Avens Publishing Group
J Neurol Psychol
September 2025 Vol.:11, Issue:1

Open Access Research Article

Journal of Neurology and Psychology

Impact of Audiovisual Brainwave Entrainment on Alpha Wave Activity: A Real-Time EEG Assessment

Cidral-Filho FJ[1,2,3], Prasad OP[4]* and Donatello NN[1,2]

[1]*Laboratory of Experimental Neurosciences, University of South Santa Catarina (UNISUL), Palhoça, Santa Catarina - Brazil*
[2]*Integrative Wellbeing Institute (IWI), Windermere, Florida - United States of America*
[3]*Research Laboratory of Posturology and Neuromodulation (RELPON), Department of Human Neuroscience, Sapienza University, Rome - Italy*
[4]*Sri Sri Neuro Centre, Warangal, Telangana - India*

***Address for Correspondence**
Prasad OP, Sri Sri Neuro Centre, Warangal, Telangana–India, E-mail Id: dromprakash9876@gmail.com

Submission: July 11, 2025
Accepted: September 15, 2025
Published: September 19, 2025

Abstract

Objective: In this study, we aimed to investigate the impact of a 20-minute audiovisual brainwave entrainment session on alpha brainwave activity using continuous real-time electroencephalogram (EEG) monitoring.

Methods: The study was conducted at the Electrophysiology Laboratory of Sri Sri Neuro Centre in Warangal, Telangana. The research included 30 healthy participants aged 18 to 65 (male and female), with no neurological or psychiatric conditions. The BrainTap headset was used for audiovisual brain entrainment targeting alpha waves, and wave activity was measured before, during, and after the session. The EEG electrodes were placed in the left side of the occipital region (O1), in the right occipital region (O2), in the left frontal lobe (F3-C3) and in the right frontal lobe (F4-C4) for readings of brainwaves' amplitude, frequency and power.

Results: Significant increases in alpha amplitude and power were observed during and after the session, particularly in the left (O1) and right (O2) occipital regions, with large effect sizes (all $p < 0.0005$). In the right frontal region (F4–C4), alpha activity also increased significantly, with medium to large effect sizes. Although changes in the left frontal region (F3–C3) were not statistically significant, moderate increases in amplitude, frequency, and power were noted. Exploratory analyses indicated that individuals with lower baseline alpha values showed greater increases, suggesting baseline activity may predict response to the intervention.

Conclusions: This study demonstrates that a 20-minute session of audiovisual brainwave entrainment significantly increases alpha brainwave activity, particularly in individuals with low baseline levels. These findings support the potential of this non-invasive technique to enhance alpha activity and inform future applications for relaxation, mental clarity, and cognitive support. Further research is needed to explore its long-term benefits and applications..

Introduction

Alpha brainwaves, typically ranging from 8 to 12 Hz, represent the dominant neural oscillation in healthy, awake individuals during relaxed, eyes-closed states. They are most prominently observed in the parieto-occipital cortex, including areas associated with visual processing, and are believed to originate from thalamocortical circuitry. Alpha activity has been implicated in a range of cognitive functions such as internal visual attention, perception, memory retention, and conscious awareness (De Koninck et al., 2023) [1].

Importantly, alpha oscillations are thought to exert an inhibitory control over cortical excitability, helping regulate information flow and sensory processing (Jensen and Mazaheri, 2010) [2]. This modulatory role makes alpha a compelling target for external brain stimulation approaches, including techniques like audiovisual brainwave entrainment. Recent findings with transcranial alternating current stimulation (tACS) in the alpha range have shown that enhancing alpha activity can yield lasting neurophysiological and behavioral effects, with potential relevance for clinical conditions involving cognitive deficits, consciousness disorders, and chronic pain (De Koninck et al., 2023) [1].

Audiovisual brainwave entrainment (aBWE) is a non-invasive technique that employs rhythmic light and sound stimuli to synchronize brainwave frequencies with external cues. By targeting specific frequencies, such as the alpha range, aBWE aims to promote desired mental states. Studies have demonstrated that aBWE can effectively influence alpha wave activity, leading to benefits like enhanced relaxation and influence of cognitive aspects (Cidral-Filho et al., 2025) [3].

While the use of aBWE devices like the BrainTap headset continues to grow, studies employing EEG to objectively measure their neurophysiological impact are still relatively limited. This study seeks to bridge that gap by investigating the impact of a 20-minute aBWE session on alpha brainwave activity using real-time EEG monitoring. By focusing on healthy adults without neurological or psychiatric conditions, the research aims to provide insights into the potential of aBWE as a tool for enhancing mental well-being and cognitive performance.

