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To Study the Effect of Mindfulness-Based Stress Reduction (MBSR) On Cognition, Sports Anxiety, And Sports Emotion Among Injured Athletes

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ABSTRACT

The purpose of the study was to examine the efficiency of Mindfulness-based Stress Reduction (MBSR) intervention on cognition, sports anxiety, and sports emotion among injured athletes. This was an experimental study design involving 30 injured athletes divided into control (n=15) and experimental (n=15). The experimental group received the MBSR intervention, while the control group who were not involved to the MBSR protocol. The Vienna Test System-Cognitrone (VTS), the Sports Emotion Questionnaire (SEQ), and the Sport Competition Anxiety Test (SCAT) tests were used for the assessment of athletes. The Wilcoxon signed-rank test and Mann-Whitney U Test were applied for statistical analysis. The outcome showed significant improvement in the experimental group after the MBSR intervention. A notable reduction in the anxiety (Z = -3.207, p = .001) and dejection (Z = -3.301, p .01), along with a significant growth in the happiness scores (Z = -2.673, p = .008). The sports competitive anxiety also decreased significantly (Z= -3.416, p=.001). In cognition, significant reduction in reaction time for correct responses (Z = -2.215, p = .027) and fewer incorrect non-reactions (Z = -2.878, p = .004). On the other side, the control group revealed no changes across all the measures. The findings indicated that MBSR intervention is an effective psychological intervention for emotion management, reducing sports competitive anxiety, and enhancing cognitive processing speed in injured athletes.

Key-words: *Mindfulness-Based Stress Reduction (MBSR), sports injury, injured athletes, cognition, sports competition anxiety, sports emotions.*

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Introduction

Sports injuries are an unavoidable aspect of an athlete's journey and often bring about substantial physical and psychological hurdles. Although the physical rehabilitation process has been widely explored, the mental and emotional impact of such injuries deserves equal attention. Injured athletes may suffer from increased anxiety, emotional strain, and cognitive disruption, all of which can negatively affect both their athletic and recovery performance (Putukian, 2016). Common psychological concerns include worries about returning to sports, doubts about post-recovery capabilities, and fear of losing athletic identity (Weinberg & Gould, 2018).

The psychological ramifications of injury go beyond physical discomfort and restricted mobility. Athletes frequently endure:

Anxiety poses a significant issue for injured athletes as it stems from concerns of reduced performance, uncertain career progression, and the potential of experiencing another injury.

Concerns about duration of recovery, the

risk of re-injury, and preparedness for the competition contribute frequently to increased stress (Ivarsson et al., 2017).

Sports inherently evoke a wide range of emotions, which include disappointment, joy, and frustration, particularly during times of loss or injury. Injured athletes often face a flood of negative emotions like anxiety, fear, and frustration. Emotional regulation becomes critical in these circumstances as the inability to manage these emotions may prolong psychological discomfort and obstruct physical healing. Feelings of anger, sadness, frustration, and helplessness are common emotional reactions (Podlog & Eklund, 2007).

Concentration and focus are crucial for athletic performance, yet injuries often disrupt training routines and heighten emotional stress, making it harder for athletes to maintain cognitive sharpness. Impaired decision-making, reduced concentration, and mental fatigue can be the result of stress resulting from the injury (AI-Shargie et al., 2024).

Such psychological reactions can mitigate the whole recovery, hinder the well-being of individuals, as well as form another injury risk (Arvinen-Barrow & Walker, 2013). Wadey et al. (2013) studied that psychological adversity can be helpful in long-term recovery and psychological interventions, moreover, it is supportive in the management of sports injuries.

To address these challenges, several psychological interventions have been developed, including MBSR- a structured program integrating mindfulness meditation, body awareness, and gentle yoga aimed at boosting emotional and cognitive resilience (Kabat-Zinn, 1990).
MBSR has been focused on mindfulness intervention, which includes body scanning, meditation, and gentle yoga that cultivates the awareness and non-judgmental acceptance of experiences (Kabat-Zinn, 1990).

MBSR principles include acceptance, non-judgmental awareness, and focused attention. Acceptance helps in encouraging the emotions and pain of athletes without emotional reactivity. Focused attention helps in increasing awareness to reduce anxiety and rumination. Whereas Non-judgmental awareness helps in carrying out discomfort and stress, which responds adaptively.

This research also shows that MBSR significantly alleviates the symptoms of depression, anxiety, and stress, positioning it as a key method for enhancing the mental health of affected athletes (Grossman et al., 2004; Zeidan et al., 2010).

