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Isolated and combined effect of SAQ and ladder training on speed among college Men Volleyball players

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Abstract
The present investigation was undertaken to examine the isolated and combined effects of Speed, Agility, and Quickness (SAQ) training and ladder training on speed performance among college men volleyball players. Sixty male college volleyball players from Puducherry were randomly selected and equally assigned into four groups (n = 15 each): SAQ training group, ladder training group, combined training group, and control group. All groups continued their regular volleyball training schedule, while the experimental groups additionally performed their respective training interventions for one hour per session, three days per week, over a period of twelve weeks. Speed performance was assessed using the 50 m dash test, which was administered before and after the training intervention. The collected data were statistically analyzed using Analysis of Covariance (ANCOVA), followed by Scheffe's post hoc test to determine significant differences among the groups. The level of statistical significance was set at $p< 0.05$.

Keywords: SAQ training, ladder training, speed, volleyball performance

Introduction
Speed is a critical component of physical fitness that plays a decisive role in the performance of modern volleyball, where athletes are required to execute rapid accelerations, quick changes of direction, and explosive movements during both offensive and defensive actions. At the collegiate level, volleyball players must demonstrate high levels of linear speed and agility to effectively perform essential skills such as spiking, blocking, court coverage, and transition play. As a result, the development of speed-related abilities has become a central focus of contemporary strength and conditioning programs in volleyball.

SAQ training has been widely recognized as an effective training method for enhancing neuromuscular coordination, reaction ability, and movement efficiency. This training approach emphasizes rapid footwork, dynamic balance, and controlled acceleration, which are directly transferable to volleyball-specific movements. Similarly, ladder training has gained popularity as a coordination-based training method that improves foot speed, rhythm, and lower-limb control while minimizing physical stress and injury risk.

Although several studies have independently reported the beneficial effects of SAQ training and ladder training on speed performance, limited research has examined their isolated and combined effects, particularly among college men volleyball players. Determining whether a combined SAQ and ladder training program produces superior improvements in speed compared to isolated training methods is of practical importance for coaches, physical educators, and sports scientists. Therefore, the present study was designed to investigate the changes in speed among college men volleyball players resulting from the isolated and combined effects of SAQ training and ladder training.

Methodology
Selection of Participants
To accomplish the objectives of the present investigation, sixty college-level men volleyball players aged between 18 and 21 years were selected from various educational institutions in and around Puducherry, India. All participants had a minimum of one year of regular volleyball training experience and were free from musculoskeletal injuries during the period of the study.

Prior to participation, the purpose and procedures of the study were clearly explained to all subjects, and their voluntary consent was obtained. The selected participants were randomly assigned into four equal groups, each consisting of fifteen subjects. Group I (n = 15) served as the SAQ Training Group, Group II (n = 15) served as the Ladder Training Group, Group III (n = 15) served as the Combined Training Group, and Group IV (n = 15) served as the Control Group. The control group continued their regular volleyball training routine and did not participate in any additional structured training program during the experimental period.

Training Intervention

The experimental training program was conducted for a duration of twelve weeks. Training sessions were held three times per week on alternate days, and each session lasted approximately one hour. All training sessions were supervised by qualified physical education professionals to ensure proper execution of exercises and to maintain uniformity in training intensity and duration.

The SAQ Training Group performed drills specifically designed to enhance speed, agility, and quickness. These drills included acceleration and deceleration exercises, rapid directional changes, reaction-based movements, and foot-speed drills aimed at improving neuromuscular coordination. The Ladder Training Group performed ladder drills focusing on foot placement accuracy, coordination, rhythm, balance, and lower-limb movement efficiency. The Combined Training Group performed both SAQ and ladder training drills within the same training session, with adequate rest intervals provided between exercises to avoid fatigue. The Control Group continued their regular volleyball practice without exposure to any specialized training intervention.

Selection of Variable

Speed was selected as the dependent variable for the present study, as it is a key performance determinant in volleyball. Speed performance was assessed using the 50 m dash test, which is a standardized and widely accepted measure of linear running speed. The test was administered to all subjects under similar environmental conditions to ensure consistency.

Testing Procedure

The 50 m dash test was conducted on a standard running surface. Each subject was instructed to sprint the distance of 50 meters from a standing start as fast as possible. Two trials were given to each participant, and the best performance was recorded in seconds for statistical analysis. The test was administered before the commencement of the training program (pre-test) and immediately after the completion of the twelve-week training intervention (post-test).

Statistical Technique

The data obtained from the pre-test and post-test measurements were statistically analyzed to determine the effects of SAQ training, ladder training, and combined training on speed performance. Analysis of Covariance (ANCOVA) was employed to assess whether significant differences existed among the four groups by adjusting for pre-test scores. This method was used to control for initial differences among the groups and to enhance the precision of post-test comparisons. When a significant F-ratio was obtained, Scheffe's post hoc test was applied to identify specific group-wise differences in speed performance. The level of significance for all statistical analyses was set at 0.05.

Results and Discussion

The present study examined the isolated and combined effects of SAQ training and ladder training on speed performance among college men volleyball players. The mean values of pre-test, post-test, and adjusted post-test scores of speed for the SAQ training group (STG), ladder training group (LTG), combined training group (CTG), and control group (CG) are presented in Table I.

