IJBMC
International Journal of Body, Mind and Culture

Volume 12, Issue 4, pp 54-63
DOI: 10.61838/ijbmc.v12i4.881

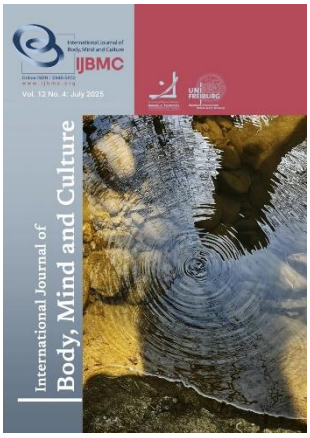
Article type:
Original Research

EEG-Based Analysis of Consumer Neurological Responses to Energy Drink Brands: A Cross-Cultural Study in Iran and Malaysia

Samira. Nazari Ghazvini[1], Younos. Vakil Alroaia[2*], Rohizat. Bin Baharun[3]

1 Department of Management, Se.C., Islamic Azad University, Semnan, Iran.
2 Department of Management, Se.C., Islamic Azad University, Semnan, Iran.
3 Professor of Marketing Management, Department of Business Administration, Universiti Teknologi Malaysia, Johor, Malaysia.

Corresponding author email address: y.vakil@semnaniau.ac.ir



Article history:

Received 28 Dec 2024
Revised 14 Jan 2025
Accepted 24 Jan 2025
Published online 21 May 2025

How to cite this article:
Nazari Ghazvini, S., Vakil Alroaia, Y., & Bin Baharun, R. (2025). EEG-Based Analysis of Consumer Neurological Responses to Energy Drink Brands: A Cross-Cultural Study in Iran and Malaysia. International Journal of Body, Mind and Culture, 12(4), 54-63.

ABSTRACT

Objective: This study investigates the differences in brain physiological responses (BPR) of Iranian and Malaysian consumers when exposed to energy drink brands.

Methods and Materials: A sample size of 24 participants was selected using G*Power software. Data were extracted using brain mapping software and analyzed through mixed ANOVA.

Findings: The results showed that Iranian participants exhibited greater brainwave changes in response to the Hype and Rockstar brands. In contrast, Malaysian participants demonstrated stronger brain responses to the Red Bull and Monster brands. Changes in alpha and gamma waves highlighted their significance as indicators for studying consumer responses in different cultures. This study demonstrates the value of EEG-based neuromarketing in identifying cultural differences in consumer behavior. Variations in brain physiological responses between Iranian and Malaysian participants reveal the impact of cultural preferences on brand perception. Alpha and gamma wave changes emerge as key indicators, providing insights for creating culturally tailored marketing strategies.

Conclusion: The findings underscore the significance of understanding the neural correlates of consumer preferences and encourage further investigation into the cultural influences on consumer responses to advance the field of neuromarketing.

Keywords: Neuromarketing, Consumer Behavior, Physiological Response, Energy Drinks

Introduction

In today's world, neuromarketing research has become a crucial tool for attracting customers and boosting sales (Alsharif et al., 2023). Compared to traditional marketing, neuromarketing provides a more in-depth examination of customer behavior, target audiences, and their interactions with products and services (Morin, 2011; Plassmann et al., 2015).

Techniques such as using experimental groups enable a brand to assess consumer behavior and preferences at a more advanced level (Vakil Alroaia & Nazari Ghazvini, 2021). One of the innovative methods in this field is the use of electroencephalography (EEG) to evaluate

customers' physiological responses to brands and various products (Plassmann & Karmarkar, 2015)

EEG essentially allows researchers to observe users' emotional states in real-time (Suomala, 2018) and obtain real-time data on brain activity, thereby achieving a deeper understanding of how consumers react to different brands (Vecchiato et al., 2011).

The level of EEG signals in each waveform and across different brain lobes (brain topography) can be analyzed, and the resulting data can be used to explain brain activity and translate it into emotions, behaviors, and cognitive functions (Andersen et al., 2019; Campbell, 2009; Takahashi et al., 2005). This information can also reveal which parts of the brain are activated in response to marketing stimuli and how these activities relate to customers' emotions and decision-making processes (Golnar-Nik et al., 2019; Khushaba et al., 2013).

For example, increased activity in areas associated with reward and pleasure may indicate a high level of attractiveness for an advertisement or product brand (Balconi et al., 2014). Therefore, it is not surprising that examining brain activity using electroencephalography (EEG) techniques has garnered attention in sensory research and consumer behavior evaluation (Shaw & Bagozzi, 2018).

