

Front-of-Pack Nutritional Labels as retail demand cues: Evidence from five voluntary-labeling markets

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ABSTRACT

Front-of-Pack Nutritional Labels (FOPLs) are usually examined as consumer information tools or public-health disclosures. In voluntary-labeling markets, they may also operate as on-pack retail cues whose adoption, visibility, and framing may be shaped by retailers and brand owners. Across five randomized between-subjects experiments with adult consumers recruited through Prolific in Poland, Spain, Italy, Portugal, and Greece (N = 731), participants evaluated manipulated product stimuli manipulated by label format, retailer framing, or endorsement source. Nutri-Score, an interpretive summary label, generated higher perceived healthiness than NutriInform Battery, a nutrient-specific label. This healthiness inference was associated with brand attitude and purchase intention across private-label and national-brand contexts. Studies 4 and 5 qualified this pattern: retailer-authored health-commitment framing did not amplify the Nutri-Score pathway, while retailer endorsement produced lower perceived healthiness, higher brand attitude, and no reliable net change in purchase intention. The findings indicate that voluntary FOPLs can operate as information disclosures and retailer-manageable cues that influence product and brand evaluation. They also suggest that managerial and policy assessments of FOPLs should consider label format, endorsement framing, and label source.

1. Introduction

Front-of-Pack Nutritional Labels (FOPLs) are usually studied and governed as public-health disclosures intended to present nutrition information in ways that support healthier choices (European Commission, 2020, 2021; World Health Organization, 2019). Prior research has examined how label formats affect attention, comprehension, perceived healthiness, and choice (Ikonen et al., 2020, 2025). Yet food choices are made in retail environments where consumers face dense assortments, limited attention, and multiple competing cues (Inman et al., 2009; Kahn, 2017). In these settings, FOPLs are visible on-pack cues that may affect product evaluation at the point of choice.

This retail perspective is particularly relevant in voluntary-labeling markets: when FOPLs are not mandatory, decisions about whether to display a label, which labeling scheme to adopt, and how to frame the label become embedded in retailer and brand-owner decisions (European Commission, 2020; Gielens et al., 2021). The label retains its informational role, but the same policy-designed disclosure may also function as a retail cue that shapes perceived product healthiness, brand

attitude, and purchase intention, especially when it enters packaging, private-label architecture, and category positioning decisions (Ailawadi and Keller, 2004; Gielens et al., 2021; Ikonen et al., 2025).

Recent research in retailing and consumer services supports examining FOPLs within the retail cue environment. Healthier food choices in stores depend on how nutrition information is combined with shelf allocation and product visibility (Grandi et al., 2021). Retail cues can also gain or lose diagnostic value depending on their consistency with product attributes (Sharma and Gour, 2026). Structural retail choices can also operate as signals that affect perceived commitment, brand attitudes, and downstream responses (Shin et al., 2026). We build on this stream by examining FOPLs as on-pack cues whose consumer effects depend on label format and endorsement framing in voluntary retail markets. Rather than introducing a new general theory, the term “retail demand cues” describes how policy-designed disclosures enter the retail cue environment when adoption, visibility, and source framing are discretionary.

This paper addresses two gaps in particular. First, FOPL research has largely examined labels as public-health or consumer-information

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interventions, whereas recent retailing research shows that visual design cues, information display, cue diagnosticity, and disclosure framing can shape consumer responses in retail environments (Gupta and Hagtvedt, 2026; Jha et al., 2026; Romero et al., 2026; Sharma and Gour, 2026). Less is known about how FOPLs operate when adoption and framing are partly shaped by retailers and brand owners. Second, prior research has rarely examined whether alternative FOPL formats activate the same healthiness–attitude–purchase intention pathway across private-label and national-brand contexts, or whether retailer involvement changes that pathway.

We examine these gaps in voluntary-labeling markets, focusing on consumer evaluations rather than observed marketplace demand. The five country studies are treated as conceptual replications across retail conditions, not as tests of cultural differences.

Accordingly, the paper addresses three research questions: whether interpretive and nutrient-specific FOPL formats differ in their ability to activate perceived healthiness; whether the healthiness–attitude–purchase intention pathway holds across private-label and national-brand contexts; and whether retailer involvement changes the strength or composition of this pathway. The corresponding objectives are to compare Nutri-Score and NutriInform Battery, test the sequential consumer-response pathway, and examine retailer commitment framing and endorsement source as boundary conditions.

We address these gaps through five experiments conducted in European voluntary-labeling markets: Poland, Spain, Italy, Portugal, and Greece. Studies 1–3 compare Nutri-Score, an interpretive summary label, with NutriInform Battery, a nutrient-specific label. These studies test whether label format influences perceived product healthiness and whether this inference carries forward through brand attitude and purchase intention across private-label and national-brand contexts. Studies 4–5 examine two boundary conditions. Study 4 tests whether retailer-authored health-commitment framing strengthens the Nutri-Score pathway. Study 5 holds Nutri-Score constant and tests whether endorsement by a retailer rather than a public authority changes perceived product healthiness, brand attitude, and purchase intention.

This research makes three contributions. First, it extends retail cue theory by showing how a policy-designed disclosure can enter the retail cue environment under voluntary adoption (Inman et al., 2009; Grewal et al., 2017; Sharma and Gour, 2026). Second, it contributes to consumer behavior research in retail food settings by identifying a sequential pathway through which FOPL format affects purchase intention via perceived healthiness and brand attitude (Kozup et al., 2003; Newman et al., 2014; Spears and Singh, 2004). Third, it contributes to research on retailer involvement and framing by showing that retailer-authored commitment framing does not amplify the FOPL pathway, while retailer endorsement shifts responses between lower perceived healthiness and higher brand attitude (Friestad and Wright, 1994; Campbell and Kirmani, 2000; Romero et al., 2026).