MBSR also focused on developing control, cognitive flexibility, and working memory, which helps in demonstrating the mindfulness training that can increase the brain regions with executive functions like the prefrontal cortex (Holzel et al., 2011).

MBSR improves the cognitive performance by enhancing attention regulation, working memory, and cognitive adaptability (Jha et al., 2007).

Moreover, studies examining the use of MBSR intervention in sports remain limited.

Objectives and Hypothesis

The purpose of the study was to examine the efficiency of Mindfulness-Based Stress Reduction (MBSR) intervention on cognition, sports anxiety, and sports emotion among injured athletes.

This investigation anticipated that there would be a marked difference in the post-test results on cognition, sports competition anxiety test, and sport emotion questionnaire when compared to the pre-test results amongst injured athletes in the experimental group.

This investigation anticipated that there would be no meaningful change in the post-test results on cognition, sports competition anxiety test, and sport emotion

questionnaire when compared to the pre-test results amongst injured athletes in the control group.

This investigation anticipated that there would be a meaningful change in the experimental group after giving the MBSR intervention in comparison with a control group, which had not received the intervention

Methodology

The current study employed an experimental design (pre-post). A total of 38 participants were initially recruited; however, only 30 participants completed the entire study and were included in the final result, or athletes who were facing sports competitive anxiety, emotional fluctuation, and impaired cognitive function. The age group for participants was from 17 to 25 years. The mean age was 20.7 (± 2.3). Athletes included in the study who were suffering from sub-acute or chronic injury and were taking physiotherapy treatment in the rehabilitation centre, in the institutional wing. Athletes who had previous exposure to psychological training intervention were excluded. Participants were not recruited from any institution other than the **GNDU campus, Amritsar (Punjab)**.

Mindfulness-based stress reduction (MBSR) intervention

The MBSR program works with formal and informal mindfulness practices. Kabat-Zinn (1990) discovered the experimental group which helps in participated in an 8-week MBSR, which works with standardized protocols. The formal sessions work for 2-2.5 hours once a week, this course can work for 8 weeks. Due to the psychological and physical limitations of injured participants, the MBSR session was modified for 60 minutes, and the informal session takes 15 minutes with the pre-recorded audio meditations to start the programs and improve working performance.

Measurement tools

1) Vienna Test System (VTS)

The VTS (Vienna Test System) was a specific test system made for computerized psychological assessments. This test system was developed by the Schuhfried company in the 1980s. And the founder of this company is Dr. Felix Schuhfried. The Vienna Test System also consists of the Cognitrone computerized test.It assesses concentration performance by evaluating an individual's attention and cognitive abilities. In the test, respondents compare geometric figures to determine if they are identical to a reference figure, indicating their responses accordingly.

2)" Sport competition anxiety test (SCAT)"

This taste was done to observe the anxiety effect on athlete performance. Also, it generates an adjunct score for elders with 10 times, 15 times observing anxiety, and 5 items were made to restrain the items to mitigate the potential response. And these responses are made on the rating scale of 3 point..

3) Sport emotion questionnaire (SEQ)

The Sport Emotion Questionnaire (SEQ) was constructed by Jones, M. V., Lane, A. M., Bray, S. R., Uphill, M., & Catlin, J. (2005). It is a psychological test that consists of 22 items measuring five distinct emotional dimensions: anxiety, dejection, anger, excitement, and happiness. It is used to measure an athlete's emotional responses before, during, and after sports performance.

Procedure

Phase 1: Pre-Test

- The research was conducted in 3 phases and At the beginning of the study, the consent form was provided to all the participants, which was signed by them.
- The Vienna test system (cognitron) was administered to 38 athletes.
- The 15-item SCAT scale was administered to 38 athletes.
- The 22-item SEQ scale was administered to 38 athletes.

Phase 2: Intervention

- In the second phase, athletes were randomly selected for the experimental group (n=19) who were called for the MBSR protocol (injured athletes), and the control group (n=19) who were not exposed to the MBSR protocol.
- The 19 athletes (injured athletes) were informed about the intervention procedure, timings for the session, and their doubts were cleared before the beginning of the intervention protocol.
- Each intervention session lasted for 1 hour and was conducted once a week across 8 weeks for all participants in the group.
- A total of 8 sessions were conducted for all the participants. During the second phase, 8 participants withdrew from the investigation, and the final sample size included n=30 participants.

