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The Impact of Psychological Intervention on Some Psychosocial Variables in Iraqi Futsal Players

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A B S T R A C T

Objective: The aim of this study was to examine the impact of psychological intervention on some psychosocial variables in Iraqi futsal players.

Methods and Materials: The research method was quasi-experimental, and the design included pre-test and post-test with control and experimental groups. The statistical population consisted of Iraqi futsal players from Baghdad, aged 20 to 30 years. Thirty individuals were selected based on inclusion and exclusion criteria, and on a voluntary and accessible basis. The participants were randomly assigned into two groups of 15 (one control group and one experimental group). The research questionnaires included the Sports Mental Toughness Questionnaire (SMTQ), the Competitive State Anxiety Inventory-2R (CSAI-2R), and the Athlete Coping Skills Inventory (ACSI-28). The research protocol involved a ten-session psychological skills training intervention (PSTMI), including one introductory session, eight skill-focused sessions (goal setting, mental imagery, mindfulness/activation regulation, and self-talk), and one concluding session based on the study by Josephson et al. (2017). Data analysis was performed using a one-way analysis of covariance (ANCOVA). All statistical operations were conducted using SPSS version 25, with a significance level set at $p < 0.05$.

Findings: The results showed that, after controlling for the pre-test effects, the difference in pre-test and post-test scores between the two groups for the variables of competitive anxiety, mental toughness, and coping skills was significant ($p < 0.001$).

Discussion and Conclusion: Therefore, it can be concluded that mindfulness intervention and psychological skills training are effective in reducing competitive anxiety and increasing mental toughness and coping skills among Iraqi futsal players.

Keywords: *Mindfulness, Psychological Skills Training, Competitive Anxiety, Mental Toughness, Coping Skills.*

1. Introduction

Mental training provides athletes with skills to better cope with challenges during competition (Röthlin et al., 2016; Röthlin et al., 2020). Previous research has reported a reciprocal and bidirectional relationship between mental health and athletic performance (Deenik et al., 2022). Despite empirical support, this bidirectional mental health model (Morgan, 1985; Renger, 1993) has faced critiques regarding the review of psychological patterns and factors in sports performance (Raglin, 2001), as well as neuropsychological methodology evaluations in sports (Comper et al., 2010), with alternative models being proposed. One such model is the iceberg model, which visually represents various emotional states (tension, depression, anger, energy, fatigue, and confusion) and their impact on readiness and athletic performance (Lochbaum et al., 2022; Lochbaum et al., 2021; Rowley et al., 1995). Another model, the ecological systems model, divides elite athlete mental health into the athlete (e.g., coping skills and personality), microsystem (e.g., coaches, family, and friends), exosystem (e.g., individual sports), and macrosystem (e.g., sports environment and media) (Hammond & Bateman, 2009; Purcell et al., 2019). Another approach, the Individual Zones of Optimal Functioning (IZOF) model, suggests that athletes perform best when they are at their optimal anxiety level (Lourenço et al., 2022; Raglin, 2001). Despite their differences, these models highlight the role of psychological factors in sports success (Vella-Fondacaro & Romano-Smith, 2023).

Some psychological skills include goal setting, mental imagery, arousal regulation, attentional control exercises, and self-talk. All of these psychological skills are attributed to better emotional regulation and attention in athletes, better functional control after failure, and overall psychological factors associated with improved performance (Röthlin et al., 2016; Röthlin et al., 2020). Additionally, self-talk training is associated with better levels of self-confidence and reduced state anxiety in athletes (Isar et al., 2022; Naphatchakorn & Phichayavee, 2023). Mindfulness training is also linked to improvements in coping styles (Birrer et al., 2012; Vidic, 2021; Vidic et al., 2017). Acknowledging the overlap between Psychological Skills Training (PST) and Mindfulness Intervention (MI) in arousal regulation, the difference between the two has been appreciated. However, based on targeted results, a combination of both approaches was considered more suitable for team needs, training style, and team preferences. Less athletic experience is associated with higher levels of competitive anxiety (Walter et al., 2019).

