



EFFECT OF ROTATOR CUFF TRAINING EXERCISES ON FUNCTIONAL THROWING PERFORMANCE INDEX IN AMATEUR CRICKET PLAYERS: A PILOT STUDY

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Abstract :

Background: Throwing is a fundamental skill in cricket that requires coordination, strength, and stability of the shoulder complex. Amateur cricket players often exhibit rotator cuff weakness, leading to compromised throwing performance and increased injury risk. Rotator cuff strengthening exercises are widely recommended to enhance shoulder function and prevent injuries.

Objective: This study aimed to investigate the effects of a structured rotator cuff training program on throwing performance and shoulder functionality in amateur cricket players.

Methodology: A pre-test, post-test pilot study was conducted on 15 amateur cricket players (8 males, 7 females) over four weeks. Participants performed supervised rotator cuff strengthening exercises five times per week. The Functional Throwing Performance Index (FTPI) was used to assess throwing accuracy, while the Shoulder Pain and Disability Index (SPADI) evaluated pain and shoulder functionality. Pre- and post-intervention comparisons were analyzed using paired t-tests.

Results and Conclusion: The study demonstrated significant improvements in throwing performance and shoulder function. FTPI scores increased from 67.06 ± 3.93 to 82.06 ± 4.39 ($p < 0.001$), while SPADI scores decreased from 48.26 ± 1.53 to 36.00 ± 2.44 ($p < 0.001$), indicating reduced pain and improved shoulder mobility. These findings highlight the effectiveness of rotator cuff exercises in optimizing performance and preventing injuries among amateur cricket players.

Keywords: Rotator cuff training, throwing performance, Functional Throwing Performance Index, Shoulder Pain and Disability Index, amateur cricket players, injury prevention.

Clinical Implication: Incorporating structured rotator cuff strengthening exercises in training regimens can enhance functional throwing performance and minimize shoulder-related injuries in amateur cricket players.

I. INTRODUCTION

Throwing is a fundamental skill in cricket, particularly in fielding and high-performance match play, requiring a combination of strength, coordination, and precision. For cricket players, especially amateurs, effective throwing depends on the functionality of the shoulder complex, which involves coordinated movements of the glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic joints^{[1] [2]}. Among these, the rotator cuff plays a pivotal role, stabilizing the glenohumeral joint during dynamic and repetitive overhead activities^{[3] [4]}. Weakness or imbalance in these muscles often results in suboptimal throwing mechanics, reduced accuracy, and increased susceptibility to injuries, emphasizing the necessity for targeted rehabilitation and strengthening programs tailored for amateur cricket players^{[5] [6]}.

Biomechanically, the throwing action is a high-speed, high-energy activity divided into five phases: wind-up, early cocking, late cocking, acceleration, and follow-through^{[7] [8]}. Each phase imposes specific demands on the shoulder complex, with the late cocking and acceleration phases generating maximal external rotation and significant torque on the rotator cuff muscles^[9]. Amateur cricketers frequently exhibit poor scapular control, limited shoulder range of motion (ROM), and compensatory trunk movements, contributing to inefficiencies in throwing mechanics^{[10] [11]}. These biomechanical flaws not only impair throwing accuracy but also predispose players to overuse injuries, including rotator cuff impingement, tendinitis, and glenohumeral internal rotation deficit (GIRD)^{[12] [13]}.

Rotator cuff training exercises have emerged as an effective intervention for addressing these deficits. By focusing on key movements such as internal and external rotation and scapular stabilization, these exercises strengthen the rotator cuff and surrounding musculature, improving neuromuscular coordination and joint stability^{[14] [15]}. Resistance-based protocols using therabands and dumbbells have demonstrated effectiveness in enhancing throwing performance, addressing muscle imbalances,

and preventing injuries in throwing athletes^{161 171}. For amateur cricket players, implementing a structured training regimen can significantly enhance their functional capacity and reduce the risk of shoulder-related injuries^{181 191}.