The primary objective of this study is to evaluate the physiological responses of customers to energy drink brands in Iran and Malaysia using electroencephalography (EEG) devices. Energy drinks, due to their caffeine content and other stimulants, have significant physiological and psychological effects on consumers (Ariffin et al., 2022). Thus, examining customers' brain responses to the branding of these products can provide valuable insights into the impact of advertisements and packaging (Vecchiato et al., 2011).

In Iran and Malaysia, cultural and social differences may lead to varying effects on customers' reactions to energy drink brands. Therefore, comparing these reactions in the two countries can help identify cultural similarities and differences in response to advertising and branding. Such information can enable energy drink companies to tailor their marketing strategies to the cultural characteristics of each country, thereby enhancing the effectiveness of their advertisements (Morin, 2011; Vecchiato et al., 2011).

Recent studies have shown that EEG-based techniques in neuromarketing enable businesses to create more engaging customer experiences and avoid ineffective marketing strategies (Khondakar et al., 2024). However, prior research has focused primarily on single-country contexts, lacking a broad cross-cultural perspective. Additionally, many studies have limited their EEG analysis to specific brainwave types or regions (Hakim et al., 2021; Hsu & Chen, 2020).

Ultimately, this study can contribute to the expansion of knowledge in the field of neuromarketing and the application of EEG techniques in marketing. In recent years, numerous studies have employed neuromarketing techniques to examine consumer behavior (Chen et al., 2022; Daroch et al., 2021). However, these studies have primarily focused on single-country contexts and have not extensively explored cross-cultural differences. Additionally, in employing electroencephalography (EEG) techniques, the analysis of consumer brain waves has often been limited to certain specific waveforms.

For example, the studies by Hakim et al. (2021) examined delta, alpha, and beta band power during the observation of advertisements. Similarly, Hsu and Chen (2020) investigated the differences between theta and beta waves while viewing subliminal and non-subliminal message advertisements (Hsu & Chen, 2020). Mateusz and Kesra (2020) explored changes in theta and alpha waves in social and commercial advertisements (Mateusz & Kesra, 2020). In other research, it has been observed that brainwave analysis is often restricted to one or two lobes of the brain (Pereira & Oliveira, 2021).

Studies using fMRI have demonstrated that individuals from different cultural backgrounds activate distinct neural pathways when processing the same marketing content. This indicates that cultural upbringing not only influences behavior but also the very mechanisms of brain function involved in decision-making. Research has shown that cultural context affects attentional control and cognitive processing. For instance, East Asians tend to engage in holistic processing, viewing scenes as interconnected wholes, while Westerners often adopt an analytical approach, focusing on individual elements within a context (Deshmukh et al., 2022).

Caffeinated beverages hold significant popularity in both the Middle East and East Asia (Poole et al., 2017). Iran, situated in the Middle East (Moeenfard et al., 2021), and Malaysia, in Southeast Asia (Alsharif et al., 2022), share a long history of caffeine consumption despite

Ijbmc.org
E-ISSN: 2345-5802

their distinct cultural traditions. The cultural differences between these two nations provide a unique framework for studying consumer behavior toward caffeinated beverages.

In Iran, traditional values and customs strongly influence consumer behavior (Karami et al., 2017). On the other hand, Malaysia's multicultural society presents a dynamic interplay of various cultural influences (Embong, 2002). These cultural dynamics can significantly shape consumers' perceptions and responses to brands.

For example, research by Vecchiato et al. (2010) demonstrated that cultural context has a substantial impact on neurological responses to marketing stimuli. This suggests that EEG studies conducted in diverse cultural settings can offer valuable insights into how cultural factors impact consumer behavior (Vecchiato et al., 2010).

These limitations underscore the need for more comprehensive and cross-cultural studies in neuromarketing, as well as the use of EEG techniques, to gain a deeper understanding of consumers' physiological and psychological responses to various brands.

Based on the review of prior research and existing gaps, this study goes beyond typical expectations to examine changes in the five leading brainwave bands—alpha (α), theta (θ), beta (β), delta (δ), and gamma (γ)—across four primary brain regions: frontal, parietal/central, occipital, and temporal lobes. It investigates responses to energy drink brands in a simulated environment, with no time constraints. Importantly, this research focuses solely on physiological brain responses of two consumer groups when exposed to brands, excluding factors such as taste, flavor, quality, and price.

By comparing EEG data from consumers in Iran and Malaysia, researchers can gain a deeper understanding of the cultural underpinnings of brand perception and decision-making processes. These insights can help marketers develop culturally sensitive strategies to improve brand engagement and consumer satisfaction.

Given these considerations, the central research question is: What are the physiological brain responses of Iranian and Malaysian consumers to energy drinks, and what differences exist between these two consumer groups?

