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Effects of mindfulness training on anxiety, stress resilience, and self-confidence in wushu taolu athletes

Xu Shuai[1abc], Sapto Wibowo[1df], Heryanto Nur Muhammad[1be].

[1]Department of Sport Education, Faculty of Sport and Health Sciences, Universitas Negeri Surabaya, Surabaya, East Java, Indonesia.

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Abstract

Wushu taolu requires not only physical skill and technical precision but also strong mental stability to perform under pressure. However, many athletes struggle with high levels of anxiety, competitive stress, and diminished self-esteem, factors that significantly undermine their performance. These persistent psychological challenges make it essential to implement mindfulness as a targeted mental intervention, enabling athletes to regulate their emotions, sustain focus, and maintain composure throughout competition. This study examined the effects of mindfulness training on anxiety, stress resilience, and self-confidence among wushu taolu athletes. A quasi-experimental design with a non-equivalent control group pretest–posttest was used. Participants were 33 athletes from the East Java Wushu Team: 17 participated in a four-week mindfulness program (three sessions per week, 30–40 minutes), while 16 continued their normal training. Standardized scales measured psychological changes before and after treatment. Results showed the mindfulness group had lower cognitive ($\Delta M = 4.76$; $p < 0.001$) and somatic anxiety ($\Delta M = 4.35$; $p < 0.001$), and higher resilience ($\Delta M = 4.82$; $p < 0.001$) and confidence ($\Delta M = 5.12$; $p < 0.001$). The large effect sizes confirm the intervention's strong impact. In conclusion, mindfulness effectively enhances athletes' psychological readiness for competition. It can be integrated into regular training programs as a practical strategy to strengthen emotional control, focus, and overall psychological performance.

Keywords: Mindfulness training, wushu taolu, cognitive anxiety, stress resilience, athletic self-confidence.

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INTRODUCTION

Wushu taolu athletes face substantial psychological performance challenges because success in this discipline depends not only on physical and technical execution but also on the ability to maintain

Correspondence author: Xu Shuai, Universitas Negeri Surabaya, Surabaya, East Java, Indonesia.
Email: 24060805019@mhs.unesa.ac.id

emotional stability, attentional control, and confidence under strict evaluative pressure. Wushu taolu is a branch of martial arts that requires a complex integration of movement artistry, strength, speed, flexibility, and aesthetic expression within highly structured routines (Lituhayu et al., 2023). Athletes are required to execute precise sequences under intense evaluative conditions, where even minor errors can significantly affect performance scores (Low et al., 2023, 2024). Wushu taolu athletes face immense pressure to perform perfectly under the watchful eyes of judges and high-performance demands, and any psychological imbalance can directly affect performance quality. Taolu performances require substantial mental engagement, indicating that psychological readiness is a critical determinant of performance that cannot be achieved through physical and technical preparation alone. In the process of training and competition, high psychological pressure often leads to excessive anxiety, decreased self-confidence, and difficulties in managing stress, all of which may directly impair performance quality. The unique combination of artistic expression, technical precision, and rigorous aesthetic judgment in wushu taolu creates psychological demands that differ substantially from those in team sports, endurance sports, or combat sports, highlighting the need for a deeper understanding of psychological mechanisms that support performance stability in this specific context.

Three key psychological factors have been widely recognized as central to athletic performance: anxiety, stress resilience, and self-confidence (Khen et al., 2025). Anxiety in sport is commonly categorized into cognitive anxiety, involving negative thoughts and self-doubt, and somatic anxiety, reflected in physiological responses such as tension and nervousness (Barrett et al., 2023). Stress resilience refers to an individual's capacity to adapt effectively to internal and external pressures (Langevin et al., 2023), while self-confidence represents an athlete's belief in their ability to perform successfully in competitive situations (Lochbaum et al., 2022; Fadare et al., 2022). These psychological components interact dynamically and collectively influence athletes' ability to cope with

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competitive demands (Akhmad et al., 2025; Salsabila et al., 2025). Theoretically, these elements work together as an integrated foundation for understanding how mental training approaches can influence athletes' psychological readiness and competitive performance.

