Score option necessarily became the dominant choice within every pair (see Table 2).

Each healthiness choice was first subjected to a one-sample binomial proportion test to exclude those product pairs for which participants did not express a significant health evaluation (not significantly different from chance at $p = .50$) for one or the other product. The one-sample binomial proportion test revealed that 28 out of 30 pairs significantly differed from 50%, meaning that one product was rated healthier than the other. Thus, 28 product pairs were retained for further analysis (see Supplemental Table S2). For example, extra virgin olive oil was indicated as healthier than salad dressing by 84% of participants ($p < .001$), and therefore, this product pair was retained for subsequent analyses, whereas "pesto" pasta sauce was rated as healthy as sausage ragù pasta sauce ($p = .960$), so this product pair was excluded.

Each product pair was then classified into one of three categories (see column "Type" in Table 2) by comparing participants' healthiness prior beliefs with the Nutri-Score labeling. The first category, "confirming" (C) pairs, included those pairs where Nutri-Score rating confirmed consumers' prior health beliefs. For example, sliced chicken for salad had a higher rating (Nutri-Score = A) than sausages (Nutri-Score = C), and participants spontaneously judged sliced chicken to be healthier than sausages 98% of the time, consistent with the Nutri-Score ratings. The second category, "disconfirming" (D) pairs, included product pairs whose Nutri-Score ratings contradicted participants' spontaneous prior beliefs. For instance, extra virgin olive oil had a lower Nutri-Score rating (Nutri-Score = D) than salad dressing (Nutri-Score = C), while 84% of participants rated extra virgin olive oil as healthier than salad dressing. A third category, "weakly disconfirming" (WD) pairs, consisted of product pairs with identical Nutri-Score ratings but inconsistent consumer beliefs. For example, a chocolate milk drink and a yogurt drink both had a Nutri-Score of B, yet 90% of participants rated the yogurt drink as healthier than the milk drink. This product pair type was not included in the subsequent analysis because it cannot be objectively said that one product is healthier than the other, given that both products have the same Nutri-Score rating.

According to the final classification, nine product pairs (Numbers 2, 5, 11, 12, 13, 17, 21, 28, 29) were categorized as "confirming," 11 pairs (Numbers 1, 9, 14, 19, 20, 23, 24, 25, 26, 27, 30) as "disconfirming," and eight pairs (Numbers 3, 4, 6, 10, 15, 16, 18, 22) as "weakly disconfirming" (see Supplemental Table S2). The remaining two pairs were classified as "neutral" because they were made of two products that received identical health ratings by participants.

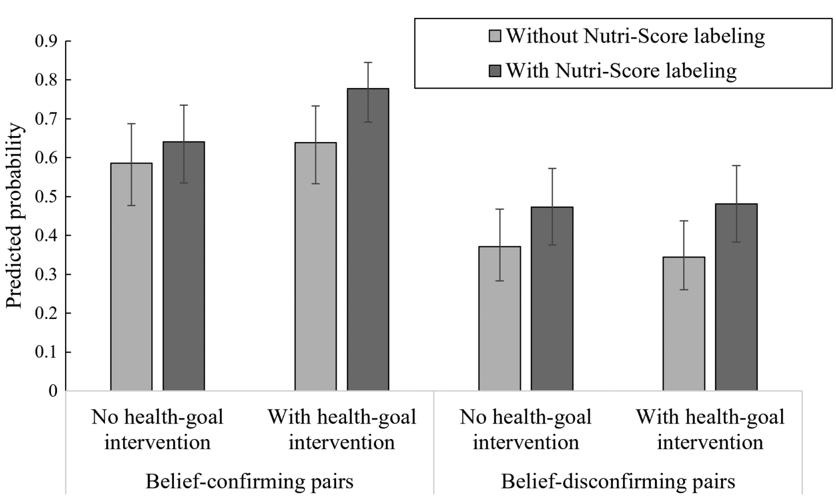
A logistic mixed-effects model was conducted to examine the effects of Nutri-Score labeling, intervention, and prior beliefs on participants' likelihood of choosing the higher Nutri-Score option. Only the nine confirming and 11 disconfirming pairs could be included in this analysis. The model included fixed effects for Nutri-Score (presence vs. absence), intervention (presence vs. absence), prior beliefs (confirms vs. disconfirms prior beliefs), and all possible two-way and three-way interactions among these variables. Crossed random intercepts for participant ID and product pair were also included to account for the repeated-measures structure of the data. Model fit indices were as follows: log-likelihood = −9,828.65, Akaike information criterion = 19,677.30, Bayesian information criterion = 19,754.00; the model explained 8.3% of variance in fixed effects (marginal $R^2 = .083$) and 21.3% including random effects (conditional $R^2 = .213$).