To assess the effectiveness of such interventions, reliable and valid outcome measures are essential. The Functional Throwing Performance Index (FTPI) is a key metric for evaluating throwing accuracy and overall performance²⁰¹. It objectively measures a player's ability to hit a predefined target within a fixed time frame, offering quantifiable insights into the functional improvements achieved through training²¹¹. Additionally, the Shoulder Pain and Disability Index (SPADI) is a subjective measure used to assess perceived pain and functional limitations in the shoulder^{221 231}. Together, these tools provide a comprehensive evaluation framework, integrating objective performance metrics with subjective self-reported outcomes.

The pathomechanics of the shoulder in amateur cricket players necessitate a focused intervention strategy to address biomechanical inefficiencies and improve functional outcomes^{241 251}. This pilot study aims to investigate the effect of rotator cuff training exercises on throwing performance and shoulder functionality in amateur cricket players. The findings are expected to provide evidence for the implementation of therapeutic interventions targeting specific shoulder muscle groups, enhancing players' performance and reducing injury risks^{261 271}.

NEED OF THE STUDY.

Amateur cricket players often experience shoulder dysfunction due to weak rotator cuff muscles, leading to poor throwing mechanics and increased injury risk. While professional athletes follow structured training programs, amateurs lack evidence-based interventions to enhance shoulder stability and performance. This study aims to assess the impact of a structured rotator cuff strengthening program on throwing accuracy and shoulder function, using the Functional Throwing Performance Index (FTPI) and Shoulder Pain and Disability Index (SPADI). The findings will help guide targeted training strategies to improve performance and prevent injuries in amateur cricket players.

3.1 Population and Sample

The population for this study included amateur cricket players who regularly participate in competitive or recreational cricket but lack access to structured shoulder-specific training programs. These players often experience mild to moderate shoulder discomfort or limitations in functionality due to repetitive overhead throwing motions, which can affect their performance and increase the risk of injuries.

The study sample consisted of 15 amateur cricket players (8 males and 7 females) aged 18–35 years, with at least two years of playing experience. Participants were selected based on inclusion criteria that required them to have mild to moderate shoulder pain or slight functional limitations without any history of major shoulder surgeries or severe injuries. Those currently undergoing other shoulder rehabilitation programs or with chronic conditions affecting physical activity were excluded. This sample was assessed using pre- and post-intervention measures, including the Functional Throwing Performance Index (FTPI) for throwing accuracy and the Shoulder Pain and Disability Index (SPADI) for pain and functional limitations.

3.2 Data and Sources of Data

The study collected both objective and subjective data to evaluate the impact of rotator cuff training exercises on throwing performance and shoulder functionality in amateur cricket players. Objective data were gathered using the **Functional Throwing Performance Index (FTPI)**, which measured participants' throwing accuracy before and after the intervention. Subjective data were obtained through the **Shoulder Pain and Disability Index (SPADI)**, assessing self-reported pain and functional limitations.

Sources of data included direct performance assessments conducted under standardized conditions and self-reported questionnaire responses. The study also referenced existing literature on shoulder biomechanics, rotator cuff strengthening, and injury prevention in overhead athletes to support the intervention rationale. These findings align with prior research emphasizing the importance of rotator cuff training in improving functional performance and reducing injury risks in throwing sports.

3.3 Theoretical framework

This study is based on the **biomechanical and neuromuscular principles** of shoulder stability, motor control, and injury prevention in overhead athletes. The **kinetic chain theory** highlights the coordinated movement of multiple joints in efficient throwing mechanics. The rotator cuff muscles—**supraspinatus, infraspinatus, teres minor, and subscapularis**—are essential for stabilizing the glenohumeral joint during high-speed throwing. Weakness or imbalance in these muscles leads to compensatory movements, inefficient force transmission, and a higher risk of overuse injuries such as **rotator cuff tendinopathy and glenohumeral internal rotation deficit (GIRD)**.

Additionally, **proprioceptive neuromuscular control theories** emphasize the role of sensory feedback in refining movement patterns. Strengthening exercises enhance **neuromuscular coordination**, improving throwing accuracy while reducing stress on passive structures like ligaments and tendons. The **pain-gating mechanism** further explains how structured training can alleviate shoulder pain by stimulating mechanoreceptors and promoting tissue adaptation. The study utilizes **Functional Throwing Performance Index (FTPI)** for objective biomechanical assessment and **Shoulder Pain and Disability Index (SPADI)** for subjective evaluation, reinforcing the need for structured rotator cuff strengthening programs to optimize performance and prevent injuries in amateur cricket players.