Mindfulness has emerged as a promising psychological approach for enhancing athletes' mental readiness. It operates by training conscious, non-judgmental attention to present-moment experiences, which helps reduce anxiety, stabilize emotional responses, and improve attentional focus during performance. Through these mechanisms, mindfulness enables athletes to respond more adaptively to competitive pressure and maintain performance consistency.

However, previous research on mindfulness in sport has primarily focused on individual sports such as athletics or swimming, as well as team sports like football and basketball (Birrer et al., 2023; Lewis et al., 2022; Röthlin et al., 2020). Empirical studies involving artistic martial arts, particularly wushu taolu, remain limited both in terms of population and the specific psychological interventions applied (Darmayasa et al., 2025). In addition, many existing studies tend to examine a single psychological variable in isolation, such as anxiety or focus, rather than investigating the simultaneous interaction among multiple key psychological factors (Barnish & Nelson, 2023). This limitation indicates that existing evidence remains insufficient to explain how integrated psychological mechanisms influence performance in sports with complex evaluative demands such as wushu taolu.

This study aims to analyze the effects of mindfulness training on anxiety, stress resilience, and self-confidence in wushu taolu athletes using a quasi-experimental approach. This goal reflects an effort to integrate a mindfulness-based mental training approach into the context of martial arts, which has traditionally relied more on conventional coaching (Kim & Lawlor, 2023), while also testing its practical applicability within daily training programs, particularly during the performance development phase. By examining these variables simultaneously within a single

intervention framework, this study provides a more comprehensive understanding of athletes' psychological readiness. Furthermore, the application of mindfulness in wushu taolu offers a novel contribution, as this discipline presents distinctive psychological demands that have not been adequately addressed in previous research.

This research offers two primary contributions. First, it integrates anxiety, stress resilience, and self-confidence within a unified mindfulness-based intervention model, thereby advancing the theoretical understanding of how these variables interact in shaping athletic performance. Second, it applies mindfulness training within the context of wushu taolu, where the interplay between artistic performance and technical precision creates unique psychological challenges. In addition to its theoretical contribution, this research also provides practical implications for developing mindfulness-based mental training programs that can be directly implemented at the coaching level. Coaches and sport psychologists can better support athletes' emotional regulation, competitive readiness, and overall mental performance by incorporating structured mindfulness sessions into regular training regimens.

Globally, mindfulness-based approaches have gained increasing recognition in supporting athletes' mental resilience and performance consistency (Myall et al., 2023). Many international sports institutions have begun integrating mindfulness into training programs to enhance both mental health and competitive outcomes (Gouttebarge et al., 2021; Rice et al., 2022). Therefore, this research is not only locally relevant but also globally relevant in enriching the scientific approach to the psychological development of competitive athletes. Coaches and sports psychologists can directly use the findings of this study as a practical guide for designing and implementing structured mindfulness-based mental training programs to enhance athletes' psychological readiness and competitive performance.

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METHOD

This study employed a quantitative approach using a quasi-experimental, non-equivalent control-group pretest–posttest design. The participants were 33 active wushu taolu athletes from the East Java Wushu Team, consisting of 18 senior athletes aged 18–25 years and 15 junior athletes aged 13–17 years. Participants were selected through purposive sampling based on the following criteria: actively involved in training and competition, not participating in other mental training programs, willingness to follow all research procedures, and providing informed consent. After completing the pretest, participants were stratified into senior and junior categories and grouped into small blocks based on similar baseline scores in anxiety, stress resilience, and self-confidence. Within each block, assignment to the experimental and control groups was conducted using constrained randomization through a lottery-based mechanism to ensure balanced baseline characteristics. This procedure minimized selection bias and ensured that participants with similar psychological profiles had an equal probability of being assigned to either group. The final allocation consisted of 17 athletes in the experimental group (9 seniors and 8 juniors) and 16 athletes in the control group (9 seniors and 7 juniors).

