International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes

Teerawat Pongsai [1], Natchanon Sungpook [2], and Wimonmas Prachakul [3]
Faculty of Education, Kasetsart University, Thailand
[1]E-mail: teerawat.pong@ku.th, ORCID ID: https://orcid.org/0009-0002-1072-4494
[2]E-mail: fedukvs@ku.ac.th, ORCID ID: https://orcid.org/0000-0001-9484-464X
[3]E-mail: wimolmas.s@ku.th, ORCID ID: https://orcid.org/0009-0006-4892-4650

Received 24/06/2025 Revised 09/07/2025 Accepted 16/08/2025

Abstract

Background and Aim: This research aimed to investigate the effects of mindfulness training on brain waves and anxiety levels of competitive karate athletes, and to compare the effects of the Mindfulness Acceptance Commitment (MAC) program on athletes' anxiety levels. The sample consisted of Thai national karate team athletes, both male and female, aged 18-28 years, who experienced moderate to high levels of competition anxiety.

Materials and Methods: The researcher employed a purposive sampling method, with the sample size determined from established tables, totaling 13 individuals. The researcher calculated the sample size using G*Power software based on Cohen's 1988 principles, with an effect size of 0.6, an α value of .05, a power of 0.8, and 1 group. To prevent sample loss due to dropout, an additional 2 participants were included, making the total sample size 15 individuals. However, due to problems with the sample group's participation in completing the research process, 5 participants declined to continue in the study, leaving a final sample of 10 participants in this research. The sample group received mindfulness training according to the MAC program in conjunction with regular karate training for 7 weeks, 2 days per week. Brain wave testing was conducted 1 week before the competition, alongside the administration of the revised State Anxiety Inventory 5 minutes before the competition and the Sport Mindfulness Scale immediately after the competition, both before and after the experimental intervention.

Results: The results from data analysis using descriptive statistics including mean, standard deviation, standard error, and Wilcoxon Signed Rank Test at the .05 significance level revealed statistically significant differences at the .05 level in alpha and beta brain waves before and after the experiment at electrodes Cz ($p=0.02$), Cp6 ($p=0.04$), Pz ($p=0.02$), and P4 ($p<0.01$), but no significant differences were found at other electrode sites. Regarding state anxiety levels and sport mindfulness levels before and after the experiment, no statistically significant differences were found at the .05 level. Therefore, it can be concluded that the Mindfulness, Acceptance, and Commitment training program demonstrates positive trends in affecting Thai national karate team athletes, particularly in terms of brain physiology, and shows promising potential for developing important psychological factors related to competition, although these effects were not clearly evident within the timeframe of this study.

Conclusion: The Mindfulness Acceptance Commitment program demonstrated potential positive effects on Thai national karate athletes, particularly regarding cerebral physiological parameters, and showed promising trends for developing key psychological factors relevant to competition performance, although these effects did not reach statistical significance within the timeframe of this investigation.

Keywords: Mindfulness; EEG; Anxiety; Martial Arts; Karate Athletes

Introduction

In contemporary times, advancements in science and technology, coupled with continuous training methodologies, have resulted in minimal differences in technique and tactics among competitive karate athletes. Therefore, mental state has become a crucial factor that determines an athlete's victory in competition. There are several methods of sports psychology training. Mindfulness training is another effective method for reducing anxiety from competitive situations. Mindfulness training in sports psychology has been designed to help individual athletes enhance their ability to be aware of the present moment (Bagheri & Dana, 2021). Active mindfulness training helps increase athletes' positive emotions (Zou et al., 2023), alleviate pressure and pre-competition anxiety, build confidence, and improve their athletic performance (Ibrahim & Almoslim, 2016). Particularly, Mindfulness Acceptance Commitment (MAC) training is specifically designed to promote sports performance. This psychological training approach focuses on mindfulness training, acceptance, and commitment (Mindfulness Acceptance Commitment: MAC). The aim of this psychological training process that emphasizes mindfulness training, acceptance, and commitment is to help athletes effectively demonstrate their potential, develop skills of

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

attention, non-judgmental awareness, and acceptance of experiences from internal experiences, while simultaneously focusing on appropriate behavioral responses according to context, to promote both current competitive behavior as well as the pursuit of their own valuable goals (Moore, 2009).