Phase 3: Post-Test

- All 15 individuals assigned to the experimental group were administered the VTS (cognitron), SCAT scale SEQ scale again after 8 intervention sessions were conducted. All 15 athletes (injured athletes) of the control group were administered the VTS (cognitron), SCAT scale, and SEQ scale after 8 weeks.

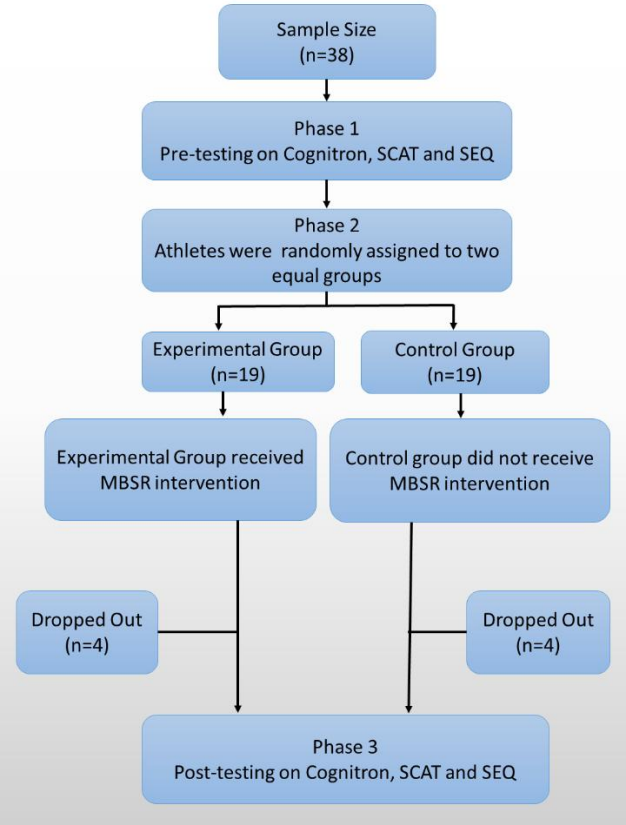

Figure 1: Process of data collection followed in the study

Figure 2: An athlete completing the task during data collection on Cognitron.

Statistical test

The data was gathered and all analyses were carried out in this investigation using SPSS 27.0 (Statistical Package for the Social Sciences, IBM Corporation, USA).

A Wilcoxon signed rank and Mann-Whitney U test were conducted, as the data did not follow a normal distribution

Result and Interpretation

Table 1: Z-values and p-values of pre- and post-data of the Experimental group on Cognitron SCAT and Sports Emotion Questionnaire.

Variable	Negative Ranks (N) (Post<Pre)	Positive Ranks (N) (Post>Pre)	Ties (N) (Post=Pre)	Z	p Sig.(2-tailed)
Anxiety	13	1	1	-3.207[c]	**.001**
Dejection	14	0	1	-3.301[c]	**.001**
Anger	6	7	2	-.258[d]	.796
Excitement	5	5	5	-.212[c]	.832
Happiness	10	4	1	-2.673[d]	.008
SCAT	15	0	0	-3.416[c]	**.001**
Sum of correct reactions	2	13	0	-2.878[d]	**.004**
Sum of incorrect reactions	7	7	1	-.157[c]	.875
Sum of incorrect non-reactions	13	2	0	-2.878[c]	**.004**
Mean time (correct reactions)	12	1	2	-2.215[c]	.027
Mean time (incorrect reactions)	10	4	1	-1.250[d]	.211

The result indicated that after the intervention, a notable change was detected in anxiety and dejection. The results showed that the intervention **significantly reduced anxiety** (Z = -3.207, p = .001) and **dejection** (Z = -3.301, p = .001), and **happiness significantly increased** (Z = -

2.673, p = .008). No significant changes were found in **anger** (p = .796), **excitement** (p = .832).

A marked difference was detected in the scores for SCAT performance in pre-test and post-test scores; Z = -3.416, p = .001, significant at p < .05. These results suggest that there has been a notable progress in SCAT performance post-intervention.

A notable change was identified in the mean time for correct reactions scores from the pre- and post-assessments; Z = -2.215, p = .027, significant at p < .05. These results suggest that there has been a significant reduction in reaction time for correct responses after the intervention programme. A notable change was identified in the sum of incorrect non-reactions in pre-test and post-test scores; Z = -2.878, p = .004, significant at p < .05. These results suggest that there has been a significant decrease in incorrect non-reactions after the intervention programme. There was no significant difference in the sum of incorrect reactions scores from the pre- and post-assessments; Z = -0.157, p = .875.