Methods

This study was conducted at the Electrophysiology Laboratory of Sri Sri Neuro Centre, located in Warangal, Telangana, India. A total of 30 healthy adults, both male and female, aged between 18 and 65 years, were enrolled. Participants were screened to ensure they had no history of neurological or psychiatric disorders. Informed consent was obtained from all individuals prior to participation.

Each participant underwent a single 20-minute session of audiovisual brainwave entrainment (aBWE) using the BrainTap® headset. The device delivers synchronized light and sound stimulation designed to promote alpha brainwave activity within the frequency range of 8 to 13 Hz. Electroencephalogram (EEG) recordings were

ISSN: 2332-3469

performed to evaluate brainwave changes before, during, and after the session. The EEG recording for the "during" phase began two minutes after the start of the session to allow the stimulation to stabilize.

EEG data were acquired using a Nihon Kohden EEG machine, a clinically validated system for neurophysiological monitoring. Electrodes were positioned according to the international 10–20 system at four key locations: the left occipital region (O1), the right occipital region (O2), the left frontal region (F3–C3), and the right frontal region (F4–C4). These placements allowed for the monitoring of alpha wave activity in both posterior and frontal cortical regions. The EEG analysis focused on three key parameters: amplitude, which reflects the height of the brainwave signal in microvolts (μV); frequency, which measures the number of cycles per second in Hertz (Hz); and power, which represents the overall energy of the signal, measured in microvolts squared (μV^2) or decibels (dB).

The EEG signals were preprocessed to ensure data quality. Artifacts were removed, and a notch filter was applied to eliminate electrical interference. Power spectral analysis and Density Spectral Array (DSA) techniques were used to evaluate brainwave activity within the 8 to 13 Hz alpha frequency band. These methods enabled real-time assessment of dynamic changes during the intervention.

Statistical analysis was conducted to compare alpha wave activity across the three phases: before, during, and after the session. Depending on the distribution of the data, either one-way analysis of variance (ANOVA) or the Kruskal–Walli's test was used. When significant differences were identified, appropriate post hoc multiple comparison tests were applied. A p-value of less than 0.05 was considered statistically significant. Effect sizes were also calculated to determine the magnitude of observed changes.

To examine whether baseline alpha activity predicted individual responsiveness to the aBWE session, Spearman rank-order correlation analyses were conducted separately for each electrode region (O1, O2, F3–C3, F4–C4) and EEG metric (alpha amplitude, frequency, and power). Three variables were included in the analysis for each metric: Alpha Baseline, average value before the session; Alpha Change During, change from baseline to the middle of the session; Alpha Change After, change from baseline to the post-session period. All analyses were performed using Jamovi, and Spearman's rho (ρ) was selected due to the non-parametric nature of the data. The goal was to assess: (a) whether baseline levels were predictive of change during or after the session, and (b) whether there was consistency between the changes observed during and after the session.

Results were interpreted using a significance threshold of $p < .05$. Correlation strength was categorized as weak ($|\rho| < 0.30$), moderate ($0.30 \leq |\rho| < 0.50$), and strong ($|\rho| \geq 0.50$).

Results

The analysis of EEG data revealed significant changes in alpha wave activity across multiple brain regions following the audiovisual brainwave entrainment session. In the left occipital region (O1), alpha amplitude significantly increased during the session ($p < 0.0001$) and remained elevated after the session ($p < 0.0001$), with large effect sizes of 1.52 (Table 1) and 1.73 (Table 2), respectively. Similarly, alpha power at this site demonstrated a significant rise during ($p < 0.0001$) and after ($p < 0.0001$) the session, with large effect sizes of 1.72 (Table 1) and 1.90 (Table 2), respectively (Figure 1).

In the right occipital region (O2), a significant increase in alpha power was observed both during ($p < 0.0001$) and after ($p < 0.0005$) the session. These changes were associated with large effect sizes of 0.98 (Table 3) and 0.86 (Table 4), respectively. Although increases in amplitude and frequency were also noted in this region, they did not reach statistical significance (Figure 2).

In the left frontal region (F3–C3), no statistically significant differences were observed in alpha amplitude, frequency, or power. However, percentage increases were observed across all parameters. Specifically, amplitude increased by 17% during and 18% after the session compared to baseline, frequency rose by 1% and 2%, and power showed a 23% increase in both comparisons (Figure 3).