Furthermore, mindfulness training also affects brainwave activity. It has been found that an 8-week mindfulness-based stress reduction program has a long-term relationship with increased alpha brainwave power, indicating that mindfulness training may enhance the ability to control emotions and attention (An et al., 2022; Morais et al., 2021). Mindfulness states can indicate different physiological characteristics. Currently, there are experiments and brainwave measurements using scientific methods, finding that humans can control brainwaves and brain-secreted substances if they have mental training to control emotional and mental states. Technology using brainwave signals has gained increasing attention, as seen from the application of brainwave signals in various fields, whether in medicine or sports, to analyze individual athlete data to gain competitive advantages. This is done by examining brainwave signals, which are small electrical signals generated by brain activity, creating weak electrical currents around the head. Researchers can utilize these various signals to classify brainwaves into characteristics that indicate different states. Particularly, alpha brainwaves have a frequency of approximately 8-13 cycles per second (Hz), recorded while awake, when the brain is resting with eyes closed, with the largest waves found at the occipital region. Cowan and Allen (2000) stated that alpha waves (8–13 Hz) are fundamental waves that reflect stable neurological and physiological states of the brain. They are associated with relaxed states, stress reduction, and concentration. Additionally, Jung and Lee (2021) also stated that mindfulness training is often associated with alpha brainwaves, and there are numerous studies on mindfulness and EEG observing decreased beta waves during mindfulness meditation training, because alpha brainwaves are considered good indicators of brain function when mental effort is required (Cremades, 2016).

Based on the properties of Mindfulness Acceptance Commitment (MAC) training that can effectively reduce anxiety, the researcher developed an interest in mindfulness training and its effects on brain waves and anxiety levels in competitive karate athletes. This interest stems from the need to find ways to reduce individual athletes' anxiety in order to promote optimal performance and enable athletes to demonstrate their maximum capabilities. Furthermore, published studies that specifically examine the application of such interventions in combat sports, including karate, remain limited in the literature.

Research Objectives

1. To study the effects of mindfulness training on the brainwaves and anxiety levels of competitive karate combat athletes

2. To compare the effects of the Mindfulness Acceptance Commitment (MAC) training program on the anxiety levels of competitive karate combat athletes before and after receiving training

Literature Reviews

Mindfulness Practice

1. Definition and Origins

Mindfulness is commonly defined as the awareness that arises through intentionally paying attention in the present moment without judgment (Kabat-Zinn, 2003). Rooted in Buddhist traditions, mindfulness has been adapted into Western psychological and medical frameworks to support mental and emotional well-being. Jon Kabat-Zinn's Mindfulness-Based Stress Reduction (MBSR) program marked a significant turning point, integrating mindfulness into secular, clinical settings to treat conditions such as anxiety, chronic pain, and depression.

2. Psychological Benefits

Research consistently demonstrates the positive psychological effects of mindfulness practice. Meta-analyses indicate that mindfulness reduces symptoms of stress, anxiety, and depression (Khoury et al., 2013). Mindfulness improves emotional regulation by increasing awareness of automatic reactions and fostering a nonreactive stance toward distressing thoughts and emotions. These outcomes are supported by cognitive models that propose mindfulness enhances metacognitive awareness and reduces rumination.

3. Neurological Correlates

Mindfulness practice also produces measurable changes in brain structure and function. Studies using functional magnetic resonance imaging (fMRI) have identified increased activity in the prefrontal cortex and anterior cingulate cortex—regions associated with attention, emotion regulation, and executive functioning (Tang, Hölzel, & Posner, 2015). Long-term practitioners show increased gray matter density in

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

areas related to learning, memory, and self-awareness, suggesting a neuroplastic response to sustained mindfulness engagement.

4. Educational Applications

Mindfulness is increasingly applied in educational contexts to support student well-being and cognitive performance. School-based mindfulness interventions have shown improvements in attention span, classroom behavior, and academic outcomes (Zenner, Herrnleben-Kurz, & Walach, 2014). Programs such as MindUP and Inner Explorer aim to enhance self-regulation and reduce test anxiety, especially in early childhood and adolescent populations.

5. Workplace and Leadership

In organizational settings, mindfulness has been linked to improved job satisfaction, reduced burnout, and more ethical decision-making. Mindful leadership—characterized by presence, compassion, and self-awareness—has gained traction as a framework for improving workplace culture (Reb, Narayanan, & Chaturvedi, 2014). Regular mindfulness training is associated with enhanced focus and reduced emotional reactivity, fostering better team dynamics and productivity.

6. Limitations and Considerations

Despite its benefits, mindfulness is not universally effective and should not be viewed as a panacea. Some individuals report increased anxiety or emotional distress during meditation, particularly in early stages of practice or with unresolved trauma (Van Dam et al., 2018). Additionally, the rapid commercialization of mindfulness has raised concerns about dilution and misapplication, emphasizing the need for culturally sensitive, evidence-based approaches in both clinical and non-clinical settings.