Mindfulness interventions and psychological skills training have been conducted on several psychological and performance variables in past research. In this regard, based on the aforementioned studies, the researcher aims to investigate the effect of mindfulness intervention and psychological skills training on psychological variables (competitive anxiety, mental toughness, coping skills) and performance skills (passing, shooting, ball control, and intercepting the opponent's ball) in Iraqi futsal players.

Experts believe that the most important factors for achieving championships include genetic, biomechanical, physiological traits, and the possession of psychological skills (Motashrei et al., 2011). The importance of psychological issues is so significant that some sports psychologists consider mental readiness as the key to success in sports (Melbye et al., 2007). Athletes often face experiences such as failure, emotional problems, and setbacks in sports, and creating effective coping strategies for adapting to these challenges is essential (Wilson, 2019). Mindfulness plays a significant role in emotional regulation. Mindfulness is a form of relaxation that affects sensory processes by influencing attention range, expectations, mood, and emotional regulation (Zeidan et al., 2010). In numerous studies with different therapeutic approaches, mindfulness has been integrated. These approaches include mindfulness-based stress reduction, mindfulness-based cognitive therapy, yoga-based mindfulness approaches, and mindfulness-based sports performance enhancement (Gardner & Moore, 2006; Gardner & Moore, 2004; Kiani et al., 2015; Peterson & Pbert, 1992; Williams & Kuyken, 2012). Better coping skills in sports are linked to overall better performance (Josefsson et al., 2017). Evidence from case studies and correlational research suggests that the use of self-talk, mental imagery, goal setting, arousal regulation, and mindfulness are all associated with objectively measured sports performance or psychological variables related to performance (Gardner & Moore, 2006; Sappington & Longshore, 2015).

The combination of psychological interventions and the examination of psychological and performance variables is of interest to many researchers. Given the limited research, particularly across different cultures and ethnicities, this seems particularly important for predicting and designing training programs for futsal players. Iraq, given its history of

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

prolonged conflict, certainly requires significant research in various fields. In this regard, it appears that this kind of research, which has not yet been conducted, is of particular importance and can contribute to determining the impact of psychological intervention on some psychosocial variables in Iraqi futsal players.

2. Methods and Materials

2.1. Study Design and Participants

This study is a quasi-experimental design with a pre-test, post-test, and control and experimental groups. The statistical population of the study consisted of futsal players in Baghdad, Iraq, aged 20 to 30 years. A total of 30 participants were selected based on inclusion and exclusion criteria and on a voluntary and accessible basis. The participants were randomly divided into two groups of 15 (one control group and one experimental group).

Inclusion criteria:

- Age between 20 and 30 years
- At least 1 year of athletic experience
- No concurrent participation in psychological protocols or therapy sessions.

Exclusion criteria:

- Absence from more than two sessions in the psychological intervention protocol and training sessions
- Failure to complete questionnaires
- Withdrawal from the study.

To collect information and measure the variables, the following tools were used:

1. Demographic Information Sheet
2. Sport Mental Toughness Questionnaire (SMTQ)
3. Competitive State Anxiety Inventory-2R (CSAI-2R)
4. Athlete Coping Skills Inventory (ACSI-28)

To gather personal and demographic information of the participants, a personal information sheet was designed. It included details such as age, height, weight, and athletic background to construct a demographic profile of the participants.

Initially, all participants will undergo a pre-test on the research variables. Among the volunteers, 30 individuals will be selected voluntarily and randomly assigned to two groups: the psychological skills intervention group (15 participants) and the control group (15 participants). After the completion of the 10 sessions, a post-test will be administered to all participants. The control group will continue their regular training without any psychological skills intervention during this period.

