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## The Role of Mindfulness Techniques in Reducing Performance Anxiety in Athletes

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### Abstract

The study “The Role of Mindfulness Techniques in Reducing Performance Anxiety in Athletes” explored common challenge faced by athletes, often impairing their ability to perform optimally in high-pressure environments. This study investigates the impact of an 8-week mindfulness intervention on reducing performance anxiety among athletes, focusing on both psychological and physiological outcomes. A total of 100 athletes, aged 18-35, were recruited and divided into intervention and control groups, representing various individual and team sports. The intervention group underwent a structured mindfulness program, incorporating meditation, body scanning, and mindful breathing, while the control group maintained their regular training routines.

Psychological assessments included the Competitive State Anxiety Inventory-2 (CSAI-2) and the Five Facet Mindfulness Questionnaire (FFMQ). Physiological outcomes were measured through heart rate variability (HRV) and salivary cortisol levels. Results revealed significant reductions in both cognitive and somatic anxiety within the intervention group, with mean cognitive anxiety scores dropping from 28.6 to 18.9 and somatic anxiety scores decreasing from 26.4 to 16.7 ( $p < 0.01$ ). Mindfulness levels increased significantly, with FFMQ scores improving from 92.7 to 112.4 ( $p < 0.01$ ). HRV metrics, particularly RMSSD, showed enhanced autonomic regulation, increasing from 32.5 ms to 48.3 ms, while cortisol levels decreased from 6.7 nmol/L to 4.3 nmol/L ( $p < 0.01$ ).

These findings underscore the effectiveness of mindfulness techniques in reducing performance anxiety by fostering emotional resilience and physiological regulation. This study highlights the practical benefits of integrating mindfulness into athletic training programs to enhance performance and mental well-being. Future research should explore long-term effects and its integration with other psychological interventions for comprehensive athlete development.

**Keywords:** Mindfulness, Performance Anxiety, Athletes, Stress Reduction, Cognitive Anxiety, Somatic Anxiety, Sports Psychology, Mental Resilience

### Introduction

Athletic performance is not solely determined by physical fitness and skill but is also profoundly influenced by psychological factors. Among these, performance anxiety is a significant challenge faced by athletes across all levels of competition. Performance anxiety, often described as a state of heightened worry or nervousness before or during competition, can manifest in both physiological and psychological forms. Symptoms such as increased heart rate, muscle tension, impaired concentration, and intrusive negative thoughts can interfere with an athlete's ability to execute their skills effectively. This phenomenon is particularly problematic in high-stakes situations, where the pressure to perform can exacerbate feelings of anxiety, leading to suboptimal performance. While traditional approaches to managing performance anxiety—such as cognitive-behavioral therapy (CBT), progressive muscle relaxation, and visualization techniques—have been widely utilized, there has been a growing interest in exploring alternative strategies that address not only the symptoms but also the root causes of anxiety. In recent years, mindfulness-based techniques have gained traction as a promising intervention for reducing anxiety and improving focus in athletes. Mindfulness, broadly defined as the practice of maintaining present-moment awareness with acceptance and without judgment, has its roots in ancient meditative traditions but has been adapted into

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contemporary psychological interventions, such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT).

Research in clinical and non-clinical populations has demonstrated the efficacy of mindfulness techniques in reducing symptoms of stress, anxiety, and depression. In the domain of sports psychology, mindfulness has been shown to improve attentional control, enhance emotional regulation, and foster resilience under pressure. Techniques such as mindful breathing, body scanning, and focused attention meditation help athletes cultivate a state of awareness that allows them to respond to stressors more adaptively, rather than reacting impulsively or becoming overwhelmed. This heightened awareness can enable athletes to perform with greater composure, maintain focus during critical moments, and recover more effectively from setbacks.

This research paper aims to investigate the role of mindfulness techniques in reducing performance anxiety among athletes. Specifically, it will examine the theoretical underpinnings of mindfulness, the mechanisms through which it influences anxiety, and the evidence supporting its effectiveness in sports contexts. Additionally, the paper will explore how mindfulness interventions can be tailored to different sports disciplines, individual athlete needs, and competitive environments. By providing a comprehensive analysis of mindfulness and its applications in sports, this study seeks to contribute to the growing body of knowledge on innovative psychological interventions that promote both mental well-being and peak athletic performance.

Through this exploration, the research highlights the potential of mindfulness as a transformative tool for athletes, not only to manage performance anxiety but also to enhance their overall psychological resilience and competitive edge. This integration of mental training with physical preparation represents a holistic approach to athletic development, aligning with the broader goal of fostering long-term well-being and success in the highly demanding world of sports.

## Methodology

This study employed a comprehensive approach to investigate the role of mindfulness techniques in reducing performance anxiety among athletes. The methodology included participant recruitment, mindfulness intervention implementation, psychological and physiological assessment, and advanced statistical analysis to determine the intervention's effectiveness.

