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Effect of Core Muscle Strength Training on Body Composition and Core Strength among Female Recreational Badminton Players

Running Title: Core Muscle Strength Training and Body Composition

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Abstract: ***Background: Badminton requires repeated high-intensity multidirectional movements, rapid changes of direction, lunges, and jumps the core musculature contributes to trunk stability, efficient force transmission, and movement efficiency. Structured core muscle strength training (CMST) may improve core muscular performance and selected body composition variables in recreational badminton players. Aim: To determine the effect of core muscle strength training (CMST) on body composition and core strength among female recreational badminton players. Methodology: A pre-experimental one-group pre-test and post-test study was conducted among 30 female recreational badminton players aged 19–25 years. Participants underwent a six-week CMST programme, three sessions per week. Body composition was assessed using a karada portable body composition monitor, while core strength and endurance were assessed using the endurance plank test and the one-minute sit-up test. Data were analysed using descriptive statistics and the paired t-test, with the level of significance set at p < 0.05. Results: Total body fat decreased from 0.27 ± 0.06 to 0.26 ± 0.06 (p=0.001), and visceral fat decreased from 4.45 ± 3.51 to 4.23 ± 3.23 (p=0.008). Trunk skeletal muscle percentage did not show a significant change (p=0.085). One-minute sit-up test score increased from 18.27 ± 5.04 to 30.53 ± 7.18 (p=0.001), while endurance plank test holding timeincreased from 26.80 ± 19.32 seconds to 49.70 ± 29.79 seconds (p=0.001). Conclusion: Total body fat decreased from 0.27 ± 0.06 to 0.26 ± 0.06 (p=0.001), and visceral fat decreased from 4.45 ± 3.51 to 4.23 ± 3.23 (p=0.008). Trunk skeletal muscle percentage did not show a significant change (p=0.085). One-minute sit-up test score increased from 18.27 ± 5.04 to 30.53 ± 7.18 (p=0.001), while endurance plank test holding timeincreased from 26.80 ± 19.32 seconds to 49.70 ± 29.79 seconds (p=0.001).***

Keywords: Badminton; Core Muscle Strength Training; Body Composition; Core Muscular Endurance; Endurance Plank Test; One-Minute Sit-up Test

1. Introduction

Badminton is a high-intensity racket sport that involves rapid multidirectional movements, lunges, jumps, overhead strokes, and frequent changes in direction. These activities require muscular strength, endurance, agility, balance, coordination, and postural stability [1,2].

Core musculature plays an important role in stabilizing the trunk and facilitating efficient force transfer between the upper and lower limbs during badminton-specific movements. The core comprises the muscles of the abdomen, lumbar spine, pelvis, and hip region, which work together to maintain spinal stability and postural control [3,4]. Adequate core strength and endurance may support movement efficiency and athletic performance [5,6].

Core muscle strength training (CMST) focuses on improving trunk strength, muscular endurance, and neuromuscular control. In addition to functional benefits, body composition is an important consideration in badminton, as excessive body fat may increase the energy demands of movement, while adequate skeletal muscle mass supports force production and physical performance [7,8].

Previous research suggests that core training can improve muscular endurance, balance, agility, and sport-specific performance. However, evidence regarding its combined effects on body composition and core strength among female recreational badminton players remains limited [9–12]. Further investigation is therefore warranted in this population.

The present study aimed to evaluate the effects of a six-week core muscle strength training program on body composition and core strength among female recreational badminton players.

2. Aim and Objectives

To determine the effect of CMST on body composition and core strength among female recreational badminton players**.**

3. Materials and Methodology

Study design and setting: A one-group pre-test and post-test study was conducted at college of physiotherapy, Sri Venkateswara Institute of Medical Sciences, and the Department of Physical Education, Sri Venkateswara University, Tirupati, India. The intervention was 6 weeks.

Ethical approval: Approval was obtained from the Institutional Ethics Committee, Sri Venkateswara Institute of Medical Sciences, Tirupati (IEC No. 1969; approval dated 18 February 2026). Written informed consent was obtained from every participant before enrolment.

Participants and sampling: Thirty female recreational badminton players were recruited by convenience sampling. Participants were aged 18-25 years, had weak core muscle strength on screening, and could provide informed consent.

Exclusion criteria: A history of major injury or surgery, neurological or systemic conditions affecting movement, or concurrent participation in another strength or rehabilitation program.

Materials: portable body composition analyzer, yoga mat, stopwatch.

Female recreational badminton players aged 18–25 years.

Able to provide informed consent.

