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Title: Decision-Making in E-Commerce Platforms: Evidence from Sustained Attention, Cognitive Inhibition, and EEG Measures

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Abstract:

Introduction: This study investigated the roles of sustained attention and cognitive inhibition in consumers' food-purchasing behavior on a simulated multi-sided online platform, using behavioral and electroencephalographic (EEG) indicators.

Methods: Thirty healthy right-handed adults (18–30 years) participated. Sustained attention and cognitive inhibition were assessed via the Continuous Performance Test (CPT) and Stroop Test. EEG signals (64-channel) were recorded during a two-stage task: food image observation and purchase decision-making ("Buy"/"Not Buy"). Spectral power (delta, theta, alpha, beta) was analyzed using EEGLAB and Welch's method. Data were analyzed using correlation and multiple regression in SPSS.

Results: Behavioral findings revealed a significant negative correlation between sustained attention and buying behavior ($r = -0.326$, $p = 0.039$), explaining 10.7% of the variance. Cognitive inhibition was not significantly related to purchasing decisions. EEG analysis showed widespread activation across all frequency bands during the observation stage. Conversely, the decision-making stage exhibited more localized activity in theta and alpha bands, suggesting selective engagement of attentional and evaluative neural networks during the choice process.

Conclusion: Sustained attention appears more critical than cognitive inhibition in shaping purchasing decisions among typical consumers. Neural evidence indicates a transition from broad perceptual activation during stimulus exposure to focused fronto-parietal activity during evaluation. These results highlight the importance of attentional mechanisms in consumer choice and provide practical insights for neuromarketing and the design of digital shopping environments.

Keywords: Sustained attention; Cognitive inhibition; EEG; Decision-making; Consumer neuroscience.

Introduction:

Attention and cognitive inhibition are fundamental components of executive functions that play a crucial role in guiding goal-directed behavior and decision-making. Attention refers to the process through which individuals select certain information from numerous environmental stimuli and allocate their cognitive resources to it, while other information is ignored (Kolb & Whishaw, 2019). One important dimension of this process is sustained attention, which refers to the ability to maintain conscious focus on a stimulus or activity for a relatively extended period of time. From a neuroscientific perspective, the attentional system involves a complex network of brain structures that enable the selection and efficient processing of information and play an essential role in the regulation of adaptive behaviors (Krauzlis et al., 2023; Saffari et al., 2023). Alongside attention, cognitive inhibition is also considered a key component of executive functions that is essential for behavioral control and decision-making. Cognitive inhibition refers to the ability to suppress automatic or dominant responses in order to select responses that are more appropriate and goal-directed (Cohen Kadosh et al., 2011). This process becomes particularly important in situations in which individuals encounter competing or tempting stimuli, enabling them to regulate their behavior in accordance with long-term goals (Barkley, 1997). Neuropsychological evidence indicates that this ability is largely associated with the activity of prefrontal brain regions and can be assessed through tasks such as the Stroop and Go/NoGo tests (Skurvydas et al., 2018). However, some studies have suggested that performance in the Stroop test may be related not only to inhibitory processes but also to parietal and prefrontal attentional networks (Heflin et al., 2011). These cognitive functions play an important role in many aspects of everyday human behavior, including consumption-related decision-making. Research has shown that deficits in cognitive inhibition may be associated with maladaptive consumption behaviors. For example, Allan et al. (2010) reported that individuals with weaker inhibitory control were more likely to engage in unintentional consumption when exposed to attractive food stimuli. Similarly, in the context of purchasing behavior, evidence suggests that impairments in executive functions, including cognitive inhibition and cognitive flexibility, are associated with compulsive buying behavior (KEFI & KEFI, 2010). Furthermore, theoretical models related to behavioral addictions indicate that the interaction between purchasing-related environmental cues, attentional biases, and weakened inhibitory control can lead to increased buying behavior and its persistence (Trotzke et al., 2020). On the other hand, the role of attention in consumer choice and decision-making processes has also been emphasized in empirical studies. For instance, eye-tracking studies have shown that the amount and duration of visual attention directed toward products can strongly predict product choice and purchasing behavior (Gidlöf et al., 2017). Additionally, visual elements such as color, imagery, and brand name salience can capture consumers' attention and influence their preferences (Riswanto et al., 2025). In digital environments, differences in levels of attention can also affect search strategies, patterns of interaction with web pages, and users' success in completing online tasks (Torabi et al., 2025, 2026). In recent decades, the expansion of online services and e-commerce platforms has significantly transformed consumer purchasing patterns (Ray et al., 2019; Reddy & Jayalaxmi, 2014). These platforms, often referred to as multi-sided platforms, facilitate interactions among users, suppliers, and other market actors while providing consumers with complex environments rich in informational and visual stimuli (Trabucchi & Buganza, 2022). Within such environments, cognitive processes such as attention and inhibition may play an important role in how individuals process information, evaluate available options, and ultimately make purchasing decisions. In recent years, the application of neuroscience methods to the study of consumer behavior has increased substantially. Neuromarketing, through the use of tools such as electroencephalography (EEG), enables the direct examination of brain activity associated with the evaluation and preference of products (Khurana et al., 2021). Studies have demonstrated that time–frequency patterns of EEG signals may be associated with consumer preferences and Like/Dislike decisions, and that these preferences can even be predicted using machine learning techniques (Hassani et al., 2022; Ouzir et al., 2024). Nevertheless, a considerable proportion of neuromarketing research has been conducted in controlled laboratory settings, and fewer studies have examined decision-making processes in interactive online environments. Despite the considerable advances in the neuroscientific study of consumer behavior, several gaps remain in the literature. First, many studies investigating attention in consumer contexts have primarily focused on visual attention, while the role of sustained attention as an important dimension of executive functioning has received less direct investigation. Second, research on cognitive inhibition has often concentrated on pathological consumption behaviors, such as compulsive buying or overeating, whereas the role of this process in purchasing decisions among typical consumers has been less frequently explored. Moreover, relatively few studies have simultaneously examined sustained attention and cognitive inhibition alongside neurophysiological indicators such as EEG within the context of online purchasing environments. Accordingly, the present study was conducted to investigate the role of sustained attention and cognitive inhibition in consumers' purchasing behavior within a multi-sided platform website environment. In this study, an attempt was made to combine cognitive function assessment with the recording of brain activity using EEG in order to provide a more comprehensive understanding of the cognitive and neural mechanisms underlying purchasing decisions in online environments.