Conceptual Framework

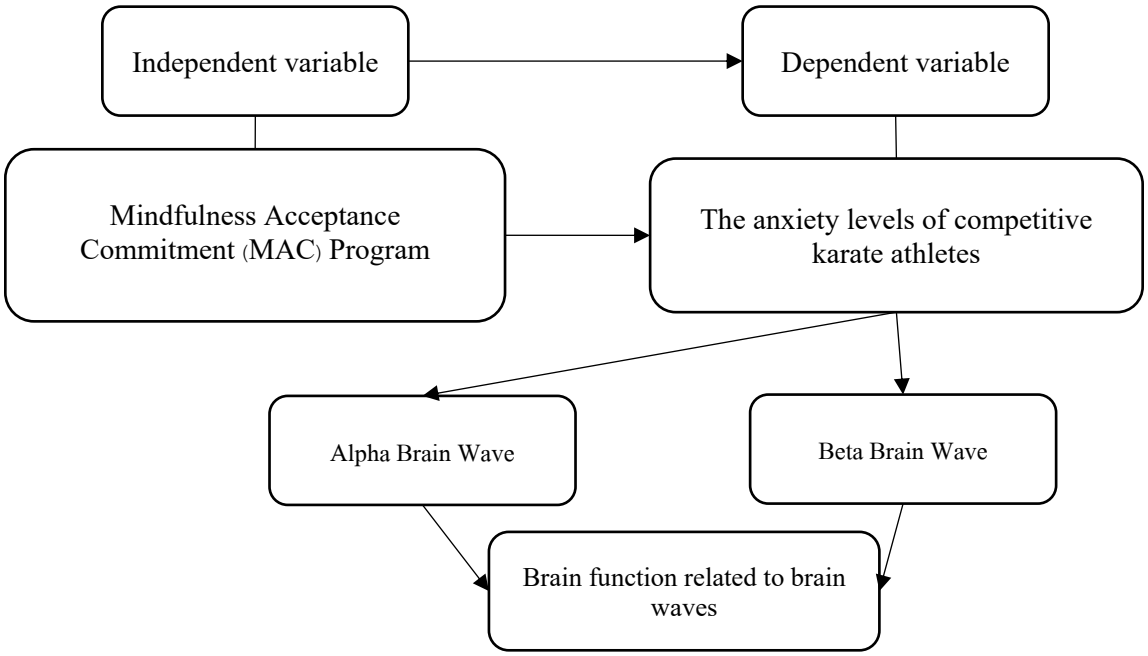

Figure 1 Conceptual Framework

Research Hypotheses

1. Mindfulness-Acceptance-Commitment (MAC) training can reduce anxiety levels in karate combat athletes

2. Mindfulness training results in increased alpha brainwave amplitude and decreased beta brainwave amplitude

Methodology

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

This research is a pre-experimental study in which the researcher conducted a single-group experiment. The objective of this research is to study the effects of mindfulness training on brainwaves and anxiety levels in competitive karate combat athletes. The research methodology consists of 3 phases as follows:

Phase 1: Development of the Mindfulness Acceptance Commitment (MAC) training program to reduce anxiety levels in karate combat athletes, and pilot testing of the developed mindfulness training program to identify deficiencies and approaches for problem-solving that may occur with the sample group. This was conducted with karate combat athletes who were not part of the sample group but had competition anxiety, using a purposive selection method.

Phase 2: Implementation of the developed mindfulness training program with the sample group to observe the development of anxiety level management in athletes during training, and comparison of the effects of mindfulness training, anxiety levels, and alpha and beta brainwaves of athletes before and after the experiment.

Phase 3: Follow-up of training results using the Revised Competition Sport Anxiety Inventory – 2 (CSAI – 2R) by Martens and Russell, and the Mindfulness Inventory for Sport: MIS Thai Version by Singhnoi et al. (2020) in real competition situations, to confirm that the effects of Mindfulness Acceptance Commitment (MAC) training help athletes manage anxiety levels and increase mindfulness in competition.

Population and Sample

The participants consisted of Thai national karate team athletes (combat category) whose names were officially announced for the 33rd Southeast Asian Games held in Thailand, and who participated in karate competitions in the 49th National Games (Chan Games) in Chanthaburi Province and the 2025 Thailand National Karate Championship. The participants were male and female athletes aged 18-28 years who experienced moderate to high levels of competition anxiety. The researcher employed a purposive sampling method, with the sample size determined from established tables, totaling 13 individuals. The researcher calculated the sample size using G*Power software based on Cohen's 1988 principles, with an effect size of 0.6, an α value of .05, a power of 0.8, and 1 group. To prevent sample loss due to dropout, an additional 2 participants were included, making the total sample size 15 individuals. However, due to problems with the sample group's participation in completing the research process, 5 participants declined to continue in the study, resulting in a final sample of 10 participants for this research.

