Effectiveness of Rotator Cuff Strength Training vs. Thrower's Ten Programme on Strength and Throwing Distance in Amateur Badminton Players-A Comparative Study.

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Abstract:

Background: Each of the various types of movement mandated by badminton are fast, powerful and require intricate coordination Be it smashes or serves in badminton. Such repetitive above headline movements cause a lot of pressure to be deposited to the shoulder joint especially to the rotator cuff muscles which bear the responsibility of making a forceful joint. In the long run these movements compromise the energy tightness of the muscles and lead to imbalances and a high incidence of overuse injuries among players including rotator cuff tendinopathy impingement syndrome and shoulder instability. The rotator cuff and shoulder pathology are widespread in athletes and have a negative impact on performance and throwing ability in particular by shortening the distance and accuracy of throws and general impact on efficiency of gameplay. The rotator cuff muscles are thus important to strengthen so as to avoid injury and increase performance. The Thrower's Ten Programme is well-implemented intervention that aims for overall upper limb strengthening, on the other hand, rotator cuff-specific training target selectively strengthen these shoulder-stabilizing muscles.

Methods: Forty six amateur badminton players (both male and female) between the ages of 18 and 25 participated in a randomized controlled trial(RCT). To ensure their eligibility for the study, participants were first evaluated using an interview questionnaire to evaluate their medical history, past injuries, and current levels of physical activity. Following the screening, participants were split into two groups at random: the Thrower's Ten program group A (n=23) and the rotator cuff strength training group B(n=23). Training was place three times a week for four weeks for both groups. Before and after the intervention, throwing distance was evaluated using a standardized throwing test upper limb explosive power test (ULEPT) and shoulder strength was tested with a push pull dynamometer(PPD).

Result: Both groups demonstrated significant improvements in throwing distance and strength after the interventions ($p < 0.05$). In Group A, throwing distance improved from 9.48 ± 1.57 to 10.91 ± 1.78 (**t = -4.37, p = 0.00025**), and strength increased from 41.78 ± 7.9 to 47.21 ± 7.6 (**t = -3.3, p = 0.0033**). In Group B, throwing distance improved from 9.01 ± 1.28 to 10.44 ± 1.6 (**t = -5.36, p = 0.00002**), and strength increased from 38.21 ± 7.38 to 44.3 ± 8.04 (**t = -3.96, p = 0.00067**). However, between-group comparisons revealed no statistically significant differences in either throwing distance (**p = 0.315**) or strength (**p = 0.162**) at week 4

Conclusion: Both Rotator Cuff Strength Training and the Thrower's Ten Program were effective in improving shoulder strength and throwing distance in recreational badminton players. While both interventions led to similar overall improvements, Rotator Cuff Strength Training showed a slightly greater effect on throwing distance, suggesting its potential benefit for sports-specific overhead performance. On the other hand, the Thrower's Ten Program demonstrated a greater trend in enhancing shoulder strength, making it valuable for general shoulder health and strength endurance. These findings highlight the applicability of both training protocols, offering flexible options for optimizing athletic performance in badminton player.

Keywords: sports performance, Thrower's Ten Program, overhead performance, rotator cuff strength, push-pull dynamometer

Abbreviation: ULEPT-upper limb explosive power test, RCT-randomized controlled trial, PPD-push pull dynamometer

Introduction:

Athletes who engage in overhead activities including badminton and those that involve lot of straining of the shoulder complex may have shoulder problems. For optimal output and minimize on the occurrences of the injuries, the shoulders need to be stable and strong. Specific shoulder muscles training programs are making their ways through various rehabilitation programs and treatments.

There are four muscles that come together as rotator cuff muscles that are vital in overhead movements and the stability of the glenohumeral joint. Thus, targeted patience with an aim of developing these muscles will improve performance and as a result will also minimize on the injuries on any athlete. In a similar vein is the Thrower's Ten Program, which is an effective rehabilitation regime that focuses on a number of resistance based exercises targeted at strengthening the shoulder and imparting on it stability and endurance.