Method & Material:

Research Design and Participants:

The present study was conducted using a quasi-experimental design aimed at examining the relationship between the cognitive processes of sustained attention and cognitive inhibition with purchasing decision-making in a simulated digital environment while simultaneously recording brain activity using electroencephalography (EEG). The target population consisted of young adults residing in Tehran, and the research sample was selected from individuals aged 18 to 30 years using a convenience sampling method. In total, 30 participants took part in the study. The required sample size was determined using G*Power software. Considering an effect size of 0.6 and a coefficient of determination of 0.4, the required number of participants was calculated to be

30. Inclusion criteria included being between 18 and 30 years old, having at least a high school diploma, being right-handed according to the Edinburgh Handedness Inventory (score greater than 8), having normal or corrected-to-normal vision, and having general physical and mental health. Exclusion criteria included a history of neurological or psychiatric disorders, use of psychiatric medications during the past three months, use of narcotic or psychoactive substances, alcohol consumption within twelve hours prior to the experiment, excessive caffeine consumption on the day of the experiment, a history of head injury, severe fatigue or lack of cooperation during the experiment, and lack of previous experience with ordering food online through the SnappFood platform. Prior to the beginning of the experiment, all participants signed an informed consent form and were informed about the confidentiality of their data as well as their right to withdraw from the study at any stage.

Figure 1. Overview of the task procedure and EEG recording timeline**.**

Instruments and Measures:

Several standardized instruments were used to assess cognitive variables and conduct initial screening. Participants' handedness was assessed using the Edinburgh Handedness Inventory (Ahmad & Mojgan, 2007), consisting of 10 five-option questions, in order to maintain sample homogeneity in terms of motor lateralization. General health status and the likelihood of psychological symptoms were assessed using the 28-item General Health Questionnaire (GHQ-28) (Seyed Mohammadreza, 2002). Cognitive inhibition was measured using the computerized version of the Stroop test (Khah et al., 2016). In this task, stimuli consisted of congruent and incongruent color words, each presented for 2000 milliseconds, with an inter-stimulus interval of 800 milliseconds. Participants were required to report the color of the ink while ignoring the semantic meaning of the word. The indices extracted from this test included the number of correct responses, number of errors, reaction time, and the Stroop interference score, which was considered an indicator of cognitive inhibition. Sustained attention was assessed using the Persian version of the Continuous Performance Test (CPT) (Habib et al., 2001). In this task, 150 stimuli were presented, including 30 target stimuli and 120 non-target stimuli. Each stimulus was displayed for 200 milliseconds, with an inter-stimulus interval of 1000 milliseconds. The main indices of this test included omission errors, commission errors, correct responses, and reaction time, which were used as indicators of sustained attention and impulse control.

