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EFFECT OF THROWER'S TEN PROGRAM ON STRENGTH, ENDURANCE AND UPPER BODY POWER AMONG THE FEMALE SHUTTLE BADMINTON PLAYERS

Physiotherapy

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ABSTRACT

Background: Badminton, particularly at the competitive level, involves frequent overhead movements that place significant demands on shoulder strength, muscular endurance, and upper body power. Female shuttle badminton players are especially prone to muscle fatigue and overuse injuries due to the repetitive nature of actions like smashes and clears. Without proper conditioning, these demands can compromise both performance and physical health. The Thrower's Ten Program (T10) is a well-established exercise protocol aimed at enhancing shoulder strength, endurance, and joint stability. Although its benefits are well documented in other overhead sports, its specific impact on female badminton players remains under-explored. **Methodology:** The research methodology employed for this study adopts a single group pre test, post test design over a period of 6 weeks. The sample size is determined as 30 participants, selected through a convenience sampling method. Pre and post measurements of the isokinetic analyser to measure muscle strength, push-up test to measure endurance, seated overhead medicine ball to measure upper body power. **Result:** After 6 weeks of training, the findings suggest that T10 training has statistical improvement for strength, endurance and upper body power with a p value of (p=0.00) **Conclusion:** Study concludes that T10 training was effective in improving strength, endurance and upper body power in shuttle badminton players

KEYWORDS

Shuttle badminton players, strength, endurance, upperbody power, isokinetic dynamometer, Thrower's ten training.

INTRODUCTION

Badminton is one of the most popular sports worldwide and ranks as the second most played sport in India after cricket[1]. It is a non-contact racket sport that demands quick directional changes, lunges, jumps, rapid arm movements, and a high degree of postural control [2]. Injury incidence in badminton is reported to range from 0.9 to 7.4 per 1000 players, with higher rates during matches compared to training sessions. Younger players more commonly suffer from ligament sprains and ruptures, while muscle strains are frequently observed in older players [3]. Common shoulder injuries in badminton include rotator cuff tendinopathy, biceps tendinopathy, muscle strains of the deltoid, trapezius, and triceps, and acromioclavicular joint injuries [4]. Various training methods exist to develop upper body strength and power, including resistance band training, multi-gym equipment, weightlifting, and circuit training. Among these, the Thrower's Ten (T10) exercise program is particularly notable. Comprising 19 targeted exercises, specifically designed to strengthen these key muscle groups. By improving strength, neuromuscular coordination, and dynamic joint stability, it becomes especially relevant for overhead athletes like badminton players [5,6].

METHODOLOGY

The study was conducted after obtaining institutional ethical approval was obtained from the institution ethics committee (IEC) of SVIMS university (IEC No:1824, Date:16/04/2025).

Materials used are stopwatch, dumb bell/ kettle ball, thera bands, floor mat, 3 kgs rubber medicine ball, atheletic tape, measuring tape. The research methodology employed for this study adopts a single group pre test, post test design over a period of 6 weeks. The sample size is determined as 30 participants, selected through a convenience sampling method. Pre and post measurements of the isokinetic analyser to measure muscle strength, push-up test to measure endurance, seated overhead medicine ball to measure upper body power.

Study Procedure: 30 players who met the inclusion criteria were recruited for the study. The following pre-test data were recorded: strength of internal and external rotators of the dominant shoulder, musculoskeletal endurance of shoulders, and upper body power. The players performed T10 exercises for approximately 60 minutes a day, 3 days a week, for a duration of 6 weeks. Each session comprised 10 minutes of warm-up, 45 minutes of T10 exercises, and 5 minutes of cool down. The program consisted of 10 exercises, which were performed in 2 sets and 10 repetitions. A rest period of 2 minutes was given between the sets. Based on individual strength, the color of the resistance band was chosen using the 10 RM strength test. After the training program, measurements of strength, endurance, and power were recorded as post-test data with outcomes isokinetic analyser for muscle strength, push-up test for endurance, seated overhead medicine ball for upper body power.

Table 1: Protocol

Training week	Duration	Set × reps
Week 1	60 mins	2×10
Week 2	60 mins	2×10
Week 3	50 mins	2×8
Week 4	50 mins	2×8
Week 5	40 mins	2×6
Week 6	40 mins	2×6

ISOKINETIC DYNAMOMETER[7]: Isokinetic dynamometry is a reliable method used to assess and train muscular strength by measuring maximum torque output at a controlled, constant angular velocity. The internal and external rotation of the shoulder joint was assessed with the participant in a seated position, ensuring proper stabilization of the trunk and pelvis using safety belts to prevent compensatory movements. The axis of rotation was carefully aligned with the longitudinal axis of the humeral shaft in the horizontal plane to ensure accurate joint motion tracking. The dynamometer settings were adjusted as follows: orientation: 20°, tilt: 50°, seat orientation: 15°. The participant positioned her arm in 90° shoulder abduction and external rotation, with the elbow flexed at 90°. The range of motion (ROM) allowed was from 0° to 90°, covering the full arc of shoulder rotation. The subject was then instructed to perform maximal internal and external rotations of the shoulder within the given ROM, following verbal cues.