2.2. Measures

2.2.1. Sport Mental Toughness

The aim of the sport mental toughness assessment was to evaluate different dimensions: confidence (questions 1 to 6), stability (questions 7 to 10), and control (questions 11 to 14) (Sheard et al., 2009). This questionnaire includes 14 questions developed by Sheard et al. (2009). It uses a five-point Likert scale: very low (1), low (2), neither low nor high (3), high (4), and very high (5). However, for questions 4, 7, 8, 9, and 10, the scoring is reversed. To calculate the score for each dimension, the total points for that dimension are summed, and for the overall score, the points for all individual questions are calculated. Higher overall scores indicate greater mental toughness in the respondent, and vice versa. In Kashani et al.'s (2015) study, content validity was assessed through expert opinions and confirmed. Construct validity was also confirmed using exploratory factor analysis, which revealed three subscales. Cronbach's alpha was used to calculate reliability, with values above 0.70 for all dimensions (Kashani et al., 2015).

2.2.2. State Anxiety

The 17-item Competitive State Anxiety Inventory-2R (CSAI-2R) was designed by Martens et al. (1990) for assessing competitive state anxiety. This tool has three components: 1) physical anxiety (questions 1, 4, 6, 9, 12, 15, 17), 2) cognitive anxiety (questions 2, 5, 8, 11, 14), and 3) confidence (questions 3, 7, 10, 13, 16). The questionnaire uses a four-point Likert scale with options ranging from very high (4), high (3), low (2), and none (1). To calculate the score for each component, the scores for each relevant item are summed. Higher scores in each component indicate a greater impact on competitive anxiety and motivation. In Kashani and Mostafayi Far's (2016) study, content and construct validity were considered appropriate for assessing the questionnaire, and Cronbach's alpha was above 0.70, showing satisfactory reliability (Kashani & Mostafayi Far, 2016).

2.2.3. Athlete Coping Skills

This questionnaire, developed by Smith et al. in 1995 in Hungary, measures coping skills related to dealing with

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

hardship, coachability, concentration, self-confidence, motivation, goal-setting, and mental readiness. It ultimately reflects the participant's overall coping skills. Athletes rate the statements based on their past and present experiences. The questionnaire contains 28 questions, grouped into seven subscales. The responses are rated on a Likert scale from almost always to almost never. The scoring for each item is as follows: almost always (3), often (2), sometimes (1), almost never (0). Each subscale can score between 0 and 12, with the final score ranging from 0 to 84. The scoring system is categorized as follows: weak (0-28), average (29-56), and good (57-84). In Iran, the ACSI-28 was validated by Barzegar (2014). The raw scores were converted to percentage scores to enhance the value and accuracy of each skill. The internal consistency of the scales was 0.86, indicating a high level of reliability.

2.3. Intervention

The ten-session intervention (PSTMI) included one introductory session, eight skill-building sessions (goal setting, motor imagery, mindfulness/arousal regulation, and self-talk), and one final session. The goal-setting and motor imagery sessions were scheduled for the first half of the program, to be conducted during the preparation phases and early stages of competition. In contrast, the mindfulness/arousal regulation and self-talk sessions were planned for the second half of the PSTMI, coinciding with the more challenging competitive games. The PST and MI sessions were adapted from previous research (Josefsson et al., 2017) and integrated into a more comprehensive PSTMI, which acknowledges the overlap between mindfulness and arousal regulation (Josefsson et al., 2017). Furthermore, both PST and MI have been reported to improve emotional regulation in athletes, and both can be successfully applied due to their "common effects" (Röthlin et al., 2016; Röthlin et al., 2020). While PST focused more on psychological skills, the mindfulness sessions emphasized exercises aimed at "letting go," using a non-judgmental approach and relaxation techniques such as progressive muscle relaxation, mindful silence, and focused observation. This ten-session protocol covered an entire national futsal knockout tournament within an eight-week period and was conducted by a psychiatrist with a master's degree in sport and exercise psychology (the principal investigator). Sessions were held once a week (Vella-Fondacaro & Romano-Smith, 2023).

