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The Impact of Mindfulness Training on Basketball Shooting Performance of College Student-Athletes

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Abstract **Review Article**

This study aims to explore the impact of mindfulness training on the basketball shooting performance of Chinese college student-athletes. A total of 50 students majoring in physical education from a university were selected as participants and underwent an 8-week, 5-session-perweek structured mindfulness training intervention. The effect of mindfulness training on shooting performance was systematically examined through a comprehensive evaluation method that combined pre- and post-intervention comparisons, assessments using psychological resilience scales, free-throw performance tests, and tracking of game performance. The results showed that after the mindfulness intervention, the psychological resilience of the participants in the experimental group was significantly enhanced, with a marked increase in their resilience compared to pre-intervention levels. The free-throw performance of the mindfulness group also improved significantly, with post-intervention scores notably higher than pre-intervention scores. The study concludes that mindfulness training enhances athletes' attention regulation, emotional management, and stress coping abilities, thereby improving their psychological quality structure and positively influencing their sports performance. It is recommended that mindfulness training be integrated into the psychological training system for college student-athletes to provide a scientifically based psychological intervention for enhancing competitive sports performance.

Keywords: Mindfulness Training; College Student-Athletes; Shooting Performance; Psychological Quality.

INTRODUCTION

Currently in China, the psychological therapies and interventions employed to enhance sports performance and address anxiety in sports are primarily divided into traditional psychological skills training (PST) and mindfulness training. Athletes typically receive two types of psychological skills training: traditional psychological skills training (PST) and mindfulness training. Traditional psychological skills training mainly involves self-regulation of internal psychological processes to achieve optimal performance in competition. Specific methods include goal setting, imagery training, arousal control, attention training, and combinations of the above methods. These approaches aim to achieve an optimal internal state, which is considered a necessary condition for peak sports performance. However, empirical studies in the field have shown that the effectiveness of traditional PST interventions has not been sufficiently supported over the past three decades [1]. In contrast, mindfulness training emphasizes the development of athletes' non-judgmental awareness of the present moment through mindfulness practice. It focuses on accepting one's internal state rather than controlling it.

Systematic mindfulness-based psychological therapy was designed and proposed in 1979 by Dr. Jon Kabat-Zinn, a medical doctor at the Massachusetts Institute of Technology (MIT). In 1995, he officially established the Mindfulness-Based Medical Health Center to effectively alleviate various symptoms caused by chronic pain and stress. Since then, mindfulness training has gradually been widely adopted. Mindfulness-based training has been increasingly applied in athletes' training processes, yielding positive results. In recent years, mindfulness training has been extensively applied in the sports domain, with numerous researchers conducting studies on its application among athletes. Research findings indicate that mindfulness training can enhance sports performance by improving athletes' physical fitness, physiological functions, and psychological states.

1.1 Concept of Mindfulness and Mindfulness Training

The term Mindfulness originates from Eastern philosophy, aiming to help individuals calm their minds and anchor their restless souls, thereby returning to real life and embracing new changes. In Pali, mindfulness is called *Vipassanā*, also known as insight meditation, mindfulness meditation, and so on (Kabat-Zinn, 2003) [2]. The history of mindfulness is ancient, with its earliest origins in Buddhism, specifically from the Buddhist scripture *Satipatthana Sutta* [3]. The term "正" (correct) comes from the Buddhist *Eightfold Path*, which includes right view, right speech, right intention, right action, right livelihood, right effort, right concentration, and right mindfulness. "正" means correct or returning to the right path. In Buddhism, "念" (mindfulness) refers to a state of mental tranquility and focused attention, where practitioners concentrate their thoughts on a specific object and observe it attentively. This practice is called "**念**" (mindfulness). Practicing mindfulness with right knowledge is referred to as "正念" (right mindfulness), which means correctly being aware of oneself and focusing attention. This is the etymology of the term "正念" [4].