The results of the Omnibus analysis on the fixed factors showed significant effects for all the main variables and for some of the interactions. In particular, the main effect of Nutri-Score was highly significant, $\chi^2(1) = 127.88$, $p < .001$, indicating a significant impact on the model (H1). Similarly, the intervention showed a significant effect, $\chi^2(1) = 23.11$, $p < .001$, as well as prior beliefs, $\chi^2(1) = 12.76$, $p < .001$ (see Figure 3).

Regarding interactions, a significant effect between Nutri-Score and intervention emerged, $\chi^2(1) = 12.76$, $p < .001$, suggesting that the effect of Nutri-Score depends on the presence or absence of the intervention (H2). In addition, the interaction between intervention and prior beliefs was significant, $\chi^2(1) = 49.00$, $p < .001$, indicating a significant relationship between these two variables. However, the interaction between Nutri-Score and prior beliefs did not reach significance, $\chi^2(1) = 0.29$, $p = .588$ (H3). Because a nonsignificant frequentist result does not by itself distinguish evidence for the

Figure 3

Predicted Probability of Choosing the Higher Nutri-Score Product as a Function of Nutri-Score Labeling, Intervention, and Prior Beliefs



Note. Error bars represent 95% confidence intervals.

absence of an effect from statistical indeterminacy, we do not interpret this result as evidence against H3. Instead, we treat it as inconclusive when averaged across intervention conditions, especially in light of the significant three-way interaction. Indeed, the triple interaction between Nutri-Score, intervention, and prior beliefs was significant, $\chi^2(1) = 4.51$, $p = .034$, indicating that the combined effect of these three variables was significant (see Figure 3; H4). To facilitate interpretation of this interaction, Figure 4 summarizes the Nutri-Score simple effects (odds ratios with 95% confidence intervals [CIs]) across the four conditions. Nutri-Score labeling significantly increased the choice of the higher Nutri-Score option in all four conditions and was largest in belief-confirming pairs under the intervention.

The estimated parameters showed that the odds of choosing the higher Nutri-Score option were 61% higher with Nutri-Score labeling compared to when it was absent, $B = 0.476$, $SE = 0.042$, $z = 11.31$, $p < .001$, $\text{Exp}(B) = 1.61$, 95% CI [1.48, 1.75]. The presence of the intervention also had a significant positive effect on choosing the higher Nutri-Score option, $B = 0.202$, $SE = 0.042$, $z = 4.81$, $p < .001$, $\text{Exp}(B) = 1.22$, 95% CI [1.13, 1.33], suggesting a 22% increase in the odds when the health-goal activation intervention was implemented. Prior beliefs also significantly influenced choices, with participants less likely to choose the higher Nutri-Score option when the information disconfirmed their prior beliefs, $B = -1.028$, $SE = 0.292$, $z = -3.52$, $p < .001$, $\text{Exp}(B) = 0.36$, 95% CI [0.20, 0.63]. This indicates that the odds of choosing the higher Nutri-Score option were about 64% lower in belief-disconfirming pairs (relative to belief-confirming pairs; see Figure 3). Consistent with this pattern, within belief-disconfirming pairs, an increase in the probability of choosing the higher Nutri-Score option corresponds to a relative shift toward the unexpectedly healthier option and away from the unexpectedly unhealthier option. However, this should not be interpreted as implying that the higher Nutri-Score option necessarily became the majority choice within each pair.