Inclusion Criteria for Sample Group Participation

1. History of training and competing at national or international levels, such as National Games, Thailand University Games, Thailand Karate Championship, SEA Games, Asian Games, ASEAN Karate Championship, Asian Karate Championship, World Karate Championship, etc., continuously for at least 1 year with national-level competition experience
2. Black belt qualification at 1st dan or higher
3. Karate combat (Kumite) athletes who have never undergone mindfulness training before
4. Consent to participate in the research

Research Instruments

1. Mindfulness Acceptance Commitment (MAC) training program created by the researcher and reviewed by 5 experts to verify the consistency between activity format and objectives (Index of Item Objective Congruence: IOC)
2. Electroencephalogram (EEG) device, Eego Sport Model EE-215 from the Sports Science Center, Sports Authority of Thailand
3. The Revised Competitive State Anxiety Inventory-2 (CSAI-2R) by Marten and Russell, translated into Thai by Dr. Pichit Muengnasane. This instrument measures situational anxiety in sports contexts among athletes and was developed from the original competitive state anxiety inventory. It consists of 17 items divided into three dimensions: Somatic Anxiety, Cognitive Anxiety, and Self-Confidence
4. Mindfulness Inventory for Sport: MIS Thai Version by Singhnoi et al. (2020). The questionnaire consists of 15 items in total, divided into 3 factors as follows: awareness, non-judgment, and Refocusing.

Development and Quality Assessment of the Research Instrument

1. Reviewed literature, journals, textbooks, and research studies, both domestic and international, related to mindfulness training, including training methodologies, to use the obtained information as a framework for developing the training program.

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

2. Designed and developed the Mindfulness, Acceptance, and Commitment (MAC) training program and appropriate implementation methods that would affect brain waves.

3. Presented the Mindfulness, Acceptance, and Commitment (MAC) training program to the main thesis advisor and co-advisor for suggestions, then utilized the feedback received to make improvements and revisions.

4. Submitted the mindfulness training program developed by the researcher to 5 experts for evaluation.

5. Presented the mindfulness training program that had undergone quality evaluation from the 5 experts for revision and improvement to the thesis co-advisor for further consideration.

6. Presented the results from the experimental implementation, along with observations, to the advisory committee and experts for further verification.

7. Applied the validated Mindfulness, Acceptance, and Commitment (MAC) training program to the research sample.

Experimental Procedures / Data Collection

1. Prepared official letters requesting cooperation from the sample group and requesting collaboration in the training program experiment, along with requesting assistance and facilities for data collection with the sample group

2. Prepared official letters from the Department of Physical Education, Physical Education Program, Faculty of Education, Kasetsart University Bangkhen, to the Sports Science Center of Thailand, requesting permission to use testing facilities and brainwave testing equipment for the sample group

3. The researcher explained details about the research objectives, training methods, testing procedures, and research duration to the sample group

4. The sample group underwent brainwave testing using the Electroencephalogram (EEG) device from the Sports Science Center, Sports Authority of Thailand, before the 49th National Games (Chan Games) karate competition, and 1 week before entering mindfulness training

5. The sample group completed the Revised Competition Sport Anxiety Inventory – 2 (CSAI–2R) by Martens and Russell, 5 minutes before competing in the 49th National Games (Chan Games) karate competition

6. The sample group completed the Mindfulness Inventory for Sport: MIS Thai Version by Singhnoi et al. (2020) immediately after the 49th National Games (Chan Games) karate competition

7. Research participants underwent training according to the Mindfulness Acceptance Commitment (MAC) training program and regular karate training for 7 weeks, 2 days per week (Mondays and Fridays)

8. The sample group underwent brainwave testing using the Electroencephalogram (EEG) device from the Sports Science Center, Sports Authority of Thailand, after 7 weeks of mindfulness training and 1 week before the Thailand National Karate Championship competition

9. The sample group completed the Revised Competition Sport Anxiety Inventory – 2 (CSAI–2R) by Martens and Russell, 5 minutes before competing in the 2025 Thailand National Karate Championship

10. The sample group completed the Mindfulness Inventory for Sport: MIS Thai Version by Singhnoi et al. (2020) immediately after the 2025 Thailand National Karate Championship competition

11. All experimental data were collected for statistical analysis

Data Analysis

1. Mean ($\bar{x}$) and standard deviation (S.D.) of the Revised Competition Sport Anxiety Inventory – 2 (CSAI–2R) and Mindfulness Inventory for Sport: MIS Thai Version before and after the 7-week experiment using Paired Sample T-Test at .05 significance level

