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Submitted: 05/01/2026 - Accepted: 07/02/2026 - Published: 29/03/2026

Neuromarketing in Fast Food: A View About Attention and Intention - Systematic Literature Review

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DOI: 10.26417/vcp16c70

Abstract

Neuromarketing, as a multidisciplinary approach, is relevant in the fast-food sector, characterised by quick decision-making and intense competition. The studies analysed demonstrate that sensory and contextual stimuli, such as packaging, nutritional labelling, point-of-sale lighting, and menu design, significantly influence attention, emotion, perceived value, and purchase intention. Studies indicate that sensory and contextual stimuli, such as packaging, nutritional labelling, lighting, and menu design, influence attention, emotion, perceived value, and purchase intention. Tools such as eye tracking, EEG, GSR/EDA, and neuroimaging techniques allow implicit processes and unconscious responses undetected by traditional methods to be captured. Despite knowledge of decision-making, a gap persists between the decision and the actual purchase. It is concluded that the ethical and rigorous use of neuromarketing can enhance the effectiveness of marketing strategies in the fast-food industry.

Keywords: neuromarketing; fast food; FMCG; purchase intention; consumer behaviour

1. Introduction

This literature review synthesises evidence from 20 studies on the application of neuromarketing and consumer neuroscience to food consumption decisions in fast-food and fast-moving consumer goods (FMCG) markets, characterised by rapid decision-making, low involvement, and intense competitive pressure (Sinha et al., 2024). In contemporary food markets, particularly in fast-food and fast-moving

consumer goods (FMCG), consumer decisions are increasingly made under conditions of time pressure, information overload and intense competition. In such environments, traditional rational-choice models struggle to fully explain purchasing behaviour, as many decisions are driven by automatic, affective and sensory processes rather than deliberate evaluation. This shift has motivated growing academic and managerial interest in approaches capable of capturing implicit drivers of choice, especially in contexts where minor design or communication changes can produce substantial market effects.

Although neuromarketing and consumer neuroscience have gained visibility as tools for understanding these implicit processes, existing research remains fragmented across methods, stimuli and application domains. In the food sector, evidence is dispersed across studies focusing on packaging, labelling, advertising, menu design or digital interfaces, often without an integrated perspective (Moya et al., 2020). This literature review addresses this gap by systematically synthesising empirical findings on the application of neuromarketing techniques to food consumption decisions in fast-food and FMCG contexts, highlighting methodological approaches, convergent results, and practical implications for marketing strategy.

The findings demonstrate that sensory and contextual stimuli, such as packaging, nutritional labelling, menu structure, point-of-sale conditions, advertising, and digital interfaces, play a significant role in shaping attention, emotional responses, purchase intention, and willingness to pay. When integrated with self-reports and behavioural data, neuromarketing methods provide a more comprehensive understanding of consumer behaviour, reducing the risk of oversimplification.

Overall, the evidence suggests that simplified visual design, credible nutritional and sustainability claims, and emotionally congruent communication strategies enhance product acceptance, including innovative food products. Thus, this provides a valuable framework for optimising product design, communication and consumer experience in FMCG and fast-food environments. However, its application must be guided by ethical standards, transparency and scientific rigour, avoiding manipulative practices that may compromise consumer well-being or public trust(Anisimova & Vrontis, 2024; Chkoniya, 2025).

2. Methodology

This study followed a systematic literature review approach using the B-On academic platform, one of the most comprehensive databases for scientific research. The search strategy was designed to ensure relevance, methodological rigour, and alignment with the study's objectives.

An initial query using the keyword *"Neuromarketing"* yielded a broad set of publications. To refine the results, successive filters were applied, including SCOPUS indexing, peer-reviewed academic journals, and a time frame limited to the last ten

years. In addition, a thematic filter related to food consumption and fast-food contexts was introduced.

After applying these criteria, 29 articles were retained for abstract screening, and 20 were selected for in-depth analysis based on their relevance to neuromarketing and food-related contexts. Grammarly (2024) is used to improve the readability and language of the work.