RESEARCH METHODOLOGY

This study employed a **pre-test, post-test experimental design** to assess the effects of a **four-week rotator cuff training program** on throwing performance and shoulder functionality in **15 amateur cricket players** (8 males, 7 females). Participants, aged **18–35**

years, were assessed using the **Functional Throwing Performance Index (FTPI)** for throwing accuracy and the **Shoulder Pain and Disability Index (SPADI)** for pain and functionality. The training sessions, conducted **five times per week**, included **warm-ups, rotator cuff strengthening exercises, and cool-downs** using resistance bands and weights. Pre- and post-test scores were analyzed using **paired samples t-tests**, with statistical significance set at **$p < 0.05$** .

3.1 Methodology

Study Duration and Setting:

- The intervention will span 4 weeks.
- Training sessions will occur 5 times per week, with one rest day per week to allow adequate muscle recovery.
- Each session will be approximately 45 minutes long, supervised by a trained physiotherapist in a clinical or gym setting equipped with the necessary resistance training tools.

Participants:

- Inclusion Criteria:
 1. Amateur male or female cricket players aged 18–35 years.
 2. At least two years of playing experience in cricket.
 3. Experience of mild to moderate shoulder pain or slight limitations in shoulder functionality but no severe injuries.
 4. Commitment to complete all sessions and assessments.
- Exclusion Criteria:
 1. History of major shoulder surgeries or serious injuries.
 2. Current participation in other shoulder-specific rehabilitation or strengthening programs.
 3. Severe chronic diseases or conditions that impair physical activity.

Pre-Study Assessment:

Before the intervention begins, the following baseline assessments will be completed:

1. Demographic Data: Participants' age, gender.
2. Functional Throwing Performance Index (FTPI): Participants will undergo a functional throwing performance test to evaluate accuracy.
3. Shoulder Pain and Disability Index (SPADI): Participants will fill out the SPADI questionnaire to measure pain levels and shoulder functionality before starting the intervention.

Intervention Protocol (4-Week Duration):

The intervention consists of structured rotator cuff strengthening exercises focused on improving shoulder stability, range of motion, and throwing mechanics. The session includes warm-up, resistance exercises, and a cool-down period.

- Session Structure (45 minutes):
 1. Warm-Up (5–10 minutes): Light cardiovascular exercises (e.g., jogging, cycling) and dynamic stretching to prepare the muscles and joints for activity.
 2. Rotator Cuff Strengthening (35 minutes):
 - Rotator Cuff Exercises: Performing exercises aimed at strengthening the rotator cuff muscles with controlled resistance. Exercises include:
 - Internal and External Rotations (using resistance bands or dumbbells) to improve strength and motion in the shoulder joint.
 - Scapular Stabilization exercises (e.g., prone Y's, T's, I's with light weights) to stabilize the scapula and ensure proper mechanics during throwing.
 - Shoulder Flexion/Extension with bands to restore normal motion and address muscle imbalances.
 - Isometric Rotator Cuff Strengthening (e.g., side-lying external rotation) focusing on increasing stability in the shoulder.
 3. Cool-Down (5–10 minutes): Static stretching to improve flexibility and relieve tension in the shoulder region.
- Frequency:
 - The exercise sessions will occur 5 times a week, with one rest day per week to optimize recovery. The schedule will consist of:
 - Weekdays (5 days): Resistance exercises, progressing in difficulty and resistance every week to ensure continuous improvement.
 - Rest Day (1 day): This allows sufficient recovery time and reduces the risk of overtraining, ensuring that participants can maintain optimal performance and strength.

Weekly Structure of Exercise Protocol:

Weeks 1–2 (Low to Moderate Intensity):

- The first two weeks will focus on proper movement mechanics, emphasizing light to moderate resistance. Training will be designed to build a foundation of shoulder stability and strength while allowing the body to adapt.