2. Nonparametric statistics using the Wilcoxon Signed Rank Test to compare mean electrode values of alpha and beta brainwaves before and after the 7-week experiment at a .05 significance level

Results

The results of data analysis comparing the Revised Competition Sport Anxiety Inventory – 2 (CSAI–2R), Mindfulness Inventory for Sport: MIS Thai Version, and alpha and beta brainwaves before and after the 7-week experiment are as follows:

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

Table 1 Mean ($\bar{x}$) and Standard Deviation (S.D.) of situational anxiety levels of athletes in the 49th National Games (Chan Games) and the 2025 Thailand National Karate Championship competition, 5 minutes before competing

Variable	Before the Experiment (n=10) $Bold\bar{x}$ ±S.D.	After the Experiment (n=10) $\bar{x}$ ±S.D.	Development percentage (%)	t	p
Somatic Anxiety	21.97 ± 5.97	21.42 ± 7.11	2.50	0.221	0.83
Cognitive Anxiety	26.91 ± 5.89	24.18 ± 7.67	10.14	1.102	0.30
Seif Confidence	28.91 ± 5.01	30.36 ± 5.43	4.77	-0.822	0.43

* P < 0.05

Table 2 Mean ($\bar{x}$) and Standard Deviation (S.D.) of the Mindfulness Inventory for Sport: MIS Thai Version before and after the experiment in the 49th National Games (Chan Games) and the 2025 Thailand National Karate Championship competition, immediately after competing

Variable	Before the Experiment (n=10) $Bold\bar{x}$ ±S.D.	%	After the Experiment (n=10) $Bold\bar{x}$ ±S.D.	%	t	p
Awareness	4.27 ± 0.96	71.22	4.42 ± 0.40	73.64	0.159	0.87
Non Judgement	2.98 ± 1.13	49.70	3.27 ± 1.20	48.49	-0.766	0.46
Refocusing	3.98 ± 1.01	66.37	4.33 ± 0.97	72.13	-1.314	0.22

* P < 0.05

From Tables 1 and 2, the comparison of mean values for situational anxiety levels and the Mindfulness Inventory for Sport: MIS Thai Version before and after the experiment showed that situational anxiety levels and mindfulness in sports of the sample group did not differ significantly at the .05 statistical significance level.

Table 3 shows the mean values ($\bar{x}$) and standard error of the mean (SEM) of alpha brainwaves from 4 electrodes that showed changes before and after the experiment.

The mean power (μV^2)	Before the Experiment (n=10)	After the Experiment (n=10)	P-value
	$\bar{x}$ ±SEM	$\bar{x}$ ±SEM	
Cz	0.43 ± 2.96	1.96 ± 0.69*	0.04
CP6	4.78 ± 2.70	7.99 ± 2.51*	0.03
Pz	1.31 ± 0.48	5.01 ± 2.09*	0.04
P4	1.69 ± 0.81	4.50 ± 1.18*	0.01

* P < 0.05

Table 4 shows the mean values ($\bar{x}$) and standard error of the mean (SEM) of beta brainwaves from all 4 electrodes that showed changes before and after the experiment.

The mean power (μV^2)	Before the Experiment (n=10)	After the Experiment (n=10)	P-value
	$\bar{x}$ ±SEM	$\bar{x}$ ±SEM	
Cz	0.62 ± 0.45	2.94 ± 1.01*	0.02

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

International Journal of Sociologies and Anthropologies Science Reviews
Volume 6 Issue 5: September-October2026: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

The mean power (μV^2)	Before the Experiment (n=10)	After the Experiment (n=10)	P-value
	$\bar{x} \pm$SEM	$\bar{x} \pm$SEM	
CP6	2.57 ± 1.23	8.54 ± 1.52*	0.04
Pz	1.17 ± 0.56	5.85 ± 2.50*	0.02
P4	2.35 ± 1.32	10.16 ± 2.64*	<0.01

* P < 0.05

From Tables 3 and 4, statistical testing using nonparametric statistics with the Wilcoxon Signed Rank Test revealed statistically significant differences at the .05 level for both alpha and beta brainwaves before and after the experiment at electrodes Cz (p=0.04), Cp6 (p=0.03), Pz (p=0.04), and P4 (p=0.01). No statistically significant differences at the .05 level were found at other electrodes.