3. Theoretical Framework: Food Decision Making

Food decision-making is a complex process shaped by psychological, social, cultural, economic, and biological factors. Unlike purely rational decisions, food choices are often shaped by contextual and emotional stimuli, which are often processed unconsciously. The literature shows that no single variable, such as price or product category, is sufficient to fully explain food consumer behaviour (Blanco-Encomienda et al., 2025; Bruwer et al., 2017).

Given the economic and social relevance of the food industry, identifying the determinants of purchase intention is central to marketing research. Studies in retail environments indicate that food selection results from a combination of sensory attributes, such as colour, shape and visual appeal, and non-sensory attributes, including information on packaging and labelling and the perception of quality associated with the brand (Gelici-Zeko et al., 2013). In this context, packaging goes beyond its utilitarian function, taking on a communicative and strategic role at the point of sale, influencing expectations, sensory evaluation, and purchase decisions (Carrillo González et al., 2024; Creusen & Schoormans, 2005; Moses et al., 2021).

Understanding of these processes has been strongly influenced by contributions from cognitive and behavioural psychology, and by Kahneman's model, which distinguishes between two decision-making systems: a fast, automatic, and emotional System 1, and a slower, deliberate, and analytical System 2. This distinction is particularly relevant for understanding everyday food decisions, which are characterised by low involvement and high repetition. More recent research also suggests the existence of a third mode of decision-making, associated with imagination and projective thinking, in which consumers anticipate future scenarios and the emotional impact of their choices, especially in decisions related to identity, lifestyle and health (Chkoniya et al., 2024).

Despite the conceptual usefulness of this typology, several authors argue that consumer behaviour does not result from the activation of rigidly separated systems. From a neuroscience perspective, the consumer experience is understood as a dynamic continuum, in which sensory information triggers automatic reactions that progressively evolve into more cognitive and conscious processes (Boozary et al., 2026; O'brien & Manfrinati, 2010)Thus, decisions emerge from the continuous interaction between automatic and deliberative processes, being influenced by both momentary emotions and conscious reasoning (Zaltman, 2026).

These different dimensions of the decision-making process pose significant methodological challenges. Direct techniques, such as questionnaires and interviews, are suitable for measuring conscious attitudes and beliefs (Greenwald et al., 2021), but have limitations in capturing automatic and non-conscious processes. Empirical evidence shows that approaches based exclusively on demographic data or personality traits produce inconsistent results in explaining food choices (Januszewska & Viaene, 2012). Complementarily, functional neuroimaging studies with experts, such as sommeliers, demonstrate brain activations associated with memory during beverage evaluation, independent of conscious verbal responses, evidencing the presence of latent processes in decision-making(Santeramo & Lamonaca, 2020).

In this context, neuromarketing emerges as a complementary approach, capable of enriching the understanding of the mechanisms underlying food decision-making by integrating measures that simultaneously capture conscious and unconscious processes, reinforcing the analysis of consumer behaviour in complex food contexts (Niedziela & Ambroze, 2021).

3.1. Limitations of traditional methods and contribution of neuromarketing

Traditional methods of consumer behaviour research, such as questionnaires, interviews and focus groups, are widely used to analyse attitudes, preferences and purchase intentions. However, they have significant limitations, as they depend on individuals' ability to access and verbalise their own mental processes, as well as on researchers' subjective interpretations (Freud, 2018) . In addition, consumers are not always able to accurately report the true motivations underlying their choices, compromising the predictive reliability of these methods (Chkoniya, Reykowska, et al., 2025). These limitations become particularly critical in the launch of new products, where between 40% and 80% fail in the market (Castellion & Markham, 2013).

In this context, neuromarketing emerges as a complementary approach, defined as the application of neuroscience tools and knowledge to the challenges of advertising and marketing(Moses et al., 2021). It is an interdisciplinary field that integrates contributions from psychology, neuroscience, marketing, and economics to understand consumers' cognitive and emotional responses to marketing stimuli (Herrmann et al., 2022). Its logic is based on the premise that understanding how the brain perceives and reacts to commercial stimuli can contribute to more effective marketing strategies (Berčík et al., 2016).