EEG Recording:

After completing the behavioral assessments, participants' brain activity was recorded using a non-invasive 64-channel electroencephalography system. Electrodes were placed on the scalp according to the international standard 10–20 system, the spatial distribution of electrodes covered frontal, central, temporal, parietal, and occipital regions, allowing the examination of neural activity associated with visual perception, attentional engagement, and cognitive control processes involved in purchase decision-making, and conductive gel was used to reduce impedance. The experiment was conducted in a room with dim lighting, controlled temperature, and sound insulation to minimize environmental interference during signal recording. Before the start of the main task, a baseline EEG recording was performed for two minutes with eyes open and two minutes with eyes closed. Participants then received a brief instruction regarding the procedure of the task and completed a short practice phase with stimuli different from the main experimental stimuli to ensure that they fully understood the instructions. During EEG recording, participants were instructed to avoid unnecessary movements, excessive blinking, or facial muscle contractions as much as possible in order to reduce movement-related artifacts in the recorded signals.

Purchase Decision-Making Task Design:

To simulate the purchase decision-making process, a computerized experimental environment was designed using MATLAB software that resembled the structure of online food purchasing environments in multi-sided platforms. The stimulus images were selected from the food image database of the Salzburg University Neuroscience Laboratory. Using Adobe Photoshop, features such as price, user ratings, and the Food and Drug Administration approval badge were added to the images. Food items were organized into four main categories: pizza, hamburger, steak, and pasta. A total of 180 food stimuli were presented to each participant. Each experimental trial consisted of four stages. First, a fixation cross was displayed for 500 to 1000 milliseconds. Next, the food image was presented without decision options for 3000 milliseconds, forming the observation stage. Afterward, a second fixation cross appeared for 600 to 800 milliseconds. Finally, the same image was presented along with the options "Buy" and "Not Buy" for 6000 milliseconds, during which participants were required to register their decision using the keyboard. Throughout all stages, EEG data and behavioral responses were recorded simultaneously.

EEG Processing and Feature Extraction:

EEG data processing was performed using MATLAB and the EEGLAB toolbox. Initially, the signals underwent preprocessing procedures including filtering, removal of segments containing excessive noise, and correction of ocular and muscular artifacts using Independent Component Analysis (ICA). After signal cleaning, epochs time-locked to the task events were extracted, and spectral power was calculated within standard frequency bands, including delta (1–3 Hz), theta (4–7 Hz), alpha (8–13 Hz), beta (13–30 Hz), and gamma (31–60 Hz). To reduce data dimensionality, power values were averaged across major cortical regions, including frontal, central, and parietal/occipital regions.

Statistical Analysis:

Statistical analyses were conducted using SPSS software. First, the distribution of the data was examined for normality, and descriptive statistics were calculated for the behavioral and cognitive variables. Subsequently, simultaneous multiple regression analysis was used to examine the role of sustained attention and cognitive inhibition in predicting purchasing behavior. In this analysis, the indices derived from the Continuous Performance Test and the Stroop test were considered as predictor variables, while the number of "Buy" choices in the decision-making task was considered as the criterion variable. Standardized coefficients, confidence intervals, and effect sizes were reported for interpretation of the results.

Result:

Data analysis represents one of the most essential stages in research based on collected empirical data. After data collection, the information is organized, classified, and summarized before entering the analysis phase, during which the data are examined in line with the research objectives, research questions, and hypotheses. The outputs of the present study were categorized into two main groups: (a) behavioral data and (b) brain signal processing data. Behavioral data included the results obtained from the psychological assessments, namely the Stroop test and the Continuous Performance Test, as well as participants' responses in the purchasing decision-making task, which were analyzed using SPSS software. In addition, electroencephalography (EEG) data were preprocessed using the EEGLAB toolbox, and spectral power was extracted for the main frequency bands including delta, theta, alpha, and beta. The results of these analyses are presented in the following sections.