Despite several program utilizing both regimens during sports rehabilitation programs, no study has examined the relative efficacy on functional outcome measures such as shoulder strength as well as throwing distance in ADULT amateur badminton players. Since the nature of the activity is fast and explosive in, it is useful for the trainers to understand the degree of superiority between these two types of training regimes in order to plan performance boosting and recovery schedules in relation to the sport.

The aim of this study was to evaluate and compare the impact of the Thrower's Ten Program and rotator cuff strength training on the shoulder muscle force and shuttlecock throwing distance of amateur badminton players of the university. The development of such hypotheses could help explain particular rehabilitation strategies for players involved in overhead sports, so it is expected that the outcomes would be beneficial.

MATERIALS AND METHODS

The ethical clearance received from institutional ethical committee of Parul University. The study included total 46 participants who were selected based on inclusion and exclusion criteria. All the participants were informed. Inclusion criteria is All male and female asymptomatic overhead recreational badminton players between the ages of 15 to 25 years ,Duration of sporting activities for 2 year with at least 6 months a year and frequency of minimum 40 minutes thrice a week, exclusion criteria is Participants who have participated in any other research in last one year, Any subjects who had any history of upper limb fractures with in past 2 months shoulder or neck musculoskeletal surgery in past 6 months, Cervical spine pathology and or spinal deformity and glenohumeral joint subluxation or dislocation with in past 6 months. Consent was taken from each participants in the signature on the consent form. Privacy and confidentiality of the subjects should be maintained. Personal information such as name, age, address, was taken After those subjects were asses with Push-pull Dynamometer, upper limb explosive power test.

STATSTICAL ANALYSIS

The data obtained from the study were analysed using Microsoft Excel (Office 365 version). Descriptive statistics, including mean and standard deviation, were calculated for all outcome measures. Paired t-tests were conducted to compare pre- and post-intervention values within each group, and independent t-tests were used to compare differences between the Thrower's Ten Programme group and the rotator cuff strength training group. A significance level of $p < 0.05$ was considered statistically significant. Graphical representations of data trends were generated using Excel's built-in charting tools for better visualization of the results.

Result

The study examined the effects of Rotator Cuff Strength Training (Group A) and the Thrower's Ten Program (Group B) on the throwing distance and shoulder strength of recreational badminton players. Within-group comparisons revealed significant improvements in both performance metrics for each group. In Group A, throwing distance increased from 9.48 cm to 10.91 cm ($t = -4.37$, $p = 0.00025$) and strength improved from

41.78 to 47.21 (t = -3.3, p = 0.0033). Similarly, Group B showed significant improvements, with throwing distance increasing from 9.01 cm to 10.44 cm (t = 5.36, p = 0.00002) and strength improving from 38.21 to 44.3 (t = -3.96, p = 0.00067).Between-group comparisons showed no significant differences at either baseline (week 0) or post-intervention (week 4). For throwing distance, the t-value was 1.017 (p = 0.315) and for strength, the t-value was 1.421 (p = 0.162), indicating that the improvements in both groups were statistically similar by the end of the study.

Group	Variable	Mean±S.D		Mean Difference	t Value	p value
		Week 0	Week 4			
A	Throwing Distance	9.48 ± 1.57	10.91 ± 1.78	-1.43	-4.37	0.00025
A	Strength	41.78 ± 7.90	47.21 ± 7.60	-5.43	-3.3	0.0033
B	Throwing Distance	9.01 ± 1.28	10.44 ± 1.60	-1.43	5.36	0.00002
B	Strength	38.21 ± 7.38	44.3 ± 8.04	-6.09	-3.96	0.00067

Table 1 Paired T-test result in within both group

Variable	Group A Mean ± S.D		Group B Mean ± S.D		t Value	p value
	Day-1	Week-4	Day-1	Week-4		
Throwing Distance	9.48 ± 1.57	10.91 ± 1.78	9.01 ± 1.28	10.44 ± 1.60	1.017	0.315
Strength	41.78 ± 7.90	47.21 ± 7.60	38.21 ± 7.38	44.3 ± 8.04	1.421	0.162

Table 2 Unpaired T-test result in between groups

Group A				
Variable	week 0		week 4	
	Throwing dis.	Strength	Throwing distance	Strength
Mean	9.48	41.78	10.91	47.21
S.D	1.57	7.9	1.78	7.6