Consumer neuroscience thus uses neuroscientific and psychophysiological methodologies to investigate latent mental processes that influence decision-making, including advertising elements, packaging characteristics, labels, or food product attributes (Pnevmatikos et al., 2017). In the food sector, this approach has gained

relevance because it enables a more in-depth analysis of consumer perceptions, emotions, and behaviour.

It is important to note, however, that neuromarketing should not replace traditional cognitive methods. In situations involving explicit preferences, such as stated liking for a product, consumers tend to provide reliable responses, making questionnaires appropriate (Attié et al., 2021). Thus, consumer neuroscience should be used as a complement to declarative methods, especially when the focus is on non-conscious or automatic processes.

While self-report methods remain central to measuring conscious emotional attitudes related to food (Moses et al., 2021), techniques such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), galvanic skin response (GSR), and eye tracking allow for the measurement of emotional, attentional, and physiological responses that escape individuals' consciousness, contributing to a more integrated understanding of food decision-making.

4. Emotions and sensory stimuli in food communication

The choice of food products and consumers' emotional relationship with brands have been extensively analysed in consumer behaviour research. The neuroscientific approach, driven by technological advances and the development of portable, minimally invasive devices, enables more objective measurement of consumers' emotional and spontaneous responses (Chkoniya, Reykowska, et al., 2025; Stasi et al., 2018). In this context, the link between neuroscience and gastronomy has given rise to the concept of neurogastronomy, which explores how sensory and contextual stimuli influence food perception and experience (Julca-Infantes et al., 2023).

Emotions play a central role in communication and food consumption, acting as mediators of decision-making. Empirical evidence shows that emotional stimuli significantly influence the perception of advertising messages (Lewinski et al., 2014), increasing the likelihood of capturing attention and being remembered (Moses et al., 2021). This effect is particularly relevant in contexts of high attentional competition, such as food retail, where consumers can be exposed to around 300 products per minute, drastically reducing the time available for conscious information processing (Rundh, 2023).

In this context, packaging takes on a strategic role that goes beyond its functional purpose, serving as a communication element that attracts attention, evokes emotions, and facilitates brand recognition. At the same time, the use of celebrities has become a frequent practice in marketing communication, functioning as an amplifier of attention and emotional response. With the expansion of social media, endorsements by public figures have become increasingly relevant as a channel for emotional interaction between brands and consumers. However, their effectiveness depends on their congruence with the message and the specific context of food consumption.

Communication research has also shown that the temporal sequence of emotions influences the persuasive effectiveness of messages. Studies indicate that sequences that begin with negative emotions and culminate in positive emotions tend to be more effective, as the emotional transition is perceived as more intense and rewarding (Grandjean & Scherer, 2021). Although this mechanism has been extensively studied in contexts such as charity advertising, its principles apply to the food sector, particularly for communicating the product's origin, production techniques, or territorial context. The emotional structure of the message influences both affect, as measured by indicators such as the Approach-Withdrawal Index (AWI), heart rate (HR), and the emotional index (EI), and memorisation processes, assessed using the memorisation index (MI).

In addition to the emotional narrative, sensory stimuli play a decisive role in food consumption. Considering that more than 70% of purchasing decisions occur at the point of sale, visual, auditory and contextual stimuli contribute to rapid responses in low-involvement contexts (Berčík et al., 2016). Aesthetic appeal directly influences the perception of food, with visually appealing products tending to be rated as tastier, leading to more positive overall judgements (Zhang et al., 2022).

Empirical evidence reinforces this relationship. Hernandez-Fernandez & Lewis (2019) demonstrated, through facial expression recognition, the association between unconscious emotional responses and verbal evaluations in the launch of new products. Complementarily, García-Madariaga et al. (2019) used EEG and eye-tracking to demonstrate the differentiated impact of images, text and colours on packaging on attention and preference formation. In the catering and food retail sector, the use of food images is a common practice to stimulate desire and encourage purchase. However, its effectiveness depends on quality and visual congruence.

