ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Vol. 14 | Issue 4| Oct - Dec 2026

www.ijamscr.com

DOI : https://doi.org/10.61096/ijamscr.v14.iss4.2026.1694-1700

Combined Effect of Sprint Interval Training and Tabata Training on Improving Speed and Endurance in College-Level Badminton Players

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Published on:

21-10-2026

Published by:

Futuristic Publications

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Abstract:

Background: Badminton is a high-intensity intermittent sport that requires repeated bursts of speed, rapid directional changes, and sustained endurance. Tabata training and Sprint Interval Training (SIT) are high-intensity training methods that may improve aerobic and anaerobic performance.

Objective: To determine the combined effect of Sprint Interval Training and Tabata training on speed and endurance among college-level badminton players.

Methods: A single-group experimental study was conducted among 30 badminton players aged 15–25 years who met the inclusion and exclusion criteria. Speed and endurance were assessed before and after the intervention using the 40-meter shuttle run test and Cooper 12-minute run test, respectively. Participants underwent a combined Sprint Interval Training and Tabata training protocol for four weeks, with training conducted on consecutive days. The collected data were analyzed using descriptive statistics and a paired t-test, with the level of significance set at $p \leq 0.05$.

Results: A statistically significant improvement was observed in both outcome measures. The mean 40-meter shuttle run score improved from 13.05 ± 1.58 to 11.60 ± 1.29 seconds ($t = 5.91$, $df = 29$, $p \leq 0.001$). The mean Cooper 12-minute run test score improved from 40.10 ± 10.07 to 45.70 ± 7.62 ($t = -8.03$, $df = 29$, $p \leq 0.001$).

Conclusion: Combined Sprint Interval Training and Tabata training significantly improved speed and endurance among college-level badminton players.

Keywords: Tabata training, Sprint Interval Training, badminton, speed, endurance, high-intensity interval training.

INTRODUCTION

Badminton is a fast-paced racket sport requiring rapid movements, repeated changes in direction, explosive actions, and sustained physical performance. Players must respond quickly to the movement and trajectory of the shuttlecock while continuously adjusting their body position during play. The physical demands of badminton involve both aerobic and anaerobic energy systems, making speed and endurance important components of performance [1–9]. Speed is essential for effective court coverage and for performing attacking and defensive movements. Similarly, endurance enables players to sustain repeated high-intensity actions throughout rallies and matches. Therefore, training methods that improve both aerobic and anaerobic performance may be beneficial for badminton players. Tabata training is a form of high-intensity interval training characterized by repeated bouts of intense exercise with short recovery periods. A traditional Tabata protocol involves 20 seconds of high-intensity exercise followed by 10 seconds of rest, repeated eight times.

This type of training has been associated with improvements in aerobic and anaerobic capacity, muscular performance, and other physical fitness components [10–16]. Sprint Interval Training involves short bouts of maximal or near-maximal exercise followed by recovery periods. SIT can produce physiological adaptations related to aerobic capacity, anaerobic performance, neuromuscular efficiency, and sprint ability [17–23]. Previous studies have investigated the effects of Tabata training, Sprint Interval Training, and other high-intensity training programs in badminton players and athletes from different sports [24–37]. However, the combined effect of Sprint Interval Training and Tabata training on both speed and endurance in college-level badminton players was the focus of the present study. Therefore, this study aimed to determine the combined effect of Sprint Interval Training and Tabata training on improving speed and endurance among college-level badminton players.

Methodology:
The study was approved by the institute ethics committee, IEC- RIPT/DT/21/4508.

Study Design
The study was conducted using an experimental single-group pre-test and post-test design.

Study Duration
The total duration of the study was six months. The intervention period was four weeks.

Study Setting
The study was conducted at the Revathi Group of Institutions.

Sample Size
Thirty badminton players who fulfilled the inclusion and exclusion criteria were included in the study.

Sampling Method
Simple random sampling was used.

Inclusion Criteria
Male and female participants.
Age between 15 and 25 years.
Active badminton players participating in the sport for the previous two years.
Competitive college-level badminton players.
Participants willing to participate in the study.

Exclusion Criteria
Players with recent lower-limb injuries.
Players who were not interested in participating in the study.
Individuals with lack of understanding.