Table 3 Showed Group A- Paired T-test Result

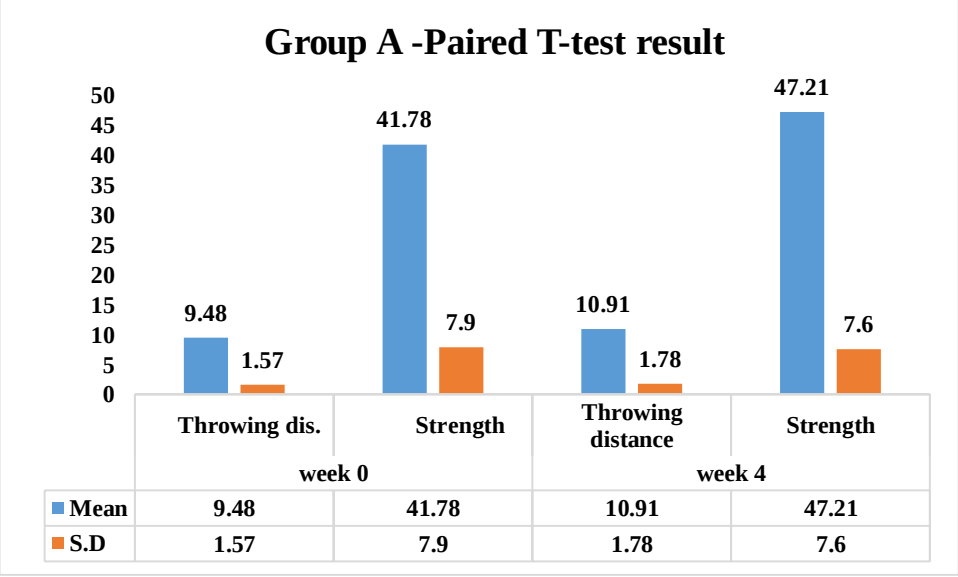

Figure 1 Shown Group A analysis of JPE. Throwing Distance and strength at week 0 and week4

Group B				
	week0		week4	
Variable	Throwing dis.	Strength	Throwing d	Strength
Mean	9.01	38.21	10.44	44.3
S.D	1.28	7.38	1.6	8.04

Table 4 Showed Group A- Paired T-test Result

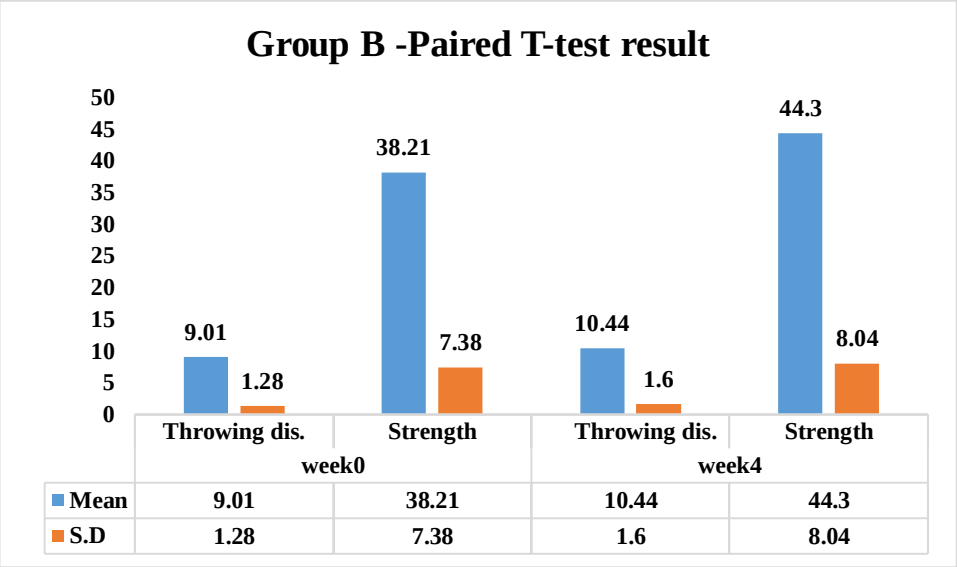

Figure 2 Shown Group A analysis of JPE. Throwing Distance and strength at week 0 and week4