Methods and Materials

Protocol and Experimental Procedure

To evaluate the physiological responses of consumers, including brainwave activity between two participant groups, an EEG-compatible simulated e-commerce platform was developed. Four energy drink brands commonly consumed in both Iran and Malaysia—Red Bull, Hype, Rockstar, and Monster—were selected for the study based on market research and popularity.

In neuroscience studies, Delta waves (0.5-4 Hz) can indicate deep relaxation or disengagement, Theta waves (4-8 Hz) relate to emotional processing, alpha waves (8-12 Hz) to engagement, beta waves (12-30 Hz) to active thinking and Gamma (30-100 Hz) linked to high-level information processing and cognitive functioning. Key brain regions include the frontal lobe for decision-making, the temporal lobe for memory, the parietal lobe for sensory processing, and the occipital lobe for visual processing. Therefore, in this test, we examined all areas of the head and all five main brain waves to identify changes in each wave across different regions.

In the study, Brain activity across four lobes (frontal, parietal, temporal, and occipital) was recorded using a 32-channel EEG cap following the 10-20 system standard. Electrode impedance was maintained below 5 KΩ throughout the signal recording process. Signals were amplified at a gain of 2000, band-passed in the range of 1-40 Hz, and sampled at 250 Hz. Two earlobes served as reference electrodes for all channels. Additionally, a built-in notch filter was employed to eliminate power line noise.

Recording Phases

Baseline Recording: Participants were instructed not to focus on any specific thought, and their EEG was recorded for 100 seconds before initiating the test.

Task Phase: Participants entered the simulated website and sequentially viewed the four energy drink brands. Each brand was displayed for a fixed duration, followed by a 30-second blank screen (control variable).

3.2 EEG Data Collection and Processing

The sample size was determined using G*Power software, with a significance level of $\alpha = 0.05$, resulting in 24 participants (13 men, 11 women; aged 25–30 years; right-handed). Participants were randomly selected

from students at the University of Tehran (12 participants) and the University of Technology Malaysia (UTM) (12 participants).

Data Collection Locations

Iranian participants: Conducted at the National Brain Mapping Laboratory, Faculty of Engineering, University of Tehran.

Malaysian participants: Conducted at the Neural Engineering Laboratory[1], Biomedical and Health Sciences Unit, Faculty of Electrical Engineering, UTM.

Health Screening: Each participant underwent a two-stage health screening:

Initial Interview: Participants completed a consent form and a standardized interview conducted by the researcher.

Medical Review: A lab physician reviewed participants' medical history, including personal and family health information.

Participants were confirmed to be in good health, with no prior neurological or cardiovascular disorders. They had not taken any medications that could affect EEG signals, nor had they experienced any sleep disturbances, ensuring they had sufficient rest for five days before the experiment. All participants demonstrated basic computer proficiency, enabling them to complete the tasks.

Experiment Design

The experimental task was designed in MATLAB (R2022b) using the Psychtoolbox environment. Ethical approval for this research was obtained from the Ethics Committee on Research Involving Humans, Iran University of Medical Sciences.

Data Analysis

To analyze differences in brainwave activity between the two participant groups, data were processed using:

Mixed ANOVA to identify significant differences in brainwave changes.

Bonferroni-adjusted t-tests to explore specific differences in brain regions.

Analysis and visualization were conducted using SPSS (version 22) and Excel, including heatmaps for identifying active brain regions.

This methodological framework ensured accurate and reliable comparisons between the responses of Iranian and Malaysian participants to the energy drink brands.

Findings and Results

The results from the mixed ANOVA (Table 1) demonstrate significant differences in brainwave changes across the energy drink brands between the two participant groups ($p < 0.05$). Significant differences were observed in delta, theta, alpha, and beta waves across all four brands. However, differences in gamma waves were significant only for Red Bull and Hype. No significant differences in gamma waves were noted between Iranian and Malaysian participants for the Rockstar and Monster brands.

Table 1

ANOVA Analysis of Brainwaves for Iranian and Malaysian Participants across Energy Drink Brands

Brand	Wave	Sum of Squares	Df	Mean Square	F	Sig
Red Bull	Delta (δ)	73.578	1	73.578	0.144	0.019
	Theta (θ)	65.934	1	65.934	0.204	0.019
	Alpha (α)	3130859.1749	1	3130859.1749	0.334	0.018
	Beta (β)	2938857.1802	1	2938857.1802	0.374	0.016
	Gamma (γ)	45.557	1	45.557	0.794	0.013
Hype	Delta (δ)	91.337	1	91.337	0.041	0.011
	Theta (θ)	77.948	1	77.948	0.189	0.041
	Alpha (α)	4752861.2193	1	4752861.2193	0.082	0.031
	Beta (β)	5553759.3246	1	5553759.3246	0.496	0.040
	Gamma (γ)	83.525	1	83.525	0.917	0.011
Rockstar	Delta (δ)	3130849.390	1	3130849.390	5.491	0.038