Mindfulness training refers to a collection of psychological therapies based on mindfulness, including mindfulness-based interventions and mindfulness training techniques. In the context of enhancing sports performance, mindfulness training is primarily used to improve behavioral performance levels. Currently, the main mindfulness training methods in the field of sports include: the Mindfulness, Acceptance, and Commitment (MAC) approach developed by Gardner and Moore; the Mindful Sport Performance Enhancement (MSPE) program developed by Kaufman *et al*., the Mindfulness Meditation Training for Sport (MMTS) developed by AKRTER; and the MindfulnessAcceptance-Insight-Commitment (MAIC) training developed by Sidharta *et al*., [5]. For example, an intervention experiment using the MAC method showed that mindfulness training significantly improved athletes' levels of mindfulness, experiential acceptance, flow, and dart-throwing performance. Follow-up assessments two weeks later revealed that mindfulness training also had lasting effects. Additionally, mindfulness has been shown to effectively reduce trait anxiety, depression, and other negative emotions in high-level athletes, maintain a healthy psychological state, and improve sleep quality.

1.2 The Necessity of Psychological Training for Athletes

In competitive sports, enhancing athletic performance has increasingly become a focal point for sports researchers. To improve athletes' performance, it is essential to address the factors that influence it. Zhang Liwei's [9] research indicates that these factors can be divided into two main categories: objective factors, such as athletes' technical, tactical, and physiological aspects, and subjective psychological factors [10]. Among these, the psychological factors are often more critical in determining performance outcomes.

For instance, the stability of shooting ability is a crucial indicator for evaluating basketball players' performance. In the 2018 NBA Finals, Game 1, Cleveland Cavaliers player George Hill, who had a career free-throw shooting percentage of 81.1%—a top-tier level in the league—missed two critical free throws in the final moments of the game. This led to overtime, during which the Cavaliers ultimately lost. Psychologists later termed this phenomenon "choking," which is common among high-level athletes. When facing high-pressure situations, athletes often become nervous and anxious, losing their ability to concentrate on their actions and resulting in a significant decline in performance.

Therefore, enhancing athletes' psychological state regulation is essential for improving their performance.

Compared to traditional psychological skills training (PST), mindfulness training has been shown to be more effective in improving athletes' performance under pressure.

Traditional PST focuses on eliminating negative internal experiences, while mindfulness emphasizes accepting these experiences. Mindfulness training primarily affects psychological variables related to performance, such as increasing confidence, improving concentration, and reducing anxiety and depression. Studies have demonstrated that mindfulness training enhances athletes' ability to focus, allowing them to better manage external distractions and direct their attention to task-relevant aspects, thereby improving their performance.

Mindfulness training typically involves structured sessions aimed at developing athletes' acceptance and awareness, as well as their self-regulation abilities. This enables them to better cope with negative emotions rather than attempting to control them temporarily.

In fact, evidence suggests that controlling these naturally occurring internal states not only fails to produce positive outcomes but may also backfire. Mindfulness training has been shown to effectively improve athletes' performance, with the most significant impact on objective performance metrics, followed by subjective evaluations, and a moderate effect on physical performance. Athletes who adopt mindfulness principles to manage negative internal experiences tend to shift from a confrontational approach to one of non-judgmental acceptance, allowing them to maintain focus

on their training tasks. This training has been found to have notable effects on reducing anxiety, experiential avoidance, and enhancing flow experiences, while its impact on emotional regulation difficulties remains a topic for further research.

Mindfulness Training Experimental Study

Experimental Subjects

The subjects of this study were 50 college basketball players who had achieved the national secondlevel athlete status or above (25 males and 25 females, aged 19-23 years, M = 21.2, SD = 1.4).