Table 1: Descriptive statistics of electrode O1- Before vs During

	Before (Mean/SD)	During (Mean/SD)	Effect size
Amplitude	9.731 (3.033)	16.85 (5.910)	1.52 (large)
Frequency	9.489 (0.5944)	9.680 (0.6843)	0.30 (small)
Power	7.196 (3.153)	12.87 (3.437)	1.72 (large)

Table 2: Descriptive statistics of electrode O1- Before vs After

	Before (Mean/SD)	After (Mean/SD)	Effect size
Amplitude	9.731 (3.033)	17.04 (5.131)	1.73 (large)
Frequency	9.489 (0.5944)	9.536 (0.5246)	0.08 (very small)
Power	7.196 (3.153)	13.14 (3.087)	1.90 (large)

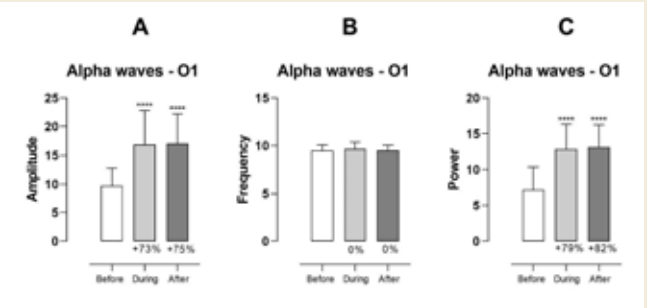

Figure 1: EEG assessment of alpha waves before, during, and after a 20-minute brainwave stimulation session in the O1 region. The data was analyzed by One-way ANOVA or Kruskal-Wallis test when appropriate. The value for significant statistical difference was set at <0.05. * Represents the significant statistical difference from baseline.

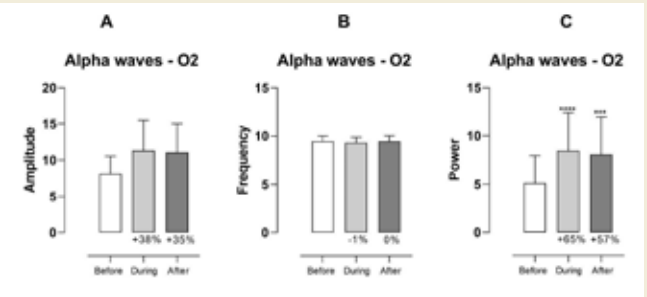

Figure 2: EEG assessment of alpha waves before, during, and after a 20-minute brainwave stimulation session in the O2 region. The data was analyzed by One-way ANOVA or Kruskal-Wallis test when appropriate. The value for significant statistical difference was set at <0.05. * Represents the significant statistical difference from baseline.

ISSN: 2332-3469

Table 3: Descriptive statistics of electrode O2 - Before vs During

	Before (Mean/SD)	During (Mean/SD)	Effect size
Amplitude	8.152 (2.379)	11.32 (4.167)	0.93 (large)
Frequency	9.450 (0.5578)	9.308 (0.5512)	0.26 (small)
Power	5.129 (2.829)	8.468 (3.932)	0.98 (large)

Table 4: Descriptive statistics of electrode O2- Before vs After

	Before (Mean/SD)	After (Mean/SD)	Effect size
Amplitude	8.152 (2.379)	11.07 (3.933)	0.90 (large)
Frequency	9.450 (0.5578)	9.446 (0.5771)	0.01 (very small)
Power	5.129 (2.829)	8.052 (3.885)	0.86 (large)

Table 5: Descriptive statistics of electrodes F3-C3 - Before vs During

	Before (Mean/SD)	During (Mean/SD)	Effect size
Amplitude	15.98 (8.746)	18.68 (9.263)	0.30 (small)
Frequency	9.205 (0.5507)	9.288 (0.4844)	0.16 (very small)
Power	10.37 (2.866)	12.71 (4.045)	0.67(medium)

Table 6: Descriptive statistics of electrodes F3-C3 - Before vs After

	Before (Mean/SD)	After (Mean/SD)	Effect size
Amplitude	15.98 (8.746)	18.82 (7.427)	0.35 (small)
Frequency	9.205 (0.5507)	9.427 (0.6689)	0.36 (small)
Power	10.37 (2.866)	12.71 (3.649)	0.71 (medium)

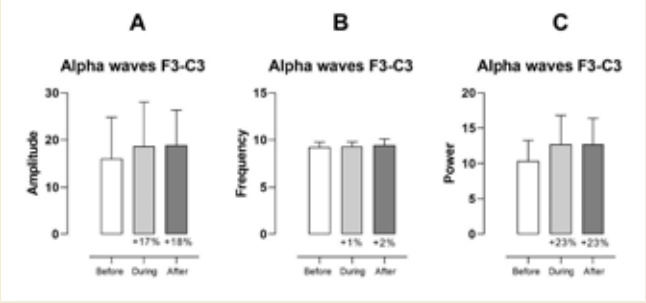

Figure 3: EEG assessment of alpha waves before, during, and after a 20-minute brainwave stimulation session in the F3-C3 region. Data were analyzed using one-way ANOVA or the Kruskal-Wallis test, when appropriate.