Data were collected using three Likert-type instruments: a competitive anxiety scale measuring cognitive and somatic anxiety, a stress resilience scale assessing the ability to cope with pressure, and an athletic self-confidence scale measuring confidence in competitive situations. All instruments were adapted into Indonesian using standardized translation procedures to ensure conceptual equivalence. Content validity was evaluated by one wushu coach and two sport psychology experts. Construct validity was examined using exploratory factor analysis, with all retained items showing factor loadings above 0.50. Sampling adequacy was confirmed using the Kaiser–Meyer–Olkin index and Bartlett's test of sphericity. Reliability testing using Cronbach's alpha indicated good internal consistency for the competitive anxiety scale (α =

0.87), stress resilience scale (α = 0.84), and athletic self-confidence scale (α = 0.89).

Before the intervention, all participants completed the pretest questionnaire. The experimental group then participated in a 4-week mindfulness training program comprising 12 sessions, held 3 times per week for 30–40 minutes per session. The intervention included mindful breathing, body scan exercises, mindful movement, and positive visualization, delivered through guided facilitation or audio instructions. The protocol was implemented following contemporary mindfulness-based practices adapted for sport contexts, while foundational concepts from Kabat-Zinn (1994) were retained as a historical reference. Participant adherence was monitored through weekly practice journals and direct observation during in-person sessions. The control group continued their regular training routine without receiving any psychological intervention. After the intervention period, both groups completed the posttest using the same instruments.

Data were analyzed using pretest and posttest comparisons within and between groups to evaluate intervention effects. The quasi-experimental design, including structured pre–post measurements and group comparisons, supports stronger causal interpretations while remaining feasible in real training settings. Data were processed using IBM SPSS Statistics version 26. The analysis followed three main steps:

1. Assumption Testing
   a. Normality was assessed using the Kolmogorov–Smirnov test.
   b. Homogeneity of variances was examined using Levene's test.

   These procedures ensured that the data met the requirements for parametric statistical tests.
2. Main Analyses
   a. For within-group changes (pretest–posttest), a paired-samples t-test was used.
   b. For between-group differences, the independent sample t-test compared the experimental and control groups.

c. When data violated normality assumptions, the Wilcoxon test (within-group) and the Mann–Whitney U test (between-group) were used as nonparametric alternatives.

3. Effect Size Estimation
   a. Cohen's d was calculated to determine the magnitude of the intervention's effect.
   b. All analyses used a 95% confidence level (α = 0.05).

This structured analytic approach strengthened the interpretation of pre–post changes and between-group comparisons, supporting causal inferences within the quasi-experimental design.

RESULT

Table 1. Descriptive Statistics of Research Variables

Variable	Group	N	Pretest Mean ± SD	Posttest Mean ± SD	Min–Max
Cognitive Anxiety	Experimental	17	25.24 ± 5.87	20.47 ± 5.32	14–35
	Control	16	23.25 ± 4.61	23.13 ± 4.63	14–30
Somatic Anxiety	Experimental	17	24.94 ± 4.94	20.59 ± 5.26	14–33
	Control	16	24.13 ± 4.80	23.06 ± 4.57	13–31
Stress Resistance	Experimental	17	26.82 ± 4.36	31.65 ± 4.27	21–35
	Control	16	26.06 ± 3.91	25.94 ± 4.40	20–34
Confidence	Experimental	17	24.94 ± 5.09	30.06 ± 5.68	11–33
	Control	16	26.50 ± 5.67	26.94 ± 5.70	18–39

Table 1 presents the descriptive statistics for all variables measured before and after the mindfulness intervention. The experimental group showed consistent and meaningful improvements across all psychological indicators. Cognitive anxiety decreased sharply, dropping from 25.24 ± 5.87 at pretest to 20.47 ± 5.32 at posttest, a reduction of 4.77 points, indicating a clear decline in intrusive worry and negative thoughts. Somatic anxiety also showed a downward trend, falling from 24.94 ± 4.94 to 20.59 ± 5.26, a 4.35-point decrease, reflecting reduced physiological tension and arousal. In contrast, the control group displayed virtually no meaningful change in cognitive anxiety (23.25 ± 4.61 to 23.13 ± 4.63) and only a very small decline in somatic anxiety (24.13 ± 4.80 to 23.06 ± 4.57), indicating that anxiety levels remained largely stable without intervention.

For stress resilience, the experimental group exhibited a notable positive shift, rising from 26.82 ± 4.36 to 31.65 ± 4.27—an increase of 4.83 points, suggesting a stronger capacity to cope with pressure and recover from stress. The control group, however, showed almost no change (26.06 ± 3.91 to 25.94 ± 4.40), indicating that resilience levels were unchanged in the absence of mindfulness training.