The intervention protocol is designed to gradually introduce athletes to various mental skills and techniques aimed at enhancing performance and well-being through structured sessions. Stage 1 begins with Session 1, an introductory session that provides participants with detailed information about the research study, including consent forms and the necessary pre-test evaluations. This session ensures participants understand the purpose and process of the intervention. Sessions 2-3 focus on goal setting, starting with an explanation of what goal setting is and why it is important, followed by a discussion of goal-setting theory. The concept of SMART goals (Specific, Measurable, Achievable, Relevant, Time-bound) is introduced, with a particular emphasis on their application in training. Participants will then engage in an assignment where they create personal training goals based on these principles. Sessions 4-5 introduce motor imagery, explaining what it is and why it is beneficial for athletes. Video examples of elite athletes utilizing motor imagery techniques will be shown to demonstrate its impact. Participants will then practice motor imagery, mentally rehearsing movements related to their sport, followed by an assignment to continue practicing this skill outside the sessions. Sessions 6-7 focus on arousal regulation and mindfulness. These sessions explain the concept of arousal, how mindfulness can help in controlling arousal, and introduce the Yerkes-Dodson curve, which models the relationship between arousal and performance. The importance of regulating arousal in sports will be emphasized, and elite athletes' videos showcasing mindfulness-based arousal control techniques will be presented. Participants will learn and practice mindfulness techniques such as progressive muscle relaxation, mindful silence, and mindful breathing, followed by an assignment to apply these techniques in their training. Stage 2 concludes with Session 10, the final session, where the skills learned throughout the intervention are summarized. Participants will receive feedback on their progress and performance, and post-test evaluations will be conducted to measure the outcomes of the intervention. Sessions 8-9 focus on self-talk, defining what self-talk is and the difference between positive and negative self-talk. Videos of elite athletes using self-talk effectively will be shown. Participants will then practice incorporating positive self-talk into their athletic routine and complete an assignment that involves applying these strategies during their training or competition.

2.4. Data Analysis

Data analysis was conducted at two levels: descriptive and inferential statistics. Descriptive statistics, including

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

mean, standard deviation, and graphical representations, were used. For inferential analysis, the Shapiro-Wilk test was employed to examine the normality of the data distribution, and Levene's test was used to assess homogeneity of variances. Additionally, a one-way analysis of variance (ANOVA) was performed to examine group differences. Data were analyzed using SPSS software (version 26) at a 0.05 significance level.

3. Findings and Results

The statistical sample of the present study consisted of 30 futsal players from Baghdad. The age of participants in the experimental and control groups ranged from 20 to 30 years. The results of an independent t-test showed that there were no significant differences between the experimental and control groups in terms of age, height, weight, and athletic background ($p > 0.05$).

The results of the Kolmogorov-Smirnov test indicated that none of the research variables were significantly different ($p > 0.01$). Therefore, it can be concluded that all the variables in the study follow a normal distribution. Additionally, the results of Levene's test show that the variance of coping skills between the two groups is equal, with no significant difference ($p > 0.05$). Thus, the assumption of homogeneity of variances between the two groups was satisfied. However, for the variables of competitive anxiety and sport mental toughness, the assumption was not met ($p < 0.05$). Therefore, the decision should be made considering the equal number of participants in both groups and in accordance with the results of other assumptions.

The assumption of equal regression slopes for both groups for the variables of competitive anxiety, sport mental toughness, and coping skills was met ($p > 0.05$). Since all research assumptions were satisfied for all variables, except for the homogeneity of variances for competitive anxiety and sport mental toughness, this assumption can be disregarded with slight leniency, given the equal number of participants in each group and the satisfaction of other assumptions. Therefore, the use of one-way analysis of covariance (ANCOVA) is permissible.

Table 1

Results of ANCOVA for Competitive Anxiety in Experimental and Control Groups

Source of Variance	SS	df	MS	F	p-value	Effect Size
Group	232.88	1	232.88	20.38	$p < 0.001$	0.43
Error	308.59	27	11.43			
Total	786.00	30				

Table 2

Adjusted Post-Test Mean for Competitive Anxiety

Dependent Variable	Group	Adjusted Mean	Standard Error
Competitive Anxiety	Experimental	47.93	0.88
	Control	53.54	0.88

The results above show that after controlling for the pre-test effect, the difference in the pre-test and post-test scores for the competitive anxiety variable is significant. The mean scores of the experimental group in competitive anxiety are significantly lower than those of the control group ($p < 0.001$). Therefore, it can be concluded that mindfulness intervention and psychological skills training are effective in reducing competitive anxiety in Iraqi futsal players.