Push Up Test [8]: The push-up test—also referred to as the press-up test—is a widely used measure of upper body muscular strength and endurance. Participants assumed the standard push-up position: hands placed shoulder-width apart on the floor, arms extended and perpendicular to the body, feet slightly apart, with the body and legs aligned in a straight line from head to heels. From this starting position, participants lowered their bodies in a controlled manner until either the chest touched the ground or a designated object (e.g., foam block or marker), or the elbows reached a 90-degree angle. Participants then returned to the starting position by fully extending the arms.

Throughout the test, the back and knees remained straight, and proper form was maintained. The movement was repeated continuously without rest until the participant reached volitional fatigue or failed to maintain proper form or rhythm or achieved a predetermined target number of repetitions. The total number of correctly performed push-ups was recorded as the final score. Only repetitions completed with proper technique and full range of motion were counted.

Seated Medicine Ball Throw [9]: To assess upper body power by measuring the maximal horizontal distance a medicine ball can be thrown from a seated position, eliminating lower body contribution with 3 kg medicine ball, measuring tape or marked floor, flat wall surface. Participants sat on the floor with their legs fully extended and feet approximately 60 cm (24 inches) apart. The back remained firmly against a wall throughout the test to ensure isolation of upper body movement and to prevent momentum from the trunk. The medicine ball was held with both hands on either side, slightly behind the center, positioned against the center of the chest, with the forearms parallel to the floor. On command, the participant forcefully pushed the ball forward in a chest pass motion, aiming for maximum horizontal distance, while keeping their back in full contact with the wall. The distance from the wall to the point where the ball first landed was measured using a tape measure and recorded to the nearest centimeter.

RESULTS

The statistical analysis was performed using the "SPSS 20.0 version software. The data was first entered into a microsoft excel spreadsheet, tabulated, and then subjected to statistical analysis.

Baseline evaluation was done for the subjects in T10 training group by using the ID, Push-up and SMBT. Subjects have undergone the intervention for 6 weeks and post-test evaluation was done by using the above measures and documented the findings. The pre- and postdata within each group were analyzed using the paired t-test, while the comparison of pre- and postdata.

Table 2: Demographic Data of T10 Training Program (n=30)

Variables	Mean(±)SD
Age (years)	18.9(±)1.42
Height (cm)	154.63(±)7.08
Weight (kg)	53.43(±)12.05
B.M.I (kg/m2)	22.23(±)4.65

Table 3: Pre and Post Values of Strength at 30º,45º,60º Angular Velocity

Outcomes	Pre mean	Post mean	Mean difference	t-value	p-value
Ext. Rot at 30º	8.98±2.56	10.27±2.56	1.29	-10.75	0.00
Int. Rot at 30º	9.80±4.78	11.15±5.29	1.35	-10.22	0.00
Ext. Rot at 45º	7.72±1.85	9.02±2.14	1.3	-13.37	0.00
Int. Rot at 45º	9.96±4.34	11.55±4.62	1.59	-6.57	0.00
Ext. Rot at 60º	6.67±1.99	7.70±2.28	1.03	-4.90	0.00
Int. Rot at 60º	8.7±4.44	10.13±4.64	2.03	-1.92	0.00

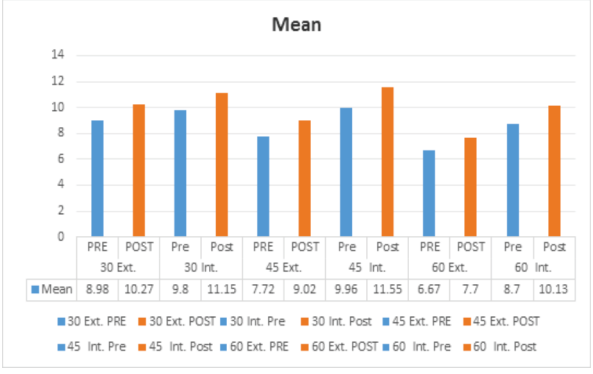

Figure 1: Graphical Representation of Pre and Post Values of Strength at 30º, 45º,60º Angular Velocity

Table 6: Pre and Post Values of Endurance Test after T10 Training

Outcomes	Pre mean	Post mean	Mean difference	t-value	p-value
Push ups	6.2±1.93	12.33±2.82	6.13	-24.76	0.00
SMBT	1.3±0.21	1.68±0.24	0.38	-39.79	0.00