A similar pattern emerged in self-confidence, where the experimental group demonstrated a substantial improvement from 24.94 ± 5.09 to 30.06 ± 5.68, a gain of 5.12 points, reflecting increased belief in personal ability and performance readiness. Meanwhile, the control group experienced only a slight increase (26.50 ± 5.67 to 26.94 ± 5.70), which is too small to indicate any meaningful psychological enhancement.

Overall, the direction and magnitude of these changes clearly show that the experimental group experienced decreasing anxiety and increasing resilience and self-confidence. In contrast, the control group's measurements remained largely unchanged. This pattern strongly suggests that the observed improvements were driven by the mindfulness intervention rather than by natural variation or regular training alone.

Table 2. Normality Test (Shapiro-Wilk)

Variable	Group	p-value
Cognitive Anxiety Pre	Experimental	0.471
	Control	0.616
Somatic Anxiety Pre	Experimental	0.737
	Control	0.717
Stress Resistance Pre	Experimental	0.212
	Control	0.798
Confidence Pre	Experimental	0.084
	Control	0.251

Table 2 presents the results of the Shapiro–Wilk normality test, which was conducted to assess whether each variable's distribution met the assumptions required for parametric analysis. Normality testing is essential because parametric statistical tests assume that the data follow a normal distribution; if this assumption is violated, the accuracy of these tests may be compromised. In this study, all variables in both the experimental and control groups obtained p-values greater than 0.05,

which indicates that the data do not differ significantly from a normal distribution. A p-value above this threshold signifies that the assumption of normality is satisfied. Therefore, the dataset meets the criteria for normality, supporting the use of parametric tests, such as paired and independent t-tests, in subsequent analyses.

Table 3. Homogeneity Test (Levene's Test)

Variable	F	Sig.
Cognitive Anxiety Pre	0.236	0.631
Somatic Anxiety Pre	0.020	0.888
Stress Resistance Pre	0.225	0.639
Confidence Pre	0.382	0.541

The Levene's Test results in Table 3 show that the p-values for all variables are greater than 0.05, indicating that the variances between groups are homogeneous. This satisfies the homogeneity requirement. These results further reinforce the validity of comparing the results between the experimental and control groups, ensuring that any observed differences are not due to unequal variances.

Table 4. Paired Samples t-Test Results (Experimental Group)

Variable	Mean Diff	SD Diff	t	p-value
Cognitive Anxiety	4.765	2.251	8.728	0.000
Somatic Anxiety	4.353	1.730	10.375	0.000
Stress Resistance	-4.824	1.380	-14.411	0.000
Confidence	-5.118	2.315	-9.114	0.000

The paired samples t-test results in Table 4 show significant differences between the pretest and posttest for all variables in the experimental group. Cognitive anxiety decreased (mean difference = 4.765), somatic anxiety decreased (mean difference = 4.353), stress resilience increased (mean difference = -4.824), and self-confidence increased (mean difference = -5.118), all with p-values less than 0.001. These changes clearly demonstrate the real impact of mindfulness training on the psychological indicators, highlighting its effectiveness in reducing anxiety and improving stress resilience and self-confidence in athletes.

Table 5. Paired Samples t-Test Results (Control Group)

Variable	Mean Diff	SD Diff	t	p-value
Cognitive Anxiety	0.125	1.544	0.324	0.751
Somatic Anxiety	1.063	1.526	2.785	0.014
Stress Resistance	0.125	1.408	0.355	0.728
Self Confidence	-0.438	1.263	-1.385	0.186

The paired-samples t-test results in Table 5 show that, in the control group, almost all variables did not exhibit significant changes. Only somatic anxiety showed a small decrease (mean difference = 1.063, p = 0.014), while the other variables, cognitive anxiety, stress resilience, and self-confidence, remained stable with p-values greater than 0.05. This highlights the contrast between the control and experimental groups, with the latter showing substantial improvements, thereby objectively demonstrating the effect of the mindfulness treatment.