[1] Neural Engineering Lab, Department of Biomedical Engineering and Health Sciences Faculty of Electrical Engineering Universiti Teknologi Malaysia

	Theta (θ)	89.561	1	89.561	1.051	0.021
	Alpha (α)	402529.0842	1	402529.0842	2.070	0.011
	Beta (β)	364570.9147	1	364570.9147	7.202	0.022
	Gamma (γ)*	94.348	1	94.348	2.328	0.538
Monster	Delta (δ)	4978.871	1	4978.871	0.852	0.035
	Theta (θ)	41.891	1	41.891	0.792	0.0321
	Alpha (α)	32281.0433	1	32281.0433	0.645	0.0227
	Beta (β)	47285.8763	1	47285.8763	1.045	0.049
	Gamma (γ)*	99.542	1	499.542	1.959	0.465

Due to the significant differences in delta, theta, alpha, and beta waves for all four brands, and gamma waves for Red Bull and Hype, follow-up analyses were conducted to determine which brain regions exhibited greater activity. To avoid errors associated with traditional post-hoc tests, Bonferroni-adjusted t-tests were used (Table 2).

Table 2

Bonferroni t-Test Results for Brainwave Activity by Brain Lobe

Brand	Wave	Frontal	Temporal	Parietal	Occipital
Red Bull	Delta (δ)	7.29	1.45	2.00	3.07
	Theta (θ)	2.87	2.25	2.91	2.69
	Alpha (α)	4.05	1.70	2.95	4.01
	Beta (β)	6.42	6.35	6.00	1.89
	Gamma (γ)	9.89	5.01	3.01	2.62
Hype	Delta (δ)	3.12	1.03	3.42	1.47
	Theta (θ)	2.22	1.76	1.33	1.52
	Alpha (α)	1.56	1.85	1.23	1.33
	Beta (β)	6.24	6.45	1.77	1.29
	Gamma (γ)	5.00	3.28	4.56	4.65
Rockstar	Delta (δ)	4.00	2.02	2.40	2.25
	Theta (θ)	3.25	1.55	1.46	3.99
	Alpha (α)	5.35	1.68	3.75	1.25
	Beta (β)	6.09	1.44	6.03	7.76
Monster	Delta (δ)	1.47	1.25	4.96	6.69
	Theta (θ)	6.69	1.50	1.85	1.50
	Alpha (α)	4.75	1.56	3.75	2.51
	Beta (β)	6.12	5.76	5.92	1.88

Red Bull: Malaysian participants exhibited higher delta, theta, beta, and gamma wave activity, while Iranian participants showed greater alpha wave activity.

Hype: Iranians displayed higher brainwave activity overall, except for alpha waves, where Malaysians had a stronger response.

Rockstar: Iranian participants showed increased delta, theta, and beta wave activity, whereas Malaysians demonstrated more significant alpha wave changes.

Monster: Malaysians had higher activity in delta, theta, and beta waves, while their alpha wave activity was lower than that of Iranian participants.

Heatmap analysis revealed that the frontal and parietal lobes exhibited the most significant changes in brainwave activity, indicating strong physiological reactions in these regions during brand observation. The frontal and parietal areas showed the highest activity levels, underscoring their pivotal role in processing emotional and cognitive responses to brand stimuli.

The significant changes in brainwave activity in the frontal and parietal lobes highlight the importance of these regions in processing brand-related stimuli. The frontal lobe's involvement underscores the emotional and cognitive engagement elicited by the brands. In contrast, the parietal lobe's activity emphasizes the role of sensory processing and spatial awareness in consumer perception. By understanding these physiological reactions, marketers can tailor their strategies to enhance emotional engagement and sensory appeal, ultimately influencing consumer behavior more effectively.

- Cross-Cultural Implications: The differences in brainwave activity between Malaysian and Iranian

participants highlight the impact of cultural factors on consumer behavior:

- Emotional and Cognitive Engagement: Cultural norms and values influence how participants emotionally and cognitively engage with brands. For example, Malaysians may exhibit more active cognitive processing and emotional engagement with certain brands, while Iranians may show a more relaxed yet attentive engagement.
- Sensory and Contextual Perception: Cultural differences in sensory preferences and contextual perception affect how brands are processed and perceived. Understanding these differences can help marketers tailor their strategies to better resonate with diverse cultural audiences. By considering these cross-cultural differences, marketers can create more effective and culturally relevant marketing strategies that enhance consumer engagement and brand loyalty.