The 1-minute sit up test, endurance plank test, and body composition analysis was performed.

A six-week core strength training session with 3 sessions per week of 40-45 min of duration.

All outcomes were assessed at baseline after 6weeks of intervention period.

4. Assessment Procedure

Player in group were done warm up for 10 minutes which include neck, shoulder, trunk, lunge movements. Each training session lasted 40 minutes, consisting of a 10-minute warm-up, 25-minute core muscle strengthening programme, and 5-minute cool-down. All training sessions were supervised by the investigator to ensure participant safety, correct exercise performance, and adherence to the prescribed training protocol.

Intervention Protocol
Total Duration: 6 weeks
Frequency: 3 sessions per week (total 12 sessions)
Session Length: Approximately 30–40 minutes
Equipment:
Yoga mat,
Stopwatch
Warm-up: (5–7 minutes)
Light aerobic activity (e.g., jogging in place or stationary cycling)
Dynamic stretches

Table 1: Six-week core strength training protocol

Exercise	Sets	Repetitions/Hold
Plank	2	5 reps/30-second hold
Side Plank	2	5 reps/ 30-second hold
Sit-ups	2	10 repetitions
Crunches	2	10 repetitions
Pelvic Bridge	2	5 reps/5-second hold
Dead Bug	2	10 repetitions (2–3-second hold)

Statistical Analysis
The statistical analysis was performed using SPSS 22 version software. The collected data were entered into the Microsoft Excel spread sheet, tabulated, and then subjected to statistical analysis.

All the descriptive and inferential statistical analyses were presented in the form of mean and standard deviation and graphically presented.

All 30 participants completed the study protocol within the 6 weeks of CMST sessions.

Since sample was normally distributed, paired t-tests were performed to compare the pre and post values to assess the training efficacy.

For all statistical analysis, $p < 0.005$

5. Results

The study sample comprised 30 players who underwent the CMST. The players were given CMST for a period of 6 weeks, comprising 3 sessions per week in consecutive days. The pre and post training values were noted by measuring body composition analyzer, one minute sit-up test, and plank hold test.

Table 2: Demographic Characteristics of Participants

Variable (n=30)	Mean	SD
Age	20.67	1.21
Height(cm)	155.67	6.57
BMI	22.25	4.57
Weight (Kg) Pre	54.04	10.56
Weight (Kg) Post	53.53	10.48

Table 3: Pre and Post-Intervention of total body fat %

	Pre-Test	Post-Test	t-stat	P-value
Mean	0.27	0.26	-4.18	0.000
SD	0.06	0.06		

Table 4: Pre and Post-Intervention of skeletal muscle mass %

	Pre-Test	Post-Test	t-stat	P-value
Mean	0.24	0.24	1.41	0.085
SD	0.03	0.03		

Table 5: Pre- and Post-Intervention of visceral fat%

	Pre-Test	Post-Test	t-stat	P-value
Mean	4.45	4.23	-2.58	0.005
SD	3.51	3.23		

Table 6: Pre- and Post-Intervention of sit-ups performed by the player

	Pre-Test	Post-Test	t-stat	P-value
Mean	18.27	30.53	13.45	0.000
SD	5.04	7.18		

Table 7: Pre- and Post-intervention of plank hold duration in seconds

	Pre-Test	Post-Test	t-stat	P-value
Mean	26.80	49.70	9.16	0.000
SD	19.32	29.79		

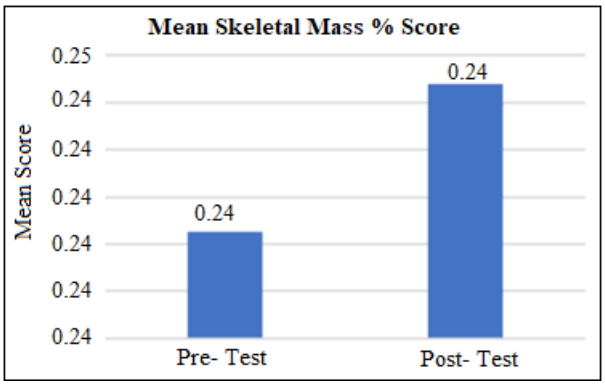


Figure 1: Graphical representation of TBF% of players

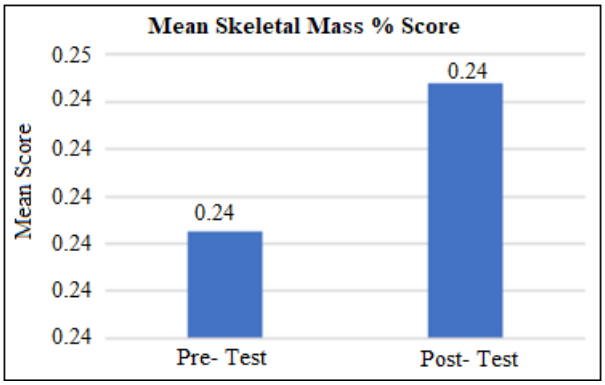


Figure 2: Graphical representation of skeletal mass %.