Table 2: Z-values and p-values of pre- and post-data of the Control group on Cognitron, SCAT, and Sports Emotion Questionnaire.

Variable	Negative Ranks (N) (Post<Pre)	Positive Ranks (N) (Post>Pre)	Ties (N) (Post=Pre)	Z	p Sig.(2-tailed)
Anxiety	8	6	1	-1.365[c]	.172
Dejection	6	8	1	-.510[c]	.610
Anger	9	5	1	-1.753[c]	.080
Excitement	7	4	4	-.929[c]	.353
Happiness	6	7	2	-.109[d]	.913
SCAT	8	7	0	-.028[c]	.977
Sum of correct reactions	7	6	2	-.524[c]	.600
Sum of incorrect reactions	9	6	0	-.171[c]	.864
Sum of incorrect non-reactions	6	7	2	-.524[d]	.600
Mean time (correct reactions)	8	7	0	-1.022[c]	.307
Mean time (incorrect reactions)	8	7	0	-.795[c]	.426

The analysis revealed no notable variation in anxiety scores recorded before and after the intervention; Z = -1.365, p = .172, dejection scores from the pre- and post-assessments; Z = -0.510, p = .610, anger scores from the pre- and post-assessments; Z = -1.753, p = .080, excitement in scores from the pre- and post-assessments; Z = -0.929, p = .353 and happiness scores from the pre- and post-assessments; Z = -0.109, p = .913. These results suggest that there has been no significant change in sports emotion (anxiety, dejection, anger, excitement, and happiness) across the testing phases in the control group.

The analysis revealed no notable variation in SCAT performance scores recorded before and after the intervention; Z = -0.028, p = .977. These results suggest that there has been no significant change in SCAT performance across the testing phases in the control group.

The analysis revealed no notable variation in the sum of incorrect reactions scores recorded before and after the intervention; Z = -0.171, p = .864, in the sum of incorrect non-reactions scores recorded before and after the intervention; Z = -0.524, p = .600, in the mean time for correct reactions scores recorded before and after the intervention; Z = -1.022, p = .307 and in the mean time for incorrect reactions scores recorded before and after the intervention; Z = -0.795, p = .426. These results suggest that there has been no significant change in cognitron over time in the control group.

Table 3: Comparative analysis of pre- and post-test data between the Experimental and Control groups on the Sports emotion questionnaire and SCAT.

Variable	Group	N	Mean Rank	Sum of Rank	U	Z	p Sig.(2-tailed)
Pre-Anxiety	Experimental	15	15.97	239.50	105.500	-.294	.775[b]
	Control	15	15.03	225.50			
Pre-Dejection	Experimental	15	18.83	282.50	62.500	-2.101	.037[b]
	Control	15	12.17	182.50			
Pre-Anger	Experimental	15	14.20	213.00	93.000	-.821	.436[b]
	Control	15	16.80	252.00			
Pre-Excitement	Experimental	15	13.80	207.00	87.000	-1.077	.305[b]
	Control	15	17.20	258.00			
Pre-Happiness	Experimental	15	12.53	188.00	68.000	-1.886	.067[b]
	Control	15	18.47	277.00			
Post-	Experimental	15	10.03	150.50			

Anxiety	Control	15	20.97	314.50	30.500	-3.423	**.000[b]**
Post-Dejection	Experimental	15	10.33	155.00	35.000	-3.234	**.001[b]**
	Control	15	20.67	310.00			
Post-Anger	Experimental	15	17.53	263.00	82.000	-1.350	.217[b]
	Control	15	13.47	202.00			
Post-Excitement	Experimental	15	14.37	215.50	95.500	-.713	.486[b]
	Control	15	16.63	249.50			
Post-Happiness	Experimental	15	14.03	210.50	90.500	-.943	.367[b]
	Control	15	16.97	254.50			
Pre-SCAT	Experimental	15	16.07	188.00	104.000	-.355	.744[b]
	Control	15	14.93	277.00			
Post-SCAT	Experimental	15	9.37	140.50	20.500	-3.840	**000[b]**

There was no notable disparity shown in pre-test anxiety data; U = 105.500, Z = -0.294, p = 0.775, in pre-test dejection data; U = 62.500, Z = -2.101, p = 0.037, in pre-test anger data; U = 93.000, Z = -0.821, p = 0.436, pre-test excitement data; U = 87.000, Z = -1.077, p = 0.305, and in pre-test happiness data; U = 68.000, Z = -1.886, p = 0.067 across the experimental and control groups. This suggests that the groups were equivalent in terms of sports emotion before the intervention.