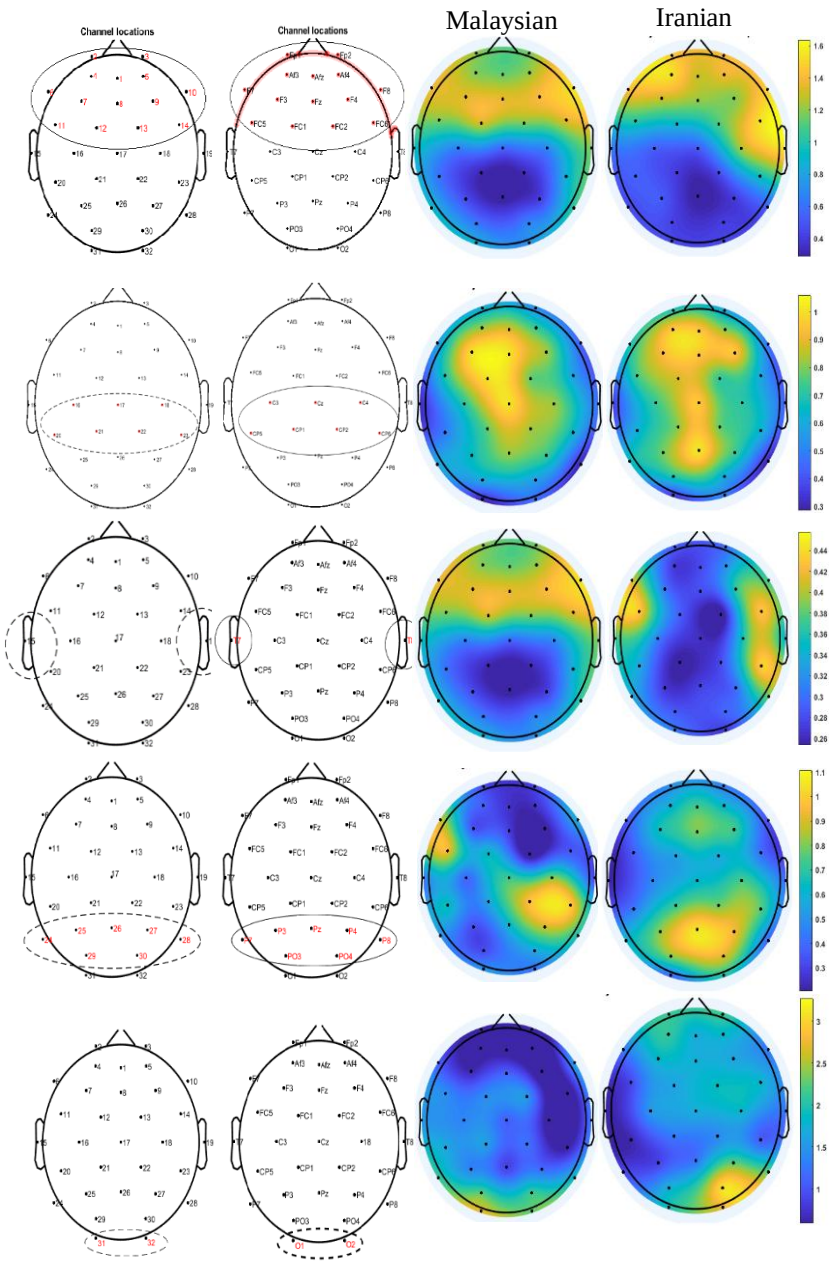


Figure 1

Average Brainwave Changes in Both Participant Groups during Brand Observation

Ijbmc.org
E-ISSN: 2345-5802

Discussion and Conclusion

This study investigated the physiological responses of Iranian and Malaysian consumers to energy drink brands using electroencephalography (EEG) technology. A simulated website in a Salkootoolbox environment compatible with EEG devices was used to observe brainwave activity. The research focused on neuromarketing aspects to explore subconscious factors influencing consumer choices, thereby contributing to consumer neuroscience and insights into cross-cultural marketing.

The findings of this study, based on brainwave frequencies and QEEG heat maps, revealed the following: Iranian participants exhibited more significant brainwave changes when exposed to the Hype brand (in delta, theta, beta, and gamma frequencies; in the frontal, parietal, and temporal lobes) and the Rockstar brand (in delta, theta, and beta frequencies across all brain lobes, especially in the frontal region). In contrast, Malaysian participants exhibited greater brain activity in response to the Red Bull brand (in delta, theta, beta, and gamma frequencies, particularly in the frontal and parietal lobes) and the Monster brand (in delta, theta, and beta frequencies, also in the frontal and parietal lobes).