Weeks 3–4 (Moderate to High Intensity):

- Intensity will progressively increase. Resistance will be adjusted based on the participants' feedback, with exercises designed to match their capacity. Increased intensity will involve incorporating dynamic movements and functional throwing-related exercises.

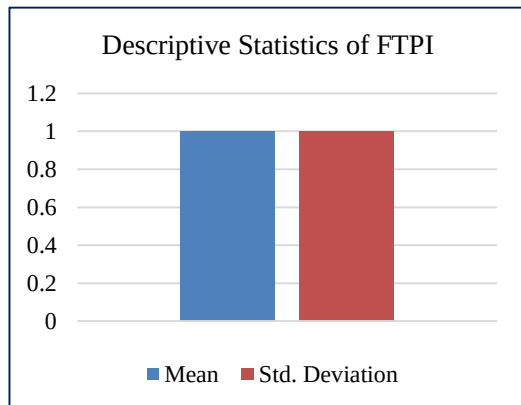
Post-Study Assessment (Week 4):

At the end of the intervention, the following assessments will be conducted:

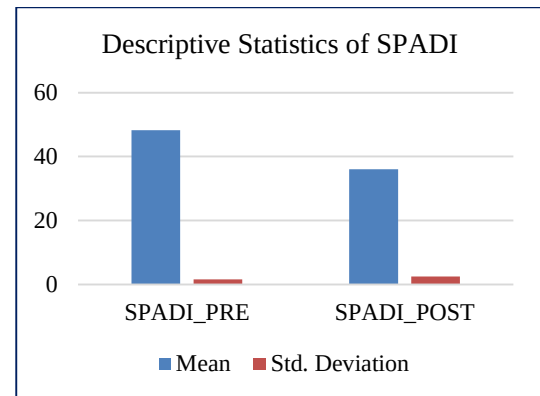
1. Functional Throwing Performance Index (FTPI): Participants will undergo the same throwing accuracy test to evaluate improvements in throwing performance.
2. Shoulder Pain and Disability Index (SPADI): The SPADI questionnaire will be re-administered to measure any changes in pain levels and overall shoulder function.

RESULT

The descriptive statistics demonstrate significant improvements in shoulder functionality and throwing performance following the intervention. The average FTPI score increased from 67.06 (SD = 3.93) pre-intervention to 82.06 (SD = 4.39) post-intervention, indicating enhanced throwing accuracy. Additionally, SPADI scores decreased from 48.26 (SD = 1.53) to 36.00 (SD = 2.44), reflecting reduced shoulder pain and disability. These findings suggest the rotator cuff training program effectively improved performance and shoulder health in participants.



Descriptive Statistics Bar graph of FTPI pre and Post score



Descriptive Statistics Bar graph of SPADI Pre and Post score

Table No.2 Comparison between Pre and Post Treatment
Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
				Lower	Upper			
FTPI_POST - FTPI_PRE	15.00	1.00	.25	14.44	15.55	58.09	14	.000
SPADI_POST - SPADI_PRE	-12.26	1.48	.38	-13.08	-11.44	-31.96	14	.000

The paired samples t-test results indicate significant changes in both FTPI and SPADI scores after the intervention.

For FTPI, the mean difference was 15.00 (SD = 1.00), with a 95% confidence interval of 14.44 to 15.55, and a t-value of 58.09 ($p < .001$), indicating significant improvement in throwing performance.

For SPADI, the mean difference was -12.26 (SD = 1.48), with a 95% confidence interval of -13.08 to -11.44, and a t-value of -31.96 ($p < .001$), reflecting significant reductions in shoulder pain and disability.

DISCUSSION

The findings of this study demonstrate that a targeted rotator cuff training program significantly improved **throwing performance** and **reduced shoulder pain and disability** in amateur cricket players. The paired samples t-test revealed a significant improvement in Functional Throwing Performance Index (FTPI) scores, with a mean increase of 15.00 ($p < .001$), indicating enhanced **functional throwing capacity** post-intervention. Simultaneously, the Shoulder Pain and Disability Index (SPADI) scores showed a significant reduction, with a mean decrease of -12.26 ($p < .001$), reflecting improved **shoulder functionality** and reduced discomfort during activity.