2. Theoretical development

2.1. FOPLs as on-pack retail cues

Retailers influence consumer evaluation by organizing the cues available at the point of choice. This role aligns with choice-construction and retail customer-experience research (Bettman et al., 1998; Grewal et al., 2009; Roggeveen and Sethuraman, 2020). These cues include packaging information, shelf position, display structure, price presentation, and other elements that help consumers make judgments under limited attention (Ailawadi and Keller, 2004; Inman et al., 2009; Kahn, 2017; Grewal et al., 2017; Gielens et al., 2021; Jha et al., 2026). In food retailing, this cue architecture is particularly important because consumers often make repeated, low-involvement choices in dense assortments. Prior retailing and consumer research on healthy food choice shows that nutrition information is more effective when considered together with the retail environment in which it is encountered,

including shelf display and product visibility (Grandi et al., 2021).

Private labels provide a central context for this argument, as they have evolved from low-cost substitutes into differentiated brand portfolios through which retailers control product attributes, packaging, quality tiers, positioning relative to national brands, and brand signaling (Ailawadi and Keller, 2004; Choi and Coughlan, 2006; ter Braak et al., 2013; Gielens et al., 2021). Because consumers often rely on heuristic cues when assessing private-label quality, on-pack information carries particular weight in private-label evaluation (DelVecchio, 2001; Richardson et al., 1994). In national-brand contexts, retailer influence is more indirect and operates through listing, visibility, category positioning, and manufacturer relationships. Private-label introduction, economy tiers, and national-brand listings can also reshape assortment, prices, and retail-format positioning (Vroegrijk et al., 2016; Geyskens et al., 2024; Ma and Siebert, 2024). Retailers therefore can manage the same FOPL directly in private-label settings, whereas in national-brand settings their influence works through listing and category decisions rather than direct control.

Under mandatory regulation, labeling schemes operate as exogenous requirements applied uniformly across the market. Under voluntary regimes, FOPLs become discretionary product cues: retailers and brand owners can decide whether labels are adopted, which scheme is selected, how consistently labels are deployed across product lines, and how labeling choices are framed. We use “retail demand cue” to refer to this specific extension of cue-based evaluation: a visible product cue whose retailer-mediated adoption and framing can affect purchase-relevant evaluations. The term clarifies how a policy-designed disclosure enters retail cue architecture under voluntary adoption. The intensity of private-label presence within a category conditions how marketing signals are received (Gijzenberg et al., 2026), and is therefore likely to matter for FOPL effects as well.

2.2. Label interpretiveness and perceived healthiness

Consumer evaluation of packaged foods often occurs under time pressure, limited attention, and dense choice conditions. In these settings, consumers rely on salient and easily interpretable cues that reduce processing effort (Van Herpen and Pieters, 2007; Grewal et al., 2017; Jha et al., 2026). Perceived healthiness is one diagnostic dimension in food categories because health-related signals can drive broader product and brand evaluations (Newman et al., 2014; Ikonen et al., 2020; Gupta and Hagtvedt, 2026). Prior work shows that nutrition claims and FOPLs alter understanding, liking, and evaluative responses (Keller et al., 1997; Talati et al., 2017; Mazzù et al., 2023, 2024).

Interpretive summary labels such as Nutri-Score compress multidimensional nutritional profiles into a single color–letter signal. This format reduces the effort required to form an overall healthiness judgment. Nutrient-specific schemes such as NutriInform Battery preserve nutrient-level granularity, but require consumers to process numerical information, integrate multiple nutrient indicators, and infer the overall meaning of the label. This interpretive burden can reduce the likelihood that the label is translated into an immediate healthiness inference in low-involvement grocery settings.

The distinction between summary and nutrient-specific labels therefore concerns the ease with which nutritional information is translated into an evaluative judgment. Holding product and category constant, interpretive summary labels should elicit higher perceived product healthiness than nutrient-specific formats.

- H1. Products displaying an interpretive summary label (Nutri-Score) elicit higher perceived product healthiness than equivalent products displaying a nutrient-specific label (NutriInform Battery).

2.3. The healthiness–attitude–purchase intention pathway

Perceived product healthiness captures a broader evaluative

inference about the product. Food evaluations also involve trade-offs among health, taste, and complementary consumption goals (Dhar and Simonson, 1999). Health cues can feed into product evaluation beyond the specific nutritional information they convey (Kozup et al., 2003; Chandon and Wansink, 2007; Gupta and Hagtvedt, 2026). These inferences can spill over from product evaluation to brand evaluation across national brands and private labels. Consistent with customer-based brand equity theory, product-level associations can contribute to brand-level evaluations when they become linked to the brand in memory (Keller, 1993). Accordingly:

- H2. Higher perceived product healthiness is associated with more favorable brand attitude.

Brand attitude is a proximal antecedent of purchase intention, as favorable attitudes increase choice likelihood by shaping affective responses, reducing uncertainty, and facilitating decision closure (Spears and Singh, 2004). In grocery settings characterized by repeated and low-stakes decisions, brand attitudes operate as efficient decision shortcuts. Accordingly:

- H3. More favorable brand attitude is associated with higher purchase intention.