Moreover, numerical analyses and QEEG maps revealed an inverse relationship between changes in alpha frequency and changes in delta, theta, and beta frequencies. Specifically, for each brand observed, when participants experienced increased delta, theta, and beta frequencies, their alpha waves decreased. Additionally, the analysis of gamma waves showed no significant differences between the gamma wave responses of the two groups of participants when exposed to the Rockstar and Monster brands.

Previous studies have associated changes in delta and theta waves with consumer emotional perception, predicting individual preferences, and identifying consumer choices (Balconi et al., 2021; Golnar-Nik et al., 2019; Hakim et al., 2021; Khushaba et al., 2013). The significant changes in delta and theta frequencies observed in this study during exposure to product brands align with these findings, indicating that these wave patterns are strong indicators of consumer responses in various contexts, especially when viewing brands.

Beta waves have been linked in prior research to predicting preferences, problem-solving, decision-making, and mental activity (Balconi et al., 2021; Hakim et al., 2021; Hsu & Chen, 2020). The increased beta activity observed during the process of viewing each brand aligns with the results of these studies. It reinforces the role of beta waves in cognitive processes and decision-making.

In reviewing prior studies, changes in alpha waves have been associated with emotional responses and attention (Bettiga et al., 2020), as well as product preferences and choices (Golnar-Nik et al., 2019; Khushaba et al., 2013). This study observed a reduction in alpha waves when participants were exposed to each brand, a finding that differed from previous studies. This discrepancy suggests that alpha wave patterns may vary based on product characteristics or cultural differences, highlighting the need for further exploration in this area.

Regarding gamma wave analysis, only the findings of Khushaba et al. (2013) were comparable with the results of this study. Moreover, changes in gamma waves between the two groups on specific brands were not significant. Thus, examining this wavelength in the context of consumer behavior underscores the potential for further development in future studies (Khushaba et al., 2013).

The results of this study contribute to our understanding of the roles of delta, theta, beta, and gamma waves in consumer behavior and decision-making processes. This precise understanding can enhance the accuracy of neuromarketing strategies and interventions. Utilizing QEEG heat maps to visualize brain activity in response to various brands and cultural groups provides a powerful tool for analyzing consumer behavior. This methodological approach can be adopted in future neuromarketing research to gain more precise insights.

The findings related to brand observation on a simulated website have practical implications for e-commerce and online marketing. Marketers can leverage this information to design more effective online shopping experiences that cater to the specific cognitive and emotional responses of different consumer groups.

This study not only confirms previous findings regarding delta, theta, and beta waves but also provides fresh insights into alpha and gamma wave patterns in response to energy drink brands. Exploring cultural

differences and focusing specifically on brand encounters offers valuable contributions to the field of neuromarketing and suggests several new directions for future research.

Understanding consumers' physiological responses to brands can also aid in the development of regulations regarding advertising and packaging, ensuring that marketing practices are both practical and ethically sound.

The study on consumer responses to energy drink brands highlights practical marketing strategies for companies like Hype, Rockstar, Red Bull, and Monster. Cultural customization is essential; brands should tailor campaigns to resonate with the cultural preferences of Iranian and Malaysian consumers based on EEG findings. Strategic product positioning can focus messaging on attributes that elicit positive neurological reactions within specific markets.

Targeted advertising can utilize insights from brainwave activity to refine strategies, selecting colors, sounds, or themes that align with emotional engagement patterns. Additionally, insights from EEG data can guide product development by identifying preferred features or formulations across cultures. Mapping customer journeys based on neuromarketing findings will help identify emotional touchpoints influencing decision-making.

However, researchers must address potential biases that could affect the validity of their findings. Non-random participant selection and prior brand familiarity may skew results towards specific demographics or influence physiological responses more than genuine preference differences among products. Moreover, cultural contexts significantly impact interpretations of EEG data related to emotional engagement. Recognizing these limitations will enrich future discussions and enhance the practical implications of the research for energy drink companies targeting diverse global audiences effectively.

This study examines the physiological responses of Iranian and Malaysian consumers to energy drink brands using EEG technology, highlighting several limitations:

EEG Resolution: Limited spatial resolution restricts the ability to pinpoint specific brain regions involved in consumer decision-making, potentially oversimplifying complex neural processes.

Cultural Bias: Results may not generalize beyond Iranian and Malaysian consumers due to cultural specificity.

Response Variability: Individual differences and external factors complicate the interpretation of data.

Emotional Measurement Limits: EEG struggles to capture deeper emotional responses processed in subcortical brain areas.

Future Research Directions:

Broaden cultural comparisons to explore universal versus culture-specific consumer behaviors.

Integrate other neuroimaging techniques (e.g., fMRI) for a more comprehensive understanding.