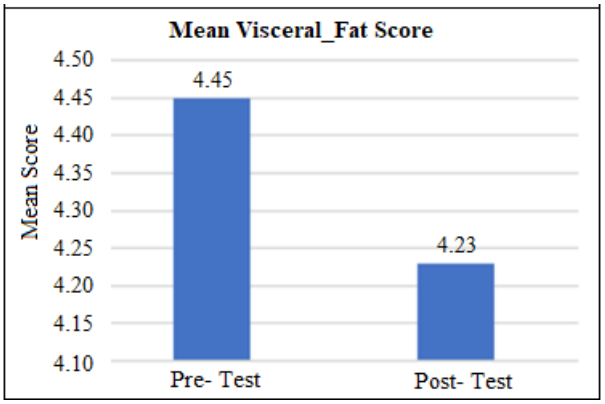


Figure 3: Graphical representation of visceral fat %

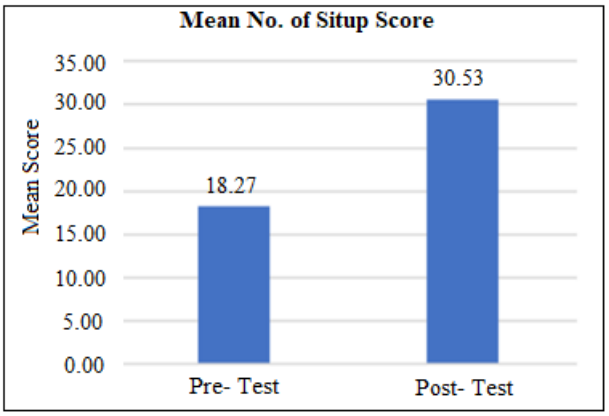


Figure 4: Graphical representation of pre and post-test of sit-ups performed by the player.

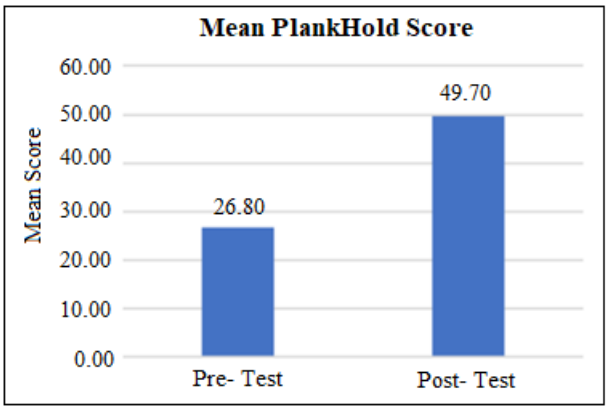


Figure 8: Graphical representation of pre and post-test of plank duration in seconds by the player.

6. Discussion

The present study evaluated the effects of a six-week Core Muscle Strength Training (CMST) program on body composition and core strength among female recreational badminton players. The findings demonstrated significant reductions in total body fat and visceral fat, along with improvements in abdominal and core muscular endurance.

Total body fat percentage decreased from 0.27 ± 0.06 to 0.26 ± 0.06 following the intervention.

7. Limitations and Recommendations

1) The study included a relatively small sample size of 30 participants.
2) The six-week intervention period may have been insufficient to produce measurable changes in trunk skeletal muscle percentage.
3) Convenience sampling may have introduced selection bias.
4) The study included only female recreational badminton players aged 18–25 years, limiting the generalizability of the findings.

8. Conclusion

The study concludes that a six-week CMST programme showed significant reduction in total body fat percentage and visceral fat percentage. The study also showed enhancement of strength and endurance of core musculature among female recreational badminton players.

Declarations

Ethics approval and consent: Institutional Ethics Committee, SVIMS, IEC No. 1969, approved 18 February 2026. Written informed consent was obtained from all participants.

Funding: No external funding was reported. Competing interests: The authors declare no competing interests. Data availability: Data are available from the corresponding author on reasonable request, subject to institutional requirements.

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