Table 3

Results of ANCOVA for Sport Mental Toughness in Experimental and Control Groups

Source of Variance	SS	df	MS	F	p-value	Effect Size
Group	48.73	1	48.73	21.19	$p < 0.001$	0.44
Error	62.01	27	2.30			
Total	585.91	30				

JAYPS Adolescent and Youth Psychological Studies
E-ISSN: 2981-2526

Table 4

Adjusted Post-Test Mean for Sport Mental Toughness

Dependent Variable	Group	Adjusted Mean	Standard Error
Sport Mental Toughness	Experimental	45.42	0.40
	Control	42.78	0.40

The results above indicate that after controlling for the pre-test effect, the difference in the pre-test and post-test scores for sport mental toughness is significant. The mean scores of the experimental group in sport mental toughness are significantly higher than those of the control group ($p < 0.001$). Therefore, it can be concluded that mindfulness intervention and psychological skills training are effective in increasing mental toughness in Iraqi futsal players.

Table 5

Results of ANCOVA for Coping Skills in Experimental and Control Groups

Source of Variance	SS	df	MS	F	p-value	Effect Size
Group	361.7	1	1386.7	454.29	$p < 0.001$	0.98
Error	21.5	27	0.79			
Total	632.98	30				

Table 6

Adjusted Post-Test Mean for Coping Skills

Dependent Variable	Group	Adjusted Mean	Standard Error
Coping Skills	Experimental	52.58	0.40
	Control	38.22	0.40

The results above show that after controlling for the pre-test effect, the difference in the pre-test and post-test scores for coping skills is significant. The mean scores of the experimental group in coping skills are significantly higher than those of the control group ($p < 0.001$). Therefore, it can be concluded that mindfulness intervention and psychological skills training are effective in enhancing coping skills in Iraqi futsal players.

4. Discussion and Conclusion

The aim of this study was to investigate the effects of mindfulness interventions and psychological skills training on competitive anxiety, mental toughness, and coping skills among Iraqi futsal players.

Mindfulness skills enable athletes to avoid focusing on negative thoughts that may arise in competitive situations, thereby minimizing cognitive anxiety. This is because the athlete is more focused on the task and the situation at hand, without attempting to judge or combat any negative thoughts that may emerge. Moreover, an athlete's mindfulness skills may help in developing alternative problem-solving skills, which contribute to eliminating negative thoughts that cause cognitive anxiety (Permadi & Nurwianti, 2018). According to the literature and previous studies, several factors may influence competitive anxiety, trait anxiety, positive and negative effects, self-confidence, extraversion, mental toughness, gender, skill level, competitive experience, and the type of sport (Cerin, 2004). One possible explanation is the set of enhanced skills associated with more experienced athletes, such as visual skills (Presta et al., 2021) and perceived effort (Inoue et al., 2022). More experienced elite athletes have been found to be more open to experience and self-efficacy, which in turn may promote self-confidence and better use of coping skills (Mitić et al., 2021).

Furthermore, having more years of experience in futsal helps athletes absorb more psychological skills during the intervention phase of mindfulness and psychological skills training. This was evident during training sessions and competitive matches, where less experienced athletes were involved. Athletes often sought guidance from more experienced athletes, while the experienced group motivated and encouraged the less experienced group. However, despite varying levels of experience, all interviewed athletes mentioned the psychological benefits of the sessions and confirmed its impact on their athletic performance. These

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

reports were consistent with the findings of the quantitative data (Röthlin et al., 2016).

In a review study, Lochbaum et al. (2022) reported improvements in athletic performance with increased self-confidence and cohesion after psychological sports interventions (Lochbaum et al., 2022). The quantitative and qualitative data obtained from the study by Vella-Fondacaro and Romano-Smith (2023) also confirmed these findings (Vella-Fondacaro & Romano-Smith, 2023). Lochbaum et al. (2022) further suggested that cognitive anxiety has a minimal negative impact on athletic performance (Lochbaum et al., 2022). This highlights the need for interventions such as mindfulness and psychological skills training to improve cognitive anxiety among athletes, ultimately enhancing their performance and overall sports experience. Intervention studies in futsal have primarily focused on performance improvement rather than the enhancement of mental skills (Azita et al., 2019; Rezvani et al., 2018).