Conduct longitudinal studies to observe changes in consumer responses over time.

Practical Implications:

Tailor marketing strategies to leverage cognitive and emotional triggers identified through EEG.

Enhance e-commerce experiences by aligning design with consumer responses.

Ensure ethical practices in neuromarketing to respect consumer autonomy and privacy.

Acknowledgments

The authors express their gratitude and appreciation to all those who contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

By the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

Authors' Contributions

All authors equally contribute to this study.

References

Alsharif, A. H., Salleh, N. Z. M., Abdullah, M., Khraiwish, A., & Ashaari, A. (2023). Neuromarketing tools used in the marketing mix: A systematic literature review and future research agenda. *Sage Open*, *13*(1), 21582440231156563. https://journals.sagepub.com/doi/abs/10.1177/21582440231156563

Alsharif, A. H., Salleh, N. Z. M., Al-Zahrani, S. A., & Khraiwish, A. (2022). Consumer Behaviour to Be Considered in Advertising: A Systematic Analysis and Future Agenda. *Behavioral Sciences*, *12*(12), 472. https://doi.org/10.3390/bs12120472

Andersen, C. A., Kring, M. L., Andersen, R. H., Larsen, O. N., Kjær, T. W., Kidmose, U., Møller, S., & Kidmose, P. (2019). EEG discrimination of perceptually similar tastes. *Journal of Neuroscience Research*, *97*(3), 241-252. https://doi.org/10.1002/jnr.24281

Ariffin, H., Chong, X. Q., Chong, P. N., & Okechukwu, P. N. (2022). Is the consumption of energy drinks beneficial or detrimental to health: a comprehensive review? *Bulletin of the National Research Centre*, *46*(163). https://doi.org/10.1186/s42269-022-00829-6

Balconi, M., Stumpo, B., & Leanza, F. (2014). Advertising, Branding, and Neuromarketing: How the Consumer Brain Works. *Neuroscience and Behavioral Reviews*, *47*, 121-135. https://doi.org/10.7358/neur-2014-016-balc

Balconi, M., Venturella, I., Sebastiani, R., & Angioletti, L. (2021). Touching to Feel: Brain Activity During In-Store Consumer Experience [Brief Research Report]. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.653011

Bettiga, D., Bianchi, A. M., Lamberti, L., & Noci, G. (2020). Consumers Emotional Responses to Functional and Hedonic Products: A Neuroscience Research Frontiers in Psychology. *11*. https://doi.org/10.3389/fpsyg.2020.559779

Campbell, I. G. (2009). EEG Recording and Analysis for Sleep Research. *Current Protocols in Neuroscience*, *49*(1), 10.12.11-10.12.19. https://doi.org/10.1002/0471142301.ns1002s49

Chen, T., Samaranayake, P., Cen, X., Qi, M., & Lan, Y. C. (2022). The Impact of Online Reviews on Consumers' Purchasing Decisions: Evidence From an Eye-Tracking Study. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.865702

Daroch, B., Nagrath, G., & Gupta, A. (2021). A study on factors limiting online shopping behaviour of consumers. *Rajagiri Management Journal*, *15*(1), 39-52. https://doi.org/10.1108/RAMJ-07-2020-0038

Deshmukh, N. P., Karne, S. S., Shinde, S. P., Shinde, D. D., & Fakira, K. S. (2022). Cross-Cultural Differences in Neuromarketing A Comparative Study. *NeuroQuantology*, *20*(1), 1178. https://books.google.com/books?hl=fa&lr=&id=25Ew9KKsbQIC&oi=fnd&pg=PA313&dq=Cross-Cultural+Differences+in+Neuromarketing+A+Comparative+Study.+&ots=WM6KHkXQs6&sig=8q_SXCA0ZbFCmhiZx5N3kR8w3Zs

Embong, A. R. (2002). Malaysia as a Multicultural Society. *Macalester International*, *12*(1), 10. https://digitalcommons.macalester.edu/cgi/viewcontent.cgi?article=1268&context=macintl

Golnar-Nik, P., Farashi, S., & Safari, M. S. (2019). The application of EEG power for the prediction and interpretation of consumer decision-making: A neuromarketing study. *Physiol Behav*, *207*, 90-98. https://doi.org/10.1016/j.physbeh.2019.04.025

Hakim, A., Klorfeld, S., Sela, T., Friedman, D., Shabat-Simon, M., & Levy, D. J. (2021). Machines learn neuromarketing: Improving preference prediction from self-reports using multiple EEG measures and machine learning. *International Journal of Research in Marketing*, *38*(3SP - 770), 791. https://doi.org/10.1016/j.ijresmar.2020.10.005