The presence of celebrities in food advertising also influences consumer attention and perception, raising ethical concerns when it promotes unhealthy products to vulnerable audiences, such as children (Chkoniya, Meneses, et al., 2025). Finally, music emerges as a relevant sensory stimulus, capable of shaping the dining experience and food choices (Hsu & Chen, 2020). Studies show that congruence between music and food context can alter sensory perception, reinforce positive emotions, and guide consumption decisions (Eremenko et al., 2025; Szakál et al., 2023; Vandenberghe-Descamps et al., 2025)

5. Neuromarketing methods applied to the food sector

Neuromarketing methods applied to the food sector include a diverse set of neurophysiological, psychophysiological, and behavioural techniques, each with specific objectives and limitations. Table 1 summarises the main methods used in the literature, the associated indicators, and their applications in the food context, highlighting the relevance of multimodal approaches for a more robust understanding of consumer attention, emotion, and decision-making.

Technique	What it measures	Key Indicators	Food applications	References
Eye-Tracking (ET)	Visual attention	Time to first fix (TTFF), number and duration of fixes, heat maps	Evaluation of packaging, menus, labels, advertising, and digital UX; analysis of claims, seals, and celebrity effect	(Pelau et al., 2022; Schukat et al., 2021; Šola et al., 2022)
Eletrodermal Activity (EDA/GSR)	Emotional arousal	Skin conductanc e	Assessment of the emotional impact of labels, nutritional claims, colours, videos and sensory campaigns	(Dzedzickis et al., 2020; Kreibig, 2010; Russo et al., 2022);
Facial Coding	Observable emotional expressions	Facial microexpres sions (emotional valence)	Advertising and sensory tests; analysis of automatic reactions to food stimuli	(Niedziela & Ambroze, 2021; Russo et al., 2022);
Electroencephalo graphy (EEG)	Brain electrical activity	Frontal asymmetry (FAA), alpha/beta bands, LPP	Assessment of emotional valence, involvement, attention and memory; impact of claims, lighting and tasting	(Berčík et al., 2016; Nittono & Watari, 2017; Russo et al., 2022);
Approach-Withdrawal Index (AWI)	Motivational trend	Derived from EEG	Assessment of the attractiveness and emotional valence of food stimuli	(Fazio & Zanna, 1981)
Memorisation Index (MI)	Memory coding	Derived from EEG	Predicting the likelihood of recall for advertisements and packaging	(Attié et al., 2021)
Emotional Index (EI)	Overall emotional intensity	GSR + FC combination	Synthetic measure of emotional response	(Vecchiato et al., 2014)
fMRI	Brain activity - haemodynamics	vmPFC, OFC, ventral striatum, ínsula	Appreciation, reward, willingness to pay, branding effects, and placebo effects	(Moses et al., 2021; Schukat et al., 2021);

fNIRS	Cortical oxygenation	Cortical activation	Studies in more naturalistic contexts: branding and food innovation	(Schukat et al., 2021)
Multimodal approaches	Attention + emotion + behaviour	ET + EEG + GSR	Integrated evaluation of packaging, menus, sampling, and UX	(Niedziela & Ambroze, 2021; Schukat et al., 2021)

6. Summary of empirical evidence and main findings

The empirical evidence analysed shows that food purchasing decisions result from complex brain processes and vary significantly between individuals and contexts, influencing aggregate patterns of market behaviour. Neuroscience methods applied to consumption allow us to understand not only how decisions are formed in the brain, but also why similar stimuli generate different responses among consumers (Adhikari, 2023; Paladino et al., 2024).

Consistently, the studies reviewed confirm that sensory, emotional, and contextual factors play a central role in food choice, often surpassing explanations based solely on rational or declarative variables. The integration of neurophysiological and behavioural measures reveals recurring discrepancies between what consumers consciously report and the implicit processes that guide attention, emotion and decision-making at the moment of purchase.

6.1. Sensory drivers, health and acceptance of new foods

Empirical evidence shows that familiar and unfamiliar foods elicit distinct patterns of neuroactivity, indicating that food novelty is particularly sensitive to communicational modulation (Wolfe et al., 2016). The introduction of labels or contextual information about unfamiliar foods is sufficient to alter neural responses, influencing perception, acceptance, and the intention to try.