In contrast, the right frontal region (F4–C4) exhibited statistically significant increases. Alpha amplitude increased during ($p = 0.0117$) and after ($p < 0.0001$) the session, with a medium effect size (0.55, (Table 7) during and a large effect size (0.86, (Table 8) after the session. Alpha power in this region also increased significantly during ($p = 0.0003$) and after ($p < 0.0001$) the session, with large effect sizes of 0.99 (Table 7) and 1.39 (Table 8), respectively (Figure 4).

To explore individual variability in responsiveness to the aBWE session, correlation analyses were conducted to examine whether baseline alpha values predicted the magnitude of change during or after the session across amplitude, frequency, and power metrics. Additional correlations between change during and after the session were evaluated to assess intra-individual consistency.

In the occipital region O1, baseline amplitude was not significantly associated with changes during ($\rho = -0.053$, $p = .780$) or after ($\rho = -0.177$, $p = .348$) the session. However, amplitude changes during and after the session were significantly correlated ($\rho = 0.501$, $p = .005$),

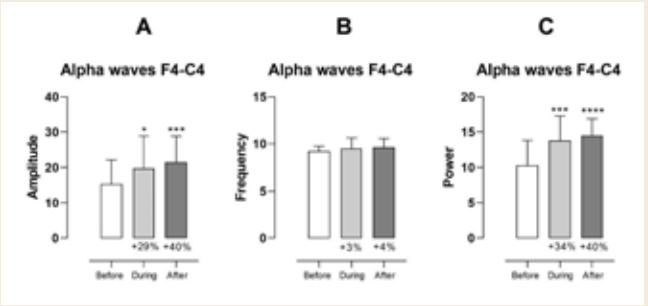

Figure 4: EEG assessment of alpha waves before, during, and after a 20-minute brainwave stimulation session in the F4-C4 region. The data was analyzed by One-way ANOVA or Kruskal-Wallis test when appropriate. The value for significant statistical difference was set at <0.05. * Represents the significant statistical difference from baseline.

Table 7: Descriptive statistics of electrodes F4-C4 - Before vs During

	Before (Mean/SD)	During (Mean/SD)	Effect size
Amplitude	15.32 (6.816)	19.78 (9.112)	0.55 (medium)
Frequency	9.198 (0.5474)	9.500 (1.126)	0.34 (small)
Power	10.30 (3.525)	13.78 (3.479)	0.99 (large)

Table 8: Descriptive statistics of electrodes F4-C4 - Before vs After

	Before (Mean/SD)	After (Mean/SD)	Effect size
Amplitude	15.32 (6.816)	21.44 (7.419)	0.86 (large)
Frequency	9.198 (0.5474)	9.621 (0.9359)	0.55 (medium)
Power	10.30 (3.525)	14.47 (2.388)	1.39 (large)

indicating consistent response patterns. For alpha frequency, baseline values predicted changes after the session ($\rho = -0.649$, $p < .001$), with lower initial frequencies showing greater increases. No significant correlation was observed with changes during the session, although changes during and after were moderately correlated ($\rho = 0.421$, $p = .020$). Regarding power, baseline levels were strongly and negatively associated with changes both during ($\rho = -0.532$, $p = .003$) and after the session ($\rho = -0.645$, $p < .001$), suggesting greater reactivity among participants with lower initial power. Changes during and after were also strongly correlated ($\rho = 0.776$, $p < .001$).

In the occipital region O2, no significant associations were observed between baseline amplitude and changes during or after the session. However, a moderate correlation between changes during and after ($\rho = 0.464$, $p = .010$) indicated intra-individual consistency. Baseline alpha frequency showed moderate negative correlations with change during ($\rho = -0.409$, $p = .025$) and change after ($\rho = -0.417$, $p = .022$), again suggesting greater responsiveness among those with lower resting frequency. A moderate correlation between changes during and after was also observed ($\rho = 0.368$, $p = .046$). No significant correlations were found between baseline power and change scores, but changes during and after the session were moderately to strongly correlated ($\rho = 0.545$, $p = .002$), reinforcing the presence of stable intra-individual responsiveness.

