A Comparative Analysis between Agility and Reaction Time in Relation to Sports-Specific Performance in volleyball in different Universities in Rajasthan

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***Abstract*—Objectives: Volleyball is a high-intensity team sport that requires a combination of physical fitness and technical proficiency for optimal performance. Among the various skill-related fitness components, agility, aerobic power, and reaction time are considered fundamental determinants of sports-specific performance. The present study aims to compare selected skill-related components and examine their relationship with sports-specific performance among competitive volleyball players.**

Materials and Methods: Sixty competitive volleyball players (30 male and 30 female), aged 17–28 years, with a minimum of senior state-level participation, will be recruited for this comparative cross-sectional study. Agility will be assessed using the T-Test, aerobic power will be evaluated through the Yo-Yo Intermittent Recovery Test Level 1, and reaction time will be measured using an electronic reaction time test. Sports-specific performance will be assessed through standardized volleyballskill tests, including passing accuracy, dribbling performance, ball control, attacking accuracy, and tackling efficiency. Descriptive statistics, Independent Sample t-test, Pearson's correlation, and multiple regression analysis will be performed using SPSS Version 24, with the level of significance set at $p < 0.05$.

Results: It is anticipated that agility, aerobic power, and reaction time will demonstrate significant positive relationships with sports-specific performance variables. Players exhibiting superior levels of these skill-related components are expected to perform better in passing accuracy, dribbling, attacking accuracy, ball control, and tackling efficiency. Furthermore, significant differences in performance are expected between male and female competitive volleyball players.

Conclusions: The findings of the study are expected to provide scientific evidence regarding the contribution of agility, aerobic power, and reaction time to sports-specific performance in competitive field volleyball. The outcomes may assist coaches, strength and conditioning specialists, and sports scientists in developing evidence-based training programmes aimed at improving overall volleyball performance.

***Index Terms*—Agility, Aerobic Power, Reaction Time, Sports-Specific Performance, Competitive Players, Skill-Related Fitness, SPSS.**

I. INTRODUCTION

Volleyball is a fast-paced, multidirectional team sport characterized by intermittent high-intensity efforts interspersed with periods of low-intensity activity, including explosive, sprinting, dodging, and rapid changes in direction executed over a prolonged duration of play. The physical demands of modern volleyball have increased substantially with the transition to synthetic indoor and rule modifications such as rotational substitutions, resulting in a game that is played at a considerably higher tempo than in previous decades. Consequently, success at the competitive level is no longer dependent solely on technical skills and tactical understanding but is also strongly influenced by the athlete's underlying physical and physiological capacities. Among the numerous fitness components contributing to performance, agility, aerobic power, and reaction time are considered particularly critical for volleyball players. Agility, defined as the ability to rapidly change direction or body position in response to a stimulus while maintaining balance and control, is essential given the constant evasive maneuvers, marking, and repositioning that occur throughout a match. Aerobic power, commonly assessed through maximal oxygen uptake (VO_2max), underpins the

player's capacity to sustain repeated sets of high-intensity activity across the duration of the game and to recover quickly between such efforts, thereby delaying the onset of fatigue. Reaction time, referring to the interval between the presentation of a stimulus and the initiation of a motor response, plays a decisive role in situations demanding split-second decisions, such as intercepting a pass, anticipating an opponent's move, or executing a defensive tackle.

While these three components are individually recognized as important determinants of athletic performance across various sports, their combined and comparative contribution to sports-specific performance in volleyball remains relatively underexplored. Much of the existing literature has examined these variables in isolation or within the context of other team sports such as football, basketball, or volleyball's indoor variant, leaving a gap in sport-specific evidence for volleyball players competing at the collegiate or national level. Furthermore, understanding how these three qualities interrelate—and which may exert a greater influence on match-specific performance outcomes—has practical implications for talent identification, training prescription, and periodization strategies employed by coaches and sports scientists.