Behavioral Results:

Demographic Characteristics

Table 1. Demographic Characteristics of Participants (N = 30)

Variable	Category	N	%	Cumulative %
Gender	Female	12	40.0	40.0
	Male	18	60.0	100.0
Education	Diploma	4	13.3	13.3
	Associate Degree	1	3.3	16.7
	Bachelor's	1	3.3	20.0
	Master's	21	70.0	90.0
	PhD	3	10.0	100.0
Total	-	30	30	-

As shown in Table 1, the sample consisted of 30 participants, including 12 females (40%) and 18 males (60%). Regarding educational level, most participants held a Master's degree (70%), followed by Diploma (13.3%), PhD (10%), Associate degree (3.3%), and Bachelor's degree (3.3%)

Handedness and General Health:

Table 2. Descriptive Statistics for Handedness and General Health

Variable	Mean	Standard Deviation (SD)
Edinburgh Handedness Inventory	10.00	0.00
General Health Questionnaire (GHQ)	19.42	5.75

As shown in Table 2, the mean score on the Edinburgh Handedness Inventory was 10.00 (SD = 0.00), indicating complete homogeneity in hand dominance among participants. The mean score on the GHQ-28 was 19.42 (SD = 5.75), suggesting that participants were within a typical range of general psychological health.

Stroop Test:

Table 3. Stroop Test Results are used for the assessment of cognitive inhibition.

Condition	Index	Test Time (sec)	Error Number	No Response	True Number	Response Time (ms)	Interference Score	Interference Time
Congruent	Mean	44	0	0	47	939	Mean 0	Mean 54
	SD	10	1	0	2	118		
	Min	38	0	0	44	802	SD 1	SD 53
	Max	61	4	3	48	1250		
Incongruent	Mean	47	0	0	46	994	Min -2	Min -30
	SD	11	1	1	7	135		
	Min	39	0	0	39	832	Max 7	Max 212
	Max	66	8	6	48	1314		

The Stroop task was used as a measure of cognitive inhibition. As presented in Table 3, participants demonstrated longer response times in the incongruent condition (M = 994 ms) compared with the congruent condition (M = 939 ms). The mean number of correct responses was high in both conditions, whereas error rates and omitted responses were minimal. This pattern reflects the expected Stroop interference effect and indicates the engagement of inhibitory control processes during task performance.

Continuous Performance Test (CPT):

Table 4. Results of the Continuous Performance Test for the assessment of sustained attention

Statistic	Response Time (ms)	Correct Responses	Omission Errors	Commission Errors
Mean	435	148	0	0
SD	37	14	1	1
Minimum	363	144	0	0
Maximum	519	150	3	5

The Continuous Performance Test (CPT) assessed sustained attention. As shown in Table 4, participants demonstrated a mean response time of 435 ms (SD = 37) and a high number of correct responses (M = 148, SD = 14). Omission and commission errors were minimal, indicating adequate sustained attention and good response control among the participants.

Normality Test:

To examine the distribution of the study variables and determine the appropriateness of parametric tests, normality was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests.

Table 5. Results of Normality Tests

Variable	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Gender	.389	30	.000	.624	30	.000
Education	.435	30	.000	.653	30	.000
Age	.143	30	.118	.931	30	.053
Attention	.317	30	.000	.754	30	.000
Cognitive Inhibition	.161	30	.044	.932	30	.057
Buying	.099	30	.200	.975	30	.676

Although the Kolmogorov–Smirnov test indicated deviations from normality for some variables, parametric tests were applied. Previous methodological research has shown that Pearson correlation and linear regression are relatively robust to moderate violations of normality, particularly with moderate sample sizes. Therefore, Pearson correlation and linear regression analyses were conducted.