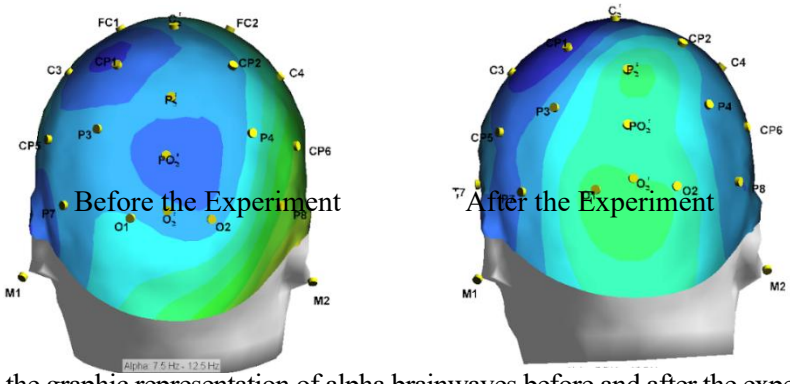

Figure 1 shows the graphic representation of alpha brainwaves before and after the experiment. Blue color indicates low levels of alpha brainwaves, and green color indicates high levels of alpha brainwaves.

From Figure 1, it can be concluded that the mean alpha brainwave values after the experiment significantly increased at electrodes Cz (p=0.04), Cp6 (p=0.03), Pz (p=0.04), and P4 (p=0.01) at the .05 statistical significance level. This can be observed from the change in green color, showing notably higher intensity.

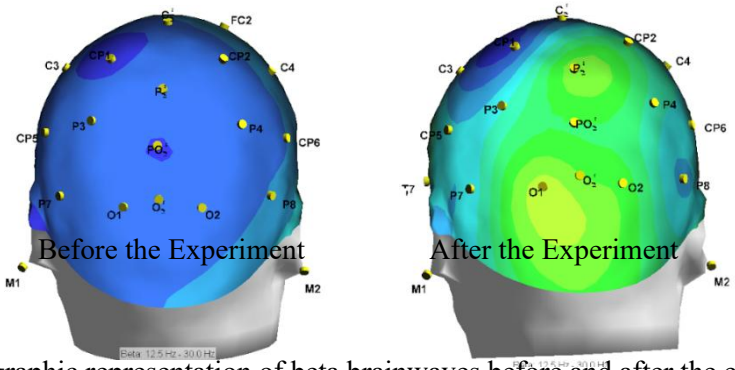

Figure 2 shows the graphic representation of beta brainwaves before and after the experiment. Blue color indicates low levels of beta brainwaves, and green color indicates high levels of beta brainwaves.

From Figure 2, it can be concluded that the mean beta brainwave values after the experiment significantly increased at electrodes Cz (p=0.02), Cp6 (p=0.04), Pz (p=0.02), and P4 (p<0.01) at the .05 statistical significance level. This can be observed from the change in green color, showing notably higher intensity.

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

Conclusion

Based on the study examining the effects of mindfulness training on brain waves and anxiety levels in competitive karate athletes, which was conducted on a sample of Thai national karate team athletes (combat category) whose names were officially announced for the 33rd Southeast Asian Games in Thailand, and who participated in karate competitions at the 49th National Games (Chan Games) in Chanthaburi Province and the 2025 Thailand National Karate Championship, comprising male and female athletes aged 18-28 years, with an experimental period of 7 weeks, the research findings can be summarized as follows:

1. Analysis of the levels of situational anxiety using the Revised Competitive State Anxiety Inventory-2 (CSAI-2R) across all three dimensions: Somatic Anxiety, Cognitive Anxiety, and Self-Confidence, measured before the experiment and after 7 weeks of experimentation in athletes before competing in the 49th National Games (Chan Games) and after the experiment in athletes before competing in the 2025 Thailand National Karate Championship, revealed no statistically significant differences at the .05 level. However, there were positive trends in developing important psychological factors for competition, although these were not clearly evident within the timeframe of this study.

Analysis of sport mindfulness levels using the Mindfulness Inventory for Sport (MIS Thai Version) across all three dimensions: Awareness, Non-Judgement, and Refocusing, measured before the experiment and after 7 weeks of experimentation in athletes after competing in the 49th National Games (Chan Games) and after competing in the 2025 Thailand National Karate Championship, revealed no statistically significant differences at the .05 level. However, there were positive trends in developing important psychological factors for competition, although these were not clearly evident within the timeframe of this study.

2. Analysis of the mean values ($\bar{X}$) and standard error of the mean (SEM) of alpha brain waves across all 32 electrodes before and after 7 weeks of experimentation using nonparametric statistics with the Wilcoxon Signed Rank Test revealed statistically significant differences at the .05 level in alpha brain waves between before and after the experiment at electrodes Cz ($p=0.04$), Cp6 ($p=0.03$), Pz ($p=0.04$), and P4 ($p=0.01$), with no statistically significant differences at the .05 level found at other electrodes.