Several studies have also demonstrated that mindfulness interventions and psychological skills training helped teams adopt a social identity approach towards the club, fostering better team spirit and self-categorization as a winning team (Rees et al., 2015). The performance improvements reported by athletes following interventions may be attributed to significant enhancements in mental health (Kent et al., 2018; Soundara Pandian et al., 2023) after the intervention. Reflecting on the qualitative data obtained from semi-structured interviews, it was noted that athletes felt pride and motivation after the end of the season. All interviewed athletes, acknowledging that these positive responses may have been biased due to winning the trophy, demonstrated a high level of camaraderie towards each other. The qualitative relationship between mindfulness interventions, psychological skills training, and the improved performance levels described during the interviews has been reported in previous studies (Rees et al., 2015).

The findings of the present study regarding competitive anxiety align with the prior research (Abdi & Gharayagh Zandi, 2019; Motashrei et al., 2011; Samadi et al., 2022; Sheikh Azadi & Hassanvand, 2020; Vella-Fondacaro & Romano-Smith, 2023). It appears that mindfulness influences variables such as positive emotions, anxiety, and relaxation, which can lead to improved performance. Research also shows that mindfulness is closely related to accountability and self-confidence, both of which are essential for enhancing athletic performance (Pineau et al., 2014). For instance, many components and dimensions of accountability (balance of challenge-task, awareness in action, clear goals, self-awareness) are features of mindfulness. The results are consistent with prior studies (Gardner & Moore, 2006; Gardner & Moore, 2004; Samadi et al., 2021; Samadi et al., 2022; Segal et al., 2002). Research suggests that mindfulness exercises are positively associated with both positive and negative emotions (Pineau et al., 2014).

Researchers believe that mindfulness training programs have successfully helped athletes reinterpret their anxiety symptoms in a practical and functional way, as they have paid less attention to the anxiety symptoms and accepted anxious states. However, some researchers suggest that differences in findings may stem from the nature of the intervention, the type of program used, the location and duration of the program, and so on. Recent research indicates that attempts to control or avoid internal negative experiences (emotions) often have contradictory effects, leading to intensification or repetition of these experiences. Mindfulness allows individuals to hold both positive and negative judgments, guiding athletes to view their anxiety non-judgmentally as an emotion that does not necessarily reflect reality (Gardner & Moore, 2006; Gardner & Moore, 2004). It seems that mindfulness training may allow related thoughts to pass through and reduce the occurrence of negative thoughts, thus decreasing work-related anxiety and irrelevant thoughts during tasks.

Moreover, these practices open a window for experiencing and finding satisfaction in experiencing undesirable internal events. Findings suggest that the willingness and satisfaction to experience work-related concerns and implicit concentration disruptions can reduce destructive negative thoughts (Thompson et al., 2011). In this study, acceptance of negative experiences and a reduced focus on anxiety symptoms may have contributed to the reduction of pre-competition anxiety. Some evidence suggests that mindfulness protocols may be associated with structural changes in areas of the brain that process sensory and cognitive emotions, which reduce negative emotions through the influence of negative emotional stimuli (Lazar et al., 2005).

Attention and focus are key elements of sports performance. Losing focus on symptoms or irrelevant tasks during competition is common. Gardner and Moore (2004) state that individuals with self-doubt and those who overly focus on irrelevant symptoms perform poorly. Mindfulness, as a metacognitive skill aimed at increasing non-judgmental awareness, enhancing experience acceptance, increasing

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

attention to the present moment, and awareness of internal and external stimuli, aims to guide athletes toward peak performance (Thompson et al., 2011). Shapiro et al. (1998) also indicate that mindfulness enhances relaxation responses, improves self-regulation of attention, and views stress as a challenge rather than a threat. Furthermore, mindfulness training reduces the experience of negative thoughts, which can effectively mitigate destructive thoughts, thereby improving performance.