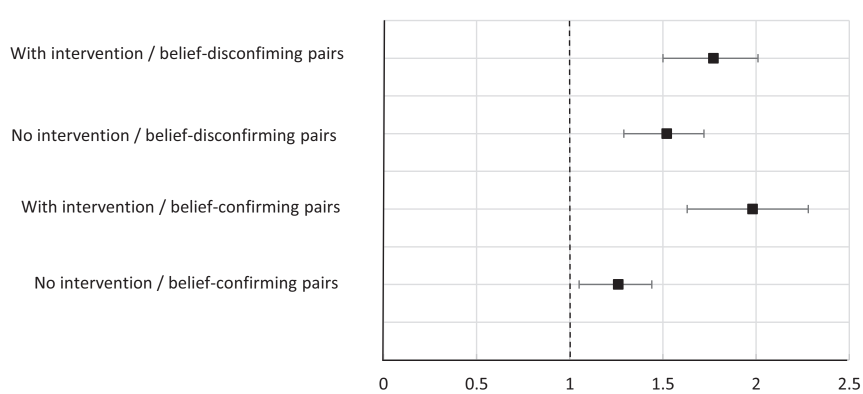
Importantly, the significant interaction between Nutri-Score and intervention, $B = 0.3006$, $SE = 0.084$, $z = 3.57$, $p < .001$, $\text{Exp}(B) = 1.35$, 95% CI [1.15, 1.59], suggests that the effect of Nutri-Score was amplified when combined with the intervention. Specifically, participants exposed to both Nutri-Score labeling and the intervention had the highest predicted probability of choosing the higher Nutri-Score product (prob = 0.643, 95% CI [0.571, 0.709]) compared to those with neither (prob = 0.477, 95% CI [0.403, 0.552]). Moreover, the interaction between intervention and prior beliefs was also significant, $B = -0.489$, $SE = 0.070$, $z = -7.00$, $p < .001$, $\text{Exp}(B) = 0.61$, 95% CI [0.54, 0.70], indicating that the effect of the intervention was smaller for belief-disconfirming than belief-confirming pairs (see Figure 3). In particular, participants exposed to the intervention had the highest probability of choosing the higher Nutri-Score products when the Nutri-Score labeling confirmed prior beliefs (prob = 0.778, 95% CI [0.692, 0.845]), compared to when it disconfirmed prior beliefs (prob = 0.481, 95% CI [0.383, 0.580]).

Most importantly, the significant three-way interaction among Nutri-Score, intervention, and prior beliefs, $B = -0.296$, $SE = 0.1341$, $z = -2.124$, $p = .034$, $\text{Exp}(B) = 0.743$, 95% CI [0.565, 0.977], suggests that the combined effect of Nutri-Score labeling and intervention on choosing the higher Nutri-Score option was influenced by prior beliefs (see Figure 3). Specifically, for belief-confirming pairs, the probability of choosing the higher Nutri-Score option increased from 57.7% (95% CI [55.2%, 60.2%]) in the no-intervention, no-label condition to 76.1% (95% CI [73.9%, 78.1%]) when both Nutri-Score and intervention were present (Figure 4). These data indicate a significant increase in preferences for the higher Nutri-Score option, in the belief-confirming pairs, when the Nutri-Score label was provided and the health goals were activated. For belief-disconfirming pairs, Nutri-Score labeling increased the probability of choosing the higher Nutri-Score option, that is, the unexpectedly healthier option relative to participants' prior beliefs, primarily when no intervention was present (from 38.6% to 47.9%), whereas adding the intervention yielded only a marginal additional increase (to 48.6%). Thus, in the absence of the intervention, Nutri-Score increased choices by 5.2 percentage points for belief-confirming pairs (57.7% to 62.9%) and by 9.3 percentage points for belief-disconfirming pairs (38.6% to 47.9%). The lower baseline for belief-disconfirming pairs reflects their definition (they run counter to participants' initial beliefs), rather than an effect of labeling or intervention.