3. Analysis of the mean values ($\bar{X}$) and standard error of the mean (SEM) of beta brain wave electrodes before the experiment and after 7 weeks of experimentation using nonparametric statistics with the Wilcoxon Signed Rank Test revealed statistically significant differences in beta brain waves at the .05 level between before and after the experiment at electrodes Cz ($p=0.02$), Cp6 ($p=0.04$), Pz ($p=0.02$), and P4 ($p<0.01$), with no statistically significant differences at the .05 level found at other electrodes.

Discussion

The research findings reveal a connection between physiological and psychological changes following Mindfulness, Acceptance, and Commitment (MAC) program training in Thai national karate athletes in the combat category. There was a statistically significant increase in alpha and beta brainwaves in the posterior brain region (occipital lobe) at the .05 level, reflecting enhanced relaxation states and more efficient visual processing (Di Dona & Ronconi, 2023; Lomas et al., 2015). This aligns with the situational anxiety testing results, which, although not showing statistically significant differences in anxiety levels and self-confidence, demonstrated positive developmental trends with decreases in physical and mental anxiety (2.50% and 10.14% respectively) and an increase in self-confidence (4.77%). Furthermore, this reflects the connection with the Sport Mindfulness Scale testing, which showed improvements in sport mindfulness across awareness (from 71.22% to 73.64%), non-judgment (from 49.70% to 48.49%), and re-focusing (from 63.37% to 72.13%). This is consistent with Gardner and Moore (2007), who found that mindfulness training helps athletes stay present and better control their reactions to stimuli. This aligns with Berkovich-Ohana et al. (2013), who found that mindfulness training reduces Default Mode Network (DMN) activity, which is associated with mind-wandering. Additionally, Bühlmayer et al. (2017) indicated that mindfulness training affects sports performance both directly and indirectly through psychological factors. The fact that some test results did not show significant differences may be due to confounding factors in actual competitive situations, such as opponent abilities, spectators, and cheering sections, as noted by Baumeister et al. (2001) and Landers et al. (1977).

In conclusion, the Mindfulness, Acceptance, and Commitment program shows positive tendencies for Thai national karate athletes, particularly in brain physiology, with promising trends in developing important psychological factors for competition, although these were not clearly evident within this study period.

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

Recommendations

Recommendations for This Research

1. Control of confounding variables in competitive situations by considering testing in more controlled simulated situations.

2. Addition of a control group in the experiment. The design should include a control group that does not receive MAC mindfulness training but may receive other forms of sport psychology training for comparison of outcomes between experimental and control groups. This would enable clearer and more reliable conclusions regarding the effects of the mindfulness training program.

Recommendations for Future Research

1. Study of long-term effects of mindfulness training programs. Future research should investigate the long-term effects of the Mindfulness, Acceptance, and Commitment (MAC) training program by continuously monitoring changes in both brain waves and psychological variables throughout the competitive season or for more than 6 months. This would evaluate the durability of outcomes and the sustainability of the training, including examining the relationship between training duration and program effectiveness, which would help determine the optimal training period for maximum benefit to athletes.

2. Comparison of mindfulness training programs with other sport psychology techniques. Research should compare the effectiveness of the MAC mindfulness training program with other sport psychology techniques, such as imagery training, positive self-talk, or relaxation techniques, to determine which technique is most effective in reducing anxiety and improving competitive performance in karate combat athletes. Alternatively, research could explore the combination of various techniques to develop more effective programs.

3. Study of the relationship between physiological, psychological, and competitive performance changes. Future research should examine the relationship between changes in brain waves, anxiety levels, and sport mindfulness with athletes' competitive performance by collecting data on competitive outcomes and athlete performance in real situations, such as competition scores, number of wins, accuracy in attacks, and defense. This would analyze how the physiological and psychological changes resulting from mindfulness training affect actual competitive ability, which would help validate the value of mindfulness training programs in developing high-level karate athletes.

Reference

An, A., Hoang, H., Trang, L., Vo, Q., Tran, L., Le, T., Le, A., McCormick, A., Du Old, K., & Williams, N. S. (2022). Investigating the effect of Mindfulness-Based Stress Reduction on stress levels and brain activity of college students. *IBRO Neuroscience Reports, 12*, 399–410.

Bagheri, E., & Dana, A. (2021). The effect of mindfulness protocol on anxiety, self-efficacy, and performance of athletes. *Sport Psychology Studies, 10*(36), 23–44.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5*(4), 323–370.