These arguments suggest that FOPL format can influence purchase intention through a sequential process. Labeling schemes first affect perceived product healthiness, which then influences brand attitude and purchase intention, consistent with cue-based accounts of product evaluation and brand response (Kozup et al., 2003; Newman et al., 2014; Spears and Singh, 2004). This sequence reflects a purchase-relevant consumer-response pathway rather than a direct persuasive effect of FOPL on choice.

- H4. Nutri-Score, compared with NutrInform Battery, increases purchase intention through a sequential mediation process in which higher perceived product healthiness leads to more favorable brand attitude.

The same sequence should operate across branding contexts. Private labels and national brands differ in equity, familiarity, and trust, yet consumer evaluations in both contexts are influenced by product cues and brand associations (Ailawadi and Keller, 2004; Keller, 1993; Gielens et al., 2021). The basic consumer-response pathway linking healthiness perceptions to attitudes and intentions should therefore remain stable. The strength with which a given labeling format activates the pathway, however, may vary across contexts. Therefore:

- H5. The indirect pathway linking Nutri-Score to purchase intention through perceived product healthiness and brand attitude holds across private-label and national-brand contexts.

2.4. Retailer involvement and endorsement source

In voluntary environments, retailer involvement forms part of the cue context surrounding FOPLs. Among the forms retailer involvement can take, two warrant particular attention: retailer-authored commitment framing and endorsement source. Both retain the primary label cue while varying the surrounding retail signal, treated here as boundary conditions of the same consumer-response pathway. Once a standardized interpretive label is present, retailer-authored health claims may provide limited incremental diagnosticity because consumers already rely on salient product and retail cues when forming evaluations (Inman et al., 2009; Grewal et al., 2017; Sharma and Gour, 2026). We therefore test:

- H6. Retailer health-commitment framing does not amplify the indirect effect of Nutri-Score on purchase intention through perceived product healthiness and brand attitude.

Voluntary adoption also introduces a source dimension. The same label may be interpreted differently depending on whether it is presented as promoted by a public authority or by a retailer. A public source may reinforce perceived independence, whereas a retailer source may make commercial motives more salient (Friestad and Wright, 1994; Campbell and Kirmani, 2000; Romero et al., 2026). Retailer endorsement may therefore reduce the healthiness implication of the label while improving brand attitude if consumers interpret the retailer as offering useful decision support. We therefore propose:

- H7a. Retailer endorsement, compared with Ministry endorsement, reduces perceived product healthiness.
- H7b. Retailer endorsement, compared with Ministry endorsement, increases brand attitude after accounting for perceived product healthiness.
- H7c. Because H7a and H7b operate in opposite directions, retailer endorsement yields offsetting indirect effects on purchase intention, resulting in no reliable total effect.

Table 1 summarizes the country, context, design, and sample size of the five studies. A fuller overview of manipulations, mediators, outcomes, and main results is reported in the Supplementary Appendix (Table A.1). Participants were recruited and compensated through Prolific and randomly assigned to one condition. Product stimuli and questionnaires were administered in local languages to avoid foreign-language processing effects (Costa et al., 2014). The five studies are intended as conceptual replications across retail conditions rather than tests of country-level differences. Because country, category, brand context, and manipulation vary across studies, the design does not isolate cultural effects. PROCESS Model 6 was used when the hypotheses involved serial mediation through perceived healthiness and brand attitude. PROCESS Model 83 was used in Study 4 because retailer commitment framing was modeled as a moderator of the serial mediation pathway. Indirect effects are interpreted through bootstrap confidence intervals because their sampling distribution is often asymmetric, making bootstrap intervals more appropriate than normal-theory significance tests (Hayes, 2022). Fig. 1 represents the proposed conceptual model.

3. Study 1: FOPL format and brand type

3.1. Objective, sample, design, and model

Study 1 tested whether Nutri-Score and NutrInform Battery differ in

Table 1
Study design and samples.

Study	Country	Context	Design	N
1	Poland	Private label; National brand	2 × 2: brand type × label format	202
2	Spain	Private label	Nutri-Score vs. NutrInform Battery	76
3	Italy	National brand	Nutri-Score vs. NutrInform Battery	99
4	Portugal	Private label	FOPL presence × commitment framing	244
5	Greece	Private label	Ministry vs. retailer endorsement	110

Note. For Studies 2 and 3, target sample sizes were set before fieldwork based on feasible Prolific recruitment within the available budget and eligible respondent pool. Final samples reflect valid, complete responses collected within the planned fieldwork window after applying study eligibility and data-quality screens.

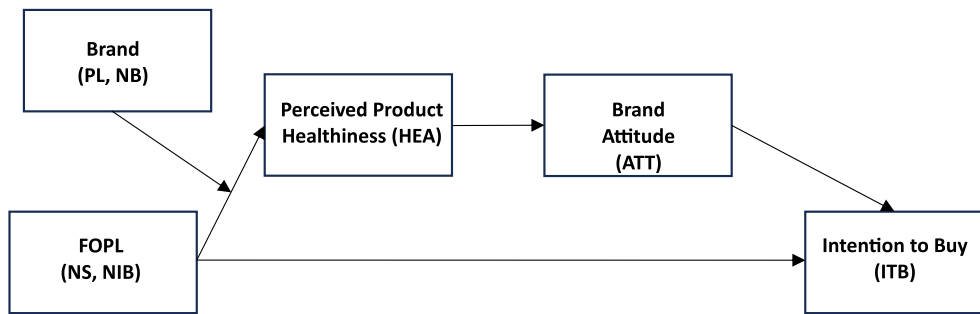


Fig. 1. – Primary conceptual model. Studies 4 and 5 examine retailer commitment framing and endorsement source as boundary conditions of this pathway.

their effects on perceived healthiness, brand attitude, and purchase intention, and whether this pathway varies across private-label and national-brand contexts. The experiment was conducted with 202 Polish consumers recruited through Prolific. The study used a 2×2 between-subjects design crossing brand type (0 = national brand; 1 = private label) with label format (Nutri-Score vs. NutrInform Battery). Perceived healthiness and brand attitude were modeled as sequential mediators of purchase intention. Measures of brand attitude and purchase intention follow established consumer-research measures (Spears and Singh, 2004); pretest details, reliability statistics, descriptive statistics, and stimuli are reported in the Supplementary Appendix.