The analysis was repeated, adding age, sex, education, and health consciousness as covariates, but none of the variables had a significant effect on the dependent variable, and the main results remained unchanged.

Figure 4

Effects of Nutri-Score Labeling on Choice of Higher Nutri-Score Options Across Belief Consistency and Intervention Conditions



Note. Points show odds ratios (Exp[B]); error bars indicate 95% confidence intervals.

Discussion

Simplified nutrition labels, such as the Nutri-Score, have been proposed as a tool to improve consumer health decisions (e.g., Egnell, Boutron, et al., 2019). However, results to date show an inconclusive picture regarding the effectiveness of these labels, with sometimes positive, sometimes negative, and sometimes no effects (Godden et al., 2023; Julia et al., 2015; Talati et al., 2019; Vandevijvere & Berger, 2021). Moreover, to date, there is no systematic explanation of the mental mechanisms on which such labels should act to achieve their purpose. This makes it difficult, if not impossible, to predict when such labels will be effective. Our study addresses both of these shortcomings, providing experimental evidence that helps to shed light on the processes underlying the ambiguous results on the effectiveness of the Nutri-Score and on the mechanisms underlying the label's influence on consumer choices.

In line with previous research that has highlighted the effectiveness of front-of-package labels on consumer choice (Hamlin, 2015; Roberto et al., 2021; Sanjari et al., 2017), we also observed that a favorable Nutri-Score score on a product increases the likelihood of purchasing that product. However, in accordance with the dual decision-making theory (Kahneman, 2003), the heuristic-systematic model of persuasion (Chaiken, 1987; Chaiken et al., 1989), and the self-regulated choice frameworks, our results suggest that the effect of the Nutri-Score varies according to the degree to which it activates health goals and the degree to which it confirms (vs. disconfirms) prior beliefs. The impact of the Nutri-Score label was minimal (a 5.2% increase) when it confirmed consumers' prior beliefs. This finding might suggest that this alignment does not "alarm" System 1 to the extent that it requires processing the label information through System 2. In agreement with studies showing that evidence that contradicts expectations is more persuasive (Rescorla & Wagner, 1972; Schultz et al., 1997), as it stimulates a greater depth of information processing and signals a threat to our beliefs (Edwards & Smith, 1996; Fisher et al., 2018; Maheswaran & Chaiken, 1991; Roese & Sherman, 2007), the Nutri-Score produced a relative increase in the probability of choosing the higher Nutri-Score option, that is, the unexpectedly healthier option relative to participants' prior beliefs, between 9.3% and 12.5% when it contradicted prior beliefs. This might suggest that misalignment with consumer beliefs might elicit additional attention and eventually more processing of the label.

However, the impact of the Nutri-Score reached its maximum (a 13.4% increase in choices) when combined with an intervention designed to stimulate health goals. Our proposed explanation, supported by the manipulation check, is that the activation of health goals acted as a lever to increase the effectiveness of the Nutri-Score because both the Nutri-Score and the intervention rely on the same mental mechanisms. In other words, these results are consistent with the hypothesis (though they do not directly prove it) that Nutri-Score labeling acts on choices by promoting systematic and analytical reasoning, based on System 2 thinking, rather than automatic and impulsive reasoning, typical of System 1 (Kahneman, 2003). This may suggest that the impact of the Nutri-Score is limited to situations where consumers pay attention to the label itself. Contrary to what one might think, although the Nutri-Score is a simplified label that uses colors and thus apparently conveys information almost automatically, our results might imply that it might not exploit automatic channels of choice; instead, it might require attention to have an impact. It is possible that, with increased use and familiarity, the label may also act automatically, but this seems not self-evident in our data and needs further research.