Berkovich-Ohana, A., Glicksohn, J., & Goldstein, A. (2013). Studying the default mode and its mindfulness-induced changes using EEG functional connectivity. *Social Cognitive and Affective Neuroscience, 9*(10), 1616–1624.

Bühlmayer, L., Birrer, D., Röthlin, P., Faude, O., & Donath, L. (2017). Effects of mindfulness practice on performance-relevant parameters and performance outcomes in sports: A meta-analytical review. *Sports Medicine, 47*, 2309–2321.

Cowan, J., & Allen, T. (2000). Using brainwave biofeedback to train the sequence of concentration and relaxation in athletic activities. *Proceedings of the 15th Association for the Advancement of Applied Sport Psychology*, 95, 12–19.

Cremades, J. G. (2016). Electro-cortical measures during visual and kinesthetic imagery performance following visual- and auditory-guided instructions. *International Journal of Sport and Exercise Psychology, 14*(4), 369–382.

Di Dona, G., & Ronconi, L. (2023). Beta oscillations in vision: A (preconscious) neural mechanism for the dorsal visual stream? *Frontiers in Psychology, 14*, 1296483. https://doi.org/10.3389/fpsyg.2023.1296483

Gardner, F. L., & Moore, Z. E. (2007). *The psychology of enhancing human performance: The mindfulness-acceptance-commitment (MAC) approach*. Springer Publishing Company.

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260

Ibrahim, S., & Almoslim, H. A. (2016). State anxiety and self-efficacy among track and field low and high performers. *Indian Journal of Science and Technology*.

Jung, M., & Lee, M. (2021). The effect of a mindfulness-based education program on brain waves and the autonomic nervous system in university students. *Healthcare (Basel), 9*(11), 1494. https://doi.org/10.3390/healthcare9111494

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156. https://doi.org/10.1093/clipsy.bpg016

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., ... & Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review, 33*(6), 763–771. https://doi.org/10.1016/j.cpr.2013.05.005

Landers, D. M., Christina, R. W., Roberts, G. C., Newell, K. M., & Nadeau, C. H. (1977). *Psychology of motor behavior and sport*. Human Kinetics Publishers.

Lomas, T., Ivtzan, I., & Fu, C. (2015). A systematic review of the neurophysiology of mindfulness on EEG oscillations. *Neuroscience & Biobehavioral Reviews, 57*, 401–410. https://doi.org/10.1016/j.neubiorev.2015.09.018

Moore, Z. E. (2009). Theoretical and empirical developments of the Mindfulness-Acceptance-Commitment (MAC) approach to performance enhancement. *Journal of Clinical Sport Psychology, 3*(4), 291–302.

Morais, P., Quaresma, C., Vigário, R., & Quintão, C. (2021). Electrophysiological effects of mindfulness meditation in a concentration test. *Medical and Biological Engineering and Computing, 59*(4), 759–773. https://doi.org/10.1007/s11517-021-02332-y

Reb, J., Narayanan, J., & Chaturvedi, S. (2014). Leading mindfully: Two studies on the influence of supervisor trait mindfulness on employee well-being and performance. *Mindfulness, 5*(1), 36–45. https://doi.org/10.1007/s12671-012-0144-z

Singnoy, C., et al. (2020). Translation and factorial validation of the mindfulness inventory for sport in the Thai version (MISt). *Journal of Sports Science and Technology, 20*(2), 67–80.

Tang, Y. Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience, 16*(4), 213–225. https://doi.org/10.1038/nrn3916

Van Dam, N. T., van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olendzki, A., ... & Meyer, D. E. (2018). Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation. *Perspectives on Psychological Science, 13*(1), 36–61. https://doi.org/10.1177/1745691617709589

Zenner, C., Herrnleben-Kurz, S., & Walach, H. (2014). Mindfulness-based interventions in schools—a systematic review and meta-analysis. *Frontiers in Psychology, 5*, 603. https://doi.org/10.3389/fpsyg.2014.00603

Zou, Y., Liu, S., Guo, S., Zhao, Q., & Cai, Y. (2023). Peer support and exercise adherence in adolescents: The chain-mediated effects of self-efficacy and self-regulation. *Children, 10*(2), 401. https://doi.org/10.3390/children10020401

Citation
Pongsai, T., Sungpook, N., & Prachakul, W. (2026). Effect of Mindfulness Practice on EEG and Anxiety Levels in Martial Arts Karate Athletes. International Journal of Sociologies and Anthropologies Science Reviews, 6 (5), 185-194; DOI: https://doi.org/10.60027/ijsasr.2025.8260