## Participant Recruitment

A total of 100 athletes aged 18-35 were recruited, equally divided into two groups: intervention and control. Participants represented various sports disciplines, including individual (e.g., swimming, tennis) and team sports (e.g., basketball, soccer). Eligibility criteria included at least three years of competitive experience and a history of moderate-to-severe performance anxiety, assessed using the Sport Anxiety Scale-2 (SAS-2). Athletes with ongoing psychological treatments or significant physical injuries were excluded to ensure uniformity in baseline conditions.

## Mindfulness Intervention Implementation

The intervention group participated in an 8-week structured mindfulness program modeled on Mindfulness-Based Stress Reduction (MBSR) but tailored for athletes. The program included weekly 90-minute group sessions focusing on mindfulness meditation, body scanning, and mindful

breathing. Participants were encouraged to practice these techniques for 20 minutes daily using guided audio instructions. The control group received no mindfulness training but continued their regular training schedules. Both groups were instructed to maintain their normal athletic routines throughout the study period.

## Psychological Assessment

Performance anxiety was assessed pre- and post-intervention using validated scales such as the Competitive State Anxiety Inventory-2 (CSAI-2) and the State-Trait Anxiety Inventory (STAI). Emotional regulation and mindfulness levels were measured using the Difficulties in Emotion Regulation Scale (DERS) and the Five Facet Mindfulness Questionnaire (FFMQ), respectively. The assessments aimed to capture changes in anxiety, emotional regulation, and mindfulness over the intervention period.

## Physiological Assessment

Physiological markers of anxiety were measured to complement psychological assessments. Heart rate variability (HRV), an indicator of autonomic nervous system regulation, was recorded using portable HR monitors during simulated competitive tasks. Salivary cortisol samples were collected at baseline and after performance tasks to assess stress hormone levels. Both measures were analyzed to determine the physiological impact of mindfulness techniques.

## Data Analysis

Pre- and post-intervention data were analyzed using paired t-tests to evaluate within-group changes and repeated measures ANOVA to compare intervention and control groups. Correlations between mindfulness levels and performance anxiety reduction were assessed using Pearson's correlation coefficient. To explore individual differences, cluster analysis was employed to categorize athletes based on responsiveness to the mindfulness intervention.

Functional connectivity in HRV data was evaluated using time-domain and frequency-domain metrics, while cortisol levels were analyzed using mixed-effects models to account for variability across time and individual stress reactivity. Additionally, qualitative data from participant feedback were analyzed thematically to capture subjective experiences of the mindfulness program.

This robust methodology ensured a multidimensional understanding of how mindfulness techniques impact psychological and physiological components of performance anxiety in athletes.

## Result & Discussions

The results of this study demonstrated a significant reduction in performance anxiety among athletes who participated in the mindfulness intervention program. The findings are presented below under psychological and physiological outcomes.

## Psychological Outcomes

The *intervention group showed a marked improvement in performance anxiety scores*, as measured by the Competitive State Anxiety Inventory-2 (CSAI-2). Pre-intervention mean scores for cognitive anxiety were  $28.6 \pm 4.3$ , which significantly decreased to  $18.9 \pm 3.8$  post-intervention ( $p < 0.01$ ). Similarly, somatic anxiety scores dropped from  $26.4 \pm 5.1$  to  $16.7 \pm 4.5$  ( $p < 0.01$ ). The control group, by contrast, exhibited no significant changes in either cognitive (pre:  $29.1 \pm 4.1$ , post:  $28.7 \pm 4.3$ ) or somatic anxiety (pre:  $25.8 \pm 5.4$ ,

post:  $25.2 \pm 5.6$ ). Mindfulness levels, as measured by the Five Facet Mindfulness Questionnaire (FFMQ), increased significantly in the intervention group. The total mindfulness score rose from  $92.7 \pm 8.3$  to  $112.4 \pm 7.9$  ( $p < 0.01$ ), with *notable improvements in facets such as observing, non-judging, and acting with awareness*. The control group showed no statistically significant changes in mindfulness levels.

### Physiological Outcomes

Heart rate variability (HRV) analysis revealed a significant increase in parasympathetic activity among athletes in the intervention group. The root mean square of successive differences (RMSSD), a key HRV metric, increased from  $32.5 \pm 6.8$  ms to  $48.3 \pm 7.2$  ms ( $p < 0.01$ ). The control group displayed no significant change (pre:  $31.9 \pm 7.1$  ms, post:  $32.3 \pm 6.9$  ms).

Salivary cortisol levels collected after simulated performance tasks were also significantly reduced in the intervention group. Baseline cortisol levels dropped from  $6.7 \pm 1.2$  nmol/L to  $4.3 \pm 1.1$  nmol/L post-intervention ( $p < 0.01$ ). The control group exhibited no notable changes (pre:  $6.9 \pm 1.3$  nmol/L, post:  $6.8 \pm 1.4$  nmol/L).

### Discussion

The findings of this study strongly support the efficacy of mindfulness techniques in reducing performance anxiety among athletes, both at psychological and physiological levels.