The proposed explanation for this study's findings, namely, that the Nutri-Score labeling system is based on an analytical process when health objectives are applied, would be consistent with previous studies, which indicated that the Nutri-Score acts by activating health goals (Hamlin, 2015; Hau & Lange, 2024; Heeremans et al., 2024; Roberto et al., 2021; Sanjari et al., 2017). In other words, this explanation suggests that the presence of a food label on a product would lead consumers to think more about the health value of the product itself, rather than (or in addition to) its taste and liking. The classical self-regulated choice framework sees food choice as primarily influenced by hedonic processes, such as individual sensitivity to food rewards and hunger states (Davis et al., 2004; Read & van Leeuwen, 1998). According to this explanation, Nutri-Score labeling would insinuate itself into this process by facilitating decisions by activating health goals and engaging System 2 reasoning, thus helping to inhibit impulsive eating behaviors. This explanation is coherent with our observation that the label's effect is amplified when health goals are activated (De Temmerman et al., 2021; Hau & Lange, 2024; Heeremans et al., 2024).

An interesting finding from our study is that the effect of the intervention aimed at promoting healthy choices was more pronounced for products whose Nutri-Score was consistent with consumers' beliefs. When the Nutri-Score indicated a score that contradicted those beliefs, it was less effective, presumably because it absorbed the consumer's attentional resources.

Information from the Nutri-Score that challenges prior beliefs could indeed engage attention and deeper processing, as suggested by theories of information processing when that information disconfirms, rather than confirms, expectations (Edwards & Smith, 1996; Fisher et al., 2018; Maheswaran & Chaiken, 1991; Roese & Sherman, 2007). Seemingly, unexpected label information may induce surprise, which is a response recognized to cause prediction-error signals that reinforce fast updating of expectations (Rescorla & Wagner, 1972; Schultz et al., 1997). Therefore, the intervention might not have added additional value, as the information in the Nutri-Score was already sufficient to induce deeper processing, reaching a sort of ceiling effect. This is one possible interpretation. However, there could be a second interpretation.

We cannot exclude the possibility that a favorable, but unexpected, Nutri-Score might have not only attracted more attention but also encouraged a greater preference for foods previously considered unhealthy by consumers, possibly depleting (rather than augmenting) the cognitive resources needed for self-control (Hagger et al., 2010; Hare et al., 2009; Tangney et al., 2004; Weathers et al., 2017). This explanation would be consistent with self-regulated choice frameworks in which healthier choices result from an equilibrium among reward assessment and cognitive control processes (Hare et al., 2009; Lim et al., 2018). For example, most participants in our sample considered natural peach juice healthier than artificially sweetened peach tea. However, they might have perceived the artificially sweetened peach tea as more attractive than natural peach juice. Consistent with the healthiness beliefs, 58% of people chose peach juice over peach tea, likely resisting the urge to buy the more attractive but less (supposedly) healthy tea. But, when the Nutri-Score was favorable to peach diet tea (B) and unfavorable to peach juice (E), the probability of choosing peach diet tea increased markedly, with 61% of participants choosing it. The effect was even more pronounced (or at least not attenuated) when health goals were activated, with 72% choosing peach diet tea.

This picture may indicate an unexpected effect of the Nutri-Score. According to dual-process theories, unexpected information about the Nutri-Score could, in cases such as this, deplete (instead of augment) the cognitive resources required for System 2 processing, thereby allowing System 1 hedonic processes to prevail, prompting consumers to choose foods previously considered unhealthy but judged as tastier. This process would occur only when consumers try to resist the temptation to choose a food that they consider healthier but less palatable. Resisting the temptation is a resource consuming task in itself. A contrary-to-expectation Nutri-Score would make this effort unmotivated. Because we did not directly measure attention to the label or experienced conflict at the moment of choice, we cannot adjudicate whether belief-disconfirming effects primarily reflect increased evaluation or reduced need for restraint; we therefore interpret these mechanisms as plausible alternatives.