Group	Throwing Dis	Strength
Group A	9.48	41.78
Group B	9.01	38.21

Table 5 Showed unpaired T-test between group week 1

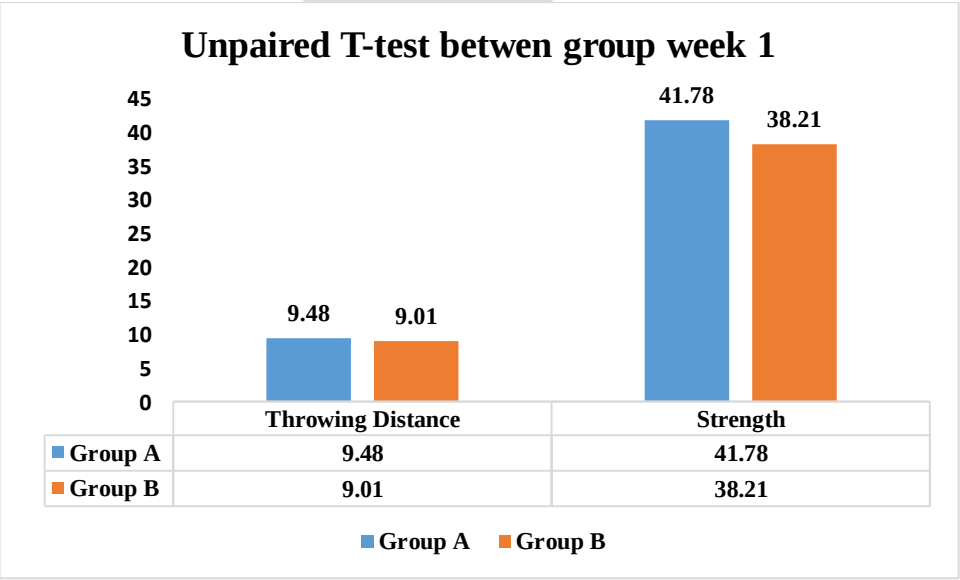

Figure 3 Shown between group A and B analysis of Throwing distance and strength at week 1

Group	Throwing Dis.	Strength
Group A	10.91	47.21
Group B	10.44	44.3

Table 6 Showed unpaired T-test between group week 1

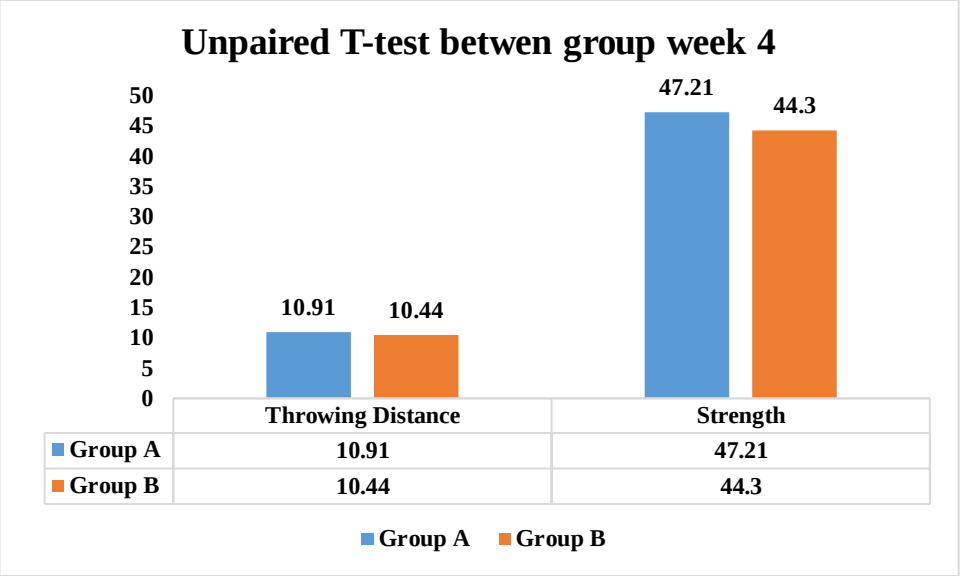

Figure 4 Shown between group A and B analysis of Throwing distance and strength at week 4

Discussion:

This study compared the effectiveness of Rotator Cuff Strength Training (Group A) and the Thrower's Ten Programme (Group B) in improving throwing distance and shoulder strength among amateur badminton players. Both intervention programs led to significant improvements within each group for both performance metrics, highlighting their efficacy in enhancing shoulder function in this population.