The significant reduction in CSAI-2 scores in the intervention group highlights the ability of mindfulness training to address both cognitive and somatic aspects of performance anxiety. By fostering present-moment awareness and reducing judgmental thinking, mindfulness likely enabled athletes to reinterpret pre-competition arousal as facilitative rather than debilitating. This aligns with previous research that suggests mindfulness promotes cognitive reframing, which can help athletes manage negative self-talk and intrusive thoughts.

Furthermore, the increase in FFMQ scores underscores the role of mindfulness in enhancing athletes' overall mental states. The observed improvement in facets such as acting with awareness and non-reactivity suggests that athletes became better equipped to manage high-pressure situations without succumbing to emotional or physiological stress responses.

The increase in HRV metrics, particularly RMSSD, indicates enhanced autonomic regulation following mindfulness training. Higher parasympathetic activity is associated with a calmer physiological state, which is critical for managing anxiety during competition. The observed reduction in cortisol levels further supports the stress-reducing benefits of mindfulness. By promoting relaxation and improving stress

recovery, mindfulness may enable athletes to perform with greater composure in competitive environments.

The effectiveness of mindfulness in reducing performance anxiety can be attributed to its influence on multiple interrelated mechanisms. Neuropsychological evidence suggests that mindfulness enhances prefrontal cortex activity, improving attentional control and reducing emotional reactivity. This aligns with the significant improvements in emotional regulation observed in the intervention group. Additionally, the physiological benefits observed in this study may reflect a reduction in hypothalamic-pituitary-adrenal (HPA) axis activity, which is often hyperactivated under stress. The findings of this study are consistent with prior research demonstrating the efficacy of mindfulness-based interventions in reducing anxiety and improving performance. However, this study extends the existing literature by providing a comprehensive evaluation of both psychological and physiological outcomes, offering a more holistic understanding of mindfulness' impact on athletes.

### Practical Implications

The results of this study have practical implications for sports psychologists, coaches, and athletes. Integrating mindfulness training into routine athletic preparation can serve as a valuable tool for managing pre-competition stress and enhancing overall performance. Tailored mindfulness programs, such as those incorporating sport-specific visualization exercises, may further enhance their efficacy.

### Limitations Future Research

Although the study demonstrates strong evidence in favor of mindfulness, certain limitations must be acknowledged. The sample size, though adequate, may not fully capture the diversity of sports disciplines or cultural differences in anxiety responses. Future studies should explore the long-term effects of mindfulness training, including its impact on recovery, resilience, and injury prevention. Additionally, exploring the integration of mindfulness with other psychological interventions, such as imagery training, could provide further insights into comprehensive anxiety management strategies for athletes.

This study provides compelling evidence that mindfulness techniques significantly reduce performance anxiety in athletes, addressing both psychological and physiological dimensions. By enhancing emotional regulation, improving autonomic balance, and reducing stress hormone levels, mindfulness empowers athletes to perform with greater confidence and composure. The findings underscore the potential of mindfulness as a transformative tool in sports psychology, offering a pathway to both mental well-being and competitive excellence.

**Table 1:** Below is a table summarizing the key results of the study

Outcome	Measure	Intervention Group (Pre)	Intervention Group (Post)	Control Group (Pre)	Control Group (Post)	Significance (p-value)
Cognitive Anxiety	CSAI-2 Score (Mean $\pm$ SD)	$28.6 \pm 4.3$	$18.9 \pm 3.8$	$29.1 \pm 4.1$	$28.7 \pm 4.3$	$< 0.01$
Somatic Anxiety	CSAI-2 Score (Mean $\pm$ SD)	$26.4 \pm 5.1$	$16.7 \pm 4.5$	$25.8 \pm 5.4$	$25.2 \pm 5.6$	$< 0.01$
Mindfulness Levels	FFMQ Score (Mean $\pm$ SD)	$92.7 \pm 8.3$	$112.4 \pm 7.9$	$93.1 \pm 8.1$	$93.8 \pm 8.0$	$< 0.01$
Heart Rate Variability	RMSSD (ms, Mean $\pm$ SD)	$32.5 \pm 6.8$	$48.3 \pm 7.2$	$31.9 \pm 7.1$	$32.3 \pm 6.9$	$< 0.01$
Stress Hormone Levels	Salivary Cortisol (nmol/L, Mean $\pm$ SD)	$6.7 \pm 1.2$	$4.3 \pm 1.1$	$6.9 \pm 1.3$	$6.8 \pm 1.4$	$< 0.01$



## Conclusion

This study demonstrates that mindfulness techniques effectively reduce performance anxiety in athletes by improving both psychological and physiological outcomes. The intervention led to significant decreases in cognitive and somatic anxiety, enhanced mindfulness levels, increased heart rate variability, and reduced cortisol levels. These findings highlight mindfulness as a practical, evidence-based tool for fostering focus, emotional resilience, and stress management in competitive environments.

Integrating mindfulness into athletic training can enhance performance and well-being, making it a valuable addition to sports psychology practices. Future research should explore its long-term impact and combination with other mental training techniques for comprehensive anxiety management.

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