A meaningful change in post-test anxiety data; U = 30.500, Z = -3.423, p = 0.000, and in post-test dejection data; U = 35.000, Z = -3.234, p = 0.001 across the experimental and control groups. These findings suggest that the intervention group experienced a significantly greater reduction in anxiety and dejection after the intervention compared to the control group.

The analysis revealed no notable variation in post-test anger data; U = 82.000, Z = -1.350, p = 0.217, in post-test excitement data; U = 95.500, Z = -0.713, p = 0.486, and in post-test happiness data; U = 90.500, Z = -0.943, p = 0.367 between the group exposed to the intervention and the control group.

The analysis revealed no notable variation in pre-test SCAT data across the experimental and control groups; U = 104.000, Z = -0.355, p = 0.744. This suggests that the groups were equivalent in terms of sports anxiety before the intervention. There was a notable change observed in post-test SCAT data across the experimental and control groups; U = 20.500, Z = -3.840, p = 0.000. It suggests that the experimental group demonstrated improvement in SCAT performance after the intervention compared to the control group.

Table 4: Comparative analysis of pre- and post-test data between the Experimental group and the Control group on Cognitron.

Variable	**Group**	**N**	**Mean Rank**	**Sum of Rank**	**U**	**Z**	**p Sig.(2-tailed)**
Pre-sum	Experimental	15	15.37	230.50			

correct reaction	Control	15	15.63	234.50	110.500	-.083	.935[b]
Pre-incorrect reactions	Experimental	15	14.00	210.00	90.000	-.935	.367[b]
	Control	15	17.00	255.00			
Pre-sum incorrect non-reactions	Experimental	15	15.63	234.50	110.500	-.083	.935[b]
	Control	15	15.37	230.50			
Pre-mean time correct reactions	Experimental	15	12.90	193.50	73.500	-1.618	.106[b]
	Control	15	18.10	271.50			
Pre-mean time non-correct reactions	Experimental	15	14.03	210.50	90.500	-.913	.367[b]
	Control	15	16.97	254.50			
Post-sum correct reaction	Experimental	15	18.03	270.50	74.500	-1.578	.116[b]
	Control	15	12.97	194.50			
Post-incorrect reactions	Experimental	15	14.50	217.50	97.500	-.623	.539[b]
	Control	15	16.50	247.50			
Post-sum incorrect non reactions	Experimental	15	13.27	199.00	79.000	-1.392	.174[b]
	Control	15	17.73	266.00			
Post-mean time correct reactions	Experimental	15	10.70	160.50	40.500	-2.987	**.002[b]**
	Control	15	20.30	304.50			
Post-mean time non-correlated reactions	Experimental	15	16.27	244.00	101.000	-.477	.653[b]

The analysis revealed no notable variation in the sum of correct reactions; U = 110.500, Z = -0.083, p = 0.935, in the sum of incorrect reactions; U = 90.000, Z = -0.935, p = 0.367, in the sum of incorrect non-reactions; U = 110.500, Z = -0.083, p = 0.935, in the mean time for correct reactions in; U = 73.500, Z = -1.618, p = 0.106, and in the mean time for non-correct reactions; U = 90.500, Z = -0.913, p = 0.367 reactions in the initial assessment comparing the control and experimental groups. This suggests that both groups were equivalent in terms of cognition before the intervention.

The analysis revealed no notable variation in the sum of correct reactions; U = 74.500, Z = -1.578, p = 0.116, in the sum of incorrect reactions; U = 97.500, Z = -0.623, p = 0.539, in the sum of incorrect non-reactions; U = 79.000, Z = -1.392, p = 0.174, and in mean time for non-correct reactions; U = 101.000, Z = -0.477, p = 0.653 in post-test between the group exposed to the intervention and the

control group.

A meaningful change in mean time for correct reactions in the post-intervention assessment between the experimental and control groups; U = 40.500, Z = -2.987, p = 0.002. This suggests that the experimental group showed a significantly faster response time for correct reactions after the intervention compared to the control group.