The present study's findings related to mental toughness align with prior studies (Mehrsafar et al., 2021; Sheikh Azadi & Hassanvand, 2020; Vella-Fondacaro & Romano-Smith, 2023). To explain these results, it can be said that with an increase in mindfulness, the general level of confidence in one's ability to overcome challenges, adherence to training regimes, and self-regulation of behaviors and feelings related to competition increases (Sheard, 2012; Sheard et al., 2009). Furthermore, mindfulness reduces perceived stress and emotional reactions to threatening situations, while helping athletes understand their emotions without judgment or interference (Ajilchi et al., 2019). One study showed that mindfulness plays a significant mediating role in the relationship between mental toughness and sports performance in college track and field athletes (Abdul Rafeeque & Sultana, 2016). Walker's research on female hockey players in 2016 showed that mindfulness was significantly related not only to overall mental toughness but also to confidence, stability, and control. Athletes with higher levels of mindfulness reported better control, stability, and overall mental toughness. It was believed that the higher the level of mindfulness, the higher the athletes' mental toughness (Walker, 2016). Many previous studies have proven that mindfulness plays an important mediating role in the mental toughness of track and field athletes or long-distance runners, though no empirical research has been conducted. In this study, a cluster sampling method and a block-randomized controlled experimental design were adopted over an 8-week mindfulness training intervention to examine the impact of mindfulness on mental toughness in female students in endurance sports. The results showed that female students who received mindfulness training had significant improvements in overall mindfulness and some aspects of it. In the 800-meter endurance running test, they also showed better mental toughness compared to pre-intervention performance and the control group. At the same time, mindfulness training also reduced the perception of exercise intensity and other negative physical feelings like fatigue in female students. Through the experimental study, this research demonstrates that mindfulness training impacts the mental toughness of female college students in endurance sports. Further results support Petrillo's research, which suggests that mindfulness training, as a form of psychological intervention, improves mindfulness, concerns related to sports anxiety, and expectations in long-distance runners (De Petrillo et al., 2009). Thompson argues that mindfulness training significantly improves mindfulness and endurance performance in long-distance runners (Thompson et al., 2011).

Mindfulness training guides awareness and attention towards a task object through breath regulation, body scanning, and attention management. By regulating cognition, memory, attention, and emotions, it can reduce the impact of sport-related worries and irrelevant thoughts (two aspects of cognitive interference during exercise) on athletic performance. Additionally, mindfulness training teaches participants to openly and non-judgmentally accept their physical experiences, avoid the influence of negative experiences on their emotions, reduce sport-related physical concerns, and improve their self-awareness regarding attention regulation and arousal regulation (Meland et al., 2015). Mindfulness practice involves breathing, body scanning, experiencing drinking and eating, walking, balancing, running, and other body awareness controls to direct attention to focusing on the present moment's task experience, thus eliminating the impact of irrelevant distractions. Attention and interfering information during endurance training reduce the occupation of working memory capacity by irrelevant attention and interference during long-duration endurance exercises, improving an individual's working memory and focus during endurance tasks. At the same time, mindfulness-based regulation of awareness and attention improves an individual's inhibition and control over past negative experiences, reduces the negative impact of past endurance training experiences on current endurance behavior, and enhances executive functioning (Hillman et al., 2009). Through open, non-judgmental experience and attention to thoughts, emotions, and bodily sensations, new behavioral feelings are formed, thereby avoiding avoidance experiences stemming from past negative experiences and memories.

Thus, mindfulness training can mitigate negative physiological and psychological reactions to competition and interference, reduce the impact of unconscious, automatic, and habitual thinking on sports behavior, and promote an individual's conscious perception. Negative

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

coping strategies such as avoiding experience in endurance running tests may decrease the difficulty of initiating endurance training and prevent the interruption of the training process, thereby increasing mental toughness in endurance sports.