The literature also confirms that visual attributes, such as colour, shape, and texture, are strongly associated with consumer preferences. In products such as snacks, positive emotions and appropriate visual stimuli significantly increase the incentive to purchase, reinforcing the centrality of the sensory dimension in food decision-making.

Russo et al. (2020) demonstrated, through the Food Choice Questionnaire (FCQ), that sensory appeal and health are the main factors in food choice. These results were corroborated by a neurophysiological study, in which health claims ('high protein', 'gluten-free') elicited a greater tendency to approach, reflected in increased positive frontal asymmetry (PFA) and reduced distance to the screen, compared with taste-

focused claims(Brdar, 2023). The inclusion of educational videos further reduced the initial aversion to innovative foods.

Sampling strategies are also effective in promoting the acceptance of new products. Nittono & Watari (2017) demonstrated that direct tasting of food, compared to mere viewing, increases motivational salience, sustained attention and predisposition to choice, especially when accompanied by a brief narrative focused on origin, benefit and social proof.

The physical context of purchase moderates the sensory experience. Studies on point-of-sale lighting indicate that warmer colour temperatures (2700–3000 K) increase positive perception in categories such as bakery and meat, while adaptive LED systems improve the experience in fresh food areas (Berčík et al., 2016).

Finally, research on menu engineering shows that the visual and linguistic organisation of menus influences choice. Limiting the number of options per section, categorising items (Stars, Workhorses, Puzzles and Dogs), and selectively using sensory descriptions improve menu performance and sales (Fedosova, 2022). Similar results emerge in the digital realm, where simplifying the decision path reduces abandonment and increases conversion (UX study).

Overall, the results converge on the conclusion that sensory and health factors are the main drivers of food purchasing decisions. The sensory dimension favours the acceptability and experimentation of new foods (Marcillia et al., 2026), while health acts as a legitimising element and reduces perceived risk, with familiarity being less decisive, especially among younger consumers.

6.2. Sustainability, symbolic identity, and individual differences in food consumption

Empirical evidence shows that consumers do not respond uniformly to food stimuli, with their decisions being shaped by personal values, communication frameworks and symbolic attributes associated with products. In this context, sustainability and territorial identity emerge as key factors in building perceived value and willingness to pay.

The European Union has formally recognised the importance of territorial identity through certification systems such as Protected Designations of Origin (PDO), Protected Geographical Indications (PGI), and Traditional Specialities Guaranteed (TSG), which ensure the authenticity of production methods and also serve as regulatory and communication tools. Certified products tend to be associated with symbolic attributes valued by consumers, such as quality, tradition, sustainability, food safety, and cultural identification (Bryła et al., 2022; Pilone et al., 2023; Russo et al., 2022), which contribute to perceptions of authenticity and uniqueness.

Sustainability is also a relevant economic driver. Studies indicate that a significant proportion of European consumers are willing to pay higher prices for products from

sustainable sources. Neuroscientific evidence reinforces these results, demonstrating that labels such as "organic" or "fair trade" activate brain regions associated with valuation and reward, namely the ventromedial prefrontal cortex (vmPFC) and ventral striatum, increasing willingness to pay and perceived taste(Fehse et al., 2017; Schukat et al., 2021).

The impact of labelling extends beyond rational evaluation to sensory perception. demonstrated that the same product is evaluated as tastier and more valuable when labelled as 'organic,' evidencing a placebo effect. Similar results were observed Anisimova & Vrontis (2024), who showed that introducing a recognised brand alters neural responses and stated preferences, even in the absence of objective sensory differences.

However, the effectiveness of labelling depends on its visual salience. Eye-tracking studies indicate that regulatory labels can be ignored when poorly positioned, with the colour and visual organisation of the packaging being decisive factors in attracting attention (Šola et al., 2022). Packaging thus plays a strategic role in symbolic communication, acting as a mediator between ethical values, brand identity and purchasing decisions.

