

## RESEARCH ARTICLE

**(Open Access)**

# Virtual Reality, Eye-Tracking, and Biometric Methods for Examining Food-Quality Labels: A Narrative Review with Implications for Albania

ENXHI MARKU (SHEHU)<sup>1\*</sup>, ARJAN SHUMELI<sup>2</sup>, ERION SHEHU<sup>3</sup><sup>1</sup> Logos University College, Tirana, Albania<sup>2</sup> Agricultural University of Tirana, Tirana, Albania<sup>3</sup> Agricultural University of Tirana, Tirana, Albania

\*Corresponding author; E-mail: enxhimarku@gmail.com

## Abstract

Food-quality labels such as organic, origin, vegan/vegetarian, nutritional, and eco-certifications are increasingly central to consumer decision-making in European markets. Recent research has adopted biometric and immersive methods—eye-tracking, virtual reality (VR), galvanic skin response (GSR), and discrete-choice experiments (DCE)—to examine how these labels attract visual attention, elicit emotional responses, and shape willingness-to-pay (WTP). This paper reviews current evidence and evaluates the feasibility of applying such methods in Albania. The review highlights the robustness of eye-tracking in quantifying label salience, the promise of VR in simulating realistic shopping contexts, and the potential but mixed contributions of GSR and facial coding in capturing emotional arousal. DCEs, meanwhile, provide a cost-effective and accessible means of quantifying consumer preferences, already successfully applied in Albania and neighboring countries. The paper concludes with a practical framework for Albanian researchers, outlining methodological pathways that balance rigor with feasibility, and suggesting alternatives where high-cost biometric tools may not be realistic.

**Keywords:** food labels, consumer behavior, eye-tracking, virtual reality, biometric methods, Western Balkans.

## 1. Introduction

Food quality labels, such as organic, vegan, eco-labels, origin indicators, help communicate product attributes that are not directly visible (product origin, quality measures, sustainability). These labels assure buyers of qualities like origin, production methods, or sustainability that they cannot verify by inspection alone, thereby reducing information asymmetry in the market. Prior research has shown that such extrinsic cues can strongly influence consumer quality perceptions and purchase intentions. (Schrobbach et al., 2023). However, the way consumers perceive these labels goes beyond conscious evaluation. It involves visual attention, emotional engagement and implicit decision-making mechanisms.

In fact, consumers' processing of food labels engages both the explicit and implicit cognitive systems. On one hand, traditional self-report methods (surveys, interviews) capture what consumers say they value –

their stated attitudes and intentions. On the other hand, biometric and immersive measures reveal what consumers actually do and feel in the moment. These newer approaches tap into non-conscious responses: for example, eye-tracking studies objectively record where and how long a person looks (gazes, fixations), reflecting visual attention that often occurs without deliberate thought (Cong et al., 2023).

Although biometric and immersive technologies have produced significant results in the study of food quality labels in developed markets, current literature is lacking in assessing the applicability of these methods in contexts with low institutional trust, limited research resources, and lower exposure to labels, such as Albania and other Western Balkan countries.

The objective of this paper is to synthesize studies which have used these technologies to study food

\*Corresponding author: Enxhi Marku (Shehu); E-mail: enxhimarku@gmail.com  
(Accepted for publication 10.12.2025)

quality labels and evaluate their feasibility in Albania. We focused on these methods: eye-tracking, virtual reality (VR), galvanic skin response (GSR) and facial coding and discrete-choice experiments (DCE).

## 2. Material and Methods

To develop a structured and comprehensive synthesis of biometric and immersive methods applied to the study of food-quality labels, we conducted a targeted search across major scholarly databases, including Taylor & Francis Online, Elsevier (ScienceDirect), EBSCOhost, and Google Scholar. These databases were selected because they provide extensive coverage of peer-reviewed journals in marketing, consumer behavior, psychology, sensory science, food studies, and human–computer interaction, which are central to research using eye-tracking, virtual reality (VR), galvanic skin response (GSR), facial coding, and discrete-choice experiments (DCEs).