In the frontal region F3–C3, baseline amplitude was strongly predictive of change after the session ($\rho = -0.599$, $p < .001$), but not during. Amplitude changes during and after the session were moderately correlated ($\rho = 0.556$, $p = .002$). Baseline frequency

ISSN: 2332-3469

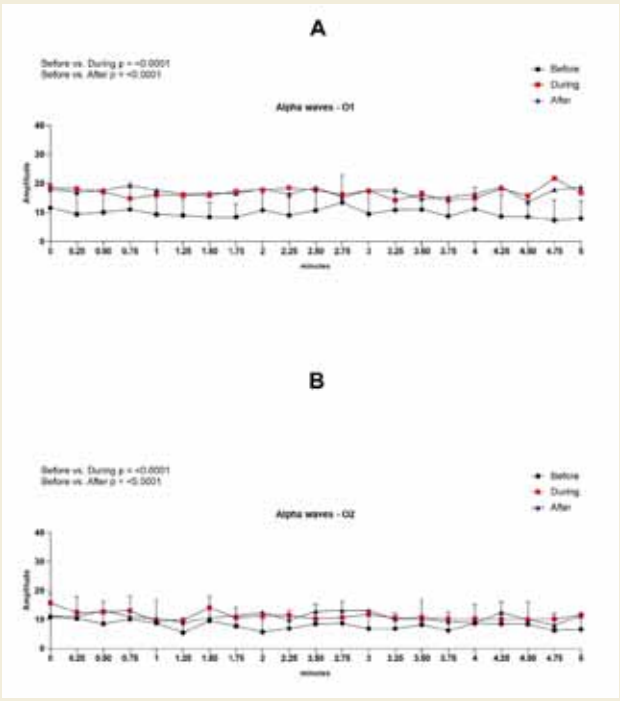

Figure 5: EEG assessment of alpha wave amplitude during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the O1 region in graph A and in the O2 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

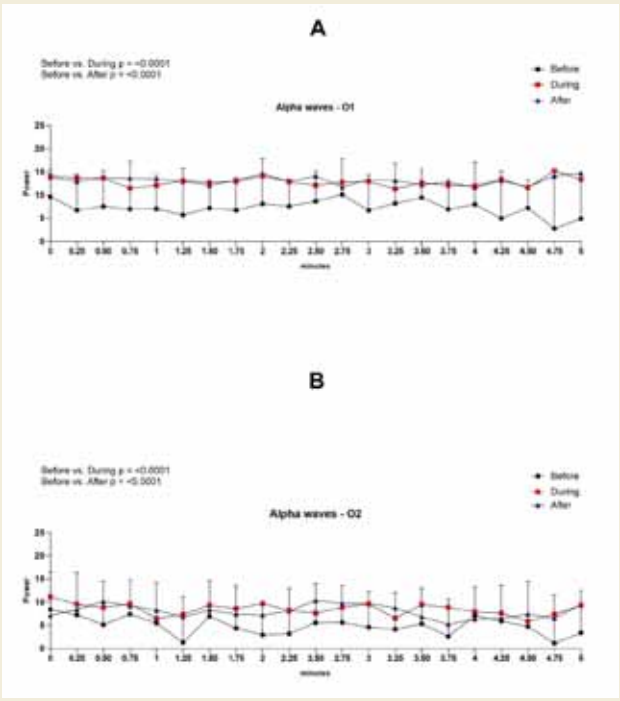

Figure 7: EEG assessment of alpha wave power during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the O1 region in graph A and in the O2 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

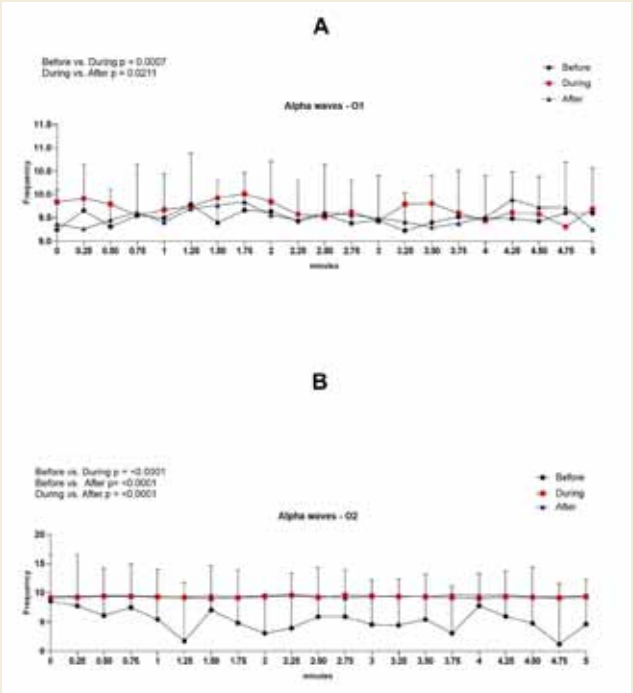

Figure 6: EEG assessment of alpha wave frequency during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the O1 region in graph A and in the O2 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