The differences between conscious and unconscious processes are particularly evident in low-perceived-risk food categories. Studies with Generation Y consumers reveal a discrepancy between rational discourse, focused on technical attributes, and attentional behaviour, predominantly guided by label design (Němcová & Berčík, 2019). These results suggest that, in certain contexts, aesthetics act as the primary trigger for attention.

In summary, food communication has a decisive impact on the acceptance of sustainable products. Strategies that combine labelling credibility, visual clarity, and sensory suitability are more effective, and individual differences and segmentation should be considered to maximise their effectiveness.

7. Applications of neuromarketing in the development, branding, and communication of food products

Neuromarketing applications in the food sector cover multiple points of contact between brands and consumers, including static and digital advertising (Ohme & Boshoff, 2019), audiovisual content (Russo et al., 2022), packaging, menus, and digital experiences. These approaches allow for an in-depth understanding of the processes of attention, emotion, and memory associated with food marketing stimuli.

Although more visible in business and mass consumption contexts, neuromarketing has also been used by non-profit organisations to optimise messages and reinforce emotional engagement with social causes (Moses et al., 2021), highlighting the versatility of these tools when applied with methodological rigour.

In FMCG and fast-food markets, characterised by quick decisions and low involvement, the literature emphasises that neuromarketing is particularly effective when integrated with declarative measures and behavioural data. The combination of Eye-Tracking and GSR with questionnaires allows for the simultaneous capture of attention, emotional intensity and conscious evaluation. At the same time, integrating performance indicators reduces the risk of interpretations based solely on emotional intensity.

In the development and optimisation of food products, neuromarketing has been widely used to assess the effectiveness of packaging and communication of attributes such as healthiness, sustainability and territorial identity (Pagan et al., 2024; Stasi et al., 2018). These elements directly influence consumer expectations, perceived quality and purchase intention, and these tools should be used ethically and complementarily.

Food innovation is a particularly sensitive area, as unfamiliar foods tend to generate ambiguous emotional responses. Empirical evidence shows that point-of-sale sampling strategies reduce uncertainty about innovation, especially when accompanied by brief narratives focused on origin or functional benefits (Nittono & Watari, 2017). In highly innovative products, clear health claims and brief educational content have been shown to reduce avoidance and increase the tendency to approach (Russo et al., 2022).

In the context of branding and design, simple layouts and clear visual hierarchy increase communication effectiveness. Eye-tracking studies show that strategically placing nutrition claims and regulatory seals in high-visibility areas reduces initial rejection and increases effective attention (Chkoniya et al., n.d.; Schukat et al., 2021; Šola et al., 2022). Claims associated with health and sustainability activate brain regions linked to valuation and reward, increasing perceived taste and willingness to pay (Chkoniya, 2021; Schukat et al., 2021).

The use of celebrities can increase initial attention, but it involves communication risks, namely the vampire effect, when there is no congruence with the product (Pelau et al., 2022). At the physical point of sale, sensory stimuli such as lighting influence perceptions of quality and choice (Berčík et al., 2016), while in digital environments, simple layouts and fewer decision paths decrease cognitive anxiety and increase conversion (Babaç & Yüncü, 2022).

In summary, neuromarketing allows for more objective validation of product development, branding, and communication decisions by integrating metrics of attention, emotion, and behaviour, provided it is applied ethically and in an integrated manner.

8. Methodological and ethical limitations of the studies analysed

Despite the growing contribution of consumer neuroscience to understanding eating behaviour, the literature highlights methodological and ethical limitations that must be critically acknowledged. Since its emergence, neuromarketing has faced problems associated with overly deterministic interpretations, pseudoscientific claims, and expectations that are out of step with the actual capabilities of the techniques used, often compounded by high costs and inappropriate application to issues that traditional methods could address.

A recurring misconception is the assumption of the absolute primacy of automatic processing (System 1) over deliberative reasoning (System 2). This view is not in line with Kahneman's model, which conceptualises decision-making as a dynamic and interactive process (Krämer, 2014). As Niedziela & Ambroze (2021) argue, neuromarketing should be understood as complementary to explicit cognitive measures rather than a substitute for them.