Procedure
Thirty badminton players aged between 15 and 25 years were selected for the study. Before the intervention, all participants underwent baseline assessment. Speed was assessed using the 40-meter shuttle run test, while endurance was assessed using the Cooper 12-minute run test. The participants underwent a combined Sprint

Interval Training and Tabata training program for four weeks, with the training protocols conducted on consecutive days.

Sprint Interval Training Protocol

The Sprint Interval Training session began with a five-minute general warm-up consisting of joint movements, jogging, and mild whole-body stretching. Participants performed four sets of 30-second all-out sprints with a four-minute recovery period between efforts. A five-minute cool-down was provided following the training session. The total duration of the Sprint Interval Training session was approximately 30 minutes.

Tabata Training Protocol

The Tabata session began with a five-minute general warm-up consisting of joint movements, jogging, and mild whole-body stretching. The training consisted of eight exercises performed for 20 seconds, followed by 10 seconds of rest. A one-minute cool-down was performed after completion of the exercises. The total Tabata training session lasted approximately 10 minutes. Following completion of the four-week intervention, the same outcome measures were administered as post-tests.

Outcome Measures

40-Meter Shuttle Run Test: The 40-meter shuttle run test was used to assess speed. Cooper 12-Minute Run Test: The Cooper 12-minute run test was used to assess endurance.

RESULT:

The results demonstrated a statistically significant improvement in both speed and endurance following the intervention ($P \leq 0.001$). The mean time for the 40-meter shuttle run decreased, indicating enhanced speed, while the distance covered in the Cooper 12-minute run test increased, reflecting improved endurance.

Table – 1 Comparison Of 40 Meter Shuttle Run Test Score Within Group Between Pre Test And Post Test Values

Test	Pre-test Mean	Pre-test S.D.	Post-test Mean	Post-test S.D.	t-value	df	Sig. (p-value)
Speed Test	13.05	1.58	11.60	1.29	5.91	29	.001***

(*- P ≤ 0.001 - Significant).**

The above table reveals the Mean, Standard Deviation (S.D), t - test, degree of freedom (df) and p-value between pre test and post test. There is a statistically significant difference between the pre test and post test values within Group at $P \leq 0.001$.

Graph – I : Comparison Of 40 Meter Shuttle Run Test Score Within Group Between Pre Test And Post Test Values

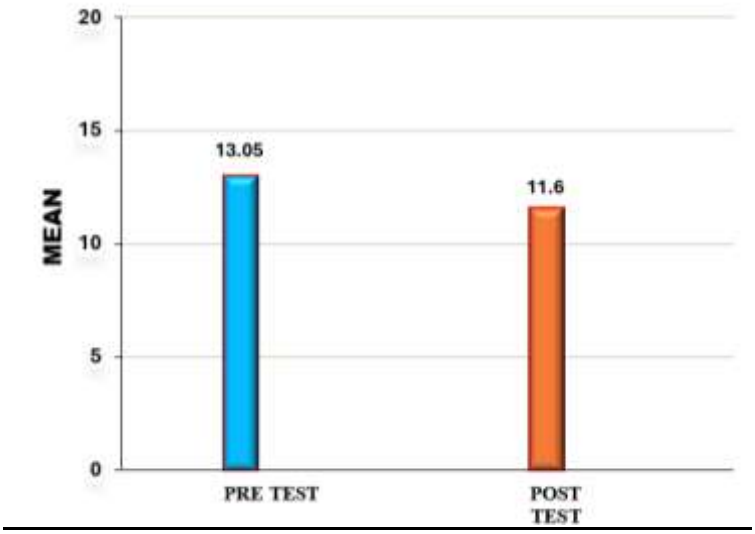


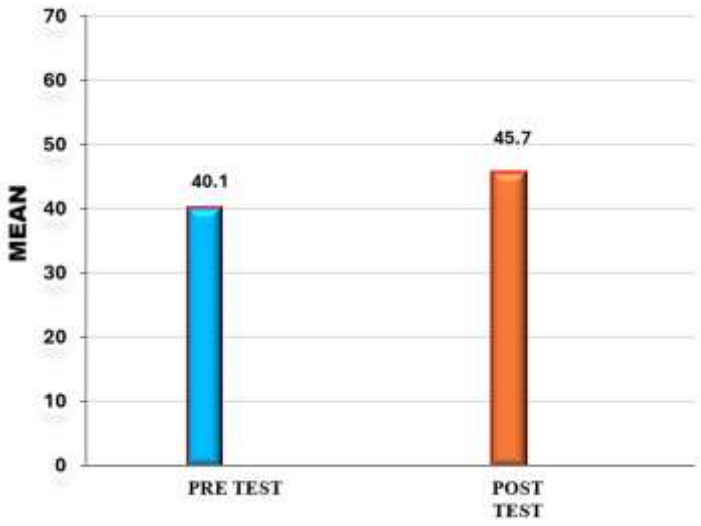
Table – 2: Comparison Of Cooper 12 Minute Run Test Score Within Group Between Pre Test And Post Test Values