3.2. Results

Brand type did not moderate the effect of label format on perceived healthiness or the indirect effect on purchase intention. The index of moderated mediation was not significant ($b = 0.0962$, $SE = 0.1064$, 95% CI $[-0.1099, 0.3211]$). Label format nevertheless affected the consumer-response pathway. With label format coded 0 = Nutri-Score and 1 = NutrInform Battery, moving from Nutri-Score to NutrInform Battery reduced perceived healthiness ($b = -0.904$, $SE = 0.214$, $p < .001$, 95% CI $[-1.329, -0.478]$; Cohen's $d \approx 0.59$). Perceived healthiness positively predicted brand attitude ($b = 0.458$, $SE = 0.042$, $p < .001$, 95% CI $[0.376, 0.540]$) and purchase intention ($b = 0.398$, $SE = 0.065$, $p < .001$, 95% CI $[0.272, 0.523]$). Brand attitude also predicted purchase intention ($b = 0.609$, $SE = 0.086$, $p < .001$, 95% CI $[0.440, 0.778]$). The direct effect of label format on purchase intention was not significant ($b = 0.005$, $SE = 0.161$, $p = .977$, 95% CI $[-0.313, 0.323]$). The final purchase-intention model explained $R^2 = 57.4\%$ of variance. Including age, gender, education, and private-label usage as covariates did not change the pattern of results.

Study 1 supports H1–H5. Nutri-Score generated higher perceived healthiness than NutrInform Battery, and this difference carried forward through brand attitude and purchase intention. The pathway was observed across private-label and national-brand contexts.

4. Study 2: private-label robustness

4.1. Objective, sample, design, and model

Study 2 examined the same label-format pathway in a fully private-label context. The experiment was conducted with 76 Spanish consumers. Participants evaluated a Carrefour private-label product displaying either Nutri-Score or NutrInform Battery. This design isolates a setting in which packaging and on-pack information are under retailer control. Perceived healthiness and brand attitude were modeled as sequential mediators of purchase intention.

4.2. Results

Perceived healthiness was higher in the Nutri-Score condition ($M = 5.88$, $SD = 0.94$) than in the NutrInform Battery condition

($M = 4.98$, $SD = 1.37$; Cohen's $d \approx 0.78$). Moving from Nutri-Score to NutrInform Battery reduced perceived healthiness ($b = -0.5549$, $p = .0179$, 95% CI $[-1.0113, -0.0984]$). Perceived healthiness predicted brand attitude ($b = 0.3457$, $p < .001$, 95% CI $[0.1934, 0.4981]$), and brand attitude predicted purchase intention ($b = 0.6865$, $p = .0002$, 95% CI $[0.3362, 1.0369]$). The direct effect of label type on purchase intention was not significant ($b = -0.3278$, $p = .1549$). Retailer trust and private-label usage were positive predictors of brand attitude.

Bootstrap analyses showed that the total indirect effect was not significant (Effect = -0.0015 , BootSE = 0.1920 , 95% CI $[-0.3687, 0.3910]$), reflecting offsetting pathways. The serial indirect effect through perceived healthiness and brand attitude was significant. The purchase-intention model explained $R^2 = 65.3\%$ of variance. Study 2 supports Nutri-Score's healthiness-activation advantage in a private-label setting, while showing that stronger perceived healthiness does not always yield a reliable total indirect effect.

5. Study 3: strong national-brand context

5.1. Objective, sample, design, and model

Study 3 tested whether the label-format pathway also operates when pre-existing brand associations are strong. The experiment was conducted with 99 Italian consumers. Participants evaluated a familiar national-brand product, Mulino Bianco biscuits, displaying either Nutri-Score or NutrInform Battery. The same serial mediation model used in Studies 1 and 2 was estimated, with perceived healthiness and brand attitude as sequential mediators of purchase intention.

5.2. Results

Moving from Nutri-Score to NutrInform Battery reduced perceived healthiness ($b = -0.700$, $SE = 0.229$, $p = .003$, 95% CI $[-1.156, -0.245]$; Cohen's $d \approx 0.60$). Perceived healthiness predicted brand attitude ($b = 0.555$, $SE = 0.104$, $p < .001$, 95% CI $[0.349, 0.760]$) and purchase intention ($b = 0.434$, $SE = 0.118$, $p < .001$, 95% CI $[0.199, 0.669]$). Brand attitude also predicted purchase intention ($b = 0.476$, $SE = 0.104$, $p < .001$, 95% CI $[0.271, 0.682]$). Label format had no reliable direct effect on purchase intention ($b = 0.297$, $p = .227$), and the total effect was not significant ($b = -0.019$, $p = .950$).

Bootstrap indirect effects supported the pathway. The indirect effect through perceived healthiness was significant (Effect = -0.3038 , 95% CI $[-0.5963, -0.0762]$), as was the serial indirect effect through perceived healthiness and brand attitude (Effect = -0.1851 , 95% CI $[-0.4094, -0.0413]$). Study 3 shows that strong brand familiarity does not eliminate the indirect pathway, although label format does not generate a reliable direct or total effect on purchase intention. The purchase-intention model explained $R^2 = 41.7\%$ of variance.