Correlation Analysis:

Table 6. Pearson Correlation Matrix

Measure		Buying	Attention	Cognitive Inhibition
Pearson Correlation	Buying	1.000	-0.326*	0.012
	Attention	-0.326*	1.000	-0.107
	Cognitive Inhibition	0.012	-0.107	1.000
Sig. (1-tailed)	Buying	0	.039	.475
	Attention	.039	0	.287
	Cognitive Inhibition	.475	.287	0
N		30	30	30

The analysis revealed a significant negative correlation between buying behavior and attention ($r = -.326$, $p = .039$). No significant correlations were observed between buying and cognitive inhibition or between attention and cognitive inhibition. Although sustained attention showed a significant bivariate correlation with buying behavior, its predictive effect in the multiple regression model did not remain statistically significant after controlling for cognitive inhibition.

Multiple Regression Analysis

Table 7. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.327	.107	.041	31.57

The regression model explained a modest proportion of variance in buying behavior ($R^2 = .107$)

Table 8. Regression Coefficients

Model	Unstandardized B	Std. Error	Standardized Beta	T	Sig.
Constant	99.008	9.833	-	10.069	.000
Attention	-13.087	7.291	-.328	-1.795	.084
Cognitive Inhibition	-0.014	0.110	-.023	-0.125	.901

Sustained attention showed a negative standardized coefficient ($\beta = -0.328$), indicating a tendency for higher attention levels to be associated with lower buying behavior, although the effect did not reach conventional statistical significance ($p = .084$). Cognitive inhibition did not show a significant relationship with buying behavior ($p = .901$).

Table 9. Zero-Order and Partial Correlations

Predictor	Zero-order	Partial
Attention	-.326	-.326
Cognitive Inhibition	.012	-.023

These results indicate that sustained attention had a modest negative relationship with purchasing behavior, whereas cognitive inhibition had a negligible association with the outcome variable.

EEG Results:

EEG Preprocessing:

EEG preprocessing was conducted using the EEGLAB toolbox in MATLAB. First, the signals were filtered using a finite impulse response (FIR) filter in the frequency range of 1–40 Hz. Faulty channels, when present, were corrected using the interpolation function in EEGLAB. Independent Component Analysis (ICA) was then performed to separate independent components. The ICLabel plugin was used to classify components and identify artifacts. Components related to eye blinks, eye movements, and muscular activity (EMG) were removed. After signal cleaning, spectral power was calculated using the Welch method in MATLAB to extract the frequency bands required for further analyses.

EEG Data Analysis:

In accordance with the objectives of the study, the spectral power of EEG frequency bands was examined during two stages of the task:

1. Food image observation

2. Purchase decision-making (Buy / Not Buy)

Channel-level analyses across frequency bands were conducted using EEGLAB, and additional analyses were performed in R to compute average values and the total power of the frequency bands. The frequency ranges used for each band are reported below. It should be noted that in different studies, these ranges may vary slightly (approximately ±0.5–1 Hz).

EEG Results:

Food Image Observation Stage:

Table 10. Significant EEG Channels During Food Image Observation

Frequency band	Channel	p-value
	Fz	0.01705
Delta	C4	0.03301
	T8	0.00185
	O1	0.04569
	Tp8	0.00502
	C1	0.049610
Theta	AF4	0.00357
	P3	0.00951
	AF7	0.033817
	Po7	0.01377
Alpha	C6	0.03325
	C2	0.03325
Beta	Fp2	0.004798

The EEG results during the observation stage revealed significant activity across delta, theta, alpha, and beta bands in several frontal, central, temporal, and occipital electrodes. This pattern suggests the involvement of neural systems related to visual processing, attentional engagement, emotional evaluation, and reward-related processing during the observation of food stimuli.

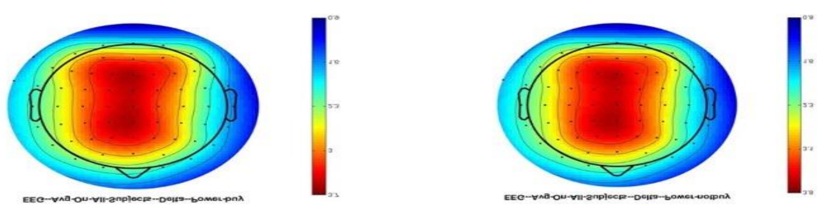
Purchase Decision-Making Stage:

Table 11. Significant EEG Channels During Purchase Decision

Frequency band	Channel	p-value
Theta	P10	0.00541
Alpha	F7	0.01329
	Cp6	0.02450
	O2	0.04465

During the decision-making stage, significant neural activity was mainly observed in theta and alpha frequency bands. These activations were located across frontal, central-parietal, and occipital regions, suggesting the engagement of neural networks associated with cognitive evaluation, attentional control, and decision-making processes. Compared with the observation stage, neural activity appeared more localized, indicating the recruitment of more specific cognitive mechanisms during the evaluation of options and the formation of purchase decisions.