TEST	PRE TEST		POST TEST		t - test		Sig
	MEAN	S.D	MEAN	S.D		Df	
ENDURANCE	40.10	10.07	45.70	7.62	-8.03	29	.001***

(*- P ≤ 0.001 - Significant).**

The above table reveals the Mean, Standard Deviation (S.D), t - test, degree of freedom (df) and p-value between pre test and post test. There is a statistically significant difference between the pre test and post test values within Group at P ≤ 0.001.

Graph – Ii :Comparison Of Cooper 12 Minute Run Test Score Within Group Between Pre Test And Post Test Values



DISCUSSION

The present study investigated the combined effect of Sprint Interval Training and Tabata training on speed and endurance among college-level badminton players. Thirty participants underwent a combined high-intensity training protocol, and their performance was assessed before and after the intervention using the 40-meter shuttle run test and Cooper 12-minute run test. The findings demonstrated a statistically significant improvement in speed. The mean 40-meter shuttle run test score decreased from 13.05 ± 1.58 seconds to 11.60 ± 1.29 seconds following the intervention. The improvement in speed may be associated with the high-intensity and explosive characteristics of Sprint Interval Training and Tabata training. Sprint Interval Training involves repeated bouts of maximal or near-maximal effort and is associated with adaptations in neuromuscular efficiency and anaerobic performance. Previous research included in the present study has reported improvements in aerobic and anaerobic performance following Sprint Interval Training [17–23, 33–37].

Tabata training involves repeated high-intensity exercise bouts with short recovery periods. Previous studies have reported improvements in aerobic capacity, anaerobic capacity, sprint performance, and other physical fitness parameters following Tabata-based training [10–16, 29–32]. The present study also demonstrated a statistically significant improvement in endurance. The mean Cooper 12-minute run test score increased from 40.10 ± 10.07 to 45.70 ± 7.62 following the intervention. High-intensity interval-based training may produce adaptations associated with improved aerobic performance and exercise capacity. Badminton requires repeated bursts of high-intensity movement combined with the ability to sustain physical performance during prolonged rallies and matches. Therefore, the combined use of Sprint Interval Training and Tabata training may provide a training stimulus relevant to the physical demands of the sport. The present findings are consistent with the

literature reviewed in the project, which reported beneficial effects of high-intensity training methods on physical performance in badminton players and athletes from other sports. However, the present study did not include a control group, the sample size was limited to 30 participants, and the intervention period was relatively short. These factors should be considered when interpreting the findings

CONCLUSION

The present study concluded that the combined application of Sprint Interval Training and Tabata training produced statistically significant improvements in speed and endurance among college-level badminton players. Following four weeks of the combined training program, significant improvements were observed in the 40-meter shuttle run test and Cooper 12-minute run test. Therefore, the null hypothesis was rejected, and the findings indicate that the combined Sprint Interval Training and Tabata training protocol was effective in improving the measured speed and endurance parameters in the participants of this study.

ACKNOWLEDGMENTS

The authors express their sincere gratitude to the management, principal, faculty members, and staff of Revathi Institute of Physiotherapy, Avinashi, for their guidance and support. The authors also thank all the badminton players who participated in the study.

Informed Consent:

Written informed consent was obtained from all participants before the Commencement of the study. Participation was voluntary, and confidentiality of participant Information was maintained throughout the study.

Conflict of interest

The authors declare no conflict of interest. This study was conducted as part of an academic project, and no external funding or influence was involved.

AUTHOR CONTRIBUTION

Christin abraham kuriakose: Conceptualization, methodology, participant recruitment, data collection, statistical analysis, manuscript preparation, and manuscript revision. Dr. Santhanalakshmi A: Study conception and design, supervision, methodology validation, interpretation of results, critical revision of the manuscript, and final approval of the manuscript. Dr. P Bright Alwin Victor: Administrative support, overall academic guidance, and final approval of the manuscript.

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