Studies 1–3 show that interpretive summary labels increase perceived product healthiness relative to a nutrient-specific alternative and that this difference is linked to brand attitude and purchase intention across private-label and national-brand contexts.

6. Study 4: retailer health-commitment framing

6.1. Objective, sample, design, and model

Study 4 tested whether retailer-authored health-commitment framing amplifies the Nutri-Score pathway. The experiment was conducted with 244 Portuguese consumers using a 2×2 between-subjects design crossing FOPL presence (0 = no FOPL; 1 = Nutri-Score) with commitment framing (0 = absent; 1 = high). Perceived healthiness and brand attitude were modeled as sequential mediators of purchase intention. Analyses used PROCESS Model 83 with 5000 bootstrap samples, controlling for private-label use, age, gender, and education.

6.2. Results

FOPL presence increased perceived healthiness ($b = 0.3797$, $SE = 0.1379$, $p = .0064$; Cohen's $d \approx 0.34$), and commitment framing also increased perceived healthiness ($b = 0.3766$, $SE = 0.1374$, $p = .0066$). The FOPL $\times$ commitment interaction was not significant ($b = -0.0039$, $SE = 0.2729$, $p = .9886$). Perceived healthiness predicted brand attitude ($b = 0.3080$, $p < .001$) and purchase intention ($b = 0.6654$, $p < .001$). Brand attitude predicted purchase intention ($b = 0.2803$, $p = .0008$). The direct effect of FOPL on purchase intention was not significant ($b = -0.1586$, $p = .2191$).

The conditional indirect effects were similar across commitment conditions. The index of moderated mediation was not significant (Index = -0.0026 , 95% CI $[-0.3610, 0.3571]$). Study 4 is consistent with H6, as retailer-authored health-commitment framing increased perceived healthiness at the mean level, but did not strengthen the Nutri-Score pathway to purchase intention. The purchase-intention model explained $R^2 = 56.3\%$ of variance.

7. Study 5: endorsement source

7.1. Objective, sample, design, and model

Study 5 tested endorsement source while holding label format constant. Participants in Greece evaluated a private-label milk product from AB Vassilopoulos displayed with Nutri-Score. The manipulation varied whether Nutri-Score was described as promoted by the Ministry of Health or by the retailer. The analysis used PROCESS Model 6 with 5000 bootstrap resamples, estimating the indirect effect of endorsement source on purchase intention through perceived healthiness and brand attitude, with private-label use, age, education, and gender as controls.

7.2. Results

Retailer endorsement, compared with Ministry endorsement, reduced perceived healthiness ($b = -0.408$, $SE = 0.161$, $p = .013$, 95% CI $[-0.727, -0.089]$; Cohen's $d \approx 0.48$). Retailer endorsement increased brand attitude after perceived healthiness and covariates were included ($b = 0.318$, $SE = 0.113$, $p = .006$, 95% CI $[0.095, 0.542]$). Perceived healthiness predicted brand attitude ($b = 0.528$, $SE = 0.067$, $p < .001$), and both perceived healthiness ($b = 0.571$, $p < .001$) and brand attitude ($b = 0.331$, $p = .017$) predicted purchase intention. Endorsement framing had no reliable direct effect ($b = -0.082$, $p = .614$) or total effect ($b = -0.281$, $p = .153$) on purchase intention.

Bootstrap analyses supported the offsetting pattern. Retailer endorsement had a negative indirect effect through perceived healthiness (Effect = -0.233 , 95% CI $[-0.435, -0.054]$), a positive indirect effect through brand attitude (Effect = 0.105 , 95% CI $[0.005, 0.237]$), and a negative serial indirect effect through perceived healthiness and brand attitude (Effect = -0.071 , 95% CI $[-0.185, -0.001]$). The total indirect effect was not significant (Effect = -0.199 , 95% CI $[-0.448, 0.060]$). Study 5 is in line with H7a–H7c. Retailer endorsement altered the relative contribution of the healthiness and brand-attitude paths,

without producing a reliable net change in purchase intention. The purchase-intention model explained $R^2 = 50.6\%$ of variance.

Across studies, the focal manipulations changed perceived healthiness by 0.38–0.90 points on seven-point scales, corresponding to small-to-moderate standardized effects (Cohen's $d = 0.34$ – 0.78 , as reported in Studies 1–5). The purchase-intention models explained $R^2 = 41.7\%$ – 65.3% of variance across studies, indicating that the practical relevance of FOPLs lies mainly in product and brand evaluation rather than in direct shifts in purchase intention. Key path estimates across studies are synthesized in Table 2.

8. General discussion

This research examined how FOPLs influence consumer responses in voluntary-labeling retail markets. Across five experiments in Poland, Spain, Italy, Portugal, and Greece, label format shaped perceived product healthiness, which then influenced brand attitude and purchase intention. Nutri-Score generated stronger healthiness inferences than NutriInform Battery across private-label and national-brand contexts. The studies also show that stronger perceived healthiness does not always produce a reliable total effect on purchase intention, because healthiness and brand-attitude pathways can operate with different strengths across contexts. The absence of reliable direct effects on purchase intention across several studies suggests that FOPLs operate through evaluation rather than persuasion: they change how consumers interpret product healthiness, and that interpretation then feeds into brand attitude and purchase intention. This pattern echoes cue-based evaluation, where on-pack labels affect product appraisal before affecting purchase-relevant outcomes.