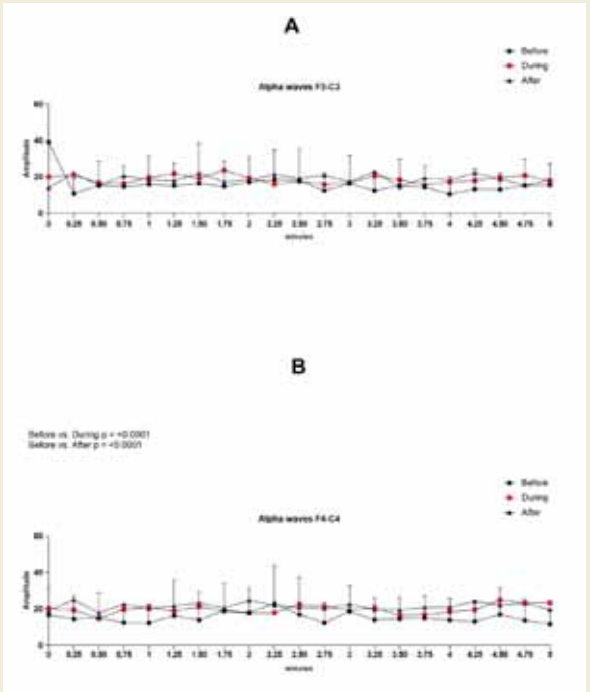

Figure 8: EEG assessment of alpha wave amplitude during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the F3-C3 region in graph A and in the F4-C4 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

ISSN: 2332-3469

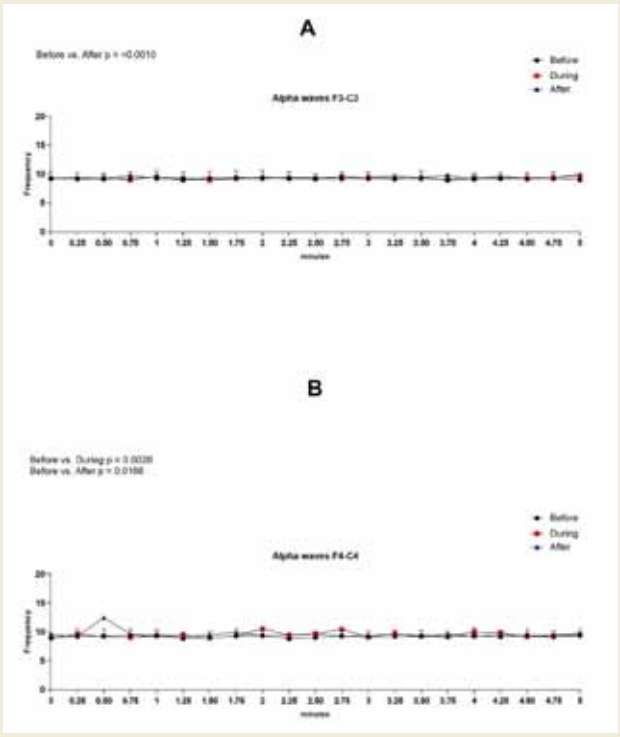

Figure 9: EEG assessment of alpha wave amplitude during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the F3-C3 region in graph A and in the F4-C4 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

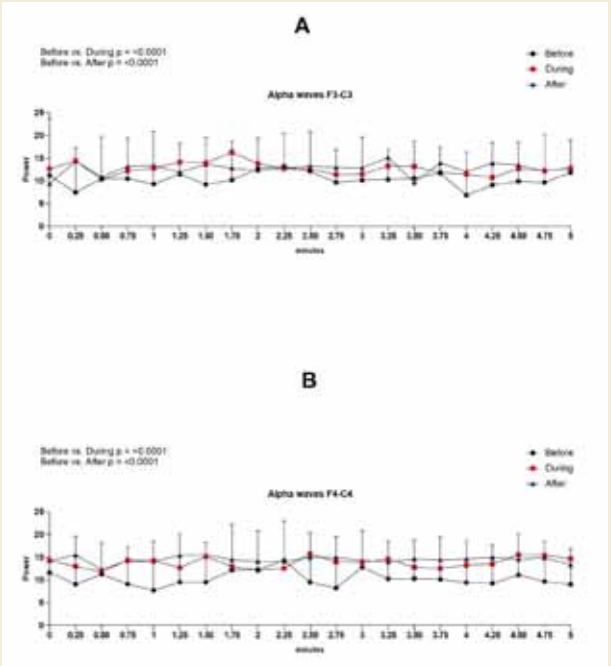

Figure 10: EEG assessment of alpha wave amplitude during the 0.25 to 5-minute interval of a 20-minute brainwave stimulation session in the F3-C3 region in graph A and in the F4-C4 region in graph B. To analyze the data a Two-way ANOVA test was performed followed by Tuckey's multiple comparison test. The value for significant statistical difference was set at <0.05.