The implications of this finding are significant: Nutri-Score labeling could inadvertently steer individuals away from an "assumed" healthy diet (according to the individual's personal view), reducing self-control and alignment with personal health goals, perhaps, contravening its intended purposes. It could be argued that the goal of the Nutri-Score is to guide consumers toward a diet deemed healthy by nutritionists rather than by consumers' personal beliefs. But, some authors might argue that the purpose of labeling should be to help individuals make healthier choices based on their (not nutritionists') health goals, which is in line with a libertarian paternalism approach (Sunstein, 2014). This observation highlights the need for further research to explore these dynamics more fully. However, determining with accuracy whether an individual's choice is motivated by hedonic principles or healthy ones is experimentally challenging given the complicated interaction between personal preferences, experiences, knowledge, and situational factors.

Overall, our findings are consistent with an account suggesting that the impact of Nutri-Score labeling on food choices might not be purely automatic but might be based on an analytical-systematic process that interacts significantly with consumers' preexisting cognitive processes and beliefs. The influence of the Nutri-Score indeed was moderated by alignment or contradiction with these beliefs, with greater persuasive effects when labeling contradicted expectations. The role of the intervention in activating health goals and eliciting analytical thinking suggests that the effect of the Nutri-Score is enhanced by improving consumer reflection, strengthening the analytical basis of its main process.

More broadly, the present findings fit a wider literature showing that informational interventions do not operate only through the provision of objective content but through the psychological and psychosocial processes they activate in recipients. In this sense, the effects of Nutri-Score labeling appear to depend not merely on the informational content of the label itself but on whether the decision context makes health considerations salient and whether the label aligns with or challenges prior beliefs. This perspective is consistent with broader work showing that the impact of information-based interventions depends on the psychological pathways through which they are received and used (e.g., Niu et al., 2026).

Limitations and Future Research

Although this study offers new potential insights into the mechanisms through which Nutri-Score labeling affects consumer behavior, several limitations should be acknowledged. Primarily, the experimental design may not fully replicate real-world purchasing environments. The choices made by participants were measured in a controlled setting, which may not fully account for the range of factors influencing decisions in actual retail contexts, such as shelf placement, promotional activities, environment, and social context. Because choices were elicited in a static online task, replication in more naturalistic shopping contexts (e.g., simulated or in-store environments) is needed to test ecological generalizability. Relatedly, while the laboratory manipulation increased self-reported deliberation, it was intentionally brief, and future studies could test stronger primes and incorporate more precise process measures.

Second, one of the independent variables in our analyses, namely, prior beliefs about product healthiness, was not experimentally manipulated but rather extracted from existing consumer perceptions; in contrast to the Nutri-Score labeling and the intervention, which were subjected to a systematic manipulation within a controlled experimental design (i.e., the same products were presented with or without the label and the intervention), the prior beliefs factor involved a comparison of different products across the confirming and disconfirming conditions. This implies that the products in the confirming versus disconfirming conditions were not identical, which could have introduced confounding variables. Other unmeasured differences between these products, such as brand reputation, familiarity, taste expectations, or packaging design, could have influenced participants' choices. Although experimentally manipulating prior beliefs presents practical challenges if one wants to use real products and real Nutri-Score values, this limitation must be acknowledged. Future research could explore methods to control or manipulate prior beliefs more directly in order to isolate their effect, for example, by using fictional products or fictional Nutri-Score values. Future studies could also try to separate the directions across pairs (e.g., by orthogonally manipulating expectedness and label valence) to more directly disentangle deliberation from relaxed restraint accounts, although this could be hard to achieve given that shifting consumer preferences toward the lower Nutri-Score item might be an unrealistic goal.