The **improvement in FTPI scores** can be attributed to the strengthening of the rotator cuff muscles, which play a pivotal role in stabilizing the **glenohumeral joint** during overhead activities such as throwing. The rotator cuff, comprising the supraspinatus, infraspinatus, teres minor, and subscapularis, works synergistically to maintain joint integrity and provide **dynamic stability**, especially during the acceleration and deceleration phases of throwing (Escamilla et al., 2009). By enhancing the strength and endurance of these muscles, the training program likely improved **shoulder coordination** and accuracy, essential for optimal throwing mechanics (Hurd and Kaufman, 2012).

The reduction in SPADI scores highlights the **therapeutic effects** of rotator cuff strengthening on shoulder pain and disability. Chronic shoulder pain in throwing athletes is often associated with **rotator cuff tendinopathy** and **glenohumeral internal rotation deficit (GIRD)** (Reinold et al., 2008). By addressing **muscular imbalances** and improving **joint mobility**, the program may have alleviated stress on the tendons and reduced pain. Enhanced muscle activation also likely contributed to better **scapular control**, which has been shown to minimize the risk of shoulder dysfunction (Kibler et al., 2013).

The underlying **physiology** further supports these results. Rotator cuff exercises target **type I muscle fibers**, improving **muscle endurance** for sustained stabilization during repetitive throwing movements. Moreover, these exercises stimulate **proprioceptive pathways**, improving neuromuscular control and the ability to perform precise movements (Cools et al., 2015). Additionally, strengthening of the shoulder musculature reduces the excessive strain on passive structures such as the labrum and ligaments, preventing overuse injuries (Staples et al., 2016).

The findings also align with the concept of **pain-gating mechanisms** and improved tissue health through exercise. Physical activity stimulates mechanoreceptors, which can suppress the transmission of **pain signals** via spinal inhibitory pathways, leading to pain relief (Ellenbecker et al., 2010). Furthermore, regular resistance exercises enhance **vascular perfusion** to the rotator cuff tendons, facilitating tissue repair and reducing inflammation, thereby improving both pain and functional scores (Hurd and Kaufman, 2012).

This study's results are consistent with prior research that emphasizes the **importance of targeted exercise regimens** in overhead athletes. For example, a study by Cools et al. (2015) demonstrated that structured training programs focusing on rotator cuff muscles significantly improved shoulder performance while preventing injuries in throwing sports. Similarly, the work of Reinold et al. (2008) highlighted the critical role of addressing GIRD and **posterior shoulder tightness** to enhance athletic performance in overhead athletes.

In conclusion, the present study underscores the significant benefits of **rotator cuff strengthening programs** in improving **functional throwing performance** and reducing **shoulder pain and disability** among amateur cricket players. The physiological basis of improved muscle strength, proprioception, and neuromuscular coordination aligns with the observed outcomes. These findings reinforce the **clinical importance** of implementing structured rotator cuff training to enhance performance and prevent injuries in athletes engaged in throwing sports. Future research with larger sample sizes and longer follow-up periods could further validate these findings and explore the long-term efficacy of similar interventions.

CONCLUSION

This study demonstrates that a structured rotator cuff strengthening program significantly enhances **functional throwing performance** and reduces **shoulder pain and disability** in amateur cricket players. The observed improvements in FTPI and SPADI scores highlight the effectiveness of targeted interventions in optimizing **shoulder stability, muscle function, and overall performance**. The physiological benefits, including enhanced **proprioception, neuromuscular control**, and reduced pain, reinforce the clinical relevance of such training protocols for injury prevention and performance enhancement in throwing sports.

FUTURE RECOMMENDATIONS

Future studies should include larger sample sizes and long-term follow-ups to validate the findings and assess sustained effects of the intervention. Additionally, exploring its impact on different age groups and performance levels would enhance generalizability.

LIMITATIONS

This pilot study is limited by its small sample size and short duration, which may restrict the generalizability and long-term applicability of the results.

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