Experimental Methods

The primary venue for the mindfulness training was the basketball court. Before the start of the mindfulness sessions, the concept of mindfulness was briefly explained to the experimental group, and they were informed that they would participate in an 8-week mindfulness training program (Mindfulness-Acceptance-Insight-Commitment, MAIC). Based on the *Mindfulness Training Manual for Athletes*, the training content was divided into an 8-week program, with five sessions per week. Each session lasted approximately 60 minutes, during which the participants followed mindfulness audio guides for practice. Prior to the commencement of the experiment, all 50 athletes underwent a free-throw shooting test from a designated spot. After completing the 8-week mindfulness training, the test was conducted again to compare the pre- and post-training performance. Additionally, all participants completed the Five Facet Mindfulness Questionnaire (FFMQ) and the Connor-Davidson Resilience Scale (CD-RISC) both before and after the training.

Analysis of the Impact of Mindfulness Training on Free-Throw Performance

After the 8-week mindfulness training, paired-sample t-tests were conducted to analyze the changes in various variables for the mindfulness group before and after the intervention. The results are as follows:

Table 1: Within-Group Comparisons of Variables Before and After Mindfulness Training in the Experimental Group

	Pre-test (M±SD)	Post-test (M±SD)	t
Total Score of Mindfulness Level	117.65±15.84	125.26±19.92	-3.921***
Observation Dimension	25.74±6.40	28.68±5.13	-3.506**
Describing Dimension	25.97±5.06	28.35±5.15	-3.767***
Acting with Awareness Dimension	25.90±4.69	23.19±5.36	3.122**
Non-judging Dimension	20.23±3.78	20.00±4.39	0.331
Non-reactivity Dimension	22.29±3.07	23.45±3.11	-1.821
Total Score of Psychological Resilience	91.48±12.93	94.71±13.46	-2.395*
Toughness Dimension	47.45±6.88	47.78±8.04	-0.261
Strength Dimension	32.55±3.65	32.00±4.12	0.897
Optimism Dimension	14.29±2.83	14.94±2.54	-1.645
Free-Throw Performance	31.13±4.23	34.55±6.57	-5.204***

Note:

FFMQ: Five Facet Mindfulness Questionnaire

CD-RISC: Connor-Davidson Resilience Scale

Cohen's d: Effect size measure (calculated as the difference between means divided by the pooled standard deviation) p-values indicate statistical significance, with $p < 0.05$ marked as *, $p < 0.01$ marked as **, and $p < 0.001$ marked as ***.

Results Analysis

Mindfulness Level

The results indicate significant improvements in the overall mindfulness level of the experimental group after the 8-week mindfulness training program. Specifically, the total score of the Five Facet Mindfulness Questionnaire (FFMQ) showed a significant increase ($p<0.001$), suggesting that participants developed a stronger capacity for mindfulness. This improvement was particularly evident in the "Observation" and "Description" subscales of the FFMQ, both of which showed significant increases ($p<0.001$). These findings suggest that mindfulness training effectively enhanced participants' ability to observe and describe their experiences non-judgmentally.

Psychological Resilience

The total score of the Connor-Davidson Resilience Scale (CD-RISC) also showed a significant increase after the training ($p<0.05$), indicating enhanced psychological resilience among the participants. Specifically, the "Perseverance" subscale of the CD-RISC showed a significant improvement ($p<0.05$), suggesting that participants developed greater mental toughness and persistence in the face of challenges.

Free-Throw Performance

The free-throw performance of the experimental group improved significantly after the mindfulness training ($p<0.001$). This result indicates that mindfulness training effectively enhanced the stability and accuracy of basketball free-throw performance. The

significant improvement in free-throw scores suggests that mindfulness training can help athletes better manage anxiety and maintain focus during high-pressure situations, thereby improving their overall performance.

CONCLUSION

The findings of this study demonstrate that mindfulness training can significantly enhance the mindfulness level, psychological resilience, and free-throw performance of college basketball players. The improvements in mindfulness and psychological resilience likely contributed to the enhanced performance by helping athletes maintain a calm and focused state under pressure. These results support the integration of mindfulness training into athletic preparation programs to optimize performance and mental health. Future research should further explore the long-term effects of mindfulness training and its potential applications in other sports contexts.