Table 6. Independent Samples t-Test on Delta Scores

Variable	Mean Exp.	Mean Control	t	p-value
Cognitive Anxiety	4.765	0.125	6.862	0.000
Somatic Anxiety	4.353	1.063	5.780	0.000
Stress Resistance	-4.824	0.125	-10.193	0.000
Confidence	-5.118	-0.438	-7.143	0.000

The independent-samples t-test results in Table 6 show significant differences between the experimental and control groups for all variables. The experimental group showed greater positive changes in cognitive anxiety (mean difference = 4.765), somatic anxiety (mean difference = 4.353), stress resistance (mean difference = -4.824), and self-confidence (mean difference = -5.118), with all p-values less than 0.001. The experimental group showed decreases in both cognitive and somatic anxiety and increases in stress resilience and self-confidence, highlighting the mindfulness intervention's positive impact compared to the control group.

Table 7. Effect Size Results (Cohen's d)

Variable	d (Pre–Post Experimental)	d (Between Groups/Delta)
Cognitive Anxiety	2.12	2.39
Somatic Anxiety	2.52	2.00
Stress Resistance	-3.50	-3.55
Confidence	-2.21	-2.55

The effect size results in Table 7 show that Cohen's d values indicate a very large effect across all variables, with values of 2.12 for cognitive anxiety, 2.52 for somatic anxiety, -3.50 for stress resistance, and -2.21 for

self-confidence in the pre–post experimental analysis. In the between-group (delta) analysis, the effect sizes are similarly large, with values of 2.39, 2.00, -3.55, and -2.55, respectively. These results strongly support the quantitative conclusion that mindfulness training has a very strong influence on all measured variables, further confirming its substantial impact on athletes' psychological readiness.

DISCUSSION

This study demonstrates that mindfulness training significantly improves psychological readiness among wushu taolu athletes, as reflected in reduced cognitive and somatic anxiety, enhanced stress resilience, and increased self-confidence. These findings are consistent with theoretical developments indicating that mindfulness operates through emotion-care mechanisms, including anchoring, acceptance, and decentering, which facilitate adaptive emotional responses under pressure (Soler et al., 2021). Through anchoring, athletes learn to direct attention toward present bodily experiences and interrupt cycles of cognitive worry and physiological tension; through acceptance, they become more open to stressful situations without resistance and can interpret competitive demands as manageable challenges; and through decentering, they reduce over-identification with negative thoughts and develop a more balanced perception of their abilities (Bao-Tam & Kristoffer, 2022; Fu et al., 2024). The observed reductions in anxiety and increases in resilience and self-confidence provide empirical support for these mechanisms as core processes through which mindfulness enhances psychological functioning in competitive settings, enabling athletes to maintain composure and sustain focus on both technical execution and artistic performance demands (Wang et al., 2023).

These findings are further supported by empirical trends showing substantial reductions in anxiety and improvements in resilience and self-confidence, which illustrate how mindfulness mechanisms operate in practice. The significant decrease in anxiety reflects improved attentional stability and reduced pre-performance rumination, while the increase in

resilience indicates greater adaptability to competitive stress. The rise in self-confidence suggests that athletes develop a more objective and constructive evaluation of their abilities, allowing them to perform with greater assurance. Together, these outcomes demonstrate that mindfulness systematically strengthens the interconnected components of psychological readiness required in wushu taolu.

The findings also align with the concept of interoceptive awareness, which emphasizes the role of bodily awareness in regulating emotional and cognitive processes (Anna et al., 2023). Mindfulness practices that focus on breathing and bodily sensations enhance athletes' ability to recognize early physiological signals of anxiety and respond with appropriate regulation strategies. Through repeated exposure to these practices, athletes develop the capacity to monitor internal states in real time, stabilize breathing patterns, and reduce muscular tension before it escalates. This process supports improved emotional control, attentional stability, and motor coordination during performance (Seabury et al., 2023). In the context of wushu taolu, where precision, rhythm, and fluidity are essential, enhanced interoceptive awareness allows athletes to synchronize internal sensations with external movement patterns, thereby improving balance, movement accuracy, and performance consistency (Kim & Lawlor, 2023). By reducing internal distractions and strengthening attentional control, mindfulness supports athletes in maintaining technical consistency under evaluative pressure.