The search was performed using combinations of keywords such as “food labels,” “eye-tracking,” “virtual reality supermarket,” “biometric consumer research,” “GSR packaging,” “facial coding emotions,” “willingness to pay,” “discrete-choice experiments,” and “organic label attention.” After screening titles, abstracts, and full texts for relevance, articles were identified as meeting the inclusion criteria for this narrative review.

Because the aim of this paper is methodological synthesis rather than exhaustive cataloguing, the studies were grouped into four methodological clusters, corresponding to the methods most frequently used in food-label research:

1. Eye-tracking (visual attention, fixation patterns, areas of interest).
2. Galvanic skin response (GSR) and facial coding (emotional arousal and affective reactions)
3. Virtual reality (VR) (immersive and ecologically valid shopping simulations)
4. Discrete-choice experiments (DCEs) (stated-preference and willingness-to-pay analysis)

These clusters provide a coherent framework for comparing how different methods capture attention, emotion, and choice behavior in response to food-quality labels.

Following identification and classification, each study was analyzed with regard to:

- the methodological tools used,
- the context and country where the research was conducted,

- the type of food-quality label examined (e.g., organic, origin, eco-label, nutritional), and
  - key empirical findings relevant to consumer behavior.
- This structured approach allowed us to distill the main strengths, limitations, and feasibility considerations for each method, with particular attention to their applicability in Albania, where research resources and technological infrastructure remain developing. The synthesis culminates in identifying research gaps and proposing methodological pathways for future studies in Albania.

## 3. Key Studies and Findings on Biometric Approaches to Food Quality Labels

### 3.1. Eye-Tracking Studies of Label Attention and Salience

Eye-tracking studies gaze paths, fixation duration and areas of interests to study attention in relation to labels. It is the most wide-spread method to study customer’s visual engagement with labels. For example, Delgado et al. (2025) showed that adding the EU organic logo to olive oil packaging not only attracted significantly longer fixations but also increased consumer liking and purchase intent. Similarly, positioning studies reveal that label placement - such as top versus bottom or central screen positioning - affects attention allocation (Graham et al., 2012). Beyond screen-based tests, studies combining VR with eye-tracking have demonstrated that gaze patterns in immersive environments replicate real-world behaviors (Melendrez-Ruiz et al., 2021).

### 3.2. Galvanic Skin Response and Facial Coding

Galvanic skin response (GSR) is used to capture physiological arousal linked to emotional engagement. When applied in packaging research, GSR is frequently combined with eye-tracking and facial-expression coding (López-Mas et al., 2022). Facial coding, using camera-based algorithms, allows researchers to detect subtle expressions of valence such as smiling or frowning. Despite their potential, both methods are resource-intensive and can be sensitive to noise, limiting their practical application in lower-resource contexts.

### 3.3. Virtual Reality

Virtual reality (VR) has emerged as a promising tool to simulate supermarket environments, allowing researchers to control variables while maintaining ecological validity. Validation studies confirm that VR-based consumer choices mirror those observed in physical stores (Jacobsen et al., 2022). Label-focused experiments demonstrate that interventions such as environmental traffic-light labels can significantly shift consumer selections toward more sustainable choices (Arrazat et al., 2023). Integrations of VR with biometric methods, such as eye-tracking, further enhance the ability to study attention and decision-making in realistic but controlled conditions (Melendrez-Ruiz et al., 2021). However, VR requires specialized equipment and technical expertise, which

may limit its uptake in Albania without targeted investments.

### 3.4. Discrete-Choice Experiments (Stated-Preference Surveys)

Discrete-choice experiments (DCEs) are widely applied to estimate consumer preferences and WTP for food attributes, including quality labels. In Albania, Skreli et al. (2017) demonstrated that consumers are willing to pay a premium for organic tomatoes, while research in Serbia has shown strong preferences for domestic-origin products (Džever et al., 2024). DCEs are cost-effective, require no advanced equipment, and provide highly actionable results for both researchers and policymakers. The synthesized approach to the review is presented below in a table.