The increase in throwing distance observed in both groups can be attributed to improved scapular positioning and enhanced kinetic chain transfer. Scapular retractor exercises in Group A may have facilitated a more efficient energy transfer from the trunk to the upper limb by optimizing scapular stability, as reported in previous studies. This stabilization of the scapula is essential for effective power generation and controlled throwing mechanics, which are critical for badminton players engaged in repetitive overhead actions.

Similarly, Group B demonstrated significant improvements in throwing distance, likely due to the comprehensive nature of the Thrower's Ten Programme. Exercises such as external rotation with therabands and D2 PNF patterns are known to activate and strengthen key muscle groups, including the rotator cuff and scapular stabilizers, thereby improving throwing mechanics. Increased motor unit recruitment and neuromuscular adaptations from these exercises may have further contributed to these results.

The improvement in shoulder strength in both groups can be explained by enhanced neural responses and intermuscular coordination, particularly during the early weeks of training. Previous research supports the notion that strength gains within the first four weeks of resistance training are primarily neural adaptations, including improved motor unit recruitment and synchronization. Although both groups achieved significant within-group improvements, between-group comparisons revealed no statistically significant differences in either throwing distance or strength post-intervention. This indicates that both Rotator Cuff Strength Training and the Thrower's Ten Programme are equally effective for these parameters over a four-week period. These findings suggest that the selection of either training program could be based on player-specific needs, preferences, or available resources.

Clinical implication: The findings of this study highlight the clinical utility of both Rotator Cuff Strength Training and the Thrower's Ten Programme in enhancing throwing distance and shoulder strength among amateur badminton players. These interventions provide structured approaches to optimize shoulder biomechanics, crucial for performance and injury prevention in sports involving repetitive overhead motions. Rotator Cuff Strength Training is particularly beneficial for focused activation and control of the rotator cuff, while the Thrower's Ten Programme offers a broader, comprehensive approach to shoulder stability, power, and endurance. Both programs can be effectively incorporated into preseason training, injury rehabilitation, or as preventative strategies, enabling clinicians and trainers to tailor regimens based on individual needs, ultimately reducing injury risks and enhancing athletic performance

Conclusion: Both Rotator Cuff Strength Training and the Thrower's Ten Programme are effective in improving throwing distance and shoulder strength in amateur badminton players. Given the similar outcomes, either program can be incorporated into training regimens to enhance performance and potentially reduce the risk of shoulder injuries in this population.

LIMITATIONS AND FUTURE SCOPE

Limitations: The study was limited by its small sample size and short intervention duration, which may not fully capture the long-term adaptations of these training programs. Additionally, the findings are specific to recreational athletes and may not be generalizable to elite-level badminton players with higher training adaptations. Future studies with larger sample sizes, longer intervention durations, and inclusion of advanced athletes are recommended to validate and expand these results.

Future Recommendations: Future research should focus on evaluating the long-term effects of Rotator Cuff Strength Training and the Thrower's Ten Programme on performance and injury prevention in badminton players. Studies with larger and more diverse sample sizes, including professional athletes, can enhance the generalizability of findings. Additionally, investigating the impact of combining these training protocols with other interventions, such as plyometric exercises or sport-specific drills, may provide a more comprehensive approach to optimizing athletic performance. It would also be beneficial to examine the role of these programs in addressing shoulder kinematics, muscle activation patterns, and recovery timelines following injuries. Finally, incorporating advanced tools, such as motion analysis and electromyography, can help provide deeper insights into the biomechanical and neuromuscular adaptations associated with these training protocols.

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