Discussion

This investigation focused to examine the beneficial effect of a mindfulness-based stress reduction protocol on cognition, sports anxiety, and sports emotion among injured athletes. The outcome of this study obtained that, MBSR intervention had an important effect on sports emotions, sports anxiety, and cognition among affected players in the experimental group, as well as there was no change in the control group.

The outcome of this study indicated that the MBSR intervention had a positive effect on sports emotions, especially anxiety and dejection among the injured athletes. The athletes in the experimental group who underwent two months of MBSR intervention exhibited a significant decline in anxiety and dejection at the end of the intervention period as compared to the control group, which did not undergo two months of intervention. The results of this study are consistent with Mohammadi et al. (2019), who investigated the impact of MBSR on injured athletes and observed notable decreases in anxiety, stress, and depression following the training. These outcomes correspond with the present study concluded that MBSR helps with emotional control and mental fortitude regarding recovery from injuries. The outcomes of this study showed that MBSR can be a helpful psychological tool for injured athletes. It helps them cope with difficult emotions, feel less anxious and sad, and become mentally stronger during recovery.

The study revealed a meaningful effect of MBSR intervention on sports competitive anxiety levels of injured athletes who received 2 months of MBSR intervention. The study of Pineau et al. (2014) suggested that mindfulness training for athletes does not eliminate performance-related stress but helps in improving the relationship with stress. It tends to reduce the tendency of emotional actions and competitive anxiety, and active plans can help in analyzing the growing evidence of MBSR, which helps in serving as a psychological tool for athletes with general performance during the injury recovery, when competitive anxiety helps in announcing the performance.

The outcomes of this study provided support for the effectiveness of the MBSR intervention on cognition among injured athletes in the experimental group. The athletes who received the 2 months of MBSR intervention showed a partial change in their cognition in comparison with the control group, who had not received the intervention. Result of this study was classified with Krompinger et al. (2007), indicating that an eight week MBSR program, focusing on the whole regimen, enhances the cognitive flexibility as well as attention compared to individuals that not engaged in the mindfulness training. The moderate cognitive gains observed in this study could be due to specific factors such as the level of injury, reasoning abilities at baseline, and the level of mindfulness practiced outside the structured sessions. Future studies could assess cognitive changes over longer periods, incorporate neuropsychological testing, and explore how MBSR influences specific cognitive domains, such as attention regulation, memory recall, and cognitive flexibility in injured athletes.

Athletes who had experienced injury and did not receive any intervention reported no significant difference in sports emotion, sports competitive anxiety, and cognition after 2 months of injury. Ivarsson et al.

(2017) Assessed that negative emotions, like frustration and agitation, were allied with a reduced chance of successfully returning to play. All these results highlights the key role of psychological factors in recovery, underscoring the importance of mental health support at the time of rehabilitation, particularly for the competitive athletes.

Conclusion

This study explored the impact of Mindfulness-Based Stress Reduction (MBSR) on sports-related emotions, cognitive functioning, and competitive anxiety in athletes recovering from injury. The findings demonstrated that MBSR was effective in reducing competitive anxiety and emotional distress during rehabilitation. Athletes who engaged in the two-month MBSR program demonstrated better emotional control and reported lower competitive anxiety than those who received no psychological support. Although cognitive improvements were observed in the MBSR group, the effects were moderate. Overall, the research reinforces the value of mindfulness-based strategies as effective tools in promoting psychological recovery and resilience in injured athletes.

Limitations

- The current study was constrained by a limited sample size, and hence, the results cannot be generalised.
- A limitation of the study was the modification of the standard MBSR protocol. Weekly sessions were reduced to 60 minutes, and daily home practice was limited to 15 minutes due to participants' physical constraints.
- Situational factors such as the healing status of the injury were not studied in detail to understand their influence on sports emotion, anxiety, and cognition during the rehabilitation period.

Recommendations

- Further research on the effectiveness of MBSR intervention on injured athletes should include a follow-up programme and be conducted on a larger sample size.
- Further researchers can focus on different types of sports (team, individual), including a group with exposure to other psychological interventions, to better understand the most effective intervention in the rehabilitation process, and add other performance-related parameters like fear of injury, self-confidence.
- Future research should explore how to integrate MBSR into standard physiotherapy and medical rehabilitation protocols, ensuring that both physical and psychological recovery are addressed simultaneously.

Practical implications

- The MBSR protocol can be adopted as an effective intervention technique for the injured athletes to alleviate negative sports emotions, competitive anxiety, and impaired cognitive functions during the injury rehabilitation process.

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