Figure 2. Topoplot of the Delta Frequency Band During Image Observation



In Figure 2**,** the topographic maps illustrate the distribution of EEG spectral power in the delta frequency band during the image observation stage. These maps represent the grand average of neural activity across all subjects for both ‘buy’ and ‘not-buy’ conditions while viewing food stimuli, with warmer colors (red) indicating higher spectral power.

Figure 3. Topoplot of the Alpha Frequency Band During Image Observation

In Figure 3, the topographic distribution of EEG spectral power in the alpha frequency band during the decision-making stage is presented. These maps compare the cortical activation patterns between ‘buy’ and ‘not-buy’ decisions, highlighting the spatial distribution of alpha oscillations across the scalp during the final choice process.

Discussion:

The present study aimed to examine the role of sustained attention and cognitive inhibition in food purchasing behavior within a simulated online shopping environment. The findings indicated that sustained attention showed a stronger association with purchasing behavior compared with cognitive inhibition, although this relationship did not reach the conventional level of statistical significance in the regression analysis. In contrast, the cognitive inhibition index derived from the Stroop test did not demonstrate a significant effect on the tendency to purchase. These findings suggest that the ability to maintain continuous focus may play an important role in processing information relevant to purchase decisions. While some previous studies have identified deficits in executive control and cognitive inhibition as contributing factors to impulsive or compulsive buying behaviors, such effects are typically observed in contexts where purchasing behavior exhibits a pathological or impulsive nature(Trotzke et al., 2020). Therefore, in non-clinical populations and in everyday decision-making situations, attentional processes may play a more prominent role than cognitive inhibition.

From a theoretical perspective, these findings are aligned with models of dual-process decision-making**,** which propose that consumer behavior is influenced by both controlled (deliberative) and automatic (attentional or affective) systems(Kahneman, 2011; Shiv & Fedorikhin, 1999). In situations where stimuli are emotionally or visually salient—such as images of food—attentional systems may dominate the decision process, leading to more intuitive or stimulus-driven choices. This theoretical lens helps explain why sustained attention rather than inhibition played a more central role in predicting purchase behavior in the current study. Analysis of the EEG data compared patterns of neural activity during two stages of the task: observation of food images and decision-making regarding purchase. The results indicated that during the observation stage, significant differences in spectral power across multiple frequency bands were observed in a larger number of channels, suggesting broader engagement of perceptual and attentional neural networks during the initial exposure to food-related stimuli. This finding is consistent with neuromarketing research indicating that initial exposure to consumer stimuli is associated with the activation of widespread attentional and sensory processing networks(Hassani et al., 2022). In contrast, during the decision-making stage, neural activity appeared more restricted but more focused, which may reflect a shift from perceptual evaluation toward cognitive selection processes. Such a pattern aligns with neuropsychological models of consumer decision-making that conceptualize observation, evaluation, and choice as sequential stages in the purchasing process(Ouzir et al., 2024). The neural findings also correspond to the functional roles of specific EEG frequency bands. Theta band activity, particularly in frontal regions, has been associated with attentional engagement, working memory load, and cognitive control(Cavanagh & Frank, 2014). Alpha oscillations, in contrast, are often interpreted as markers of cortical inhibition and attentional gating, reflecting the brain's suppression of irrelevant information during goal-directed behavior(Klimesch, 2012).In the current study, the predominance of theta and alpha modulation during decision-making suggests the involvement of fronto-parietal networks responsible for maintaining attention and evaluating available options. This pattern resonates with prior EEG studies in consumer neuroscience reporting similar activity during preference judgments and brand evaluation tasks(Pozharliev et al., 2015; Ramsøy et al., 2018). The convergence of EEG findings with the behavioral results further suggests that sustained attention may constitute a neural basis for processes involved in purchase selection. Previous research has similarly demonstrated that attentional mechanisms play a critical role in guiding consumer decision-making, and that the visual presentation of products can directly influence individuals' attentional allocation(Gidlöf et al., 2017). Moreover, in online shopping environments, visual design and the arrangement of graphical elements can significantly affect consumer attention and, consequently, the likelihood of product selection(Riswanto et al., 2025). This interplay between visual attention and consumer behavior reflects the dynamic integration of cognitive and affective components, which jointly shape the motivational value attributed to consumer stimuli(Plassmann et al., 2015). Importantly, these findings also have practical implications. Understanding that sustained attention, rather than inhibitory control, is a stronger predictor of consumer decisions suggests that digital marketing strategies might benefit from focusing on attention-capturing design elements—such as motion, color contrast, and spatial framing—rather than on cognitive load reduction alone. Likewise, manipulating the visual saliency of products may influence purchasing behavior, as salient stimuli can bias the accumulation of decision evidence and increase the likelihood that a product will be selected, particularly in rapid choice situations(Milosavljevic et al., 2012) .Overall, the findings of this study suggest that sustained attention plays an important role in cognitive processes related to purchasing behavior, and the neural activity observed across different stages of exposure to food stimuli supports this pattern. These results may contribute to a deeper understanding of the interaction between cognitive and neural processes in consumer decision-making and provide a foundation for future research in neuromarketing and the design of digital shopping environments.