Hsu, L., & Chen, Y. J. (2020). Neuromarketing, subliminal advertising, and hotel selection: An EEG study. *Australasian Marketing Journal (Amj)*, *28*(4), 200-208. https://doi.org/10.1016/j.ausmj.2020.04.009

Karami, M., Olfati, O., & Dubinsky, A. J. (2017). Key cultural values underlying consumers' buying behaviour: A study in an Iranian context. *Journal of Islamic Marketing*, *8*(2), 289-308. https://doi.org/10.1108/JIMA-06-2015-0039

Khondakar, M. F. K., Sarowar, M. H., Chowdhury, M. H., Majumder, S., Hossain, M. A., Dewan, M. A. A., & Hossain, Q. D. (2024). A systematic review on EEG-based neuromarketing: recent trends and analyzing techniques. *Brain Informatics*, *11*(1), 17. https://doi.org/10.1186/s40708-024-00229-8

Khushaba, R. N., Wise, C., Kodagoda, S., Louviere, J., Kahn, B. E., & Townsend, C. (2013). Consumer neuroscience: Assessing the brain response to marketing stimuli using electroencephalogram (EEG) and eye tracking. *Expert Systems with Applications*, *40*(9), 3803-3812. https://doi.org/10.1016/j.eswa.2012.12.095

Mateusz, P., & Kesra, N. (2020). Cognitive neuroscience in the design process of social advertising. *Procedia Computer Science*, *176*, 2959-2968. https://doi.org/10.1016/j.procs.2020.09.207

Moeenfard, M., Khaloo Kermani, P., Jaldani, S., & Sharif, A. (2021). Caffeine Determination in Various Types of Coffee Brews and Studying the Effect of QuEChERS Method on Its Extraction Compare to Conventional Approach. *Iranian Food Science and Technology Research Journal*, *17*(1), 173-186. https://doi.org/10.22067/ifstrj.v17i2.86410

Morin, C. (2011). Neuromarketing: The new science of consumer behavior. *Society*, *48*(2), 131-135. https://doi.org/10.1007/s12115-010-9408-1

Pereira, T., & Oliveira, A. (2021). The usefulness of the averaging rule in consumer studies: A partial replication with an eye at neuroeconomics. *European Review of Applied Psychology*, *71*(5), 100718. https://doi.org/10.1016/j.erap.2021.100718

Plassmann, H., & Karmarkar, U. R. (2015). Consumer neuroscience: revealing meaningful relationships between brain and consumer behavior. In D. D. R. M. I. Norton & C. Lamberton (Eds.), *The Cambridge Handbook of Consumer Psychology* (pp. 152-179). https://doi.org/10.1017/CBO9781107706552.006

Plassmann, H., Ramsøy, T. Z., & Milica, B. (2015). Branding the brain: A critical review of the literature on neuroimaging in marketing. *Journal of Consumer Research*, *41*(5), 142-1438. https://doi.org/10.1086/680218

Poole, R., Kennedy, O. J., Roderick, P., Fallowfield, J. A., Hayes, P. C., & Parkes, J. (2017). Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes. *bmj*, *359SP - j5024*. https://doi.org/10.1136/bmj.j5024

Shaw, S. D., & Bagozzi, R. P. (2018). The neuropsychology of consumer behavior and marketing. *Consumer Psychology Review*, *1*(1), 22-40. https://doi.org/10.1002/arcp.1006

Takahashi, T., Murata, T., Hamada, T., Omori, M., Kosaka, H., Kikuchi, M., Yoshida, H., & Wada, Y. (2005). Changes in EEG and autonomic nervous activity during meditation and their association with personality traits. *Int J Psychophysiol*, *55*(2), 199-207. https://doi.org/10.1016/j.ijpsycho.2004.07.004

Vakil Alroaia, Y., & Nazari Ghazvini, S. (2021). *Eye Tracking (Experimental design)*. Termeh. https://www.tobii.com/resource-center/learn-articles/eye-tracking-experiment-hypothesis-and-variables

Vecchiato, G., Babiloni, F., Astolfi, L., Toppi, J., Cherubino, P., Dai, J., Kong, W., & Wei, D. (2011). Enhance of theta EEG spectral activity related to the memorization of commercial advertisings in Chinese and Italian subjects. *2011 4th International Conference on Biomedical Engineering and Informatics (BMEI)*, *3*, 1491-1494. https://doi.org/10.1109/BMEI.2011.6098615

Vecchiato, G., Cherubino, P., Trettel, A., & Babiloni, F. (2010). Neuroelectrical imaging and neuromarketing: A new avenue for understanding consumer behavior. *Journal of Consumer Behaviour*, *9*(4), 293-304. https://doi.org/10.1002/cb.326