The findings extend research on healthy food choice in retail environments. Prior work shows that nutrition information in stores interacts with shelf allocation, product visibility, category characteristics, and the broader retail choice environment (Grandi et al., 2021). Our results add that the format of FOPL information matters because it affects how easily consumers translate nutrition information into healthiness inferences. Interpretive labels provide less granular information than nutrient-specific labels, but they offer greater evaluative efficiency at the point of choice.

The results are also aligned with recent research on retail cue diagnosticity and signaling. Sharma and Gour (2026) show that retail cues shape product evaluation when consumers perceive them as diagnostic and consistent with product information. Shin et al. (2026) show that retail business-model choices can operate as signals that shape perceived commitment and brand attitudes. Voluntary FOPLs can likewise function as on-pack cues that shape product-level and brand-level evaluations. Their effect depends on information format and endorsement source.

This interpretation also clarifies the role of the five-country design. The studies were not designed to estimate country effects or compare national cultures. They use different voluntary-labeling markets to examine the proposed mechanism across variation in brand type, category, retailer involvement, and endorsement source.

A key implication is that voluntary labeling regimes create a practical interface between public-health objectives and retail decision-making. Labels designed to inform consumers may become part of packaging, private-label, and category-positioning decisions. Rather than implying that retailers can fully control label meaning, the evidence points to a more limited effect: retailers may benefit from the brand-attitude value of label endorsement, while explicit retailer endorsement can also reduce perceived healthiness relative to public endorsement.

8.1. Theoretical implications

Three theoretical implications follow. First, it extends retail cue theory to voluntary FOPL environments. Prior retail research shows that

Table 2

Key path estimates across studies. The predictor X differs by study: label format in Studies 1–3, FOPL presence in Study 4, and endorsement source in Study 5.

Study	X to HEA	HEA to ATT	HEA to ITB	ATT to ITB	X to ITB direct	Main interpretation
1	−0.904***	0.458***	0.398***	0.609***	n.s.	NutriInform lowers HEA versus Nutri-Score
2	−0.555*	0.346***	0.215†	0.687***	n.s.	NutriInform lowers HEA; total indirect effect n.s.
3	−0.700**	0.555***	0.434***	0.476***	n.s.	Indirect paths significant; total effect n.s.
4	0.380**	0.308***	0.665***	0.280***	n.s.	Commitment does not moderate the pathway
5	−0.408*	0.528***	0.571***	0.331*	n.s.	Retailer endorsement lowers HEA, raises ATT

Note. In Studies 1–3, X is coded as NutriInform Battery relative to Nutri-Score. In Study 4, X is Nutri-Score presence relative to no FOPL. In Study 5, X is retailer endorsement relative to Ministry endorsement. †p < .10; *p < .05; **p < .01; ***p < .001.

consumers rely on cues embedded in assortments, displays, packaging, interfaces, and product presentation when making judgments under limited attention (Inman et al., 2009; Grewal et al., 2017; Jha et al., 2026). The evidence indicates that a policy-designed nutrition disclosure can enter the same cue architecture when adoption and framing are discretionary. The contribution specifies how FOPLs operate as retailer-managed or retailer-mediated cues in voluntary-labeling markets.

Second, the research contributes to consumer behavior research in retail food settings by identifying a sequential pathway through which FOPL format affects purchase intention. Label format first shapes perceived product healthiness, which then influences brand attitude and purchase intention (Kozup et al., 2003; Newman et al., 2014). This helps explain why FOPLs affect consumer response even when direct effects on purchase intention are absent. The theoretical implication is that FOPLs shape evaluative processing before any behavioral response is likely to emerge.

Third, the research contributes to source and governance-cue research. Retailer-authored health-commitment framing did not amplify the Nutri-Score pathway, suggesting that additional self-authored claims may add little once a standardized interpretive label is present. Retailer endorsement, however, reduced perceived healthiness and increased brand attitude (Friestad and Wright, 1994; Campbell and Kirmani, 2000; Romero et al., 2026). Source framing can therefore shift the relative weight of product-level and brand-level evaluations, even when label format remains constant.

8.2. Managerial implications

The findings identify evaluation mechanisms that retailers, manufacturers, and policymakers should consider when assessing FOPL decisions in voluntary-labeling markets. The evidence derives from controlled consumer experiments; the implications therefore concern consumer evaluation processes rather than observed marketplace performance. By country context, Study 1 in Poland points to label-format effects operating across both private-label and national-brand settings. Higher perceived healthiness in the Spanish private-label sample (Study 2) did not translate into a stronger total effect on purchase intention. Study 3 shows that a strong national-brand identity, as in the Italian sample, does not eliminate the indirect pathway. Portuguese consumers (Study 4) did not respond more strongly when retailer-authored commitment framing accompanied Nutri-Score. In Greece, retailer endorsement (Study 5) raised brand attitude while lowering perceived healthiness.

Across these contexts, retailers should consider how easily consumers can translate FOPL information into healthiness judgments. Interpretive labels may reduce evaluation effort, especially for private labels, but the evidence does not imply that retailer endorsement should be used aggressively. When the label is explicitly presented as retailer-promoted, perceived healthiness declines relative to public endorsement. A more credible communication approach would emphasize alignment with recognized public or third-party standards.

For manufacturers, FOPL scheme choice may become relevant in retailer negotiations and category-positioning discussions, especially

when retailers use interpretive labels as part of the product evaluation environment.