ANCOVA revealed no significant differences among the groups in the pre-test scores, indicating homogeneity at the baseline level. However, statistically significant differences were observed among the groups in the post-test and adjusted post-test scores at the 0.05 level, demonstrating the effectiveness of the training interventions on speed performance. The adjusted post-test mean values indicated that the combined training group achieved greater improvement in speed performance when compared with the SAQ training group, ladder training group, and control group. This superior improvement may be attributed to the synergistic effect of integrating SAQ and ladder training within the same training program. The combined approach likely enhanced multiple components of speed simultaneously, including acceleration ability, neuromuscular coordination, and movement efficiency, resulting in greater overall performance improvement.

To identify specific group-wise differences, Scheffe's post hoc test was applied, and the results are presented in Table II. The post hoc analysis revealed significant mean differences between the experimental groups and the control group, as well as between selected experimental groups, indicating that structured speed-oriented training programs were more effective than regular volleyball training alone.

The improvements observed in the SAQ and ladder training groups may be explained by the emphasis of these training methods on rapid foot movements, coordination, and efficient force application. Similar findings have been reported in earlier studies, which documented significant improvements in speed following agility- and footwork-based training interventions. The graphical representation of pre-test, post-test, and adjusted post-test mean values of speed, illustrated in Figure 1, further confirms the superior performance of the combined training group.

Table 1: ANCOVA on speed of SAQ training, Ladder training, combined training and control groups

	STG	LTG	CTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-test Means	6.17	6.18	6.15	6.17	BG	.007	3	.002	.200
SD	.144	.095	.079	.085	WG	.612	56	.011	
Post-Test Means	6.02	6.09	6.08	6.16	BG	.147	3	.049	5.386
SD	.112	.104	.082	.077	WG	.508	56	.009	
Adjusted Post-Test Means	6.029	6.082	6.102	6.164	BG	.141	3	.047	27.527
					WG	.094	56	.002	

Required F (0.05), (df 3, 56) = 2.76, (df 3, 55) = 2.77 at 0.05, significance. BG - Between Groups, WG - Within Groups, df - Degrees of Freedom

Table 2: Scheffe's Confidence Interval Test Scores - Speed (Scores in seconds)

STG	LTG	CTG	CG	MD	CI
6.029	6.082			0.053	0.10
6.029		6.102		0.073	
6.029			6.164	0.135*	
	6.082	6.102		0.02	
	6.082		6.164	0.082	
		6.102	6.164	0.062	

Required C.I Value 0.10 at 0.05 level

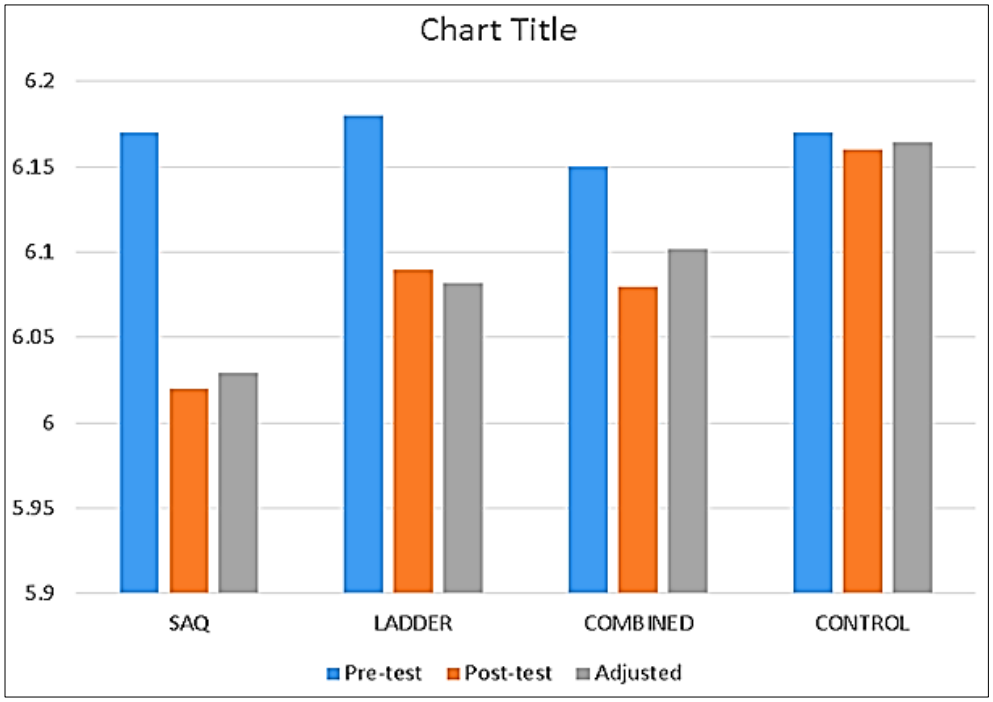

Fig 1: Bar diagram showing pre-test, post-test and adjusted post-test mean values of speed

Conclusion

The present study investigated the isolated and combined effects of SAQ training and ladder training on speed performance among college men volleyball players. The findings of the study revealed that both SAQ training and ladder training independently contributed to improvements in speed when compared with the control group, indicating the effectiveness of structured speed-oriented training programs. The results further demonstrated that the combined SAQ and ladder training program produced greater improvements in speed performance than either training method performed independently. This suggests that integrating multiple training modalities enhances neuromuscular coordination, movement efficiency, and acceleration ability more effectively than isolated training approaches.

Based on these findings, it may be concluded that a combined SAQ and ladder training regimen is a more effective method for improving speed performance among college men volleyball players. Coaches, physical educators, and strength and conditioning professionals are therefore encouraged to incorporate combined SAQ and ladder training into regular training programs to optimize speed development in volleyball athletes.

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