Finally, real-world purchase decisions are influenced by marketing mix factors such as pricing, promotions, shelf placement, and brand advertising. These factors were not measured or manipulated in the present task, which used static product displays without price or promotional information. Future field studies should test whether Nutri-Score effects are amplified or attenuated under realistic retail conditions (e.g., price promotions, end-cap displays) and whether effects vary by brand familiarity or brand equity.

Constraints on Generality

We acknowledge several constraints on the generality of our results. These constraints relate to the characteristics of the participants, the materials used, and the context of the study. Our study was conducted on Italian consumers in a laboratory setting. The Italian cultural context, including eating habits, unfamiliarity with Nutri-Score labeling, and attitudes toward health and nutrition, may have influenced the observed effects. Therefore, the generalizability of our results to consumers from different cultural or national backgrounds is uncertain. For example, in countries where Nutri-Score labeling is more widespread or where consumer health consciousness is different, the impact of labeling and interventions may vary. Although we believe that the cognitive mechanisms underlying decision making are universal, cultural factors could modulate the extent to which Nutri-Score labeling influences choices. The food products used in the study were well-known Italian brands (at least according to the authors). This means that product characteristics such as brand loyalty, packaging design, or taste expectations could influence choices by interacting with the Nutri-Score labeling. Although we have tried to select products representative of common consumer choices and have tried to vary the products as much as possible, the specific attributes of the materials used limit the generality of the results to other products or categories. Future research could vary the product selection or include a wider range of items to test the robustness of the effects. In addition, cross-market differences in food-production standards and labeling regulations (e.g., Europe vs. the United States vs. Canada) may yield differences in product formulation and labeling conventions; therefore, replications using country-specific product sets are needed to evaluate the generalizability of the observed effects.

As mentioned in the limitations, the study was conducted in a laboratory environment, which, while allowing for the control of extraneous variables, does not fully reproduce the complexity of real-world shopping environments. We acknowledge that the controlled environment may have accentuated the participants' focus on Nutri-Score labels and health-goal intervention, potentially amplifying their effects compared to what might occur in everyday settings. At the same time, we consider that the fundamental cognitive processes observed (i.e., prior belief effects, intervention effects, labeling effects) are not exclusive of laboratory settings but are normal processes of everyday reasoning.

Practical Implications

The findings of this study have important practical implications for policymakers, the food industry, and health promoters. For policymakers, large-scale implementation of Nutri-Score labeling could prove to be an effective strategy for promoting higher Nutri-Score options, provided that labeling is supported by targeted interventions to activate health goals. Nutri-Score effects indeed seem to depend on goal salience; therefore, implementation strategies that increase label visibility and comprehension should strengthen its impact, for example, using standardized location on the front of pack (same zone across brands) so shoppers learn where to look or by using a consistent size and contrast rules (minimum label size; avoid clutter around it) so the label is not visually "lost." Also, repeating the Nutri-Score next to the price label on the shelf can help. Brief explanatory materials (e.g., a one-sentence legend clarifying that A–E summarizes overall nutritional quality per 100 g/100 ml and is intended for within-category comparisons) and short health-goal prompts at the point of decision (e.g., "take a moment to compare Nutri-Scores before choosing") could be valuable strategies, whereas introducing the Nutri-Score into the market without such implementation strategies that stimulate attention and understanding of the label might not have a strong impact.

For the food industry, manufacturers have the opportunity to reformulate products to achieve a more favorable Nutri-Score score. More broadly, Nutri-Score is best interpreted as a relative, within-set cue that supports substitution toward the higher Nutri-Score option among close alternatives, rather than as an absolute indicator that a product is "healthy." This can be beneficial even when the "healthier" option is still an indulgent food, because the label is not intended to equate such items with minimally processed foods (e.g., vegetables) but to summarize nutritional quality for within-category comparisons and to incentivize reformulation (by the industry). On the other hand, when a tempting product receives an unexpectedly favorable score, the label may be interpreted as permissive; health promoters wishing to use the label could therefore emphasize that Nutri-Score supports comparisons within a category and complements (rather than replaces) broader dietary guidance.

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