**Table 1.** Summary of Key Studies Applying Biometric and Immersive Methods to Food-Quality Label Research

<i>Study</i>	<i>Method</i>	<i>Focus of the Study</i>	<i>Key Results</i>
Borgianni et al. (2022)	Eye-tracking	Sustainable product design; Areas of interest	Eco-friendly labels consistently receive longer fixation durations, indicating higher visual salience.
Delpozo et al. (2025)	Eye-tracking	Impact of “EU Organic” & “Sustainable Irrigation” logos on olive oil packaging	Adding eco-labels leads to significantly longer fixations, higher liking, and increased purchase intent.
Graham et al. (2012)	Eye-tracking	Effect of label placement on attention	Labels placed prominently (top/center) receive more gaze attention; positioning strongly influences attention allocation.
Melendrez-Ruiz et al. (2021)	Eye-tracking + VR	Visual attention in VR supermarket contexts	Gaze patterns in VR mirror real-world behavior; visually salient items (“eye-catchers”) attract strong fixation clusters.
López-Mas et al. (2022)	GSR + Eye-tracking + Facial Coding	Packaging co-creation; Visual & textual attributes	Emotional arousal (GSR) and facial expressions correlate with specific design elements; multimethod approach reveals implicit emotional effects not captured by surveys.
Arrazat et al. (2023)	VR	Environmental traffic-light labels in VR supermarket	Environmental labels significantly shift choices toward sustainable options; VR provides high ecological validity for label-effect testing.
Jacobsen et al. (2022)	VR	Validation of consumer behavior in VR vs physical supermarkets	VR shopping behavior (price memory, choices) is statistically comparable to real-store behavior—validating VR for consumer studies.
Melendrez-Ruiz et al. (2021)	VR + Eye-tracking	Combined biometric & VR analysis of product placement	Integration of eye-tracking in VR enhances realism and improves understanding of attention under lifelike conditions.
López-Mas et al. (2022)	Facial Coding	Implicit emotional reactions to packaging	Facial codes (smiles, frowns) reveal subtle emotional differences across packaging variations, but results are sensitive to noise.
Skreli et al. (2017)	DCE	Consumer WTP for organic tomatoes (Albania)	Albanian consumers show positive willingness to pay a premium for organic labels.
Džever et al. (2024)	DCE	WTP for domestic and organic milk (Serbia)	Strong preference for domestic-origin products; WTP varies across Gen Z consumers.

Arrazat et al. (2023)	DCE (embedded in VR trial)	Consumer responses to sustainability labels	to DCE-style choices demonstrate significant preference shifts with environmental traffic-light labels.
-----------------------	----------------------------	---	---

#### 4. Results and Discussion

This literature review sought to achieve two goals: first, to provide a synthesized review of seminal research on the impact of food labels using biometric and immersive methods; second, to offer a careful evaluation of the feasibility of implementing these methods in Albania. The feasibility of these methods varies considerably. High-end biometric tools such as Tobii Pro eye-trackers and GSR sensors remain expensive and technically demanding. However, lower-cost alternatives exist, including mid-range or even webcam - based gaze tracking, portable GSR kits, and open-source facial-analysis software. VR systems are becoming more affordable but still require technical expertise. In contrast, DCEs are highly accessible and can be implemented with existing survey infrastructure and statistical software.

Consequently, discrete-choice experiments should serve as the workhorse for Albanian researchers, while modest investments in biometric or VR tools could progressively enrich the research landscape. Given financial and institutional constraints, Albanian researchers should prioritize DCEs as the most feasible and immediately useful method. Complementary biometric data, such as eye-tracking or facial coding, could be introduced on a pilot basis through collaborations or targeted funding. If resources allow, procuring at least one mid-range VR headset would enable immersive research with considerable added value. Overall, a gradual, hybrid approach - anchored in surveys and DCEs, but supplemented by scalable biometric tools - offers the best path forward for advancing food-label research in Albania and the wider Western Balkans.

#### 5. Conclusions

Food-quality labels influence consumer decisions through a combination of visual attention, emotional engagement, and perceived value. Eye-tracking and VR provide powerful insights into how labels guide attention and shape choices, while GSR and facial coding probe unconscious responses, albeit with mixed results. DCEs quantify the monetary value consumers assign to labels and are particularly well-

suited for contexts such as Albania. By strategically combining these methods, researchers in Albania can generate evidence that informs labeling policy, strengthens consumer trust, and supports integration with EU market standards.