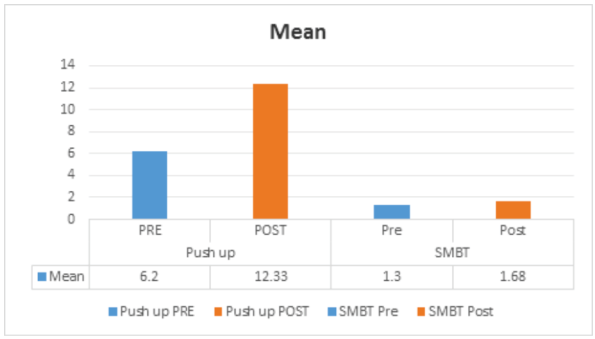

Figure 2: Graphical Representation of Pre and Post Values of Push up and SMBT

Interpretation

The demographic characteristics of the participants (n=30) revealed a young and relatively homogeneous group, with a mean age of 18.9 years, mean height of 154.63 cm, mean weight of 53.43 kg, and an average BMI of 22.23 kg/m², indicating that most participants fell within the healthy weight range.

Following the T10 training program, participants demonstrated significant improvements across all outcome measures. The strength of both external and internal rotators increased consistently in all measured groups, with statistically significant gains ($p = 0.00$), indicating enhanced shoulder stability and muscular strength. The external rotators showed mean improvements ranging between 1.03 and 1.30, while the internal rotators improved by 1.35 to 1.59, confirming the program's effectiveness in targeting the shoulder musculature.

Additionally, upper body endurance and power improved markedly. Push-up performance nearly doubled, with a mean difference of 6.13 repetitions, demonstrating enhanced muscular endurance. Similarly, the seated medicine ball throw (SMBT) distance increased significantly by 0.38 meters, reflecting a substantial improvement in upper body power. Overall, the findings suggest that the T10 training program is effective in improving shoulder strength, endurance, and upper body power in young female athletes, thereby enhancing functional performance relevant to overhead sports activities.

DISCUSSION

The aim of this study was to determine the effect of the Thrower's Ten (T10) training program on strength, endurance, and upper body power in female shuttle badminton players. Demographic data including age, height, weight, and BMI were collected. Most participants fell within the normal BMI range, indicating a healthy athletic population. This provides a suitable baseline for evaluating the physical performance effects of the intervention.

The Thrower's Ten Program, developed by Kevin E. Wilk (2011), was originally designed to activate and strengthen the major muscles required for overhead throwing. It emphasizes strength, endurance, and power development of the shoulder complex. Initially validated in sports like tennis, javelin, and badminton, the T10 protocol is widely accepted for its efficacy in improving performance among overhead athletes [43]. In the present study, shoulder strength was assessed using isokinetic testing at 30°, 45°, and 60° ROM. The results in table 3, 4, 5 indicated a statistically significant improvement ($p = 0.00$) post-intervention, suggesting that the 6-week T10 program was effective in strengthening shoulder musculature. Similar results found in a study by Escamilla et al., who reported that T10 exercises led to increased throwing velocity in young baseball players by enhancing shoulder strength. The exercises were noted for their simplicity and practicality in implementation[44].

Wilk et al. further observed that T10 exercises improve neuromuscular control and contribute to dynamic shoulder stabilization through targeted activation of the rotator cuff muscles [45]. Similarly, Patel et al. highlighted improvements in rhomboid muscle strength, which is crucial for scapular and shoulder stability [46]. Another study reported significant improvements in external rotator strength with exercises performed at 90° abduction and 90° elbow flexion, a key component of the T10 protocol [47]. Wilk et al. found that prone horizontal abduction at 100°, one of the most effective T10 exercises, generated higher

activation in the supraspinatus, medial deltoid, and posterior deltoid compared to other movements [48]. This supports the use of the T10 program for selective activation and strengthening of the shoulder stabilizers. Several studies [47–49] consistently show that T10 exercises targeting the rotator cuff and shoulder girdle stabilizers significantly enhance muscle strength. The current findings align with these results, confirming the T10 program's effectiveness in developing shoulder complex strength. Yeol et al. also noted improvements in scapular retractor strength and throwing distance among hammer throwers who followed the T10 protocol, supporting the findings of enhanced upper body power [52]. Similarly, Myers et al. found the exercises effective for activating shoulder muscles and enhancing rotational power, also recommending them as a pre-performance warm-up to boost power output [53].

CONCLUSION

The Thrower's 10 training program proved to be effective in enhancing strength, endurance, and power among female shuttle badminton players. Significant improvements were observed in shoulder rotator strength, push-up performance, and upper body power, all of which are crucial for executing overhead strokes and sustaining high-intensity rallies. These findings suggest that incorporating the T10 program into regular training can not only improve performance but also support injury prevention.

Limitations

- Sample size was small
- Couldn't be generalized to the whole badminton players population
- Smaller geographical area was covered
- Smaller age group was taken
- Only female badminton players were included

Recommendations

- Large sample size is recommended
- These fitness components can be studied in both males and females in other sports players.

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