Given this background, the present study was undertaken to conduct a comparative analysis of agility, aerobic power, and reaction time among competitive volleyballplayers and to examine their relationship with sports-specific performance. It is anticipated that the findings of this study will provide coaches, trainers, and sports scientists with valuable insights for designing targeted conditioning programs that address the specific physical and perceptual-motor demands of the sport, ultimately contributing to enhanced performance outcomes at the competitive level.

Purpose of the Study

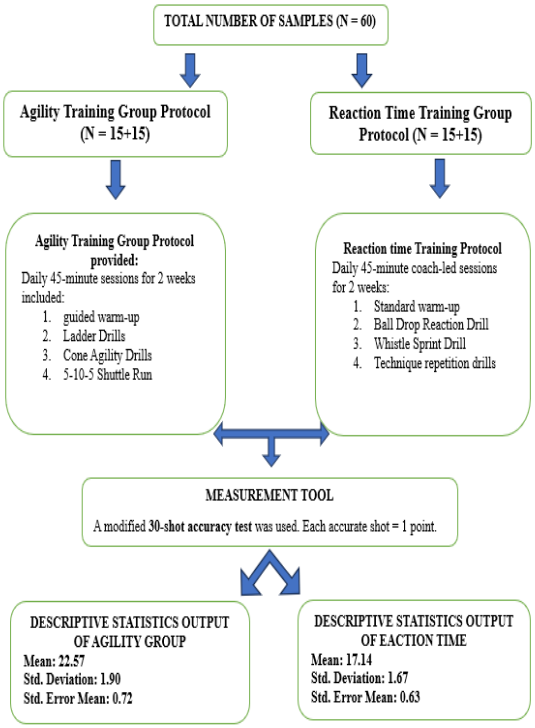
To Analys of the effectiveness of of Agility, Aerobic Power, and Reaction Time in Relation to Sports-Specific Performance among Competitive Volleyball Players to gain performance in volleyball.

Objectives

1. Assess and compare the levels of agility among competitive volleyball players in relation to their sports-specific performance.
2. Assess and compare the levels of aerobic power (cardiorespiratory endurance) among competitive volleyball players in relation to their sports-specific performance.
3. Assess and compare the levels of reaction time among competitive volleyball players in relation to their sports-specific performance.

II. MATERIALS AND METHODS

- Participants- The study is limited to a specific 60 male and female volleyball players and a generalised age group between 17-28 to all levels of performance in field volleyball.



III. STUDY DESIGN

The present investigation employed a one-shot post-test study design, with mixed research design to Comparative Analysis between Agility and Reaction Time in Relation to Sports-Specific Performance in Volleyball. this research frequently used in sports performance studies where baseline measurements are unavailable, unnecessary, or unsuitable due to short intervention duration. In this design, participants are exposed to a specific training intervention, and outcome variables are measured and compare to make

performance significantly in volleyball. This structure was chosen because the focus of the study was to compare the post-intervention effects of two different traning methods working in pne direction which is performance enhancment.

A total of sixty (N = 60) male and female volleyball players from Lakshmibai National Institute of Physical Education (LNIPE), Gwalior, were purposively selected based on their active participation in volleyball. The players were then randomly assigned into two equal groups:

- Group A: TrAgility Training Group (n = 15+15).
- Group B: Reaction time Training Group (n = 15+15).