Limitations and Future Research Directions:

Limitations:

Despite efforts to control laboratory conditions and carefully implement the research protocol, several limitations should be considered when interpreting the results. First, the relatively small sample size may have reduced the statistical power of the study and limited the generalizability of the findings. Second, the study was conducted in a controlled laboratory setting; therefore, real-world consumer decision-making conditions may not have been fully replicated. Third, although EEG is a suitable tool for examining the temporal dynamics of brain activity, it has limitations in precisely identifying the spatial sources of neural activity. Additionally, in some cases, technical challenges associated with EEG recording equipment may influence the quality of the collected data. Finally, the focus of this study was on purchasing decisions related to food products; therefore, generalizing the findings to other domains of consumer behavior requires further investigation.

Future Research Directions:

Based on the findings and limitations of this study, several directions for future research can be suggested. First, employing larger sample sizes could increase statistical power and improve the generalizability of the results. Second, expanding the experimental task design—by increasing the diversity of stimuli, manipulating variables such as product price or ratings, and examining longer task durations—may help identify more precise neural–behavioral patterns. Furthermore, the use of multimodal approaches, such as combining EEG with techniques like functional magnetic resonance imaging (fMRI) or eye-tracking, could provide a more comprehensive understanding of the neural mechanisms underlying consumer decision-making. Additionally, conducting similar studies in other domains of consumer behavior, such as purchasing electronic products or other consumer goods, may help evaluate the extent to which the present findings can be generalized. Finally, developing inter-institutional collaborations with laboratories and research centers could strengthen research infrastructure and enhance the quality of future studies in this field.

Conclusion:

The aim of this study was to investigate the relationship between cognitive processes and neural activity in food purchasing decision-making using behavioral indicators and EEG recordings. The behavioral results indicated that participants demonstrated appropriate cognitive performance. In the Stroop task, the expected interference effect was observed, reflecting the engagement of cognitive inhibition processes. In addition, the results of the Continuous Performance Test (CPT) indicated that participants exhibited an adequate level of sustained attention and response control. Correlation analysis revealed a significant negative relationship between sustained attention and purchasing behavior, indicating that higher levels of attention were associated with a lower tendency to purchase during the experimental task. However, cognitive inhibition did not show a significant relationship with purchasing behavior. The regression analysis further indicated that although sustained attention was somewhat related to purchasing behavior, this relationship did not reach conventional levels of statistical significance, and cognitive inhibition did not show a significant predictive role in purchasing behavior. The EEG findings also provided important insights into the neural mechanisms involved in this process. During the stage of observing food images, significant activity was detected across multiple frequency bands, including delta, theta, alpha, and beta, in frontal, central, temporal, and occipital regions. This pattern suggests the involvement of widespread brain networks related to visual processing, attentional allocation, emotional evaluation, and reward processing during exposure to food-related stimuli. In contrast, during the stage of deciding whether to purchase or not, significant activity was primarily observed in the theta and alpha frequency bands and in a smaller number of channels. This more focused pattern may reflect the engagement of cognitive networks associated with option evaluation, attentional control, and decision-making processes.

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