For policymakers, the results indicate that voluntary labeling systems should be evaluated by considering consumer comprehension, label format, endorsement source, and the way labels are embedded in retail packaging and category decisions.

8.3. Social implications

For voluntary FOPL systems, the social concern is to preserve usability and source clarity. Labels that are easier to interpret may help consumers form healthiness judgments at the point of choice, but retailer endorsement can also change how credible the healthiness signal appears. From a social perspective, voluntary labeling regimes should therefore avoid ambiguity about who stands behind the label and should make nutrition information accessible without turning the label into a purely commercial cue.

8.4. Limitations and future research

This research has several limitations. First, the studies use adult consumer samples across five European markets, but they are not nationally representative probability samples. Future research should replicate the findings with representative grocery-shopper panels or retailer field data. Second, the evidence is based on controlled experiments and stated intentions, and the mediators and outcome were measured with the same self-report instrument, as is common in this literature. This design isolates the proposed cognitive–evaluative mechanism but cannot fully capture revealed behavior in complex retail environments. Scanner data, loyalty-card records, or quasi-natural experiments following FOPL rollouts would help assess interactions with price, promotion, competing shelf cues, time pressure, and assortment structure.

Third, the studies focus on voluntary-labeling markets and two prominent schemes, Nutri-Score and NutriInform Battery. Future research should compare mandatory and voluntary regimes and examine other formats, including traffic-light systems, endorsement logos, and hybrid health-sustainability labels. Fourth, the studies do not directly measure health consciousness, nutritional literacy, retailer trust, skepticism toward retailer motives, or perceived source independence. These variables may condition endorsement-framing effects and should be measured directly.

9. Conclusions

In voluntary-labeling markets, FOPLs function as information disclosures and on-pack retail cues. Across five European markets, summary labels generated stronger perceived healthiness than nutrient-specific labels. This healthiness inference influenced purchase intention through brand attitude across private-label and national-brand contexts.

Retailer involvement produced different effects depending on how it entered the labeling context. Retailer-authored health-commitment framing did not strengthen the Nutri-Score pathway. Retailer

endorsement reduced perceived healthiness but increased brand attitude, producing offsetting effects on purchase intention. These results suggest that voluntary FOPL systems should be evaluated in terms of information quality, format, source, and retail framing. For managers, policymakers, and food manufacturers, the practical issue is how labels operate once they enter the retail choice environment.

CRedit authorship contribution statement

Marco Francesco Mazzù: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Alessandro Casadei:** Data curation, Formal analysis, Software, Visualization, Writing – original draft, Writing – review & editing. **Angelo Baccelloni:** Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing.

Ethical statement

All studies were conducted in accordance with applicable ethical principles for research involving human participants. Participants provided informed consent before taking part in the studies.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used AI-assisted tools to support language editing. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the manuscript.

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Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jretconser.2026.105057>.

Data availability

The data supporting the findings of this study are available in Harvard Dataverse at <https://doi.org/10.7910/DVN/GMW9M7>.

References

Ailawadi, K.L., Keller, K.L., 2004. Understanding retail branding: conceptual insights and research priorities. *J. Retailing* 80 (4), 331–342.
Bettman, J.R., Luce, M.F., Payne, J.W., 1998. Constructive consumer choice processes. *J. Consum. Res.* 25 (3), 187–217.