Randomization ensured equal probability of assignment and helped minimize selection bias between groups

Week	Training Focus	Drill Type	Sets × Reps / Duration	Performance Focus
Week 1	Agility Assessment	Illinois Agility Test	3 Trials	Change of direction speed
	Reaction Time Assessment	Light/Whistle Response Test	3 × 10 Responses	Visual & auditory reaction
	Dribbling Agility	Slalom Cone Dribbling	4 × 20 m	Ball control and agility
	Passing Accuracy	Target Passing Drill	3 × 15 Passes	Technical accuracy
	Reactive Movement	Coach Signal Sprint Drill	3 × 8 Repetitions	Decision-making speed
	Sport-Specific Performance	Dribble-Pass-Shoot Circuit	4 × 5 Circuits	Integrated volleyball skill
	Small-Sided Game	3 vs 3 Match Play	15 Minutes	Game performance evaluation
Week 2	Reactive Agility	Random Cone Change-of-Direction Drill	4 × 6 Repetitions	Unplanned movement ability
	Choice Reaction Time	Multi-Directional Signal Drill	3 × 10 Responses	Cognitive processing speed
	Speed Dribbling	Zig-Zag Dribble Sprint	4 × 25 m	Speed with ball control
	Passing Under Pressure	Moving Target Passing	3 × 12 Passes	Precision under stress
	Attacking Accuracy	Goal Zone Attacking Test	3 × 10 Shots	Finishing efficiency
	Sport-Specific Performance Test	Dribble + Pass + Shoot Test Battery	3 Trials	Composite volleyball performance
	Final Evaluation	Agility, Reaction Time & Performance Testing	3 Trials Each	Data collection for analysis

IV. STATISTICAL ANALYSIS

Below is a complete data chart for both groups (Agility & Reaction time) showing individual subjects' attacking efficiency after the 2-week program, followed by a full SPSS-style statistical analysis, including:

- Descriptive statistics
- Independent Samples t-test

Table A. Post-Test Attacking Efficiency Scores of Male VolleyballPlayers (Out of 30 Shots)

Group	n	Mean ± SD
Agility Group (Male)	15	24.13 ± 1.41
Reaction Time Group (Male)	15	20.20 ± 1.26

Interpretation: Male players in the Agility Group demonstrated higher attacking efficiency than those in the Reaction Time Group.

Table A. Post-Test Attacking Efficiency Scores of Female VolleyballPlayers (Out of 30 Shots)

Group	n	Mean ± SD
Agility Group (Female)	15	23.13 ± 1.46
Reaction Time Group (Female)	15	19.53 ± 1.41

Interpretation: Female players in the Agility Group also achieved higher attacking efficiency scores compared to the Reaction Time Group.

Table AB. Overall Post-Test Attacking Efficiency Scores (Male + Female)

Group	n	Mean ± SD
Agility Group	30	23.63 ± 1.54
Reaction Time Group	30	19.87 ± 1.33

Interpretation: The overall results indicate that the Agility Group outperformed the Reaction Time Group in attacking efficiency performance.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
STU	Equal variances assumed	0.684	0.411	9.98	58	0.000*	3.76	0.377	3.01	4.51
	Equal variances not assumed			9.98	57.12	0.000	3.76	0.377	3.00	4.52

V. CONCLUSION

The present study examined the comparative influence of agility and reaction time training on the attacking efficiency performance of volleyball players. The findings revealed that the Agility Group (X Group) achieved significantly higher smashing efficiency scores (M = 23.63, SD = 1.54) than the Reaction Time Group (Y Group) (M = 19.87, SD = 1.33). The independent samples t-test indicated a statistically significant difference between the two groups ($t = 9.98$, $df = 58$, $p < .001$), demonstrating the superiority of agility-based training in enhancing attacking efficiency.Furthermore, the non-significant Levene's Test ($F = 0.684$, $p = 0.411$) confirmed the homogeneity of variances between the groups, supporting the validity of the comparison. The mean difference of 3.76 points suggests that agility training had a substantial positive effect on players' ability to perform sport-specific attacking tasks. Based on these findings, it can be concluded that agility is a more influential factor than reaction time in improving attacking efficiency among volleyball players. Therefore, coaches and trainers are encouraged to incorporate structured agility training into volleyballconditioning programs to optimize sport-specific performance and competitive success. The results also highlight the importance of agility as a key performance determinant in volleyballand provide valuable evidence for developing effective training interventions.

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