These results are also consistent with research linking mindfulness to increased psychological resilience. Mindfulness components such as present-moment awareness, non-judgmental acceptance, and focused attention contribute to athletes' ability to withstand psychological stress (Wong et al., 2022). This effect becomes stronger when supported by emotional intelligence, which enables athletes to recognize, understand, and regulate their emotional responses more effectively (Wu et al., 2021). In this study, the observed increase in resilience reflects the functioning of emotional intelligence processes, as athletes who developed greater

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emotional awareness through mindfulness were better able to identify rising stress and apply adaptive regulation strategies. This interaction between mindfulness and emotional intelligence provides a coherent explanation for improved resilience, demonstrating that mindfulness builds the foundation of awareness while emotional intelligence enables strategic emotional regulation. Integrating mindfulness and emotional intelligence, therefore, constitutes a key strategy for building optimal mental resilience in wushu taolu athletes.

The reduction in anxiety and the improvement in stress resilience observed in this study may also theoretically imply enhanced self-regulation under competitive conditions. In this context, impulsivity should be understood as an indirect theoretical implication rather than a directly measured outcome. Previous research has shown that mindfulness can reduce impulsive tendencies by strengthening self-regulation and reducing emotional reactivity in high-pressure situations (Terres-Barcala et al., 2022). For wushu taolu athletes, improved self-regulation supports emotional stability, prevents overreactive responses, and ensures consistent execution of technically demanding movements (Balk & Englert, 2020; Sousa et al., 2023). Enhanced self-regulation enables athletes to maintain technical consistency and performance stability even under intense competitive pressure, reinforcing the relevance of impulsivity as a theoretical extension of the present findings.

Overall, these findings confirm that mindfulness is not merely a relaxation technique but an adaptive psychological strategy that integrates emotional regulation, interoceptive awareness, mental resilience, and attentional control. The present study extends existing literature by providing empirical evidence of how mindfulness influences multiple psychological variables simultaneously within the specific context of wushu taolu. The findings highlight the importance of integrating psychological training into athletic development, particularly in disciplines that require a balance between technical precision and artistic expression. Importantly, the empirical results clearly demonstrate that structured mindfulness

training produces measurable psychological improvements, thereby validating the theoretical mechanisms discussed. From a practical perspective, these findings provide a strong foundation for coaches and sports psychologists to design and implement structured mindfulness-based training programs that enhance athletes' psychological readiness, emotional stability, and performance consistency, ultimately supporting optimal competitive outcomes.

CONCLUSION

This study confirms that mindfulness training significantly reduces cognitive and somatic anxiety while increasing stress resilience and strengthening self-confidence in wushu taolu athletes, demonstrating that a structured four-week intervention effectively enhances athletes' psychological readiness under competitive conditions. These empirical findings highlight the effectiveness of mindfulness as an intervention targeting key psychological variables essential for martial arts performance. From a theoretical perspective, these improvements can be explained through interconnected psychological mechanisms, including the emotion-care processes of anchoring, acceptance, and decentering, as well as enhanced interoceptive awareness, self-regulation, and attentional control, with the observed increase in resilience also reflecting the role of emotional intelligence in supporting adaptive emotional regulation. Based on these findings, mindfulness should be understood not merely as a relaxation technique but as a comprehensive psychological strategy that promotes emotional stability, sustained focus, and consistent performance. These results provide a clear bridge between theoretical mechanisms and real-world applications, demonstrating how mindfulness-based processes can be systematically integrated into wushu taolu training contexts. Practically, the findings offer coaches and sports psychologists clear, evidence-based guidance for designing and implementing structured mindfulness-based mental training programs that support technical skill development, psychological readiness, and performance stability. Integrating mindfulness into wushu taolu training

programs has the potential to produce athletes who excel physically, technically, and mentally, equipping them to meet competitive demands at national and international levels. It is recommended that mindfulness be embedded within long-term athlete development frameworks to ensure sustained psychological benefits. However, this study has limitations, including the relatively short intervention duration and the modest sample size, which may limit generalizability; therefore, future research should involve longer intervention periods and larger, more diverse samples to further validate and extend these findings across broader athletic populations.

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