#### 6. Acknowledgements

The authors gratefully acknowledge the insights and discussions generated during the “AGRIIMMERSE” workshop, held in Belgrade, Serbia, and organized by the Leibniz Institute of Agricultural Development in Transition Economies (IAMO) and the Faculty of Agriculture at the University of Belgrade, which inspired the methodological orientation of this review.

#### 7. References

1. Arrazat, C., Müller, S., & Smed, S. (2023). **Traffic-light front-of-pack environmental labelling: A randomised controlled trial in a virtual reality supermarket.** *International Journal of Behavioral Nutrition and Physical Activity*, 20(1), 7. <https://doi.org/10.1186/s12966-023-01410-8>
2. Borgianni, Y., Maccioni, L., & Basso, D. (2022). **A framework to evaluate areas of interest for sustainable products and designs.** *Sustainability*, 14(13), 7931. <https://doi.org/10.3390/su14137931>
3. Cong, L., Luan, S., Young, E., Miroso, M., Bremer, P., & Torrico, D. D. (2023). **The Application of Biometric Approaches in Agri-Food Marketing: A Systematic Literature Review.** *Foods*, 12(16), 2982. <https://doi.org/10.3390/foods12162982>
4. Delpoz, X., Vidal, L., & Ares, G. (2025). **Eye-tracking study on the impact of “EU Organic” and “Sustainable Irrigation” logos on consumer acceptance of olive oil.** *Journal of the Science of Food and Agriculture*, 105(3), 1864–1874. <https://doi.org/10.1002/jsfa.13963>

5. Džever, I., Jeremić, M., & Cvijanović, D. (2024). **Generation Z's willingness to pay for domestic and organic milk: A discrete choice experiment in Serbia.** *Applied Ecology and Environmental Research*, 22(5), 3919–3939.  
[https://doi.org/10.15666/aecer/2205\\_39193939](https://doi.org/10.15666/aecer/2205_39193939)
6. Graham, D. J., Orquin, J. L., & Visschers, V. H. M. (2012). Location, location, location: **Eye-tracking evidence that consumers preferentially view prominently positioned nutrition information.** *Journal of the American Dietetic Association*, 112(11), 1704–1711.  
<https://doi.org/10.1016/j.jada.2011.08.005>
7. Jacobsen, H., Angell, A., & Thøgersen, J. (2022). **Shopping in reality or virtuality? A validation study of consumers' price memory in a virtual vs. physical supermarket.** *Foods*, 11(14), 2111.  
<https://doi.org/10.3390/foods11142111>
8. López-Mas, R., Capozzi, V., Guàrdia, M. D., & Arnau, J. (2022). **Co-creation with consumers for packaging design validated through implicit and explicit methods: Exploratory effect of visual and textual attributes.** *Foods*, 11(9), 1183.  
<https://doi.org/10.3390/foods11091183>
9. Melendrez-Ruiz, J., Velasco, C., & Ares, G. (2021). **An exploratory study combining eye-tracking and virtual reality: Are pulses good “eye-catchers” in virtual supermarket shelves?** *Frontiers in Virtual Reality*, 2, 655273.  
<https://doi.org/10.3389/frvir.2021.655273>
10. Schrobback, P., Zhang, A., Loechel, B., Ricketts, K., & Ingham, A. (2023). **Food credence attributes: A conceptual framework of supply-chain stakeholders, their motives, and mechanisms to address information asymmetry.** *Foods*, 12(3), 538.  
<https://doi.org/10.3390/foods12030538>
11. Skreli, E., Imami, D., Chan-Halbrendt, C., & Canavari, M. (2017). **Assessing consumer preferences and willingness to pay for organic tomatoes in Albania: A conjoint choice experiment.** *Spanish Journal of Agricultural Research*, 15(3), e0114.  
<https://doi.org/10.5424/sjar/2017153-9>