showed a moderate negative correlation with change during the session ($\rho = -0.418$, $p = .022$), and a trend toward significance after the session ($\rho = -0.327$, $p = .078$). No significant correlation was observed between frequency changes during and after the session. Power demonstrated a strong negative correlation between baseline and post-session change ($\rho = -0.587$, $p < .001$), and a trend during the session ($\rho = -0.357$, $p = .053$). Power changes during and after the session were strongly correlated ($\rho = 0.591$, $p < .001$).

In the frontal region F4–C4, baseline amplitude was not associated with change during the session and showed a borderline negative correlation with post-session change ($\rho = -0.349$, $p = .060$). However, changes during and after were strongly correlated ($\rho = 0.660$, $p < .001$). For frequency, no significant associations were found with baseline values, but the correlation between changes during and after approached significance ($\rho = 0.351$, $p = .057$), indicating consistent response trends. Power analysis revealed a strong negative correlation between baseline values and post-session change ($\rho = -0.598$, $p < .001$), with a trend during the session ($\rho = -0.283$, $p = .129$). A strong correlation between power changes during and after the session was observed ($\rho = 0.688$, $p < .001$).

Overall, these findings suggest that participants with lower baseline alpha frequency and power, particularly in occipital and frontal regions, exhibited greater increases in these metrics following the aBWE session. Moreover, the consistent correlations between changes during and after the session across multiple channels and parameters support the presence of stable, trait-like responsiveness to the intervention.

Discussion

This study demonstrates that a single 20-minute session of audiovisual brainwave entrainment using the BrainTap headset significantly enhances alpha brainwave activity, particularly in the occipital and right frontal regions. These findings are consistent with the proposed mechanism of action of aBWE, which aims to synchronize endogenous brain activity with externally delivered rhythmic auditory and visual stimuli.

Importantly, correlation analyses revealed that individuals with lower baseline alpha frequency and power tended to exhibit greater increases in these measures following stimulation, particularly in occipital and frontal regions. This inverse relationship suggests that initial resting-state alpha levels may serve as predictors of responsiveness to aBWE. Furthermore, strong positive correlations between changes during and after the session were observed across multiple metrics and brain regions, indicating consistent intra-individual responsiveness and potentially stable neuroplastic effects.

The observed increases in alpha amplitude and power, especially in the O1 and O2 regions, suggest heightened neural synchrony in posterior cortical areas commonly associated with visual processing, relaxation, and internalized attention. Enhanced alpha activity in these areas may reflect a transition from external task engagement toward a relaxed but alert state. This aligns with previous research indicating that alpha oscillations are a hallmark of meditative and restorative cognitive states (Abhang et al., 2016) [4].

In the present study, the F3–C3 region did not show statistically

ISSN: 2332-3469

significant changes in alpha amplitude or power following the aBWE session. However, modest percentage increases were observed, which may suggest a subtle modulation not captured with statistical significance in this sample. Prior research has indicated that alpha activity in the left frontal region may be more variable and task-dependent, especially in resting-state conditions. For instance, Zhao et al. (2024) [5] found associations between alpha parameters in F3 and executive functioning, particularly in clinical populations or under cognitive task demands. Bonança (2024) [6] reported frontal theta increases but not consistent alpha changes during active math tasks, emphasizing the differential roles of frontal regions under cognitive load. Additionally, studies on microstate dynamics suggest that posterior alpha power may modulate or interact with frontal systems, dynamically shaping network activation (Croce, 2020) [7]. Therefore, the absence of strong effects in F3–C3 in this resting-state protocol may reflect a more indirect or state-dependent role of left frontal alpha activity, as opposed to the more robust and consistent alpha generation observed in occipital and right frontal regions.

These findings contribute to the growing body of evidence suggesting that non-invasive neuromodulation techniques such as aBWE can induce measurable neurophysiological changes in brain function. Given the role of alpha oscillations in stress regulation, attentional control, and mental clarity, these results may have broad implications for applications in mental wellness, workplace performance, and potentially in clinical interventions targeting dysregulated alpha activity.

However, some limitations should be acknowledged. The study lacked a sham or control condition, making it difficult to fully isolate the specific contribution of the BrainTap stimulation from placebo effects or general relaxation. The sample included only healthy participants, and the effects of repeated sessions or long-term use were not evaluated. Additionally, while EEG provides excellent temporal resolution, it does not allow for source localization of alpha activity beyond the electrode level.