From a methodological point of view, studies based on EEG or fMRI often use small samples, limiting the generalisability of results and external validity, especially in food contexts that are heavily influenced by cultural and situational factors (Schukat et al., 2021). Furthermore, these techniques do not allow for direct inference of mental states, requiring rigorous experimental designs and cautious interpretations of neurophysiological indicators (Niedziela & Ambroze, 2021).

The integration of methods is therefore essential. Empirical evidence shows discrepancies between stated responses and observed behaviours. While consumers claim to value rational attributes, eye-tracking data indicate that attention is predominantly directed to the packaging's visual design (Němcová & Berčík, 2019). The absence of integrated approaches can lead to marketing strategies based on incorrect assumptions about consumer rationality.

Another limitation relates to the experimental context. Many studies favour highly controlled laboratory environments at the expense of ecological realism(Carrillo González et al., 2024). Although methodologically justifiable, this option may reduce the transferability of results to real purchasing contexts. Nevertheless, there is an absence of significant effects should be interpreted in light of the experimental design and stimulus characteristics, rather than as a methodological weakness per se (Ohme & Boshoff, 2019).

At the applied level, the literature identifies frequent risks in the use of neuromarketing insights, including inadequate lighting, inconsistent sampling actions, overly complex menus, information overload, and misuse of celebrities, enhancing the vampire (Berčík et al., 2016; Fainshtein et al., 2024; Fedosova, 2022; Nittono & Watari, 2017; Pelau et al., 2022). In digital environments, long paths and inconspicuous claims increase cognitive friction and abandonment (Šola et al., 2022).

From an ethical standpoint, neuromarketing research requires high standards of transparency and accountability. The collection of neurophysiological data must be accompanied by informed consent, avoiding manipulative practices or the undue extrapolation of results, especially in vulnerable audiences. The literature also underscores the need to integrate neuroscientific data with behavioural measures and business indicators, to avoid confusion between emotional intensity and actual preference (Schukat et al., 2021).

In summary, neuromarketing makes a relevant contribution to the study of food consumption, provided it is applied with methodological rigour, multi-method integration and a clear ethical framework. Recognising these limitations does not weaken the field but rather contributes to its scientific consolidation and responsible use.

Future research should prioritise projects that use multiple methods, employ ecologically valid contexts, and ethically integrate neurophysiological and behavioural measures in food-related contexts.

9. Conclusion

This review demonstrates that neuromarketing, when applied with methodological rigour and an ethical framework, is a relevant tool for understanding and optimising consumer decisions in food contexts characterised by quick choices, high competition and strong sensory stimuli, such as the FMCG and fast-food markets. The evidence analysed confirms that these decisions result from the interaction between conscious and non-conscious processes, in which attention, emotion, memory, and the perception of value play central roles.

Consistently, the literature emphasises the importance of multi-method integration. The combination of eye-tracking, psychophysiological measures (GSR/EDA), neurophysiological indices derived from EEG (FAA, ERP/LPP), and, where relevant, neuroimaging techniques (fMRI/fNIRS) provides a more robust understanding of the consumer experience. However, no single metric is sufficient, and triangulation with behavioural measures and business indicators is essential to avoid misinterpretation (Niedziela & Ambroze, 2021; Schukat et al., 2021).

At the applied level, clear principles emerge, simple layouts and effective visual hierarchy in packaging and labelling; emotionally structured and congruent communication; adjusted sensory stimuli at the point of sale; and reduced cognitive friction in digital environments. In food innovation, evidence suggests that familiar shapes, clear health claims, and brief educational content help reduce neophobia and increase acceptance (Russo et al., 2020).

Despite its potential, the literature warns of relevant limitations, such as small samples, laboratory contexts, and risks of over-extrapolation. Thus, neuromarketing should be used in a transparent, integrated, and responsible manner, complementing

traditional methods and avoiding manipulative practices (Niedziela & Ambroze, 2021).

In summary, neuromarketing does not replace classic market research, but decisively reinforces it. When integrated with business metrics and applied with ethical discernment, it offers a practical guide to improving the effectiveness of food strategies and creating sustainable value for brands and consumers in highly competitive markets.

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