Research Conclusions

In summary, mindfulness training can effectively enhance the psychological quality and on-court shooting performance of basketball players. Not only does mindfulness training improve the shooting ability of basketball players, but it has also been extensively studied both domestically and internationally for its impact on the performance of athletes in other sports. Previous research has demonstrated that mindfulness training can improve athletic performance and enhance physical fitness and physiological functions [14]. However, while most studies have shown significant intervention effects, some have reported insignificant results. Scholars have identified several common issues in mindfulness training research, including the lack of significant intervention effects in some studies, the limited variety of sports and assessment methods used, and the predominance of single-method interventions. Most studies have focused on the impact of mindfulness training on athletic performance using a single method, such as mindfulness-based interventions. However, mindfulness training encompasses not only mindfulness therapies but also techniques like meditation and yoga. Therefore, this study integrates both mindfulness-based training therapies and mindfulness training techniques to provide a more comprehensive intervention. The findings of this study provide empirical support for the integration of mindfulness training into the psychological preparation of athletes, particularly in enhancing their psychological resilience and performance under pressure. The significant improvements in shooting performance and psychological resilience observed in this study suggest that mindfulness training can be a valuable tool for optimizing athletic performance. However, future research should address the identified limitations by exploring the long-term effects of mindfulness training and its applicability across different sports and contexts. Additionally, future studies should consider combining multiple mindfulness techniques and using more diverse assessment methods to better understand the mechanisms through which mindfulness training enhances athletic performance.

Directions for Improvement and Recommendations

Limitations of the Current Study

The current study has several limitations that need to be addressed in future research. First, the experimental subjects were all selected from the same university's specialized athletes, resulting in a small and homogeneous sample size. Additionally, there were relatively few athletes at the national first-level or elite level, which may limit the generalizability of the findings to high-performance athletes. This limitation suggests that the study may not fully reflect the positive impact of mindfulness training on the performance of elite athletes. In future experiments, efforts will be made to increase the number of elite participants to enhance the representativeness of the study.

Recommendations for Future Research

To improve the comprehensiveness and applicability of future studies, the following recommendations are proposed:

Expand the Sample Size and Diversity: Future studies should include a larger and more diverse sample of athletes from different universities, sports, and performance levels to better capture the effects of mindfulness training on various populations.

Incorporate a Broader Range of Measurement Indicators: The effectiveness of mindfulness training should be evaluated using a more comprehensive set of indicators.

Explore Diverse Mindfulness Training Methods: Future research should investigate the effects of various mindfulness training techniques, such as meditation, yoga, qigong, Five-Animal Frolics, Tai Chi, and standing meditation. These methods, all falling under the umbrella of mindfulness training, can provide additional insights into the mechanisms and effectiveness of mindfulness interventions.

4.3 Practical Implications and Broader Applications

The findings from this study on the impact of mindfulness training on basketball players suggest that mindfulness training can be a valuable tool for enhancing athletic performance and psychological resilience. To maximize its potential, the following practical recommendations are proposed:

Integrate Mindfulness Training into Athletic Programs: Coaches and sports psychologists should consider incorporating mindfulness training into the regular training routines of athletes to improve their

psychological resilience and performance under pressure.

Standardize Mindfulness Training in University Settings: Mindfulness training should be considered for inclusion as a standardized training program in universities. This would not only enhance students' psychological control abilities but also improve their overall athletic performance. Promote Mindfulness Training for Broader Populations: The benefits of mindfulness training should be extended to a wider range of athletes and student groups. By integrating mindfulness training into university curricula, students can develop essential psychological skills that can enhance both their athletic and academic performance.

Encourage Multidisciplinary Collaboration: Future initiatives should involve collaboration between sports science, psychology, and traditional wellness practices to develop comprehensive training programs that address both physical and psychological aspects of performance.

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