In interpreting these findings, it is important to consider the distinction between statistical significance and effect size, particularly in the context of EEG research, which is often characterized by high inter-individual variability and relatively small sample sizes. In this study, regions such as O2 and F4–C4 exhibited both statistically significant increases in alpha power and large effect sizes, underscoring the robustness of the observed effects. More broadly, the inclusion of effect size metrics alongside p-values provides a more comprehensive interpretation of intervention outcomes. Even when statistical significance is not reached, medium or large effect sizes may reflect meaningful physiological modulation, especially in small samples where statistical power is limited. This dual-metric approach is particularly relevant for evaluating the neurophysiological impact of non-invasive brain stimulation techniques such as aBWE.

Future research should investigate the longitudinal effects of repeated aBWE sessions, explore different stimulation protocols, and include control groups to rule out non-specific effects. Studies involving clinical populations may also help determine whether this approach can benefit individuals with disorders linked to dysregulated alpha activity, such as anxiety or insomnia.

In summary, these results further support the effectiveness of the intervention in modulating alpha activity, especially among individuals with lower baseline alpha power or frequency, who demonstrated the most pronounced increases. This finding suggests aBWE may be particularly well-suited for populations with hypoactive alpha states, potentially including those with stress, anxiety, or cognitive overload.

Conclusion

The results of this study demonstrate that a single 20-minute session of audiovisual brainwave entrainment using the BrainTap headset significantly enhances alpha brainwave activity, particularly in the occipital and right frontal regions. These changes were marked by statistically significant increases in both amplitude and power, with large effect sizes observed in multiple sites.

Additionally, exploratory analyses suggest that baseline alpha power and frequency may predict the magnitude of response, with individuals showing lower initial levels exhibiting greater changes. These findings support the relevance of individual variability in resting-state EEG profiles as potential biomarkers of responsiveness to aBWE interventions.

The findings suggest that audiovisual entrainment is a promising non-invasive technique for modulating brain activity associated with relaxation, internalized attention, and mental clarity. While the effects were immediate and robust, further research is needed to explore the duration of these changes, their functional outcomes, and their applicability in clinical or performance-oriented settings.

This study contributes to the growing evidence base supporting brainwave entrainment technologies and highlights the value of real-time EEG assessments in understanding their neurophysiological impact.

Executive Summary

- This white paper summarizes a pilot study examining the effects of a 20-minute audiovisual brainwave entrainment (aBWE) session using the BrainTap headset on alpha brainwave activity.
- Real-time EEG monitoring in 30 healthy adults revealed significant increases in alpha amplitude and power, particularly in the occipital and right frontal regions.
- These findings suggest that aBWE may be an effective non-invasive method to enhance relaxation and mental clarity by increasing alpha brainwave activity. Further studies are encouraged to explore its long-term benefits and applications.
- Exploratory analyses showed that individuals with lower baseline alpha levels experienced greater increases, suggesting that baseline alpha may predict response to aBWE.

Acknowledgements

We would like to thank Dr. Patrick Porter from BrainTap for donating the BrainTap devices used in this study.

References

1. De Koninck BP, Brazeau D, Guay S, Herrero Babiloni A, De Beaumont L

ISSN: 2332-3469

(2023) Transcranial Alternating Current Stimulation to Modulate Alpha Activity: A Systematic Review. *Neuromodulation* 26:1549-1584.

2. Jensen O, Mazaheri A (2010) Shaping functional architecture by oscillatory alpha activity: gating by inhibition. *Front Hum Neurosci* 4:186.
3. Cidral-Filho FJ, Porter P, Donatello NN (2025)An Integrative Review of Brainwave Entrainment Benefits for Human Health. *Appl Psychophysiol Biofeedback* 50: 3-9.
4. Abhang PA, Gawali BW, Mehrotra SC (2016) Technological Basics of EEG Recording and Operation of Apparatus. *Introduction to EEG- and Speech-Based Emotion Recognition*, 19-50.
5. Zhao M, Hu G, Lu Y, Yang Q, Chen X, et al (2024) Association between electroencephalogram alpha-band oscillations and executive and processing functions in patients with cerebral small vessel diseases. *J Cereb Blood Flow Metab* 44: 1302-1315.
6. Bonança GM, Gerhardt GJL, Molan AL, Oliveria LMA, Jarola GM, et al. (2024) EEG alpha and theta time-frequency structure during a written mathematical task. *Med Biol Eng Comput* 62:1869-1885.
7. Croce P, Quercia A, Costa S, Zappasodi F (2020) EEG microstates associated with intra- and inter-subject alpha variability. *Sci Rep* 10: 2469.