Campbell, M.C., Kirmani, A., 2000. Consumers' use of persuasion knowledge: the effects of accessibility and cognitive capacity on perceptions of an influence agent. *J. Consum. Res.* 27 (1), 69–83.
Chandon, P., Wansink, B., 2007. The biasing health halos of fast-food restaurant health claims: lower calorie estimates and higher side-dish consumption intentions. *J. Consum. Res.* 34 (3), 301–314.
Choi, S.C., Coughlan, A.T., 2006. Private label positioning: quality versus feature differentiation from the national brand. *J. Retailing* 82 (2), 79–93.
Costa, A., Foucart, A., Arnon, I., Aparici, M., Apesteguia, J., 2014. "Piensa" twice: on the foreign language effect in decision making. *Cognition* 130 (2), 236–254.
DelVecchio, D., 2001. Consumer perceptions of private label quality: the role of product category characteristics and consumer use of heuristics. *J. Retailing Consum. Serv.* 8 (5), 239–249.
Dhar, R., Simonson, I., 1999. Making complementary choices in consumption episodes: highlighting versus balancing. *J. Mark. Res.* 36 (1), 29–44.
European Commission, 2020. Report from the Commission to the European Parliament and the Council Regarding the Use of Additional Forms of Expression and Presentation of the Nutrition Declaration.
European Commission, 2021. Inception Impact Assessment. Food Labelling—Revision of Rules on Information Provided to Consumers, 2021. Available online: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12749-Food-labelling-revision-of-rules-on-information-provided-to-consumers_en.
Friestad, M., Wright, P., 1994. The persuasion knowledge model: how people cope with persuasion attempts. *J. Consum. Res.* 21 (1), 1–31.
Geyskens, I., Deleersnyder, B., Dekimpe, M.G., Lin, D., 2024. Do consumers benefit from national-brand listings by hard discounters? *J. Acad. Market. Sci.* 52 (1), 97–118.
Gielens, K., Ma, Y., Namin, A., Sethuraman, R., Smith, R.J., Bachtel, R.C., Jervis, S., 2021. The future of private labels: towards a smart private label strategy. *J. Retailing* 97 (1), 99–115.
Gijsenberg, M.J., Schmitt, J., Wieringa, J.E., Srinivasan, S., 2026. Advertising sequence response dynamics and the impact of retail environments. *J. Retailing* 102 (1), 95–113.
Grandi, B., Burt, S., Cardinali, M.G., 2021. Encouraging healthy choices in the retail store environment: combining product information and shelf allocation. *J. Retailing Consum. Serv.* 61, 102522.
Grewal, D., Levy, M., Kumar, V., 2009. Customer experience management in retailing: an organizing framework. *J. Retailing* 85 (1), 1–14.
Grewal, D., Roggeveen, A.L., Nordfält, J., 2017. The future of retailing. *J. Retailing* 93 (1), 1–6.
Gupta, T., Hagtvedt, H., 2026. Upward-tilted logos cue perceptions of unhealthiness. *J. Retailing* 102 (1), 63–77.
Hayes, A.F., 2022. Introduction to Mediation, Moderation, and Conditional Process Analysis: a Regression-based Approach, third ed. Guilford Press.
Ikonen, I., Aydinli, A., Verlegh, P.W.J., 2025. Adding good or removing bad: consumer response to nutrition claims. *J. Retailing* 101 (4), 659–678.
Ikonen, I., Sotgiu, F., Aydinli, A., Verlegh, P.W.J., 2020. Consumer effects of front-of-package nutrition labeling: an interdisciplinary meta-analysis. *J. Acad. Market. Sci.* 48 (3), 360–383.
Inman, J.J., Winer, R.S., Ferraro, R., 2009. The interplay among category characteristics, customer characteristics, and customer activities on in-store decision making. *J. Market.* 73 (5), 19–29.
Jha, S., Balaji, M.S., Guha, A., Biswas, A., See-To, E.W.K., Ravula, P., 2026. The effect of recommendation display position on review persuasiveness: moderating roles of temporal distance, affect, and valence. *J. Retailing* 102 (1), 165–183.
Kahn, B.E., 2017. Using visual design to improve customer perceptions of online assortments. *J. Retailing* 93 (1), 29–42.
Keller, K.L., 1993. Conceptualizing, measuring, and managing customer-based brand equity. *J. Market.* 57 (1), 1–22.
Keller, S.B., Landry, M., Olson, J.M., Velliquette, A.M., Burton, S., Andrews, J.C., 1997. The effects of nutrition package claims, nutrition facts panels, and motivation to process nutrition information on consumer product evaluations. *J. Publ. Pol. Market.* 16 (2), 256–279.
Kozup, J.C., Creyer, E.H., Burton, S., 2003. Making healthful food choices: the influence of health claims and nutrition information on consumers' evaluations of packaged food products and restaurant menu items. *J. Market.* 67 (2), 19–34.
Ma, M., Siebert, R.B., 2024. The impact of private label introduction on assortment, prices, and profits of retailers. *J. Ind. Econ.* 72 (1), 356–389.
Mazzù, M.F., Baccelloni, A., Romani, S., 2023. Counteracting noncommunicable diseases with front-of-pack nutritional labels' informativeness: an inquiry into the effects on food acceptance and portions selection. *Br. Food J.* 125 (13), 562–578.
Mazzù, M.F., He, J., Baccelloni, A., 2024. Unveiling the impact of front-of-pack nutritional labels in conflicting nutrition information: a congruity perspective on olive oil. *Food Qual. Prefer.* 118, 105202.
Newman, C.L., Howlett, E., Burton, S., 2014. Shopper response to front-of-package nutrition labeling programs: potential consumer and retail store benefits. *J. Retailing* 90 (1), 13–26.
Richardson, P.S., Dick, A.S., Jain, A.K., 1994. Extrinsic and intrinsic cue effects on perceptions of store brand quality. *J. Market.* 58 (4), 28–36.
Roggeveen, A.L., Sethuraman, R., 2020. Customer-interfacing retail technologies in 2020 & beyond: an integrative framework and research directions. *J. Retailing* 96 (3), 299–309.
Romero, M., Slejko, G., Abell, A., 2026. The power of words: how linguistic framing affects consent in retail privacy policies. *J. Retailing* 102 (1), 149–164.
Sharma, Y., Gour, A., 2026. Help or hurt? When platform filters contradict product attributes in online retail. *J. Retailing Consum. Serv.* 93, 104875.

- Shin, D.C., Lee, A., Lee, G., 2026. Branded, partnered, or opting out: a comparison of secondhand business models in shaping consumer responses. *J. Retailing Consum. Serv.* 89, 104641.
- Spears, N., Singh, S.N., 2004. Measuring attitude toward the brand and purchase intentions. *J. Curr. Issues Res. Advert.* 26 (2), 53–66.
- Talati, Z., Norman, R., Pettigrew, S., Neal, B., Kelly, B., Dixon, H., Ball, K., Shilton, T., 2017. The impact of interpretive and reductive front-of-pack labels on food choice and willingness to pay. *Int. J. Behav. Nutr. Phys. Activ.* 14, 171.
- ter Braak, A., Dekimpe, M.G., Geyskens, I., 2013. Retailer private-label margins: the role of supplier and quality-tier differentiation. *J. Market.* 77 (4), 86–103.
- Van Herpen, E., Pieters, R., 2007. Anticipated identification costs: improving assortment evaluation by diagnostic attributes. *Int. J. Res. Market.* 24 (1), 77–88.
- Vroegrijk, M., Gijsbrechts, E., Campo, K., 2016. Battling for the household's category buck: can economy private labels defend supermarkets against the hard-discounter threat? *J. Retailing* 92 (3), 300–318.
- World Health Organization, 2019. Guiding Principles and Framework Manual for front-of-pack Labelling for Promoting Healthy Diet.