Negative physiological experiences and memories from previous endurance training increase an individual's painful feelings about their body. This can lead individuals to experience negative emotions such as tension, worry, or depression when faced with similar situations, resulting in avoidance experiences or even stress disorders, which are significant factors affecting female students' participation in endurance sports. Therefore, Jones suggests that catastrophizing pain mediates the relationship between mindfulness and endurance sports performance, which is a key factor influencing female students' participation in endurance sports (Jones & Parker, 2016). However, in addition to the body's physiological responses (increased heart rate, shortness of breath, and muscle pain) and the secretion of chemicals that cause pain during endurance training, an individual's perception of pain is also influenced by judgment, expectations, and personal anticipations. Other emotions and cognitive differences such as memory, coping strategies, and personality can either inhibit or enhance an individual's perception of harmful activities. Metacognitive beliefs about worry play a crucial role in the relationship between pain behavior and pain catastrophizing. Positive cognitive beliefs about worry mediate the relationship between neuroticism and pain catastrophizing, while negative cognitive beliefs about worry mediate the relationship between pain catastrophizing and self-reported pain behavior (Schütze, 2016). Pain is variable, and emotions and cognition are integral to pain perception. Therefore, an open and non-judgmental attitude towards physical experiences in mindfulness exercises is used to cultivate and improve the acceptance and tolerance of pain and other negative physical experiences, reducing the negative impact of negative experiences on current endurance (McCracken et al., 2005). The task-related sports and avoidance coping strategies that have been shown in many studies in recent years (Arch & Craske, 2006; Ortner et al., 2007). Therefore, mindfulness training improves an individual's open, non-judgmental acceptance of physical experiences, enabling individuals to accept, adapt to, and not reject various pains in endurance sports, thereby enhancing pain tolerance and avoiding negative coping strategies such as avoidance.

In recent years, some researchers have proposed that cognition, self-confidence, focus, representation, behavioral coping, and other factors related to sports situations should be incorporated into the research domain of mental toughness from a diverse perspective to form a new concept and category of mental toughness. They argue that cognition, emotional regulation, and behavioral coping strategies play a significant role in mental toughness (Wang et al., 2021). The core of mindfulness is attention, an open, non-judgmental attitude, and acceptance of current physical experience. Mindfulness training represents a new generation of cognitive-behavioral therapy for mental disorders, regulating cognition, memory, and emotions through attention regulation and acceptance attitudes (Hayes et al., 2006).

The results of the present study regarding coping skills align with the prior findings (Permadi & Nurwianti, 2018; Rico-Lara et al., 2023; Terzioğlu et al., 2020; Vella-Fondacaro & Romano-Smith, 2023; Vidic, 2021; Vidic et al., 2017). In explaining the results, it can be stated that the anxiety experienced by athletes increases as a result of their interpretation process when faced with a competitive situation filled with both external and internal demands. Misinterpretation of stressful situations leads to increased anxiety in athletes. Their ability to interpret these situations when confronted with competitive challenges may be influenced by their mindfulness and coping skills, which affect how they interpret any pressure faced during competitions. Therefore, when predicting competitive anxiety, which can hinder optimal performance, factors that may affect athletes should be considered, with mindfulness and coping skills being crucial in this regard (Permadi & Nurwianti, 2018).

Mindfulness can reduce an athlete's anxiety before a competition (Baltzell et al., 2014; De Petrillo et al., 2009; Gardner & Moore, 2006; Gardner & Moore, 2004; Moghadam et al., 2013). Other studies investigating the impact of mindfulness interventions on anxiety in general suggest that mindfulness can reduce anxiety levels (Forman et al., 2007). Additionally, an athlete's coping skills, which encompass some of the cognitive coping components, can assist them in handling competitive situations under pressure and in reducing competitive anxiety (Khodayari et al., 2011).

The relationship between mindfulness, cognitive forms of approach-focused coping (e.g., positive reappraisal), and well-being has been identified, indicating that mindfulness training enhances cognitive coping (de Vibe et al., 2018).

JAYPS Adolescent and Youth Psychological Studies E-ISSN: 2981-2526

5. Limitations & Suggestions

Limitations of the study include individual differences among the participants and the use of convenience sampling. It is recommended that future research focus on larger sample populations and random sampling to enhance the generalizability of the results.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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